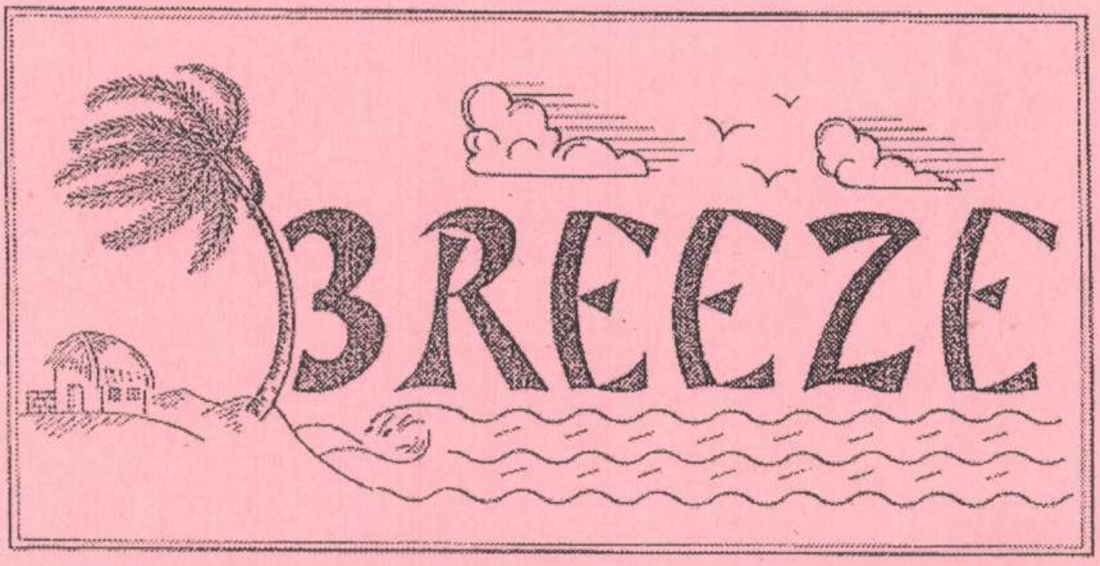

The newsletter of Indian Meteorological Society, Chennai chapter

Vol. 10 - Issue 1, September 2007

Contents

EDITORIAL

Dear Member,

I have the great pleasure in releasing this issue, Volume No. 10, Issue –1, of BREEZE. I request you to send your valuable suggestions for further improvement.

There were a number of scientific activities since the release of last issue. I have summarized the events and also furnished the forthcoming events on the last page of this issue.

With a view to accommodate more contributions and taking into account of space constraints, I appeal to all the members to submit their contribution in 2 to 3 pages within the stipulated dates to avoid delay. We propose to bring out the next issue of Breeze by the end of December 2007. Articles may kindly be sent to the Editor before 31st October through email to ims.chennai6@gmail.com or *rns*115@gmail.com

With Best Wishes,

R.Nallaswamy
Editor
Chennai September 2007

Those who wish to become members of IMS can download the application form and the other details from the website of IMS Chennai Chapter.

Website : http://education.vsnl.com/ims chennai
E-mail : ims.chennai6@gmail.com

Membership details of IMS-Chennai Chapter as on September 2007

Life Members: 83 Ordinary Members: 69 Total : 152

+

Radhanath Sikdar: Pioneer Indian Meteorologist

By

R.R. Kelkar[1]

"Cloud and Sunshine: The science, history and philosophy of meteorology".

Dr. R.R. Kelkar (former Director-General of Meteorology) has started a very interesting web blog http://rrkelkar.wordpress.com *"Cloud and Sunshine: The science, history and philosophy of meteorology"*. It deals with various aspects from the poetic to the scientific. It starts with a post on "*Radhanath Sikdar: Pioneer Indian Meteorologist*". The article is reproduced here with the permission of Dr. Kelkar. Readers may visit the website for many more interesting articles.

S. Raghavan, Retired DDGM

This article is based on the information researched and compiled meticulously by Ms Anjana Chaudhuri, Retired Director, India Meteorological Department, Kolkata, and Hony. Research Fellow of the Asiatic Society, Kolkata. She had sent the information to Dr S. M. Kulshrestha, Retired Director General of Meteorology, New Delhi, in the years 2000-01, and he had then kindly shared it with me. The credit for this information goes entirely to Ms Chaudhuri. I also thank her for going through this manuscript and making valuable revisions. This article is also available online at my blog http://rrkelkar.wordpress.com

R. R. Kelkar, Retired DG-IMD, Pune

It is not commonly known that long before the India Meteorological Department was established in 1875, an Indian was at the helm of a government meteorological observatory under the British rule. In the year 1829, an observatory had been set up in the premises of the Office of the Surveyor General of India on Park Street at Calcutta (now Kolkata). The Surveyor General at that time was George Everest.

V. N. Rees served as the Superintendent of the Calcutta observatory from its establishment in 1829 until his retirement in October 1852. Radhanath Sikdar, then Chief Computor of the Great Trigonometric Survey of India, was entrusted with the charge of this observatory in addition to his main responsibility in surveying work.

Radhanath's new appointment was greeted with great enthusiasm by the leading Calcutta dailies, not only because he was the first Indian to occupy this responsible position, but because he has already earned great fame in geodetic surveying work.

[1] Dr. R.R. Kelkar, former DGM, IMD

Radhanath Sikdar had joined the Survey of India at Dehra Dun in December 1831 in the post of Computor and he was the first Indian to do so. He was barely nineteen years old at that time. Dr Tytler, Professor of Mathematics at Hindu College, Calcutta, had recommended his pupil's name to George Everest for his keen mathematical proficiency and investigative mind. Both George Everest and his successor, Andrew Waugh had held Radhanath in high esteem, and Everest had this to say about him, "There are few in India, whether European or native, that can at all compete with him. Even in Europe these mathematical attainments would rank very high."

