Indian Meteorological Society, Chennai Chapter
Newsletter Vol.16, Issue No.2, Dec 2016

Contents

From the Chairman's Desk…

Dear members of IMS Chennai chapter and readers of BREEZE,

It is my privilege to update you on the activities of the chapter, since the release of the previous issue of BREEZE dated Jun 2016 (Vol.16, Issue 1).

The Annual General Body (AGB) meeting of the chapter was held on 01st July 2016. A new council of office bearers for the biennial term 2016-18 was elected during the AGB. As the newly elected Chairman, I have undertaken the responsibility of improving upon the activities of the society. As suggested by some senior members of the society during the AGB, we are planning to arrange for periodic scientific lectures and other outreach programmes.

A talk on '***X-ray Crystallography : an essential tool for modern drug discovery***' by Dr. K. Gunasekaran, Assistant Professor, CAS in Crystallography and Biophysics, University of Madras, Chennai 600 025 was arranged on 11.08.2016 at Regional Meteorological Centre, Chennai. A talk on '***Humour and Meteorology***' by Shri S.Raghavan, Retd. Deputy Director General of Meteorology (DDGM), India Meteorological Department (IMD) was held on 19th October 2016 at the same premises.

A seminar on ***Monsoons-2016*** covering the salient features of the southwest and northeast monsoons 2016 with special reference to cyclone VARDAH that made landfall over Chennai on 12th December 2016 was held on 28th Feb 2017. Aside from IMD experts covering the two monsoons and tracking of the cyclone VARDAH, guest lectures on '***Disaster management and rehabilitation measures taken in association with cyclone VARDAH***' by Dr.K.Satyagopal, IAS, Commissioner of Revenue Administration and Disaster Management, Govt. of Tamil Nadu and '***Impact of largely deficient northeast monsoon 2016 on the agricultural prospects for the state of Tamil Nadu***' by Shri S.Santhanagopalakrishnan, Additional Director, Department of Agriculture, Govt. of Tamil Nadu were also held. Gists of some of the talks during the event also find place in this issue of BREEZE along with articles on recent meteorological events.

I am also immensely happy to note, that the scientific contributions of two of our Chapter members have been aptly rewarded. **Shri S.Raghavan**, Retired DDGM, IMD Chennai and Fellow of IMS has been awarded ***Life-time achievement award*** by the IMS (National). **Ms. B.Amudha**, Scientist-D, IMD Chennai has received World Meteorological Organisation - ***Vilho Vaisala Award*** for the year 2016. A write-up on this award is also included in this current issue of BREEZE.

As part of news from IMS(National), the first circular on **INTROMET-2017** and plans for **IMS- Diamond jubilee celebrations** are put up in the IMS (Hq) website. Notifications on these circulars with website links are included in this issue for the benefit of our Chapter members.

I hope that the material published in this issue will quench the scientific thirst of the readers to some extent.

With best regards
S.B.Thampi, Chairman, IMS Chennai Chapter, Chennai

Membership details of IMS-Chennai Chapter (as on Dec 2016)
Life Members: 148; Ordinary Members: 4; Total : 152

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

HOW TO GET MORE WATER OR MORE RAIN

by
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Our need for water is increasing and we are not satisfied with the rainfall that we get. How to increase the availability of water? A report said some time back that Chennai city alone has a water demand of 1200 million litres per day (MLD) which is expected to increase to 2100 MLD by 2031. For the non-urban areas the biggest demand is for agriculture. Bur there are also demands for industries including what may be considered non-priority sectors e.g. cool drink manufacture. So even if rainfall continues at the present rate there is no hope for meeting the demand. *But, is the rainfall itself changing?* According to Rathore et al 2013, (STATE LEVEL CLIMATE CHANGE TRENDS IN INDIA Meteorological Monograph No. ESSO/IMD/EMRC/02/2013) the trends in the southern states in the period 1951 to 2010 are as below.

Trends in annual and seasonal rainfall (mm/year)

State	Number of stations	Annual	Winter	summer	Monsoon	Post-monsoon	Change in 50 years mm
AP and Telangana	94	+1.31	+0.29	+0.35	-0.14	+0.46	+65.5
Karnataka	222	-0.05	+0.10	-0.41	+0.61	+0.14	-2.5
*Kerala	18	-1.43	-0.40	-1.15	-2.42	+1.68	-71.5
*Lakshadweep	2	+3.22	-0.33	-0.44	+1.73	+0.83	+41.5
TN and Puducherry	207	+0.80	-0.16	-0.47	-1.35	+1.49	+40

*The number of stations in Kerala (and of course Lakshadweep) is rather small

There are positive and negative changes but these are not alarming. What is of concern is that some studies find an increase in short spells of heavy rain instead of a temporally more even distribution of rainfall. How to manage this situation?

