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The Original
**PREDICTING WEATHER
BY THE MOON**

by
Ken Ring

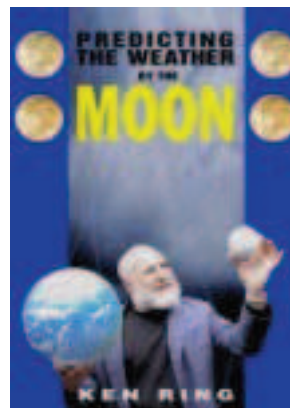
Luna.

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This book was first printed in 1999, a result of about three years' work, the culmination of 20 years of observing moon cycles and research. At first self-published, after two years the rights were purchased by Hazard Press (Christchurch, NZ), one of a number of independent NZ book publishers that support and bring unusual NZ works to a wider audience.

Hazard Press in turn temporarily leased the contract for UK coverage to Gothic Image Publications, a New Age publisher based in Glastonbury. In 2003, Hazard Press ceased publishing this book and on request returned all rights to the author. In the UK, although not contractually enabled to do so, Gothic Image chose to continue publishing using the cover at bottom right.

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Despite requests to desist, this process has continued unabated. As no small claims international books tribunal exists there seems little that can be done to stop what has been intellectual theft for 7 years, other than making it available **free online**. It may make no difference, but if every similarly treated author did the same it might go some way toward deterring pirating by unauthorised publishers.

One advantage of offering the book in this way is that we can offer the original that suffered some editing in both printed versions for reasons of space. It also enables us to announce the book that has been written since *Predicting Weather By The Moon*. The new work has valuable additions, updated with new techniques including matching of past year records to current and future years. These cover 1802 - 2012 which means forecasting by seasons is possible to 2012 and beyond if the reader merely repeats the demonstrated pattern. In effect one can go 200 years ahead. The new book is called *The Lunar Code* and is now published by Random House (NZ) Ltd. The author recommends *The Lunar Code* to the longterm weather planner and serious weather buff. It is available from all NZ bookshops or online from various sources, including www.predictweather.com.

We wish readers enjoyment of this free book in their first steps on the road of what will be an exciting and rewarding journey. Please send it to your friends!

*Ken Ring
Auckland
NZ*

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By the same author

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Formation of the Moon

OTHELLO: 'It's the very error of the Moon; She
comes more near the Earth than she was wont'
- Shakespeare, Othello

Formation of the Moon

There are three theories about how the Moon came to be in place: that the Moon came from the Earth, that the Moon was captured by the Earth and that the Earth and Moon were formed together. Was the Moon once part of a larger planet earth, getting ripped away, possibly forming the Pacific Ocean, following a massive interplanetary explosion? Or was she at one time in an orbit around the Sun, somewhere between Mars and Earth and some 2,500 million years ago came just that bit too close; to be embraced in a permanent hug around the Earth; an event that caused a sudden mighty disturbance in Earth's orbit around the Sun in which from that moment on, Moon and Earth commenced a mutual orbit around a common centre of gravity, lying

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about 2,903 miles from the centre of the Earth? Or did the Moon form out of initial cloud of gas and dust at the same time and same place as the parent planet?

The current theory is that third possibility, that of co-formation, much weight being given to the fact that both Earth and Moon seem to be the same age. It seems that the solar nebula, the beginning of moons-to-be (called proto-moons) draw material to themselves from the cloud of gas and dust around them. Because of the extreme cold of space, this theory seems to explain the many icy moons around the giant planets in the outer solar system.

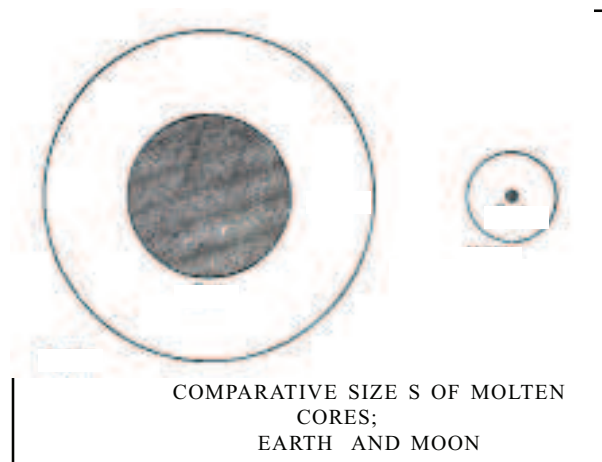
The temperature difference which plays a role in the formation of the planets seems also to play a role in the formation of their moons. Just as the planets became more and more icy the further from the sun, moons seem to be more and more icy the further from the planet they orbit. For example, Jupiter's moon Io (close to Jupiter) is very rocky, but Europa (farther from Jupiter) has more ice, Ganymede and Callisto (further still from Jupiter) have lots more ice.

By whatever means it came to be in place, as Earth's Moon finished forming, about 4.5 billion years ago, the surface was hit by the remains of the boulders which are thought to have formed the Earth. During this time the Moon warmed and experienced volcanism. There is abundant evidence of volcanic plains from this time period. Toward the end of the period of bombardment by boulders, scientists think that the Moon was hit by a series of very large boulders, these collisions forming what we know to-

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day as the Lunar Maria.

Has the Moon a molten core? Because of its small size, the Moon would have cooled very rapidly compared



with the Earth. Soon, the Moon would have cooled completely to the form we see today. Surface activity in the form of plate tectonics and other forms of surface activity ceased once the Moon cooled. Even the interior of the Moon seems to have cooled to the form of relatively tiny molten activity, no more than 450 miles in diameter.

With no atmosphere and no magnetic field, the Moon's surface is exposed directly to the solar wind; which is the electromagnetic field of energy encompassing the sun. In its 4 billion year lifetime many hydrogen ions from the solar wind have become deeply embedded in the Moon's surface. Rich in hydrogen, they may one day provide fuel

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to run lunar-based factories.

The Moon has a crust, about 60-150 km thick. The interior composition of a moon can be guessed from density measurements, and also determined more exactly from spacecraft navigation data when a spacecraft passes by or goes into orbit around a planet or moon. The density of iron is about 5 g/cm³. The density of silicate rock is about 3 g/cm³. The density of the Earth's Moon is about 3.3 . This density is close to that of silicate rock, suggesting that the Moon has a large mantle made mostly of rock.

Has the Moon an atmosphere? In decades past it was accepted that moons such as the Earth's moon or the moons of Jupiter were airless bodies with no atmosphere whatsoever. Now, however, measurements have shown that most of these moons, including our own, are surrounded by a thin atmospheric region of molecules.

The atmosphere may come from the release of gases such as nitrogen and carbon dioxide and carbon monoxide, and radon, which originate deep within the Moon's interior.

Another source are molecules which are loosened from the surface by bombardment of the surface by other molecules from space. These molecules may migrate across the surface of the Moon, to colder regions where they recondense into the ground, or they may fly off into space. This mechanism is a source of water and helium. Was there ever lunar water and if so does some still lie under the Moon's poles?

For once it was believed that the Moon contained

Formation of the Moon

no water. Moon rocks collected by Apollo astronauts (at lunar equatorial regions) contained no water traces. Lunar mapping performed by the orbiting Galileo spacecraft at coarse resolution, also found no vestige of water. But the more recent Clementine mission made measurements which do suggest that small, frozen pockets of water ice may be embedded in shadowed regions of the lunar crust. Although the pockets are thought to be small, the overall amount of water might be quite significant. This water may come from comets which may continually bombard the Moon, or water in the form of molecules which migrate to the coldest regions of the Moon where they refreeze on the surface, trapped inside enormous craters -some 1,400 miles (2,240 km) across and nearly 8 miles (13 km) deep - at the lunar poles.

Due to the very slight tilt of the Moon's axis, only 1.5 degrees, some of these deep craters never receive any light from the Sun - they are permanently shadowed. This means that the frozen water must remain there, otherwise energy from sunlight would split much of this water into its constituent elements hydrogen and oxygen, both of which would fly off into space immediately.

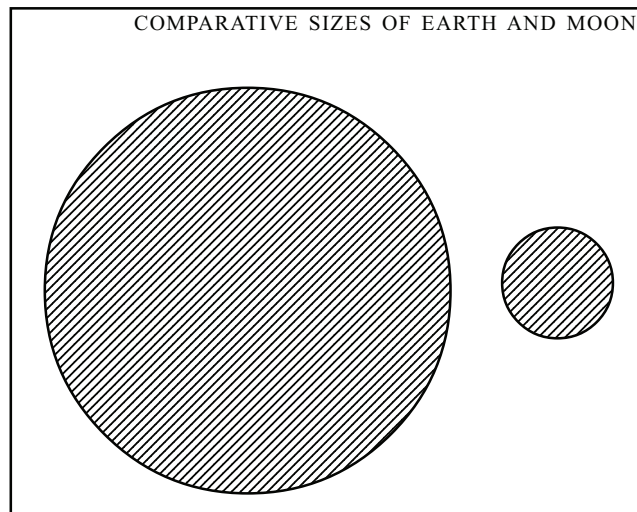
HOW LARGE AND FAR IS IT?

The Moon is unusually large. Its diameter is 2,163 miles, compared to 7,927 miles for the mean diameter of Earth. The Earth is three and a half to four times bigger than the Moon and 81 times as massive(as heavy) as the Moon. For our solar system this is an extremely high ra-

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tio, compared to the planet it orbits. (Pluto's Moon Charon is a notable exception) For instance, the nearest comparison is that of Neptune's Moon 'Triton', which is only one two hundred and ninetieth of Neptune's mass.

There is, consequently, an unusually large gravitational attraction operating between Moon and Earth. That is why it has such a gravitational effect on everything that moves freely – its pull is about two and a half times that of the



Sun. When the Moon is closer or brighter this attraction is increased.

The Moon is about 240,000 miles away from our Earth. This is almost ten times the distance around our Earth. If it could traverse space, a train speeding at 65 mph would take about five months to get there. If the Earth was the size of a basketball, the Moon would be the size of a

tennis ball.

Space is called 'space' because there's so much space there. Hold a peppercorn between your index finger and thumb. Imagine it is the Earth. The moon would be a pinhead an inch away. What is the proportional distance to Alpha Centauri, our nearest star neighbour? From New Zealand you would have to catch a plane to Singapore and stand in that city holding another peppercorn.. Astronauts who flew to the Moon were struck by how the Earth and Moon seemed tiny specks in an infinite, empty void. So large are the emptinesses that separate celestial bodies, that most illustrations exaggerate the size of the objects to avoid rendering them as invisible dots.

On this scale, all human spaceflight with the exception of the Apollo lunar missions has been confined to a region of two pixels surrounding the Earth. Seeing the Moon's orbit in its true scale brings home how extraordinary an undertaking the Apollo project was. Of all the human beings who have lived on Earth since the origin of our species, only 24 have ventured outside that thin shell surrounding our Home Planet. Even the orbit which geosynchronous communications satellites occupy is only a little more than a tenth of the way to the Moon.

The Earth is a planet, revolving around the Sun once in a year, and the Moon is a satellite, revolving around the Earth at around 2,300 mph in just less than a month. If you were on the Moon you would have days and nights, but each day and each night would be two weeks long.

The Moon moves rapidly with respect to the back-

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ground stars. It moves about 13 degrees (26 times its apparent diameter) in 24 hours (slightly greater than its own diameter) in one hour. This rapid motion has given it a unique role in the history of astronomy. For thousands of years it has been used as the basis of calendars. Isaac Newton deployed crucial information from the Moon's motion around the Earth for the law of gravity.

Almost everyone has noted that we see the same face of the Moon all of the time. It's the 'Man in the Moon' that children are enthralled by. One thing this shows us is that the Moon turns exactly once on its axis each time that it goes around the Earth. The pull of the Earth over millions of years has caused the Moon, which once rotated by itself, to now be relatively orbit-free, in what we see as a face-to-face dance of the Earth and Moon.

It drifts eastward with respect to the background stars (or it lags behind the stars). It returns to the same position with respect to the background stars every 27.323 days.

Half a billion years ago, the Moon lay closer to the Earth in its orbit and it has been moving away into the beyond of outer space ever since, at the rate of about an inch per year. As the Moon recedes, our month increases by about a second every 4,000 years. We know from fossil records of rock formation that 350 million years ago the month was a day and a half shorter, making for closer to 13 months in the year rather than 12.

There seems to be general agreement that at one stage, thousands of millions of years ago, the Moon was closer to us than it is today; perhaps as little as 12,000 miles. If

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so, then the month, or time taken for it to orbit the Earth, would have been a mere 6.5 hours. The tides raised by the two bodies upon each other would have been violent indeed. Yet the Moon would have suffered more from this proximity. These mutual tides would have slowed down each other's axial rotations and pushed the Moon further away.

About 500 million years ago the Moon would already have been 200,000 miles away, still with a bulge toward the Earth which would have kept slowing the Moon's spin. Finally, the Moon would have stopped rotating altogether; its revolution would have been 27.3 days, and the Earth's rotation would have increased to 24 hours.

The process is still continuing, because the Moon's tidal pull on the Earth is still slowing us down. Each day is approximately 0.00000002 seconds longer than the day before. This works out to a gain of one second in a hundred thousand years, which only becomes noticeable when comparing lunar eclipses observed many centuries ago.

Although the Moon is still receding from us it will not keep receding indefinitely. At around 350,000 miles it will start to come in again, due to the tidal effects brought by the Sun, and then it will be broken up eventually by the Earth's gravitational pull. It will end as a swarm of orbiting particles around Earth in a system of rings like those of Saturn. We would no longer have tides, except one big one permanently aimed towards the sun. Life on Earth would be impossible because there would be only atmosphere on the Sun side of the Earth. There would probably be no water; just one big stationary cloud.

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But wait - that wouldn't happen. By the time the Moon would have come that close, in about 30,000 million years time, the Earth/Moon system will have ceased to exist about 25,000 million years before that, because of changes in the Sun..

The Moon in Ancient History

Mesopotamia is now a fertile plain bordered by the Tigris and Euphrates rivers in the Middle East. Today the territory is occupied by Iraq and Kuwait. People known as the Sumerians first settled here in about 4,000 to 3,500 BC., in the city states of Ur, Babylon and Uruk.

Ur was one of the first settlements to be established in the area, and became one of the most prosperous Sumerian city states. The city of Babylon became the religious and cultural center of the region. In Ur, numerous annual and monthly festivals were held, including a monthly feast to celebrate the first sighting of the New Moon. In the eyes of the Sumerians, each month began with the emergence of the New Moon in the heavens and ended with its disappearance at the next New Moon. The months were about 30 days long, with the first quarter occurring on the 7th, and the Full Moon on the 15th. This resulted in 12 months or moon cycles occurring each year, which resulted in a year of 354 days. They also divided the day

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into 12 periods, and further divided these periods into 30 parts, (4 minute increments).

As early as 3500 B.C. they constructed four-sided monuments called Obelisks which acted like a sun-dial. By watching the moving shadows, they were able to mark off high noon as well as the solstices and equinoxes. They also erected large observatories or watch towers in the temple complexes of the great cities to study celestial phenomena. The biblical Tower of Babel was said to be such a monument.

Ur has been called Abraham's city. According to the Scriptures, Abraham faced serious problems. The Moon worship in the city was considered an abomination to God in some quarters, and, with his father Terah, Abraham left Ur to go to another center of Moon worship at Haran. After Terah died, Abraham accepted the challenge to go on to the Promised Land of Canaan.. Joshua Chapter 24 makes it clear that Terah worshipped false gods. In the pre-Christian era, Moon observance and measurement for weather and harvest prediction generally became systematized as Moon worship.

The fundamental debate between those who believed that the Moon exerted terrestrial influences and those who believed that only a non-celestial God controlled life on earth, still persists to this day.

The Sumerians worshipped the Moon god Sin, which not surprisingly, today, is the word that has come to mean the very transgression of moral law. The Latin word sinister meant 'left' and was long associated with evil. It was an insult to extend the left hand for a handshake. The older

The Moon in Ancient History

Indo-European root word *es* meant ‘all that there is’ and ‘that which is true’. Among modern derivations are *is*, *sooth-sayer*, *entity*, *essence*, and *present*. Etymology is never fixed in stone, and perhaps what was considered abnormal, for example, *lefthandedness*, came to represent a darker side of life, and a Moon symbol (the word ‘*sin*’) became a label for heresy because of the changing religious power structures.

Standing in Ur is the Ziggurat of Nanna, a temple and center of worship to Sin, built around 2100 B.C. Sin had several different names that referred to different phases of the Moon. The name ‘Sin’ itself indicated the ‘crescent’ Moon, (*Ceres*, later became the name of the Roman goddess of agriculture, hence the words *crescent*, *kernel*, *create* and *increase*) Nanna the name during Full Moon, and *Asimbabbar* which meant the beginning of each lunar cycle.

Sin was said to be the descendant of the sky god An, and was born from the rape of the grain goddess *Ninlil* by the air god *Enlil*. For this crime, *Enlil* was banished by the assembly of the gods to live in the underworld. When *Ninlil* realized she was pregnant, she decided to follow *Enlil* to the world of the dead to let him witness the birth of his child. But the birth of a child in the underworld would have imprisoned him forever in the Hades, the kingdom of the Dead. As an appeasement, *Enlil* offered the next three children who were going to be born to the infernal deities. This allowed their first child Sin to ascend to the Heavens to light the night sky.

This myth related to Sin’s birth explains why

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Sumerians viewed a lunar eclipse as an attack of demons against the Moon. During the lunar eclipse, Sumerian kings used to wash themselves, believing these rites could bring the purification of the Moon.

Because the Sun and Moon appear roughly equal in size, they were generally considered in the same creation stories. They were most often depicted as husband and wife, and were attributed human emotions such as anger, jealousy and love. The rules of community conduct took their cue from the narrated stories about the behavior of the Sun and Moon. In many cultures the Sun was the god of Life and Goodness and the Moon represented the Underworld, presumably because of its association with the powers of darkness.

The Bedouins of Egypt pictured a tale of unfulfilled sexual passion between a boring husband, the Moon, and the Sun, his hot-blooded wife. In a sexual fury, the Sun attacked the Moon which resulted in what we now observe as spots on the Sun and scars on the Moon. Although they went separate ways, they still had sexual contact once a month, the result of which it was believed caused the shrinking phases.

Some Central Asian tribes regarded the Moon as the shy one of the pair, who only crept up to the sky when humans were asleep. Sometimes it hid and didn't appear at all.

According to North American legend the Moon and Sun as husband and wife, were once enclosed in a solid stone house, until a worm bored holes so that a gopher

could insert fleas. Irritated by the insects, the Sun and Moon raced up into the heavens.

'Once on a time Ke'so, the Sun, and his sister, Tipä'ke'so, the Moon ("last-night sun") lived together in a wigwam in the east. The Sun dressed himself to go hunting, took his bow and arrows and left. He was absent such a long time that when his sister came out into the sky to look for her brother she became alarmed. She traveled twenty days looking for the Sun; but finally he returned, bringing with him a bear which he had shot. The sun's sister still comes up into the sky and travels for twenty days; then she dies, and for four days nothing is seen of her. At the end of that time, however, she returns to life and travels twenty days more.

The Sun is a being like ourselves. Whenever an Indian dreams of him he plucks out his hair and wears an otter skin about his head, over the forehead. This the Indian does because the Sun wears an otter skin about his head.'

- Native American folktale

But in a North East Indian legend, the Moon was a brother lusting for his beautiful sister, the Sun. Both were of equal size and brightness. She repelled his advances by flinging ashes in his face, thus resulting in the cool planet we see today and explaining the universal taboo on incest.

In Greenland, the Moon is again a brother, Annigan, who chases his sister, the Sun Goddess Malina across the sky. So intent is he on the chase that he forgets to eat and

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grows thinner and thinner, eventually stopping to rest. Dropping to earth he hunts and catches a seal which he eats, then returns once more to the chase. This scenario is enacted out month in and month out, explaining the New Moon seal hunt among the Eskimo.

The 'Man in the Moon' idea exemplifies the masculinity and is widespread. In Northern Europe, among Lithuanian and Latvian peoples, it was told that the male Moon wedded the Sun, but the Sun rose at dawn leaving the Moon to wander alone, courting the morning star. In anger and jealousy, the Sun cleft the Moon with a sword, explaining the diminishment of the phases.

Aborigines of Australia call the Moon 'The Wanderer'. In an ancient tale, a man was chased off the edge of the world by a dingo (wild dog). When he returned, he was so hungry that he gorged himself on opossums. The dingo returned, found him and once again gave chase. But the man was now too fat to move and the dog ate him. When it had finished, it tossed one of the man's arm bones in the sky, where it became the Moon-man.

Rongo was the name of the Moon god in Babylonia, and was known by that name too in pre-European New Zealand and Hawaii. Rongo was believed to control nature and act as a fertilising agency, causing winds and crops to flourish.

The Moon has always been the symbol of fertility. Early Man made rock drawings matching crescent moons to the horn-shapes of known animals. The ram's horn became an important religious symbol, just as crushed horn persists today in Asia as an aphrodisiac. An awareness of

The Moon in Ancient History

the 28 day regularity of the lunar cycle can be seen in cave markings in Spain, which date back to 7000BC. Any rituals associated with crops, rain, success in battle or courtship were held on New or Full Moons.

In some cultures, such as the Roman, festivals were so numerous that a Moon Watcher was needed to sit on a hill and blow a trumpet at the first sign of the New Moon, shortly after sunset on the western horizon, when it appears as a very thin crescent. From that time the times of the month's festivals were set down.

The Roman *calends* actually meant that day of the New Moon, the first day of the month. On that very day it was publicly announced on what days the nones and ides of the month would fall. Even today in the ancient Middle East, the month begins with the actual observation of the first crescent. Astronomers of old were delegated to stand on a high place and peer low into the west at dusk to spy the visible signal that would indicate that they did not need to add a 30th or a 31st day to the present month but instead could wipe the slate clean and begin the cycle over again with Day 1. One can imagine the difficulties we would have today paying rent, collecting debts, and meeting deadlines, if such a system had persisted.

As each Moon phase took approximately seven days to complete, the number seven was considered the most mystical. Not only was the week divided into seven days but there were the seven celestial bodies, seven colors in the rainbow and seven notes to the musical octave before the pitch starts to repeat. And high tides become low every

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seven days, then high again to high water mark almost exactly 14 days later.

Tides were viewed not only in the oceans but menstrually and in life and death as well. It was observed that life ebbed and flowed, and the Moon was believed to played a big role in human death. For Persians, Indians, Greeks, Eskimos and some African tribes, the Moon was a stopping place for departed souls on their way to heaven. As it filled each month increasing in size, some souls, unable to find room, were sent back to earth for reincarnation. The crescent shape allowed for a boat image, carrying souls. In Egyptian life, heavily dependent on the Nile for food, water and transport, the crescent Moon-shaped boat became a symbol for life's journeying.

Where a female Moon was fertile, a male Moon was lustful: either way, sexuality was implied. It was widely believed that young women risked pregnancy just by staring at the Moon or laying naked in moonlight.

The concept of fertility in crops, birth and rebirth gradually gave the Moon its status of femininity.

In Greek times, lunar fertility cults sprang up, headed by high priestesses. Lunar, a relatively minor Roman goddess, became an all-powerful deity when the Roman Empire expanded to include Europe and the Middle East, adding together diverse traditions of Moon-worship.

Lunar became the personified goddess of the Moon. Later she is identified as the Roman goddess of nature, fertility and childbirth and Hecate is the Greek goddess of the crossroads. She is most often depicted as having three heads; one of a dog, one of a snake and one of a horse. She

The Moon in Ancient History

is usually seen with two ghost hounds that were said to serve her. Hecate is most often misperceived as the goddess of witchcraft or evil, but she did perform some deeds worthy of credit. One such was when she rescued Persephone, (Demete's daughter, the queen of the Underworld and the maiden of spring), from the Underworld. Hecate is said to haunt a three-way crossroad, each of her heads facing in a certain direction. She is said to appear when the ebony moon shines.

In China, too, the Moon loomed large in mythology. The earliest Chinese calendar was based on lunar cycles, with observations of both the Sun and the Moon. The



twenty-eight divisions of the Chinese lunar year were called Hsiu, "Houses" and each House was inhabited by a warrior-consort of the Moon goddess. Such a calendar was also used in Japan, Korea, and Vietnam.

The belief is that long ago, the Earth was in a state of havoc because there were 10 suns in the sky, and these were the sons of the Jade Emperor. Rivers dried up, the land became barren, and many people died. Seeing the death and destruction caused by his sons, the Jade Emperor took this

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matter to the god Hou Yi . The Emperor asked Hou Yi to persuade his sons to rise up away from the earth to end the catastrophe. When Hou asked the suns to leave the sky, they refused. Made angry by their defiance, Hou Yi, a great archer, launched arrows at the suns, shooting them down



one until his wife Chang O pleaded with him to save on sun to keep the earth warm and bright. Knowing that the Jade Emperor was furious at the slaying of his sons, Hou Yi and Chang O were forced to stay on earth. Chang O was unhappy, so her husband tried to win back her favor by gathering herbs that would give them once again the power to ascend to heaven. Chang O remained angry, however, and ate all the herbs herself. She flew up to the moon, where she remains alone, living in the Moon Palace.

In a story of patience, Wu Kang, a restless good-for-nothing decides to become an immortal but can't stick to lessons from his immortal tutor. Asking to go to a new place, the immortal takes him to the Moon. Once there, the tutor instructs Wu to chop down a cassia tree. The cassia tree, if not completely chopped down in one day, reappears whole the next day. As Wu Kang lacked, and still lacks the patience to finish the job, he is up there chopping still..

To the Chinese, the Moon was a timepiece. Being an agricultural people, they planted and harvested by the Moon and gave special attention to the Moon in times of worship. During the Tang Dynasty (A.D. 618-906) the 15th day of the eighth lunar month was made an official holiday - Moon Festival.

In Taiwan, the Harvest or Fruit Moon (Full Moon in September) signals a time for romance and family togetherness. The 15th day of the eighth lunar month marks the mid-autumn Festival, also known as the Chinese Moon Festival. On this special day, Chinese people worship in temples throughout Taiwan and hold joyous family reunions at home. After nightfall, entire families go out under the stars for picnics in public parks. It is also a for the lovers, who sit holding hands on riverbanks and park benches.

According to folk legend, the 15th day of the eighth lunar month is also the birthday of the Earth god, or Tu-ti Kung. Thus the festival has come to symbolize the fruitful end of a year's hard work in the fields. Farm families across the island express their gratitude to the Earth God as to Heaven, represented by the Moon, for the year's good blessings.

During the Yuan dynasty (A.D. 1280-1368) China was ruled by the Mongolian people. Leaders from the preceding Sung dynasty (A.D. 960-1280) were unhappy at submitting to foreign rule, and set how to coordinate the rebellion without it being discovered. The leaders of the rebellion, knowing that the Moon Festival was drawing near, ordered the making of special cakes. Backed into each mooncake was a message with the outline of the attack. On

Weather By The Moon

the night of the Moon Festival, the rebels successfully attacked and overthrew the government. What followed was the establishment of the Ming dynasty (A.D. 1368-1644). Today, round Moon cakes, as a reminder of family unity, are eaten to commemorate this event.

In agrarian Chinese society, festivals marked the passage of time. Lifestyles may have changed in modern Taiwan, but the traditional festivals carried forth from ancient Chinese society remain an important part of family life. There are many legends that claim to be the origin of the festival for celebrating the radiant moon.

One of the most popular is the story of Hou Yih, an official and bodyguard of an emperor in the Hsia Dynasty (2205-1818 B.C.), and his beautiful wife, Chang-O. As the legend goes, Chang-O stole from her husband an elixir said to ensure youth and immortality. Upon swallowing the drug, she soared to the Moon, where her youth and beauty were preserved. As punishment for the theft, however, Chang-O was doomed to stay in the firmament forever.

Among the most ancient of monuments are the remains of giant stone structures erected by Neolithic man in France and other regions throughout the world. There are about 900 megalithic circles concentrated in the British Isles alone. These, believed to be of Celtic origin, range in height from about 1m to 22 m. There are single standing stones or monoliths, stone circles (consisting of many monoliths) and perfectly aligned rows of monoliths.

The best examples of these are located near the is-

land town of Carnac, in the Morbihan region of Brittany, where there are almost four thousand megaliths arranged in a variety of configurations. They date from around 5,000 to 2,500 BC. There are long ranges of standing stones planted strategically into the ground in parallel alignments.

Some have speculated that these stones served as astrological systems, Druid temples, calendars or ancient astronomical observatories and many ascribe a precise astronomical orientation to the alignments. There are also table-like arrangements, dolmens, believed to be funeral monuments, with passageways linking the world of living with the world of the dead.

In Salisbury, southern England on the River Avon, is Stonehenge, the most famous of all megalithic monuments. These megaliths consist of four concentric ranges of stones. They could be as old as 20,000 years - dispute as to their age still ensues. It is thought that Egypt may have been occupied for 600,000 years, perhaps putting the Great Pyramid back to about 300,000 years old. If so, then Stonehenge, which is exactly half the Pyramid in its dimensional ratios, could be as old as that also. Ancient Britain at one time had the same standards of measurement as the Egyptians; including fathoms, leagues, miles, feet and also cubits, rods, and reeds - the last three which have been lost in Britain for many



hundreds of years. That Stonehenge is half ratio to the Pyramid can be seen if one draws a triangle on the ground with one side across the diameter of the middle, and the other two sides meeting at the Heel Stone. The total is exactly half the size of the Pyramid as viewed from the side. The Pyramid is 756 feet along its base. Stonehenge is 378 feet in diameter.

Stonehenge was used to predict eclipses of the Sun and Moon, the Moon's declination cycle, as well as the Sun's, and the measurement of solstices and celestial phenomena such as lunar eclipses. It was as if the people of that region were obsessed with lunar declination and the times the moon crossed the ecliptic.

