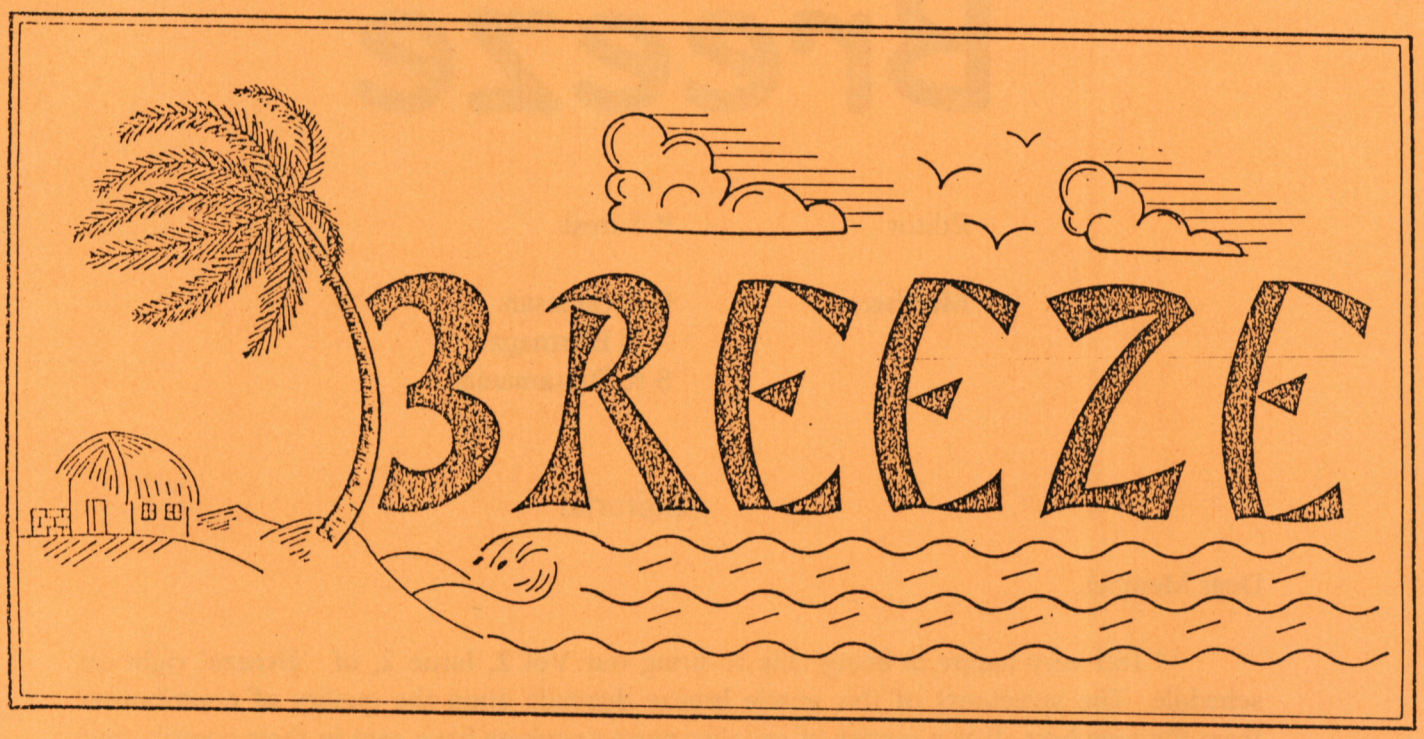

The news letter of Indian Meteorological Society, Chennai chapter

Vol 2 Issue 2 July - December '99

Contents

Breeze

Editorial

Dear Member,

I feel very happy in being able to bring out Vol 2, Issue 2, of 'Breeze' right on schedule. The sweetness of this gentle breeze depends upon the quality of contribution from the members. It is a matter of joy that more members have sent in their contribution this time. With a view to accomodating as many contributions as possible in any single issue, on account of space constraints, may I appeal to all the members to submit their contribution in not more than two pages(about 600 words).

We propose to bring out the next issue of 'Breeze' by April 2000. Kindly send your article to the Editor by January 2000. An appeal for donation was made in the last issue of 'Breeze'. Interested members on the concerns of Meteorology are requested to donate their ~~might~~ either by cash or by way of cheque/DD drawn in favour of "Indian Meteorological Society, Chennai chapter" and send to the undersigned.

With Seasonal greetings,

Chennai
01.11.99

R.Suresh
Editor

Status of Membership of IMS Chennai Chapter as on 1.11.99.		
Life Members	-	99
Annual Members	-	38
Total	-	137

"FALLS- ALARM' is a 'TRUE - ALARM' and/or LAW OF LOW

by

G. S. GANESAN

I could not have agreed with my friend more. My friend said, "Kutralam is the only place where the falls is true!". What he meant, of course, was Kutralam - like places famous for their water-falls. The 'falls' is a grand spectacle - that fills the eyes. It fills the ears with a rare roar that makes you crave for more. It fills soul too for it reminds you of the compassionate ways of God when He or His beloved son descends as an 'Avatar'. Strangely enough, it is only when curtains of water fall down, the stage reveals a drama of unmatched splendour.

Falls are a grand spectacle. Not always though. Whoever of us has outgrown the child in us when we can barely contain a giggle (not peals of laughter) on seeing a pompous person slipping off banana peels! - a slip is but a minor fall.

Falls can be tragic too. When the Imperious Julius Ceasar was stabbed, he was aghast to see his closest friend inflicting the wound. It is then, he cried "Et tu, Brute?(You too Brutus?) - Then, fall Caesar". Caesar was felled to death by 'the most unkindest cut of all' - an act of ingratitude on the part of his friend; when the mighty Caesar was laid so low, did not Antony rush to the milling masses and cry in agony "O, what a fall was there, my countrymen! ?".

