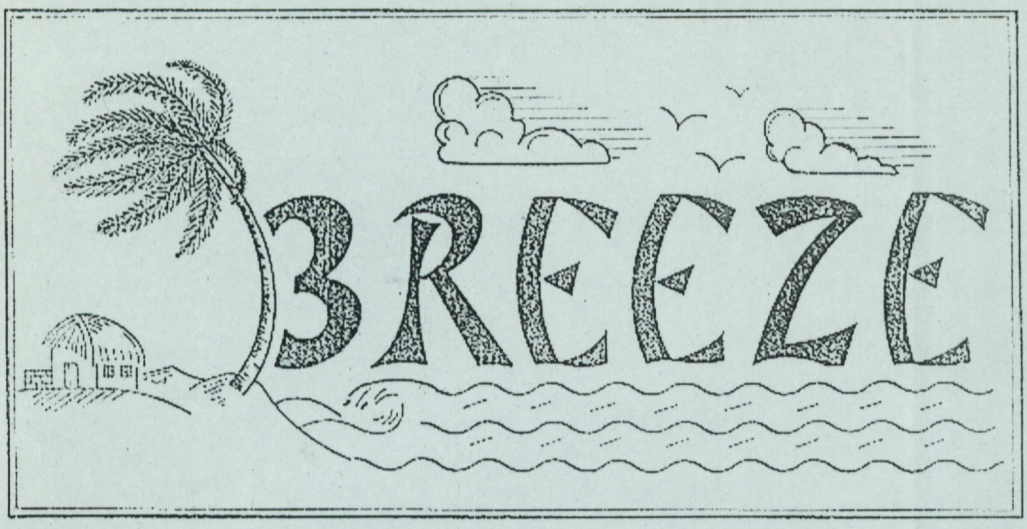

The newsletter of Indian Meteorological Society, Chennai chapter

Vol 7 - Issue 1, June 2004

Contents

EDITORIAL

Dear Member,

I have the great pleasure to release this issue ,Volume No.7, Issue –1, of Breeze with seasonal greetings. This edition contains mostly the synopses of the lectures delivered by various speakers in the monsoon seminar arranged at Regional Meteorological Centre, Chennai on March 23rd in connection with World Meteorological Day celebration. This issue of Breeze can also be browsed at URL http://education .vsnl.com/ims chennai

It is proposed to conduct a seminar on "Public Weather Services" shortly by inviting media personnel and other user agencies of meteorological information. Contributions are invited from members and other well wishers, for this seminar. The details of the proposed seminar will be published in the official website of IMS Chennai chapter soon.

The next issue of Breeze is likely to be finalised in December 2004. Members who desire to send articles for publication may send it to the Editor by 15 November 2004 through e-mail.

With Best Wishes,

P.V.Revikumar
Editor
Chennai dated 30 June 2004

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_chennai@vsnl..net

The Editor and the IMS-Chennai Chapter are not responsible for the views expressed by the authors.

Membership details of IMS-Chennai Chapter as on 30 June 2004

Life Members: 63 Ordinary Members: 79 Total : 142

MONSOON AND WATER CRISIS IN TAMIL NADU

Dr.T.N.Balasubramanian*

1. Scenario

Monsoon rainfall is the basic resource for water availability in Tamil Nadu. Out of 30 districts in Tamil Nadu, Salem, Dharmapuri, Krishnagiri, Namakkal, the Nilgiris, Kanyakumari districts and parts of Villupuram, Cuddalore and Perambalur districts mostly benefit from Southwest monsoon season (June-September) rainfall, while all the 30 districts in Tamil Nadu are highly benefited from Northeast monsoon season rainfall (October-December). If any deviation occurs from normal rainfall either during Southwest monsoon season or during Northeast monsoon season in an year, the water availability in Tamil Nadu would be always at stake in all the three sources of irrigation viz. tank, canals, and wells. The normal rainfall in Tamil Nadu during cold weather period (January- February) is 46.4 mm, while it is 140.9 mm during hot weather period (March-May), 334.0 mm during South west monsoon period (June – September) and 459.0 mm during Northeast monsoon period (October – December).

2. Supply and Demand for Water in Tamil Nadu (2025)

The supply and demand gap for water during 2025 in Tamil Nadu as reported by Palanisamy (2003) is 2.2 Million Hectometres (MHM), i.e. the total water supply will be 4.7 MHM, while the demand for water for agriculture will be (5.2 MHM) and non- agriculture (1.7 MHM). These data indicate that the water resource must be enhanced through a National river linking programme or there must be a discipline to minimize the water use both in agriculture and non-agricultural activities.

Out of the total available water in Tamil Nadu, presently agriculture consumes about 85 percent, while it is 15 percent for domestic use and Industry. The Central Water Commission estimated the requirement of water for different sectors for the year 2025. Domestic use may require about 5 percent of total water availability, while it is 18.2 percent for industry and energy, 73.3 percent for irrigation and 3.5 percent for other uses.

A decadal analysis was made by Palanisamy (2003) on net irrigated area in Tamil Nadu comparing the net irrigated area of 2000's with 1970's. The study indicated that there is no drastic change (-8.0%) in net irrigated area under canals between 1970's and 2000s while it is -30% for tanks, +93% for wells and -50% for other sources. However the overall data for Tamil Nadu indicated that because of enhanced net irrigated area brought under wells there is 9 percent increase in total net irrigated area in Tamil Nadu during 2000's (26.9 lakh ha) as compared to net irrigated area, which existed during 1970's (24.8 lakh ha).

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*Professor and Head, Department of Agricultural Meteorology,
Tamil Nadu Agricultural University, Coimbatore – 3.
(Lecture delivered at the Monsoon Seminar, IMS Chennai Chapter on 23 March 2004.)

3. Monsoon rainfall performance in Tamil Nadu

A study was undertaken to understand the performance of both monsoon rainfall (Southwest and Northeast) in Tamil Nadu from the year 2000 (Selvaraju and Balasubramanian, 2004). The study was undertaken agroclimatic zone-wise and the results are presented hereunder.

3.1. Northeastern zone

This zone consists of Chennai, Kanchipuram, Thiruvallur, Cuddalore, Villupuram, Vellore and Thiruvannamalai districts.

The study indicated that out of eight seasons in four years (Southwest monsoon and Northeast monsoon of 2000 to 2003) four districts viz, Kanchipuram, Thiruvallur, Cuddalore and Thiruvannamalai recorded below average rainfall in seven seasons. Overall deviation from normal rainfall in this agroclimatic zone was -16.9% for the past eight seasons. Negative anomalies were found in at least 3 out of 4 Northeast monsoon seasons in the past four years in all the districts of this agro climatic zone.

3.2. Northwestern zone:

This zone mainly comprises of Dharmapuri, Krishnagiri, Salem and Namakkal districts. This zone is mostly benefited from Southwest monsoon rainfall. But in the study period between 2000 and 2003 in 3 of the 4 Southwest monsoon seasons, these districts did record below average rainfall (-3 to -58%). These districts, in addition, recorded below average rainfall from (-3 to - 49%) in all the four Northeast monsoon seasons.

3.3. Western zone

This zone consists of Erode, Coimbatore, Karur, Dindugul and Theni districts. These districts in Tamil Nadu are well known for low annual rainfall record and the annual average rainfall is around 650 mm. The study indicated that six out of eight seasons had below average rainfall in Erode, Coimbatore and Karur districts. Karur was the mostly affected district, recording below average seasonal rainfall in all the eight seasons of the study period from - 2 to - 76 percent.