Radhanath proved to be an invaluable asset to the Survey of India and in 1851 he was promoted to the post of Chief Computor, and transferred to Calcutta. It was with this background that the *Friend of India* had said in its issue of 11 November 1852 about Radhanath Sikdar: "This native gentleman, lately Head Computor in the same establishment, has long been the first among few natives, whose scientific acquirements emulate those of Europeans...and we have little doubt that he will ably fulfill his duties as the head of the office of which he has long been the soul." Immediately after assuming charge of the Calcutta observatory, Sikdar prepared a table for reduction of barometric observations to 32°F for which he had to develop his own formula. It was based upon the physical concept that the temperature reduction was to be applied on two counts: the thermal expansion of the brass scale attached to the barometer and the dilatation of the mercury column in the tube. Sikdar's work was significant because it made it possible to compare pressure observations taken at different times.

A note describing Sikdar's formula was communicated to the Journal of the Asiatic Society of Bengal by the Deputy Surveyor General, Col. H. L. Thuillier and it was published by the Journal in 1852 (Vol. 21, No. 4, pp. 329-332). During the years 1829 to 1852, the Calcutta observatory had not been taking observations at strictly specified hours, but around sunrise, apparent noon and sunset, which varied from day to day. No instrumental correction or bar-reduction was applied. Radhanath introduced the system of hourly observations with proper corrections right from December 1852. Meteorological abstracts of hourly, daily and monthly means of the principal meteorological elements and many derived parameters, were published regularly in the Proceedings and Journal of the Asiatic Society of Bengal from December 1852 to1877 without a break. The credit of introducing accurate, systematic and uninterrupted hourly meteorological observations in the country, as well as their methodical processing, should go to Radhanath Sikdar. After he retired in November 1862, Gopinath Sen followed his methodology until 1877, when the Alipore observatory began to run independently.

The prime mover of the India Meteorological Department, H. F. Blanford, wrote in his first Administration Report, that the 24 years' data from 1853 to 1877 of the Surveyor General's Observatory "are the finest piece of our knowledge of the climate of Calcutta."

Radhanath became a member of the Asiatic Society of Bengal in 1853 and he was inducted as a member of its Meteorology and Physical Science Committee in 1858. It was Radhanath Sikdar, who in 1852, had reported to the then Surveyor General, Andrew Waugh, about a Himalayan peak that was the tallest in the world, and which was later named by Waugh, after his predecessor, as Mount Everest. It was Sikdar again who had started in 1853, a time signaling service for ships, based upon observations of the transit of stars across Calcutta. Sikdar retired from government service in 1862, after which he led an eventful life devoted to social work and popularization of science until death came upon him on 17 May 1870.

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Southwest Monsoon 2006

By

S.R.Ramanan[2]

Southwest monsoon onset took place on 26th May, almost a week prior to the normal date. The seasonal rainfall for the country as a whole ended up with a figure of 99.6 percent of its LPA (Long Period Average). It was not well distributed in time and space. Every monsoon is unique in its own way. This monsoon saw large number of systems in the month of August (usually termed as the break period). Four depressions formed over Bay of Bengal and all of them moved in a west northwesterly/westerly direction south of latitude 25°N, causing excess/normal rainfall over central parts of the country.

Monsoon current arrived over parts of southeast bay, Nicobar Islands and south Andaman Sea on 17 May. It further advanced steadily and covered the western parts of peninsular India and northeast by 6th June. The main reason for the rapid advance of the monsoon along the west coast was due to an embedded cyclonic circulation along the off shore trough. There was a prolonged hiatus for 16 days from 7 June to 22 June. The large mid latitude trough affected the other semi permanent features like Tibetan high and Tropical Easterly Jet stream. It affected the heat low and replaced the convergence with down stream divergence. As result the atmosphere became less baroclinic and affected the formation of the new systems.

The second hiatus in advancement of the monsoon occurred between 1 and 8 July. Monsoon covered the entire country on 24 July with a delay of 9 days.

The season in general had been active in terms of the number of Monsoon lows and depressions. Sixteen systems (1 severe Cyclonic Storm, 8 Depressions/Deep Depressions and 7 low pressure areas) formed during the season. Most of the systems in bay formed due to the descending upper air systems.

The following table gives the number of meteorological districts that were normal/excess during past few years.

Year	Number of districts Normal/Excess
1998	83
1999	67
2000	65
2001	68
2002	39
2003	75
2004	56
2005	72
2006	60

Semi permanent Systems

Monsoon Trough

The monsoon trough appeared on 1 June and it became diffused after a week. A Deep Depression over bay during first week of July resulted in its reappearance. When monsoon covered the entire country on 24 July it got established 2° south of the normal position. During August it was

[2] Shri S.R. Ramanan, Director, ACWC Chennai

3-4° south of its normal position. During September either full or part of the trough remained close to the foot hills.

Heat Low

The heat low formed near its normal position on 23 May and more or less remained in its normal position till 4 September except during 8-15 June.

Month	Value (hPa)	Dates
June	990	27
July	985	8
August	989	3
September	997	2

Tibetan Anticyclone

The Tibetan anti cyclone was established on 7 June in 500,300 and 200 hPa. It was seen till 14th September at 300 & 200 hPa at the normal position. It was mostly absent at 500 & 300 hPa levels during most days in June. It was seen slightly northeast to its normal position during August and much to its north in September. During September it was absent on many days.

Tropical Easterly Jet stream

The maximum value of 100 Knots was found over Thiruvananthapuram at 128 hPa on 1 July.

The cross equatorial flow over the Arabian Sea (Equator to 5°N/5°S).

The surface winds north of 5°N were stronger than normal by 10 Knots during first week of June, second, third and last week of July. It was stronger by 10-15 Knots during September. It was hovering around normal values during September and remaining weeks of June and August.

Cross equatorial flow over the Bay

The winds were having normal values north of 5°N during the Southwest monsoon period except during second and third weeks of July (Actually it was stronger by 10 Knots in that period).

Off shore trough

The Off shore troughs could be seen along the different parts of the west coast (at the surface and lower levels) on most of the days from 27 May to 25 September with breaks of few days.