Falls are not mainly tragic either. Rainfall is welcome. Indeed it is deficiency of rainfall - fall of fall - that can be tragic. Excess of it, too.

Rainfall is a meteorological phenomenon. Windfall, in addition, is an unexpected bonanza. I guess, it is welcome.

Rainfall denotes the fall of rain drops. Land fall is not a 'fall of land' but a 'fall on land', say of a cyclone when the system crosses the land.

Dew drops can be due to the 'dew fall' overight and/or water rising to the top of the leaves and/or water vapour condensing on the surfaces. Exact details call for a study long overdue.

A drop is a fall. A fall can be a drop too. One can speak of a fall of a drop. Can one speak of a drop of a fall?

There is a thing called seasonal fall. It may refer to fall in a season-for example, rainfall in monsoon season. Or it may refer to a season - like a season called 'Fall' (one often marvels at the conceptual homogeneity that leap-frogs vast distances and finds same expression in different tongues. Just as there is a season called 'Fall' in English there is (Leaf-fall season) in Tamil). Or 'seasonal fall' may refer to price-fall expected in a season.

Price-fall is an example of a fall that may be welcome mostly but not universally. Price-fall is welcome to the buyer; I suspect, is not so to the seller.

Foot-falls ! Some leave foot-falls that echo and reecho in the corridors of Time. When the first man printed his feet on the soil of moon, "it is a small step for man, but a giant leap for mankind". His feat will be remembered for all time to come.

But the falls that concern meteorologists most is the pressure falls on the surface and in the lower levels of atmosphere. It is a very significant diagnostic and prognostic tool.

If pressure falls uniformly over a wide area, it is of interest. But if it falls more steeply at one place, in comparison with what obtains in neighbourhood, pressure-inequalities-over a unit distance (pressure-gradients) build up. If the rate of fall is large, in comparison with neighbourhood, pressure-gradient too increases at a more rapid rate. The low pressure system intensifies, in response to the rate of fall of pressure. With the progressive and faster and faster rates of fall, the low-pressure system becomes well-marked, then intensifies into a depression, deep depression, cyclonic storm, and severe cyclonic storm and so on. Depending on the progress of the rate of fall the tick of the caution-alarm turns into a tinkle, then perhaps into a scream, a gong, a roar, and louder and louder roars of increasing decibels. Falls! Alarm-bell ring!

A few maxims of meteorology may be laid down in this context. It appears that these maxims are applicable not only to Meteorological field (Nature's activity) but also to Forecasting Centre (Nature - watcher's activity - Nature - watcher comprises mainly an organisational set-up meant for the purpose).

In the following, 'the rate of fall' refers to the rate of fall of pressure in the lower levels of atmosphere in a particular place, (in comparison with what obtains in the neighbourhood).

MAXIM I : THE LARGER THE RATE OF FALL, THE LARGER IS THE CONVERGENCE.

Meteorological Field (M.F.) : It is well known that with the progressive intensification of a system, convergence tends to increase.

Forecasting Centre (F.C.) :

As the system intensifies, requirement for more and more weather data increases. Therefore, the stage is set for larger and larger convergence of greater amount weather data generated and collected at more frequent intervals through more and more communication channels pressed into service for the purpose.

Similarly, there is an increase in the convergence of interpretational inputs in the form of exchange of information and ideas among the personal engaged in the work. The meeting can take place either in person or as it happens often, in communication space.

MAXIM 2 : THE LARGER THE RATE OF FALL, THE LARGER IS THE RISE.

M.F. : As the convergence gets accentuated, vertical air currents gain upward momentum thereby.

F.C. : As the rate of fall becomes large the system intensifies. As the system intensifies, as though in compensation for the fall of atmospheric pressure, the pressure of work (of generation and collection of observation of interpretation and of communication) rises.

MAXIM 3 : THE LARGER THE RATE OF FALL, THE LARGER IS THE INFLOW AND THE LARGER IS THE OUTFLOW.

M.F. : It is seen that with the progressive intensification of a system, inflow at lower levels and outflow at higher levels increases.

F.C. : Inflow of more data takes place. Similarly as the system intensifies, outflow in the form of advisories and warnings, and bulletins increases at a faster rate.

MAXIM 4: STORM PROMPTS SURGE

M.F. : A Cyclonic Storm usually brings about strong surge in favourable areas.

F.C. : As the deep depression intensifies into a cyclonic storm there is a sudden and sharp upsurge of activity in the meteorological centre calling for more and more concerted action.

Well, having set out the afore-said maxims, one more may be in order. Certin falls like price falls are welcome or otherwise, depending on what you are-buyer of seller. Is welcome to pressure falls dependant rather upon the rate of fall of the element. A maxim indicated is :

"One falls for a fall, if fall is such as to produce required fall only".

When uncoiled, this statement means "one is inclined to view with favour the pressure-falls, if the pressure-falls are such that under given circumstances, it can result in required rainfall without adverse side effects".

A study of falls cannot be a time light-hearted distraction. 'Falls' calls for a study of pretty much gravity. The story runs that it is the sight of an apple falling that launched Sir Isaac Newton on to a study of gravity (Apple also is said to have played an equally important role in the fall of Man - but that is different).

Now falls the curtain.

CLIMATE PREDICTION AND GLOBAL WARMING

by

S. Raghavan

[During a recent visit to the Colorado State University(CSU), Fort Collins, Colorado, USA, I had occasion to discuss various topics with Profs. W.M. Gray, Prof. R.A. Pielke Sr., and others, besides giving a talk on "Tropical Cyclone Scenario In India". The present article is based on my discussions as well as some of their writings on the subject of climate change prediction and global warming].

It was very encouraging to find leading scientists at CSU agreeing with me that the noise being generated about global warming due to human activities and its consequences is vastly exaggerated and amounts to a "hype", . Some "coolness" on the subject is needed as Prof. Lindzen (1990, Bull. Amer. Meteor. Soc., **71**, 3, 288-299) of MIT put it. (I recall that a popular article by me some years ago suggesting such coolness was not welcome for publication either to Indian Meteorological Society or to local newspapers).