In 1964, Gerald Hawkins, Professor of Astronomy at Boston University subjected the Stonehenge site to numerous tests. He concluded that the Stonehenge architecture acts as sort of a neolithic computer, used to predict eclipses of the Sun and Moon. Stonehenge astronomers were also counting off eclipse "seasons" which recur about every six months. The site's axis points roughly in the direction of the sunrise at the summer solstice.

It is the opinion of this author that stone circles were nothing less than weather calculators and giant teaching tools, not only to depict climatic changes but also to instruct about transoceanic navigation. For instance, the base length of the Pyramid was 1/110,000th the circumference of the earth in miles. Stonehenge would have been on the navigation seminar list. We have to conclude that the seas were being traversed much earlier than we presently give credit to. In his book "Ancient Maps of the Sea Kings"

Charles Hapgood displays recently unearthed early cartographic maps from the Persian era, showing the southern ocean with New Zealand (Los Roccus Insulis) as two tiny islands, and more importantly, Antarctica with no snow on it, as verified by the United States Air Force Research Division in Massachusetts. The last time snow was absent in Antarctica was 6000BC. For such early navigation by Europeans, sound knowledge of mathematics and global distances would have to have been known, along with teaching techniques.

The Moon was always numerically tied to the whole celestial environment. In ancient astronomy there were seven celestial bodies visible to the naked eye and thought to revolve in the heavens about a fixed earth and among fixed stars. These seven bodies were Mercury, Venus, Mars, Jupiter, Saturn and the Sun and the Moon. But because it is our nearest neighbor in space and makes visible changes day by day, it is not hard to see that the Moon has fascinated humankind the most. Little wonder that it has been considered responsible for such variances as tides, moods, battles, weather and sexual attraction.

Inhabitants of coastal villages for thousands of years have relied on fishing for survival, and have needed lunar data for tide variations. It would not have gone unnoticed that the menstrual cycle too is lunar and tidal, tying us, especially women, to the Moon's possible influence. But in our species' biological history could the cycle of the Moon have become the cycle of ovulation?

Being hunter/gatherers, early humans, probably the

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females, would have had to keep going as long as they could have while there was light to gather enough food. When they couldn't hunter/gather, which would have been 3 days in the month, what else was there to do? Could this have been the time reserved for mating? It could follow that human bodies might have developed a lunar-analogue time clock to control the secretion of chemicals responsible for the breeding cycle which could have become the menstrual cycle. Given that the hunter/gatherer period lasted a million years, there was time for such a biogenetic rhythm to evolve.

The menstrual cycle is 28-35 days in most of the other primates as well, especially the Great Apes, the gorillas, chimpanzees and orangutans. Some, like the New World and Old World monkeys are still around 30-40 days, but the Persimians, the more primitive primates, are only once a year. From a primitive form of primate that hasn't evolved, they are more like non-primates.

In the rest of the animal kingdom, seasonal reasons for ovulation patterns seem more important than Moon phases. That way young can be born in warmer weather. The Ungulates; (the giraffes, the elephants and antelopes) are all seasonal, as are reptiles. Rodents, like rats, rabbits are flat out all the time. Also, the place humans evolved may not have been very seasonal, winter and summer in northern Africa being of no special significance. All of the evidence collected with non-primates indicates that they breed at that time because of environmental factors due later; spring producing fresh growth and available food. It is well documented that human female flat-mates adjust their men-

strual cycles to each other, indicating that the cycle can be psychologically changed. This happens in zoo-confined primates as well. The primate menstrual cycle is generally a 28 day one, and as 28 days is the true moon cycle and not 31, this speaks more of a tie-up to the moon than if the menstrual was a 31 day cycle.

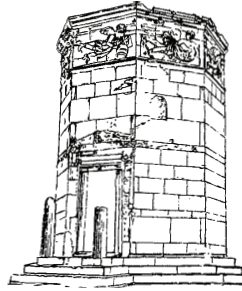
In the Lebembo Mountains bordering Swaziland the small part of a baboon's thighbone, dating from about 35,000BC has been discovered with 29 notches engraved upon it. It is the earliest known tallying device. Was it a Moon phase counter? The earliest form of a known lunar calendar consists of notches etched into bones 20,000 years ago by paleolithic tribesmen in central Africa. The groups of tallies are arranged in groups of 14, which many believe to have been a record of days, measuring the time between Full and New Moon. Presumably, it was important to know when the next continuous night-light for hunting activities would occur, or when possibly the next mating period could be expected.

In northwestern Mexico we find the same type of recording dating from a much later period of 2000-3000BC. carved on stone. These lunar calendrical tallies appear alongside lists of weapons and kills.

Early Moon Watchers

In 450B.C. the Greek philosopher Aristotle, in his book *On The Heavens*, had noted that the Earth had to be a round sphere rather than a round plate because eclipses of the Moon were caused by the Earth coming between the Sun and the Moon. Before him, in 450BC Anaxagoras of Clazomenae reasoned that because the Earth's shadow on the Moon is curved, the earth itself must be spherical. If the Earth had been a flat disk, the shadow would have been elongated and elliptical.

The Athenian 'Tower Of The Four Winds' dates back to the First Century BC. An early observatory, it displays on its eight faces, carved figures representing the eight winds recognised by Aristotle three centuries earlier. Aristotle had divided winds into two classes, polar and equatorial, and described with amazing accuracy the weather and the month likely to occur for each.



The most industrious compiler of classical weather

Early Moon Watchers

lore was Aristotle's pupil Theophrastus. His *Book of Signs*, written about 300BC, described more than 200 portents of rain, wind and fair weather, and a few that were alleged to reveal what the weather would be like for the coming year or more. As well as introducing cloud folklore ('in the morning mountains, in the evening fountains') he described signs to be found in the behaviour of sheep, the way a lamp burns during a storm (probably due to atmospheric changes) and the crawling of centipedes toward a wall.

He was the first to note that a halo around the Moon signified rain coming. He also claimed that flies bite excessively before a storm. Research shows this to be incorrect, unless they had different flies 2000 years ago. Nevertheless, his book was a major reference work for forecasting for the next 2000 years. The Roman poet Virgil(70-19BC), in his agricultural treatise *The Georgics*, said

'The father himself laid down what the Moon's phases should mean, the cue for the south winds dropping..'

He also wrote

'Nor will you be taken in by the trick of a cloudless night
When first at the New Moon her radiance is returning
If she should clasp a dark mist within her unclear crescent
Heavy rain is in store for farmer and fisherman'

The earliest known almanac was written in Egypt in about 3000BC. Almanac is an Arabic word that means '*Calendar of the skies.*' When Columbus sailed west 500 years ago, around an Earth he thought was shaped like a modern rugby ball, he, like other sailing captains of his time, had in

Weather By The Moon

his possession an early German nautical almanac. Along with the almanac's calendar of movements of the planets, stars and Moon, were contained instructions about the weather, such as Moon's halo precedes rain or snow, high tides meaning storms at sea, and Northern lights heralding cold weather .

Only priests, astrologers, and men of authority had access to these ancient texts - the accumulated wisdom of millenia of Persian, Greek, Islamic and European science. The almanacs also listed future lunar eclipses. When a Jamaican chief threatened to withhold the food supply to Columbus's hungry and mutinous crew in 1504, the resourceful navigator threatened to remove the Moon permanently. It was the early evening of 1st March and an imminent total lunar eclipse; a fact known only to Columbus. As the Moon started to disappear, the frightened chief, overawed by the mariner's apparent mighty powers, relented. The Moon, within the hour then reappeared. They had no further trouble with their food supplies!

Benjamin Franklin, George Washington, Thomas Jefferson, James Madison and John Quincy Adams all kept daily weather records, in order to devise some patterns for predictions.

Since biblical days, it has been known that particular months bring particular winds.

*Out of the south cometh the whirlwind – Book of Job.
'When ye see the south wind blow, ye say, There will be heat; and it cometh to pass' -St. Luke.*

And as Bartolomaeus Anglicus, 13th century scholar, observed

'The North winde...purgeth and cleanseth raine, and driveth away clowdes and mistes, and bringeth in cleerness and faire weather; and againward, for the South winde is hot & moyst, it doth the contrary deedes: for it maketh the aire thicke and troubyly, & and breedeth darknesse.'

Around 200A.D. the Greek mathematician, astronomer and geographer Ptolemy, resident in Alexandria, re-examined the old idea that the earth was stationary and that everything else revolved around it. He concluded that the idea was flawed because if true, at times the Moon would have to appear twice as big as at other times. That it did not was quite worrisome to Ptolemy but something, fearing for his life he was forced to ignore, because the Christian church needed a picture of the universe that did not conflict with the Scriptures, leaving plenty of room outside the sphere of stars for heaven and hell.

Ptolemy also fully described what has come to be known as the 'Moon illusion', in which the Moon hanging low over the horizon looks much bigger than when it is high in the sky. Actually it is the same size. This is not an optical effect but a psychological one.

The Mayan, the Chinese and the Egyptians, did seem to know about the longer Moon cycles and passed the knowledge on. In this way they were able to plot and plan over several lifetimes for solstices, equinoxes and eclipses. For instance, it was known that eclipses repeat

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on a cycle of exactly 6,585.3 days. We can guess that the cycles that were the most useful were those visible and immediately relevant to daily life. The Maya *tzolkin*, or 260-day cycle, the most important time unit in the Mayan calendar, was really the nine-Moon (265.7 day) interval between human conception and birth.

Ptolemy and the Greeks knew that the Moon moves around the Earth, but their faith in the purity of numbers, and therefore in the staunch belief that orbits all had to be circular, which symbolized perfection (thinking that God would not have created otherwise) prevented them from realising the true picture of Moon movement and caused a period of intellectual stagnation on the subject for 1300 years. Copernicus, a Polish astronomer, published a book in 1543, claiming that the Earth rotates on its axis, and, with the other planets in the solar system, revolves around the Sun. This was the birth of modern astronomy, yet even he was stuck on the notion of perfectly circular orbits.

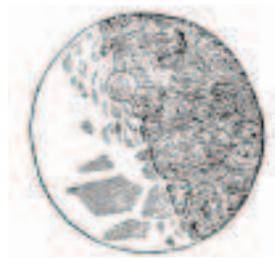
It was left to Johannes Kepler, whose first *Law*, published in 1609, stated that the planets and Moon move around the Sun in ellipses. His second Law, published in the same year, stated that the speed of a planet around the Sun depends on its distance. In other words, the nearer the faster. Mercury, which is 36 million miles from the Sun, moves much more quickly than Earth, at 93 million miles. Mercury's day is about 25 days long and its year 88 days..

The Moon, too, changes its speed as it comes nearer to Earth and slows as it moves away, all in the space of a month, with sometimes devastating climatic results to the

Early Moon Watchers

inhabitants of Earth.

The first known map of the Moon was drawn around 1600 by William Gilbert, physician to Queen Elizabeth I and pioneer investigator of magnetism. From 1609 onwards, Galileo, using telescopes built himself, made a whole series of dramatic discoveries of Moon features and or-



Galileo's drawing of the Moon

bits. Galileo did not invent the telescope, rather he made better lenses than were currently available, and so his peers might check his work he ground more which he sent to them.

Suddenly, telescope making was the rage. In 1647 Hevelius, a city councillor of Danzig in Poland built an observatory on the roof of his house and gave names to everything on the Moon he could think of. About half a dozen of his names are still in use. He also printed maps of the Moon, using ink on a copper-plate. After his death his maps survived, but the plate got melted down and made into a teapot.

Around this time, as serious scientific observation began, Moon worship began its decline in the Western world, due almost entirely to suppression by the Catholic Church.. For mediaeval Christians, comparisons between

Weather By The Moon

the Virgin Mary and the Moon were based on the Moon's physical perfection. Finding, by means of telescopes, that there were craters, mountains and other irregularities implied an unacceptable insult to the Mother of the Church.

Fertility and growth had always been a mystery to early thinkers and writers, hence the Moon, also mysterious, was always thought to be the king of mystery and magic. The catalogue of its lunar powers developed by the Egyptians, had been spread by the Greeks, and then by the Romans throughout the Western world through their military expansionism. When the Roman Empire declined, the ancient writings had been saved by the Arabs, who then in turn provided the principle sources of magic for the European Renaissance and hence for modern witchcraft.

By now, the believed ability of witches to control the fate of other individuals was feared by ordinary people. They and their Moon-based knowledge were rooted out in vicious inquisitions and the proponents rounded up and tortured or drowned. Moon worship went underground, as did much old wisdom as regards the powers of human thought and emotion, climate predicting, and planting knowledge.

Much remains still suppressed today. Yet two traditions centred around fertility persist. One is about childhood. A child born upon a Full Moon, it is said, will be strong, and long life will come to those born when the Moon is one day old. However, the dark of the Moon is the most unlucky time for birth. The other tradition is success in harvesting.

Early Moon Watchers

*Diana...Diana...Diana
I am summoning
Forty-five spirits from the west!
I am summoning forty-five sprits from the east!
Rains, rains, rains,
Give from your wide skies, burst water upon ius!
Behold our wine in your chalice,
Accept our offerings to you!
Send the dark clouds over us,
Surround our fields with stormy rains,
You who wield the thunderbolts,
We call upon thee!
Blessed be! Blessings be!
-From the Dianic Tradition and the Rites of Life by
Zsuzsanna Budapest*

They were the earliest of our modern astronomers and they set the foundations in place for modern science. Without Newton we would have no written physics for gravity. Without Franklin we would not have realised the electrical nature of storms. Nevertheless, Copernicus, Galileo, Kepler and those who came subsequent, like Benjamin Franklin, Sir Isaac Newton, Laplace and Lamarck all called themselves astrologers.

Weather By The Moon

PLANTING BY THE MOON

Early farmers always planted by the Moon. Because rainfall, temperature, and light affect the germination of seeds, it was important to know how the Moon affected weather. When the Moon passed in front of a particular constellation, cultivation, sowing and planting were enhanced. For instance, when the Moon passed in front of the sky region of Leo, not only was the formation of fruit and seed furthered, but the quality of the seeds was improved. The four formative trends appear in the sequence: - root, flower, leaf, fruit/seed, and these trends are repeated three times in the course of 27 days. The duration in which each impulse is active varies in length between one and a half and four days. The inner quality though, was considered to be individual to each constellation, which puts the Moon as the reflector of the ever-changing quality of the Sun throughout the course of the year.

MOON REGION	ASTROL. NAME	AFFECT ON
Bull, Virgin and Goat	Taurus, Virgo, Capricorn	Root development
Twins, Scales and Water Carrier	Gemini, Libra, Aquarius	Formation of the flower
Crab, Scorpion and the Fishes	Cancer, Scorpio, Pisces	Leaf region
Lion, Archer and Ram	Leo, Sagittarius, Aries	Fruit/seed region

Planting by the Moon



Moon, her chariots drawn by maidens, exerts her influence over wells, streams and the sea, fishing and boating of all kinds, and even over the travelling mountebank who is performing the cups and balls trick on the table in the distance.

-Ronan Picture Library and Royal Astronomical Society

Weather By The Moon

Almost all cultures we know of have set farming clocks around the month. Then crops were planted and harvested at particular phases.

MAORI AND THE MOON

The pre-European Maori month was purely a lunar one, commencing with the New Moon –or rather, with the *Whiro* night, when it is not visible – it follows that the named nights of the Moon’s age always presented in the same aspect, and so served as a reliable calendar. Maori farmers began planting *kumara* (sweet potato) on the nights called *Oue*, *Ari*, *Rakaunui*, *Rakaumatohi*, *Takirau*, and *Orongonui*, which were the 4th, 11th, 17th, 18th, 19th and 28th nights of the Moon or lunar month. No planting was done during Full Moon, nor on ‘*Korekore*’ days (21st, 22nd, and 23rd nights) for it was believed that very poor crops would result. Although absolute uniformity was rare among the various tribes of the Maori people, due to scattering and diversity; nevertheless, most planted close to these dates. The planting months were September, October and November.

‘Kumara was planted at the time when the Moon is due north, at Sunset, or twilight, the planting may be continued for three days. Some tribes planted the tubers only during spring tides, that is for a period of three days at that period’

An exception seems to have been for gourds, which were big tuber bowls grown for storage. They were not eaten but used to hold seeds and water. Because they required rapid vigorous growth, gourds were generally planted *on* the Full Moon. This practice seems widespread.

Maori and the Moon

TUHOELUNAR FISHING CALENDAR

1 2 3 4	Whiro Tirea Hoata Oue	Good fishing
5 6 7	Okoro Tamatea-tutahi Tamatea-anana	Poor nights for fishing. <i>Kokopu</i> do not sleep soundly
8 9 10 11 12 13	Tamatea-aio Tamatea-kaiariki Ari-matanui Huna Mawharu Maure	Very poor fishing-nights. On the <i>Ari</i> night the light of the torches will alarm the fish and so they dart away. On the <i>Huna</i> night the fish are concealed.
14 15 16 17 18 19 20 21 22	Ohua Atua Hotu Turu Rakau-nui Rakau-matohi Takirau Oika Korekore	Fishing impossible; Moonlight too strong; fish cannot be approached.
23	Korekore-piri-ki-te-Tangaroa	Fishing may be successful after midnight.
24 25 26 27 28 29 30	Tangaroa-amua Tangaroa-aroto Tangaroa-kiokio Otane Orongonui Mauri Mutuwhenua	

Weather By The Moon

A publication of the Bishop Museum at Honolulu states that the *Cucurbita maxima*, the giant Hawaiian gourd, was cultivated in pre-European Hawaii in this exact lunar period also. It seems to have been common practice throughout the Pacific.

Fishing was similarly tied to lunar events. Certain winds were known to blow at certain times of the month. To the eastern Maori, four days after New Moon came the so-called '*Winds of Tamatea*', which turned to blow from the east, bringing wind and a rougher sea – at least, on the East Coast. Fishermen did not venture out to sea during that period.

Some Moon phases were said to bring more fish. Although there was no written language, the Maori had a rich artistic culture and fishermen kept tallies using an intricate system of symbols. On the next page is a list of the Tuhoe tribe names of the 'nights of the Moon' as the Maori put it; (for they spoke of 'nights' where we use the term 'days') together with their value as fishing nights for the fish called *Kokupu*.

The typical Maori fisherman's calendar looked like a series of dots, dashes, crosses, L shapes etc. Perhaps it was all that remained of what might have once been a written almanac. After all, wherever the Maori people came from, thousands of years ago, there would have existed a written language, be it India, China, Egypt or the Americas. And each of those had accrued almanac information for thousands of years. The beginning of the Maori new year was the June New Moon coinciding with the appearance of Pleiades, located in Taurus, popularly known to us as the

Seven Sisters. The Maori called it Te Matariki.

A parallel mention to Pleiades appears in the Greek poet Hesiod's monthly calendar of *Works And Days*, written seven years before Christ was born. This was a written calendar, timed to the Moon phases for the whole year, and describing weather, planting and social information. In it one could find when to geld horses, when to hunt birds and when the north wind would blow.

At the time when the Pleiades, the daughters of Atlas, are rising begin your harvest, and plow again when they are setting.

The Pleiades are hidden for forty nights and forty days, and then, as the turn of the year reaches that point they show again, at the time you first sharpen your iron.

But if the desire for stormy sea-going seizes upon you why, when the Pleiades, running to escape from Orion's grim bulk, duck themselves under the misty face of the water, at that time the blasts of the winds are blowing from every direction then is no time to keep your ships on the wine-blue water.

Other passages in *Works* suggest that the disappearance of these particular stars around the Full Moons and Perigees (Moon was closest to the Earth.) of October and November was associated the deterioration of the weather, with consequent danger particularly to sailors. The second halves of those months were the worst

Oct: Do not sail

Nov: haul ship on land.

Weather By The Moon

There is even a right time and a wrong time in Hesiod to have sex:

*then is when the goats are at their fattest, when the wine tastes best,
women are most lascivious, but the men's strength fails them most, it shrivels them, knees and heads alike.*

This corresponded to early July in our calendar, when women are most desirous but men are in their most dried-up condition! For the opposite case, daytime around 12th September;

*the feel of a man's body changes
and he goes much lighter'*

And closer to our period, in 1688 an author wrote

the double conjunction of Venus and the Moon produces extreme lubricity, brings venereal disease, and causes women of quality to become enamored of menservants.'

MADNESS, ILL-WINDS, AND THE MOON

On the 24th June 1994, a tremendous thunderstorm over London flooded accident and emergency departments. Ten times as many people as would normally be seen for breathing problems were registered in the 30 hours after the storm and almost half those affected had never suffered asthma before. Many hospitals ran out of inhalers and drugs, and staff were stretched to the limit. On top of this there were over 50 ground strikes of lightning just prior to the deluge. Interestingly, the 24th June was also the day of the June Full Moon. It was also two days after the Perigee.

Much data has been collected connecting weather and human activities, from the increase of domestic disputes and violence around the Full and Perigee Moon to the frequency of the borrowing of non-fiction in public libraries. No-one has explained why these astronomical facts could be relevant. Scientists, psychiatrists and physicians have scratched their heads looking for more obscure explanations.

Although the Full Moon alone has long been said to account for more incidents of epilepsy, crime and heart attacks, mostly these reports are dismissed as folklore, because medical science would wish that modern thinking has gone beyond the primitive belief that the moon can make you sick.

The word *lunacy* is self evident. As recently as 1842 in Britain, the Lunacy Act declared officially that a lunatic was someone who was 'rational during the first two phases

Weather By The Moon

of the Moon, and afflicted with a period of fatuity in the period following the Full Moon.' Madness due to the Moon has been cited as defense in murder trials, as well as for drunkenness and theft. Crowd behavior is said to magnify, for the good and bad.

Whether or not you wish to believe the claims, the superintendents of mental hospitals used to put extra staff on overtime when a Full Moon was expected and even gave inmates a precautionary whipping. Yet there is evidence of more admissions at Full Moon. Patients already admitted also may be more disturbed than at other times. The Philadelphia Police Department reported that cases of fire-raising, kleptomania, homicidal alcoholism and other crimes against the person increased in number as the Moon waxed and decreased as it waned. Perhaps it is because the moon pulls energy and moisture upwards, and in humans this means more reaches the brain at heightened moon times. We are, after all, over 80% water.

Dr Frank A. Brown of Northwestern University took oysters from Long Island Sound on the east coast of the U.S. and moved them a thousand miles inland to Evanston, Illinois. In darkened, pressurized tanks, they continued to open and close their valves to the rhythm of the tides at Long Is. After two weeks they gradually changed their rhythm to that of the tides at Evanston *if* that city had been on a coast. Although shielded from the light of the Moon, they were clearly governed by its movement relative to the Earth at that location, indicating that their body clocks were affected by changes in terrestrial magnetism for which the Moon was responsible. If oysters were affected in this way,

it is conceivable that man would be too. Many have always thought so.

An old Cornish saying goes *No Moon, no man*. A baby born when no moon was visible would not live to be adult. In north-west Germany the Moon was regarded as a mid-wife, because births were believed to be more frequent when the tide was rising, just as many coastal inhabitants believed deaths occur on the outgoing water. Are these old wives tales?

Studies verify some of this. In a study of more than 11,000 births over a period of six years at the Methodist Hospital of Southern California in Los Angeles, it was found that six babies were born when the Moon was waxing(before Full Moon) to every five born when it was waning(after Full Moon). The same results were obtained in Freiburg, Bavaria, by Dr W. Buehler after studying 33,000 births, with the added refinement that boys tended to be born on the wax and girls on the wane.

Does the Moon affect other bodily processes? Dr Edson Andrews, a Florida ear-nose-and throat surgeon, found 82% of his patients bled and needed urgent operations around the time of the Full Moon. Dr F. Peterson found that in his Chicago practice, tuberculosis sufferers were more likely to die just after the Full Moon and least likely on the 11th previous day, probably because of Moon-induced changes in the acidity or alkalinity of the blood. This is of interest in my family at least, as the mother of my children, terminally ill with cancer, died on July 14th, 1995, two days after the Full Moon in perigee.

The Fiji military coup led by George Speight occurred

Weather By The Moon

on the day of Full moon, as did the invasion of Iraq by US forces. Sir Peter Blake, international yachtsman and environmentalist, met his death on the perigee. Perhaps the effects are due to gravitational pull of bodily fluids, or perhaps there is, as Dr Leonard J. Ravitz suggests, a link between lunar phase and changes in the electrical field that surrounds the human body.

Returning to the menstrual enigma, in the 1920s a Swedish chemist, Svante Arrhenius kept records of 11,807 menstrual periods, compared them with the phases of the Moon and found they were more likely to start when the Moon was waxing than at other times. This places ovulation 14 days earlier, around or just after New Moon, which supports a scenario of primitive Homo Sapiens mating during the dark moon time.

But unfortunately for the case, there must be many thousands of women who could produce contradictory results. However, the premenstrual syndrome is by now established. 63% of women surveyed in Britain's Holloway Prison committed crimes during their premenstrual or menstrual period. In girls schools a similar pattern emerges for menstrating pupils, of absenteeism, clumsiness, rebellion and low exam performance.

Even wind *directions* seem to affect humans. The Si-rocco is an oppressive hot dry southerly wind on the north coast of Africa blowing in from the Sahara. By the time it crosses the Mediterranean to Europe it has become cooler and moist. It is renowned for causing sluggishness and mental debility. The Southerly Buster is a sudden cold south-

erly wind in southeast Australia. It follows a warm northerly, and can make the temperature drop 36degF in a matter of hours, and induces miserableness and depression.

In the normally tropical Central American highlands, when the cold 'norther' hits, many Indians contract fatal pneumonia, just as many in North America get head colds in early spring. And in Canterbury, New Zealand, the cold breezes from the south can drop as the warm north wind from the tropics takes over. Visitors are told to watch out - a northwester will make you lethargic. A nameless east wind that blows over London only in the months of November and March was once linked by an 18th Century British court physician to regicide. Voltaire quotes the doctor, an acquaintance, as saying the wind caused

'black melancholy to spread over the nation. Dozens of dispirited Londoners hanged themselves, animals became unruly, people grew dim and desparate. Because of that east wind, said the doctor, Charles I was beheaded and James II deposed.'

Schoolteachers will complain that schoolchildren 'play up' more in dry weather than in humid conditions. When a wind is blowing they become more unsettled and cannot line up properly, and students seem to do better in exams when the Moon is in Perigee, Full or New, and/or if gusty weather is occurring outside the exam room.

Just why this is so seems to be linked to the Moon's often recorded influence in battles. Plutarch observed that a big battle is often followed by rain, and the notion that warfare somehow causes rain has surfaced with every war.

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It was still flourishing in the muddy trenches of World War I. The idea is that the sweat of soldiers produces rising rain-stimulating vapors, or that the waters are shaken from the clouds by the noise of cannon.

But it is more likely that men fight more when their adrenalin systems are stimulated by the lunar cycle, and that the same gravitational effect that the moon exerts to produce a storm or weather change will also produce a kind of micro-storm within a person's head. There would be a use, too, for a sympathetic climatic backdrop to the drama and excitement of an imminent battle.

There are several interesting examples of this. In January, 1777, during the early, critical days of the American Revolution, George Washington found himself trapped fighting against the British garrisoned at Princeton. On January 2nd the wind changed to the northwest and the roads began to freeze. Washington immediately took the offensive. He slipped out of the trap, marched his inspired army 12 miles to the outskirts of Princeton in the dead of night, and caught the British by surprise. And perhaps it was just a coincidence that it was also a New Moon.

The 6th of June 1944 proved marginal weather, with choppy seas and overcast skies. It was the Allied Invasion of Normandy. The Germans, doubting an invasion in such inclement conditions, were caught completely off guard. It was the week of the Moon's Perigee and the day of the Full Moon. Perhaps another coincidence?

No one can deny that aspects of the environment are predictable. Day follows night, summer follows winter, most of us sleep when it's dark, eat at midday and watch the

6.00pm news. Random events are for the most part whimsically quaint, as when the phone rings and it turns out to be the person you were thinking about. Oh, you exclaim, I must be psychic. But there is also a likelihood that between your and your friend's life, some parallel pattern exists unaware to you both..

The 'trade' winds blow steadily between latitudes 10deg and 30deg, from the NE in the Northern Hemisphere and from the SE in the Southern Hemisphere. Of importance to merchant sailing ships dependent on wind power, (hence called 'winds that blow trade' by 18th century navigators) the trade winds shift in direction in a predictable way according to the seasonal shift in the high-pressure belts.

They made the traffic in black slaves possible from the 16th to the late 19th Century. Ships voyaged out from Plymouth, England, on the northeast trades, from Europe to Africa's Guinea Coast with goods to be exchanged for human cargo. Then, loaded with slaves, the ships rode the southeast trades across the Atlantic to the West Indies and thence Charleston, South Carolina, there to barter the slaves for sugar, rum or cotton. Then they would follow the American coast northwards and return to Europe on the more northern prevailing westerlies to complete the trip..

Early sailors also relied on the 'Roaring Forties.' These are winds occurring at 40deg S latitude that blew steadily around The Horn. They were formerly known as the Brave West Winds.

The Monsoon is time-predictable (end of May and end of October) and has always played an important part in

Weather By The Moon

the economy of the Middle and Far East. It blew the frail craft of the first adventurous traders from the east coast of Africa across the Indian Ocean to the rich Malabar Coast of India. And in the First Century AD., Arabian mariners, trimming their sails to it, fared safely northeast across the Gulf of Aden to the mouth of the Indus River. Three centuries later, they rode the steady monsoon winds all the way to China.

Even today, India's economy is at the mercy of the monsoon. The country's huge rice crop, the staple food for its teeming millions, depends on moisture that the monsoon brings from the Indian Ocean. In Greek, *mene* means Moon, while the word *monsoon*, and *season* derive from from *mausim*, the Arab word for Moon.