Withdrawal

Based on absence of rainfall for consecutive five days and establishment of an anticyclone in the lower trophospheric levels, the withdrawal of southwest monsoon from western parts of Punjab and Rajasthan was declared on 21 September which is a fortnight delay from the normal withdrawal. It withdrew from most parts of India by 27th September. On 16 October, Monsoon withdrew from entire country, Bay and Arabian Sea.

Monsoon lows and & Depressions caused flood situations in several states like Maharashtra & Goa, Gujarat, Orissa, Madhya Pradesh, Chattisgarh, Rajasthan, Jammu & Kashmir, Uttar Pradesh, Bihar, West Bengal, Assam, Andhra Pradesh and Kerala. 25 Percent of the districts experienced moderate drought and 6 percent severe drought conditions.

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DISASTERS AND DEVELOPMENT

By
R.V.Sharma[3]

There is no doubt that disasters are increasing in frequency. Three fold increase in severe natural disasters was seen in the 1990s in comparison to 1960s. Between the 1960s and the 1990s, the economic costs increased more than nine- fold. Developing countries have been hit by disasters very badly. Ninety percent of disaster victims, worldwide, reside in developing countries. The vulnerability of those living in risk prone areas is perhaps the single most important cause of disaster casualties and damage-and this vulnerability is continuously increasing. For example, 40 of the 50 fastest growing cities in the world are in earthquake zones.

Disaster is defined as the impact of a hazard upon a population or area that is vulnerable to such impacts causing substantial damage, disruption or casualties beyond the capacity of the affected population to cope with unaided. A hazard is defined as phenomenon that is potentially damaging and implies a risk to a population because of the potential for its occurrence.

Disasters occur when hazards result in immense societal impacts affecting lives, livelihoods, social or political economies, and environments. Mitigation, preparedness, and prevention can reduce the destruction and suffering caused by natural hazards. Future efforts should focus on three critical areas (i) better preparedness through application of information from early warning systems, (ii) more effective response policies, and (iii) reduced vulnerability of the population. Work in these areas must be incorporated into development programs and strategies.

Institutional structures that facilitate the integration of relief, mitigation, and development need to be developed. Information and technology are critical components for mitigating disasters.

Important points

1 Higher ocean temperatures lead to an exponentially higher rate of evaporation and which contributes to enhanced water vapour content in the lower/middle atmosphere. This promotes high precipitation intensities and tropical cyclones.

2. Numerous studies in the United States, Europe, and Australia show that rainfall intensities are increasing. In many regions of the middle and high latitudes there has been a shift in rain distribution patterns both in regional and seasonal terms (e.g. Central Europe: hot dry summers and warm wet winters).

3. Tropical cyclones may form and sustain in areas where the ocean surface temperature is at least 27^0 C. They transfer energy from the warm sea but quickly lose strength in colder areas or over the land. The warming of the oceans extends the breeding areas for tropical cyclones so that they can occur in regions that were once not exposed to this peril.

4. Extensive mountain glacier retreat may be observed throughout the world and has already assumed dramatic proportions in some regions. This was the outcome of investigations undertaken by the World Glacier Monitoring Service (UNEP and ETH Zurich), which looked at more than thousand glaciers throughout the world. The glaciers in the Alps, for instance, have lost more than a third of their area and more than half of their volume since their last peak in the middle of the 19th century

[3] Dr. R.V. Sharma, DDGM, RMC Chennai. rvs555@rediffmail.com

5. The melting of the glaciers contributes to the rise in sea levels; another factor is the thermal expansion of ocean waters when the water temperature rises. In global terms the rise in the 20th century was more than 10 cm. Even this rise is a threat to the existence of countries that lie just above sea level. Small island states in the Indian and Pacific Oceans and countries as Bangladesh are at risk.

6. Since global warming is by no means distributed evenly across the face of the earth, it stimulates windstorm activity outside the tropics. As a result in many areas, for instance in the North Atlantic, the differences in temperature and air pressure have increased. This has resulted in more stormy low-pressure systems. Intense low-pressure systems are being observed in this area in the recent decades.

7. Changes in temperature or precipitation patterns at certain periods of the year have impact not only on ecosystems but also trigger or intensify extreme events and natural catastrophes.

8. Many other changes have also been observed. These include the hitherto inadequately addressed problem of large-scale destruction of the soil.

Information and technology transfer

The information and technology transfer has a critical role to play in the areas of **preparedness, effective response, and reducing vulnerabilities**. However, the simple dissemination of information and technology to vulnerable areas / countries is not sufficient. The appropriate information and technology need to be provided to the right place and to the right people, at the right time.

- Who are the end users?
- Who are the decision-makers?
- How will the information or technology be used?
- What information is needed / required by those on the ground?
- What are the local capacities to process and effectively use this information or technology?
- Is the information or technology appropriate for the region?

Effective use of Early Warning Systems for natural phenomena

- Public awareness campaigns and emergency planning
- Development and implementation of improved building design
- Hazard mapping for earthquakes, volcanoes, landslides, etc.
- Weather monitoring stations, river stage monitoring, and satellite image downlinks and analysis.

Effective information and technology transfer is a key element in the integration, and intersection of relief and development. However, the information and technology transfer and disaster mitigation and preparedness as a whole need to be incorporated into development.

What can we expect in the 21st century?
Do we need "absolute security"?
It may not be possible within the foreseeable future to forecast all the qualitative and quantitative changes with complete precision. In view of population development and the economic trends to be expected in the most densely populated regions of the world, it is likely that the emission of greenhouse gases will increase in the future at an ever faster rate than in the past. To this extent, then, a doubling of the concentration of carbon dioxide even in the first half of the 21st century would

appear to be quite realistic (pre-industrial: approx. 280 ppm, 1990: approx. 350 ppm, forecast for 2030: approx. 560 ppm; ppm = parts per million).

According to the recent report of the Inter-governmental Panel on Climate Change (IPCC), the mean global temperature will have risen by several degrees by the end of the 21st century, with an uncertainty range of about 1-4 degrees. The trend of 0.2-0.3 degree average increase per decade responsible for the current disasters is substantially alarming when compared with an increase of 0.7 degrees per century observed in the past. The speed is so high that numerous ecosystems, including many types of forest, will probably be unable to adapt at an adequate rate.

