The news letter of Indian Meteorological Society, Chennai chapter

Vol 2 Issue 1 January - June '99

Contents

Breeze

Editorial

Dear Member,

I feel highly delighted in bringing out Vol 2, Issue 1 of 'Breeze', though little belated. The success of the news letter depends on the prompt and accurate response and quality contribution from the members. As such I appeal to all members to send their article(s) of interest concerning meteorology/atmospheric science for its consideration in forthcoming 'Breeze' - Vol 2 Issue 2 (July - December)- latest by 15.9.99

'Breeze' is circulated to members of IMS, Chennai spread from Madurai to Kalahasti and it is also sent to other chapters for wider circulation. As such those who can try and send advertisement to appear in 'Breeze', on payment indicated below, would be doing a good turn to further the cause of this publication.

(Rates : Half page = Rs.250/- Full page = Rs.500/-)

For further information the undersigned may be contacted.

Chennai
12.7.99

R.Suresh
Editor

INTERACTION OF THE BIG AND SMALL

by

S. RAGHAVAN

The concept of turbulent eddies transferring energy, from bigger to smaller scales was expressed by the well-known verse by L.F. Richardson in his 1922 book (Weather Prediction by Numerical Process).

Big whirls have little whirls that
feed on their velocity,
And little whirls have lesser whirls
And so on to viscosity
in the molecular sense.

There are several interesting verses of similar genre, some of them predating Richardson.

The vermin only teaze and pinch
their foes superior by an inch .
So, Natralists observe, a Flea
Hath smaller Fleas that on him prey,
And those have smaller Fleas to biteem
And so proceed ad infinitum.
Thus every Poet in his kind
Is bit by him that comes behind;
Who, tho too little to be seen,
Can teaze, and gall, and give the Spleen.
--- Jonathan Swift (1733) On Poetry a Rhapsody.

Great fleas have little fleas upon their backs to biteem
And little fleas have lesser fleas, and so ad infinitum,
And the great fleas themselves in turn, have greater fleas to go on:
While these have still, and greater still, and so on.
--- Augustus de Morgan (in a review of a book in 1863)

And the great whirls in turn supply still greater whirls rotation;
And these feed greater still, up to the general circulation.
--- Frank Gifford (1972) On the origins of Richardsons rhyme
Bull. Amer. Meteor. Soc. 53, 548.

And the big whirls of bigger ones partake in the rotation,
Until at last we reach the general circulation in the global sense.
O.M.Ashford (1985).
Prophet or Professor : The Life and Work of Lewis Fry Richardson
Adam Hilger, Bristol.

(All the above taken from the book calculating the weather ; Meteorology in the twentieth century by F. Nebelov, Associated press, 1995, 255, PP.)

Another area in Meteorology, of interaction of the Big and Small is in cloud physics. It is called Matsya Nyaya in sanskrit -- The law of the Fishes by which the big devour the small. Because of the dependence of saturation vapour pressure on the curvature of the drop surface, the smaller drops in clouds evaporate and the moisture is deposited on the bigger ones. Thus the big drops devour the small!

APPLICABILITY OF THEORY CHAOS - PAST, PRESENT AND FUTURE

by

R. SURESH and **N. SIVAGNANAM**

PREDICITABILITY OF DYNAMIC SYSTEMS

The last three decades have witnessed a great resurgence of interest in the study of dynamical systems through deterministic models. The classical (Newtonian) physics describes dynamical systems (a dynamical system is one whose status changes with time) through equations, mostly of the form differential & partial differential, that can predict the future behaviour (motion) of the system being studied . The astronomers come out with astounding accuracy in predicting the planetary positions years ahead. However, the predictability of many other dynamical systems with precision and accuracy has always been posing problems to the scientists. The accuracy of prediction depends on the governing laws, it is needless to say. External random factors like random noise and fluctuations in the physical field and random initial conditions have been cited, so far as the main causes for the not-so-accurate predictability and/or forecast error. However, the recent non-linear dynamic theory has proved that the long range predictability is limited on account of the systematic internal randomness or chaotic behaviour which may occur in a simple deterministic system.