Nature *is* predictable. It is often said that the weather is fickle. Surely not - the weather knows what it is doing. It is the forecasters who may be fickle. The whole thrust of science is towards discovering nature's patterns. Therefore to begin with there must be an assumption that some predictable patterns exist. As discoveries are made, more patterns are revealed. It would be more unusual to find that events occurred in isolation, with no precedence or subsequence. There is no true random, because what we know of random is also something predictable. 'Random' comes from the Old french word *randir*, meaning to run. Running is hardly a random activity.

So it is with the weather, which is triggered by the movements of the Moon. There is nothing mysterious about the moon's motion. It has been measured extensively and

is as predictable as clockwork. After 133 years, or 7 cycles of 19 years, the moon loses about 19 minutes, or 10 seconds per year. A watch with that degree of accuracy would indeed be valued..

But we cannot easily see slow movements. Try watching a child or a flower grow, or the big hand of a clock move. Because we do not see slow changes unless we write them down, we easily miss the variations in the way the Moon moves and appears to change, invisible to the naked eye even within just two days.

Little wonder then that memories of some changes of movement over longer periods, like certain cycles encompassing 8 years, 18.6 years, 133 years, 679 years and more, go unnoticed by most people. When we experience a flood or a tornado and tell each other that this has been the worst in living memory, we could be easily misleading themselves.

Living memory is a concept seized on by the media to create headlines. This sells newspapers. But in reality living memory does not go very far. Test this on a friend and you may find that more often than not, they may not be able to remember what the weather was doing or what they happened to be wearing Monday or Tuesday of last week.

Through the Phases

One of the most familiar things about the Moon is that it goes through phases from New (all shadow) to 1st Quarter (1/2 appears to be in shadow) to Full (all lit up) to Last Quarter (opposite to the first quarter) and back again to New. This cycle takes 29.53 days and is known as the Moon's *synodic* period. The Moon moves through four visibly differentiated phases in about four weeks. New Moon to 1st Quarter, to Full Moon, to Last Quarter, and back to New Moon again, occurs at nearly seven day intervals.

We know that the phases are due to how the Sun illuminates the Moon because of the relative positioning of the Earth, Moon and Sun. We observe that not much of the Moon is illuminated when it is close to the Sun. The smaller the angle between the Moon and the Sun, the less we see illuminated. When the angle is within about 6 degrees we see it in a New phase. Sometimes that angle is 0 degrees and we have a *solar eclipse* - the Moon is in New phase and it is covering up the Sun. Conversely, the greater this angular distance between the Moon and the Sun is, the more we see illuminated. Around 180 degrees we see the Moon in Full phase. Sometimes (about twice a year) the Moon-Sun angle is exactly 180 degrees and we see the Earth's shadow covering the Moon - a *lunar eclipse*. The table opposite gives a summary of about when the Moon is vis-

Through the Phases

ible and where to look. This applies everywhere in the world at roughly the same times of the local day.

PHASE	RISES in eastern sky	CROSSES southern sky in N hemisphere, northern sky in S. hemisphere	SETS in western sky
New Moon	Sunrise	Noon	Sunset
1st Quarter	Noon	Sunset	Midnight
Full Moon	Sunset	Midnight	Sunrise
3rd Quarter	Midnight	Sunrise	Noon

During its phases, the Moon does not shine with its own light, but gets its light from the Sun, as the Earth does. The shape of the Moon seems to change a little from night to night. But the Moon doesn't really change shape. Because the Moon circles the Earth once every day, only those on Earth who are in relative darkness can see it, and what they see is only the part of the Moon that has Sunlight falling on it. Most of us no longer believe that the Moon is born again when new, and dies on the wane, or that, as was the belief in Morocco, a completely new Moon comes each month, and the place where the Dead dwell, paradise, is full of old Moons.

We look at the Moon almost every time we look up and we think we know it. But presumably because it is so familiar, many people do not realise, that a *Full* Moon can be only seen at night, between sunrise and sunset, and never

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during the day. Or that during each month there is one day near Last Quarter when the Moon doesn't rise until after midnight and therefore into the *next* day, and one similar day near 1st Quarter when the Moon doesn't set.

The phases bring their own weather patterns. Cloudiness is quite influenced by small-scale local topography – ridges, bodies of water, hills and cities. But atmospheric-tidal effects make clouds formation predictable to some degree: the presence of clouds changing whether or not the Moon is risen or has set. For instance around a New Moon, if rain is about, as in the colder months, then we can more expect it between early evening and the following dawn, the skies being generally clearer during the day.

At the beginning of its Phase cycle, if you could imagine three balls viewed from above, being the Earth, Moon and Sun, it would be as if the Moon in the middle starts to move anticlockwise away from the Sun and around the Earth. Of course the Earth is spinning all the while within the Moon's orbit. Every time the Earth moves 360deg, the Moon moves 12deg.

The following Moon shapes apply to the northern hemisphere. In the Southern Hemisphere the Moon is reversed, so just think of it the other way round. This is because to those in the north, southern hemisphere folk are standing on their heads. In the northern hemisphere the moon moves from left sky to right sky(their East to West) but E to W as viewed from the south is from right to left.

NEW MOON

The New Moon cannot be seen during the day as the Sun's glare is too strong, nor at night, when it is on the other side of the world. Trying to see extremely 'young' moons is in some places a sport in itself. The record is 14.5 hours (two English housemaids in 1916). But at any age under 24 hours the Moon is breathtakingly thin and barely brighter than the low dense sky around it.

A day or two after New, the Moon appears as a thin sharp-horned crescent shape suspended above the western horizon, its cusps always pointing away from the Sun which is already set. At this stage it sets shortly after Sunset.



When it is two or three days out from New Moon, it goes by the name of *waxing crescent*.

WAXING CRESCENT .



At this time, any cloud around breakfast time may clear by 10.00am and stay clear until early evening. In the days following, it grows, (waxes) appearing when viewed from Earth at Sunset further away toward the east. It rises a bit less than an hour later each day, and in about a week after New Moon, appears as the familiar 'half-moon' shape, the 1st Quarter, which is overhead at sunset.

FIRST QUARTER



The 1st Quarter Moon is the Moon you see in daylight in the afternoon. Its glare (nearly 4 times fainter than that of the Full Moon, surprisingly) is in the sky in the evening, but if you wait up till about midnight it will be seen then to set.

Typical of the 1st Quarter could be cloud or rain (if about) before lunch, with clearer skies from lunchtime to midnight. In an overhead view the Moon would be to the right of Earth, and forming a Moon-Earth-Sun right-angle. Because the Moon is sitting on our orbital path around the sun, three and a half hours ago the Earth was where the Moon now is.

In the Northern Hemisphere, the 1st Quarter appears, when viewed from ground-level on Earth, as a D shape, but is reversed 'down under' in the Southern Hemisphere because viewers are viewing it moving in the opposite direction. Writing from the Southern Hemisphere, the little reminder I use is that when the Moon is approaching Full it is Coming and I think of the C shape. When it is on the other side of Full and approaching New it is Departing and I think of the D shape. As it is the reverse in the Northern Hemisphere, I would suggest readers there adopt *expa*nDing and Collapsing. A few days later in the month, more than half

its visible disk is lighted, called waxing gibbous.

WAXING GIBBOUS .



It can be seen high in the east late in the afternoon, and skies are more likely to remain clear until the wee small hours of the next morning. Any cloud or inclement weather generally appears in the early morning and could last until just after lunch.

FULL MOON



When it reaches Full Moon phase, the Moon is most prominent, rising opposite the setting Sun and illuminating the sky all night long with a pale yellow light. It is in the sky all night, so bright that you can't see any other stars except the major constellations.

There are more superstitions about this phase than any other. It is bad luck to view the Full Moon through the branches of a tree. The Full Moon has been said to cause madness, cause hair to grow on were-wolves, increase crime, eat clouds, swallow the wind and cause rain on a Saturday. Some of these would appear some hold truth: statistics have shown that violent storms are prevalent just after the Full and New Moons.

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From above and looking down, it would look as if the Moon was on the opposite side of the Earth to the Sun. When we gaze up at the Full Moon and see the night sky beyond it, we are gazing into the far reaches of the universe, beyond the limit of our orbit around the Sun, into space we never as a planet enter.

Full Moon is called a Night Moon, because that is the only time it is in our sky. When the Full Moon becomes a couple of days old, some may claim to be able to see it in the early morning, but although it is still quite full looking, it is no longer really a Full Moon. Over the Full Moon phase, cloud and rain, if about, will mainly appear during the day, clearing by evening and staying clear until sunrise the next day. If a barbecue is to be held, picking the full moon night of the month will usually guarantee clear weather.

Two weeks have now passed since New Moon. The Moon, continuing on its relentless orbit, comes around the Earth on the far side to once again approach the Sun. A few days out from Full Moon, it has become Waning Gibbous.

WANING GIBBOUS .



The Moon's appearance is now an exact mirror-image of the Waxing Crescent. From just before lunch until just before dinner is the likely period for cloud, whilst the skies

Through the Phases

are more likely to be clearer from an hour or two before midnight until morning tea the next day.

LAST QUARTER



A week after being Full Moon, the Moon is overhead at Sunrise, and is called 3rd or Last Quarter. It now looks like a C in the Northern Hemisphere and a D in the southern hemisphere. A mirror-image of the 1st Quarter, it is said now to be 'on the wane'.

Having risen progressively later during the night, it remains in the sky well after the Sun has come up. It is the Moon seen by daylight before lunch. Now, its position marks where Earth will be in space (on our orbit around the Sun) in three and a half hours time. At Last Quarter, one can typically expect any cloud or rain that is about, to be overhead in the afternoon and early evening, clearing somewhat by in the wee small hours of the following morning with skies staying reasonably clear until lunchtime the next day.

Two or three days later, the cloudiness appears mainly in the evening through midnight. Sometime in the night the skies are more likely to clear and stay clear until late afternoon the next day. Now the Moon is known as Waning Creescent:

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WANING CRESCENT,



In this phase, the Moon appears as a mirror image of the Waxing Crescent. Reduced to a thin banana shape, the gradually vanishing sliver can be glimpsed rising low in the east before Sunrise, before vanishing altogether for a couple of days as it becomes lost in the glow of the Sun's light.

We are at the month's end, the disk is gone. When we see no Moon we speak of the 'New Moon', but this is a misnomer because it is not really renewed until we see its crescent again a few days later in the evening twilight.

The whole phase process takes roughly 29 and a half days. In the past, weeks originated as quarters of this lunar cycle. If New Moon falls on a Sunday, so will 1st Quarter, 3 times out of 4. Almost all cultures we are aware of throughout ancient history have set their farming clocks around the moon's month. Crops were planted and harvested at particular phases.

Later we will cover a little more fully how each of the four phases can affect the weather. But for now, we need to have a closer look at gravitation.

Tides and What pulls What

The weather is nothing more than the Moon pulling the atmosphere around. Why it should do so is rather complex Newtonian physics, and how the weather around the world varies is due to the variations in the movements of the Moon. First we will examine the phenomenon of gravitational pull, and then what exactly is being pulled. Finally in this chapter we will discuss how this varies short and longterm.

WHAT IS A TIDE?

A common misconception is that the Moon revolves around the Earth, but actually the Moon and Earth revolve together around their common center of mass, or gravity. The two astronomical bodies are held together by gravitational attraction, but are simultaneously kept apart also by an equal and opposite centrifugal force produced by their individual revolutions around the center-of-mass of the Earth-Moon system. The centre-of-revolution of this motion of the Earth and Moon around their common center-of-mass (*barycentre*) lies at a point approximately 1,068 miles beneath the Earth's surface, on the side toward the Moon, and along a line connecting the individual centers

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of-mass of the Earth and Moon. However, at local points on, above, or within the Earth, these two forces of mutual planetary attraction are not in equilibrium, and oceanic, atmospheric, and Earth tides are the result.

ALL TIDES

All the tides are caused by different strengths of the Moon's gravity at different points on the Earth. The side of the Earth facing the Moon is about 4000 miles closer to the Moon than the center of the Earth is, and the Moon's gravity pulls on the near side of the Earth more strongly than on the Earth's center. This produces a tidal Earth bulge on the side of the Earth facing the Moon. The Earth rock is not perfectly rigid; the side facing the Moon responds by rising toward the Moon by a few inches on the near side. Estimates have ranged from 6-12 inches for the Earth Tide. The notion that the land beneath your feet, with you on it, rises a few inches to meet the moon as it passes overhead each day is hard to accept, as we have nothing to compare the vertical movement to.

The Sun and Moon pull on everything, and the resultant directions of those separate (and at New moon times, combined) pulls depend on the mass of what is being pulled. The more fluid seawater responds quicker than the land, and the air responds quicker than the sea. There is a bulge of water continually underneath the transiting moon which produces the ocean tides, but also a larger and quicker bulge of air and a smaller and slower bulge of land.

Whilst a known high sea tide is on the moon's side of the earth, it has often been speculated upon as to why there

is always a corresponding high tide on the earth's opposite side. About two centuries ago it was assumed that when the moon was on one side of the earth, it pulled the centre of the earth away from the sea on the other side, leaving a big hole into which the sea flowed back, causing a high tide there. The trouble with that idea was that the moon pulls on all parts of the earth. As it also pulls on the sea it could also be said that the sea gets lower on the opposite side of earth to the moon, and therefore a *lower* tide should result. Then somebody tried to explain it away by blaming centrifugal forces.

The idea came from the thought that centrifugal forces explained why the atmosphere was higher at the equator than at the poles, the idea being that it was 'thrown out' more as the earth rotated. The 'troposphere' is that lower region of the atmosphere, where the higher you go the cooler it gets. The troposphere is highest at the equator, being on the average about 18 km. high there. It is lower in the moderate latitudes, and only 4-6 km. high above the ground at the poles. The weight of the atmosphere is constantly changing as the changing barometric pressure indicates. Yet one would imagine centrifugal forces to be *constant*. The height of the atmosphere also is continually changing, as a daily lunar air tide would suggest.

It was worked out that the atmosphere rotates with the same angular velocity as the earth and behaves like a fluid, and using the known maths of centrifugal force it was calculated that Earth's polar and equatorial axes must be about 35,000 and 52,000 miles respectively; and so at the equator the atmosphere must extend more than 21,000 miles

above the ground. At these distances from the ground the gravitational force of the earth is JUST equal to the centrifugal force due to rotation. But from the measurement of the pressure of the earth's atmosphere, it was *later* deduced that the atmosphere is only 17 and not 21,000 miles high. More recent observations of the flight of meteorites and of the polar auroras leads to conjecture that the atmosphere reaches to a height of 130 miles (meteorites) or over 400 miles (polar auroras). Radio measurements yield about 200 miles for the upper layer. So computations based on centrifugal forces versus astronomical observation differ in the proportion of 17 and 21,000, which means they were drastically out in their calculations.

Centrifugal force would only explain why the atmosphere would be 5 times higher at the equator if the atmosphere was thrown out to 21,000 miles. The fact that it is only about 1% of that distance means that centrifugal force is negligible.

Something else pulls the atmosphere out of shape, and that something else piles up the high tide on both sides of the earth at once. The more likely explanation is the pull of the major luminaries. The Sun's gravity produces parallel tides that are about half as strong as the Moon's and produces its own pair of tidal bulges. They combine with the lunar tides. At New and Full Moon, the Sun and Moon produce tidal bulges that add together to produce extreme tides.

The *actual* reason for the two high seatides at once on opposite sides of the earth was solved by Newton, but no one understood him at the time. He attributed the effect to classical astrological principles, in which planetary bod-

ies exert pulls on earthly things at certain 'potent' angles. The moon and other planets pull on the oceans tangentially only at 45° angles which because of vector geometry nullify the earth's gravity. These angles can sum to 90° , 135° , 180° and 225° with equal potency, because in space there is no up or down, nor left or right. Therefore a strong pull at 45° will also register at 225° , which is exactly on the earth's opposite side. The tangential component is effectual as it acts at right angles to gravity and is therefore unopposed by it. Newton wrote "the Tangential Component varies as the Sine of Twice the altitude of the Sun or Moon, and when the altitude of these Luminaries is 45° the Force is at a maximum.."

Here was the key. For two and a half centuries it had been discoverable. Yet no one amongst the eminent and endowed men of science has recognised it, even to this day. The idea of planets behaving in this way has been labelled heretic for centuries, because it upsets those of religious conviction who would rather that a deity had sole influence over everything, and therefore that planets have no influential power. The schism of recent centuries between astrology and religion has come from this basic difference as to who or what is in control.

TIDES SLOW EARTH ROTATION

As the Earth rotates beneath the tidal bulges, it attempts to drag the bulges along with it. A large amount of friction is produced which slows down the Earth's spin. The result has been that the day has been getting longer and longer by about 0.0016 seconds each century.

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Over the course of time this can have a noticeable effect. Astronomers trying to compare ancient solar eclipse records with their predictions found that they were off by a significant amount. But when they took the slowing down of the Earth's rotation into account, their predictions agreed with the solar eclipse records. Also growth rings in ancient corals about 400 hundred million years old show that the day was only 22 hours long then, and that there were over 400 days in a year.

Gravity acts both ways. Eventually the Earth's rotation will slow down to where it keeps only one face toward the Moon. The Earth has also been creating tidal bulges on the Moon and has slowed it's rotation down so much that now it only rotates once every orbital period. For that reason the Moon now keeps one face always toward the Earth.

Ocean tides occur with a dominant period (the time between successive high or low tides) of 12 hours and 25 minutes. High tide comes twice a day; once under the Moon (or somewhat behind it, because friction with the solid Earth delays the water), and once when the Moon is on the opposite side of the Earth.

The Sun also has a tidal pull on the Earth, rather less than half that of the Moon. So at or just after the New and Full Moons of each month, when Sun, Moon and Earth are in line, the tide is amplified into a 'spring' tide (nothing to do with the season called spring)

There is a tidal swelling on *both* sides of the Earth. So whether spring tide is at New or Full Moon, if there is one floodtide under the noonday Sun, the other is at mid-

night.

As high tides are produced by the heaping action resulting from the horizontal flow of water toward two areas of the Earth representing positions of maximum attraction of combined Moon and Sun, low tides are created by a compensating maximum *withdrawal* of water from areas around the Earth midway between these two humps.

Normally there are two tides a day, called semi-diurnal. When there is only one tide per day, this is called diurnal tendency, and is caused by lunar declination, 28.5° from the equatorial plane. Twice a sidereal month (just under 15 days) during Full and New Moon the tides are the strongest tides, the spring tides. At 1st and Last Quarter of the Moon's phases the Sun and Moon pull at right angles to one another, and the tides are weakest, the neap tides.

When the Moon is near; that is, in Perigee, its tidal pull is greater. Perigees will be discussed a little more fully in the next chapter. Perigees are greater when they coincide with New or Full Moon. At these times of coincidence, we expect the highest tides of the year - those of greatest amplitude - and lowest low tides. Perigean spring tides may cause coastal flooding, especially if, as is usually the case, they happen to be accompanied by storms. This is because the Moon in Perigee acts in a more pronounced way on the *atmospheric* tide as well.

The tidal day is 24 hours 50 minutes, longer than 24 hours because of the lunar orbit. The Earth-Moon tidal coupling lengthens the day; this lengthening is due to tidal friction.

Weather By The Moon

Can the tide influence the wind? All motion and all energy are relative. Consider two large masses such as some of the Earth's atmosphere(air) and some of the Earth's surface(ocean). There is friction produced between the two bodies when they are not both at rest. When one of them starts moving, air across calm water or tidal motion underneath still air, the other will also be made to move due to that friction at the surface point of contact. It is not just here and there: Because of the areas of ocean involved there is a phenomenal friction effect. That is why a fog will often roll in on the tide.

Blow across a saucer of water and watch what happens. The amount of energy transferred will depend on the size of the masses, the area of the surfaces in contact, the roughness of those surfaces, the relative motion and the duration of the surface friction.

So just as the wind whips up the waves, so do the waves affect the wind. The air will be swept along by waves together with the swell if significantly large, because travelling waves encapsulate and pass on pockets of air. Between the tropics, the trade winds and the main sea currents flow in the same direction.

What if there was no Moon? Without a Moon in the sky there would be no life on Earth. The Sun would evaporate all the water of the seas to a cloud and the Earth would revolve inside the cloud. That enormous cloud would face the Sun all the time because the Sun would be the only gravitational attraction on Earth.

The Moon is slowing the earth down. The second consequence of the Moon's pull on Earth is to slow Earth's

Tides

rotation. As Earth's rotation speed decreases the Moon must move farther from Earth to conserve angular momentum. This process is slow. Every 350 years we have to add another second to the length of our year.

Tides also occur in large lakes, within the solid crust of the Earth, and in the atmosphere. The latter really *are* 'high' tides!

ATMOSPHERIC TIDES

The Sun is the major source of energy available to the Earth. At the Earth-Sun distance of 93,200,000 miles (150,000,000 km) about one two-billionth of the Sun's outpouring of energy (mostly in the visible-light range of the spectrum) is intercepted by us. Most of this is absorbed by the atmosphere and the solid Earth, giving rise to heating of the gas of the atmosphere and the rock and water of the surface.

The heat of the sun warms the atmosphere and the Earth. The atmosphere is a pile of gases 200 miles thick that, along with the body of water we call the sea, is held to the Earth by our own gravity. Without this gravity all the oceans would fly off into space. The atmosphere would go too.

What does the atmosphere weigh? The total weight of Earth's atmosphere is about 4.5×10^{18} kilograms, or nearly five thousand million million tons. Thus the weight of the atmosphere per unit area, or its pressure, is about a ton per square foot at sea level. A layer of water about 10 meters, or 33 feet deep sitting on the Earth at every point, would exert the same pressure at the Earth's surface as does

the atmosphere.

The scale of size of the atmosphere is incredible. The imagination can only boggle at something weighing so much that can, and frequently does when the Moon dictates, move so fast. There is no sea tide remotely like it.

On a hot afternoon, the atmosphere picks up water from the Gulf of Mexico at the rate of 5.5 billion tons an hour, hoists it up and carries it northeast by the millions of tons, to release it later as rain over New York and southern New England. A single, small, fluffy cloud may hold from 100 to 1,000 tons of moisture. A summer thunderstorm may unleash as much energy in its short life as a dozen Hiroshima-style bombs, and 45,000 thunderstorms are brewed around the Earth every day. Yet one hurricane releases almost as much energy in one second.

The very size of the atmosphere offers protection or shielding, between the Earth's surface and space. Without the shielding of the atmosphere, life could not continue on Earth; and without the atmosphere life could not have developed on Earth, at least in the form in which we know it. It is known, for example, that the Sun emits high - energy radiations - ultraviolet and X rays - and that even more energetic radiations - cosmic rays, pervade space; and these radiations would kill living things.

We know that they enter the atmosphere in lethal amounts but are stopped long before reaching the surface. The absorption by the atmosphere of these powerful forms of radiation accounts for many of the properties, particularly electrical, of the higher atmosphere.

Tides

The atmosphere shelters us from the fierce heat and cold of space, filters out damaging rays of sunlight and burns up several million billion meteors each day to harmless cinders before they reach the earth's surface. It pulls up water from the ocean surface and recycles it to nourish life all across the planet.

What constitutes the atmosphere? The mixture of gases is generally called air. Its main constituents are nitrogen and oxygen, in a ratio of about four to one. By percentage of volume of water, one part in 1000 is in the air.

Water source	Water volume (cubic miles)	% of total water
Oceans	317,000,000	97.24%
Icecaps, Glaciers	7,000,000	2.14%
Ground water	2,000,000	0.61%
Fresh-water lakes	30,000	0.009%
Inland seas	25,000	0.008%
Soil moisture	16,000	0.005%
Atmosphere	3,100	0.001%
Rivers	300	0.0001%
Total water volume	326,000,000	100%

(Source: Nace, U.S. Geological Survey, 1967)

By molecular weight, water vapor at 18 is the lightest component. Then comes nitrogen 28, 'AIR' 29, oxygen 32, argon 40, CO2 44, ozone 48, and CFCs the heaviest at over 100. It is clear that CO2 and CFCs being heavier than air constitute no global warming threat as they sink to the ground and there should be no ozone layer in the stratosphere - the ozone too should sink. yet the composition of the lowest 100km of the atmosphere is observed to be uni-

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form. The reason is that the atmosphere in the lowest 100km is turbulent and the gravitational separation is simply overwhelmed by the turbulence. Above 100km, there isn't so much turbulence, and the atmosphere does separate gravitationally.

There is only 350 parts per million of CO₂ in the atmosphere at any one time. Over 99% is permanently at either ground level or beneath the oceans.

COMPOSITION OF THE ATMOSPHERE	
Percentage in dry air	Gas
78.08	N ₂ (Nitrogen)
20.95	O ₂ (Oxygen)
0.93	Ar (Argon)
0.03(1)	CO ₂ (Carbon Dioxide)
0.0018	Ne (Neon)
0.0005	He (Helium)
0.0001	Kr (Krypton)
0.00005	H ₂ (Hydrogen)
0.000009	X (Xenon)

Weather, as it affects humans, is mostly confined to the lowest 15 to 25 kilometers (km) of the atmosphere, for it is in this lowest part that most of the mass of air is contained. (To convert kilometers to approximate number of miles, multiply by 0.6)

There is also weather in the *upper* part of the atmosphere from about 60 km above the Earth to a height of 300 to 1,000 km. Strong winds, storms, and great electrical

manifestations such as auroral displays occur there.

The atmosphere extends from the Earth's surface outward, becoming less dense. The Sun, too, has what we call an atmosphere, streaming out into space far beyond the orbit of the Earth, well into the outer reaches of the solar system. This *solar wind* flows around the Earth's magnetic field, creating an elongated cavity within which the Earth's atmosphere is confined. The outer limit of the solar wind has been estimated to be one light year, which is the distance you would reach if you travelled at the speed of light (186,000 miles per second, or 7 times around the earth in one second). As light from the Sun reaches us in 8 minutes, and thus we sit at only 8 minutes of a light year in distance away, the solar wind definitely has an effect on our environment.

The dependence of life upon the atmosphere is not a one-sided relation, for an atmosphere of some sort on primeval Earth not only allowed life to originate and develop but was itself modified, perhaps considerably, by living things. The free oxygen in the atmosphere, for example, would not exist without plant photosynthesis.

Humans really live between the sea of air and the sea of water, and these two seas are interrelated. Their reaction with each other is one of the important factors in weather. Weather is simply the state of the atmosphere: Is the air cool or hot? dry or moist? still or in motion (windy)? clear or cloudy?

From space, the atmosphere looks very thin. If the Earth was a round party balloon, the atmosphere would be only as thick as the rubber enclosing the air. If the earth

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was the size of a medicine ball, the atmosphere would be only 1 millimetre more in diameter. Moreover, on that scale the amount of water in the seas would be only a tablespoon-full, tipped onto the medicine ball. This seems surprising; if the seas covered the earth uniformly, they would only average one kilometre deep.

Just as the seas are free to move, so is the atmosphere, which is less dense and able to move quicker. Water is 800 times heavier than air. We have no trouble accepting that the moon moves the seas. Moving the air is easier and move it does, constantly.

The atmosphere is invisible to us. We don't see it, anymore than a fish sees water. Everything we sense is due its presence, for smells are carried on the wind, sounds are really air compressions, feelings on our skin surface are partly due to temperature changes, and visible colors are affected by the air which diffuses light.

The atmosphere is heated by the Sun when the Sun heats the Tropics, which is that imaginary line around the Earth at some 23° north of the line of the equator - Tropic of Cancer (the Northern Tropic) and the Tropic of Capricorn (the Southern Tropic) 23° south of the equator. 'Tropic' means *to turn*. The Tropics were the names given to the apparent limits of the northern and southern passages of the Sun. To peoples long ago they were the solstice point at which the Sun 'turned back' toward the Earth, as viewed from the ground. We still call this band the tropics - virtually the area of the Earth containing all places between imaginary latitude lines running through Sahara, Calcutta/Mexico - and Johannesburg, Brisbane and Rio de Janeiro.

Tides

Air has mass. A submarine has fins and propellers just as does an aeroplane. The vessel is held buoyant underwater because water has mass and can support something moving through it. An aeroplane is held up for the same reason. Air has weight. This can be proven by balancing an inflated balloon and a deflated one on either end of old-fashioned scales and see if one end goes down.

Because the atmosphere has mass it can be and is, pulled around by the gravitational pull of the moon, which acts on all movable things that have a mass. We have atmospheric tides for the same reason that we have sea tides.

The atmosphere shields us from the Sun's fierce rays and from the extreme cold of outer space. It acts as a blanket, an insulator, and as such holds heat from the Sun. As the atmosphere moves, it carries the Sun's heat with it. What makes the atmosphere move? There is only one possibility, the Moon. There is nothing else in the sky remotely near us. The Moon, by its gravitational pull, directly and daily distributes the Sun's heat around areas of the Earth when it pulls the atmosphere around.

The discovery that the Moon causes a daily atmospheric tide was made in 1939 by two British scientists, Appleton and Weekes. Yet to this day, many are still unaware that the air comes 'in' as the moon rises and goes 'out' when the moon sets. The fact that the atmosphere is moved by the Moon is a key to understanding the weather. How and where the Moon moves determines where the atmosphere goes. When the moon is over the Northern Hemisphere, there is more of the atmosphere on that side of the

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Earth. That does not mean that the Southern Hemisphere has no air, because if that was so everybody would suffocate. It merely means that as there is a bulge in the atmosphere, and so more of it is on the Moon's side. The Moon gravitationally pulls it because the atmosphere is a movable fluid. Consequently there is *always* an atmospheric bulge beneath the Moon.