The results of recent research suggest that EL Nino and La Nina may also be affected by climate change. Global warming could generate more frequent El Nino events or could intensify them or prolong them. Since these ENSO phenomena, as they are called, have a lasting effect on the weather and on natural catastrophes in many regions of the world, a further deterioration in the risk situation must be expected.

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Relevance and variation of per capita normal annual rainfall amongst a few Indian States with emphasis on Tamilnadu

By

Y.E.A Raj[4] and D. Rajan Babu[5]

Tamil Nadu located in the south eastern parts of peninsular India has a fairly interesting hydro-meteorological climatology. The state receives a normal annual rainfall (NAR) of nearly 100 cm with the north east monsoon season of October – December contributing to nearly 48 % of its NAR. Fig 1 presents the spatial distribution of NAR of Tamil Nadu. A north - south strip along the east coast of the state between Chennai and Kodiakarai receives normal rainfall of 130-155 cm with Vedaranyam receiving prodigious northeast monsoon rainfall of nearly 105 cm, and an NAR of 153 cm. The NAR decreases westwards from the east coast. Salem (96cm), Tiruchi (87 cm), Madurai (74cm), Coimbatore (61cm), and Palayamkottai (74 cm) are some of the interior stations receiving NAR of less than 100 cm. Over coastal Tamil Nadu also NAR decreases from north to south. It is relatively lower in the southern coastal belt that is boundary to the Gulf of Mannar. This decrease appears to be due to the protected nature of the Gulf with the Srilankan land mass lying east and the Indian peninsula lying west. Adiramapatnam (124 cm), Tondi (84 cm), Pamban (91 cm), Tuticorin (61 cm) and Kanyakumari (84cm) are a few representative stations lying on this stretch.

The north-south oriented Western Ghats which separates Tamilnadu from its western neighbouring state of Kerala is also a climatic discontinuity with the two states experiencing vastly differing climates. Some regions of Tamil Nadu situated in the passes of Western Ghats receive slightly higher rainfall for e.g. Pollachi with an NAR of 89cm compared to nearby Coimbatore and Shenkottah 131cm compared to co-located Palayamkottai. Valparai located at an elevation of 1108m a.s.l. in Coimbatore district receives NAR of 287cm . In the Hilly Udhagamandalam district NAR is 100-150 cm in the eastern side (Ooty 130 cm and Conoor 150 cm) but increases to 250 -400 cm in the windward side(Gudalur 229 cm , Devala 388 cm.). Kanyakumari district situated in the extreme southern parts by and large lies in the western (windward) side of Western Ghats. This small district manifests sharply defined spatial NAR variation within short distances and also has a north western sub region that records the highest amount of NAR in Tamil Nadu in the plains. Kanyakumari (84cm), Nagercoil (100 cm), Thuckalay (150cm) Kulasekaram (200cm) and Pechiparai (220cm) are stations representing this variation and the zone of high rainfall.

In this article we study the NAR distribution of Tamil Nadu, its neighbouring states and also a few states located in the Northern India from a specific angle, i.e. with respect to the population density of the various states and thereby it is shown that Tamil Nadu is perhaps in a disadvantageous position as for percapita water availability when compared to most of the other Indian states.

In Table 1 we present the area, total population, population density and NAR of Tamil Nadu and the other three southern states namely Andhra Pradesh, Karnataka and Kerala. As seen Kerala with a population density of 819 people per sq km is the most densely populated state followed by Tamilnadu (478) and both Andhra and Karnataka at 275. The NAR is high in Kerala at 295 cm; it is 90 cm for Andhra, 115cm for Karnataka and 104 cm for Tamil Nadu. The area of Tamil Nadu is 130058 sq km and a large part of this area (71 %) receives NAR less than 100 cm and so can be classified to belong to *dry farming tract* (DFT). When we compare the NAR of Tamilnadu with that of neighbouring states such as Andhra Pradesh, Karnataka and Kerala, the NAR of Tamilnadu is close to the values of Karnataka and Andhra. Kerala due to its favourable geographical position receives a very high NAR.

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[4] Dr. Y.E.A. Raj, Director, RMC Chennai

[5] Shri D. Rajan Babu, Sc. Asst., RMC Chennai

For a fairly large region such as a state, its water requirement can be met only from the following two sources (i) Rainfall and (ii) Water transported and brought in by large rivers. In respect of (i) rainfall realised in a region is a direct source of water and can be harvested. It gets stored in natural / man made storage locations such as lakes, ponds, reservoirs etc and may be internally transported through natural rivers or man made canals. Further nature has provided its own way of storage by the accumulation of sub surface ground water which gets recharged from rainfall/ or run off from rivers. In respect of (ii) a region can get plenty of water from a large river and so could be fertile even if the rainfall directly realised is meagre. For e.g. Pakistan receives low rainfall but the mighty Indus River flowing through, supplies it with plenty of water.

TABLE-1

State/Region	Area sq km	Population (2001 census)	Population Density per sq km	NAR mm	NARPC mm/person/ sq km
Andhra Pradesh	275045	75727541	275	900.7	3.28
Karnataka	38863	52733958	275	1153.4	4.19
Kerala	191791	31838619	819	2946.3	3.60
Tamilnadu	130058	62110839	478	1035.4	2.17

TABLE 2

State/ District	Population Density per sq km (2001 census)	NAR mm	NARPC mm/person/ sq km
Maharashtra	314	1169.7	3.72
MP	196	1244.5	6.34
Orissa	236	1474.4	6.24
Rajasthan	165	477.3	2.89
Thanjauvr (TN)	612	1053.0	1.72
Coimbatore(TN)	566	694.4	1.23
Vellore(TN)	807	917.0	1.14
Chittoor(AP)	247	827.5	3.35
Kolar(KAR)	307	730.5	2.38
UP	689	800.0	1.16
Bihar	880	1050.0	1.19
Punjab	482	599.3	1.24
Haryana	477	578.0	1.21