SENSITIVE DEPENDENCE OF INITIAL CONDITIONS

The main purpose of the area of non-linear dynamics is to describe the complex physical processes in terms of deterministic models. The output of these deterministic models depends on initial conditions. Numerous examples are available in every branch of science that explain the unpredictability of the dynamic systems. Very simple deterministic models of dynamical systems can yield results that resemble that of random process experiment (e.g.) famous butterfly effect and Lorenz attractor.

CHAOS AND STATISTICS

Though statistical methods can be used to filter the external noise for the long term forecast, the internal randomness may not be removed by these models. Statisticians developed stochastic models that are capable of describing complex phenomena. But these models use randomness as a basic concept by assuming that probability partially governs the system/process being studied. Hence uncertainty in stochastic model, though it may be very small, is inescapable. On the other hand, the new area of study of dynamical systems and chaos aims at describing randomness as the result of a known deterministic process. The term chaos is usually reserved for dynamical systems whose state can be described by differential equations in continuous time or difference equations in discrete time. Once a system is in the chaotic state, all the initial conditions will be insignificant and the system is ergodic. Thus, statistical models are still the best for the study of long-term forecasts.

PHYSICAL SYSTEMS - CLASSICAL AND HAMILTONIAN MECHANICS

The study of turbulence is one of the oldest, hardest and most frustrating chapters of physics. The region of dissipation, namely, the spatial set on which turbulent dissipation is concentrated can be modelled by a fractal geometry. Our knowledge of the geometry of turbulence is still in primitive stage. Part of fractal analysis, specialists observe, is the geometric counterpart of the analytic analysis of correlations and spectra. Typical examples of fractal geometry in meteorology (other than the turbulence spectra) are cloud boundaries, rain squalls seen on radar screen etc. The question before us is whether these systems can be modelled ; if so, order of dimension of such system is integer or fraction.

In the study of physical systems, it has become customary to undertake this pursuit in terms of phase space of a system, such that points in these space represent instantaneous description of systems' status at different points of time. For instance, phase space of a single moving particle system is 6 dimensional (3 position coordinates + 3 momentum coordinates). A system with 'n' moving particles has 6n dimensional phase space. Classical quantum mechanics describes the behaviour of dynamical system through Hamiltonian functions which depend on coordinates of the phase space and on time.

FRACTALS - SELF SIMILARITY

Another approach to the study of dynamical systems is through the estimation of dimensions of fractals. Fractals have non-integer dimensions and exhibit self-similarity at all levels of magnification. Transformations such as dilatation, rotation may retain self-similarity but fractals have self-similarity obtained through bounded deformations. The simplest geometric property of a fractal is measured by its dimension,. Fractals appear either as a descriptive tool for studying irregular sets and forms or a mathematical description resulting from an underlying chaotic dynamic system.

A periodic attractor, through Fourier analysis, shows a power spectrum with large spike at fundamental frequency and evenly spaced low amplitude harmonics ; a quasi-period attractor has several fundamental frequencies and their lower harmonics. Since the component frequencies are smeared out in the case of a chaotic attractor, they would have a continuous power spectrum without any significant spike. This envisages that constructing a linear model may require infinite dimension whilst non-linear models may have low-dimensional attractor in phase space. In other words, non-linear models are parsimonious in describing chaotic behaviour which attracts statistician to the theory of chaos.