Why is there not an atmospheric bulge equally on the opposite side of the Earth? Air acts as a liquid, but only in the sense that it can be moved around due to its fluidity. Bearing in mind that gravitation only has a pulling effect, the result is that the atmosphere is stretched under the moon and becomes more compacted on the opposite side of the earth. The difference between the air and the sea is that gases are by their nature compressable and stretchy, whereas water is neither.

With water there is a lag, due to the slowness of water to move against itself. Although some, there is not nearly so much lag with the atmosphere. Earth rotates at 1000mph and jet streams can go 500mph, so the air bulge moves almost as fast as the Moon.

At Perigee (when the moon is closest to earth, once per month)the atmospheric bulge of things on Earth towards the Moon is enhanced. After all, the Moon is closer and so exerts more gravitational pull. The stretching then gets more pronounced, as the air tide increases as does like the sea tide, a fact known to fish as they stay out at sea during Perigee and do not venture close to land.

These tides in the atmosphere have some effect upon

Tides

radio reception. Before satellites were employed, long distance radio communication was made practicable by the presence of reflecting layers in the upper part of the atmospheric blanket, known as the ionosphere. Researchers showed that reception was best when the Moon, Earth and Sun are in a straight line (either Full or new Moon)

The atmosphere keeps two things at bay - the intense searing heat of the Sun and the murderous cold of space. Wherever the atmosphere starts to thin, either of these two can enter more easily. Through less dense parts of the atmosphere, the cold of space descends and if rain is about, causes greater condensation of water droplets so that the rain falls. Since air behaves nearly as an ideal gas, and vertical distance is proportional to volume over a specified surface area, the thickness between two pressure levels is proportional to the mean temperature of air between those levels. So low values of thickness mean relatively cold air.

That's why the Moon, if over the Northern Hemisphere could bring bad weather news for the Southern Hemisphere. The effect of the lower air tide is opposite for summer and winter. In the hotter season, the relative lowering of the atmosphere offers relatively less resistance to the sun. With less protection from the sun's fierce heat, heat waves can ensue. In winter the lower atmosphere can bring increased cold which can translate into snowfalls and storms at night when the Sun no longer is in the sky to warm the ground. That is why a low atmospheric tide effect is common at night around New Moon time, when the Moon is on the opposite side of the Earth .

The rule is; when the Moon is in the sky, there is less

likelihood of rain.

It matters where the Full or New Moon is, that is to say, which hemisphere the Full moon is over. The Full Moon shifts hemispheres from summer to winter. During the Southern Hemisphere winter, the Full moon is over the southern part of the globe, and it is over the north for the Northern Hemisphere winter. When the Full moon is over the Northern Hemisphere during the southern summer, the Southern Hemisphere experiences a greater atmospheric tide effect.. The bulge in the atmosphere will be over the north, leaving the south with an atmosphere that is lower after the moon has set. That is why a winter Full Moon in the Southern Hemisphere generally brings either rainier conditions or more oppressive humidity.

The New Moon is the opposite case. It will be over the Southern Hemisphere in their summer but over the Northern Hemisphere in the northern winter, therefore over the opposite hemisphere to the one experiencing winter.

Games organisers would be wise to take note of this: Sporting events held in the afternoons, between Full Moon and Last Quarter have been shown to invite increased risk of heat exhaustion because of the extra heat coming through the shorter atmosphere. Any high energy event like the marathon should be held in the early morning of this Moon phase.

Clouds play a role in the effect of the atmospheric tide. They trap heat below them. This is often very striking at night. If a cloud layer is present in the winter, the air will be much warmer at night than if the sky was clear. If such a cloud layer dissipates, the temperature is sure to drop

sharply as the ground radiates its heat energy unhindered into space. In a shorter atmosphere, when a cloud obscures the sun, the temperature on the ground may suddenly turn cold. This occurs when the moon is between Full and Last Quarter.

The Moon acts too, to monitor the solar wind. Consider the Sun's role. The Sun is the major source of energy available to the Earth. At the Earth-Sun distance of 93,200,000 miles (150,000,000 km) about one two-billionth of the Sun's outpouring of energy, mostly in the visible-light range of the spectrum, is intercepted by us. Most of this is absorbed by the atmosphere and the solid Earth, giving rise to heating of the gases of the atmosphere and the rock and water of the surface. Although the sun irradiates the atmosphere between the Sun and the Earth, at the time of the New Moon and the 1st Quarter the Moon gets in the way and so there is a lower frequency of magnetic disturbance than between Full Moon and Last Quarter of the month. As more work has been done on the Moon's effect on the magnetic field, it has been realised that the Moon shields the Earth from the solar wind at New Moon, and that this magnetism decreases four days before Full Moon and increases again four days after the Full Moon. The cause is instability or disturbance in the magnetosphere tail, caused by the entry of the Moon to the Earth's magnetic tail, known to extend out beyond the orbit of the Moon.

It is this geometry of the tail and the Moon's orbital velocity that ensures the disturbance of the *neutral sheet* the day before the Full Moon.(1969 Fraser-Smith)

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The effect can be duplicated in gardening. Subjecting seeds to a magnetic field before planting increases the yield of certain crops. A Russian company does this via the Internet using a mail order system. Yet many indigenous peoples, including the Early Maori, did most of their planting just after the New Moon. Presumably this gave the seeds just enough magnetic dosage. Planting later would have been slightly too harsh. The question must be asked, did they discover this through trial and error or is this scientific knowledge thousands of years old? There is every reason to believe there were many peoples in NZ before the Fleet Warriors, and in the legends of the latter are descriptions of what was taught by those who came before - the *tangata whenua*, the Enlightened Ones, the 'guardians of the land.'

With the magnetic field effect sufficiently established, scientists (Lethbridge) analyzed thunderstorm frequencies for the U.S. in relation to the Full Moon. During a thunderstorm they measured the electrical potential of a tree and the ground. For several hours before the onset of a storm, the ground measured a positive electric potential of 60 mv for several hours. The electrodes in a tree showed also a 40-50mv potential. Then quite suddenly, the positive potential of the ground potential dropped to zero and became the negative potential of 20-30 mv. As the storm passed, this was reversed and the ground recorded a positive potential again of 60 mv. A very similar change occurred in the tree potentials prior to the storm, with the development of reversed polarity paralleling the Earth, beginning somewhat sooner and taking a little longer to develop. It could be said that planting seeds according to

the Moon's phase allows them to experience such electrical field changes.

We always talk about the Sun's heat, but the Moon has a heating effect on us too. In 1995 Robert Balling (of the team John Shaffer, Randall Cerveny and Robert Balling, of Arizona State University) found an influence of the Moon's phase on daily global temperatures. In the course of a lunar cycle, it happens that the global temperatures in the lower *troposphere* (the lowest 6 kilometers of the atmosphere) are warmest about 5 to 8 days before the Full Moon and coolest during the New Moon, after which the temperatures cooled.

During a period of nearly 5,934 days (more than 200 synodic cycles) between 1979 and the early months of 1995, the phase of the Moon accounted for a global variation in temperature of about 0.02 to 0.03 degrees Celsius. Maybe not enough to fear getting moonburnt, but it is significant enough to alter weather.

The same team found that the Moon also heats the Earth's poles. Using 17 years of satellite temperature data, they found that the poles show a temperature range of 0.55 degrees C during a lunar month. This range of temperature is 25 times greater than for global temperatures as a whole. It shows that there is a strong pole-ward transfer of heat near the Full Moon but the transfer weakens near the New Moon.

A study by Kirby Hanson and his colleagues at the National Oceanic and Atmospheric Administration showed a lunar effect on the timing of the maximum spring rainfall

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in different parts of the United States. It seems that maximum spring rainfall readings occurred progressively later in the synodic month as you moved from the West Coast to the East Coast, with a time-shift delay of about 13 days between the two coasts.

In any hemisphere, whether or not anticyclonic or cyclonic systems are generated depends on which way the Moon is progressing on its declination cycle, i.e. to the north or to the south. If one is in the Southern Hemisphere and the Moon is coming up from the south, the airflow causes anticyclones to be formed to the left and cyclones to the right. The cyclones are short-lived, because they are already well to the east. Anticyclones will then move over the country. This will be repeated around almost every southern declination in the Southern hemisphere. Southern declinations are usually accompanied, in winter, by Full moons. Colder weather more often features around Full moons, because most heat gets lost from the day when the skies are clear overnight.

WHAT CAUSES EARTHQUAKES?

Moon quakes do not have the frequency or power of quakes on Earth, but there are about 3,000 in the Moon per year, penetrating different layers of the Moon. There is evidence that moonquakes increase when the Moon is closest in its orbit to Earth. Correspondingly, we might expect an increase in earthquakes at that time, (the perigee) too. Earthquakes are triggered by the Moon in its monthly move-

Earthquakes

ment north and south of the equator and its orbit around the Earth. The word 'triggered' is used here because the Moon may pass over a danger point many times until the strain on a fault becomes too great, after which the fault may give in one sudden movement.

Picture a molten mass with overlapping plates floating on it. The tide beneath them moves and the plates are jostled. Eventually a tear or gap in the plates forms. The tectonic plates can only be moved about the planet by the Moon's orbit, for without a Moon there would no reason for them to move. It is the only regular gravitational attraction which can put steady pressure on such plates to dislodge them.

One of the main danger times is when the Moon is crossing the equator during the monthly declination cycle. This is the time while the Moon is moving quickly between the hemispheres. When the Moon is at the maximum 28° declination, it will cross the equator twice each month at about seven degrees in a day which gives considerable pull on the planet. At minimum 18° , it crosses at about four degrees in a day and the effect is less positive.

The other danger point is while the Moon is at either of the maximum declination positions north and south of the equator. The Moon is at those positions for about three days and does place considerable strain on the tectonic plates while there. It must be remembered that the Moon is always on the move and a quake can happen at any time.

Perigee has a grander tide too. It spends half of its 8.85 year orbit over each hemisphere in its turn. Around the end of year 1999 the Perigee started to leave the South-

ern Hemisphere and began occurring over the Northern Hemisphere. It featured there for about four years, placing a greater strain on the tectonic plates over the Southern Hemisphere while there.

In G. A. Elby's book "Earthquakes" (Heinemann 1980), 209 earthquakes dating back to 1505 were recorded with their dates. We can check each quake against Moon phases. 96% of those quakes recorded which were above 6 on the Richter Scale, occurred exactly on or within a day of one extreme feature of Moon cycle, that is, New Moon, Full Moon, Apogee or Perigee. 75% involved two factors; when the say, the Perigee plus Full or New moon were on the same day.

It is interesting that Apogee (Moon furthest away in the month) keeps popping up as a factor too. One can imagine a tent held by tight guy ropes. If one extra guy rope is added (viz. Perigee) the tension will be swung more in one direction. If one guy rope is removed (viz. Apogee), the whole system will tend to swing in the other direction. Also Apogee Moons covers a wider area because the precession angles combine with the further distance. The Moon could have a greater 'swing' between declination points, adding up to an extra trajectorial increment. Any plates 'due to go' so to speak, at the edge of the Moon's orbital influence, may receive a final push.

Precession angle? Declination points? We are getting ahead of ourselves. We should look first at Perigees more closely.

PERIGEES AND APOGEEES

The rising or setting Moon looks large on the horizon due to an illusion of perspective playing tricks on the eye. Apart from that, most assume the Full Moon high in the sky is always the same. A spectacular phenomena escapes notice by the vast majority of people simply because the eye and brain can't compare the size and brightness of objects observed on separate occasions. The Full Moon varies dramatically in size and intensity, and hardly anybody notices.

As the Moon travels anti-clockwise around the Earth, orbiting the same way as the Earth as both go around the Sun, it's orbit is not a perfect circle. That would indeed be a marvel. It does not remain a constant distance from the Earth. This was discovered or rediscovered by Hipparchus, the 2nd Century Greek astronomer, so it is by no means news. He realised that the Moon wanders in and out, towards the Earth and away again, as if the Moon is on a fixed spring, for the outer limit is relatively fixed and varies much less than the inner.

This cycle is called the Apogee/Perigee, or the Apsidal Cycle, and we say that the Moon's orbit around the Earth is *elliptical*, that is to say, off-centre, like a circus-clown's bicycle wheel. It has a substantial eccentricity, as major Solar System bodies go, of 5.49%. In addition, the tidal effect of the Sun's gravitational field increases this eccentricity when the orbit's major axis lines up with the Sun-Earth vector or, in other words, the Moon is Full or New.

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The combined effects of orbital eccentricity and the Sun's tides result in a substantial difference in the apparent size and brightness of the Moon at Perigee and Apogee. Apogee is generally about 404,510 km(252,700 miles) from the centre of the Moon to the centre of the Earth. Compare that to a typical Perigee of 359,000 km(221,500 miles). So from when the Moon is most distant from the Earth, to when it is at its closest point, there is a difference of about 50,211km (31,200 miles)

The changes in distance are thus quite considerable, and the Moon's apparent diameter at Apogee is only nine tenths of the same value at Perigee.



The difference is sufficient to add 20% to a high sea tide when the Moon is at Perigee, for this is when the Moon's gravitational attraction is at its strongest. But the difference is not marked enough to be noticeable with the naked eye. If this off-center orbit of the Moon were drawn to a scale of, say, three inches in diameter, so that it could be fitted onto a page of this book, it would look circular unless carefully measured.

Although extreme values for Perigee and Apogee distance occur when Perigee or Apogee passage occurs close

Perigees and Apogees

to New or Full Moon, long-term extremes are in the months near to Earth's perihelion passage (closest approach to the Sun, when the Sun's tidal effects are strongest) in the first few days of January. The Moon's perceived size is up to 25% larger at a Full-Moon Perigee compared to Apogee. Most people don't notice the difference because they see the Moon in a sky that offers no reference by which angular extent may be judged. To observe the difference, you have to either make a scale to measure the Moon, or else photograph the Moon at Perigee and Apogee and compare the pictures.

When Apollo 11 Commander Neil Armstrong walked on the Moon on that historic day of Monday July 21st, 1969 this date had been taken into account by the NASA planning team months before. The day of the Perigee for that month was July 28th, leaving them with a few days spare. The Moon was sitting at 357,925km away. Why wait for a Perigee? To save fuel. Why stack on board more weight than you have to? Especially 31,000 miles worth.

The fact that it was July was significant too. Perigees have an order, with one closest and others at different orders of closeness. July's was no ordinary Perigee, but the closest equal for the year, saving the project an extra 10,000kms of travelling distance than if they had chosen any other month than July or June in 1969.

When we gaze at the Moon on a still Full Moon evening we think of the Moon as being very bright but it is really no brighter than asphalt. Next time you see the Full Moon rising just after sunset, try to position yourself so

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you can see it alongside a stone wall. You will see that the Moon is no brighter than the appearance of stone in full sunlight. This is yet another illusion and due to the fact that we see the Moon against a dark sky.

When the Moon is Full near Perigee, you'd expect it to be brighter than a Full Moon near Apogee and it is - lots brighter. Since the Moon shines by reflecting Sunlight (not very well; it reflects only about 7% of the light that strikes it, about the same as a lump of coal) the two factors determining the intensity of Moonlight at the Earth are the intensity of sunlight striking the Moon and the distance reflected light travels from the Moon to the Earth.

Since the difference between the minimum and maximum distance of the Moon, 50,345 km, is an insignificant fraction of the average distance from the Sun to the Earth and Moon, 149,597,870 km, the intensity of sunlight at the Moon can be considered constant even though sunlight intensity at the Moon does vary due to the eccentricity of the Earth's orbit around the Sun. The intensity of light varies as the inverse square of the distance between a light source and the observer. For instance, considering the Perigee and Apogee distances from Earth in the sample photograph, the distance at Apogee was 1.1363 times the Perigee distance, and hence the Moon's intensity at Perigee was the square of this quantity, 1.2912 times brighter - about 30%.

Like the variation in angular size, few people ever notice this substantial difference in the intensity of moonlight at Perigee and Apogee because there's no absolute reference against which to compare them. If you could flick

Perigees and Apogees

a switch and move the Moon back and forth between Apogee and Perigee, the difference would be obvious, though not as evident as you might expect from a 30% change in illumination due to the logarithmic response of the human eye.

The Moon brightens dramatically when Full - interestingly, it is more than *twice* as bright at the moment of Fullness than only 2½ days before or afterward.

It may have been noticed that the two images of the Moon in the photograph differ not only in size, but in the position of features on the disc of the Moon. This might seem puzzling in light of the frequently-stated assertion that the Moon always keeps the same face toward the Earth. But this generalisation is not strictly true; in fact, the combination of the eccentricity and inclination of the Moon's orbit causes the Moon, as seen from the Earth, to nod up and down and left and right.

These apparent motions, the *lunar librations*, allow us to observe, over a period of time, more than 59% of the Moon's surface from the Earth, albeit with the terrain in the libration zones near the edge of the visible disc, only very obliquely. In other words, we really see more than half the Moon's face. However, librations have not been observed to in any way affect earth's weather.

The 'ecliptic' is the Sun's apparent path around the earth, which is actually the line of earth's orbit extended out into space. It is so named because it is the path along which eclipses occur. The ecliptic forms the arbitrary centre of the zodiac. When the Moon is south of the ecliptic due to its position along its inclined orbit, observers on

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Earth at that time are looking down onto the Moon's north pole, with the Moon's equator appearing below the middle of the visible disc. Since the Moon is, at that moment, south of the equator as seen from Earth, an observer in the Northern Hemisphere is additionally displaced northward and can see farther past the north pole of the Moon.

At the time of the Apogee photo, the situation was the opposite; the Moon was both above the ecliptic and $22\frac{1}{2}^\circ$ north of the celestial equator. Consequently, observers on Earth saw the south pole of the Moon tilted toward them, with the lunar equator displaced toward the northern limb of the Moon.

Why does this happen? When the Moon is closer to the Earth, around Perigee, its orbital motion is faster and carries it past the Earth faster than its constant rotation speed. But when the Moon is near Apogee, its slower orbital motion causes the rotation to get a bit ahead of the orbital motion, revealing terrain on the other side of the mean limb. The mean distance to the Moon, 384,401 km, is the semi-major axis of its elliptical orbit. The closest Perigee in the years 1750 through 2125 was 356,375 km on 4th January 1912. The most distant Apogee in the same period will be 406,720 km on 3rd of February 2125. In reality, extreme Perigees and Apogees always occur close to a New or Full Moon.

The mean distance is not equidistant between the minimum and maximum because the Sun's gravity perturbs the orbit away from a true ellipse. Although the absolute extremes are separated by many years, almost every year has a Perigee and Apogee close enough to the absolute lim-

its.

Apogee and Perigee are not on the same day each month, but if you kept a running record you would discover that 8.85 years is the exact length of the Apogee/Perigee cycle. Of that time, half (approx 4 years) is spent over one hemisphere, and half over the other. Whatever hemisphere the Perigee is over will generally be subject to more inclement weather around the globe during the Perigee duration.

The Moon, relatively speaking, speeds up and slows down at different rates in the four weeks from one Perigee to the next, moving at its greatest speed when it is at Perigee and at its slowest when furthest from the Earth at Apogee. The Moon's speed is also affected by the lunar phases, since the Sun's pull on the Moon is different in the various lunar quadrants. For instance, the Moon moves faster from the Last Quarter to the New Moon, and slower from the New Moon to the First Quarter. It also speeds up from the First Quarter to the Full Moon, and slows down from the Full Moon to the Last Quarter. A quickening also occurs at lunar equinox - when it crosses the equator twice a month. When the Moon speeds up its gravitational pull is enhanced. Speed and force are intertwined. A bullet thrown at the wall by hand will only bounce off it, but if fired from a gun will go through the wall. All that has been added to the bullet is extra speed, but it manifests as force. In a similar way, the secret of breaking blocks with the edge of the hand in a karate chop is the speed the hand is travelling. A faster Moon might, given the season, induce gale winds and changeability, faster weather systems, thunderstorms or tropical cy-

clones.

IN FISHING

It was important for Maori to know when Perigee occurred because it affected the fishing.. At Perigee the extra gravitational effect whips up the tides and the weather, causing higher tides and rougher seas. Fish don't come near the shore at this time because the churning of the sea near the shallows causes sand to get in their gills. So the fishermen would stay home. Besides, it was safer. But at Apogee, when the Moon was far away, therefore having less pull, the conditions were calmer and the fish swam closer to the land. The Maori fishing calendar is Perigee/Apogee-driven, and it makes good sense. Fishermen will tell you even today, that fish bite better a couple of days just before a storm. A storm is usually Perigee-driven and the fish are soon going to have to swim further out where food supply is scarcer. So after the storm they will be back, and hungry. It will be good fishing then too. The Maori priest in charge of fishing (the *tohunga*) had to know in advance when perigee was imminent. It was not uncommon for the fishing *tohunga* to be put to death if he was wrong. Moon was in Perigee was secret knowledge, passed from teacher to apprentice.

How did the early Maori priest know when it was Perigee? He used a callibrated measuring stick to tell him when the Moon was closest. It is simple enough to run your thumb along a stick with the arm outstretched, and measure the size of the diameter of the Moon (whenever it was visible) around that month. Add two weeks or 14 days and you have

Perigees and Apogees

the Apogee. Go a couple of days each side of perigee and you know when to best fish or when to expect poor returns..

In Europe it was believed there were parallels in the way the Moon orbits around earth and the way the Earth orbits around the Sun. Full Moon was compared to summer and the New Moon in its darkness to winter. Emergence from the New Moon was regarded as a spring-like renewal, whilst Last Quarter suggested a mini-autumn. At Christmas time the Sun stands at its lowest point against the background of the Archer.

There is some truth to this with regard to weather, even if it appears a little whimsical. The best climatic conditions for the month are more likely to be New Moon to First Quarter, whilst thunderstorms and lightning are more common around Last Quarter.

IN PLANTING

The effect of plant growth during Apogee was traditionally compared to the time of year when the Earth is furthest from the Sun:

The tendency in the plant-world is to run to seed, when the growth forces decrease. This more settled nature is reminiscent of mid-summer. Thus the effect of the Moon's Apogee on *seed* plants can be beneficial, giving settling time in the soil without the to-ing and fro-ing of the soil's fluids. For the sowing of leaf crops, however, this time is definitely unfavourable. Carrots sown during these days

Weather By The Moon

easily become woody. The only leafy plant to react posi-

FOR	TIME OF CYCLE	BACKGROUND	EVENT	EFFECT
SUN				
	Christmas	Archer	Winter solstice	day shortest length, starts getting longer
	Easter	Fishes	Spring equinox	day and night equal length
	Midsummer		Summer solstice	Longest day, shortest night
	Michaelmas		Autumn equinox	Day and night equal length
MOON				
	Lowest point	Archer		Plant forces start getting stronger
	Highest point	Twins		Greatest growth point, plant now begins orienting itself more towards the root.

tively to being sown at apogee is the potato.

But the Moon's Perigee, which can be compared to a midwinter with the Earth nearer to the Sun, has a very different effect. For seed plants, germination is poor. Most of these plants are inhibited in their growth and are also more subject to attacks from fungus diseases and pests. Apogee days are mainly clear and bright, whilst those at Perigee are mostly dull, heavy or rainy. These principles remain in force today as the basis for biodynamic gardeners who plant by the Moon.

Perigees and Apogees

PERIGEE AND DISASTERS

Most of New Zealand's major weather-related disasters have occurred around the Perigee. Below are some well known events that have been written into New Zealand's history books.

There are many more; but space does not permit the listing of all. As the Earth passes under the Moon in 24 hours, the reader might care to delve into newspaper reports and see if other areas around the globe received inclement conditions at roughly the same times.

COMPARING CYCLES

The Perigee/Apogee cycle alternates every 4 years, as can be seen in the next table of Perigees. Every 4 years

EVENT	DATE	PERIGEE
Napier Earthquake	3/2/31	Same day
Tangiwai Disaster	24/12/53	Same week
Wahine Disaster	10/4/68	Same week
Abbotsford Slip	8/8/79	Next day
Cyclone Tracy	25/12/74	Same week
Cyclones Bola and Dreena	10/1/97	Same day
Cyclone Cora	25/12/98	Same week
Tsunami New Guinea	19/7/98	Two days before
Hurricanes S. America	3/11/98	Next day
Floods Hokianga. NZ	21/1/99	Same week
Columba Earthquake	26/1/99	Same day

Weather By The Moon

Perigee also changes hemispheres. As can be seen, Perigee dates for 1991 nearly match those in 1995; those in 1992 nearly match those in 1996 etc. Is there a cycle that takes into account both the New/Full Moon and Perigee/Apogee cycles, such that the Moon exactly repeats itself in both of these ways? Yes; every 133 years! If you have newspaper records of weather at your locality 133 years ago, it will match what happens today. So, for example, 1st April 2003 will be not unlike 1st April 1870.

Compare the tables on the next pages for the year 1730, +133 to get to the year 1863, +133 to get to 1996 etc., to find parallels for dates of phases and Perigee/Apogees. Uncannily, the parallel days are no more than 3 days

	1991	1992	1993	1994	1995	1996	1997	1998	1999
JAN	28th	19th	10th	6th/- 31st	27th	19th	10th	3rd/- 30th	26th
FEB	25th	17th	7th	27th	23th	17th	7th	27th	20th
MAR	22nd	16th	8th	28th	20th	16th	8th	28th	20th
APR	17th	13th	5th	25th	17th	11th	5th	25th	17th
MAY	15th	8th	4/31	24th	15th	6th	3/39	24th	15th
JUN	13th	4th	25th	21st	13th	3rd	24th	20th	13th
JUL	11th	1/30	22nd	18th	11th	1/30	21st	16th	11th
AUG	8th	27th	19th	12th	8th	27th	19th	11th	7th
SEP	5th	25th	16th	8th	5/30	24th	16th	8th	2nd
OCT	2/27	23rd	15th	6th	26th	22nd	15th	6th	26th
NOV	24th	18th	12th	3rd	23rd	16th	12th	4th	23rd
DEC	22nd	13th	10th	2/30	22nd	13th	9th	2/30	22nd

Perigees and Apogees

out in 400 years. But are ALL years close to that pattern? Definitely not. In the final table on the next page, examine the first few dates for say, 1978. They are way out.

It is interesting to ponder the fact that 133 is exactly 19×7 . This was another connection to the ancient mysticism of the number 7. Also, nineteen years, in the social history of most of the world's cultures, is nearly the period length we loosely call a generation. (*gene* = to repeat)

Weather By The Moon

YEAR 1730	Perigee	Apogee	New Moon	Full Moon
JAN	17th	1st/29th	18th	4th
FEB	14th	26th	17th	3rd
MAR	12th	25th	18th	4th
APR	6th	22nd	17th	3rd
MAY	4th	20th	16th	2nd
JUN	1st/30th	16th	15th	1st/30th
JUL	28th	13th	15th	29th
AUG	25th	10th	13th	28th
SEP	22nd	6th	12th	26th
OCT	17th	4th	11th	25th
NOV	13th	1st/29th	10th	24th
DEC	11th	26th	9th	24th

YEAR 1863	Perigee	Apogee	New Moon	Full Moon
JAN	18th	3rd/30th	19th	5th
FEB	15th	27th	18th	3rd
MAR	15th	27th	19th	5th
APR	9th	24th	18th	4th
MAY	6th	22nd	17th	3rd
JUN	3rd	18th	16th	1st
JUL	1st/30th	15th	15th	1st/30th
AUG	27th	11th	14th	28th
SEP	24th	8th	13th	27th
OCT	20th	6th	12th	26th
NOV	15th	3rd/30th	11th	25th
DEC	12th	28th	10th	25th

Comparing Cycles

YEAR 1996	Perigee	Apogee	New Moon	Full Moon
JAN	19th	5th	20th	5th
FEB	17th	1st/29th	18th	4th
MAR	16th	28th	19th	5th
APR	11th	24th	17th	4th
MAY	6th	22nd	17th	3rd
JUN	3rd	19th	16th	1st
JUL	1st/30th	16th	15th	1st/30th
AUG	27th	12th	14th	28th
SEP	24th	9th	12th	27th
OCT	22th	6th	12th	26th
NOV	16th	3rd	11th	25th
DEC	13th	1st/29th	10th	24th

YEAR 2129	Perigee	Apogee	New Moon	Full Moon
JAN	20th	6th	20th	5th
FEB	17th	2nd	18th	4th
MAR	17th	1st/29th	20th	6th
APR	13th	26th	18th	4th
MAY	8th	24th	18th	4th
JUN	5th	20th	16th	2nd
JUL	3rd/31st	18th	16th	2nd/31st
AUG	29th	14th	15th	29th
SEP	26th	10th	13th	28th
OCT	24th	8th	13th	27th
NOV	19th	5th	11th	25th
DEC	14th	3rd/30th	11th	25th

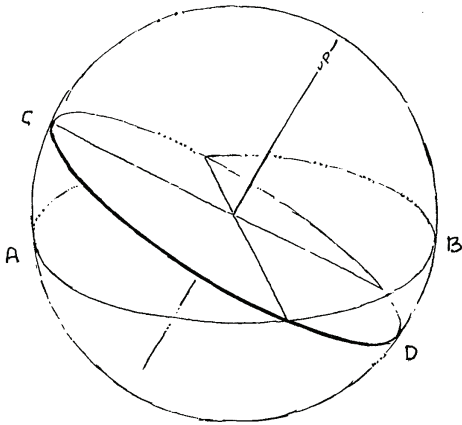
Weather By The Moon

YEAR 1978	Perigee	Apogee	New Moon	Full Moon
JAN	8th	21st	9th	24th
FEB	5th	17th	7th	23rd
MAR	5th/31st	17th	9th	24th
APR	26th	12th	7th	22rd
MAY	24th	24th	7th	4th

(not a printer's mistake, intentionally cut-off)

The Moon's Declination

Many folk think the Earth is, in space, like the diagram on the previous page. But it's really more like this. Imagine if you will, that AB is a ball with a spinning top called CD, spinning inside it around the direction of C then out of the page towards your chest and then on to D



and around again. Imagine the inner spinning top is the Earth.