NAR: Normal Annual Rainfall NARPC: NAR per capita

A rainfall amount of 1 cm received over an area of 1 sq km would be equivalent to 10000 kilo litres (1 kilo litre = 1000 litres) or 3.53 lakh cubic feet of water. The total amount of rain water realised over the whole area of a state from rainfall can be easily derived from the data furnished in Table 1 for each state. For e.g. Tamil Nadu should receive in a year, an average of 104 x 130058 x 10^4 kilo litres or 4777 tmc feet (thousand million cubic feet) of water. But, for any state, not all such amount would be available for use. Nearly 33 % of rainfall received is lost through evaporation and so can not be used at all. Nearly 45 % is run off through rivers and a part of this quantum of water can be utilised. Close to 22 % seeps in to subsoil and some of this could be recovered. In a relatively low income country such as India 82 % of the water is used for agriculture, 10 % for industry. The remaining 8 % gets utilised for house hold requirements such as drinking, cooking, washing, gardening, cleaning etc. This is generally estimated to require an optimal quantum of 100 litres of water per day per person.

With this background information we define another interesting parameter which is the quantum of NAR expressed in per capita (NARPC unit: mm/person/sq.km) for each state. If a region receives high NAR it can sustain a large population. If the NAR is low and the population is also low then also water availability may not be a problem. However if NAR is low but population density is high there could be water shortage over the region if external sources for supply of water are not available. The NARPC is an index based on both NAR and population density and indicates the extent of water availability in a large region per capita. The NARPC has been computed for all the southern states and is presented in Table 1. We observe that this parameter is highest for Karnataka at 4.19, followed by Kerala (3.60), Andhra (3.26). Tamil Nadu has the lowest NARPC of 2.17, which is substantially lower than the figures of other three states, the obvious reason being the higher population density of Tamil Nadu.

As for availability of water through rivers also, Tamil Nadu is in a disadvantageous situation. The mighty and perennial Godavari river flows through Andhra and the Krishna river runs through both Andhra and Karnataka. There are also large no. of other rivers flowing in the above two states which register good flow during monsoon. Though large areas of Andhra and Karnataka are categorised as coming under DFT (ie. NAR < 100 cm), insofar as availability of water for agricultural and household requirements is concerned, these two states are definitely better placed than Tamil Nadu. Kerala with a high NARPC of 3.60, lower temperatures and consequently lower evaporation is also in a far better situation as for water availability is concerned.

On the other hand Tamil Nadu has the lowest value of NARPC at 2.17 and also is not served by large rivers. Cauvery is the largest river flowing through Tamil Nadu and as past experience has shown the quantum of water it discharges is inadequate to meet the farming requirements of both upstream and downstream farmers in several years. Certain other large 'rivers' flowing through Tamil Nadu such as Palar , Vaigai and Vaippar are almost apologies of rivers and hardly manifest any visible water flow even during excess northeast monsoon seasons. Of late several such rivers have attained notoriety, being known for the sand mining activities in the river beds rather than as sources of water.

The existence of modest NAR vis-à-vis higher population density of Tamil Nadu is further authenticated when we look into the NAR and NARPC figures for a few other states of India (Table 2), a few individual districts of Tamilnadu and co-located districts of neighbouring states . For Maharashtra, Madhya Pradesh and Orissa the NARPC values are 3.73, 6.34 and 6.24 respectively. Even for a state such as Rajasthan where more than 50% of the area is desertified the figure is 2.89. Whereas Thanjavur district which is called the granary of Tamil Nadu the NARPC is only 1.72. Coimbatore which is a very dry district has the value 1.23. For Vellore district it is 1.14. However for the districts of Chittoor of Andhra the figure is 3.35 and Kolar of Karnataka it is 2.38. These are co-located districts of Vellore but situated in other states and as shown have much higher NARPC figures.

The unfavourable NARPC obtained for Tamil Nadu could perhaps be one of the reasons as to why expectations of state administration, media and also the people are frequently on the higher side in regard to realised rainfall. For e.g. even when normal or above normal rainfall is realised, the situation is frequently described as drought or monsoon failure in Tamil Nadu whereas a similar situation is better reconciled in regions such as Interior Karnataka or Rayalaseema. Obviously even when normal rainfall is realised the same is apparently not adequate to sustain farming and other activities owing to the dense population.

There are of course a few Indian states with NARPC values lower than that of Tamil Nadu. In Table 2 we also present the statistics for Utter Pradesh, Bihar, Punjab and Haryana. As seen the NARPC values vary between 1.16 and 1.24 for the four states due to modest rainfall and very high population density. But it must be noted that several large perennial rivers flow through these states ensuring water availability.

Even if NAR or NARPC are low, a region can perhaps be self sufficient in water if the available water is fully exploited or if water conservation measures are undertaken. The following is a list of steps which if adopted could go in some way in attaining self sufficiency in water. (i) Harvesting of rain water at macro and micro levels, (ii) Adaptation of scientific agricultural techniques that exploit water optimally, (iii) Partial shift in the pattern of farming and cultivation for e.g. shifting from rice to other grains whose requirements of water are less, (iv) Recycling of water by large industries, (v) Recycling of bath water for use in flushing of toilets in residential complexes etc.

Historically civilisations have tended to develop along the banks of large and perennial rivers or in high rainfall zones, the dominant reason being water availability. Viewed from this context the reason as to how Tamil Nadu , with its modest rainfall and not being served by perennial rivers has achieved such a relative high population density which appears to have prevailed historically and documented since the census began in 19th century is not clear. A saving grace however is the encouraging demographic trend of Tamil Nadu as revealed through recent successive national decadal census statistics. The increase of population in the state was only 17, 14 & 11 % during the decades 1971-81, 1981-91 & 1991-2001 respectively. These figures are much lower than the Indian national average figures of. 22, 21 & 19% respectively. The population increase is expected to reach a plateau in the state during the decade 2031-2041 with a density of nearly 550 people per sq.km when the NARPC would have a value of 1.83. The slower population growth has obviously helped the state in tiding over the water crisis.