1. Conservation of water

Our ancestors had built irrigation tanks to conserve rain water for the whole year and to facilitate recharge of ground water. Tamil Nadu alone had about 41,000 such tanks and there were a similar number in Karnataka. They were apparently maintained well in the olden days by local people who were made responsible. But land use changes made in the interests of "*development*" have resulted in neglect, truncation, silting, filling up or total destruction of tanks. Ground water recharge has also been prevented. Wetlands which absorb water during rain have also been truncated. Natural runoff of rain water has been blocked in many cases resulting in floods and in some cases landslides. Extensive land use changes by way of deforestation, destruction of beneficial vegetation such as mangroves and conversion of agricultural land to other uses has occurred. Available surface water is also polluted by various effluents. Rain in heavier spells may lead to more frequent flooding. Since the excess water runs off without seepage or storage there were will be more droughts also. There is a tendency to disregard such factors and attribute floods and droughts exclusively to variations in rainfall or to "*climate change*".

2. Ground water

Over exploitation of ground water has resulted in lowering of water table and little water is available. In some areas it has led to sea water intrusion.

3. Desalination of sea water

Desalination has been used widely in West Asian countries. We have some desalination projects for drinking water. For example, two of them provide water to Chennai. But this is a costly venture and unsuitable for irrigation of crops.

4. Increasing rainfall by cloud seeding

Some State governments have been trying this, not on a scientific basis but as a desperate measure during droughts. The efficacy of such "*operational*" seeding programmes is unproven. It also needs expensive facilities like aircraft and radar. The protagonists are constrained to try to prove its success by statistical methods to justify the expenditure. Above all it is often not realised that suitable clouds must be available to seed and enhance rain!

5. Geo-engineering

There is a report that the United Arb Emirates plans to construct an artificial mountain to intercept moist winds and enhance rainfall, with the help of US scientists. To give an idea of the likely cost is said that a 1.2 mile high mountain proposed in the Netherlands[1] is estimated to cost at least US$230 billion. *[Source: Bulletin of the American Meteorological Society, September 2016]*. It is not clear whether the environmental implications have been studied.

A (natural) mountain in Hawaii, USA is said to have a concave surface on the windward side, intercepting moist winds which produce rain. With this analogy, a leading scientist has suggested that an extension should be built to the Jawadhi hills in Tamil Nadu to present an appropriately oriented surface to the northeast monsoon winds so that copious rain can be produced in that area. This is not a hare-brained idea. He has modelled the idea using geographical data. The structure would probably be "a wall (with concrete perhaps) that is more than 500 m tall and about 12 km wide at the appropriate angle to the front face of the mountain". Engineering feasibility is reported to have been examined. It is suggested that water can flow by gravity to Chennai City.

It is true that even small hills or small water bodies can produce an increase in precipitation locally. The particular area may get more rain in the NE monsoon season. But numerous questions arise.

What will be the impact on rainfall leeward of the wall and over the rest of the State?

What will be the impact on SW monsoon rainfall when the winds are westerly? Will it produce flooding or landslides or loss of agricultural land?

Besides scientific and engineering issues, the following have to be considered.

What is the cost benefit ratio considering that the increase of rainfall will be localised and so the benefit willbe restricted to a small area?

What will be the effect on ecology, environment and biota?

[1] Much of the Netherlands is below sea level. Walls to prevent sea water intrusion make sense but it is not clear whether the mountain proposed is for rainfall augmentation in that country.

What will be the socio-economic and socio-political implications for the local population (displacement, dispossession of land, loss of livelihood)?
What will be their perception if the water from a project in their area is taken to Chennai?

Similar questions have been asked about river-linking proposals and even about dams and no clear answers are available.

The solution seems to lie therefore in restoring water bodies, storages, wetlands and water flow routes to the extent possible, preventing encroachment of these and in curbing excessive depletion of ground water. Changes in cropping patterns and methods of irrigation are being encouraged but more can be done in this respect.

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INDIAN METEOROLOGICAL SOCIETY - LIFE TIME ACHIEVEMENT AWARD TO SHRI S.RAGHAVAN, FELLOW, IMS CHENNAI CHAPTER

Shri Soundararajan Raghavan, *son of a farmer, was born in Coimbatore, Tamil Nadu in 28th November, 1932. He took a First class B.Sc. Honours degree from Madras University in 1952 in Physics with specialisation in "Wireless" and taught in a College for about a year. He joined the India Meteorological Department (IMD) in 1953 and worked in the offices of the Department at Pune, New Delhi and Chennai for over 37 years in various capacities. He had specialised training in the United States Weather Bureau and Japan Meteorological Agency. He retired from the Department as Deputy Director-General of Meteorology, the Head of the Southern Region of IMD, in 1990*

In IMD, Shri Raghavan has been involved in operations, research and personnel training in the fields of Instruments and Observations, Radar Meteorology, Agricultural Meteorology and Tropical Cyclone Warning and Disaster Management. He was the Principal Delegate of India to the tenth session of the Commission of Instruments and Methods of Observation (CIMO) of the World Meteorological Organisation and was on the Advisory Working Group of CIMO. He has conducted many researches mainly in the fields of Radar Meteorology, Upper air observations and Tropical Cyclones and their Impact.