There are too many uncertainties involved in the estimation of global climate change and more so in assessing the consequences of that change. This is not to deny the need for research and action on the subject such as reduction of greenhouse gas emissions. *The question to be considered here is whether numerical models can predict climate change over long periods with sufficient skill to be useful. The answer, as of now, appears to be* **"no"**.

Large investments are being made in the USA and elsewhere on development of numerical climate models. Numerical models have succeeded to a considerable extent in short period forecasting especially outside the tropics. They have improved remarkably in recent years aided by the introduction of ever faster computers which enable more parameters to be included and more resolution achieved. But this does not necessarily mean that similar achievements are possible in the near future on the climate scale. Numerical modelling of climate involves the following difficulties.

1. Imperfect representations of the highly non-linear atmosphere-ocean systems tend to degrade quickly (the butterfly effect). It appears unlikely that the energy and momentum exchange processes will be sufficiently well parametrized in the foreseeable future to make long term climate predictions.
2. The pioneers of numerical weather prediction (NWP) (Lorenz, Charney) set a limit of about 15 days as the time limit for deterministic predictability. This seems to have been forgotten by those who attempt "statistical average" deterministic climate predictions for a season or a year or even a century. We cannot be sure that there are no systematic errors in the energy and moisture forcing functions over long time periods.
3. Numerical modelling starts with current initial conditions and uses a knowledge of physics to see how they will evolve in the future. The physics is too complicated and inadequately known for detailed parametrization. The models do *not* use knowledge of the past behaviour of the atmosphere-ocean. This latter can be utilised by empirical models which do not require a detailed knowledge of the

---------contd.

physics. *Numerical models must show skill superior to empirical methods to be useful; at present they don't.*

4. Numerical models have become too complex for any one person to understand. They may give good results for some time due to compensating errors. But the true reasons for success or failure are not fully investigated.
5. The potential for scares and false alarms due to imperfect models or imperfect understanding of them is enormous. The global warming scare is itself an example. Another instance is the prediction of "nuclear winter" several years ago which later had to be amended as "nuclear autumn"!
   Serious errors have been pointed out e.g. in the GCM (General Circulation Model) estimates of solar radiation. The errors are four times larger than the assumed impact of human-made greenhouse gases, thus pulling down the credibility of the model.

Prof. Gray believes that *empirical methods of climate prediction* which make use of the wealth of past data on the behaviour of the atmosphere-ocean system *are more likely to yield good results.* These methods do not need a complete knowledge of the physics involved. His motto is "*You can observe a lot just by watching*".

He disagrees with the common impression that the ocean gives more long -term predictive signals than the atmosphere. Although the atmosphere may be forced by long-term changes in the ocean, measurements in the latter are less accessible and have a database going back to a much shorter period than in the atmosphere. Trends originating in the ocean can often be better detected in the atmosphere. Precursor signals for ENSO (El Nino - Southern Oscillation) are found in the stratospheric QBO (Quasi-Biennial Oscillation) and the Singapore 100 hPa temperature anomalies. The atmosphere is also the primary forcing agent associated with SST(Sea Surface Temperature) variations.

Prof. Gray is using these methods in his well-known yearly prediction of hurricane activity in the Atlantic, with a fair degree of success. He looks at past analogues and considers numerous parameters such as low pressure waves off the African coast, the Azores anticyclone, pressures in the east Atlantic and the Caribbean, West African rainfall, surface temperature and pressure, ENSO, QBO, the Atlantic thermohaline circulation system and others. This year he forecast high activity (nine hurricanes) at a time when only one tropical storm had developed, but soon after his forecast, four systems followed in quick succession [Dennis (the menace!), Cindy, Emily and Floyd],

One concern of these scientists is that the lopsided funding in favour of numerical modelling studies of climate is affecting funding for other important ones, e.g. the empirical studies mentioned above and also urban and indoor air pollution and toxic waste disposal. There appears to be a feeling that some numerical modelling groups manage to get money from funding agencies by overstating their capabilities.

To get the consensus views of American meteorologists, I looked up the Policy Statement of the American Meteorological Society on Global Climate Change. The latest available on their web site was one formulated in 1990!

Do you agree with these views? You don't? Please write to the Editor of Breeze giving your views.

THE SCIENCE (? ART) OF METEROLOGY*

(*Spelling deliberate)

by

A.S. PONNUSWAMY

(with no pretentions to knowledge of scientific inquiry)

All of us are familiar with the Science of Meteorology, some of us with the science of Metrology but few of us with Meterology. While Meteorology deals with highly unpredictable parameters, and Metrology with precise weights and measurements, the science (of art?) of Meterology concerns the highly (un)predictable elements of human behaviour.

Meterology can be defined as the Science (?Art) of meters - autorickshaw meters - to be more precise. Like the weather, which is location specific and time dependent, this science is also location specific. Though the design and mechanism of the meter as such is location and time independent, the science of reading it is highly location specific and time dependent. The meter at Chennai behaves totally differently compared to its counterpart at Bangalore for instance.

We may perhaps appreciate the behaviour of the input parameters making the Science of Meteorology by examining them more closely.

TEMPERATURE :

This is measured by the response of the passenger to the readings of the meter and is directly proportional to it. There is also an advection effect owing to the language of the driver. It shoots up further when the reading is extrapolated by way of additional fare. It is highly time and location specific and obeys inverse laws of the science of Meteorology. For the same reading the temperature is the maximum during late night or early morning travels especially when the vehicle is hired to remote location and depending on the sex of the passenger, since correction (or collection?) charts (demands) are constructed accordingly.