3.4. Southern zone

Madurai, Ramnad, Vridhunagar, Sivagangai, Tirunelveli and Thoothukudi form this zone. Out of eight seasonal rainfall study from 2000 to 2003, seven seasons had below average rainfall -14 to -76 in Virdhunagar and Thoothukudi districts, while below average seasonal rainfall was recorded for six seasons in Madurai and five seasons each in Ramnad and Sivagangai districts. The overall deficiency in the last four years for this agroclimatic zone was -16.9 percent.

3.5. Cauvery Delta Zone

This zone consists of six districts viz, Tiruchirapalli (part of district), Perambalur (part of district), Pudukottai (part of district). Thanjavur, Nagapattinam and Thiruvarur. Nagapattinam and Thiruvarur districts recorded deficit rainfall from -3 to -61% in all the eight seasons of study, while it was deficit in six seasons in Tiruchirapalli, Perambalur and Thanjavur districts. The overall deficit in rainfall at this zone is computed as -16.8 percent over the past four years.

3.6. High Rainfall Zone

The district Kanyakumari is the only district that falls under this zone. This district is meteorologically known for bi-modal heavy rainfall. Interestingly, in all the seasons, except Northeast monsoon 2002, this district recorded below average rainfall from - 4 to -83 percent.

3.7. Hilly and high altitude zone

This zone is mostly dominated by both Southwest and Northeast monsoon seasonal rainfall. Except Northeast monsoon 2003, in all the seven seasons, the rainfall deficit was from -7 to -64%.

The overall study indicated the following:

1) Continuous meteorological drought occurred in both seasons of the four years study period in all the districts of Tamil Nadu against the regular pattern of four years of normal seasonal rainfall followed by one year deficit rainfall. This must be the reason for lesser surface run off in the geographical (130069 km^2) area of Tamil Nadu. Scientifically, from the information of different types of hydrographs of catchments, it might be due to two reasons.

i) Rainfall intensity is lesser than rate of infiltration and
ii) Volume of infiltered water is lesser than soil moisture deficiency in all the four years of study (eight seasons).

This situation has created water crisis in Tamil Nadu presently.

4. Management of Water Crisis

A two way approach can be employed to challenge the water crisis.
i) Water management for agriculture
ii) Homestead water management

4.1. Agricultural Water Management

It is understood that agricultural sector consumes about 85 percent of the total water available in Tamil Nadu. High water requirement crops like rice (1200 mm), Sugarcane (2000 mm) and Banana (2000 mm) are largely grown in Tamil Nadu from canal irrigated areas, tank irrigated areas and well irrigated areas. The need of the

hour is to change the cropping pattern from high water requirement crops to low water requirement crops. As reported by Palanisamy (2003), the return per unit of water (Rs/m^3 water) was above one for rice in all the districts of Tamil Nadu except Pudukottai, Ramnad, Virdhunagar, Sivaganga and Tirunelveli districts. Among the districts where more than one was recorded, the highest return per unit of water (Rs/m^3 of water) was more with Tiruchirapalli district (1.55) followed by Erode (1.51) and Coimbatore (1.48). This indicated that rice must be encouraged where it gives higher yield with less water input. Hence there is an urgent need to delineate rice-efficient cropping zones in Tamil Nadu and Government encouragement may be given to the farmers where the efficient cropping zone lies. In the non-efficient zone area farmers may be discouraged from growing rice and alternatively some other efficient crops may be introduced in the existing cropping pattern.

If we examine the productivity of different crops per unit of water in Tamil Nadu as reported by Palanisamy, (2000) though sugarcane and banana give 2.9 and 6.5 rupees per m^3 of water used respectively, their water requirement was on the higher side (2000 mm each). However, the other crops like pearl millet, finger millet, groundnut and onion give a return of Rs. 2.2, 2.6, 4.2 and 9.4 respectively with a total water requirement of 450 mm, 500 mm, 450 mm and 400 mm. At the time of water crisis it is wise to switch over to these crops against raising sugarcane, banana and rice to a possible extent.

In addition to having sound alternate cropping pattern which requires less water, all water saving techniques so far recommended by Tamil Nadu Agricultural University for various crops must be popularised with the farmers. This includes drip irrigation sprinkler irrigation, surge irrigation, alternate furrow irrigation etc.

Further in drylands of Tamil Nadu (45% of cultivable area) all the water received from rainfall must be conserved in the soil profile through in situ moisture conservation practices and collection in farm ponds and recycling. For this purpose watershed approach may be meticulously followed with most efficient monitoring.

4.2. Home stead water management

Water management at the household is also very important, similar to field water management. The following areas are suggested.

i. Harvesting rain water at home
ii. Minimising water requirement at home

4.2.1. Harvesting rain water at home

The Government of Tamil Nadu has taken the right direction in this regard and provision of rain water harvesting structures in all houses has been completed during August 2003. This impact on the ground water recharge will be known in a few years.

4.2.2. Minimising water requirement at house

i. The water requirement per person may be reduced to 42 litres/day (Drinking 2 litres, bathing 20 litres washing clothes and toilets use 20 litres). This can be exercised till the water situation in Tamil Nadu improves.
ii. Replacing wornout pipes and taps and closing the leakages in all the water pipes.
iii. Clean the cars and two wheelers with wetted cloth.
iv. Practicing irrigation to home garden in the evening hours rather than in the morning.
v. Using shower for bath rather than water from the buckets.
vi. Using washing machine with full load once in a week.
vii. Reusing the used water for cloth washing to clean the houses and toilets.
viii. Reducing the flush-out tank capacity from 10 litres to 5 litres in the toilets.
ix. When drawing water from pipes to containers, close the pipe when $\frac{3}{4}^{th}$ container is filled up so as to avoid over flow.

Conclusion

Though there is no loss of water as per hydrological cycle, its availability is becoming scarce across the world including Tamil Nadu. Water use must be minimised both in agriculture and also at home. There may be some ecological imbalance temporarily, but it will vanish in the long run.

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GLOBAL FEATURES ASSOCIATED WITH INDIAN SOUTHWEST AND NORTHEAST MONSOONS – 2003

Y.E.A.Raj*

The overall performance of southwest monsoon 2003 over India can be considered to be quite good . The June-September southwest monsoon rainfall over India realised during the years 1999-2003 and the monthly and seasonal rainfall figures of India for the above season along with the normal values are presented below in Tables 1 & 2 respectively.

Table – 1

Year	1999	2000	2001	2002	2003
Rainfall as % anomaly	-5	-8	-8	-19	5

Table - 2

Month	June	July	August	September	JJAS
Rainfall 2003 as % anomaly	12	6	-4	9	5
Normal Rainfall (mm)	157	286	258	169	869

As seen from the above tables the performance of southwest monsoon during 1999-2001 was subnormal followed by the severe drought of 2002 when the realised monsoon rainfall over India was deficient by 19 % from normal. The good performance of southwest monsoon 2003 with 5 % excess rainfall registered over India, to some extent, has compensated the severe rainfall deficiency of 2002 and has also helped to maintain the stationary character of the monsoon rainfall series. Spatial distribution of rainfall during southwest monsoon 2003 was also good with 23 out of 36 meteorological subdivisions and 75 % of the districts registering normal to excess rainfall.