The following inferences can be drawn from the above discussions (i) Normal annual rainfall of Tamilnadu is modest at nearly 100 cm (ii) The state has a relatively high population density with even dry districts located in the dry farming zone manifesting a very high population density. (iii) The state has one of the lowest per capita annual rainfall figures indicating availability of less amount of water compared to most other states (iv) The state is not fed by large/perennial rivers save perhaps for the legendary Cauvery.(v) Thus in a relative sense it is in a disadvantageous situation as for water availability is concerned. (vi) Therefore people depend substantially on rainfall both for agricultural and household requirements of water. (vii) With expectation on rainfall too high there is a tendency to describe the rainfall situation as drought even if normal rainfall has been realised. (viii) The success achieved by the state in controlling its population has evidently resulted in slower temporal decrease of NARPC.

How much of population density can be supported by a state for a given a value of NAR is a moot question. As discussed, water management and various other factors play a crucial role in the optimal use of water and in attaining self sufficiency in water. Barring a few northern states, Tamil Nadu has the lowest NARPC and in the absence of adequate feed from rivers the state is definitely in a disadvantageous situation in regard to water availability compared to most other Indian states. Given the current management and usage pattern of water in the state, Tamil Nadu is generally considered as a water deficient state and our analysis based on NARPC amply substantiates this fact.

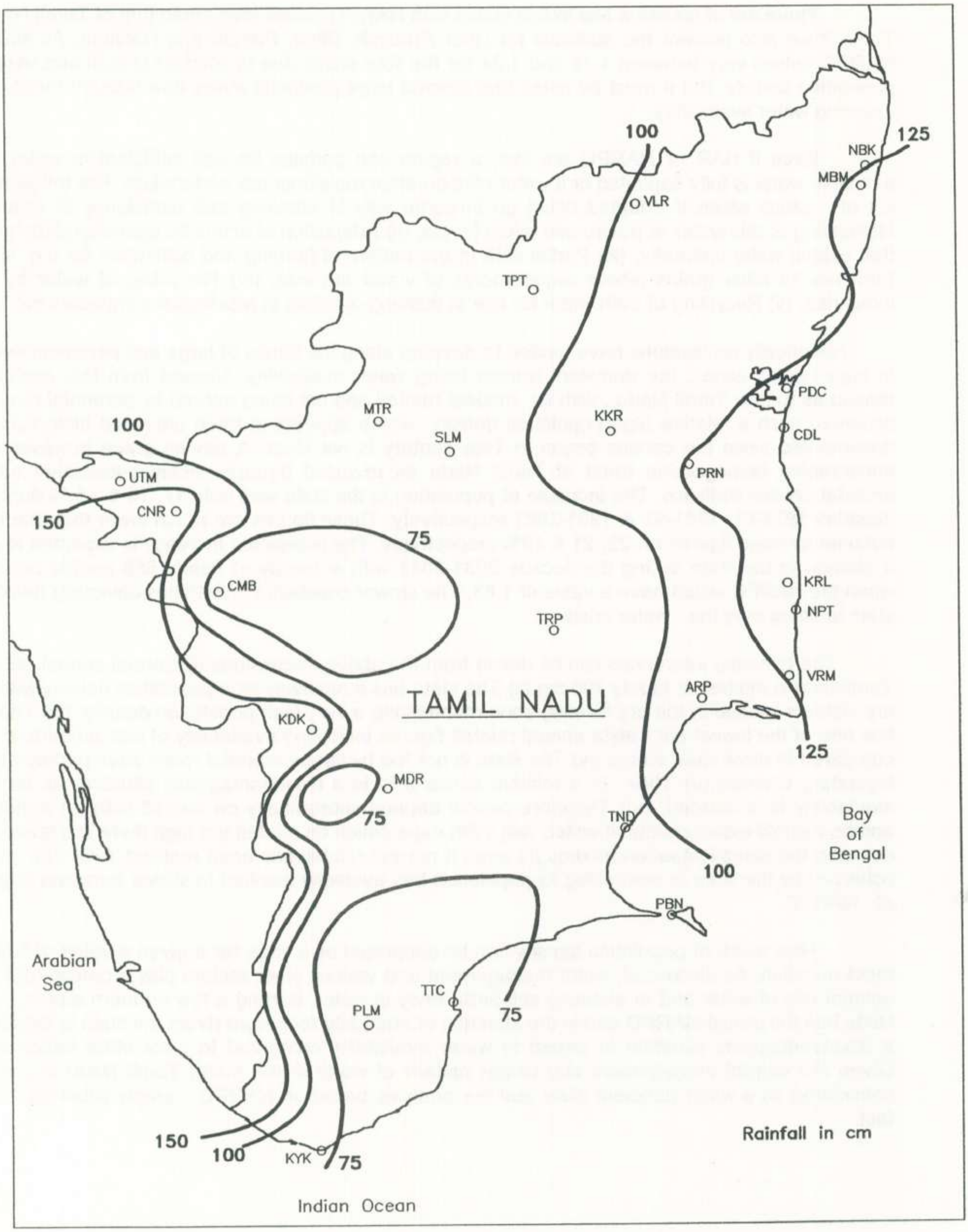


Fig.1 Normal annual rainfall of Tamil Nadu

Temperature Measurements in India – Then and Now

By

K.V. Balasubramanian[6]

Temperature in surface observatories of the India Meteorological Department is presently measured from the thermometers housed in a Stevenson Screen. A **Stevenson screen** or **Instrument shelter** is a meteorological screen to shield instruments against precipitation and direct heat radiation from outside sources, while still allowing air to circulate freely around them. It forms part of a standard weather station. The screen creates, as near possible, a uniform environment in relation to the air outside. The Stevenson screen is usually designed to hold various instruments including thermometers (ordinary, maximum and minimum), a hygrometer, a dewcell, a psychrometer and a thermograph. Stevenson screens may also be known as a 'Cotton Region shelter', an 'Instrument Shelter', a 'Thermometer Shelter', a 'Thermoscreen' or a 'Thermometer screen'. The use of a standard screen allows temperatures to be compared accurately with those measured in earlier years and at different places. It was designed by Thomas Stevenson (1818-1887), a British civil engineer and father of the famous English writer Robert Louis Stevenson.