Shri Raghavan has been a Consultant or Resource Person or Lecturer or Chairman/Member of Committees on various subjects to the WMO, Asian Disaster Preparedness Center, Bangkok, IMD, Ministry of Earth Sciences, several units of the Indian Space Research Organisation, Madras School of Economics, Ministry of Defence, Council of Scientific and Industrial Research, Indian Institutes of Technology, Madras and Kharagpur, Indian Institute of Tropical Meteorology and various Universities. He was a Member of the Faculty of Marine Sciences at Cochin University of Science and Technology.

He was a Program Committee Member and Invited Delegate to the "First Asian Conference on Radar in Meteorology and Hydrology (ARAD-2007)", in China in 2007. He was also Principal Investigator of a Department of Science and Technology Project on Study of Precipitating Weather Systems at the National Atmospheric Research Laboratory.

He has in his credit about 70 scientific papers published in Indian and foreign journals. He has authored a book on "Radar Meteorology" published in Europe in 2003. He has written chapters in a book on "Storms" published in the UK and a book on "The Economics of India's Space Programme" published by Oxford University Press in India.

Shri Raghavan is a Member of the Indian Meteorological Society since 1957 and became Fellow of the Society in 2000. He is also an Emeritus Member of the American Meteorological Society, a Fellow of the Institution of Electronics and Telecommunication Engineers and Life-Member of the Association of Hydrologists of India and of the Indian Astronautical Society.

In recognition of his outstanding contribution to the education and research in Meteorology and particularly in Radar Meteorology, in the fields of Instruments and Observations, Agricultural Meteorology, Tropical Cyclone Warning, Disaster Management etc., the Indian Meteorological Society is privileged to confer upon ***Shri Soundararajan Raghavan – the Life Time Achievement Award of the Indian Meteorological Society*** *on this day of 18th December, 2016.*

INDIAN METEOROLOGICAL SOCIETY, CHENNAI CHAPTER

EXPRESSES

HEARTY CONGRATULATIONS!!!

TO

REVERED SHRI S.RAGHAVAN,

FELLOW, INDIAN METEOROLOGICAL SOCIETY

ON CONFERMENT OF PRESTIGIOUS

INDIAN METEOROLOGICAL SOCIETY - LIFE TIME ACHIEVEMENT AWARD

2016 - KERALA'S EVER LOWEST ANNUAL RAINFALL SINCE 1901

by
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Kerala receives an average rainfall on 23 mm in January –February , 378 mm in summer season (March-May), 2051 mm in the Southwest monsoon season (June-September) and 477 mm in the northeast monsoon season (October-December) totaling an annual rainfall of 2928 mm as per the latest averages based on 1951-2000. Thus the rainfall in January to February accounts for 10% of the annual total, summer rainfall is 13%, southwest monsoon rainfall is 70% and northeast monsoon rainfall is 16% of the annual rainfall. The total annual rainfall of Kerala varies from 3650 mm in the north to 1750 mm in the south. The coefficient of variation of annual rainfall of Kerala is less than 15% in the north and less than 20% in the south.

The rainfall of southwest monsoon in 2016 was excess or normal in 85% of the country while the remaining 15% of the country received deficient rainfall. The most affected deficient part of the rainfall in this year's monsoon was in the southwest peninsular India consisting coastal Karnataka, South Interior Karnataka and Kerala, the highest worst deficiency of 34% being in Kerala. Normally when the country goes into drought in the southwest monsoon, Kerala too go into drought on a few occasions. But the year 2016's case is a bit strange, when majority of the country had good rainfall, southwestern peninsular India had poor rainfall leading to drought . There may hardly be one or two of occasions when such a thing had happened earlier.

Meteorologically drought over an area or place may be defined as a situation when the principal rainy season rainfall is less than 75% of normal . It is further classified as moderate drought if the rainfall deficit is between 25% and 50% and severe drought when the deficit is more than 50%.

Kerala never experienced severe drought during the southwest monsoon (June to September). However, Kerala had experienced 12 moderate drought years during the period 1875-2008 in the southwest monsoon season. Kerala received the lowest southwest monsoon rainfall in 1918 with 105.7cm while the second lowest rainfall was in 2002 with 129.0 cm. The southwest monsoon rainfall in 2016 was 135.2 cm and it is the third lowest with 34% deficiency. It may also be mentioned that Idukki district received the lowest southwest monsoon rainfall of 157 cm in 2016 since 1976.

The probability of occurrence of annual rainfall of less than 75% of the normal is about 8% for Kerala, i.e., about in once every 12 years . The probability of occurrence of excessive rainfall in the state as a whole is about 4%, i.e., about once every 25 years. (India Meterological Department publication - Climate of Kerala, 1985). During the period of 1901-2010 there have been eleven years of deficient annual rainfall based on the earlier annual normal of 3107 mm over Kerala and the years were 1934(-20%), 1951(-23%),1952 (-23%), 1965(-23%) 1972(-20%), 1976(-28%), 1982(-24%), 1986(-27%) 1987 (-25%) and 2000(-21%), 2003 (-22%).