For this is what it looks like. CD is the Earth's equator. BOD is the Earth's tilt. The Earth slides around the Sun in the plane of AB, tilted all the while. It's this tilt, CD as compared to AB, about 23.5 degrees, (measured through BOD), that gives us our seasons, because the parts of the Earth at any one time leaning closer to the Sun are having their summer. The tilt always tilts the same way, and because it goes around the Sun in the same fixed tilted position, for half the year the top of the tilt is closer to the sun and for the other half of the year it is the turn of the bottom half, which means the Earth spends six months on one side of the Sun and six months on the other. This tilt *is* slowly changing, varying between 21 and 24 degrees and taking 42,000 years for that little variation, which means our seasons are very slowly getting longer, but that need not concern us in our discussion about the Moon.

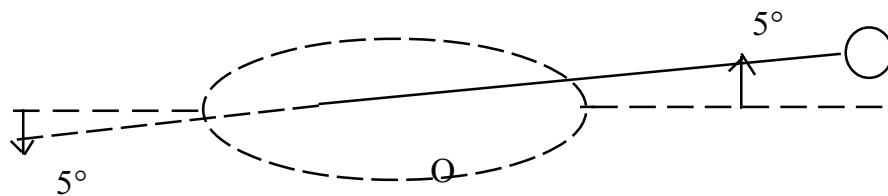
Most satellites that are close to their planets such as our Moon is, revolve in their planets' equatorial planes, that is to say, the Moon would be expected to go around us at CD. But not this moon. Our satellite ignores the Earth's equator and swims merrily along in the same plane around the Sun as the Earth does, which is AB (the ecliptic plane). That is because it is more influenced by the Sun and therefore its orbit around the Sun, than it is by the Earth and its orbit around the Earth.

However, the Moon's movement around AB is *not* in a flat plane. Have you ever held a dinner plate just above a table, given it a slight turn and dropped it? If it doesn't break, it hits the table and wobbles round and round as it settles

Declination

on the table surface. If you could imagine circle AB having a wider circle around it – that would be the Moon’s orbit – and this wider-circle-moon’s-orbit behaves just like a wobbly dinner plate - while AB is steady, the wider circle wobbles around it. How much does it wobble up and down with respect to AB?

Assuming we take our reference point as the plane of AB, it varies a maximum of 5 degrees above and then 5 degrees below the ecliptic (the plane of AB - its orbit plane around the Sun) on the opposite side of the Earth, crossing the equator as it goes around one cycle of AB. That takes a month. For two weeks it is above AB and for the next two weeks it is below AB. This wobbly action has nothing to do with the Full/New Moon phases or the Perigee/Apogee. It’s a separate cycle, called the *monthly declination cycle*.



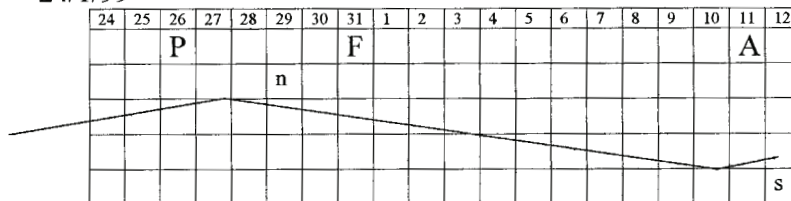
Weather By The Moon

So for half the month the Moon is rising in the north-east, and for the other half of the month it is rising in the southeast. Also, twice a month it crosses the equator - once going from southern declination point to northern, and once going from northern declination point to reach the southern point.. How does it affect the weather?

When the Moon peaks at its northern monthly declination *or* its southern monthly declination, the weather can be said to be *slow-moving*, because the moon is moving parallel to the Earth's rotation and things are held relatively steady for two or three days. That goes for good weather or bad. The weather bureaus sometimes call this slow down a 'blocking' system, as if something was preventing any faster movement. But nothing is being 'blocked'.

This happens twice-monthly. Then the Moon starts to plunge down or up from its declination points, picking up angular momentum and moving faster as it crosses the equator at AB. As it moves past AB the Moon tends to cause the weather to be changeable because of its faster movement. It is akin to the faster movement at the midpoint of a pendulum. Whatever weather is around at the start of the time of northern or southern declinations will last 3 or 4

24/1/99



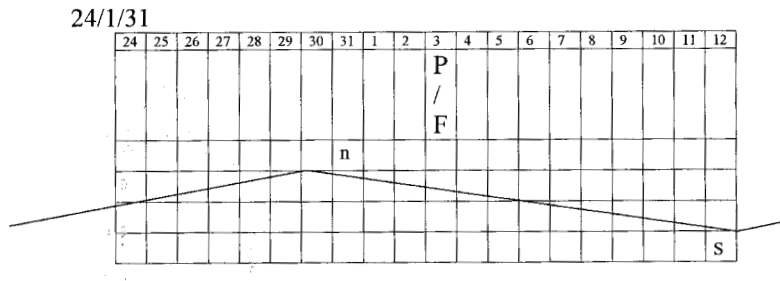
Declination

days, while weather occurring when the Moon is crossing the equator cannot be trusted to last for too long.

Weather disasters often occur when the Moon is in the opposite declination to where you happen to be. If the Moon is up at its northern point, the Southern Hemisphere can get bad weather and vice versa. This will be further described when we look at the effects of the *atmospheric tide*.

Look at the weather chart for the week of 24th Jan, 1999. This was the week of the devastating Earthquake disaster in western Columba, where over 1000 people died. The date of the disaster was the 26th of January 1999; exactly on the Perigee. Three factors, all Moon-related, are in evidence here.

The Perigee can be relied on to cause trouble, and it's proximity to the Full Moon for that month increases the gravitational effect of the Moon upon the Earth. But our attention might also be drawn to the fact that the Moon is near the northern declination on the date. This would add to the fuss. That means that the moon was already 'over that way', actually almost directly overhead at the time. Four coincidences.



Weather By The Moon

But then almost to the day (March 26,th to be exact) on another Full Moon day in 1812 there was an Earthquake in exactly the same place; Columbia. That was 187 years ago, which, being 18.6×10 is exactly 10 full *maximum* declination cycles of the Moon, earlier. Maximum declination cycles are described in the next chapter.

Let's look at another Earthquake, this time the gigantic Napier Earthquake in New Zealand, in 1931.

Once again, a major quake occurred within a day or two of the northern declination for that month (January).

The position of the Moon north or south seems to seriously affect most weather, and the northern or southern declination points are the touchstones. It is not just earthquakes; - thunderstorms, tornadoes, tsunamis, cyclones, hurricanes and floods are all part of the same process of increased gravitational pull.

When we looking at a weather map, we want to know the direction of the weather; that is, whether or not an anticyclone(fine weather) that might be sitting north of the country at present, will pass over our country or skip us by. The rules are quite simple. If the Moon is at either its northern or southern monthly declination points, the weather situation will remain as it is for a few days. Mostly, *the weather will move at this time along the latitude lines.* This situation persists for a couple of days on either side of the declination point. Therefore, if the anticyclone in question is north of us, it will stay north and go slowly from west to east. Winds will be mainly westerlies.

Declination

But if the Moon is not at either the northern or southern declination points, but is crossing the equator, it drags anticyclones with it in the same direction. So if the anticyclone is north of us and the Moon is travelling between north and south, the anticyclone will be pulled by the Moon down across the country on a diagonal *across the latitude lines*. On the weather map this will be southwest up to northeast when the Moon is travelling to its northern point and northwest to southeast when the Moon is travelling towards the southern declination point.

More frequent and slower moving anticyclones, especially over the South Island of NZ, leads to brief periods of cold southerlies and in winter it leads to increased frostiness. Whether or not anticyclonic or cyclonic systems are generated depends on which way the moon is going. If coming up from the south, the airflow causes anticyclones to be formed to the left and cyclonics to the right. The cyclonics are short-lived, because they are already well to the east. Anticyclones will then typically move over the country. You will get this happening around almost every southern declination. Southern declinations are usually accompanied, in winter, by full moons. Colder weather more often applies around full moons, when the skies are clear overnight and heat gets lost from the day.

In the opposite hemisphere, if coming down from the northern dec, the SE airflow would still cause anticyclones to be formed to the left (as viewed from space) and cyclonics to the right. The northern hemisphere would typically get this happening around a northern declination. Northern declinations in the northern hemisphere are usu-

Weather By The Moon

ally accompanied, in summer, by new moons. Once again, colder weather in winter more often applies around full moons, when the northern declination plays host to the full moon phase and the atmosphere is stretched at night.

The 27.5 day monthly cycle of lunar declination contributes to the overall tidal effects. The closer the Moon comes to being overhead, the more powerful are its effects. The greatest possible astronomical tide-generating force occurs when, at the same time, the Sun is at its Perigee, the Sun and Moon are at Full or New Moon and both the Sun and Moon have zero declination. This is called the Nodal Cycle and happens about once in 1600 years. It happened in 250 B.C., 1400 A.D, and it will occur again around 3300 A.D.

In the story so far, the Moon rises along the eastern horizon and sets along that of the west, due to the real rotation of the Earth from west to east. The Moon is also moving in its orbit from west to east, so it seems to travel eastward among the stars, covering about 13° per day. The apparent path of the Moon is not very different from that of the Sun - the angle between the two is only 5° , which is not very much even though it is sufficient to prevent eclipses occurring every month. The Moon wobbles, going around the Earth from a northernmost point to a southernmost in 14-days, and then back up again. It also comes in closer once per month, and has a corresponding furthest point away two weeks later

Syzygy refers to the situation whereby the centers of

Declination

the Sun, the Earth, and the Moon lie along a common line. One of the most devastating east-coast coastal storms on record in the USA took place during 5th - 8th March in 1962. The New Moon, Perigee, and crossing the equator combined on 6th March 1962. When the Moon is over the Earth's Equator (as in the months of Spring and Fall Equinoxes), the amplitudes of morning and night-time tides are the same. In March 1962, 5 successive high tides fell into the category of super-elevated Perigee spring tides of nearly equal magnitudes. The storm center became blocked so that the high winds kept blowing, all the while that the higher-than-normal astronomic tides of equal magnitude were moving in and out. The result was huge and widespread destruction.

There is a large electrical factor too, in violent storms. The Moon is magnetically locked to the Earth. Surges in the magnetic field cause inductive heating in the core/mantle of the Earth. Increases in the global magnetic fields add energy to hurricanes that are moving to the mid-latitudes, in synchronisation with the lunar equatorial crossings (North or South). In other words, if there is a storm brewing around the middle band of Earth and the Moon is crossing the equator at that moment, the storm will be magnified.

Imagine that a wobbling dinner plate settles a bit so it nearly flattens out and then as you watch, it slowly rises up again into a bigger wobble. You keep watching and you see it settle back down again, only to rise again later and repeat

the pattern. It's almost as if it is on an expanding and contracting screw-thread.

It is this variation in the wobble that produces the so-called Greenhouse Effect, Southern Oscillation, Humboldt Current Effect, Global Warming, El Nino, and La Nina patterns. The scientific world is currently in a tizz over these words and has been since 1987. But since 1863, the planet's temperature has risen by only 0.1°C, and so far the effects have not been too catastrophic.

No, the earth is not anywhere yet heating up to furnace point, the poles aren't melting, we won't suffocate to death because of aerosols killing all the oxygen, and nor are motorcars killing the planet. We should curb pollution that messes up our immediate environment, but there is nothing to panic over. When one realises what the Moon is doing, it is clear that its cycles are predictable. It has been moving from one end of its cycle to the other for thousands of years; and the weather has followed suit.

MAXIMUM DECLINATION

Let us recall how a spinning and wobbling flat dinner plate might slowly rise up again into a bigger wobble, only to settle back down a bit and repeat the process. Imagine that on the edge of such a spinning plane sits the Moon. That is the picture for each month, one spin every 27 and a half days. For each monthly declination, we pictured the Moon starting on AB as a reference point and going around while dipping below and then around further and coming back up to the beginning again. It does this month in and

Declination

month out, year in and year out as the monthly ‘declination cycle’. It gets complicated, as this cycle *itself* undergoes a gradual change.

We can think of it starting around AB. Let’s call that the low-point. The Moon wobbles around the Earth all year, about 13 times. After a year of such monthly declinations, it has changed slowly, by 1° , either north or south depending on where it is in the cycle. That means the declination angle changes $1/13^\circ$ or 0.08° per month. So after a year it has risen up into a slightly bigger wobble - still crossing AB to go underneath, still circling the Earth once per month with a northern and southern declination and two equatorial crossings. But its *range* of movement to the north and south along the eastern horizon is now slightly more than it was the previous year.

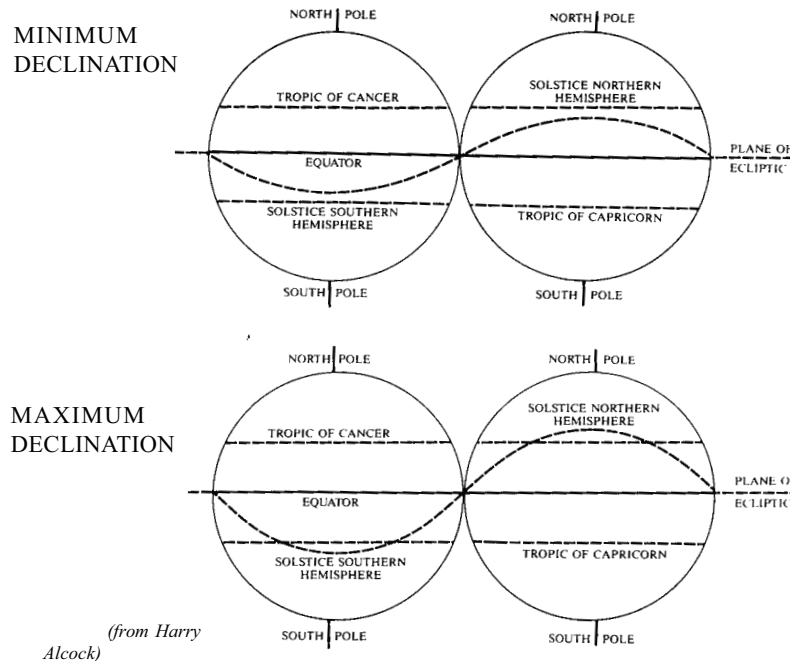
Suppose BOD is already at low - point, This in angles is 18° above and below the equator each month (because the Earth’s tilt is 23° and the Moon’s minimum declination angle is 5° from the ecliptic (actually 5.145396°). The last time the Moon was at its 18° declination point occurred on 16/3/97. After 9 years, after adding a degree per year, the new monthly declination is 28° above and below the equator - the maximum possible monthly declination. The last high end was 29/9/87, which is when scientists first coined the term ‘Greenhouse Effect’. At 1° added per year, we will reach the upper level again in 22/3/06. 223 declinations is the whole cycle.

As seen from the centre of the Earth the Moon drifts up and down slightly *more* than 5° in the course of each orbit. That’s because the Earth swings a little too, due to

Weather By The Moon

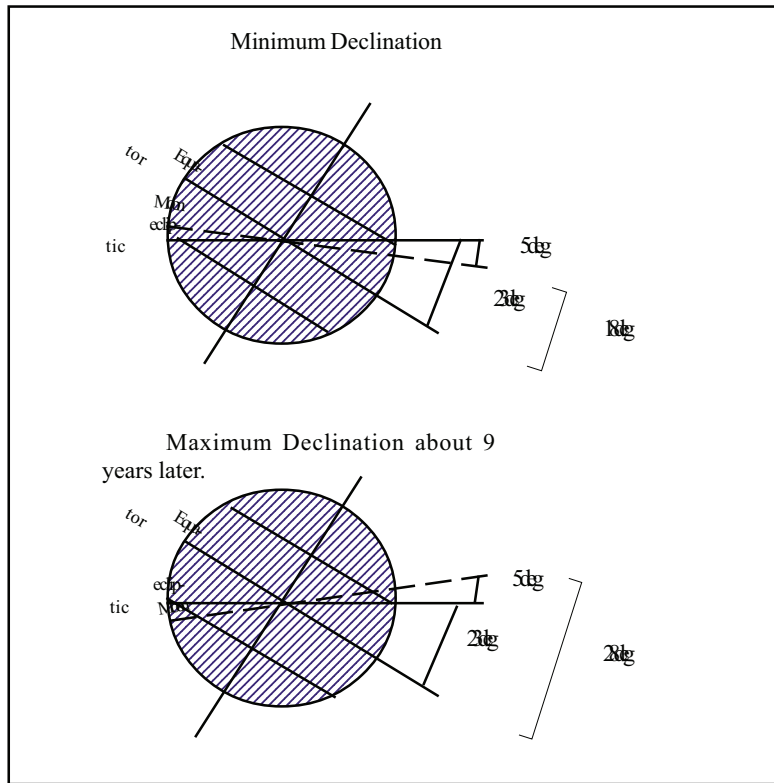
the Moon's pull on Earth, rather like two square dancers who grasp hands and swing each other in a circle..

This 18.613-year cycle is very important, and at the risk of boring the reader, I will explain it again. The Earth is tilted up already, by 23.5 degrees. An extra 5° is added or subtracted from the 23.5°, making 18° at the low end of the cycle and about 28° at the high end, about 9 years later. As you look at the diagrams overleaf it may become clearer. The Moon is pictured in two positions – the lower at 18.°(23.5-5), and the higher at 28.°(23.5 +5).



Declination

The range of influence of the Moon due to gravitational pull on a slice of the atmosphere changes throughout the 18.613-Year Declination Cycle because at the high end the Moon is ranging over more of the earth every month than was the case at the low end of the cycle. Fortnightly changing hemispheres, the Moon ranges over a fairly narrow band of the Earth's surface *between* the Tropics at the 18° end. But it ranges so widely at the 28° end, now *out-*



Weather By The Moon

side the Tropics, that it now covers parts of the Earth's surface that approach the polar regions.

The declination of a star does not change much in a human lifetime. However, the declination of the Sun and

4,000BC	24.1deg.
3,000BC	24.0deg.
2,000BC	23.9deg.

	Maximum	Minimum
4,000BC	+28.4deg / -30.2deg	+18.1deg / -19.8deg
3,000BC	+28.3deg / -30.1deg	+18.0deg / -19.7deg
2,000BC	+28.2deg / -30.0deg	+17.9deg / -19.6deg

the Moon change from day to day. The Sun throughout the year always has roughly the same declination values from one year's date to the same date the next year. For example, at the summer solstice the Sun will always have a declination value of about $+23.5^\circ$. At the winter solstice, it will be -23.5° . At the Equinoxes, the value will be 0° . For the Moon, during the Maximum Declination, the midwinter Full Moon will have a declination of about $+28^\circ$, and the midsummer Full Moon will be about -29° . The Mini-

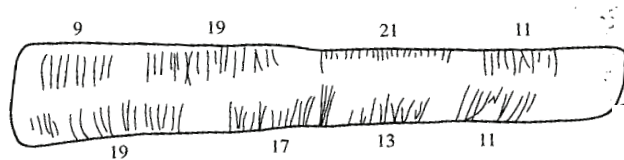
Declination

imum Declinations are about $+18^\circ$ and -19° . Yet these, of course, are modern values. It is interesting to compare pre-historic declinations.

SUN'S DECLINATION AT SOLSTICES AND POSITIONS OF THE MOON

Present-day values of the solar and lunar extreme positions have changed slightly over the centuries, because of the Precession of the Equinoxes – the top-like ‘wobble’ of the Earth as it spins on its axis. The wobble has been caused by the Moon’s gravitational proximity. Each Earth wobble takes about 25,920-years to fully complete. The Sun and Moon do not now move quite as far to south and north at their limiting positions as they did in the prehistoric past.

Did they know all this thousands of years ago? That the Moon is on an 18-19 year maximum-minimum-maxi-

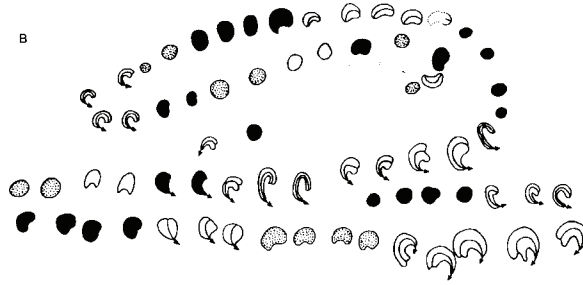


imum declination cycle was known in ancient times. Tally



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marked rock, stones and bones have been found that indi-



cate years marked off in groups of nine. A bone-handle tool found by Jean de Heinzelin at Ishango near Lake Edward in Africa dates back to 9,000BC. A much older bone from the Dordogne Valley of western France, dating back to 30,000BC, shows deep slash marks along the top edge, totalling 18 or 19, whilst what looks like possible Moon marks are etched onto the left. We don't know what is on the other side in terms of 'Moons', but clearly there were 9 in a small group in the center.

Are the circles Moons? Below and overleaf are clearer views of marks on one of the bones from the same site.

Stones in ancient stone circles indicate the declination range points. Major declination point is called Major Standstill, and minimum declination Minor Standstill. Major and Minor Standstill stones can be seen on most intact stone circles. At Stonehenge, if one was to stand at the Heel Stone, with one's back leaning against it so that the whole monument was behind one, and look straight ahead across the vast plain stretching out below, one can see two long straight banks resembling a railway track (The Avenue). The

Declination

left bank line is the Moon's Major Standstill and the right one is the Minor Standstill.

In ancient Egypt, 'New' may have originally meant 'nine'. 9 is halfway between 18. The word *newn* was used to indicate both the rising of the Sun in the east and the first appearance of the New Moon. At the 9 year mark we get the Moon's Minimum Declination. So was the New Moon originally known as the 'Nine' Moon? Then there's the word 'climate'. The Greek word was *klima*, meaning slope of the heavens. The word came to mean the climb of Earth latitudinally from the equator. Climate then came to mean weather patterns occurring specific to a latitude. Related words today are *climb* and *climax*. Could it once have referred to the movements of the Moon?

Where are we at now? The Moon, in 2003 has reached the 26° declination angle north and south of the equator each month. Around December 2003 it will reach 27° for the first time since April 1990. The perigees have been in the Southern Hemisphere since November 2002 and will remain so till November 2006. The Moon is on the way up to the highpoint of the 18.6-year cycle, which will be reached on the 22nd March 2006. The most recent low point (18°) was on 16/3/97.

There are other cycles too, of the Earth, that cause changes in the whole picture, because Earth's cycles also affect what the Moon does. One such is *the Angle of Precession*, the 42,000 year oscillation in which Earth's tilt varies from side to side 21.4° to 24.9°. At the moment we are 23.5deg and increasing our tilt, but our seasons will not get more extreme until a few thousand years time.

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There is an additional polar wobble in which the poles move around in a 22 year cycle, also caused by the Moon's gravitational pull, causing shifts in the position of magnetic north. Then there are cycles within cycles, like the monthly variation between the minimum declinations(18deg) and the mid-points(23.5deg), which sees the same progression of 49 months, 50, 53, 54 and then 49 again; making a grander cycle of 4 x 18 years, or 72 years. This is inter-linked with the Precession of the Poles, for a day is lost in 72 years if one is using a lunar calendar. As the seasons would gradually slip behind unless the calendar dates were corrected, vernal equinox(March 22nd)was considered a possible tweaking day. Observation of *when* the Sun rose exactly in the east marked out Equinox Day, i.e. which day would be called March 22nd. Once it was designated as March 1st, the beginning of spring and the start of a new season. Calendric changes have seen the actual date shift forward. To know where due east was required marker stones, and these also can be seen on ancient stone circle arrangements.

SUMMARY

The Moon moves in four main ways at once.

- 1) the Phase cycle, that everyone can see(New Moon/Full Moon)
- 2) the Perigee cycle, which can be noted with the aid of some measuring device or official almanac.
- 3) the Monthly Declination cycle, which can be observed if you watch for the very second the Moon rises each day and record how far along it is from due east along the eastern horizon; and
- 4) the Maximum/Minimum Declination cycle that cannot be seen, in which the declination itself changes in the manner of a roller-coaster over 18.613 years. What does all this mean for our weather?

What Causes Weather?

The Moon gives us pleasant balmy weather but also severe damaging storms and all that which is in between

Wherever the Moon happens to be around the globe, it affects the weather there. Also relevant is the time in its monthly cycle and its closeness(perigee). Most bad weather occurs in the second half of the Moon's phase, that is, between Full Moon and New Moon, particularly in the week after the Moon is Full. Tornadoes occur before the Moon rises or after it has set, that is, when it is absent from the sky, which means at night during New Moon or day during Full Moon/Last Quarter. The same goes for hailstorms and cloudbursts.

Whirlwinds and waterspouts also occur at this time, but need heat ascending and so occur more in the summer months or in equatorial conditions.

At Apogee(Moon furthest from Earth) the atmospheric tide is not as high on the Moon's side, so then not as shortened on the opposite side either. As the atmospheric effect is the one on the opposite side to where the Moon is, there tends to be fairer weather at Apogee when the Moon is not in the sky than is normally the case.

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Storms are also phase-related, the most likely time being Last Quarter during, for the Northern Hemisphere, when the Moon is at its southern monthly declination point. The converse applies in the Southern Hemisphere, when it is at its northern monthly declination point. If lightning happens to be at night, it is more likely to occur around New Moon or 1st Quarter.

Where the New Moon is over the Northern Hemisphere and going south towards the Equator, and conversely when the Full moon is over the Southern Hemisphere and going north towards the Equator, cyclones are generally absent in both hemispheres.

There are some alternative forecasting systems that say the positions of the planets have some bearing on the weather. One would be unwise to dismiss any possibility that seemed scientifically sound. Some environmentalists put much faith in the plotting and record-comparing of solar flare disturbances. Some systems involve just watching for sunspot activity, which forms an 11 year cycle. It is safe to say that when Mercury crosses the Sun, colder weather ensues if in winter and hotter temperatures than normal(which may lead to tornadoes, typhoons, tropical cyclones or hurricanes)if summer. But as the Moon is the closest to us, it is hard to overlook the fact that lunar gravitational attraction has by far the strongest potential to change things here on earth.

There also seems to be an effect from the alignment of Saturn(which orbits every 29 years) and Jupiter(which orbits every 11 years), when together on the opposite side

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of Earth to the Sun, that correlates with widespread cyclonic weather on Earth. It might be that these two huge planets at that time are having the same effect on the Sun that a Full Moon does on us. One could imagine that their combined gravitation could be pulling increased electrical activity from the Sun towards themselves, bringing it across Earth on the way. The effect would be more on the Sun than on Earth, but the magnetosphere, or Solar wind of electrical particles streaming from the Sun out into space, could affect our electrical fields. We are but 8 minutes into the solar year in terms of distance from the sun, and therefore getting almost the full brunt of the solar wind of electrical particles creaming over our planet. As more of the magnetic fields of the solar wind are concentrated by the close proximity of several planets, multiple crossings of them increase the magnetic effects felt in the weather systems. The Lunar declination cycle of 27.32 days just happens to be locked in phase with the 27.32 day magnetic rotation cycle of the Sun, because that is the way the Earth/Moon system conserves its angular momentum, and still responds to the magnetic flux changes.

The results arrived at by planet observers may still be lunar-based. The average sunspot activity cycle of 11 years coincides with the orbit of Jupiter. Sunspot activity is caused by the proximity of Jupiter to the sun. Jupiter is almost 318 times the size of earth – which means that if Earth was a peppercorn, Jupiter would be a grapefruit. Saturn is about 95 times as large as Earth. Given these sizes, it is further likely that they have an effect on each other

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and a combined effect on the Sun. In their half-orbits, Jupiter and Saturn are alternately together on the same side of the sun, and then on either side at 180deg to each other, with the Sun in the middle of them. This condition could be the catalyst to commence the sunspot cycle.

The famous Australian forecaster Inigo Jones employed this for many years in his long-range forecasting system. Jupiter and Saturn, he said, shielded the sun from the magnetic field through which the solar system moves. At the time of this shielding, sunspots were absent from the Sun and this was supposedly a time for droughts in Australia. Why this should be so was never mentioned.. But in between were times of sunspots, storms and floods. Based on this, droughts were forecast for the summer of 1995-1996 and 1998-1999 way back in 1949. So far this has proven correct, for the Crohamhurst Observatory he founded, and his successor Lennox Walker. Apparently the next big drought, with dry summer, autumn *and* winter, will be 2001-2002 followed by a dry spell in 2004-2005 and a moderate drought in 2007-2008.

But the same results could have been forecast from lunar records. The combination of average sunspot cycle periodicity and the cycle of Jupiter is about 35 years. The Moon's cycle of 29 days and the sunspots' rotation of between 24 and 28 days can be confused together. Without wishing to cast aspersions on the clearly successful work done by the Crohamhurst Observatory, I think it is worth pointing out that the Sunspot-Jupiter-Saturn effect, which uses records of similar rotation periods, could be shown to if not actually *be* Moon cycles all along, at least be par-

alleling them.

WHAT IS EL NINO?

El Nino means a *regular* eastward migration of warm water from the tropical western Pacific Ocean. Because it was first noticed in recent times by Peruvian and Ecuadorean fishers, it has an Hispanic name. Rather than being a recent phenomenon, samples from a lake high in the Andes have shown El Nino has been playing havoc with the world's weather for at least 15,000 years. A team led by Don Rodbell, from New York's Union College, in 1999, digging in the Andes, found a continuous geological record and evidence that ancient civilisations 5,000 and 8,000 years ago planned for and used the El Nino rains to boost crop production.