DIMESIONALITY ANALYSIS AND INFERENCE

The most commonly used dimensions are fractal dimension, capacity dimension, Hausdorff dimension, Correlation dimension, Balatoni-Renyi information dimension and Lyapunov dimension. Out of all these dimensions, perhaps some more dimensions which have not been listed above, correlation dimension is the one widely used as it is computationally efficient, easily programmable and reconstruction of the original attractor is relatively easy. But one has to use atleast N observations whose estimated dimension is D , say such that $2 \log_{10}(N) > D$. In simple words, atleast 1000 observations must be used to estimate the dimensionality of a system whose dimension is less than 6, to avoid spurious results !. It is not out of place to mention here that the computation of this diemensionality (for 1000 observations case) may take some tens of computer hours in a 486 machine and may be a few tens of hours in pentiums. However, as of now, the inference one can derive from the dimensionality analysis is only of the order of minimum number of variables that would be necessary and how many would be sufficient for modelling the system being considered. These inferences, perhaps may not be cost-effective since what is expected from this new branch of science is only to identify those variables that are necessary and/or to address the problem of non-linear dynamics rather than giving lower and upper bound of number of variables required for modelling.

LIMITATIONS

i. The theory of chaos has the basic assumption that the transients will die out on a long time-series and the motion has reached the attractor. But, in real world situation such a condition seldom prevails.

ii. If the environmental noise in the data is large or stochastic, it may be difficult to separate it from the deterministic portion. Hence, the advantage of deterministic process over stochastic process will be lost.

iii. Though the lower and upper bound of variables required to model the system have been identified by the correlation fractal dimension analysis, as of now, theory does not describe how to identify the independent variables. Hence in the present day scenario, the variables are being identified as the past observables of the same time series

(univariate concept) or any related variable (multivariate concept) through the statistical relationships or based on our knowledge of physics.

Despite the above limitations, the theory envisages the following interesting concepts :

a). How various time-series could be characterised based on the Euclidean distance between innumerable pairs of points in the 'n' dimensional phase space.

b). The difference between random process and deterministic process.

APPLICABILITY TO ATMOSPHERIC SCIENCE/METEOROLOGY

The presence of obvious periodicities such as daily cycle, seasonal or annual variations in weather/climate series intuitively tells us that short term prediction is feasible while long term prediction could be plausible through extrapolation. But unfortunately the atmosphere often exhibits variation and fluctuations that are irregular. Physical models (which require enormous computing power to solve the model equations, parameterize the physical phenomena etc.) are expected to provide accurate forecasts. However, operational meteorologists do know that these models do not give uncertainty free forecasts for the following reasons :

a). The models are neither complete nor true representatives of governing physics albeit they are good approximations to atmospheric behaviour.

b). Some of the physical processes operate on very small scales that could not be represented in the models.

c). The atmosphere is incompletely observed (i.e.) inadequacy of data (of course, this limitations is being overcome to some extent thanks to remote sensing).

WHAT IS NEEDED NOW

i. There are considerable literature available now-a-days indicating the presence of low-dimensional strange attractor in many climatological time series. This kind of result, novel fifteen years ago and of interest a decade ago, is too well known to be of much interest now. Both climatologists and 'chaoticians' should now realize that simply by arguing that a dynamical system can be characterized by 'n' number of variables is of little 'use value ' unless one determines what those variables should be, and the latter problem must be solved by other means. Novel contribution to this literature must now be expected to go beyond arguing that this or that phenomenon may be chaotic.

ii. Low order fractal dimension of the weather systems despite the fact that large dimension of the phase space in which they are embedded have been established. A strange attractor is very well robust and highly stable even with all its mixed-upness. It is tunable with controlled feedback. Identifying system specific feedback mechanism or parameters which can almost fully explain the system is the direction to which researchers are expected to contribute.

iii. In order to deal quantitatively with uncertainty, it is imperative to employ rules of probability till such time we (a) understand the physics of atmosphere

completely, (b). are able to receive the required very fine mesh data in real time and have the capability to process the same at the desired speed. New mathematical concepts/models to fix this uncertainty problem need to be explored. If this is done theory of chaos may eliminate Laplacian fantasy of long-term deterministic predictability in a similar way that quantum theory eliminated Newtonian and Einsteinian ideas of controllable measurement process.

iv. In the absence of fixing the problem of solving complex, non-linear dynamics in an operationally viable manner, uncertainty-free weather forecasting will continue to be a nightmare for the aspirations of operational meteorologists.