The traditional Stevenson screen is box shaped, constructed of wood, in a double-louvered design. However, it is possible to construct a screen using other materials and shapes, such as a triangle. According to the standards of the World Meteorological Organization (WMO) agreed standard for the height of the thermometers is between 1.25 m (4 ft 1 in) and 2 m (6 ft 7 in) above the ground.

The interior size of the screen will depend on the number of instruments that are to be housed. A single screen may measure 765 mm high by 610 mm wide by 593 mm deep (30.1 in by 24.0 in by 23.3 in) and a double screen 765 mm high by 1050 mm wide x 593 mm deep (30.1 in by 41.3 in by 23.3 in). The unit may be mounted on a wooden stand or a metal pipe.

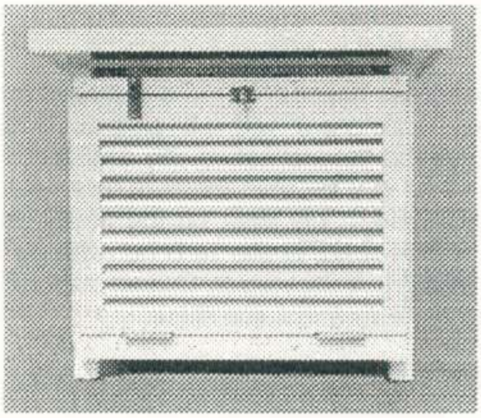


Fig 1; A typical modern Stevenson Screen

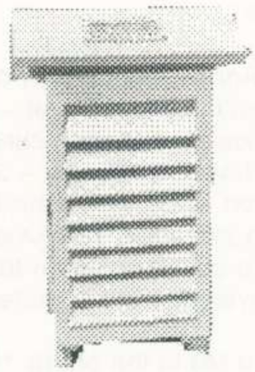


Fig 2: The marine screen. It is specifically designed for use at sea (ships) or wherever the weather is particularly extreme

[6] Shri K.V. Balasubramanian, Asst. Met., RMC Chennai

The top of the screen was originally comprised of two asbestos boards with an air space between them. These asbestos boards have generally been replaced by a laminate due to health and safety reasons. The whole screen is painted with several coats of white paint to reflect radiation and will usually require repainting at every two years periodicity.

The Stevenson Screen became a standard for housing the thermometers in India presumably after 1922. Prior to that the thermometers were kept insode a 'thermometer cage'. This cage itself was kept inside a thatched shed popularly known as 'Indian standard shed'. A description of the arrangement of thermometers in 1873 at Alipore Observatory of Calcutta (now known as Kolkota) is as given below:

"Thermometers are usually exposed in cages 2' wide, 1¾' high and 4" deep. The back and front door of the cage being of wire netting, while the top, bottom and sides are of wood. At the top and towards the front, which faces north, there is a projecting roof or pent house 6" wide, and a similar sloping board, twice as broad, projects at the back. Such cages are always hung under a thatched sheds which keep off the direct rays of the sun, the sloping roof of the cage being intended merely to stop the solar rays which may sometimes enter the shed below the eaves when sun is near horizon."

This kind of exposure was thus similar in all essentials to that given by 'Glaisher's Stand' adopted at Greenwich Observatory.

During 1915 and 1917-18 J.H. Field, MA conducted a series of observations "On Exposure of Thermometers In India". Photographs 1(a) and 1(b) show the arrangement of thermometers in various shed at Agra. Photo 1(c) shows the same in Madras. In the above study Mr. Field mentions "It appears probable that practice in india merely drifted into the use of open sheds at the early stage when north verandahs were commonly used for exposure of thermometers". In the above study J.H. Field concluded that the Stevenson Screen provides best results compared with other arrangements. Based on this it was decided to replace all sheds slowly to Stevenson Screen to get a standard exposure to thermometers in the country.

Details of fig 1(a) to (e):

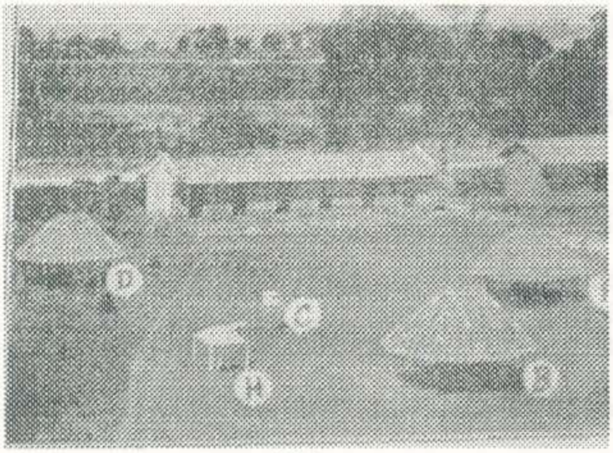
1(a) Experiment done in Agra – comparison of temperatures housed (A) in a standard Indian shed 20' x6' at the eaves, 5' from the ground, roof – thatched, thickness 6" with a 3" pipe as ventilator in its ridge. A hanging cage inside the thatched shed to house the thermometers. (B) similar to A but roof with Allahabad tiles. (C) Stevenson Screen – 22" L x 12 ¼" D x 16¾" H, made of teak wood, painted white, four double louvered sides, perforated top and bottom, the door on the north side has 14 louvers and the remaining sides has 17 louvers. (D) A tiled shed similar to B but with an additional wooden lining to the roof to cut off radiation from the tiles (H) A Stevenson Screen surrounded by an extra slopping wooden louvered shield to protect the sides from direct sun shine.

1(b) Standard Indian shed (A) in the photo 1(a) inside which thermometer cage is hung.