*Director, Regional Meteorological Centre, Chennai
(Synopsis of the lecture delivered at the Monsoon Seminar, IMS Chennai Chapter on 23 March 2004.)

For the four southern subdivisions where the October-December northeast monsoon rainfall is significant, the rainfall realised for the year 2003 is as under:

Table – 3

Subdivision	Actual mm	Normal mm	% anomaly
TN	435	469	-7
Kerala	482	506	-5
CAP	401	311	29
R/seema	188	215	-13

As seen from Table 3 the northeast monsoon rainfall was excess in only one subdivision and near normal but with negative anomalies in the other three subdivisions.

Some of the global features associated with the southwest and northeast monsoons of 2003 will now be discussed.

During June-September 2003 the Southern Oscillation Index was near normal except in June, when it fell below –1. SST anomalies over Nino 1+2 region were consistently negative during pre-monsoon and monsoon seasons reaching the lowest anomaly of –1.8 °C in May. However SST anomalies over Nino 4 region were positive in all the months of 2003. In Nino 3 & 3.4 regions the anomalies had intermediate values. The La Nina effect albeit weak appears to have played some role in effecting the good performance of Indian monsoon.

Based on the global monthly charts prepared and published by National Centers for Environmental Protection (NCEP) it was found that there was less convection over the Nino region throughout the monsoon season. By and large, lower Outgoing Longwave Radiation (OLR) values, with negative anomalies more prevalent than positive anomalies, were recorded over the Indian region. Both Bay of Bengal and Arabian Sea branches of the monsoon were stronger in 2003 as indicated by the substantial quantities of cloud liquid water present over both the seas during monsoon. Storms and typhoons in the Pacific generally moved along a west/northwesterly track during June – September 2003. This was in contrast to the situation in 2002, when Pacific systems had maintained predominantly north-northwesterly tracks.

The northeast monsoon activity was a bit subdued over southern peninsula despite having a good start. The cumulative rainfall over Tamil Nadu which stood at 15 & 7 % above normal on 29 October & 3 December respectively slumped to 7 % below normal by 31 December. On 11 December a depression originated over south Bay of Bengal at about 5 °N and intensified into a cyclonic storm on 13th. Contrary to the track predictions made by most of the global NWP models (such as National Centre for Medium Range Weather Forecasting (NCMRWF), European Centre for Medium Weather Forecasting (ECMWF), NCEP etc) which predicted landfall over Tamil Nadu coast, the cyclone eventually crossed the Andhra coast on 15th, which

resulted in a dry spell over Tamil Nadu. Barring this cyclone the northeast monsoon activity was weak over the peninsula in December especially over Tamil Nadu.

The OLR anomalies were negative over parts of Bay of Bengal during October-November indicating enhanced convection. In December substantially higher convection over Indo-China region that extended to Australia appears to have resulted in reduced convection over southern peninsular India and Bay of Bengal.

In contrast to the pattern of relation that (El Nino – Southern Oscillation) ENSO parameters exhibit with southwest monsoon, negative Southern Oscillation and El Nino favour a good northeast monsoon where as positive Southern Oscillation and La Nina favour a weak northeast monsoon. However these relations are well defined only when the ENSO events are in the extreme. Further, antecedent ENSO parameters of June- October manifest the strongest relation with northeast monsoon rather than the concurrent parameters of November/December. For the year 2003 save for the weak La Nina mentioned earlier, normal ENSO conditions prevailed during June-October. When the performance of northeast monsoon-2003 is appraised in conjunction with its overall broad-based relation with ENSO as elucidated earlier, the latter appears to have played little role in modulating the former.

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SOUTHWEST MONSOON – 2003

S.R.Ramanan*

Southwest monsoon onset took place on 8 June 2003. Though it was behind schedule by a week, its overall performance was far superior to that of Southwest Monsoon 2002. During 2002, the country ended up with a deficit of 19 percent and in 2003, it ended up with a figure of 105 percent of its LPA (Long Period Average). July 2002 had a record deficit of 49 percent. July 2003 was bountiful.

Though the onset in Andaman Sea was ahead of schedule (16 May instead of 21 May), the Severe Cyclonic Storm over the Bay halted its further advance. It not only delayed the onset over Kerala but also affected the wind pattern in the Bay. As a result of this Severe Cyclonic Storm, heat wave conditions occurred in Andhra Pradesh and parts of Tamil Nadu. The monsoon, which started on 8 June over Kerala, covered most parts of the country on 27 June and the entire country was covered on 5th July, about 10 days prior to the normal date.

The Arabian Sea branch saw rapid advance due to strong monsoon current and it covered West Rajasthan by 19 June. In marked contrast, the Bay branch was slow with spells of stagnation, the longest being 7-18 June over North Bay and Sub Himalayan West Bengal & Sikkim.

A week by week cumulative rainfall study indicates that till 18 June, 66 percent of subdivisions remained either scanty or deficit. North Interior Karnataka & Kerala were the subdivisions with maximum deficit. South Interior Karnataka remained deficit till 18 June and during five weeks of July, August and September. Andaman & Nicobar Islands were scanty up to 20 August and again from 27 August to 17 September. Jammu & Kashmir remained deficit till 30 July, whereas all other subdivisions were either normal/excess.

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

Year	Number of districts Normal/Excess
1998	83
1999	67
2000	65
2001	68
2002	39
2003	75

*Director, Regional Meteorological Centre, Chennai.

(Synopsis of the lecture delivered at the Monsoon seminar, IMS Chennai Chapter on 23 March 2004)

Semi permanent Systems

1. Monsoon Trough

The monsoon trough got established on 5 July. It remained more or less in normal position till 16 September and only the western end shifted north of normal position during July end, mid August and early September. Another salient aspect was, there was no break monsoon situation. The eastern end of the trough was either in normal or south of its normal position.

2. Heat Low

The heat low formed over West Rajasthan and adjoining part on 22 May and remained till 15 September. The lowest value of the pressure in different months and the dates on which it occurred is given below.

Month	Value (hPa)	Dates
June	986	7,8 & 27
July	990	4,9 & 30
August	991	9
September	993	2

3. Tibetan Anticyclone

The Tibetan anti cyclone was established on 15 June in 500, 300 and 200 hPa levels. It was seen till 14th September at 300 & 200 hPa at the normal position.

4. Tropical Easterly Jet stream

The maximum value of 125 Knots was found over Minicoy at 116 hPa on 25 July. 100 Knots wind speed was reported in Trivandrum on 21 & 27 June and on 16 July at 120-hPa level. Chennai reported the same value at 119 hPa on 14 July.

Cross equatorial flow over Arabian Sea

The following table gives the cross equatorial flow over the Arabian Sea

Month	Normal Value (knots)	Values in 2003 (knots)
June	10-12	10-12
July	12-14	+10
August	10-12	+5 to 10
September	8-10	+5 to 10

Cross equatorial flow over the Bay

The winds were having normal values (8-10 knots) during the first fortnights of June and July and weaker during the second fortnights. During August, it was

greater than normal (8-10 knots) by 10-15 knots and by 5 knots in the second fortnight. In the month of September 2003, the wind values were greater than normal (8-10 knots) by 10-15 knots in the first half and weaker by 3-5 knots in the second half.