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WEATHER FORECASTING AND PUBLIC APATHY

by

N. JAYANTHI

It is a well known fact the weather forecasters are often criticised unduly. In this connection, I came across an article by Mr.R.W. Burpee some time back ' On cyclone forecasting' which appeared in the Journal of American Met. Society of September 1998 issue, wherein his interview with Mr. Cecil Gentry had referred to an incident that the latter came across while working under Sir G.Nortan, a very senior hurricane forecaster of the U.S. Weather Bureau and who was also the former chief of the 'Hurricane Centre' at Miami.

Mr.Nortan enjoyed writing to people who either complimented or condemned the hurricane service. He often used to receive numerous letters from a particular person who was always critical about the cyclone advisories in ways that were completely unjustified. He demanded accuracy that far exceeded the state of art. Finally Nortan decided that there was no point in reasoning further with that person and he wrote a letter something like this.

Dear Sir,

I am sorry you cannot appreciate the general excellence of our work. As an Irishman to another, begorrh, I believe you are right that you have not been getting your money's worth for the taxes you pay to support the Miami's hurricane centre.

The weather bureau recently estimated that a single tax payer contributes 1/7th of one cent each year to support hurricane forecasting in this office. Enclosed is a penny which will refund your portion of support for the next seven years.

Very Sincerely Yours

(G.NORTAN)
CHIEF FORECASTER

Could somebody tell me also about how much is the Indian tax payer's contribution for the sustenance of weather forecasting of IMD particularly the local weather forecast component so that I could also arm myself to reply those people who often unjustifiably criticise forecasts and forecasters ?

THE MOST DIFFICULT TASK

by

G.S. GANESAN

The idea struck me like a flash of lightning. It was all illumination for a nano-second and only slow, it stentorian, rumblings after a while. The idea seemed so sacred. I felt scared to share it with the public. But when one of my senior colleagues mentioned it, even elaborated upon it to an extent, I felt reassured of the essential validity of the ideas.

The idea is simply this: The most difficult task in tackling the subject of meteorology is the proper pronunciation of the title of the subject namely METEOROLOGY. The spelling, I would say is less troublesome, an order less difficult.

As pointed out my by senior colleague, Meteorology when pronounced by some, seems to refer to 'METROLOGY' - a study of measurements. The contents of this subject-METROLOGY-certainly pervade all scientific subjects. Meteorology-the science of the atmosphere cannot be an exception. Equally, one cannot but reckon with the meteorological factors also. Like air, one of the elements it deals with, it is all pervasive. Meteorological factors such as temperature have to be taken into account while evaluating the true measurements of length and possible countermeasures to be

taken for contraction-expansion etc. (say of Railroads). In fact, in meteorological measurements themselves-say pressure by mercury barometer-corrections for other meteorological factors such as temperature are to be employed. Meteorology and Metrology constitute a brotherhood or a sisterhood as feminists would say. Meteorology affects every field of enquiry. Metrology is indispensable in every field of study.

The other day, I was travelling by train to Madras. The day it is obvious, belongs to a bygone era when Chennai was called Madras, officially. A voluminous gentlemen, who refused to display his face, burying it in a sheaf of newspapers, spreading them far and wide, was sitting opposite me. He on account of his portly frame, was claiming more space than what appeared legitimate.

But his obvious intent to extend the outer limits of the occupied territory through the artifice of stretching the newspaper exacerbated the aggrieved feelings of all around. Suddenly, like a pale moon emerging from this sheets of clouds, his face was revealed to the public at large. Delighted by the 'dharshan'- an unexpected one at that- I ventured a smile with a view to spreading the message of amity among neighbours. He regarded me for a while and the dreaded question came. He asked me " what are you doing to earn a living ?". Summoning up all modesty, I replied " Well, I am working in the field of meteorology in UAS". This reply sparked a chuckle and a verbal stream on the part of the said portly gentleman. "Ah", he said, "you people are doing a marvelous work, sparing no effort, leaving no stone unturned to locate gold or copper or even tin". He added "no doubt, USA is employing you all at such an enormous expense". He, as he unwound himself, sounded as though he thought American streets, were paved with nothing but pure sheets of gold. All that a passerby, has to do to get rich, is to scratch indifferently now here, now there and at the worst of times to dig a bit diligently. I could not quite understand the tenor of his talk. Then it dawned upon me that he obviously took Meteorology for Metallurgy (study of metals) on account of my (mis) pronunciation and UAS (short for University of Agricultural of Sciences) for USA (United States of America) ! I was actually working in the agricultural field(s) of meteorology at that time.

