WEATHER FORCASTING

Weather forecasting is the application of current technology and science to predict the state of the atmosphere for a future time and a given location. It is essential for especially for fishermen and farmers.

Weather forecasts are made by collecting as much data as possible about the current state of the atmosphere (particularly the temperature, humidity and wind) and using understanding of atmospheric processes (through meteorology) to determine how the atmosphere evolves in the future. However, the chaotic nature of the atmosphere and incomplete understanding of the processes mean that forecasts become less accurate as the range of the forecast increases. Traditional observations made at the surface of atmospheric pressure, temperature, wind speed, wind direction, humidity, precipitation are collected routinely from trained observers, automatic weather stations or buoys. During the data assimilation process, information gained from the observations is used in conjunction with a numerical model's most recent forecast for the time that observations were made to produce the meteorological analysis. Numerical weather prediction models are computer simulations of the atmosphere. They take the analysis as the starting point and evolve the state of the atmosphere forward in time using understanding of physics and fluid dynamics. The complicated equations which govern how the state of a fluid changes with time require supercomputers to solve them. The output from the model provides the basis of the weather forecast.

WEATHER FORECASTING FROM LOCAL INDICATORS

Ethnic tribes and other local people, especially farmers, fishers and hunters are very astute weather watchers and are quick to recognize weather conditions and whether. Local forecasting often combines empirical observations and weather predictions through the phenological patterns of plants and the behaviour of birds and other animals. The production and application of local forecasts are deeply localized, derived from an intimate interaction with a micro environment whose rhythms are intertwined with the cycles of seasonal changes. The vulnerability caused by vagaries of the weather creates a knowledge base among farmers in the form of Indigenous Technical Knowledge (ITK) that helps people to overcome uncertainty and prepare for possible adverse or favorable events. Local indicators and local knowledge systems cannot be replaced with scientific knowledge, because they are **holistic** and **specific to local situations**, providing farmers and others with the ability to make decisions and prepare for the coming agricultural year. Mechanisms for integrating both traditional and scientific weather forecast systems would reduce uncertainties and improve farm management, as well as provide a basis for integrating scientific forecasts into existing decision processes of farmers.

For the traditional weather forecasters, the phenology of certain plants and behaviors of certain animals is a reliable indicator of a wet or dry year, or for the onset of the rainy season or adverse weather conditions. Farmers often use such indicator plants and animals in planning for their cropping activities, especially when other indicators are not evident. There is a tendency for western-educated individuals to dismiss such traditional weather knowledge as simply a set of beliefs designed to explain the stories of nature that people could not explain in any other way. Despite the presence of modern technology to predict weather conditions over the next day or month in a specific location, folk weather lore (knowledge) has remained an important form of local weather forecasting, and can serve to supplement public meteorological information and weather prediction. People have been attempting to predict the weather for a very long time and have used a number of different methods, some of which have proven very effective and successful. There is an urgent need to authenticate the various traditional methods of weather prediction, especially rainfall forecasting, and ways to predict other natural weather phenomena such as floods, cyclones, etc.

As very few scientific studies have ever been conducted in ancient Astro-science and almost all that have been undertaken have reported encouraging and positive outputs, there seems to have enormous scope for studying ancient sciences in greater depth. Unfortunately, with the advent (arrival) of scientific technologies over the past century or so, ancient knowledge which is **holistic** and **multidimensional in nature**, has often been sidelined. The most important aspect regarding our ancient scriptures is that the weather of the upcoming year(s) can be predicted with relatively high accuracy. More accurate and reliable weather forecasts would be obtained through a synthesis of different approaches, both ancient and modern.

PLANT INDICATORS

Plants and certain fungi can accurately forecast the certainty of wet and dry weather. In western countries, some fascinating facts were recorded for dandelions (*Taraxacum officinale*), wild indigo (*Baptisia australis*), clovers (*Trifolium repens*) and tulips (*Tulipa gesneriana*), all of which **fold their petals (leafs) prior to the rain**. *Pleorotus ostreatus*, a type of edible mushroom (fungus) growing on stumps and tree trunks, **expands prior to a rain** and **closes in dry weather**. Mushrooms abound when the **weather is moist** as do mosses and seaweeds. In fact, seaweeds exposed on the rocks at low tide seem to swell and rejuvenate in the high humidity preceding wet weather. Traditional indicators of an **upcoming rain include**: **ripening and early rotting of fruits, unusual flowering of plants**, increased length of inflorescence, etc. The petals of the **morning glory** (*Ipomoea purpurea*) act as a good weather indicator – **with wide open blooms indicating fine weather and closed petals predicting rain and bad weather**. This opening and closing also occurs with the flat-leaved vanilla (*Naravelia zeylanica*). In coastal areas, seaweed is often used as a natural weather forecaster. Brown sea algal weed, Kelp, for example, when exposed during low tide, shrivels and feels dry in fine weather, but swells and becomes damp if rain is in the air.