Kerala's lowest annual rainfall since 1901 was in the year 2012 with a rainfall of 219.4 cm [January-February with 2.3cm, summer (March to May) with 30.9cm., southwest monsoon (June to September) with 155.1cm and with northeast monsoon (October to

December) 31.1cm]. This record lowest annual rainfall of Kerala since 1901 led to moderate drought.

In this year 2016, Kerala received a rainfall of 1.9cm in January-February , 31.3cm in March to May (summer), 135.2cm in June-September (Southwest monsoon season) and 18.5cm in the Northeast monsoon season , thus totaling annual rainfall for 2016 becoming 186.9cm beating the earliest lowest ever recorded annual rainfall of 219.4cm in 2012 since 1901. A comparison of rainfall of 2012 and 2016 for the season is as follows.

Seasonal and annual rainfall of Kerala during 2012 and 2016

Season	2012			2016		
	Actual cm	Normal cm	Deperature %	Actual	Normal	Departure %
Winter	2.3	2.3	0	1.9 cm	2.3	-17%
Summer	30.9	38.0	-18%	31.3	38.0	-18%
SW monsoon	155.1	204.0	-24%	135.2	204.0	-34%
NE monsoon	31.1	48.1	-35%	18.5	48.1	-62%
Annual	219.4	292.8	-26%	186.9	292.8	-36%

District wise annual rainfall for 2012 and 2016 are given in the following table.

Annual rainfall over various districts of Kerala during 2012 and 2016

District	2012 rainfall (mm)	2016 rainfall (mm)	Remarks
Kasargode	3047	2466	Lowest since 1976 in 2016
Kozhikode	2921	2258	-do-
Kannur	2661	2216	-do-
Malappuram	1975	1534	lowest 1460 mm in 1982
Palakkad	1698	1350	lowest since 1976 in 2016
Wayanad	2834	1327	-do-
Trivandrum	1104	1198	lowest 1104 mm in 2012
Kollam	1621	1912	lowest 1621mm in 2012
Pathanamthitta	1771	2134	lowest 1245 mm in 1979
Alleppey	1829	1769	lowest since 1976 in 2016
Kottayam	2248	1884	-do-
Idukki	2586	2112	-do-
Ernakulam	2573	2326	-do-
Thrissur	2338	1867	-do-
Jan - Feb	23	-	-
Total	2194	1869	lowest ever in 2016 since 1901

A comparison of annual rainfall of two poor years of 2012 and 2016 show that except for the three southern districts of Thiruvananthapuram, Kollam and Pathanamthitta, all other districts of Kerala recorded lower annual rainfall in 2016.

Thus 2016 recorded an annual rainfall of 1869 mm as against a normal of 2928 mm. The three lowest annual rainfall recorded by Kerala are 2016 with 1869 mm, 2012 with 2194 mm and 1976 with 2250 mm. 2016 is the lowest record annual rainfall of Kerala. In 2012 the annual rainfall was 26% deficient while 2016 it is deficient by 36% as against a normal of 2928 mm.

The most striking feature of this year's rainfall of Kerala is the southwest monsoon, deficiency was highest with 34%, while 85% of the country got normal or excess rainfall and the northeast monsoon was largely deficient too with 62% close to very near record lowest northeast monsoon rainfall and summer rainfall being 18% deficient has all contributed to the record lowest annual rainfall of Kerala since 1901. Two lowest annual rainfall in 2012 and 2016 in quick succession is also a striking feature and the rainfall amount of less than 200 cm is also very striking. The implication of this poorest rainfall will be felt in the water and power front in the coming months.

The government is getting geared up to meet the drought situation of Kerala with all resources at its command.

Nomenclature

-19% to +19%	-	*Normal*
-20% to -59%	-	*Deficient*
Greater than 60% deficiency	-	*Large deficiency*
20% to 59%	-	*Excess*
60% and above	-	*Large excess*

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SALIENT FEATURES OF NORTHEAST MONSOON – 2016

by
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Background

After a good run of Northeast Monsoon (NEM) over the meteorological subdivision of Tamil Nadu (TN; including the union territory of Puducherry) in the recent decade with 8 years of continuous excess-normal seasonal performance (October-December) during 2004-2011 and the most recent year 2015 recording 52% excess NEM rainfall and with the southwest monsoon (SWM) rains of 2016 over TN ending up at -19%, it was hoped that NEM 2016 would at least be normal. Under strong El Nino and positive-normal Indian Ocean Dipole (IOD) conditions which are generally associated with good NEM performance, NEM 2015 saw some extremely heavy rainfall activity and unprecedented floods over the north coastal districts of Chennai, Kanchipuram and Thiruvallur. However, during Oct-Dec 2016, the background flow pattern was completely different from the scenario during Oct-Dec 2015 with the development of weak La Nina over the equatorial Pacific and IOD being negative to near normal. IMD's seasonal prediction on NEM 2016 indicated near normal rainfall over the southern peninsula [including the meteorological subdivisions of TN, Coastal Andhra Pradesh (CAP), Rayalaseema (RYS), South Interior Karnataka (SIK), Kerala (KER) and TN] during Oct-Dec 2016. However, the performance of NEM 2016 was far from the expected lines.