PRESSURE :

This can be defined as and measured by the heart beats of the passenger due to mental pressure developed concurrently with the rotation of the fly wheel inside the meter. It registers an abnormal increase on occasions when wrong routes are deliberately chosen with apparent and professed innocence by the driver. Like in the case of weather, it also rises during and after a spell of rain especially in cities like Chennai. It suffers a longer recovery time even after the passenger alights and records maximum at the time of payment and especially when one learns that smaller denominations less than five rupees or ten rupee notes do not pass as good discharges of liability.

HUMILITY :

This is a very useful parameter which can be and is very often used to full advantage by both parties, the driver and the passenger. One may be sure that one is going to be fleeced by the driver who shows abnormal humility all along the route only to shower the choicest of abuses if one refuses or shows semblance of reluctance to pay extra fare after alighting. One may also use it to avert a black eye using this paramater to one's advantage in facing a Sylvester Stallone in Kakki. In such situations this parameter demands that it will be prudent to open the purse than the mouth.

Like in weather prediction, there are also elements of continuity and conventions when the instrumental readings are seldom taken seriously. As in the case of weathermen who most often rely on the cloud cover to prognosticate the weather, the auto driver also relies more on the crowd cover to prognosticate his fortune. There are fixed demands and demands which fix the passenger especially when he is in a helpless position, say when he has appendages in the form of ladies, children and aged persons.

Suggested further reading : (1) Book of Slangs (2) Futility of Arguments (3) Prudence of travelling by Metro Service (4) Erosion of Indian Rupee (5) Wisdom of not travelling at all.

BASICS OF CLOUD SEEDING

By

R. G. SUBRAMANIYAN

1. Our gaseous atmosphere consists of 78 % of Nitrogen and 21 % of Oxygen by volume. Argon, Neon, Helium, Carbondioxide, Carbon monoxide, sulphurdioxide, Nitrogen dioxide are also present in small quantities. Water vapour varies upto 3 %, which is responsible for the formation of clouds.

2. In a given volume of air at a certain temperature, water can exist as vapour upto a certain limiting amount after which it starts to condense. At this point the air is said to be saturated. Normally air contains small particles, called condensation nuclei, on which condensation commences when air becomes saturated. However, in very clean air, it is possible for the amount of water to exceed the saturation value. This is called supersaturation. If the whole atmosphere is perfectly clean and dustfree, no cloud will be formed! In warm cloud seeding technique, condensation nuclei like sodiumchloride is used for accelerating warm rain process.

3. In a well developed convective cloud, for want of ice forming nuclei, droplets of water forming cloud may exist as liquid water at temperatures well below 0°C. The water droplets are said to be supercooled. In the cold cloud seeding technique, ice nucleating agent like silver iodide is used to accelerate the cold rain process.

4. There are several constraints to cloud seeding operation.

a. Seedable clouds should be present over the target or catchment area over which precipitation is needed.

b. The cloud has to be seeded when it is in growing stage. When it has reached the mature stage and starts precipitating cloud seeding will not produce any useful effect. Hence the development of clouds over the target area has to be continuously monitored.

c. Topography and climatology of the region should be thoroughly studied before planning cloud seeding.

d. The most difficult aspect is the delivery of the nuclei to the clouds which is a costly and challenging venture.

e. During severe drought conditions, cloud seeding will not be effective.

f. The environmental aspect has to be taken into consideration. Indian Institute of Tropical Meteorology, Pune were conducting their experiments using ground based generators at field station near Tiruvellore. This was abandoned as the neighbouring land owners complained that this operation affected their rain crops!

5. For cloud seeding to be successful, it is necessary that the cloud is in a growing stage with sufficient quantity of super saturated/supercooled water. Suitable clouds have to develop by natural process. Hence it is incorrect to call cloud seeding as artificial rain making. Cloud seeding at best can be a supplement and cannot be a substitute for the natural process of rain.

6. Cloud seeding is also used for hail suppression and dissipation of supercooled fog at airports.

7. It is difficult to quantify the benefit of cloud seeding. Hence the cost benefit ratio of the same cannot be estimated.

TAIL PIECE

Thomas Henderson, President of Atmospherics incorporated, USA (the firm which conducted cloud seeding operation in Chennai in the 80's) narrated an interesting incident. During his visit to one of the African countries, he observed that the natives set fire to vast areas of sugarcane fields, after completion of their harvest. After 2 to 3 hours huge dark clouds developed over the area followed by heavy precipitation.

In ancient days our ancestors used to perform 'Yagna' in a 'Homakund' burning certain selected twigs and leaves soaked in ghee. This was carried out at certain specified time of the day, accompanied by the chanting of verses in praise of Varuna, the Rain God, to produce rain. Was it some ground base generator they were using to seed the clouds?

WEATHER LORE

by

B. Amudha

Weather lore is the accumulation of rules and rhymes for predicting the weather. Often formulated before instruments were not fir in the technical definitions of the modern day meteorology. Nevertheless, it is interesting to read them. Often it makes us wonder about the keen sense of observation of our ancestors. Their efforts from time immemorial were the foundations upon which the science of Meteorology were laid.

A study of the rhymes and proverbs helps us to understand what man knew about forecasting weather before science came along. For instance, haloes are traditionally signs of approaching rain and feature in a variety of rhymes.

" Last night the sun went pale to bed
The moon in haloes hid her head
T` will surely rain - I see with sorrow
Our jaunt must be put off tomorrow "

There is some truth in the rhyme, though not always, because cirrostratus producing haloes precedes frontal rain. The moon is considered as an excellent aid to observation at night because its light and appearance help detect the presence of clouds. Virgil, refers to moon in 'the Goergics' on the 'Art of Husbandry' and describes the thin water drop cloud (one of the stages of an advancing front) as

" If she should clasp a dark mist within her unclear cresent Heavy rain is
in store for farmer and fishermen"

The moon's phases do affect ocean tides, and if high tide coincides with strong winds the combination can be disastrous; but the moon does not cause winds. This has been aptly putforth in the rhyme:

" The moon and the weather
may change together
but a change of the moon
does not change the weather"

The disastrous effects which are likely to occur when a lightning strikes have been described in the following poem, which indicates that a huge storm cloud wielded all the powers of destruction.