ANIMAL INDICATORS

In traditional weather forecasting, the onset of the rainy season and upcoming rain is also indicated by the unusual behavior of certain animals. Traditional indicators of an upcoming rain include: unusual chirping (tweet) and bathing with sand of birds, native frogs croaking near swampy areas and hiding their egg masses, dragon-flies flying low, female native crabs migrating from rivers to brackish water, spider spinning shorter and producing thicker webs, wasps hiding their honeycomb, etc. During the onset of heavy rain, crickets (grasshopper) produce shrill infrasonic sounds. These kinds of sounds produced before onset of heavy rain is a type of alarm because storms and thunder generates sound waves at those frequencies as well as it is also the matter of changes in barometric and hydrostatic pressure. Normally, these pressures fluctuate slightly. Animals are highly tuned into any changes beyond natural fluctuations, which can signal big changes in the weather. These variations can trigger an animal's survival mechanism. The animals' instinctive reaction is to seek shelter in the face of potentially violent weather. For example, abnormal conditions like storms such as Kal-Boishakhi (local storm in Bay of Bengal during summer) and hurricanes cause large decreases in air pressure and water pressure. Animals exposed and accustomed to certain patterns can quickly sense these changes. Researchers observed this type of behavior among a group of sharks as they tracked the sharks' movements during tropical storm. After the barometric pressure dropped just a few millibars - an occurrence that causes a similar change in hydrostatic pressure - several sharks swam to deeper waters, where there was more protection from the storm. Birds and bees also appear to sense this drop in barometric pressure and will instinctively seek the cover of their nests or hives. Birds also use their ability to sense air pressure to determine when it is safe to migrate.

ROLE OF SATELLITE IN WEATHER FORCASTING

Weather satellites carry instruments called radiometers that scan the Earth to form images. These instruments usually have some sort of small telescope or antenna, a scanning mechanism, and one or more detectors that detect either visible, infrared, or microwave radiation for the purpose of monitoring weather systems around the world.

The measurements these instruments make are in the form of electrical voltages, which are digitized and then transmitted to receiving stations on the ground. The data are then relayed to various weather forecast centers around the world, and are made available over the internet in the form of images. Because weather changes quickly, the time from satellite measurement to image availability can be less than a minute.

Most of the satellites and instruments they carry are designed to operate for 3 to 7 years, although many of them last much longer than that.

Weather satellites are put into one of two kinds of orbits around the Earth, each of which has advantages (and disadvantages) for weather monitoring. The first is a "geostationary" orbit, with the satellite at a very high altitude (about 22,500 miles) and orbiting over the equator at the same rate that the Earth turns. This allows the satellite to view the same geographic area continuously, and is used to provide most of the satellite imagery you see on TV or the internet.