Withdrawal of Southwest Monsoon and Onset of Northeast Monsoon 2016

During 2016, the withdrawal of SWM up to 15°N latitude, which is an important criterion for declaring the commencement of NEM rains, took place around 17th October. Subsequently, an upper air cyclonic circulation formed in the westerly flow in the lower latitudes around 18th October. Under its influence, a low pressure area formed over central Bay of Bengal (BOB) on 19th which concentrated into a depression over central and adjoining southeast BOB on 21st. The depression moved initially northeastwards towards Myanmar coast, intensified into cyclonic storm (CS) ***KYANT*** and then recurved west-southwestwards towards westcentral BOB. It then weakened into depression off south AP coast on 27th. On 28th and 29th, the depression further weakened gradually, and its remnant moved south / southwestwards towards coastal Tamil Nadu (CTN). Simultaneously, the low level winds reversed to northeasterlies resulting in favourable conditions for the onset of NEM over CTN on 30th October. The rainfall activity covered the interior parts of TN and Kerala on 31st October. As such, during 2016, setting in of easterlies over the southeastern coastal region of peninsular India and commencement of NEM rains over CTN occurred almost simultaneously on 30th October. However, only scattered rainfall activity was observed during the onset phase. The Madden-Julian Oscillation (MJO) was in an unfavourable phase (7-6) during the period 24th-31st October 2016 and the rainfall spell did not sustain longer.

The extended SWM into the second half of October and the formation of CS ***KYANT*** over the BOB led to a late onset of NEM over CTN by about 10 days. However, such a late onset is not unprecedented as climatologically, during the last 115 years of 1901-2015, onset of NEM has occurred on or after 25th October on 28 occasions with 8 occurrences going into November. The most delayed onset has been in 1915 on 11th November.

Forecast of setting in of favourable conditions and onset of NEM 2016 over CTN on 30th October was indicated on 26th October.

Synoptic scale weather systems during NEM 2016

During Oct-Dec 2016, 4 low pressure systems formed over the BOB and 1 over AS as listed below:

a. ***Cyclonic storm 'KYANT' over the Bay of Bengal during Oct 21st /0000 -27th /1800***
b. ***Depression over the Bay of Bengal during Nov 2nd /1500 – 6th /1200***
c. ***Cyclonic Storm "Nada" over the Bay of Bengal during Nov 29th /1200 – Dec 2nd /0300***
d. ***Very Severe* Cyclonic *Storm 'VARDAH' over the Bay of Bengal (6th /0900 - 13th/0000 Dec 2016)***
e. ***Depression over the Arabian Sea (17th/0300 -18th /0300 December 2016)***

Further,a fewtransient easterly wave troughs also passed through the southern parts of BOB during the 2nd-4th weeks of November.However, contributions from these synoptic systems to the NEM 2016 have been only meagre.

Formation of the first system, **CS *KYANT*** over BOB on 21st October and its further movement over the BOB until its weakening off south Coastal Andhra Pradesh (SCAP) coast on 27thdelayed the onset of NEM over CTN. However, its remnant was associated with the onset of NEM over CTN on 30th October and active NEM conditions over TN on 31st October. *Isolatedheavy* to *very heavy* rainfall occurred over TN on 31st October and *isolated heavy* rainfall occurred over Kerala during 31st October-2nd November.

The second system, a ***Depression***during 2nd-6thNov 2016, moved initially towards north Coastal Andhra Pradesh (NCAP) but then re-curved towards Bangladesh coast. Associated with the passage of this system, there was *isolated heavy* rainfall activity over NCAP on 04th November. However, it led to sweeping away of available moisture along and off Tamil Nadu coast and penetration of dry and cold wind from the north which caused weak NEM conditions over the southern peninsular India during the first week of November even though isolated *heavy* to *very heavy* rainfall was reported over TN during 01st-05th November.

Subsequently, a series of transient low intensity weather systems (upper air trough / trough of low pressure at mean sea level prevailed over the extreme southern parts of BOB during the rest of November. However, due to penetration of dry and cold winds from the north, the easterlies over the southeast BOB did not traverse upto the southeastern peninsular coast of India as the winds became northeasterlies over the western parts of southwest BOB and turned towards Sri Lanka and adjoining region skipping major part of the southern peninsular India. As such, during this period, the Indian NEM region could not benefit much from associated rainfall activity. There has been *scattered* rainfall activity over TN on 14thNovember with *isolated heavy* to *very heavy* rainfall occurrences during 13th-15thand *isolated heavy* rainfall over Kerala on 14th in association with an upper air trough in easterlies over southwest BOB on 12thNovember which moved westwards and was observed off Sri Lanka-Tamil Nadu coast on 13th and 14thand over comorin area to south Konkan coast on 15th. A trough of low pressure at mean sea level over equatorial Indian ocean and adjoining southwest BOB during 16th-20th November caused *scattered* rainfall activity over TN on 18th and *isolated* rainfall activity during 19th-23rd November.