" A crack of thunder suddenly, with lightning hail and fire
Fell on the church and tower here and ran into the choir
A sulphurous smell came with it, and the tower strongly rent
The stones abroad into the air with violence were sent
One man was struck dead, two wounded so they
died a few hours after....."

There is a story as to how the custom of christening hurricanes was revived. During the second World War, it is said that an enthusiastic radio operator, also a keen

observer of the weather issued a hurricane warning while on sea and started singing a few bars of "Every little breeze seems to whisper Louise'. The hurricane was thereafter referred to as 'Louise'. Whether the story has credibility or not, naming of a hurricane has been accepted as a practical idea for accurate transmission of weather information.

The trouble with weather proverbs is that they are not always right for all times and for all places. A proverb which is a sure-fire in the United States may not be so in Africa.

Some of the few contradictory weather proverbs obviously show that they must have been widely used in different places. They are:

Fair weather cometh out of the North
The North wind bringeth forth rain
The north wind is best for sowing seed
and the south for grafting

Some proverbs predict rain from the direction of the wind. Proverbs concerning southerly breezes can also be misleading, depending on where one lives:

The south wind warms the aged, and the South wind is the father of the poor.

A few other proverbs illustrate the infinite variety of subject and opinion.

One swallow does not make a summer.
Red sky in the morning, sailors take warning.
A year of snow, a year of plenty.
Rainbow in the morning gives you fair warning.
The first Sunday after Easter settles the weather
for the whole summer.
March comes in like a lion and goes out like a lamb.

Any body who has come across the collections of weather sayings will be impressed by their variety. They illustrate the importance of weather in human affairs. The interest and the motivation to know about the weather more and more must have been a guiding force for all those great men who toiled and invented instruments for measuring pressure, rain, humidity etc.

The science of weather has attained glorious heights and while basking under the technological advancements, let us also remember the foresight of farmers and their brethren who were instrumental in the gradual development and customary usage of weather proverbs.

References:

1. Dan Ramsey, 1945, How to forecast weather, 1st Ed, Tab Books INC., Blue Ridge Summit, PA 17214, p78-90.
2. Ingrid Holford, 1982, The Guinness book of Weather - Facts and feats, 2nd Ed., Guiness Superlatives Ltd., 2 Cecil Court, London Road, Enfield, Middlesex, p222, 236.

ARE THE EARTH SCIENCES MORE DIFFICULT THAN OTHER BRANCHES OF PHYSICS ?

by

S. RAGHAVAN

In the last issue of "Breeze" Suresh and Sivagnanam, stated that "the study of (atmospheric) turbulences is one of the oldest, hardest and frustrating chapters of physics". Many eminent scientists have agreed. Here are some opinions.

British Physicist H. Lamb in 1932:

"I am an old man now, and when I die and go to heaven there are two matters on which I hope for enlightenment. One is quantum electrodynamics and the other is *turbulence in fluids.* And about the former, I am really rather optimistic."

Turbulence was allegedly described by Einstein, Sommerfield and Feynman as the greatest unsolved problem in classical physics.

"As a young man, my fondest dream was to become a *geographer.* However, while working in the customs office I thought deeply about the matter and concluded it was far too difficult a subject. I then turned to Physics as a substitute" - Albert Einstein (unpublished letters).

FOG MENACE

by

N. JAYANTHI and S. GOVINDACHARI

Of late the incidences of fog are widely published in the media giving detailed reports of their duration, intensity along with number of flights cancelled, delayed, diverted etc. Viewing in a lighter vein, fog is a source of inspiration to the poets, figment of imagination for romantic persons and visionaries, a water fillip to the farmers, frost protector to orchard growers and a good scenery or flash back material for cinema and TV people, etc. But it is a major source of inconvenience to especially air travellers and globe trotters due to the great reduction in atmospheric visibility.

Despite rapid technological advances made in understanding and detecting the fog mechanism, it still continues to be the most serious hazard to all the three modes of navigation viz. air, sea and land. With the advent of jet age and ever increasing density of air traffic the problem is of more serious concern to aviators. To cite a recent example of this year fog season, fog menace over the busy international airport at Delhi has caused a virtual stand-still of all aircraft operations resulting in huge revenue loss to aviation

industry, gruelling time for officials, untold misery to stranded travelling public etc. Similarly shipping industry is probably the oldest victim of fog. The ocean liners and freighters are vulnerable to the dangers of fog. During winter months valuable hours of sea travel are lost due to fog. Similarly automobile collisions and traffic jams are also due to fog.

Types of Fogs :

What is fog? To define it in simple terms, it is nothing but a cloud near or on the surface of the earth when the horizontal visibility of an observer is restricted to 1000m or below, while cloud is nothing but a fog above the ground. Unlike other clouds, fog can persist for a few hours to several days, dissipating on its own, due to atmospheric heating and strong vertical mixing.

Fogs are essentially of two types viz Radiation fog and Advection fog. Radiation fog occurs when the stagnant moist air cools progressively below critical temperature in a cloudless night when the air becomes saturated with water vapour. This temperature is then known as dew point temperature. Radiation fogs occur mostly over land because land cools faster than long wave radiation goes on unabated all through the night on a clear sky. Hence conditions that are favourable for formation of Radiation fog are Clear nights for cooling, light to calm winds for ensuring mixing and subsequent dissipation and high percentage of relative humidity, normally greater than 80%, ensuring moisture for condensation.

Advection fog, as the term itself suggests, requires transportation or mixing of air between regions by contrasting temperatures. For example Tropical air of warm moist air which advects towards land in winter produces advection fog over land while in summer when warm dry land based air flows towards ocean which are relatively less warm, fog occurs over oceans. It is generally a temperate and high latitude phenomenon. Steam fog is another type of advection fog. When cold air advects towards warm air, it will look like smoke ribbons. This type of fog is most common in Arctic regions.