Synoptic disturbances

A Deep Depression was seen during 25 to 28 July. A Depression occurred during 27& 28 August. The number of low pressure and well-marked low-pressure areas were 12 and most of them descended from the upper air circulation. With a solitary exception, all the systems formed in the oceanic area and crossed the land.

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 6 June to 17 September with breaks of a few days.

In the final analysis, all the subdivisions except Interior Karnataka and Kerala received normal/excess rainfall.

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SALIENT FEATURES OF NORTHEAST MONSOON - 2003

P.V.Revikumar*

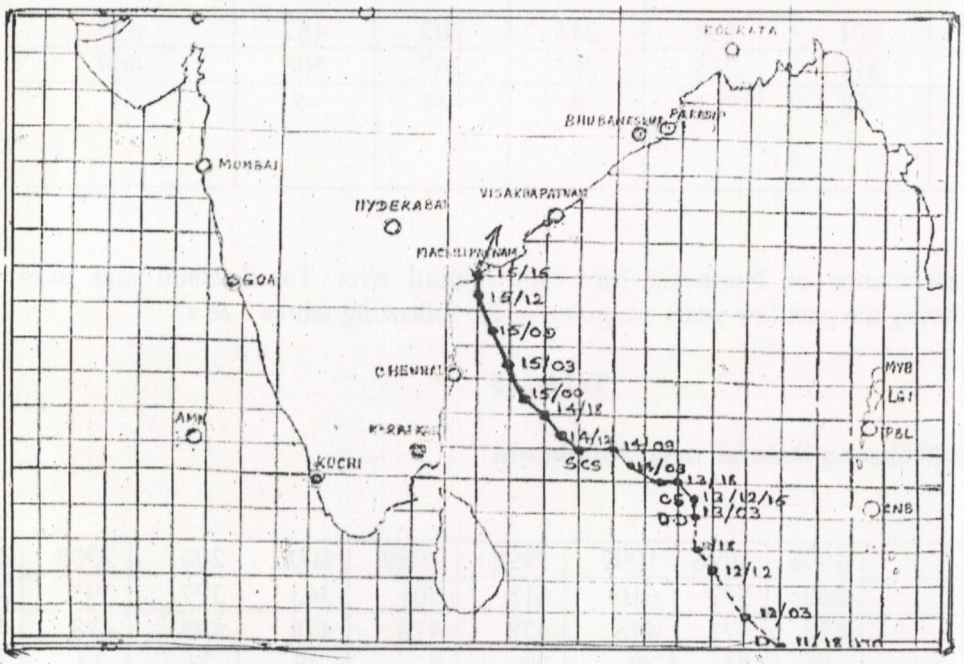
The overall performance of Northeast Monsoon 2003 over Tamil Nadu was near normal but in most of the districts the rainfall was deficient.

Northeast Monsoon rains commenced over Tamilnadu and adjoining areas on 19 October well in time. The onset dates during the past few years are given in the following table.

Table – 1

YEAR	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Date of onset	18 OCT	23 OCT	11 OCT	13 OCT	28 OCT	23 OCT	02 NOV	16 OCT	25 OCT	19 OCT

The significant features of this year's Northeast Monsoon period were i) Cyclone activity over Bay and Arabian sea was very much subdued ii) No Depressions or Cyclonic Storms affected Tamil Nadu coast as such. iii) Two Depressions, which formed over the Bay of Bengal crossed Andhra Pradesh coast on 7 and 28 of October respectively. iv) The only Severe Cyclonic Storm which formed over the Bay of Bengal, crossed Andhra coast near Machilipatnam on 16 December. The track of the system is given in the following figure.



*Meteorologist Gr.I., Regional Meteorological Centre, Chennai.
(Synopsis of the lecture delivered at the Monsoon seminar, IMS Chennai Chapter on 23 March 2004)

The storm had attained a maximum intensity of T 3.5 and gales of the order of 150 kmph lashed Krishna district of Andhra Pradesh at the time of landfall resulting in wide spread damage. About 57 deaths were reported due to the impact of the storm. The highest rainfall reported in 24 hours was at Repalle 19 cm, whereas the cumulative rainfall for 3 days exceeded 45 cm at several places.

The performance of Northeast Monsoon over Tamil Nadu was not quite satisfactory in.this year .Though a trough of low pressure was seen off Tamil Nadu coast on a number of occasions, the rainfall activity was good on a few days only. Since the trough never extended north of Cuddalore latitude, the rainfall activity was mostly confned to the central and southern parts of the state. This resulted in a deficient rainfall over the northern districts including Chennai.

The progress of rainfall on a weekly basis reveals that there were only a few significant spells such as from 3-6 October, 19-22 October, 8-10 November and 14-16 November. The monsoon was never active or vigorous during any period during this season.

The Following table gives the sub- divisional statistics of rainfall.

Table - 2

Sub Division	CAP	RAYL	SIK	CK	KER	Tamilnadu/PDC
Actual	401	188	215	202	482	435
Normal	311	215	203	267	506	469
Departure from Normal	28	-13	6	-24	-5	-7

Performance of Northeast Monsoon rainfall over Tamil Nadu and over Chennai during the past few years are given in the following tables 3 & 4.

Table – 3

Northeast Monsoon Rainfall over Tamilnadu

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003
Actual	260	593	610	618	501	343	377	395	435
Normal	478	477	478	478	478	478	478	478	469
Departure from Normal	-46	24	70	29	5	-28	-21	-14	-7

Table – 4

Northeast Monsoon Rainfall over Chennai

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003
Actual	53	126	157	72	53	40	102	91	35
Normal	76	76	76	76	76	76	76	76	76
Departure from Normal	-39	66	98	2	-32	-41	35	-20	-54

It is seen that for the last few years the monsoon did not perform well in Tamil Nadu and in Chennai district. In fact in 2003, the deficiency in rainfall was more in Chennai district (54%). The accumulated deficiency in rainfall leads to the depletion of ground water potential resulting in acute water crisis.

The performance of Northeast Monsoon in Tamil Nadu during the year 2003 was not very satisfactory. No major synoptic systems like cyclonic storms, depressions or low pressure areas affected the state as such. The synoptic systems formed in Bay of Bengal moved towards Andhra coast. The trough activity off Tamil Nadu coast which is a usual phenomenon during the Northeast Monsoon period was relatively weak during the year 2003. These factors resulted in less rainfall activity over most parts of Tamil Nadu in 2003.

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TRACKING OF MACHILIPATNAM CYCLONE, DECEMBER 2003 BY DOPPLER WEATHER RADAR, CHENNAI

S.Kalyanasundaram*

Introduction

India Meteorological Department (IMD) is replacing its conventional S-Band radars in a phased manner with S-Band Doppler Weather Radars (DWR). The first DWR installed at Cyclone Detection Radar (CDR), Chennai replacing the outlived analogue radar has been declared operational from February, 2002. Now with DWR, in addition to reflectivity, it is possible to determine the maximum velocity prevailing inside a cyclonic storm and use this information for improving our capacity to predict the intensity and movement of the storm besides storm surge. 'Machilipatnam Cyclone December, 2003' is the first system that moved into the radar range and was tracked successfully by DWR Chennai.

Radar Observation

Spiral bands with significant features started appearing from 1056 UTC of 14 and the probable vortex centre was first reported at 1156 UTC of 14 December, 2003. Vortex centre could be reported with 'fair' confidence from 1800 UTC to 2100 UTC of 14 and at 0300 UTC of 15 as a fairly defined 'EYE' was seen during this period. During the remaining period the vortex centre could be estimated only by the spiral bands. Later from 0700 UTC of 15 the vortex centre could not be estimated due to ill-defined spiral bands.