Then, a trough of low at meal sea level over southeast BOB during 24th-25th November moved westward over southwest BOB and adjoining equatorial Indian ocean on 26th and 27th. It became a ***low pressure area (LOPAR)*** on 28thand concentrated into a ***Depression*** on 29th/1200 UTC near 6.5°N/87.5°E. It moved westnorthwest-northwestward and intensified into ***CS NADA*** on 30th/0300 UTC. Subsequently in moved westwards and weakened into Depression and crossed north Tamil Nadu coast near Nagapattinam (about 20 km south of Karaikal) between 0400 and 0500 hrs IST on 02nd December. It then moved further westwards and weakened into a well marked low pressure area and lay over interior Tamil Nadu and neighbourhood 02nd /0300 UTC. Itfurther weakened intoa LOPAR at 12 UTC of 02nd and moving westwards it emerged into Arabian sea and lay as a low pressure area over Lakshadweep and neighbourhood on 3rd December. Associated with the landfall and further westward movement of ***NADA***, *active* NEM conditions with *isolated heavy* rainfall activity prevailed over TN on 2nd and 3rd December.

On 4th December, another***LOPAR*** formed over South Andaman sea and neighbourhood which became well marked on 05thconcentrated into a ***Depression***on 06th/0900 UTC over southeast BOB near 8.5°N/91.0°E. Moving north-northwest wards, it intensified into ***CS VARDAH*** on 08th/0000 UTC. Subsequently, moving westnorthwest-westwards, it intensified into severe cyclonic storm (***SCS***) and very severe cyclonic storm (***VSCS***)***VARDAH*** on 09th/1800 UTC and 10th/1200 UTC respectively. Moving west-westsouthwestwards, it then crossed north Tamil Nadu coast close to Chennai between 0930-1130 UTC of 12thDecember with maximum sustained surface wind speed of 100-110 kmph gusting to 120 kmph. After landfall it moved west-southwestwards and weakened into a CS in the evening of 12th and further into a Depression in the early morning of 13thover North Interior Tamil Nadu and into a well marked low at 0300 UTC of 13thand lay over North Interior Tamil Nadu and adjoining South Interior Karnataka. It then emerged into Arabian sea and lay over southeast Arabian sea off Karnataka-Kerala coast on 14th. Associated with the passage of the system, *very heavy* to *extremely heavy* rainfall activity was reported on 13th December from Kancheepuram, Thiruvallur, Vellore and Salem districts of North Tamil Nadu [Satyabama universityARG (Kancheepuram Dist) 38 cm, Kvk Kattukuppam ARG (Kancheepuram Dist) 34, Kancheepuram (Kancheepuram Dist) 28, Kalavai AWS (Vellore Dist) 23, Poonamallee (Tiruvallur Dist) 22, Chembarabakkam (Tiruvallur Dist) 21, Chennai AP (Kancheepuram Dist) 20, Sriperumbudur (Kancheepuram Dist) 17, Chembarambakkam ARG (Tiruvallur Dist) 16, Yercaud (Salem Dist), Alangayam (Vellore Dist) 15 each, Tambaram (Kancheepuram Dist) 14, Chennai(NBK) (Chennai Dist), Thiruvalangadu (Tiruvallur Dist) 12 each].

Seasonal rainfall performance

At the end of the season, the seasonal rainfall figures indicated that the entire region fell under *large deficient* category (-60% to -99%) with SIK recording -70%, CAP and RYS: -66%, TN and KER: -62%. During the whole season, there have been only 4 days of *active* NEM conditions over KER, 3 days of *active*NEM over TN and 1 day each over CAP and RYS. Also, there has been a day of *vigorous* NEM activity over RYS. Regarding *heavy* rainfall occurrences, there has been one day of *isolated very* to *extremely heavy* rainfall over TN, two days of *isolated very heavy* rainfall over CAP and one day of *isolated very heavy* rainfall over RYS during the passage of VSCS VARDAH, 1 day of *isolated very heavy* rainfall over TN during the onset phase of NEM and three days of *isolated very heavy* rainfall over north TN in November in association with the passage of trough in upper air easterlies during 13th-15th November.

In the monthly scale, October and November rainfall over all the subdivisions was *largely deficient*. TN, which depends more on NEM rainfall than the SWM rainfall became *largely deficient* in October due to late onset of NEM on 30th October. The other subdivisions generally benefitted by the SWM (KER, SIK, CAP, RYS) also ended up *largely deficient* in October as the SWM activity in October was generally over north of the NEM region. In November, the ***Depression*** over BOB (02nd -06th November) that moved towards Bangladesh coast, penetration of cold and dry air from the north into the southwest BOB and adjoining NEM region and confinement of activity due to troughs in easterlies to south of Indian latitudes led to poor NEM activity and *large deficiency* over the region. But for the lone week ending 19th October when Kerala received normal to excess rainfall (extended SWM), rainfall during all other weeks in October and November was *deficient* to *largely deficient* in all the NEM subdivisions. Subsequently, due to the passage of **CS *NADA*** and **VSCS *VARDAH*** rainfall over TN, CAP, RYS and SIK was *normal* to *large excess* during the first two weeks of December and this rainfall brought down the cumulative rainfall figures by 10% or more in these subdivisions. This was the only silver lining to an otherwise hopeless situation that arose from the destructions caused by the landfall of ***VARDAH***.