In our country, in winter season after the passage of a low pressure disturbance moving from west, normally known as western disturbances in North Western regions, occurrence of radiation fog is most common, in the rear of a western disturbance. In North Eastern regions during the same period radiation fogs occur over river valleys. Radiation fog is a localised phenomena while advection fogs occur over a wide area. Also fogs are less frequent in Tropics, while their frequency is high in mid and high latitudes.

There are also other less scientific classifications of fogs like dry fog, wet fog, land fog, smog, black fog, ice fog etc. While dry fog does not wet the clothing, the wet fog makes the surface of ones clothing damp. Sea fog originates over ocean and it could either remain there or drift towards shore. Land fog normally is due to radiation and dissipates quickly.

What is of great concern which is mainly attributed to anthropogenic influence is the fog due to environmental pollution. These are two type viz. city fog and black fog. The city fog is also called smog which is nothing but a combination of smoke and fog which normally occurs over the industrial towns and metros mainly due to smoke emission and its hydroscopic nature coupled with stable atmospheric conditions. Black fog is also a smog but has a greater content of soot particles.

Artificial dispersal of fogs :

Considering its hazardous potential, particularly in transport sector, it became imperative to disperse or eliminate the fog by artificial means. The dissipation for existing fogs can be achieved by several methods. Whatever be the method, the main objective is to improve visibility conditions. There are so many preventive and dispersal methods being adopted in developed countries. As far back as in 1947, the Russians demonstrated weather modification methods successfully and facilitated landing of an Indian Air Force plane carrying Shri. Jawaharlal Nehru in Moscow Airport, when it was raining there. The oldest and most successful method of dissipating fog is by ground based heating, like using combustion of hydrocarbon fuels or spraying hot water etc. In the case of ice fogs, dry ice seeding method or dynamic seeding of the area from helicopters etc. Another method is injecting large quantities of dry air using huge air blowers which would induce the evaporation of the fog particles. Fog prevention is another fog modification method. In this method control of moisture, condensation nuclei and cooling are undertaken.

Evaporation method is one of the promising approaches in fog dispersal. In this method the air temperature is raised by application of artificial heating techniques, chemical desiccants such as calcium chloride, sodium chloride and urea when introduced or sprinkled in the air which are highly hydroscopic will remove the water vapour and thus prevent the fog formation.

Fog at Chennai airport :

In general fog can be considered as a localised phenomenon. The moisture and cooling that are required for its formation are locally influenced by both the atmospheric and topographical conditions. As far as Chennai airport is concerned, occurrence of Radiation fog is quite common during post monsoon and winter seasons viz. November - February and sometimes in March also.

A study of fog menace over Chennai airport during 9 year period 1990-98, has been taken and the number of days of fog presented in a tabular form. Figures given within brackets are those occasions when visibility fell below 800m.

Year	Jan	Feb	Mar	Nov	Dec	Total
1990	10(8)	4(-)	-(-)	5(3)	3(1)	22(-)
1991	12(6)	9(4)	1(-)	2(2)	4(4)	28(16)
1992	5(4)	4(3)	6(5)	-(-)	-(-)	15(12)
1993	16(13)	3(1)	3(2)	3(1)	8(2)	33(19)
1994	12(10)	12(8)	3(2)	1(-)	1(-)	29(20)
1995	15(7)	15(7)	12(9)	6(1)	1(-)	49(24)
1996	10(4)	9(1)	4(-)	4(4)	3(1)	30(10)
1997	11(5)	18(9)	1(-)	2(-)	4(3)	36(17)
1998	3(1)	3(-)	1(-)	4(1)	-(-)	11(2)

The critical value of 800m is very important for Chennai airport since it is the DGCA approved operating minima for Chennai which is a category (Cat I) aerodrome for the ILS RWY 07. No jet aircraft can land or take off when the visibility falls below 800m with ALS.

The climatological Table (1931-60) giving normals of fog days at Meenambakkam(Chennai) monthwise is presented below.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
0.8	0.7	0.3	0.1	0	0	0	0	0	0.4	0.1	0.4	3.0

Comparison of fog frequencies during 1990-'98 indicates a definite increase in the occurrence, frequency and intensity of fog at Chennai.

This steady increase in the number of fog occurrences over Chennai during last decade may be attributed mainly to enormous increase in the number of automobiles and industries around the airport. As Cat III may not be practicable at Chennai it is high time that atleast Cat IIB or Cat IIC facility be made available at Chennai in the new millenium as the city is likely to be extended in all directions. In India, Delhi alone is Cat IIA aerodrome where DGCA approved 'Met Minima' is 400m. After Cat IIB (200m) and Cat IIC (100m) the western world now is racing to provide zero visibility landing facility in airports like Paris Heathrow, Washington etc. This is call Cat III facility where the pilot lands or takes off blindly under zero visibility condition using localiser, glide path and three range markers. Such facility requires rigorous training of the pilots continued with periodical refresher courses.

MUSINGS ON SOUTH WEST AND NORTH EAST MONSOONS - 1999

by

Y.E.A. RAJ

We have just seen off yet another south west monsoon and those in the south are experiencing the beginning of north east monsoon. Is the 1999 South West Monsoon season the last one in the century or it is the 2000 SW monsoon that will be termed as the 'end of the century' monsoon ? There is some confusion as to whether the year 1999 or 2000 signifies the end of the 20th century. In any case the Indian Meteorological community has not so far projected the 1999 monsoon as the last monsoon of this year as the present century comes to a close at the end of the year 2000.