Salient features of the system as seen by the Radar

The system as a whole moved with an average speed of 15 kmph, during the period of radar surveillance. Initially it headed towards northwest, later changing the course towards north of northwest (Fig. 1). Overall intensity of the radar echoes were seen to be moderate to strong (40 to 45 dBZ) (Fig. 2) and the vertical extent of the major cloud mass was limited to 10 ± 2 km only. As the system remained more than 200 kms away from the radar for the major period of surveillance, many detailed features of the intense core region could not be probed by the radar. However, a few important features were visible when the system centre was less than 200 km from the radar. The maximum sustained wind speed measured by the radar was 30 mps (108 kmph) at a height of 1.8 km at about 150 km to the northeast of the radar (Fig. 3). Occasional maximum of about 34 mps (122 kmph) was also observed during real time. Horizontal velocity estimated through Volume Velocity Processing (VVP) (Fig. 4 & 5) in a cylinder of 30km radius from the radar indicates the storm's position towards east of radar on the 14 and its northward movement on the 15 (as can be seen from the backing of winds).

*Director, Cyclone Detection Radar, Chennai.

(Synopsis of the lecture delivered at the Monsoon seminar, IMS Chennai Chapter on 23 March 2004)

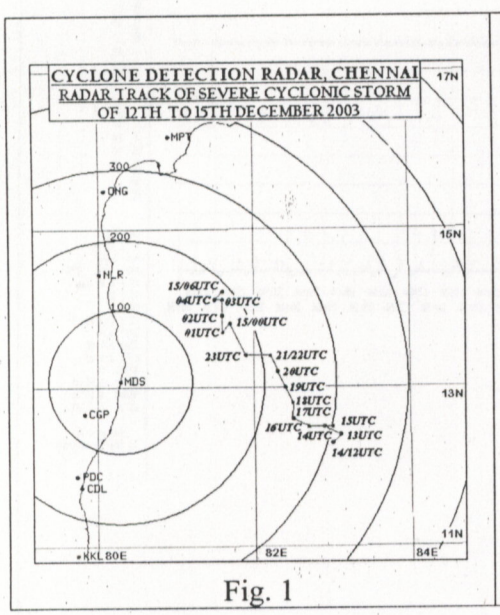


Fig. 1

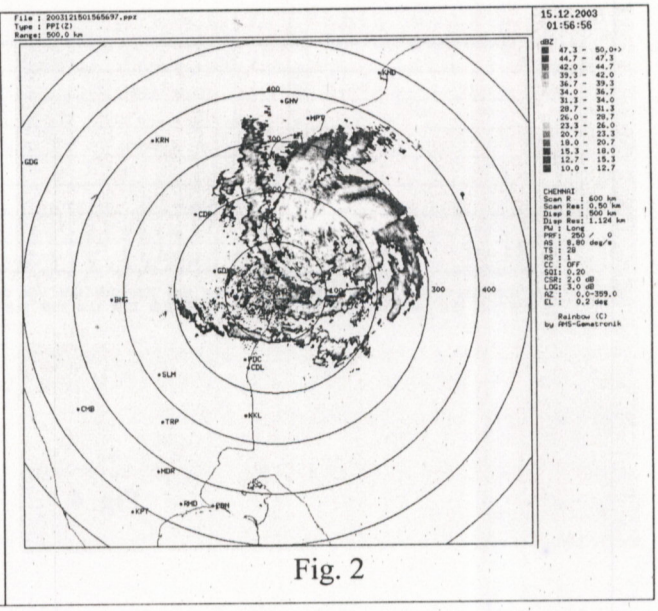


Fig. 2

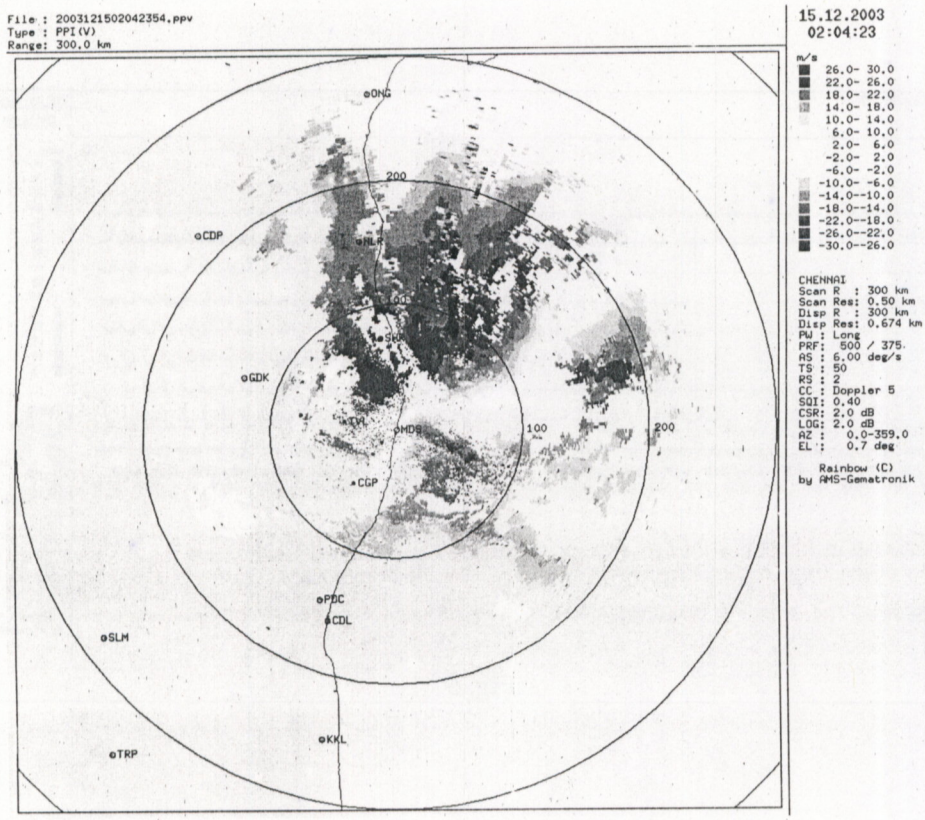
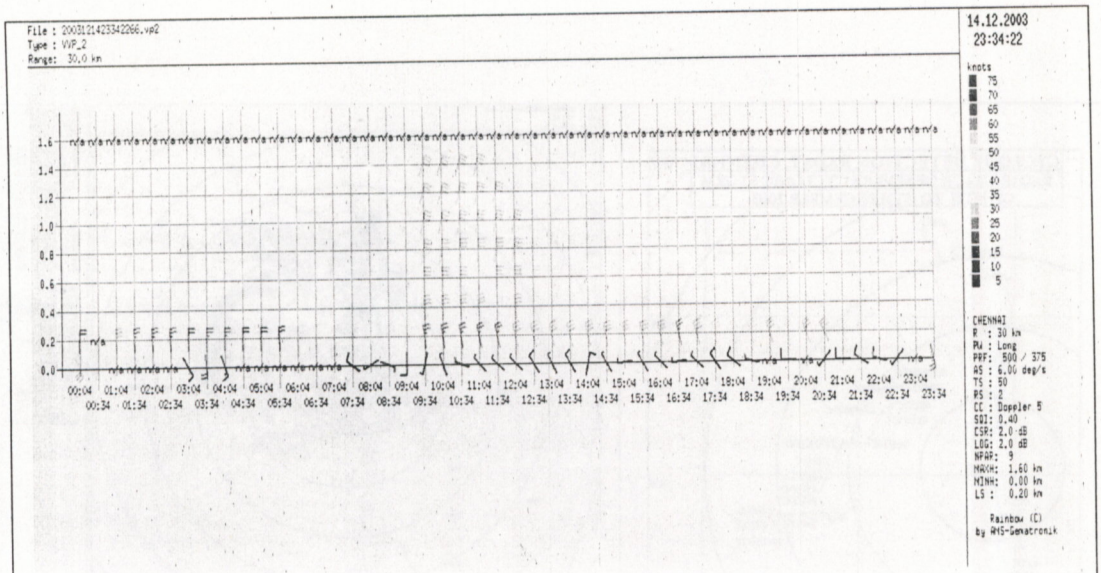