Ice-core records from the Andes in Peru also suggest these climate fluctuations have been part of Earth's weather cycle for thousands of years. Some scientists speculate the topsy-turvy weather patterns began when glaciers stopped receding and sea-levels stabilized some 5,000 years ago. They have also identified El Niño signatures hundreds of thousands of years old in coral growth rates. From evidence found in coral reefs, tree rings and polar ice cores, scientists have now traced El Ninos back five millennia.

In the 1500s, fishermen in Peru noticed that unusually warm coastal currents reduced their anchovy landings. At the same time, local farmers noticed the warming coincided with increased rainfall. Wondrous gardens sprung from barren arid lands in some regions, and the years were

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called “años de abundancia” - years of abundance in Spanish. In other regions, torrential rains brought ruin. Because the warming often peaked around Christmas, the current was nicknamed ‘El Niño’ - the Christ child in Spanish.

Eighteenth century European sailors recorded other bizarre events in their logbooks . The coastal waters were stained crimson with El Niño. Their ship hulls were rotting in oxygen-depleted waters that were suddenly home to exotic sea-snakes, alligators and sharks.

In a normal year, the trade winds blow from South America to Asia, pushing warm water to the far reaches of the western equatorial Pacific. During an El Niño, this pool of warm water sloshes across the Pacific to Peru as the normal winds weaken. The warmer-than-normal water adds heat and moisture to the air above it, creating thunderclouds and an atypical storm track with far-reaching effects.

High temperatures, flooding in parts of the Northern Hemisphere in recent times - these add up to El Nino weather patterns. During 1974 - 75 sea currents ceased to flow strongly from the Southern Ocean causing fish to either die or migrate to more fruitful areas to feed. Because the normally nutritious current ceased to provide sufficient food at that time, the fish departed and the sea birds died as there was insufficient fish left to feed them and fishermen went bankrupt.

In 1982, a monster-sized El Niño rolled across the Pacific with wildly unexpected consequences. It was to date the largest, most intense El Niño in modern times. Farmers in Peru were up to their eyeballs in rain. Fires scorched Borneo. Droughts hit Australia. An estimated 2,000 peo-

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ple died. All told, the damage estimates ranged from \$8 billion to \$13 billion. Between 1983 and 1992, and probably at other 'El Nino' times, the east coasts of the North Island (New Zealand) were subjected to a 'bloom' on the sea floor preventing bottom feeding fish to receive sufficient food and dying, due to insufficient tidal or current movement to clear the 'bloom' away.

El Niño is correlated with droughts in Australia, Ethiopia, Indonesia and Zimbabwe, stronger hurricanes in the Eastern Pacific and weaker ones in the Atlantic. Scientists have been enthusiastically rushing into print since 1997 was identified as the beginning of the latest El Nino cycle. But are the words 'El Nino' a cure-all explanation for every weather pattern that occurs?

LA NINA?

After the summer of 1988/89 a new weather term was on the lips of meteorologists: *La Nina*. This was said to be the 'positive' phase of the Southern Oscillation, the opposite of El Nino, or El Nino's cooler sister. La Nina was immediately stated to be the reason for a drought in New Zealand in the South Island. It also happened to be the beginning of decline of the 28° declination of the Moon. The previous dry spells had been in 1969, 1950, 1932 and 1914; all years of the Moon in 28° declination.

On Jan 29th 1999 (NZ Herald), a spokesman for the National Climate Centre said

"..we are looking at significant problems in the decades ahead and incredibly depressing problems in the next century or two"

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And in a NZ Herald article 20/2/99,

“the La Nina pattern will continue through autumn..over the next three monthsthere is only a slight chance of above-average rain”

They didn't know that rain was imminent. Ten days later, in the same newspaper:

“There are signs that the La Nina weather system may be on its way out”.

We had previously witnessed a university ecologist making front page news saying NZ had better start growing tropical fruits. It seems that they decided that the La Nina pattern would persist for the next 50 or 200years, then it rained just once and La Nina was declared over.

WHAT CAUSES EL NINO?

El Niño is as much an atmospheric event as an oceanic one. The winds and the waters communicate with each other half-way around the world, influenced together by the Moon. El Nino is what happens when the Moon's declination and the Earth's tilt at 23.5° coincide. El Nino is merely the midpoint of one half of the 18.613-year Maximum/Minimum Declination Cycle. At 23-24° there are two El Ninos in the one cycle. When the angle is increasing passing thru 23-25 degrees, much more equatorial moisture is pumped into the mid latitudes, and when the angle is decreasing thru 25-23 degrees, much more Polar, and middle latitude dry air is pulled toward the equator. The combined effects of the Sun and Moon's tidal forces reinforce each other either way. We came into the upside of this pat-

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tern in May 2001 thru July of 2002. By mid-2003 the pattern will cease, with the next El Nino pattern due around the southern hemisphere summer of 2009/10.

The Moon transports the warm tropical atmosphere into the temperate zones, thus increasing the average temperatures there. A warm band of water mainly warms the area between the Tropics for the first and last quarters of the 18.613-year cycle. Tidal currents up the west coast of South America stall and the Gulf Stream gets no warm water inflow. The result is at those times very cold winters in areas of the upper northern hemisphere like Canada, and in extreme southern hemisphere areas like the South Island of New Zealand. It can also mean heat waves in those areas in the summertime, because there is not enough atmospheric insulation from the heat of the Sun..

This was a pattern the world saw from 1995 to 1998. Less warm tropical air was moved by the Moon north and south of the equator each month into the temperate zones, bringing with it below average temperatures.

The 1974 and the 1992 'El Nino' had the same components in that the slope of the inclination (to the ecliptic) had the 5° northern about the Sun, and 5° below that plane at the spring equinox of the Southern Hemisphere. The Moon, as it were, hinges upwards at the Tropic of Capricorn when moving northwards and downwards from the Tropic of Cancer when moving south.

During the 1964, 1982 and 2000/01 'El Nino' periods the slope is in the Northern Hemisphere of their au-

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tumn equinox. The overall effect is that the 1974 and 1992 El Ninos affected the Northern Hemisphere more than the Southern Hemisphere, as it again will in 2010. The 1964 and 1982/83 El Nino did affect the Southern Hemisphere more than the Northern Hemisphere and therefore, predictably the 2001-2 years have also affected the Southern Hemisphere more.

WHAT IS THE GREENHOUSE EFFECT?

In the late 1980's the term 'Greenhouse Effect' came into our vocabulary to try to explain the high temperatures the world was experiencing. In the early 1990s, we were in a below average period which saw cooler temperatures, particularly during the winter months in both hemispheres. These conditions are more noticeable over the higher latitudes. The closer one is to the tropics the less the effect one gets from the lower temperatures in winter.

The Greenhouse Effect is merely the other side, in the 18.6 year lunar cycle, that is, the opposite end to El Nino. That means it occurs every 4.5 years before the peak of El Nino. In the Greenhouse years, the Moon distributes warm tropical air and water over a wider band of the earth. It has nothing to do with greenhouses, human activities, gaseous emissions, oceans rising or methane production. It has everything to do with the Moon. The next to occur will be 2005-7. These years will see droughts in many countries, and if history is anything to go by, these drier conditions will be described in the usual frantic international media beat-up as the worst in living memory..

SCIENTISTS SOMETIMES WRONG

In March 1998, scientists declared that a 2km-wide asteroid called 1997 XF11 was on a near-collision course with Earth. Understandably, this provoked international concern. It was later discovered that the asteroid would miss the Earth by at least a million kilometres.

Ministers from Antarctic Treaty nations were told by New Zealand scientists that global warming could melt icecaps and raise sea levels by as much as 6 metres (18 feet) in the next generation, which, if true, would wash away thousands of coastal villages around the world. This was reported around the world by Reuters. But other scientists suggest that a modest warming of the Earth would *lower* sea levels, by increasing evaporation from oceans with subsequent deposition and accumulation of snow on the polar icecaps.

GLOBAL WARMING?

The public has been drip-fed the idea that human-induced global warming is both real and dangerous. Every weather extreme has been linked to it, or to El Nino and La Nina. Because we hear these buzzwords repeated so often, a subliminal message is delivered of parched farmland + global warming, suffering farmers + global warming, unchecked economic growth + global warming and the list seems endless. A similar process occurs with cancer. Health researchers link cancer to anything and everything. Why? To qualify for taxpayer-funded governmental grants

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for commissioned studies. We have seen the CO2 debate come and go, the methane scare, the CRCs and hydrocarbons, and now the next source of income for the researchers looks like being the prospect that genetically-modified foods will destroy civilisation as we know it, and needs looking into.

It has been little reported that a United Nations-sponsored Intergovernmental Panel on Climate Change that claimed that global warming was occurring caused 17,000 scientists in the US, including 2300 specialists in the field of climate change to sign petitions stating otherwise.

OZONE?

The prestigious science journal *Geophysical Research Letters* produced a special edition in November 1986, on the subject of ozone depletion. Forty-six of the world's leading climatologists submitted individual papers on their research and findings. This is a portion of the final overview..

“..despite the number of public pronouncements, no clear link between man-made pollutants and ozone depletion over Antarctica has been established...indeed the appearance of the South Polar total ozone minimum has been observed since the late 1950s, well before man-made pollutants could have had any impact on the stratosphere”

In fact, the culprit CRCs are heavier than air so would find it rather difficult to float upwards, are inert so probably wouldn't combine with anything, and because of population densities in the Northern Hemisphere would surely

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travel more to the Arctic if they went anywhere.

Are nests being feathered? In the 1960s geophysicists believed that with enough resources they could predict earthquakes, and in 1966 the Japanese government funded a \$270 million per year program. In 1997, after wasting \$2.5 billion dollars on no results, the program was axed.

WHAT WEATHER ARE WE INTO NOW?

The temperatures in the Pacific Ocean were, at time of writing of the first edition of this book(1999) still above the average because the Moon's restricted movement at 20° north and south of the equator each month; still 3° inside the tropics and holding the Sun's heat within that tropical belt.. At time of writing(2003) temperatures have been heating up and some regions like the southeast of NZ have been heating up more as the maximum declination time approaches. Although dryness is being experienced, winters are getting milder and summers are becoming cooler.

The NZ National Climate centre said on National Radio (5/9/96) that parts of New Zealand during the 1996 winter had had their coldest temperatures in decades, some were record lows. The last period to have conditions which duplicate the present was in the mid 1970's when the public at large was being warned of the coming 'Ice Age'.

The years when the Moon was at the 28° declination last century and offering higher temperatures and droughts, severe in some instances, for a year or two on each side were; 1914, 1932, 1950, 1968, and 1986. The next hot years will be near 2,006. The cool years were those near

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1905, 1923, 1941, 1959, 1978, 1997 and will be again about the year 2,014. We are just past the midpoint, 2001-2. There have been cold winters in the far south(South Island of NZ) of the world and the far north(US, Canada and UK.)up until this midpoint time, but also hot summers in those places. After 2004 the winters will be wetter and warmer, and the summers more mild.

My colleague Harry Alcock collected local rainfall figures (in Waikato)based on the maximum declination of 28° against the minimum of 18° over a three year period while the Moon was at that declination and covering three periods of the 18.6 year cycle. The results are illuminat-

The 28deg. years	1949	3059mm
	1968	3299mm
	1986	3029mm
		Total 9387mm

The 18deg. years	1940	3381mm
	1959	3592mm
	1977	3496mm
		Total 10,469mm

ing.

The differences between the 28° and 18° rainfall figures are consistent and total 1082mm or 43 inches. The changing declination of the Moon from the 28° down to 18° and back again to 28°, north and south of the equator has the depressions and anticyclones drifting eastwards at differing latitudes, so that depressions, being 'further down country' already, would be expected to drift south-eastwards over the Southern Hemisphere. And this did occur frequently during the winter of 1997.

The declinations control the direction of depressions. As the declination moves either north or south, so the depressions will cross the country with those changed latitudes. The same changing latitudes will take place with anticyclones. Prior to 2000, in New Zealand, anticyclones have been predominantly about the south of the South Island, with winds over the North Island frequently from an easterly quarter. With a 28° declination the anticyclones will seldom cross New Zealand to the south. Anticyclones will follow the Moon northeast when the Moon is moving from the Southern Hemisphere northwards and southeast when moving southwards. The east drift as a component of the southeast or northeast drift follows the Moon's orbit which is eastwards around the earth.

Tidal heights are also affected by the changing declination of the Moon between the 18-28° north and south of the equator each month over the nine year period. The declination shifts the location of cyclonic systems. As the Moon incrementally changes its declination angle year by year the latitudes change by the same rate at which cyclones

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or depressions occur. That is why cyclones vary from year to year. The only time when comparisons can be made between one year and the next is when the Moon is at maximum or minimum declination of 18° or 28° , because for about 3 years around these points the Moon's declination is relatively stationary. Recent stationary years were 1995-1999(18°) and coming up, 2005-2008(28°)

Direction of anticyclones and cyclonics can demonstrate the influence of the Moon. As the Moon travels from east to west, it tries to drag the atmosphere with it. The Moon exerts its pull along its path that has been between the tropics. A band of atmosphere around the Earth's equator is pulled east to west. But the Earth is rotating west to east underneath it. The lighter and more numerous water-laden-free gases move the easiest. The southern edge of a northern anticyclone and the northern edge of a southern anticyclone, are moving westwards, into the direction of the Moon's pull, which is why in the Northern Hemisphere anticyclones rotate clockwise, and anticlockwise in the Southern Hemisphere. The cyclonics form in the low pressure areas between the 'gaps' in the anticyclones.

The Barometer

In 1638 Galileo noticed that a suction pump used to pull water from a well could not raise water more than 34 feet. His pupil, Torricelli, realised that this was due to the weight of the atmosphere, and confirmed his theory with an experiment. Knowing that mercury is 14 times heavier than water, he realised that if 34 feet of water was held up by the atmosphere in a column (such as a well, or a tube) then an amount of mercury one fourteenth that of water could also be held up. So he took a tube three feet long and filled it with mercury, sealed the end momentarily with his finger, inverted the tube and immersed the end in a bowl of mercury. The health hazards of this were not of course known. The level of mercury in the tube was about 30 inches. The empty space at the top was a vacuum. Watching it and recording over several days, Torricelli discovered that there were variations in the height. Without realising the full implications, he had demonstrated the existence of air pressure and invented the barometer and altimeter.

The French scientist Blaise Pascal repeated Torricelli's experiment, and realised that any air closer to earth would be compressed by the weight of air immedi-

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ately above it, and therefore air high on mountain tops would exhibit less pressure. He proceeded to demonstrate this, climbing to the summit of Puy-de-Dome and returning to the sea-level town of Clermont all in one day, with measuring equipment and observers on the ground. From this he gave the world the altimeter, measured in kilopascals(kp), still bearing his name.

PROOF OF ATMOSPHERIC TIDES?

Pascal conducted his experiment on the 22nd September, 1648. The 18th September was the day of the New Moon/Perigee combined. He had planned to do it 3 days before on the 19th, but had to wait for the unsettled weather(typical of a Perigee Moon!) to clear. The 22nd would have been a day moon, close to the Earth. The atmosphere would have been stretched upwards by day and reduced by night, accentuated by the Perigee.

Pascal could not have known that the barometer could be silent testimony to the existence of atmospheric tides. It measures the weight of atmosphere pressing down on a surface, which is atmospheric pressure but unfortunately not atmospheric volume, i.e. height, which is why it may often annoyingly rain while the barometer stays constant.

In our school physics we learned about Boyles' and the Ideal Gas Laws, which states that volume and pressure are inversely proportional to temperature. A glance at the table may clarify matters. When the volume of a gas decreases, as is the case on your side when the Moon is on the far side of the Earth, pressure varies with temperature. That means that if it goes cold the barometer will stay the

Barometer

NEW MOON	ATMOSPHERE on daylight side	BAROMETER STEADY	BAROMETER DROPS	BAROMETER RISES
RISING	Volume air increasing	If temp rises	If temperature steady	
SETTING	Volume air decreasing	If temp drops		If temperature steady

same: as long as the height keeps decreasing. And if it gets warmer the barometer will rise, if the volume of the gas is still depleting.

If the height of the atmosphere overhead is increasing because the Moon is returning some of the atmosphere from the other side, as it would do 4 or 5 afternoons after the New Moon, (on the day of Pascal's experiment the Moon was not in the sky until mid-afternoon), then as the temperature increases, the barometric pressure will remain the same. By noting the changing temperature, by another method of measurement (thermometer) and adding that to the fact that the barometer had stayed the *same*, Pascal might easily have deduced that the volume of the atmosphere and therefore its height had increased! If he had figured out the Moon's effect on the atmosphere and calculated-in the phase times, he might have realised just what the atmosphere was doing.

Consider the times. It was New Moon 4 days before, New Moon time 2.00am. Given that the Moon rises 50 minutes later each day, puts moonrise at about 4-6pm in France on that day. He spent time on the mountain then came down. Being September late afternoon, the tempera-

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ture would have dropped slightly as the Moon was bringing the atmosphere back. The increased height would have cancelled out the temperature drop and the barometer would have stayed steady. Which is exactly as reported. When Pascal returned to ground, the Rev Father Chastin, his sea-level observer, reported that the quicksilver level had remained constant despite weather being very unsettled, then clear and still, then rainy, foggy and finally windy.

If the New Moon is rising, the barometer may stay steady if it gets warmer and drop if temperatures stay the same. If the New Moon is setting, the barometer may stay steady if it gets colder and rise if temperatures stay the same. This also explains heat waves. When the Moon is not in the sky, the atmosphere is somewhat depleted and if there is a high pressure system operating, there is less atmosphere to keep the Sun's heat from building up the ground temperature.

Proving the air changes height is tricky because no instruments have been built yet to determine it. As air is invisible, the eye would not pick up an incoming airtide as it can an incoming seatide. Expecting a barometer to measure atmospheric height is about as successful as expecting a thermometer in boiling water to read differently in boiling soup. A weather balloon(which houses a barometer) if allowed to rise and fall with the atmosphere, will be buoyant like a ship or cork in the sea, and stop at its buoyancy point. It gives no information out about its true height, but tells instead only of the surrounding temperature.

Barometer

Pascal also missed a previous opportunity by only two days. Had he gone up the mountain 4 days beforehand, when he had originally *planned* to, and taken note of the day and night differences in pressure at that height (which would have entailed staying up on the mountain); then compared them to those taken at sea-level over the same period he might have noted some pressure discrepancy changes over the course of a day that could be expressed as a function of height.

The atmosphere can alter in height by several miles twice a day like the sea tide. Yet the barometer may not change, because it only measures, at sealevel, the weight of a column of air a square inch in ground area. The barometer does not and cannot measure the height of the atmosphere, only the weight. Such an experiment has yet to be done. I believe it has been.

Harry Alcock, an umbrella maker from the Waikato, told me how he once fitted a filtered photographic exposure meter to a telescope aimed at the Sun. The filter was a lens from a discarded pair of sunglasses. The meter was graduated for a reading range of from 14.0 – 14.7. The telescope had an elevation angle calibration fitted, and readings were taken throughout the day so Sun angles could be catered for. Brightness values were recorded on every cloud-free day. Later, the experiment was repeated using a Cushing solar energy meter, yielding the same results. Why brightness? Because the less compacted the atmosphere, the duller will be the Sun, there being more interference to the passage of the Sun's rays through the atmospheric layers.

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The readings under similar conditions through a succession of Moon phases showed brightness could vary by up to 25%. Taking the accepted total atmospheric depth to be 60 miles; the difference in the height of the atmospheric bulge, then, could be up to 15 miles. Readings always increased in intensity before rain, - without fail the rain arriving the next day. Moreover, if the increased brightness was in the afternoon, then that was also when it would rain on the morrow. The readings would increase while the barometer stayed high if a front was approaching and if a clear day and high reading, the following day was nearly always cloudy. I

The bluer the sky, the more likely it is that the Moon is somewhere in the sky. Extra sunlight gets through when the atmosphere is shorter which is after the Moon has set. Extra sunlight means more glare, and the sky looks more pale and white.

Having said all that about barometers, the instrument can be useful when the mercury is actually *changing*, but at the same time one should watch the thermometer. Then you can more accurately safely predict some change in the weather. But when the needle stays constant the weather may change or stay the same. At any one time you can't, just by looking at the barometer *alone* tell if the atmosphere is higher or lower. Is there a way to use the barometer to 'read' weather changes?

Yes. If the barometer stays the same but the temperature drops, there's a chance of rain. If the barometer stays the same but the thermometer rises, expect a clearing. If the barometer goes up but the thermometer stays the same,

Barometer

rain could ensue again. If the barometer rises or falls while the thermometer plunges, a thunderstorm could be close by. Barometer falling with thermometer rising - heavy rain. When both rise, either the wind is about to change or the weather is to improve; but when both fall, weather is deteriorating quickly. If the barometer is constant, it means rain or clearing; if it drops; rain, frost, or thaw, and if it rises; wind change, gale, rain, frost or clearing. The mercury level seldom falls for snow. And a first rise after a low *or* a rapid rise can indicate unsettled weather.

Robert Fitzroy, captain of the *Beagle* on which Charles Darwin sailed around the world, formulated 'forecasting remarks' that became popular and were inscribed on barometers. They are reprinted overleaf. On some instruments purchaseable to this day one can still find these 'guides'. If you want to buy one, choose the one with as many bellows as possible – the more bellows, the more accurate. The best of all, if a little expensive is a barograph.

The average rate of fall of the barometer when signalling a warm front(which can cause a depression, as does a cold front) will be found to be 2.5 mb/hr. For the first 5 hours the rate will be low(1 mb/hr), but over the next 5-10 hours the rate of fall increases. In about 4 hours the rate may be 3 mbs/hr – a gale warning...perhaps.

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BAROMETRIC CHANGES.

A fall of half a tenth of an inch or more in half an hour is a sign of storm

A fall when the thermometer is low indicates snow or rain

A fall with a rising thermometer indicates wind and rain from the southward

Sharp rise after low foretells stronger blow

Sinks lowest of all for the great winds, not necessarily with rain Greatest heights are for easterly or northeasterly winds

In calm frosty weather, the mercury stands uncommonly high

After very great storms, it rises very fast

The more northerly places have greater alterations

In very hot weather, the falling indicates thunder

In winter, the rising presages frost, and in frosty weather, but if the mercury falls 3 or 4 divisions, there will be a thaw.

If a continued frost and the mercury rises, there will be snow.

Unsettled motion of mercury, uncertain changeable weather

Sudden fall in spring, winter or autumn means high winds and storms, but in summer heavy showers and thunder

When there has been no storm before or after the vernal equinox(March 21), the ensuing summer is dry, five times in six.

Steady rise shows that fine weather may be expected, but in winter - frost

Predicting

1. PLOT DECLINATIONS FOR THE MONTH

The Moon moves around the earth once per month on or about the Earth's plane of orbit around the Sun. It strays a degree a year from this plane, never going above or below 5° , making for an 18.613-year cycle in all. Within the month, it spends 14 days in one hemisphere and 14 days in the other, oscillating around the ecliptic. When it is uppermost it is at the northern declination point, and travelling parallel to the earth for 3 or 4 days. The weather at this time will be slow-moving. Winds and anticyclones will be dragged along latitude lines.

Then the Moon treks downward towards the southern declination point. Dragged by the Moon as it crosses the Equator either going northwards towards its northern declination point or southwards towards the southern point at this time weather patterns are often called fast-moving weather systems. Winds at this time will generally be northerly (from NE or NW) or southerly (from SE or SW).

How do you find out when the declinations occur? This information is available from many astrological books and programmes, or sometimes from your local newspaper. Another way is to obtain a publication put out every 10

years called the American Ephemeris.

2. Get in tune with the perigees.

If you don't want to keep referring to a measuring stick, held up to the Moon, information on when to expect its next Perigee can be found in nautical almanacs published by the coastguard, and many Moon calendars. The weather will nearly always turn for the worse at Perigee time, dishing up winds, high swells, high tides, stronger winds and possible gales. For an online free perigee calculator, that you can download to use offline for any date, go to

<http://www.fourmilab.ch/earthview/pacalc.html>

3. Plot and compare past cycles.

There are many New/Full Moon cycles. One is called the Metonic and is exactly 19 years, as can be seen by the following two tables in which Full Moons 19 years apart fall on nearly the same day. If the moon causes the weather, then the implication is clear – weather can be predicted by looking back. Weather conditions in the future will be the same as it was in the past where the Moon is worked out to be again in the same place in the sky.

In the tables opposite are the dates of all Full Moons over a 19 year period. It is easy to see the 19 year cycle. This means one can only look at weather maps 19 years ago. Also 38 years ago. But it is not the whole story, although it will give some indication. Perigees must be also taken into account. However with the 19 year cycle, monthly declinations match, also Moon rise and set times

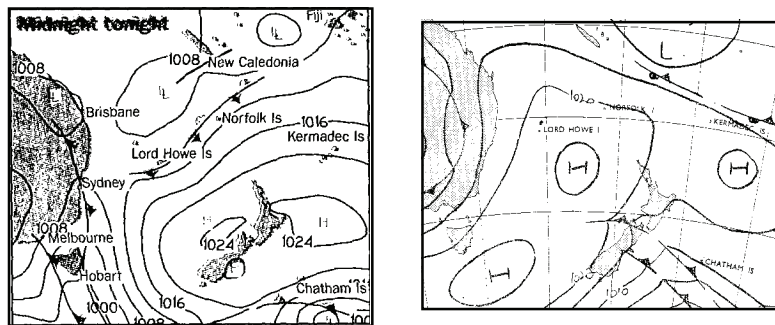
Predicting

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1981	20	19	21	19	19	18	16	14	14	14	12	11
1982	10	8	10	8	8	7	6	5	4	3	2	1
1983	29	27	29	27	27	25	25	24	22	22	21	20
1984	19	17	17	16	15	14	13	12	10	10	9	8
1985	7	6	7	5	5	3	2	30	29	29	28	27
1986	26	25	26	25	24	22	21	20	18	18	16	16
1987	15	14	16	14	14	12	11	9	8	7	6	5
1988	4	3	4	2	31	30	29	27	26	25	24	23
1989	22	21	22	21	21	19	19	17	15	15	13	13
1990	11	10	11	10	10	8	8	7	5	4	3	2
1991	1		1	29	28	27	27	25	24	23	22	21
1992	20	18	19	17	17	15	15	13	12	12	10	10
1993	9	7	8	7	6	5	4	2	1	1	29	29
1994	28	26	27	26	25	23	23	21	20	20	18	18
1995	17	16	17	16	15	13	12	11	9	9	7	7
1996	6	5	5	4	3	2	1	29	27	27	25	25
1997	24	22	24	23	22	21	20	18	17	16	15	14
1998	13	11	13	12	12	10	10	8	6	6	4	4
1999	2	1	2	1	30	29	28	27	25	25	23	23
2000	21	20	20	19	18	17	17	15	14	13	12	11

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2000	21	20	20	19	18	17	17	15	14	13	12	11
2001	10	8	10	8	8	6	6	4	3	3	1	1
2002	29	27	29	27	26	25	24	23	22	21	20	20
2003	18	17	18	17	16	14	14	12	11	10	9	9
2004	8	6	7	5	5	3	2	30	29	28	27	27
2005	25	24	26	24	24	22	21	20	18	18	16	16
2006	14	13	15	14	13	12	11	9	8	7	6	5
2007	4	2	4	3	2	1	1	28	27	26	25	24
2008	23	21	22	20	20	19	18	17	15	15	13	13
2009	11	10	11	10	9	8	7	6	5	4	3	2
2010	30		1	29	28	26	26	25	23	23	22	21
2011	20	18	20	18	17	16	15	14	12	12	11	11
2012	9	8	8	7	6	4	4	2	1	30	30	28
2013	27	26	27	26	25	23	23	21	19	19	18	17
2014	16	15	17	15	15	13	12	11	9	8	7	6
2015	5	4	6	4	4	3	2	30	28	27	26	25
2016	24	23	23	22	22	20	20	18	17	16	15	14
2017	12	11	13	11	11	10	9	8	6	6	4	4
2018	2	1	2	1	30	28	28	26	25	25	23	23
2019	21	20	21	19	19	17	17	16	14	14	13	12

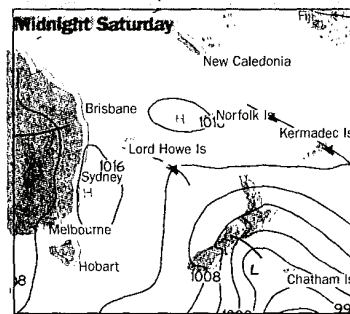
Weather By The Moon

and so much will be in place. The atmospheric tide will be nearly the same. 38 years is also a guide. If records have been assiduously collected at one locality in question, so much the better. When you adjust for perigee – bingo, you can predict the weather.



By way of example, above are two maps, 19 years apart, being 1/1/03 on the left (courtesy NZ Herald) and 1/1/84 on the right. The double-centred high is common to both, as is a low sitting to the north of NZ.

The Moon is in the sky again in the same position with respect to the background of stars one lunar year later. The lunar year differs from the solar year by up to 10 days. Therefore, 353-355 days is another cycle worth looking at. One goes back a year then comes forward by 7-10 days. It is not exact, because a year is not as good as 19 in terms of averages. So in the example above, which is the weather for 1/1/03, one would look at 7-11th January 2002



Predicting

OTHER FORECASTING SYSTEMS

Many systems have been proposed and most will work in their own way, once the operator gets in tune with the system. The Herschel Chart was a forecasting device put together by farmers in Europe nearly 400 years ago, named after an astronomer-royal in England, Sir William Herschel. He devised this particular methodology to predict the weather long-range so he could arrange for his observing sessions with the telescopes.