Despite good activity over BOB, the NEM performance, from the Indian context, was utterly poor. For its impact on agriculture over TN as well as for the destructions caused by the landfall of ***VARDAH,*** the season is very likely to be noted and quoted often, of course for its notoriety, in future.

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Professor Dr. VilhoVäisälä Award-2016 for the development and implementation of instruments and methods of observation in developing countries

Ms. B. Amudha, Scientist-D, Regional Meteorological Centre, India Meteorological Department (IMD), Chennai and Dr. Rabia Merrouchi, National Meteorological Service, Morocco were awarded the coveted Sixth Granting of the Professor Dr. VilhoVäisälä Award-2016 for the development and implementation of instruments and methods of observation in developing countries in Madrid, Spain on 28 September 2016 in the Technical Conference on Meteorological and Environmental Instruments and Methods of Observation (CIMO TECO 2016) organised by the World Meteorological Organisation (WMO) during 27-30 September 2016. Ms. B. Amudha received the award from Dr. Wenjian Zhang, Assistant Secretary General, WMO.

The award is in recognition of the technical report WMO– Instruments and Observing Methods (IOM) ReportNo.117 entitled "*Survey on alternatives for dangerous and obsolete instruments: evaluation of the questionnaire and recommendations for alternatives*" (http://library.wmo.int/pmb_ged/iom_117_en.pdf). The document is her contribution when she served as a member of the WMO Expert Team on Regional Instrument Centres, Calibration and Traceability during the tenure 2010-14 having been officially nominated by IMD, New Delhi. The questionnaire was prepared by her and uploaded by WMO in their web site in August 2013. The responses received from the Member countries were analysed and the final version is available in the web site of WMO since January 2015.

The report enables a WMO Member country to determine where it stands in relation to other WMO Members in regard to its use of dangerous or obsolete instrumentation, and offers some ideas on how to replace these instruments by suggesting possible alternatives which are currently used in Morocco. The report gains significance in the background of two landmark events. The Fifteenth Session (2-8 Sept. 2010) of the CIMO highlighted the need for simple, stable and accurate instruments to replace mercury based and obsolete instruments widely used in National Meteorological and Hydrological Services. The global treaty Minamata Convention on Mercury, 2013 ratified by 128 member countries accentuates the phasing out of mercury based meteorological instruments by the year 2020 as mercury is hazardous to both mankind and the environment.

Prof. Dr. Vilho Väisälä Award for an Outstanding Research Paper on Instruments and Methods of Observation was established in 1985 and the first award presentation ceremony took place in 1986. Prof. Dr. Joseph P. Pichamuthu, of M. Visvesvaraya Institute of Technology, Bangalore is the first Indian to receive this award in 2005. A second Professor Dr.Vilho Väisälä Award for the Development and Implementation of Instruments and Methods of Observation in Developing Countries was established in 2004. Both awards granted bi-annually are administered by the WMO and they carry a medal, diploma and a cash prize of US$ 10,000 to be shared by the co-authors of the publication.

Ms. B. Amudha is the first Indian and the first IMD official to receive the prestigious Prof. Vaisala award instituted for developing countries.

INDIAN METEOROLOGICAL SOCIETY, CHENNAI CHAPTER

EXPRESSES

HEARTY CONGRATULATIONS!!!

TO

MS. B.AMUDHA

ON RECEIVING THE COVETED

WMO- VILHO VAISALA AWARD, 2016

News from IMS – National

http://www.imetsociety.org/wp-content/pdf/event reports/2016/intromet_15_09_2017.pdf

IMS Diamond Jubilee Celebrations

2017

http://www.imetsociety.org/wp-content/pdf/event-reports/2017/IMS_Diamond_02_01.pdf