I recently met a member of the tribe called well-informed men. This member was truly so and I concede this meeting is such a rare occurrence in one's life, as meetings go. After exchanging the usual plethora of pleasantries this well-informed man bombarded me with questions on meteor-showers and asked why, on a particular night, during which the experts and that he would be treated to a never-to-be matched grand spectacle of showers of meteors, of sheets of rainbows arching from skies to the earth, the event did not come to pass. He lamented that he missed his sleep in order not to miss this show but in the event he missed both, for the promise of prophets was not redeemed. He demanded an explanation (or an apology ?) from me. I explained to him that our subject of meteorology is essentially concerned with rain-showers rather than with meteor-showers. Meteorology to his was a study essentially of meteors only, a flowering branch of astronomy.

I was however told that both "Meteors" and "Meteorology" derive these names from the root word (in Greek ?) meaning lofty/raised. It is matter of great gratification that we all are active participants in the exploration of a lofty subject :

However, the intriguing question remains : " How to pronounce correctly Meteorology ?".

A BOLT FROM THE BLUE

by

R.G. SUBRAMANIYAN

Some months back a news item in a daily mentioned about the landing of a mysterious balloon-borne object near Thiruvottiyur, which turned out to be a radiosonde released by the IMD. The public, in general, are not aware that IMD releases radiosonde balloons, twice daily, from its network of upper air monitoring stations in India. On reading the news item, I was reminded of a funny incident that took place in 1973 when I was serving in the radiowind observatory at Karaikal.

It was a fine September evening. The villagers of Palaiyur (a village located on the bus route from Karaikal to Kumbakonam) assembled in the toddy shop to have their usual quota of drink to relieve the day's ordeal and misery. While the revelry was in full steam, suddenly a white object with a glowing lamp* landed from the sky in the nearby field. On seeing the mysterious object , the bustle subsided and all those assembled around the toddy shop ran helter skeltor in sheer panic. The matter was immediately reported to the Sub-inspector of Palaiyur police station. Mr.Natarajan, SI visited the spot with his team. What he saw was a strange sight. A parachute-like object was on a tree top to which some long threads were attached. At the end of the threads was a white box with another small box at its bottom in which a glowing lamp was seen. A thin rod was protruding from the bottom which had partially penetrated the ground. Being an ex-serviceman, who had served in the communication wing of the army, it took little time for Mr.Natarajan to conclude that the object was radio transmitter. He detached the box from the threads and disconnected the battery leads to the transmitter. A couple of villagers were watching him with awe and admiration, of course from a safe distance. From the markings on the instrument he found out that it was a meteorological instrument from Karaikal Rawin observatory. Normally it is the practice of the police stations, which collect such instruments to send it to the nearby meteorological office through one of their constables. But Mr.Natarajan himself visited our observatory with the instrument, mainly to acquaint himself with our activities. At the time of parting he said he was happy that for about a week there was no law and

order problem in his village, thanks to the landing of our instrument near the toddy shop. But the toddy shop owner would not have been happy, however, was a moot point ! .

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* In 1973 valve transmitter was enclosed in a transparent plastic box at the bottom of the rawin instrument, whose glow was conspicuous at dawn and dusk hours.

BRIEF REPORT ON TROPMET - 99

TROPMET - 99, the eighth in the TROPMET series of IMS Symposia was held at Chennai from 16 - 19 February 1999 under the joint auspices of Indian Meteorological Society, Chennai Chapter and Regional Meteorological Centre, Chennai at the premises of R M C Chennai. **" Meteorology Beyond 2000 "** was the focal theme of the symposium.