The Herschel Chart takes the time of change of phase of the Moon and converts that to a prediction of the weather over the next several days after the Moon changes phase. The exact time of change of phase of the Moon is determined by looking up charts 40 to 50 years in advance.

In America, Benjamin Franklin wrote and published his own *Poor Richard's Almanac*, predicting the weather for 25 years from 1732. His average annual sale was around 10,000 copies. Franklin ridiculed astrological predictions, yet reportedly kept careful daily weather records. His method was lunar, and at that time it was usual practice for people to carry pocket almanacs that carried daily weather predictions, much as one would carry a pocket diary today.

Franklin was a scientist. Other scientists were doing it elsewhere, too. In France, Jean Baptiste Lamarck issued long range weather predictions based on lunar data in his *Annuaire Meteorologique* from 1800 to 1811. And in Germany, Rudolf Falb (1833-1903) became known as 'the lunar prophet.'

**THE WORST EVER DROUGHTS
BETWEEN 1820 – 1976 (England and Wales)**

YEAR	STARTING MONTH	PERIOD	RAIN (inches)	YEAR DIFFERENCE	Approx. number of 17-19 year cycles
1893	March	3 month	2.8		
1929	Feb	3 month	2.8	36	2
1921	Feb	6 month	7.0		
1976	March	6 month	8.1	55	3
1854	Feb	12 month	24.3		
1888	Feb	12 month	24.5	34	2
1921	Aug	16 month	34.6		
1975	May	16 month	29.8	54	3
1853	Dec	18 month	36.7		
1887	June	18 month	39.2	54	3
1857	Dec	18 month	40.6		
1874	Feb	18 month	40.5	17	1
1853	Oct	24 month	56.6		
1887	Feb	24 month	58.7	34	2

Predicting

HISTORICAL EVIDENCE FOR THE 19-YR CYCLES

From the *Annals of Loch Ce*, we know that the summer of 1252 and 1253 was so dry that people crossed the river Shannon to Ireland without getting their feet wet. This matches the conditions of 1975-76, which have been the worst drought in England and Wales since rainfall records began.. The difference is 722 years, almost exactly thirty-eight 19 year cycles.

In between (nearly sixteen 19 year cycles later) was the Great Fire of London in 1666, which was a period so dry that the River Thames was just a trickle.

In NZ a severe drought occurred in Otago, in the South Island in 1982. It was repeated in 1999, almost one cycle later. Each time it was described as the worst in living memory. Rather than any momentous shift in the world's climate, it is far more likely to be an indication of the fallibility of the living memory.

There is no doubt that looking back to old records works. Some alternative forecasters latch onto just one system that works for them – they adjust it in their mind slowly over time with careful observation once they get a basic framework. One often encounters farmers, surveyors, mountaineers, fishermen and foresters who are legendary forecasters in their own environments. They swear by what they have come to know and rely on.

4 . CHECK OUT THE WIND

According to 'Buys Ballot's Law', dating back to 1857, when the wind is blowing on your back, the low pressure(bad weather coming) is always on your left hand

side in the Northern Hemisphere, and always on your right hand side if you are in the Southern Hemisphere. This refers to how the wind in the Northern Hemisphere blows anticlockwise around a centre of low pressure and clockwise around a centre of high pressure.

5 . LOOK AT CLOUDS

The coldest clouds are found at high altitudes while warmer clouds are found closer to the earth's surface.

There are three basic cloud types. The first is *cumulus* cloud which looks like cotton wool or ice-cream. It is like steam, water vapour that sits mainly at an altitude of 2,000 feet - the height at which rising warm air condenses out in the formation of water vapor. True cumulus form mainly when the Moon is absent from the sky, in the morning during 1st Quarter, at lunchtime during Full Moon, and in the afternoon during Last Quarter.

The second type is *cirrus* and its variations. This sits far higher, anything up to 12 miles up, and is composed of ice. Cirrus can look like candy floss, or mares'-tails (as it is sometimes called) or "mackerel sky" because it looks like closely packed ribs in rows. Mares' Tails look like long, well-defined wisps of cirrus clouds, thicker at one end than the other. If cirrus is in the daytime it is mostly when the Moon is in the sky, often during New Moon. High clouds generally indicate that the Moon is above the horizon.

The third is *stratus*, or straight undefined layers with no edges. These fill the sky with a misty and blurred look. Expect a cloud-filled sky 24 hours later but not rain.

Simply speaking, cumulus indicates settled weather,

Predicting

and cirrus means a storm coming. When cirrus is very sparse and doesn't cover the sky it can mean very good settled weather, but this is not a common sight.. Watch to see if it changes. The bad weather sign is when cirrus starts to spread from one horizon to the other, above the bunchy cumulus. From the first sign of cirrus, expect weather to worsen in 36 hours.

Cirrus heralds the beginning of a depression and also the end of one. Slowness to form over the whole sky indicates bad weather for a long duration, but quick formation means a storm that will last only a day. If it has been stormy

CLOUD TYPE	DESCRIPTION	LEVEL	PREDICTION
Cumulus	Puffy	Low to high	Settled weather, unless increasing and becoming more dense. Disperse in the evening. Life: 5-15 minutes
Alto cumulus	Cloud mountains, towers	Middle	Often heralds a frontal depression.
Cirrus	Streaky, still, wispy	High	Heralds a depression.
Stratus	Misty	Low	When stratus moves in behind middle and high level clouds, expect rain or snow soon.
Mammatus	Clumps of cloud protruding downward	Low to middle	Strong winds, hail, lightning, possible tornado threat.
Alto cumulus (mackerel sky)	Resembles scales of fish	Middle	Indicates changing weather.
Contrails	Straight lines behind aircraft	High	Very dry conditions.

Weather By The Moon

and you see cirrus clouds you can safely say that the storm has finished - fine weather will generally occur within 24 hours if the wind doesn't change. When you see clouds many-layered, in vertical halls and columns and clearly arranged simultaneously at different altitudes, this generally means unsettled weather approaching.

Haloed and coronas around the Moon, often associated with cirrus, indicate the presence of middle or high level clouds which are often a sign of cold fronts, advancing rain or storms.

Hence:

A circling ring of deep and murky red, soon from his cave the God of storms will rise.

PROVERBS

There are many proverbs that retain some truth and some that are worth keeping for their poetry alone. They are all part of our folklore.

FROM USA

'If a groundhog sees its shadow at noon on 2nd Feb, the following 6 weeks will be cold.'

'When birds and badgers are fat on October, expect a cold winter.'

FROM ENGLAND

'St Swithin's Day(15th July)if ye no rain,
for 40 days it will remain;
St Swithin's Day an ye be fair,

Predicting

for 40 days 'twill rain nae mair."
'March winds April showers, bring forth May flowers'
Warm wind, the west wind, full of bird cries'
'Mares tails cause ship to lower sails'
'Rainbow at night is sailor's delight; rainbow in morning is sailor's
warning'
'When dew is on the grass, no rain will come to pass'
'Hens scratching and mares' tails
Make tall ships carry small sails'
'The nearer the kingfisher is to the house, the nearer the rain'
'Watch where is the opening to the hedgehog's nest – wind will
blow the other way'- means that winter severe our way.'

'Oak before Ash; only a splash;
Ash before Oak, in for a soak.'
'A leaking May and a warm June,
bring on the harvest very soon.'(Scotland)

FROM EUROPE

'January wet, no wine you get '(Southern Europe)
'When March has April weather,
April will have March weather.'(France)
'Rain before seven, shine before eleven'
'Cow with its tail to the west makes weather the best, cow with
its tail to the east makes weather the least.'
'Frost on the shortest day(22nd Dec)
'When it rains in August,
it rains honey and wine.'(France and Spain)

FROM AUSTRALIA

'Mamamtus brings storm with bad NE gale'
'Scarlet sky sunset or morning means rain'
'Yellow sky at sunset means wind on the morrow

Weather By The Moon

FROM NEW ZEALAND

'When cabbage trees bloom well, a long dry summer spell'
'Pohutakawa has mass of blossom means summer not too wet'
'Early flax flowers, few summer showers'

SIGNS IN NATURE

1 . OF WORSENING WEATHER

(animals seem unsettled)

Cows stop eating, lie down before rain or gather together
in a corner.

Ditches smell dank and damp.

Sheep stay under trees

Cats rub their ears. Chckens roost late.

Bees very excited, seek protection, returning to the hive
before a storm.

Insects become more active, fly close to ground and water.

Spiders disappear.

Birds and bats fly lower. Birds appear excited, flock
together, and fly this way and that.

Frogs croak more.

Scarlet pimpernel flower closes.

Pine-cones close.

Seaweed becomes limp.

Early arrival of waxwing in autumn(indicates harsh
winter)(Europe)

Dolphins sporting in a calm sea prophesy wind from the
quarter from which they came.

Predicting

Ants hurry to and fro carrying their eggs. They run in circles, when rain is about and in straight lines when it is fine.

Seabirds fly into interior.

Aquatic birds leave inland lakes.

Swamp birds nest further up valleys, to coincide with expected water levels when eggs hatch..

Cattle enter stalls late.

Roe deer and other game seem to lose their shyness and leave the woods.

Fish jump from water.

Earthworms come out of holes.

2 . OF BETTER WEATHER

(animals seem industrious)

Swallows fly high in search of insects.

Spiders spin webs. Seaweed stiffens.

Bush birds stay longer in bush in summer, winter still far off.

Early-spring arrival of swallow and cuckoo(Europe)

Dolphins splashing in a billowy sea.

Cranes flying high in silence.

3 . OF WEATHER CHANGE

(Animals seem annoyed)

Owl or morepork screeching.

Sheep skip and sport.

Oxen sniff the air or paw the ground.

Many birds have special rain or weather calls.

4 . OF EARTHQUAKES

(Animals seem to panic and want to get out into the open)

Weather By The Moon

Chickens shriek, won't go into coups.
Cats completely disappear and mice and rats run around freely.
Wild cats wail.
Cattle kick up a commotion.
Dogs run in circles.
Birds call in the dark.
Caged birds flap wildly and call out.
Fish panic and jump above water surface
Rabbits raise their ears, jump aimlessly and bump things.
Insects form swarms.

WEATHER IN BRITAIN

British weather is typically a series of depressions

WIND FROM	WEATHER
South and southeast	Fair, then cloud, then rain from west. Warm.
Southwest	Overcast, cloud, drizzle, fog, warm.
West and northwest	Squalls, thunderstorms, hail, but then becomes fine. From Atlantic, brings brief snowfalls.
If anticyclone is over Scandanavia	Long fine spells(summer).
East and southeast	Dry and warm(prevents depressions from forming).

WEATHER IN NEW ZEALAND

Weather comes mainly from the west, southwest and

northwest.

WIND FROM	WEATHER
Southeast	Fair and warm.
Southwest	Cooler.
West and northwest	Moist, rain-bearing.
East	Long fine spells(summery).

WEATHER IN USA (GENERAL)

WIND FROM	WEATHER
West	High pressure readings and good weather.
East	Falling barometer and rain or snow.
Northwest	Moist, rain-bearing.
Swinging from easterly to westerly	Bad weather improving.

Weather By The Moon

WEATHER IN USA (NORTHEAST)

WIND FROM	BAROMETER	WEATHER
SW to NW	Steady.	Fair, with little temp. change for one or two days.
SW to NW	Rising fast.	Fair, followed by rain within two days.
SW to NW	Steady.	Continued fair with little tem., change
NW.	Falling slowly.	Frontal system approaching. Fair for two more days.
S to SE	Falling slowly.	Rain within 24 hours.
S to SE	Falling fast.	Wind rising in force, rain within 12-24 hours.
SE to NE	Falling slowly.	Rain in 12-18 hours.
SE to NE	Falling fast.	Rising wind, rain within 12 hours.
E to NE	Falling slowly.	In summer, light winds, rain not immediately likely. In winter, rain in 24 hours.
E to NE	Falling fast.	Rain probable in summer in 24 hours. In winter; rain or snow and windy.
SE to NE	Falling slowly.	Steady rain for one or two days.
SE to NE	Falling fast.	Rain and high wind, clearing within 36 hours.
S to SW	Falling slowly.	Clearing within a few hours, fair for several days.
S to E	Falling fast.	Severe storm imminent, clearing within 24 hours; colder in winter.
E to N	Falling fast.	Severe NE gale, heavy rain in winter, heavy snow and cold wave.
going to W	Rising fast.	Clearing and colder.

Looking Directly at the Moon

Watch the phases of the Moon, because there are weather patterns associated with each phase. By the Middle Ages it was realised that there was no such thing as moonlight; what we see is reflected sunlight. Of all the moonlight that we see, it is still only a tenth of what actually falls on the Moon. And if you were on the Moon you would see earthlight - reflected sunlight bounced off Earth. The Moon's phases are simply the changing angle that the Moon makes as it is seen at different times between us and the Sun.

Early in the third century BC, Aristarchus of Samos accurately determined the distance of the Moon from Earth by measuring Earth's shadow on the Moon during a lunar eclipse. But it was Galileo who, gazing through his telescopes at an imperfect Moon, realised that real truths about celestial bodies were within man's reach.

Although there were a few inaccurate adages, like that a Full Moon on a Saturday foretold bad weather, pointing at one brought bad luck but getting married under one was lucky, much ancient Moon-weather predicting was quite sound. Two in one month was said to bring floods and one at Christmas foretold a bad harvest. Shakespeare put little trust in the matter when he wrote

Weather By The Moon

*“O! swear not by the moon, the inconstant moon,
That monthly changes in her circled orb,
lest that thy love prove likewise variable.”
-Romeo and Juliet*

There are some predictions one can make just by watching the phases.

NEW MOON (DAY MOON)

New Moon Rise always occurs early morning, 6 - 7.30am

The New Moon and 1st Quarter Moon are always over the hemisphere experiencing summer. The New Moon is a day Moon, meaning it is overhead during the daytime hours, which tends to cause clear mornings and evenings, with any cloudiness being mainly at midday (unless the Moon is in Perigee, which would cause more cloud and possibly daytime rain). Night skies are mainly clear and cool, even in the summer. If the weather is unsettled and there is rain about, the rain will be mostly in the period of early evening until dawn.

The New Moon attracts the Moon to be in Perigee, and the Perigee + New Moon combination often correlates with earthquakes. There is maximum gravitational pull at this time, due to the Sun and Moon being in line, and the fact that the Moon is closest to the Earth for that month. Any *night* tornadoes usually come at a New Moon.

Predicting

At this phase, the Moon is in the sky from early morning to early evening. It cannot be seen as there is too much sunlight around. It is higher in sky in summer which increases the effect of the atmospheric tide, and therefore the likelihood of unpleasant weather, at night. As the New Moon passes through a solstice or maximum declination (June 22nd or December 22nd)it tends to slow, creating a stationary weather system if summer.

If a winter New Moon, there is a likelihood of snow at night. If accompanied by a Moon in Perigee, expect a storm if summer, gusty winds and cloud if autumn. On the other hand, if Moon is in apogee, if summer, a heatwave is possible.

Atmospheric tide higher in day, lower at night

A New Moon at the time of the March equinox brings daytime gales.

FIRST QUARTER (DAY MOON)



1st Quarter Moon rises just after lunch, sets just after midnight

This is the most settled phase, storms occurring least between now and Full Moon. It is commonly a time of weakened poleward upper air heat flow. Because of the magnetic shielding effect from the Sun, there is some diminished electrical presence. If a tornado occurs in the

Weather By The Moon

early morning hours and up to midday, it is usually when the Moon is in the 1st Quarter. This is the time of the month referred to by the adage 'rain before seven, over by eleven.'

There should be cloud and rain, if about, only before lunch. Because the atmospheric tide is thinner in the morning during this phase, early morning is the time of greater possibility of a tornado, as well as rain and cloudiness. Rain is less likely in the evening. After midnight there may be some lightning and electrical storms. If it is a 1st quarter Moon in perigee, hurricanes are possible.

In the summer, expect clear mornings with dew on the ground, and in winter, cold mornings accompanied by frost and snow.

FULL MOON (NIGHT MOON)



Full Moon rises around sunset and sets around sunrise

Around Full Moon there is a strong poleward transfer of heat to the upper atmosphere, which makes the warmest daily temperature on Earth 0.20 degrees warmer than at New Moon. Also, after Full Moon, as the Moon enters Earth's magnetic tail, there begins more interference with cosmic radiation.

Thunderstorms are frequent a maximum of 2 days after the Full Moon. Most tornadoes occur from Full Moon

Predicting

until Last Quarter, because this is the time when the Sun applies the most heat to the ground. There is more likelihood of storm activity in general, that is, hurricanes and typhoons, between Full and New Moon than between New and Full.

This is a time for mainly daytime cloud and rain. Lower in the sky in summer, the Moon creates an atmospheric tide that is thinner in summer and thinner in the afternoon. It may rain in the early morning, as the Moon sets. Midday may be cloudy and the afternoon may be tornado time in some areas. Rain is less likely in the evening and overnight the sky will probably be clear.

Whirlwinds, waterspouts and a heatwave are high possibilities just before the Full Moon in summer. In the winter one can look forward to the prospect of daytime snowstorms.

When the Full Moon is in Perigee, there is usually an extra low atmospheric tide effect near midday. If it is summer, very warm temperatures will result. But Moon in apogee at this time can also bring a possible heat wave. At the solstice the weather patterns slow down.

LAST (3RD) QUARTER (NIGHT MOON)



The Last Quarter Moon rises around midnight 12-1am

There is a greater tendency for electrical storms at

Weather By The Moon

this time than at any other Moon phase in the month. Just why probably has something to do with the Van Allen Belt, which is the protective magnetic field encircling Earth from pole to pole, which shields Earth from too much electrical energy from the Sun. Because the Full/Last Quarter Moon is a night Moon, that is to say, it is over the opposite hemisphere during the day, by gravitational attraction it pulls the Van Allen Belt towards itself and so, because Earth is in the way, those charged particles are pulled closer to the Earth. During the day the charged particles electrify the clouds which have formed because the cold of space has entered the lowered daytime atmosphere. This is often a recipe for an electrical storm.

The Last Quarter is a time of cloudy afternoons and early evening cloud and at that time too, possible rain. There is also increased ozone (more electrical activity on the upper oxygen), and more meteoric dust, which the Moon pulls from the Sun and towards Earth.

Ice nuclei are more predominant in the sky (which means thunderstorm formation is more likely) and plant growth increases due to plants becoming more electrically charged, and having the least protection from the magnetic solar wind around the Sun.

The early morning and midday bring no rain, but in the afternoon showers will fall if rain is about. The evening is a possible time for tornadoes and electrical storms in the afternoon/evening. Rain is less likely after midnight.

If Summer, the last quarter Moon can make the day very hot and the winter day very cold, especially if the wind comes from the northeast or northwest in the Northern

Predicting

Hemisphere or southwest to southeast in the Southern Hemisphere.

Last Quarter Moon in Perigee brings an extra low atmospheric tide in afternoon. If summer, things will be very warm

If the Moon is in the sky, there is LESS likelihood of rain.

The presence of the Moon in or on the water was considered a source of magic for good and evil. In India there is a cure for nervous disorders which involves drinking water that has reflected the light of the Full Moon from a silver bowl. Scientifically speaking, this would be the time when the atmosphere was thickest, and so perhaps oxygen enrichment may at this time of the day provide health and an energy increase.

Therefore note when the Moon rises and sets, because when it is gone from the sky above you, the atmospheric-tide-effect of a thinner atmosphere where you are comes into force. Keep an eye on the Moon's diameter-size, so you can get a rough idea of the Perigee. Then you can work out the next Perigee by adding 27 days.

Reading Weather maps

Most newspapers display daily weather maps, distributed by the local meteorological service. The maps are accurate and describe the current situation; and are generated from an international radar and satellite hook-up. Teams of media weather-forecasters employ 3 or 4 different computerized models from at least half a dozen satellite agencies. Because some satellite readouts are taken from different vantage points and times of the day, they often appear contradictory. In such cases forecasters arbitrarily decide which one to utilize. If the weather forecast in the morning says it will be a fine day and by lunchtime there is a downpour, then they picked the wrong model. The maps don't lie - it is only the interpretation of them that may be off. There is a tendency to describe the weather as fickle, if it does not match what was forecasted. But the weather knows what it is doing. Perhaps in such cases it is the forecasters who are fickle.

WHAT ARE ISOBARS?

We are all familiar with the black contours or whorls on every weather map. They signify lines of equal pressure. Pressure is the total weight of air, or vertical mass

(also called the geopotential, or amount from earth) measured for one square meter above that point. It is measured in inches or millibars – smaller units of pressure that measure about 3/100 of an inch. Sea level has been selected as a standard so that pressures at different locations can be compared. By selecting sealevel, where the atmosphere has zero height, the *changing* height of the atmosphere is factored out, hence the Moon's potential for daily changing the height of the air cannot be observed. Sea level pressure is usually around 1000 millibars.

Low pressure at sea level can indicate cyclonics or storms near the surface of the earth. High pressure (at sea level) can indicate calmer weather. Below 1016mb usually signals potential for rain. Low pressure may be followed by a depression. Gales in middle latitudes nearly always form around depressions. Above 1020mbs indicates a ridge, and quiescent weather, with light winds.

Decreasing mbs, observed over a couple of days, can indicate an approaching or intensifying storm. Increasing heights can indicate clearing weather.

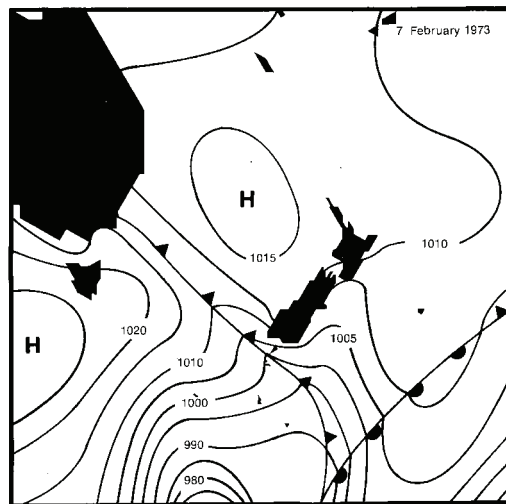
ANTICYCLONES

Counterclockwise rotation of the winds in Southern Hemisphere, clockwise in Northern Hemisphere, are associated with calm weather.. Anticyclones drift towards the east in both hemispheres. Wind speed is generally light in the centre but can be strong on the outer fringe where it blends in towards a low pressure zone. Anticyclones are often persistent, as air has had a chance to consolidate, and the whole system tends to drift rather than pick up speed.

Weather By The Moon

Barometric pressure can rise steadily whilst an anticyclone is developing, and fall during receding.

Example 1. Heat wave, record summer high temperatures, 3 days after New Moon, 7th Feb. 1973



CYCLONES

Clockwise rotation of winds in the southern hemisphere, anticlockwise in the northern hemisphere, are associated with cyclones or storms at upper levels, and will tend to coincide with troughs or gaps between the anticyclones. Cyclones and depressions tend to drift east or southeast in the Southern Hemisphere and east or northeast in the Northern Hemisphere.

A tropical cyclone is a low pressure circulation in tropical latitudes, having wind speeds more than Beaufort 8, but less than 12(hurricane). A hurricane or typhoon is

Weather Maps

respectively the American and South East Asian name for a tropical cyclone. They form and travel over oceans and degenerate to depressions when they reach land. Cyclones develop mainly when the seas reach a temperature of about 28degC and this usually occurs when the Sun is over a particular hemisphere and close to or past its solstice position of that tropic, which will allow sufficient time for the sun's rays to heat the sea to that critical temperature.

The reason there are no cyclones off Brazil is probably due to the very large volume of cold fresh water from the Amazon that keeps the temperature of the adjacent oceans below that required for a cyclone to form. Where conditions are warm enough for them to form, the heating process will continue after the Moon has crossed the equator and into the other hemisphere.

The build-up of heat will be speeded to that level during a Full Moon phase and into the Last Quarter because that is the time for the low atmospheric tide, both from the Moon being a night moon and because the Moon is over the opposite hemisphere. Also, if the Moon is at perigee, the atmospheric tide will be even lower because of the greater gravitation effect from the Moon in that period. Occasionally the New Moon will cause a tropical cyclone to form, mainly due to the increased gravitational pull occurring and especially if the Moon is at or near to crossing the equator at this time.

The worst cyclone of last century hit Bangladesh on November 13, 1970. The Full Moon was on the 14th, and the Moon was in Perigee on the 11th, 3 days before. The destruction was widespread with an estimated up to a mil-

lion killed.

Every 20 years (about a Moon cycle), New Zealand experiences an 'extreme norwester'. The most famous was in the first week of August, 1975, a week when the New Moon and Perigee happened on the same day (7th). Winds reached 170kmh and caused destruction ranging across 800 miles.

One particular weather-related disaster stands out in the minds of the New Zealanders, because it happened within memory and because of the large cost of human life.

THE WAHINE DISASTER

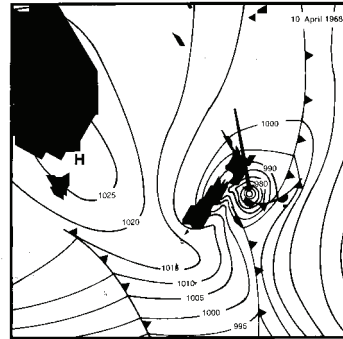


It was 10th April 1968. The meteorological service knew there was a severe tropical depression with central pressure of below 975 millibars, centred 60 miles east of North Cape and moving sou-southeast at 20 knots. It was predicted to hit the Wellington area the next day, strong northerlies changing to southerlies, increasing to gale or storm force by morning.

The tropical depression or cyclone had already been battering the north of the North Island, as storm warnings that had been out for a week after causing havoc in the Coral Sea, close to the Solomons, 2000 miles to the northwest, now moved down to NZ on a northeasterly gale. It was 3 days prior to a combined Full Moon and Perigee. Swollen streams burst their banks and landslides blocked highways.

Weather Maps

The captain of the inter-island ferry *Wahine* was experiencing great difficulty keeping on course in the height of the storm in Cook Strait. As he attempted to enter Wellington Harbour the ship struck Barrett Reef, foundering in the harbour barely 100 yards



from the shoreline opposite the suburb of Seatoun. The vessel was abandoned and although a massive rescue operation was immediately mounted, 51 of the 734 passengers lost their lives.

The bad weather wasn't confined to the South Pacific. Newspapers around the world carried similar stories. Storms raged throughout the United States killing at least 15 people. Trees fell in Kansas, crushing two cars. Dust storms and strong winds crashed a private plane in New Mexico. Winds of up to 100mph occurred in Louisiana, Mississippi and Alabama, tearing down communications and damaging buildings. Thunderstorms shook the Ohio Valley and out-of-season snow fell in the north-central States. Hailstorms damaged homes and greenhouses in the northern States.

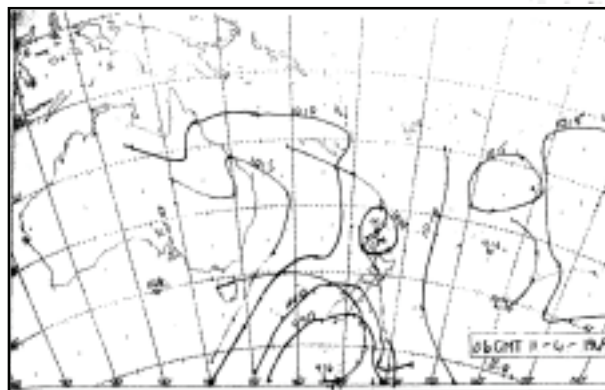
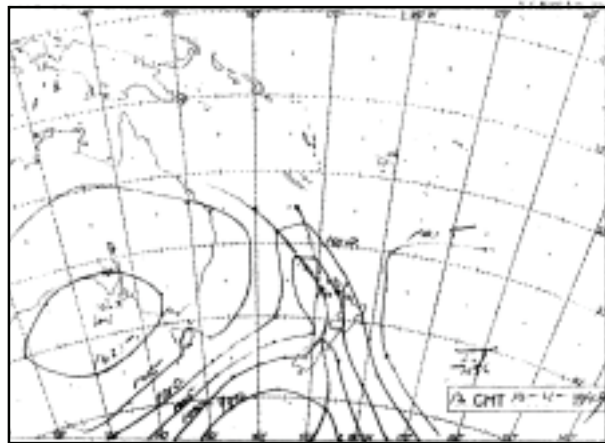
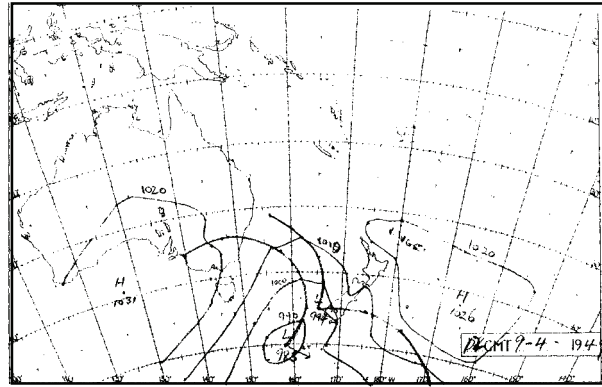
Let us go back to a different day in history. In Ecuador, 50 people were drowned or missing as flood waters of the Tumbamba River swept through the city of Cuenca, collapsing 10 bridges. In Portugal a ferry carrying 130 passengers sank in the River Douro after hitting a sandbank, drowning 50. More than 100 were killed and another 100

Weather By The Moon

injured in Brazil when a train plunged into the Tangua River, northeast of Rio de Janeiro. Most of the passengers were Easter holiday makers, sleeping when the train sped over a bridge that wasn't there. In Spain, 19 were killed when two trains collided in the atrocious weather. And in England, a minor air crash. In New South Wales, heavy rain caused flooding that almost totally submerged the town of Warren population 2000. It was the 10th of April, same day as the Wahine capsizing. Same date. Same position of the Moon; (within 4 days of Full Moon in perigee). There was just one difference - ALL THE ABOVE newspaper reports were from the same date, ONE MOON CYCLE BEFORE.