Fig. 3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15
10
5
CHENNAI
R : 30 km
PW : Long
PRF: 500 / 375
AS : 6.00 deg/s
TS : 50
RS : 2
CC : Doppler 5
SQI: 0.40
CSR: 2.0 dB
LOG: 2.0 dB
NPAR: 9
MAXH: 1.60 km
MINH: 0.00 km
LS : 0.20 km
Rainbow (C)
by AMS-Gematronik

Fig. 4

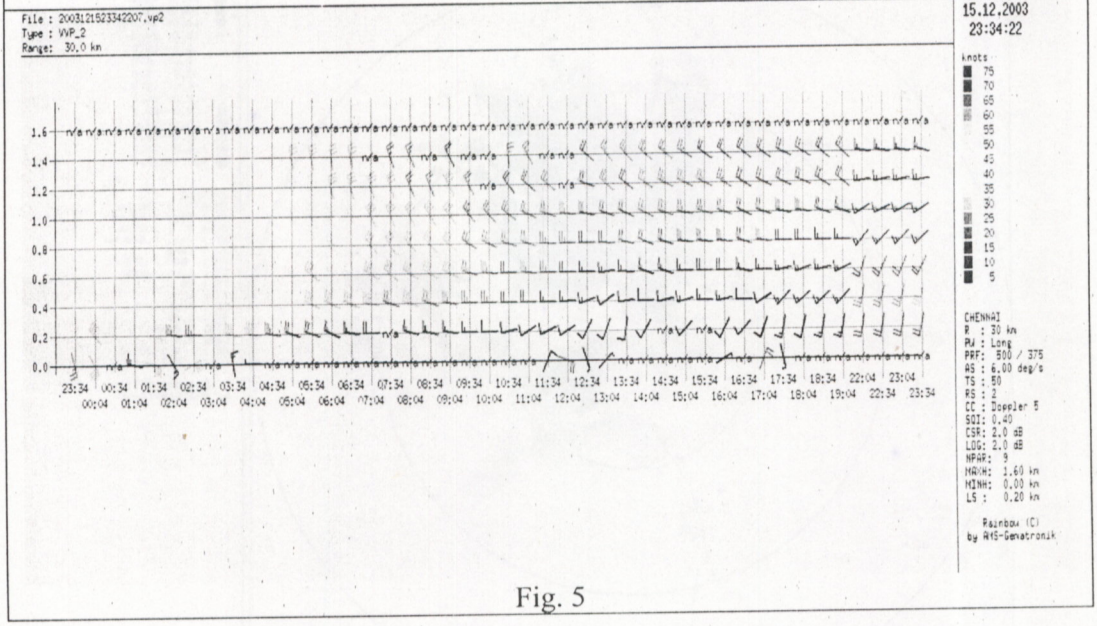
File : 20031215233422O7.vp2
Type : VVP_2
Range: 30.0 km
15.12.2003
23:34:22
knots
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
CHENNAI
R : 30 km
PW : Long
PRF: 500 / 375
AS : 6.00 deg/s
TS : 50
RS : 2
CC : Doppler 5
SQI: 0.40
CSR: 2.0 dB
LOG: 2.0 dB
NPAR: 9
MAXH: 1.60 km
MINH: 0.00 km
LS : 0.20 km
Rainbow (C)
by AMS-Gematronik

Fig. 5

SALIENT FEATURES OF RAINFALL OF CHENNAI CITY

V.K.Raman*

Chennai is a major metropolitan city in south India. Located on the east coast, it covers an area of about 170 Sq.Km, with a population of about 6 million. The Nungambakkam observatory (Lat13° 04′N, Long 80°15′E), established during 1792, is the oldest observatory in the country. The rainfall of Chennai city assumes greater importance, in view of water shortage experienced, due to expanding activities in various sectors with the increasing population over the years. Certain salient features of rainfall recorded at Nungambakkam observatory, representing this important city are briefly discussed here. Rainfall data for the years 1901-2003 have been considered.

Annual Rainfall

Compared to the seasonal/monthly rainfall, annual rainfall represents all the 4 seasons (covering all the 12 months) and hence the features of annual rainfall are considered. Chennai city has an annual normal rainfall of 1266.9 mm (Based on IMD Climatological tables 1950 –1980). Figure-1 represents the distribution of annual rainfall over Nungambakkam for the years 1901 – 2003. Salient features of the annual rainfall for the 20th century are given below

Highest annual rainfall - 2444.8 mm (1996) (193 % of normal)
Lowest annual rainfall - 552.2 mm (1904) (43.6% of normal)
Highest decadal rainfall - 14,565.3 mm (1991-2000)
Lowest decadal rainfall - 11,061.7 mm (1931-1940)
The annual rainfall of 738.1 mm (58.3% of normal) recorded for the year 2003 is the 3rd lowest for the last 103 years.

552.2 mm (1904) – (43.6% of normal)
635.3 mm (1938) – (50.1 % or normal)
738.1 mm (2003) – (58.3 % of normal)

Decadal rainfall

Figure-2 indicates the distribution of decadal rainfall for the last10 decades covering the years 1901 – 2000. There has been a gradual increase of decadal rainfall for the past 5 decades, with the decade 1991 – 2000 registering the highest rainfall of 14,565.3 mm. The lowest decadal rainfall is 11,067.7 mm (1931-1940)

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* Director, Meteorological Office, Chennai.