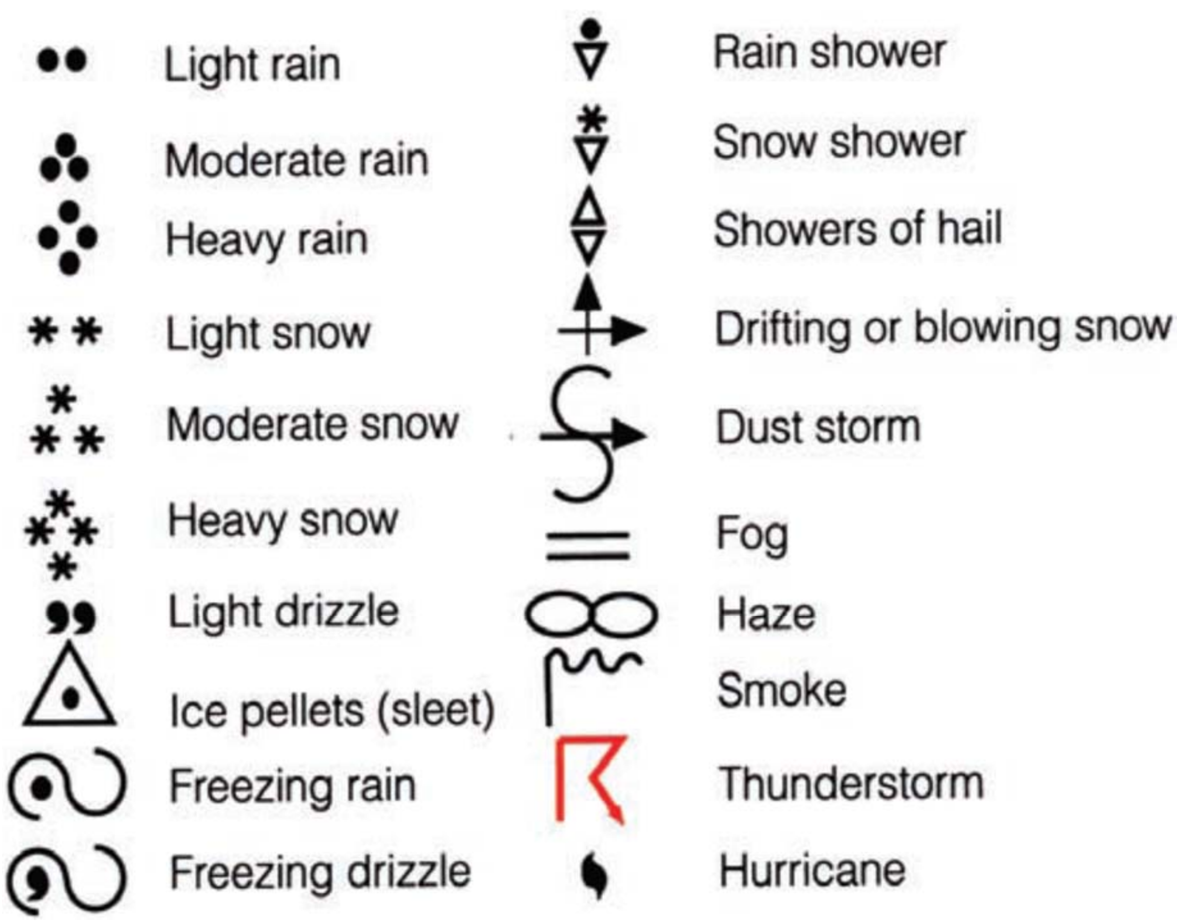
The disadvantages of a geostationary orbit are (1) its very high altitude, which requires elaborate telescopes and precise scanning mechanisisms in order to image the Earth at high resolution (currently, 1 km at best); and (2) only a portion of the Earth can be viewed.

The other orbit type is called near-polar, sun-synchronous (or just "polar"), where the satellite is put into a relatively low altitude orbit (around 500 miles) that carries the satellite near the North Pole and the South Pole approximately every 100 minutes. Unlike the geostationary orbit, the polar orbit allows complete Earth coverage as the Earth turns.

These orbits are "sun-synchronous", allowing the satellite to measure the same location on the Earth twice each day at the same local time. Of course, the disadvantage of this orbit is that the satellite can image a particular location only every 12 hours, rather than continuously as in the case of the geostationary satellite. To offset this disadvantage, two satellites put into orbits at different sun-synchronous times have allowed up to 6 hourly monitoring.

But because of the lower altitude (500 miles rather than 22,000 miles), the instruments the polar-orbiting satellite carries to image the Earth do not have to be as elaborate in order to achieve the same ground resolution. Also, the lower orbit allows microwave radiometers to be used, which must have relatively large antennas in order to achieve ground resolutions fine enough to be useful. The advantage of microwave radiometers is their ability to measure through clouds to sense precipitation, temperature in different layers of the atmosphere, and surface characteristics like ocean surface winds. Because of their global coverage, some of the measurements from polar orbiting satellites are put into computerized weather forecast models, which are the basis for weather forecasting.

COMMON WEATHER SYMBOLS



Synoptic Charts

With an understanding of how the air moves and how clouds and rain form, much prediction can be made by simply observing the sky overhead, observing wind direction and noting the temperature and humidity of the air. But to be able to predict and forecast weather it is necessary to understand the development of weather systems such as depressions and anticyclones by means of isobar plots. Meteorologists plot isobaric patterns on synoptic charts.

The first stage in preparing a synoptic chart is to chart the position of each meteorological station. These are marked by a small circle. The weather report for each station is then plotted in and around the circle, documenting the station's recorded temperature, rainfall, pressure, wind speed and direction, and cloud coverage. The station circle and various elements of the weather make up weather symbols.

When plotting of the meteorological observations is completed, the forecaster then uses the values of pressure at all the stations to identify isobars - lines of equal pressure. The completed synoptic chart with symbols and isobars usually reveal a few standard weather patterns. The positions of fronts and regions of low and high pressure can also be plotted on the synoptic chart, which show the weather conditions of different areas at a particular time. With skill and experience the meteorologist can use the synoptic chart to forecast the weather up to 24 to 48 hours ahead. Synoptic charts are updated at least every six hours, plotting new weather symbols and isobars, in order that the weather forecast can remain as accurate as possible.