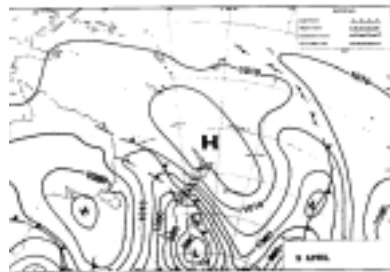
So could the Wahine tragedy conditions have been foreseen? Opposite is the sequence of the old meteorological service maps, hand-drawn as they were back then a 19-year Moon cycle previously, from 9/4/49 to 11/4/49. One can see a rather nasty-looking low pressure system moving up and over the country from the south. Southerlies always whip the Cook Strait into a fury. By the 10th it appears to be crossing the middle of the country. The storm's centre has reached the north by the 11th but stormy conditions still look to be prevailing over areas to the south. We can assume that the day of 10/4/49 would not have been sunny and pleasant, least of all calm. We can also postulate that all shipping through the Cook Strait would have been advised to wait till the bad weather had subsided. And one Moon cycle *after* the 10th April 1968?

Weather Maps



Weather By The Moon

As expected, 19-years later another bad-weather system passed up and over NZ from the south, moving from the 9th to lie across the north by the 11th. Was there bad weather that day in Wellington? The records show 47.5mm



fell on the 9th April 1987, with 21.8mm the next day. This time the wind was not vicious, being from the NW on the 9th but changing to the south by the 10th, too late to do any damage.

This system of predicting ahead using the 19-year moon cycle must also take note of the wild card - the Perigee. In 1949 the April Perigee was on the 12th and the Full moon on the 13th, in April 1968 both Full Moon and Perigee were on 14th, but the perigee of April 1987 was not till the 18th. Furthermore, in April 1949 the Perigee was the 4th closest for the year whereas Perigee of April

1968 was the 5th closest, and that for April 1987 the 11th closest. The latter was a day that did produce a southerly change, but being only the 11th closest approach of the

Weather Maps

Moon to Earth for the year meant it would not have generated strong winds. On the other hand the perigee of April 1949 being the 4th closest would lead us to expect the weather to have been equally if not more vicious to that on the day of the Wahine disaster.

LANGUAGE OF WEATHER MAPS

A **front** is the interface between air masses at different temperatures. A warm front is when the air behind the front is warmer than that ahead of it - the pips (triangles or half circles) are put on the side of the front towards which the front is moving. A cold front is when the air behind the front is colder than the air ahead of it.

Occluded front - a composite of two fronts, formed when a cold front overtakes a warm front or quasi-stationary front. The point where the occluded, warm and cold front come together is called the Triple Point, an area of extreme instability, and often where severe storms can be found.

Stationary front - no real temperature change from one side of the front to another, mostly a change in wind direction as the front moves through.

Trough - an elongated area of relatively low pressure often associated with disturbances like showers, rain, clouds.

High pressure - associated with clear skies, nice weather

Low Pressure - associated with clouds, precipitation. An ascending air motion is associated with cloudiness and rain. High values of relative humidity indicate the

Weather By The Moon

availability of moisture. When large rates of ascent are located with high moisture availability, heavy rainfall will likely occur.

Advection (a localised temperature change) of moisture by the wind can be inferred by noticing the direction and rate at which moist areas appear to be blown. Similarly, temperature advection can be inferred by noticing whether the wind is blowing cold air toward a warm region, or warm air toward a cold region. The direction of flow of the wind is generally from west to east throughout the middle and high latitudes of both hemispheres, but this doesn't apply to the tropics..

Strong divergence at upper levels is usually associated with strong vertical velocities in the middle troposphere, and severe weather/heavy rainfall. Picture hot summer air rising as two cold fronts combine. Make this 3 days after the New Moon and Perigee happen together. On 21st January 1969, thunderstorms and hail hit the lower North Is, blocking drains and flooding towns.

Recipe for snow – just after New Moon – polar winds from southeast, sudden weather change associated with a cold front.

WHAT MAKES A THUNDERSTORM?

The static charges bled to the ground substrate bias it electrically, so the last wave of frontal activity through an area sets the stage for the lightning interactions with further invading air masses. Storms traveling along standing frontal boundaries have mostly inter-cloud discharges. This frequently occurs at times of the North or South dec-

lination points.

On the other hand, when the Moon crosses the Earth's ecliptic during its monthly cycle, if it is generating storms on a fast moving front, there are more cloud-to-ground discharges.

WHAT IS A TORNADO?

Most tornadoes are the product of warm, moist air rising through cooler air and creating highly energized storms called supercells which give off energy called 'latent heat,' creating an updraft. Then the whole is hit by wind shear—two layers of wind, one moving fast on top, the other slower below it—which spins the updraft wildly, forming a meso-cyclone, a whirling column of air six miles wide. And then a downdraft at the edge of the meso whips out a tightly wound whirlwind, coiled in the shape of a funnel, blowing at a minimum of 60 mph. The tornado that swept across Missouri, Illinois and Indiana on March 18, 1925 (same day of the perigee), ranks first in distance (219 miles), dimension (a mile-wide funnel), 689 dead.

WHAT IS A HURRICANE?

Isobar lines close together = strong winds. Hurricanes describe windspeed, on something called the 'Beaufort' Scale, adopted in 1802 by Sir Francis Beaufort. It ranges from 0(calm) to 12(hurricane wind).

Weather By The Moon

BEAUFORT WINDS SCALE

Beaufort Number

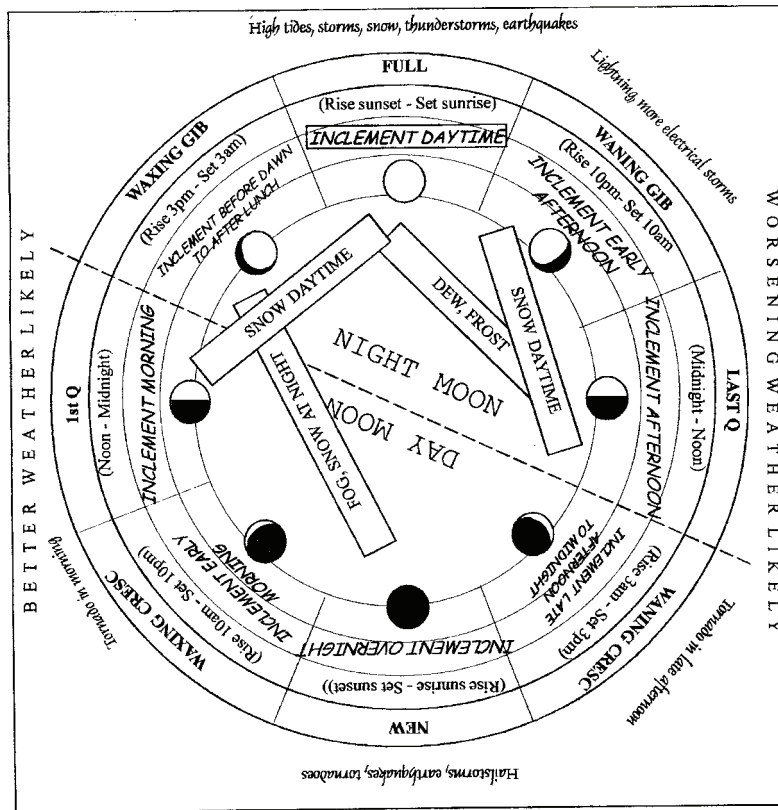
0	<i>Calm <1 mph, Smoke rises vertically Like mirror</i>
1	<i>Light air 1-3 mph, Smoke drift Ripples no crests</i>
2	<i>Light breeze. 4-6 mph, Wind felt on face, leaves rustle. Small wavelets, crests don't break</i>
3	<i>Gentle breeze 7-10mph, Leaves and twigs in constant motion, flags extend, Large wavelets, crests break, 'whitehorses'</i>
4	<i>Moderate breeze, 13-18 mph Dusraises, small branches move. Longer waves, frequent whitehorses</i>
5	<i>Fresh breeze 19-24 mph, Small leafy trees sway. Moderate waves, chance of spray</i>
6	<i>Strong breeze 25-31 mph, Large branches move, telegraph wires whistle Large waves, white foam and spray</i>
7	<i>Near gale, 32-38 mph Whole trees in motion, hard to walk, Sea heaps up and white foam blown in streaks</i>
8	<i>Gale 39-46 mph. Twigs break off trees Waves about 5 metres high</i>
9	<i>Strong gale. 47-54 mph. Damage to chimneys and roofing, Waves 7 metres high, spray affects visibility</i>
10	<i>Storm 55-63 mph. Trees uprooted. Sea white, heavy and shock-like, 9 metre waves</i>
11	<i>Violent storm 64-72 mph. . Seldom over land Waves hide medium-sized ships, foam everywhere</i>
12	<i>Hurricane 73 and over mph Sea completely white with driving spray</i>

OTHER WEATHER CONDITIONS

NAME	WHEN LIKELY	HOW FORMS
DEW	Full Moon Waning Gibbous Last Quarter	Temperature of the ground drops to cause condensation of the air immediately above it. Need still, clear night. Must be high humidity in the air next to the ground, low humidity in the air just above it. Absence of cloud allows ground to cool enough for moist air just above it to condense. In the desert, dew is often the main water source for plants and animals.
FOG	New Moon, 1st Q to Waxing Gibbous.	As for dew, but deeper layer of moist air is required. It is possible to have dew without fog but not fog without dew. Fog is low cloud and forms mainly at night.
FROST	Full Moon to 3 rd Q	On clear nights, when conditions allow for fast cooling to below freezing. (Slow cooling only results in dew.)
SNOW	At night; New Moon to Waxing Gibb.. In day, Waxing Cresc. to Last Q., including 1 st Q., Waxing Gibb., Full M. and Waning Gibb.	Freezes in atmosphere before it falls. Ice crystals bond in cloud and then fall through cold air. Sign of high winds, blizzards, or avalanches.
HAIL		Rapid freezing, drops and melts and freezes again as it encounters warmer and colder air.

Weather By The Moon

QUICK ATMOSPHERIC-TIDE CHART
(NORTHERN HEMISPHERE)



Q's and A's

Q: I take it the term 'stretched' refers to the atmosphere's height, as if we were talking of the thickness of the skin of an apple or an orange - not its molecular density. But isn't height the same as pressure?.

A: The idea of thicker is indeed molecular density. A gas is different to a solid. If a solid is stretched it's thinner, but a gas stretched gets away from thickness issues because the faster molecular movement tends to redistribute and equalise. Gravity only acts on mass. On the far side of the Earth the area holding the atmosphere is still a closed container - its limits are set by Earth's gravity. So when the height of the air is lower, the air still expands to fill the space, which is why pressure remains the same whatever the height. I don't think 'thickness' is a good word for a gas.

Q: Why should a topdresser airplane be more careful than an airliner about where and when during the course of the day it flies?

A: Topdressing planes use propellers and airliners don't. The jet would not be subject to atmospheric stretching because all that makes the jet go forward is the opposite reaction of the jet-thrust moving backward

Q: If you use the phrase 'atmospheric tides', your reader should get a clear idea of the similarities and differences

between water and air when they are pulled. For example, water doesn't change its density?

A: It does when it gets hotter or colder and when it turns to steam, but not when it is acting in a tide..

Q: Since your thesis depends on the Moon pulling the air, I don't think it's enough to presume about the height of the air on the sides and far side of the earth. We can picture the ocean's bulge and its causes. There has to be a way found to picture the atmosphere's bulge- by experiment or measurement or mathematical model - or an airtight line of reasoning.

A: It's difficult to prove. One can only infer, by deduction, that it is there. We do know about subatomic particles by the effects they cause. Rutherford split an invisible atom. It seems we don't have to see them to form theories which are workable. I can't see New York, but logic tells me it's there. By denying the role of the moon scientists are not even applying gravitational dynamics.

Q: The moon's bulge doesn't change the pressure?

A: No, it just changes the height

Q: So the moon overhead must make the air both denser and higher at the same time? that's what the bulge means?

A: Higher, yes. Density would vary with height and temperature. More volume, and more of it, though, for sure.

Q: Are you actually "looking at the moon" when you predict the weather or looking at weather maps of earlier days?

A: Both. I'm looking at the Moon for the phases, at the size for the perigee proximity, and presence and position in the sky. That gives me a rough read for the next few days. But for the details I

Weather By The Moon

go to past weather maps. I look at *last* month around the same time of *this* month - weather is similar. I look at *last year* where the Full Moon and Perigees match for *this* month - weather is generally similar. Then I look back at the 19 year ago maps and search for matching full/new/perigee/apogee settings, coinciding with northern and southern declinations. It is amazing how similarly they overlay with the current year. I could pick any 18-19 year cycles, that is 36-38 years ago as well, as I have all those maps. There's a little more variation, but not all that much, the further back you go. Then I look at what I have and average it. I find the anticyclones are very reliable and predictable; they repeat their patterns almost exactly. But depressions tend to be more temperamental.

Q: I find it astonishing that such a difference exists between near side and far side atmosphere.

A: I suppose no more astonishing than the sea-tide.

Q: I've a feeling photographs showing the air's moonbulge may already be in existence. A satellite taking pictures of the earth during a major burn such as of oil (as in the Gulf War) or forest or explosion such as volcanic eruption will show the air made visible by the smoke. The same satellite might show the bulge made visible by cloud as well.

A: We'd have to have at least two photos taken of the same place within a 24 hour day. They'd have to be infra-red, to take care of the absence of light. But we don't have to even do that. A circle of cloud around a pinnacle-shaped hill can act as a visible barometer.

Q: Since air moves so much faster than water, would not the

Questions

percentage of air shifted be much greater than the percentage of water shifted?

A: Yes, because gravity wouldn't act as much on the air to stop it moving from the far side. The airtide is about 20% at times but a watertide can rise about two metres which probably isn't as much as 20%

Q: How did you calculate one moon cycle? The dates you gave aren't 18.6 years apart.

A: Anything from 18-20. It varies. You look for the same conditions combining together within 6 months or so.

Q: Can you tell where north and south is from looking at the Moon?

A: The Moon generally rises in the east and sets west or northwest. When Full, the Moon is opposite to the Sun in the sky, and to observers in the Northern Hemisphere of the Earth it lies due south at the stroke of midnight. For those watching from the Southern Hemisphere, it lies due north at midnight.

Q: It seems to me it would be important to know the shape of the bulging atmosphere, and specifically how the height of the atmosphere on the far side from the moon compares to that of the portions at right angles to the moon ie the "low tide" zones. Is there any way of judging simply whether the atmosphere on the far side is thicker or thinner than that at the sides of Earth -what you'd call the midzone atmosphere?

A: I don't think there would be any midzone atmosphere.

Presumably the atmosphere on the far side is lower than that at the sides of the Earth because the Moon would be pulling the atmosphere in this zone. That would to some extent take in the

Weather By The Moon

atmosphere at the sides, really in effect leaving only the atmosphere in the whole lower hemisphere lower. An analogy would be a torch shining on a basketball. All the top hemisphere would be illuminated and the back side would be in darkness. The transition point would be at the 'equator' and would just be an imaginary line, not any sort of band. There would not be a halfway situation where it would be half-lit at the sides or even a level of dark at the sides that could be compared to the underneath. The bulge on the Moon's near side is just a greater volume of gases, that's all, and therefore the "tide" would be higher. The atmosphere can move very quickly to be under the Moon; probably quicker than the Moon itself travels. There is just more atmosphere in that region of sky. The *upper parts* of the atmosphere would get stretched more toward the Moon, that is, that upper part that is furthest from Earth's gravitational influence.

Appendix 1

TRADITIONAL NAMES FOR FULL MOONS

JANUARY	Old Moon, or Moon After Yule
FEBRUARY	Snow Moon, Hunger Moon, or Wolf Moon
MARCH	Sap Moon, Crow Moon, or Lenten Moon
APRIL	Grass Moon or Egg Moon
MAY	Planting Moon or Milk Moon
JUNE	Rose Moon, Flower Moon, or Strawberry Moon
JULY	Thunder Moon or Hay Moon
AUGUST	Green Corn Moon or Grain Moon
SEPTEMBER	Fruit Moon, or Harvest Moon
OCTOBER	Hunter's Moon
NOVEMBER	Frosty Moon, or Beaver Moon
DECEMBER	Moon Before Yule(Yule is Christmas) or Long Night Moon

Journey

At the age of three I can remember riding my tricycle and noticing the Moon moving with me. I stopped, and it did. Then I saw the Moon racing across the sky, behind the scattered clouds. My 3 year old brain couldn't work out why it was speeding and getting nowhere.

The first word my infant son Keri uttered was Moo, because he couldn't say moon. But I can quite conceive that he only said it to shut me up, because I would point to it and repeat the word ad nauseam assuming he was interested..

During the 10 years between 1970 and 1980, as a young family we lived in a mobile home, making our way slowly around the North Island of New Zealand. We did this so that we could homeschool, and the law in those days required that we lived more than 30 miles from a bus route. Not owning land anywhere south of Auckland, we reasoned that the only way to do it would be to buy an old bus, convert it to a home and live in it.

Our lifestyle became one of subsistence, because we were continually in remote parts of the country, far from towns and shops. We found people living off the land, for survival. There was the drover, the swaggie, the poor farmer, the hippy (which we were taken for) and the gypsy. The culture of the traveler is today romanticized by the house-truckers, but in those days there were no monthly craft fairs,

no cell-phones, and one had to contend with social isolation. But the richness of the characters we came across made up for that. A never-ending line of elderly folk shared with us old world knowledge about fishing, native plant medicines, and food available from the wild.

The set fishing-net was out every day and we camped on the coast, for there are fish everywhere, especially off season when all the holiday makers and their noisy boats trot off home.

I ran my net twice a day, because many fish can see the net in the moonlight, and won't go into it. Nor can they reverse away, because fish don't swim backwards, especially against a current. So they would often stay poised a foot or so from the mesh, waiting for the tide to turn. I would encounter this often. Wading into the sea I might see half a dozen fish in the net already and two or three waiting. By splashing the water behind them I could get them to dive into the net and become entangled. I would do this day in and day out all year around.

This would often get me out of bed at two or three in the morning wading into the tide, even in the middle of winter. It could be cold, certainly, but the cold didn't occur to me. After all, I had a job to do. If I had stopped to think of the cold I would probably never have ventured in. I would then get back into a lovely warm bed and my freezing feet did not impress my wife.

It was in my interests to find out from the locals what fish were running, coming up rivers to spawn at this or that time of year, and where the good spots were. Very often we would get misinformation of course, and you could gener-

ally detect this because the narrator would tell you one thing and do another when he thought you weren't watching.

I had to refer to tide tables because I always set the net at low tide. I also had to refer to planting guides. *That* was all to do with the drovers. These silent throwbacks to a previous century moved on horseback, unshaven, sullen figures, in their Man From Snowy River-type oilskins, towing fresh pack horses behind, and surrounded by ever-moving yelping keen dogs.. They 'drove' cattle from Gisborne to saleyards and abattoirs further north, to Rangiora near Tauranga and Horotiu on the other side of Hamilton. You would see them coming miles away, hundreds of animals slowly moving, stopping to graze, holding up traffic in many cases and leaving messy roads as they went through a small town. The bigger towns had special back roads for them signposted 'Stock Route'.

The drovers 'planted out'. They carried little germinating seedlings with them in springtime, which they put in the ground so that when they came by that way again, they could reap a harvest. Although they had no land of their own, they picked areas that were hidden from view - the back of a disused rubbish dump, the downside bank of a newly formed bridge approach or the top area on both sides of where a new road cut through a former hill.

In this way, here and there the drovers established little growing patches. All were out of sight from the road, and unknowingly, well fertilised by the farmer. The drovers grew things that took care of themselves, like pumpkins, butternuts, potatoes, beans.

Journey

Once we learned what they were doing, and it was in their interests to tell us so we didn't steal their food supplies if we accidentally found them, we started doing it too. So we had to know when to plant.

My wife and I acquired old planting calendars, found in second hand bookshops. We started noticing that the Maori fishing guide and the planting calendar often seemed to match up. Both were based on the perigee/apogee cycles of the Moon. It turned out that you fished and planted mainly on the apogee, whatever that was. Then someone told me about the old tohungas' measuring sticks.

I wanted to discover the reasoning behind these calendars. It seemed to me that planting and fishing depended on the climate, which meant weather, so what caused heavy seas, strong winds and rain, must be very patterned. By then I had also started to notice that the worst storms often happened at the time of highest tides. Was there a link, and if so, could a system of prediction be devised that covered a whole year? What did the old sages know, and how did they get their information?

It turned out that the Maori elders who had been so knowledgeable about fishing and planting drew blanks when it came to weather patterns. It was up to me. I knew I had to start collecting records. That was the obvious place to start. I had already studied the cloud patterns somewhat, and could roughly 'read' the sky.. It's easier in the country - your eye travels along the line of the hills and then upwards, a restful and natural thing to want to do, whereas in the city the houses on the skyline seem to scramble the visual transition and discourage the eye from looking up. Perhaps it's

Weather By The Moon

just that in the town we don't have to look up, because we prefer to pay the forecasters to do it for us.

I obtained cloud information from a children's book from the library. Much of it seemed to work. But I wanted to know more. So I invested in all manner of weather-reading equipment; a barometer, temperature gauge, wind velocity gauge, weathervane, rain gauge and a hygrometer (for measuring humidity).

In a diary I kept a daily record of air pressure, wind speed, air temperature, humidity, Moon phases, and the weather that was just above me. I figured that if there was a Universal System it would work just above me as anywhere else. Gravity works on everything so why not also on the wind, Moon and tides. Newton didn't have to go all over the world dropping apples.

I had to have a scale of weather conditions, and it was a subjective one. I decided on 13 different weather states and allotted them each a number value.

- (1) - clear day, fine weather, blue sky, no wind.
- (2) - relatively clear day, slight cloud, occasional breeze.
- (3) - quite thick cloud, a bit blowy, blue sky poking through
- (4) - overcast, no blue patches
- (5) - cold conditions, windy, slight drizzle(not real rain)
- (6) - rain, very intermittent.
- (7) - unpleasant continual drizzle, not much wind.
- (8) - rain plus wind
- (9) - wind howling, intensity varying, not so much rain
- (10) - lashing wind and rain

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(11) - non-stop wind and rain

(12) - severe storm, buckets of water, can't go outside

(13) - electrical hurricane

On my scale, rain kicked in at number six. I kept this up for four years, every day my first task in the morning and last thing before bed, and I averaged what the day could be described as. This I entered with the other data. At the end of the first year I graphed it all out, my weather values up the vertical axis plotted against all the other variables along parallel horizontal axes.

It came as a big surprise to me that to begin with, the only factors that coincided with a weather value reading exceeding six were the Full and the Perigee phases of the Moon. All the other factors seemed to have no consistent bearing. Sometimes it rained when it was cold, sometimes when it was warm. Wind speed and humidity similarly showed no pattern.

By the end of the second year I could see the pattern repeating for Full moons and perigees and I realised that Full moons mainly brought bad weather in winter, whilst New moons were the culprit in summer. I began to predict weather for myself and my immediate friends. I had made up a perigee stick and was using that until I realised you could just look it up the nautical almanac to see when the next perigee was coming. Of course you can always see when the Full moon was coming.

The basic rules were: if it was Full Moon, guaranteed rain or change. Same if perigee, with gusty winds as well. If perigee and Full Moon occurred on the same day, a dou-

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ble lot of bad weather. If perigee and full Moon occurred a few days apart, the bad weather hung over those days. I didn't yet know about declinations and the air tide, although I would stand watching the sea for hours and wonder if the air was subject to the same dynamics of tidal flow. Commonsense told me it must be, but if so, why wasn't I taught it at school?.

No-one, except my wife Jude, believed in my work. A group of us were all set to travel to Nambassa, the rock music festival. I noticed from the almanac that the Full Moon and the Perigee were due to coincide just before the festival and so I said don't go, it will pour down. But they all went anyway - without us. And as I thought would happen, a torrential downpour right on the site on the last day thoroughly washed everyone out. No amount of told-you-sos altered my critics' opinions that I just got lucky.

The Sydney-to-Hobart Yacht Race was held, I think, the next year. It had maximum media coverage in this country, as many of our finest and most experienced yachtsmen and women were taking part. A violent storm at sea turned what started as an exciting race into a catastrophe. Six boats went down, including one named the Spirit of Enterprise, the pride of the NZ fleet. I was expecting it, Full Moon on the same day as the Perigee, a few days before the race.

I was sure I had found out something that maybe others ought to know about. So I took my data into the Observatory in Auckland to see if it was known to climatologists, and if so why yacht races were held at such daft times of the year. I was told, politely, that my work wasn't scientific enough, and the information was not new. They weren't

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interested, not even in seeing my collected data.

Then I rang the TV news-weather office. Their response? We know all that stuff. I said if you know it, why don't you tell the people? Oh, they said, we're not here to educate. But I disagreed. You are so! If I knew of some danger and I didn't tell, I could be locked up!

I reasoned that public information gatherers like media have an ongoing responsibility to pass on vital information, especially to yachtsmen if they know the weather was going to get bad.

I am sure they are not unkind people, and the truth is that they really don't know. Only a handful of researchers and long-range forecasters bother to investigate the lunar link to the weather. Perhaps this is because everyone who is supposed to know these things, the meteorologists, say the Moon doesn't affect the weather, so that's that. Because no-one questions it there seems little need in most people's mind to investigate the matter.

My final act was to go to the library and look up all the weather-related disasters in New Zealand's history that I could think of, and match them against the Moon phases nearest those dates, to try to establish some pattern. Amazingly, almost ALL the weather-related disasters that I looked up (about two hundred) happened in the same week of either the Full Moon or New Moon and/or coinciding with the Perigee.

Then I had enough to present to the print media. I approached the NZ Herald and they printed a full page article, written by chief reporter, Philip English based on material almost word-for-word that I supplied. I was very ap-

preciative, because in the days following I was contacted by people who either currently used the Moon phases themselves or could tell me what their grandparents did, in terms of weather prediction, fishing and planting.

So I wrote out the perigees for the next year and put Philip a little more in the picture. He was enthusiastic and started noticing them for himself. He suggested that I write this book.

By this time I had acquired access to the Internet. I put out a call to Climate Centres around the world, places with names like The Alaska Climate Research Centre. My question was always the same. Can anyone tell me of any links between the Moon and the weather? Replies ranged from *absolutely, yes*, to *there may be a link but it hasn't been established*, to *sorry, no link at all*.

But I knew in mind there was a link. I had proved it time and again with my own records. By now I had about 20 years worth. I could scarcely believe that the scientific community were that much in the dark, and even divided over it. Yet who was I? Even my own local observatory had denied it.

In 1998 they held another Sydney-to-Hobart yacht race. They held it again at the time of the perigee. Sixty-seven of the boats turned around and limped back. Some were lost without trace. Experienced men drowned. I contacted the newspaper again and Philip ran another story on my theories. One of the callers was someone called Harry Alcock.

Harry explained on the phone that he had been following my articles and had been meaning to write to me

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for two years. As an umbrella manufacturer, he had needed to know what the weather was going to be in the weeks following so he wasn't wasting money on advertising if the week was going to be rain-free. And so he had embarked on a personal quest for weather knowledge, discovering, like myself, by trial and error. When he rang me he had mostly retired from his version of forecasting. Before he rang me, he had written to the same newspaper, a letter he later showed me

Dear Sir,

Your article on Ken Ring(Jan 18) and his reference to the moon influencing the weather is correct. It would also seem that depressions will predominate near the dates he mentions, when the Moon is at perigee and also close up to the Full Moon, up to November anyway. The depressions will all be either over New Zealand or about the south of the country. To expect meteorologists to support him is optimistic, they would only finish up with egg on their face.

Yours faithfully

H.F.Alcock

Meeting Harry and his wife Dulcie was, I think, mutually inspirational. He was elderly and in poor health, and so I visited every fortnight, more often if I could get there, and we collaborated constantly during the final four years of his life. He showed me how to read an ephemeris properly, for up till then I had only scanned one for what I required, and I introduced him to stone circles, ancient civilisations and the computer, and we often felt like small children rediscovering ancient knowledge that had remained hidden for so long. To this day I remain very grateful to the Alcocks for their open generosity, hospitality and support.

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I do miss Harry and would love to update him on what I have uncovered and developed since his passing. This work will take more than one or two lifetime's work to finally unravel, and the job of convincing mainstream science has not even begun. I know I am not alone in thinking that this may one day be the meteorology of the future, and has the ability to save lives and millions of dollars in the agricultural sector through advance warnings of floods, hailstorms and freezing spells.

Those are roughly the events leading up to this point. I fulfilled a dream started 25 years ago, that I might someday come up with a workable system for foretelling weather. It is a long way from Opotiki and a long way from those bus days. My children are now grown and yet my passion for continuing what I started has not diminished. They are fond of telling their acquaintances to be warned - if you meet Dad on the street and comment on the weather you may still be there two hours later.

I am now many life-years on from 3, yet when I look up and see it on any night, I have to say the Moon holds the same fascination for me. For hundreds and thousands of years, it has inspired poets, lovers, dreamers and prophets to watch its many shapes and moods. I hope through this book it will inspire more.

*Ken Ring
Auckland
2003*

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Last but by no means least; thanks to all who have written articles and books that I have been able to source and quote from, listed in the following pages. As there are so many, I hope I will be forgiven for my not first asking direct permission in writing, and that my thanks and the listing here is acceptable. -KR

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