(Synopsis of the lecture delivered at the Monsoon seminar, IMS Chennai Chapter on 23 March 2004)

FIGURE - 1
CHENNAI (NUNGAMBAKKAM) - ANNUAL RAINFALL : 1901-2003

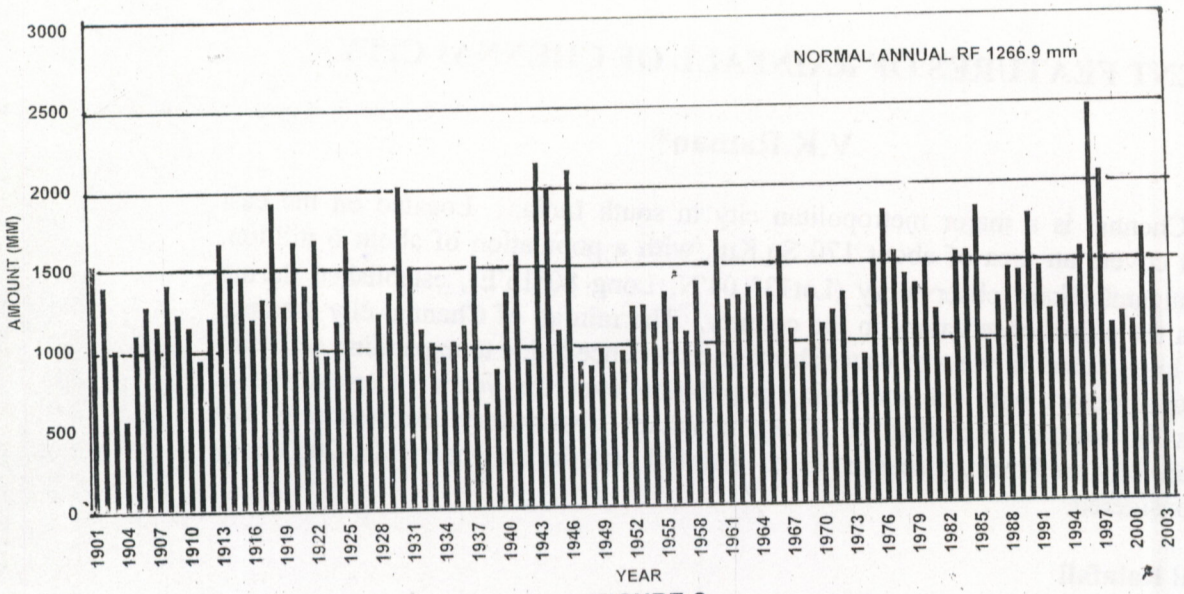


FIGURE-2
CHENNAI (NUNGAMBAKKAM) DECADAL RAINFALL [1901-2000]

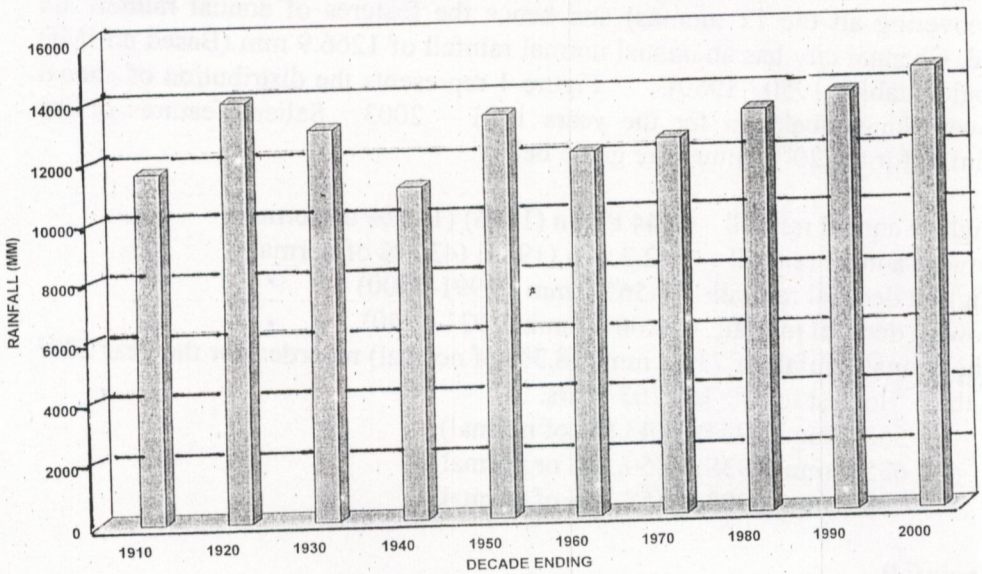
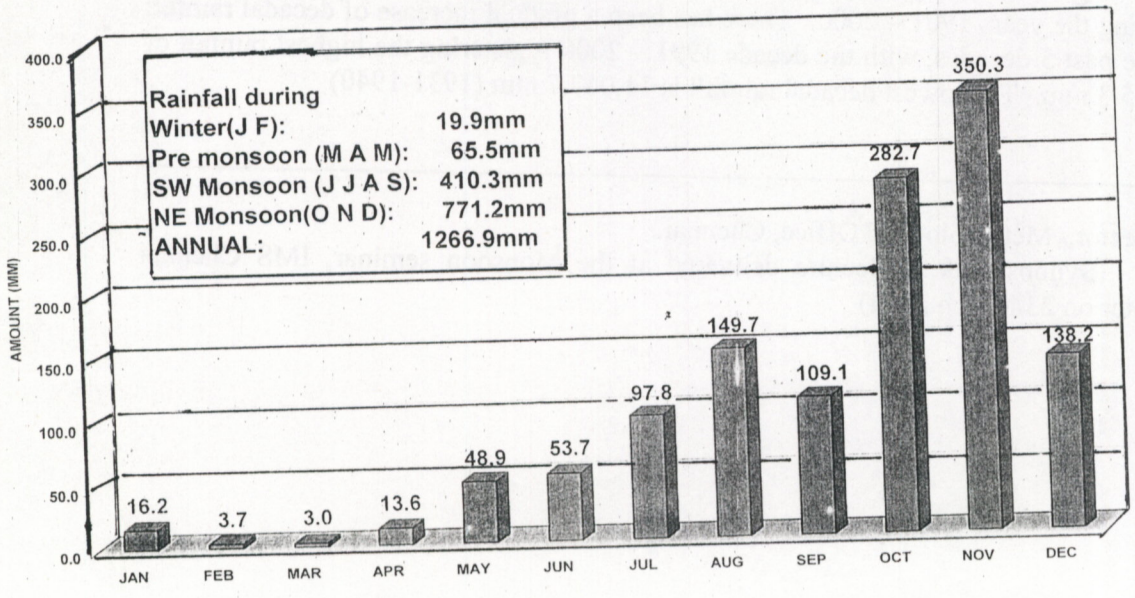


FIGURE - 3
CHENNAI CITY (NUNGAMBAKKAM) - NORMAL RAINFALL



TOTAL RAINFALL DURING WINTER SEASON (JF): 19.9; PRE-MONSOON(MAM): 65.5; S-W MONSOON (JJAS): 410.3; NE MONSOON (OND): 771.2
ANNUAL: 1266.9; HIGHEST 24-HR RF (MM) EVER RECORDED: 452.4 [25 Nov 1976]

Seasonal rainfall

Figure-3 gives the monthly distribution of normal rainfall over Chennai (Nungambakkam) city. The normal rainfall (mm) season wise, with % contribution towards annual rainfall is given below

Season	Months	Normal rainfall mm	% Of annual
Winter	Jan & Feb	19.9 mm	1.6%
Summer	Mar, April & May	65.5 mm	5.2%
SW monsoon	June, July, Aug and Sep	410.3 mm	32.3 %
NE monsoon	Oct, Nov and Dec	771.2 mm	60.9%

The normal rainfall during the 5-month period (i.e.) January to May hardly accounts for less than 7% of annual rainfall. Major portion of rainfall is expected during NE monsoon season (60.9%), followed by SW monsoon season (32.3%) (60.9%)

NE Monsoon

II. Best Rainfall Years (mm)

Sl.No.	Year	Amount Rainfall (mm)
1.	1997	1570.7
2.	1946	1547.4
3.	1913	1417.3
4.	1930	1398.2
5.	1943	1343.1

Worst Rainfall years (mm)

Sl. No.	Year	Amount Rainfall (mm)
1.	1909	132.8
2.	1904	149.1
3.	1949	264.7
4.	1938	266.4
5.	2003	311.5

SW Monsoon

III. Best Rainfall years (mm)

Sl.No.	Year	Amount Rainfall (mm)
1.	1996	1154.8
2.	1961	759.2
3.	1988	711.1
4.	1975	658.2
5.	1991	638.5

Worst Rainfall years (mm)

Sl. No.	Year	Amount Rainfall (mm)
1.	1920	136.1
2.	1933	153.2
3.	1913	177.0
4.	1952	196.9
5.	1972	197.2

It may be noted that in all the top 5 best years (1997, 1946, 1913, 1930 & 1943) the NE monsoon rainfall alone had even exceeded the annual rainfall normal.