The holding of the above symposium was a long awaited event for both IMS, Chennai Chapter and RMC Chennai and the symposium set high standards in every aspect, such as fund raising, organisation, scientific content etc. The symposium was attended by 187 delegates hailing from various Scientific Laboratories, Institutes and Universities spread all over India. Nearly 150 contributory papers were read and 13 special talks delivered during the course of the symposium.

The inaugural function which was held at the CLRI auditorium on 16th February 1999 became a media event with some of the luminaries in the Indian Scientific field, such as Prof. U. R. Rao and Dr.M.S.Swaminathan gracing the occasion. Dr. R. R. Kelkar, DGM, IMD welcomed the gathering and Shri. A.K.Bhatnagar, Chairman LOC and DDGM , RMC Chennai proposed the vote of thanks during the inaugural function. The concluding session was held on 19th February at 1630 hours.

An IMS general body meeting was held at RMC Chennai on 17th February evening. The proceedings of the symposium are proposed to be printed and are expected to be made available by the end of 1999. Detailed report on TROPMET - 99 has been printed and has been made available to all the delegates and donors.

Y.E.A.RAJ
Secretary, LOC, TROPMET - 99

ACTIVITIES OF IMS CHENNAI CHAPTER

1). Annual General Body (AGB) meeting was held on 6.5.99 and the following office-bearers have been unanimously elected for the term 1999 - 2001.

Chairman	:	Shri. S.Raghavan
Secretary	:	Shri. R.Suresh
Jt.Secretary	:	Shri. P.C.S.Rao
Treasurer	:	Shri. E.R.Sukumar
Council members	}	Kum. B.Amudha
	}	Shri. A.K.Bhatnagar
		Shri. G.S.Ganesan
		Dr. N.Jayanthi
		Dr.S.Rajarathnam
		Shri. J.Shanmugasundaram
		Dr.S.Sivarajasingham
		Shri. R.G.Subramaniyan
		Shri. S..K.Subramanian (ex-officio)

The minutes of the AGB was communicated to member of this chapter on 20.5.99. Secretaries of other chapters have also been informed of the names of the office-bearers.

2) Executive committee had its first meeting on 27.5.99 and discussed about the programme of activities-present and future. It was decided to conduct a mini-seminar on "Monsoons of 1999" during January 2000. IMS HQ has been approached for funding the same. A committee headed by Dr. N. Jayanthi has been constituted to identify topics that are of interest to students of school and college level so that Society can offer lectures at schools and colleges as part of popularising meteorology. Scientific tour to places of interest have also been discussed in that meeting. Various ways and means for generating funds for the Society have been discussed at length and a sub-committee comprising Dr.N.Jayanthi and Shri. S.K.Subramanian has been formed to identify prospective donors in this connection. Editorial committee of "Breeze" has been re-constituted as follows.

Shri.R.Suresh	-	Editor
Shri.G.S.Ganesan	}	
Shri.A.K.Bhatnagar	}	Members
Shri. S.K.Subramanian	}	

3) A talk on " Total solar Eclipses" by A.K.Bhatnagar, Deputy Director General of Meteorology, Regional Meteorological Centre, Chennai had been arranged on 17.6.99.

AN APPEAL FOR DONATION

Indian Meteorological Society, Chennai chapter is expanding its activities like organising symposia/lectures and bringing out publications containing articles of interest. For this additional funds are required. . We therefore appeal to all those interested in the concerns of meteorology to contribute generously in the form of donations which will be gratefully acknowledged.

Donations may be sent to

R.Suresh,
Secretary,
Indian Meteorological Society,
C/O Regional Meteorological Centre,
50, College Road, Chennai 600 006.

(Crossed Demand Draft/Cheques may be drawn in favour of "Indian Meteorological Society, Chennai Chapter, Chennai").

Status of membership of IMS Chennai chapter as on 1.7.99

Life members	35
Annual members	90
Total	125