1(c) The Madras shed – south Indian type used in Madras during the experiments conducted in May-June 1922. The shed differs to some extent from the standard Indian shed in Fig 1(b) used in all other parts of the country, and is a survival from early days before meteorological work in India was coordinated under a single department. The differences are i) open ended roof, ii) Provision of east and west side lattices to keep off, in these low latitudes, the ear and late direct sun shine from the instrument.

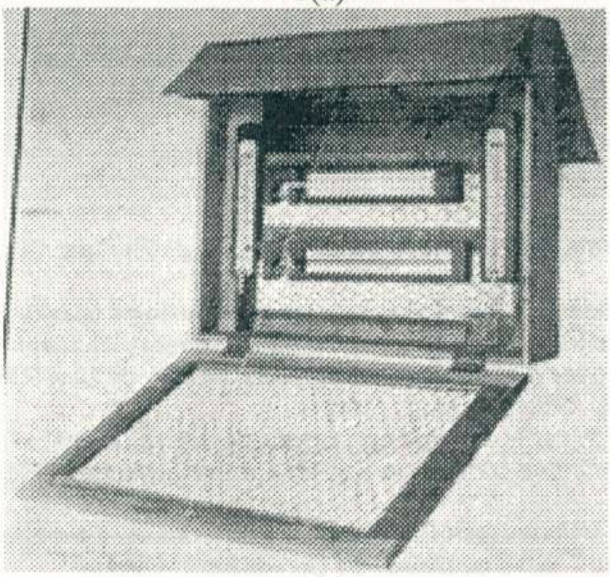
1(d) the temperature cage with mesh door.

1(e) Madras/Bengal sheds

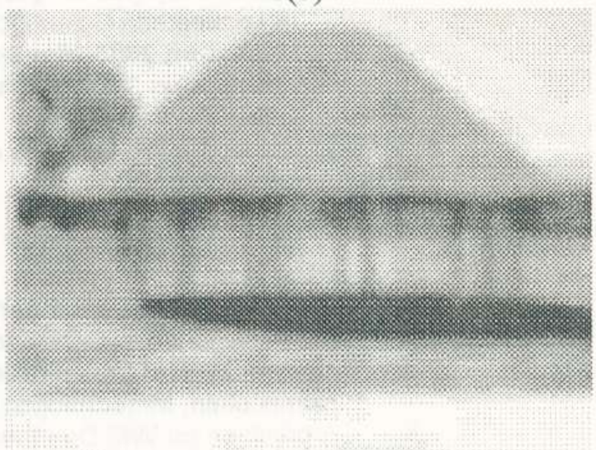


1(a)

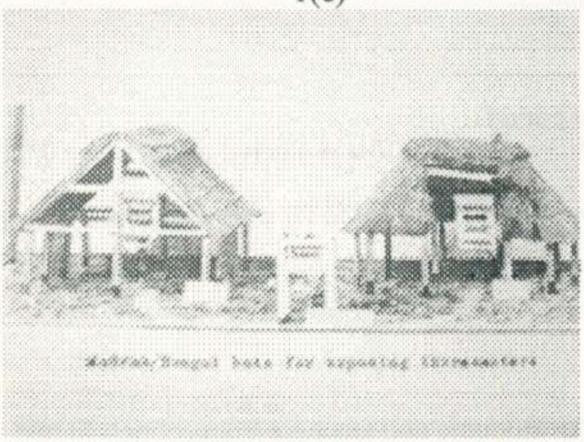
1(b)



1(c)



1(d)



1(e)

References:

1) Indian Meteorological Memoirs – Vol. XXIV, Part III, "On Exposure of Thermometers in India", J.H. Field, PP 21-74, 1922.
2) Indian Meteorological Memoirs – Vol. II, Part VII , "On observations of Temperature and Humidity at a height of 4 feet and 40 feet above the ground at Alipore Observatory, Calcutta – by S.A. Hill, B.Sc., - 10.10.1885, pp 449-471.

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Chapter News

Scientific Talks and Lectures

1. **Modeling of Inundation Due to Tsunamis and Storm Surges** by Dr. M.V. Ramanamurthy, Scientist E, Integrated Coastal and Marine Area Management, Chennai on 22.12.2006.
2. **Multiscale High Resolution Meteorological Modeling by** Dr. S.G. Goplakrishnan, NCEP/NOAA/National Weather Service, Washington DC, USA on 19.01.2007.
3. National Science Day was celebrated on 28th February 2007 and the following three Scientific Talks were arranged
   i. **Trends in Information and Communication Technology** by Dr. R.V. Sharma, DDGM, RMC Chennai.
   ii. **More Crop per drop** by Dr. M. Velayudham, Executive Director, M. S. Swaminathan Scientific Research Foundation, Chennai.
   iii. **Monsoon 2006- Review of performance of Southwest and North East monsoons 2006** by Shri S.R. Ramanan, Director, ACWC Chennai.

4. World Meteorological Day was celebrated on 23rd March 2007. The following Scientific Talks were arranged.

   i. **Is our Climate changing? - Some relevance to India** by Dr. R.V. Sharma, DDGM, RMC Chennai.
   ii. **Environmental Issues pertaining to Global Warming and Solutions thereof** by Dr. R. Nagendran, Centre for Environmental Studies, Anna University, Chennai.
   iii. **Meteorological Observations over Antarctica-Indian perspective** by Shri P.A.V. Nampoothiri, Meteorologist Gr. I, AMO Chennai.
   iv. A brochure on WM Day theme **"Polar Meteorology; understanding Global Impacts"** was prepared and distributed to members of media and participants of WM Day.
5. **"Launch of Weather Channel and Venue Specific Weather Information-Forecast System for Commonwealth Games – 2010 at Delhi"** by Dr. Akhilesh Gupta, Advisor(Earth Sciences) to the Hon. Minister for Science and Technology, on 05.04.2007.

Other Important Events

1. Local council met five times during the period.
2. Annual General Body meeting was held on 19.07.2007 and elected a new council for 2007-09.
3. Circulars and ballots for National Council Election for 2007-09 were sent to all the members.

Forth coming Events

1. One day seminar on Climate Change for students and teachers from schools in and around Chennai is likely to be conducted on 30th October 2007.

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