Other Features (Monthly and Daily)

November is the rainiest month with a normal rainfall of 350.3 mm (27.6% of annual rainfall) followed by October 282.7 mm (23.3%). Other features:

- August 149.7 mm (11.8%) and December 138.2 mm (10.9%) September 109.1 mm (8.6%)
- Highest rainfall of 1088.4 mm has been recorded during November 1918.
- Lowest rainfall of 5.1 mm has been recorded during November 1904.
- Contributions of rainfall during the months January to May is not very much, accounting for less than 7% of annual rainfall. This is reflected in the following table, which gives the total number of years during which no rainfall has been received.

Sl. No	Month	No. of years when NO rainfall was received during 1901 – 2000
1.	January	13 years
2.	February	56 years
3.	March	62 years
4.	April	37 years
5.	May	18 years

- Significant amount of rainfall has also been received during the above months, of course on very rare occasions (with less than 5% of the years)

  Wettest rainfall years for these months are

January	1915	244.1 mm
February	1984	377.6 mm
March	1994	262.2 mm
April	1901	191.0 mm
May	1952	389.4 mm

24 Hours Rainfall

Highest 24 hours rainfall ever recorded was 452.4 mm, on November 25, 1976.

24 Hours ever-highest rainfall for a few other months with dates are given below:

Month	Rainfall (mm)	Date
October	279.7 mm	(22.10.1969)
December	261.6 mm	(10.12.1901)

January	212.9 mm	(15.01.1915)
February	294.0 mm	(17.02.1984)
May	244.3 mm	(22.05.1952)
June	282.2 mm	(14.06.1996)

Summary

- The annual normal rainfall of Chennai city is 1266.9 mm which is quite substantial compared to many other cities in India and elsewhere in the world.
- Chennai city had received more than 1000 mm as annual rainfall during 80% of the years and continuously for 16 years from 1987 to 2002.
- 1996 has been the best rainfall year of the century (1901-2000) with a record annual rainfall (2444.8mm) and record SW monsoon rainfall (1154.8mm) and reasonably high NE monsoon rainfall (1258.3 mm)
- The annual rainfall for 2003 was 738.1 mm and 3rd lowest in the last 103 years the other two years being 1904 (552.2 mm); and 1938 (635.3 mm)
- Major contribution of rainfall occurs during NE Monsoon (Oct- Dec) (60.9% of annual) followed by SW Monsoon (June to Sept) Season (32.3% of annual)
- The contribution of rainfall during the first 5 months January to May is generally quite insignificant. These months together account for less than 7% of the annual rainfall. On very rare occasions (less than 5% of the years) there may be some significant contribution during these months.
- There has been a general feeling among the public that the rainfall has been decreasing over the years. This is not the correct picture. The actual position is that except year-to-year fluctuations, there has been no significant reduction of rainfall over the years. In fact the rainfall has been mostly consistent, considering on a decadal basis, with a marginal increase over the last 5 decades(1951-2000) On the other hand, the population keeps on increasing over the years and with a resultant expanding activities in various spheres, the demand for water has naturally been increasing and the per capita availability of water has naturally come down! By better management of water resources, intensive rainwater harvesting, and conservation measures this problem can be reasonably solved. (Even with 1000 mm of annual rainfall, the total volume of rain water received over Chennai city (170 Sq Km) comes to around 17,000,000 million litres. A substantial portion of this volume goes as runoff !

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Weatherwise

UNUSUAL WEATHER CONDITIONS OVER TAMILNADU AND KERALA IN MAY 2004

P.V.Revikumar

A low pressure system formed in the south Bay of Bengal in the first week of May, crossed Tamil Nadu coast, moved westwards across Kerala and emerged into the Arabian sea on 5 May and concentrated into a Depression This type of synoptic system moving dead west across peninsular India is not common and is very unusual in May.

This system produced extensive rainfall activity over Tamilnadu and Kerala leading to flood situation in several districts of both the states, which were facing drought conditions during this period of time. This unusual phenomenon had significantly reduced the summer heat in Tamilnadu and Kerala.

This low pressure system attained cyclonic intensity near northern parts of Lakshadweep area on the evening of 5 May leading to disturbed weather conditions over Lakshadweep island. Aminidivi island station recorded 117 cm of rainfall in 24 hours ending at 0830 hours IST on 6 May which is an all time record for that station.The cumulative rainfall record for 72 hours for Aminidivi from 5 to 7 May was 184 cm, a record in its history.

The storm intensified into a Severe Cyclonic Storm and moved northwestwards. It subsequently recurved towards northeast weakened into a Depression and crossed Gujarat coast on the night of 10 May.

Followed by this synoptic system, another Cyclonic Storm formed over North Bay of Bengal on the evening of 17 May which recurved towards northeast and crossed Bangladesh – Myanmar coast on the night of 19 May.

Under the influence of these synoptic disturbances the wind and weather pattern over extreme south Peninsula became very conducive for the onset of southwest monsoon over Kerala, well ahead of the normal onset date. This year southwest monsoon rain had commenced over Kerala and adjoining areas of Tamilnadu on 18 May about two weeks earlier than the normal date of onset, 1 June.

CHAPTER NEWS

A mini seminar "MONSOON 2003" was conducted on 23 March 2004, in connection with World Meteorological Day celebrations. Seven scientific presentations were made.

- "Weather, Climate and Water in the Information Age by Dr. A.Mohanakrishnan, Chairman, Cauvery Technical Cell, Chennai.
- "Monsoon and Water crisis in Tamilnadu by Dr.T.N.Balasubramanian, Professor & Head, Department of Agricultural Meteorology, TNAU, Coimbatore.
- "Review of performance of SW Monsoon 2003" by Sri.S.R.Ramanan, Director, Regional Meteorological Centre, Chennai.
- "Review of performance of NE Monsoon 2003" by Sri.P.V.Revikumar, Meteorologist Gr.I., Regional Meteorological Centre, Chennai.
- "Global features associated with SW and NE Monsoon 2003" by Dr.Y.E.A.Raj, Director, Regional Meteorological Centre, Chennai.
- "Doppler Weather Radar Tracking of Machilipatnam Cyclone December 2003" by Sri.S.Kalyanasundaram, Director, CDR, Chennai.
- "Salient features of Chennai city rainfall" by Sri.V.K.Raman, Director, M.O.Chennai.

Scientific Lectures

- "Meteorological Data Dissemination – A Review and a New development in the field" by Sri.S.R.Ramanan, Director, Regional Meteorological Centre, Chennai and Sri.K.G.Suresh Kumar, Meteorologist Gr.I., M.O.Chennai, on 28 May 2004.

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