Now coming to the monsoon itself, this year the monsoon broke in over Kerala on 25th May, at least a week ahead of its normal date of 1st June. The northward progress of the monsoon was fairly consistent and it covered the entire country by 12 July. However the monsoon maintained a normal to below normal activity almost throughout its duration. Table 1 provides the weekly and seasonal performance of the monsoon for various meteorological weeks. Except during a brief interval in June the cumulative rainfall was always below the normal rainfall by 3-10%.

When the South West monsoon season came to an end the country had recieved 95.5% of the seasonal normal, a deficit of 4-5%. This was contrary to the expectation in the beginning of the season that the country was poised to yet another above normal monsoon with several pre-cursors of monsoon turning out to be favourable. The 500 mb April ridge whose normal latitudinal position is 15°N over India was most of the days located north of 20 N this year. M.S.L pressures were below normal over the country by 1- 2 mb during March to May. Maximum temperatures by 2-3°C and minimum temperatures by 1-2°C were above normal over most parts of India during March-May 1999. At 200 hpa weak westerlies prevailed over the peninsula during pre-monsoon season. The southern oscillation index (SOI) was hovering between 0 and 1.4 during March-May. Negative SST anomalies prevailed over Pacific in Nino 1+2, Nino 3 and Nino 3-4. The north Indian Ocean (i.e., Bay of Bengal, Arabian Sea etc.,) had SSTs warmer by nearly 0.5°C than normal.

Despite these overwhelming favourable factors the South West Monsoon of 1999 ended up registering a deficit of nearly 4-5 % from the normal. Is it possible to adduce any reasons ? The inadequate cyclogenesis over Head Bay, the near absence of intense depressions stalking long tracks across the country, the non developement of secondary monsoon disturbances such as MTCs could be cited as a few. The regular observer of weather charts and satellite pictures would not have missed the almost complete lack of clouding over Bay of Bengal and Arabian Sea on a large number of days. It appeared that most of the clouding over India got developed insitu and that cloud movement from the ocean into the landmass was not so conspicuous.

Perhaps the slightly below normal rainfall of South West Monsoon 1999 - could be reconciled if not comprehended from a statistical point of view. Table 2 provides the All India South West Monsoon rainfall (IMR) figures for the period 1991-99 as Percentage of Normal. As seen, beginning from 1993 the country has been experiencing an excellent run of normal to above normal IMR for 6 years with a mean value of 103 % and lowest 99%. There have been atleast two epochs of similar behaviour during 1901-99, viz. (i) 1942-50, 9 years mean 105% lowest 100% (ii) 1953-61, 9 years mean 109 %, lowest 100 %. Despite the presence of these high epochs in the IMR time series, one felt that a 'correction' in the form of a below normal rainfall in 1999 was not some thing which could not be unexpected.

Now let us move on to the post monsoon season or the North East Monsoon for the southern peninsula and first consider its onset phase. Table 3 provides the 0.9km 0530 hrs wind over Madras for 25 September - 22 October and also the rainfall activity over Coastal Tamil Nadu. As seen the transition from westerlies to easterlies took place on 1 October and the easterlies continued without any interruption whereafter save for two days interregnum on 17 & 18 October in association with a cyclonic storm over Bay of Bengal that moved northwestwards. As such 1 October could be taken as the firm date of easterly onset over coastal TamilNadu heralding the all important beginning of the easterly regime South of 15 ° N. The widespread rainfall that commenced on 4th October subsequently to the onset of easterlies could be taken as associated with the onset of North East Monsoon. If that were so, this year's onset would become the earliest onset during the century, for the previous earliest onset was on 5 October for the year 1943, acccording to the criteria discussed by the author (Mausam, 1992, 43, 3,p 273-282).

Now, what are the prospects for the NE Monsoon of 1999 ? With the SW monsoon rainfall over the southern peninsula deficient by 14% and over Tamil Nadu by 36% the people of these regions would be eagerly hoping for a good performance from the NE monsoon for their agricultural and hydrological needs. Does the massive South West Monsoon over India pre-influence the smaller scale North East Monsoon over the peninsula ? The statistical correlation between IMR and North East Monsoon Rainfall of Tamil Nadu (NMRT) is negligible but certain other types of analysis based on date of 1901-98, suggest the existence of a different type of relationship. Whereas a deficient (<90%) or normal IMR (90-110%) does not appear to exercise any influence over the ensuing NMRT, an excess (>110%) IMR is followed by a deficient (<80%) or normal (80-120%) NMRT and not by an excess (>120%) NMRT. This perhaps suggests the existence of some sort of 'discordant' rather than a decisive relationship between IMR and NMRT.

Some amount of work carried out by the author (Mausam, 1998, 49, 2, p247-254) has revealed that seasonal prediction of NMRT is possible albeit with limited accuracy. The predictors for NMRT could be found generally in the upper troposphere of India (from the work which has so far been done). During the pre-monsoon season of March - May, India is overlain by westerlies at 200 hPa level with the sub-tropical ridge (STR) located in the southern latitudes. During the monsoon, the STR shifts substantially to the

north and again shifts back to south during the post-monsoon season of October - November.

The philosophy behind the seasonal forecasting model for NMRT as developed by the author relies upon the intensity and evolution of the upper tropospheric anticyclone (UTA) during pre-monsoon and monsoon and thence into post-monsoon. A strong UTA during pre-monsoon is associated with westerly anomalies over the peninsula and if these (anomalies) persist into the South West Monsoon season, result in weak easterlies or weak Tropical Easterly Jet Stream (TEJ) over the peninsula and in turn weak UTA (or Tibetan High) during monsoon. Further persistence of this feature into the post monsoon results in strong UTA during October - December and is likely to be conducive to a good NE monsoon activity over southern peninsula, complement of the above features would be favourable to a weak NE monsoon.

For the year 1999, the pre-monsoon season was characterised by weak UTA and the monsoon by strong TEJ. Thus we expect a slightly weak UTA over peninsula during NE monsoon this year portending to a 'near normal to normal' monsoon. It must be added that the confidence that could be reposed over the above prediction is not that high due to large forecast error, relatively smaller sample size of the database, the smaller size of the region(i.e. Tamil Nadu) for which the forecast is meant and above all the volatile and chaotic nature of North East Monsoon.

While pondering over the accuracy and reliability of such a seasonal outlook on monsoon rainfall a few general comments on weather forecasting to end this article appear to be in order. Prediction of Indian monsoons and their various features, be it in the scale of short, medium or long range is always a challenge to the forecaster. Equations governing the atmosphere and the weather provide some of the classical examples of non linear dynamics and the resultant "Theory of Chaos". Such intractability frequently makes atmospheric prediction way off the mark. However there is a positive side as well. It is such incongruity that makes atmospheric prediction a fascinating science and provides the atmospheric scientist with his job and keeps him occupied.

TABLE 1

SW Monsoon rainfall as percentage departure from normal (PDN) for various weeks during June - September 1999.

A	B	C	A	B	C
9/6	-50	-41.4	4/8	-10	-4.2
16/6	18	-10.0	11/8	-5	-3.5
25/6	11	11.0	18/8	-37	-5.0
30/6	-30	0.4	25/8	-36	-7.7
7/7	-51	-12.3	1/9	-23	-8.1
14/7	-23	-14.9	8/9	-18	-8.3
21/7	22	-5.3	15/9	8	-7.5
28/7	-17	-5.4	22/9	-18	-6.5
			29/9	23	-5.1
			30/9	-	-4.5

A : Last date of the week ; B/C :RF PDN for week/season ending

TABLE 2

SW Monsoon rainfall over India 1991-99 (as percentage of normal)

Year :	1991	92	93	94	95	96	97	98	1999
RF :	92	92	100	109	99	102	102	106	96

TABLE 3

0530 Hours , 0.9 KM asl wind direction (WD) over Madras and Rainfall distribution over Coastal Tamilnadu 25 Sep - 20 Oct, 1999

Date	WD	RF	Date	WD	RF
25 Sep	SSW	D	09 Oct	SSE	I
26	SSW	D	10	ESE	Sc
27	SSW	I	11	S	I
28	NW	Sc	12	NNE	I
29	WNW	Sc	13	NE	I
30	S	W	14	NNE	Sc
01 Oct	SSE	Sc	15	N	FW
02	ESE	Sc	16	NE	FW +
03	ESE	I	17	W	Sc
04	E	W +	18	WSW	Sc
05	-	W +	19	S	I
06	SE	W ++	20	NE	I
07	SSE	FW			
08	SE	I			

D- Dry, I - Isolated, Sc - Scattered, FW- Fairly widespread, W - Widespread

Lectures arranged during July-October 1999 by IMS Chennai chapter.

1) "Monsoon variability" by Prof. R.N. Keshavamurthy, Bangalore on 4.8.99.
2) "Geographic Information System – concept & implications" by Prof. N. Sivagnanam, University of Madras, Chennai on 7.10.99.
3) "Marine Pollution by Dr. V.V. Giridhar, Scientist, CECRI, Chennai on 27.10.99.

TROPMET – 99 PROCEEDINGS

As all the members of IMS Chennai chapter are well aware Tropmet – 99 symposium was held very successfully from 16-19 February 1999 at RMC Chennai. We are now bringing out the proceedings of Tropmet-99 as early as possible. The proceedings will contain 15 Invited/Special Talks (or their abstracts) and 99 contributory papers.

The editing and refereeing of the papers have since been completed and the publication is in the proof stage. We expect to distribute copies of Proceedings to all delegates and authors of the papers by February 2000.

Y.E.A. Raj, Secretary, Proceedings Committee.

CHAPTER NEWS

Dear Member,

As announced in the last issue of "Breeze" a new Local Council has been constituted in our Chapter. I am particularly happy that a number of experts from various disciplines, not only meteorology, are in the Council. All the Council members are keen that the Chapter should take up various activities in pursuance of the objectives of the Society besides continuing the usual lectures, annual seminar and annual visit to a scientific institution.

Popularisation of the Science of Meteorology among various sections of the public was identified as an important activity. A sub-committee on this subject consisting of Dr. N. Jayanthi (Chairperson) and Dr. S. Sivarajasingham and Shri S.K. Subramanian (Members) has recommended the following steps.

1. A half-day Seminar for school teachers who teach topics relating to meteorology.
2. Periodical, open house, Question and Answer sessions for school students.
3. Inter-school Quiz on meteorology, with prizes.
4. Members to address Science Clubs at schools.
5. Exclusive meeting with media representatives on meteorological phenomena.
6. Bringing out booklets (1) on the outcome of the above meetings and (2) on various topics at popular level. Outsiders may be encouraged to send weather queries to Breeze..
7. Seek the cooperation of local institutions to exhibit scientific films and prepare new ones.
8. Radio and TV channels may be approached to conduct periodical weather-related programmes (Quiz, Interviews, Q & A sessions, Talks).

The Council at its meeting on 27 September 1999 appreciated the efforts of the Committee but felt that because of various constraints we can immediately take up only some of these recommendations for implementation. Accordingly, it is proposed to have a Teachers' Seminar early in 2000, followed by a Student Quiz.

These can be implemented only with the cooperation of the IMD. The DDGM, RMC, Chennai has very kindly agreed that the Conference Halls and related facilities may be used. We are thankful to him.

Even so, there are constraints. We need resource persons who can spare the time to prepare good scientific material for these events and conduct them.. We look to Members to take active part in organising these events. We also need funds, the finances of the Chapter being precarious. The three events, the Monsoons-99 Seminar, the Teachers' Seminar and the Quiz will alone cost several thousand rupees. While we are exploring various possibilities of raising funds, we are grateful to some Members who have donated money. We thank them and hope that more will come forward to do so.

4 October 1999

Yours sincerely,
S. Raghavan
Chairman, Chennai Chapter
Indian Meteorological Society