FURY OF CYCLONE VARDAH: TAKES FROM MEDIA REPORTS

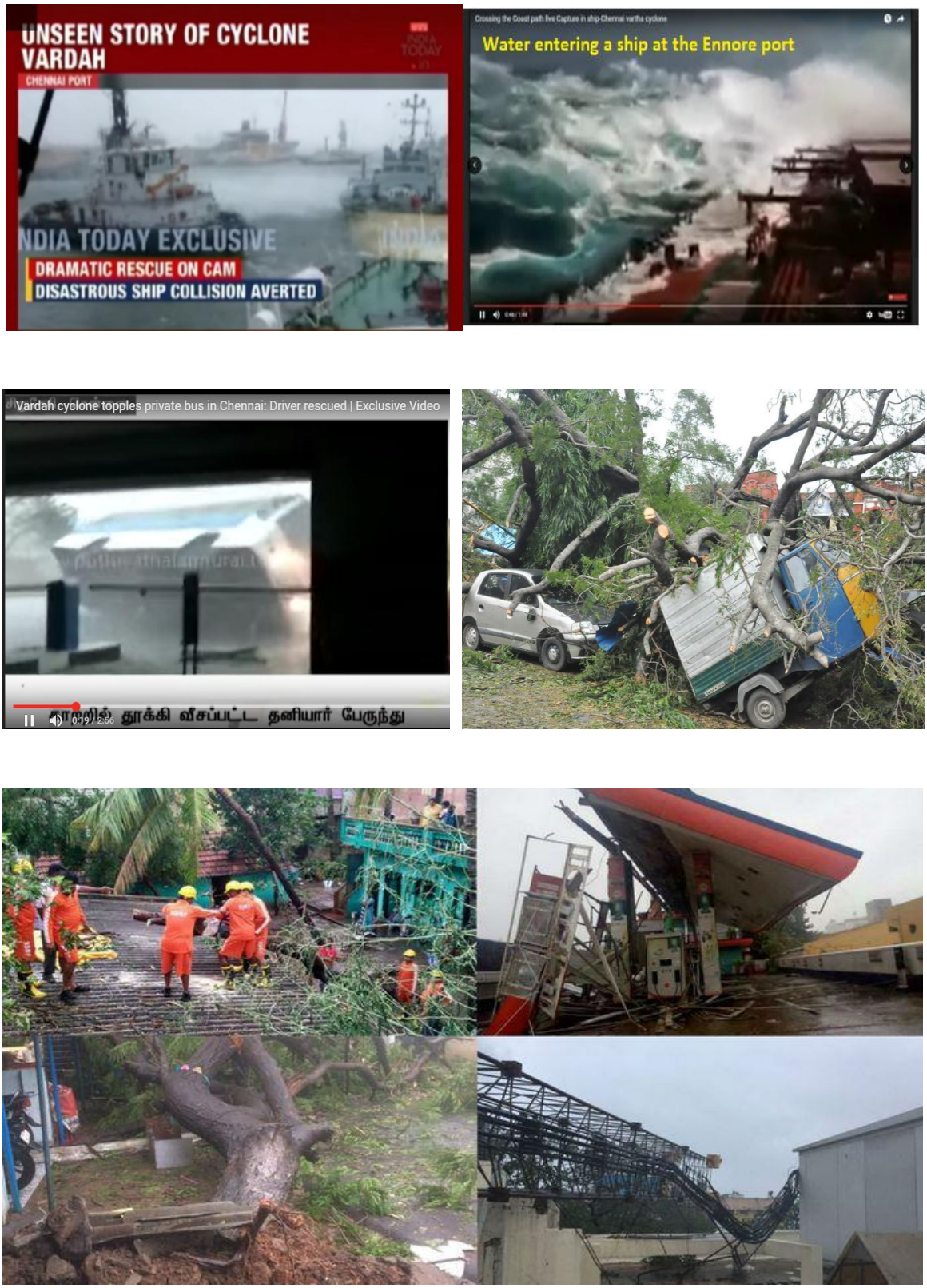
by
B.GEETHA
India Meteorological Department, Chennai

Come cyclone and the India Meteorological Department and other meteorological agencies along with the National and State Disaster Management Authorities and several other Non-Governmental Organizations put in their best round the clock services for early warning and disaster preparedness measures. Roles of meteorological communities in forecasting and warning and the disaster management authorities in minimizing loss of lives and rehabilitation after the disaster strikes are well known and duly acknowledged. Of late, another community – the electronic media, is making a mark in cyclone impact assessment by providing vivid visuals of ground zero truth through their round the clock coverage of the landfall scene from different locations, braving the severe weather conditions. The visuals collected by the media during the landfall of cyclone VARDAH over Chennai on 12th December 2016 provide us a wealth of information about the landfall scene - different kinds of adverse impacts at various locations of landfall area at various instants of time. As such, they also provide evidences to understand the landfall impact characteristics, viz., the length of coastal belt covered by the landfall, various kinds of impacts and the duration of the landfall process itself. Though in general terms, a cyclone landfall is described by 'landfall point' and 'landfall time' which refer to crossing of the cyclone centre from the sea to land, in reality, from the disaster management perspective, it may have wider scope covering the wall cloud region as well where the most intense winds and precipitation are expected and hence may extend beyond the limits of landfall 'point' and 'about an hour' duration. Estimation of actual areal extent and duration of landfall can be supported by the media visuals which provide very fine insight into areal extent of landfall and landfall duration. In the case of VARDAH landfall, the impacts over the 60-odd km stretch between north of Ennore to Tambaram, as caught by the electronic media, provide solid evidence for reiterating the location of landfall region and also give supportive evidence for determination of actual duration of the landfall process itself, which could be over a few hours. Various kinds of impacts caught by the media at different locations would supplement the post-landfall survey conducted by the India Meteorological Department and could also throw light on asymmetry in the wind and precipitation structures during the landfall.

Sample damage scenes collected by the electronic and the print media are shown in Fig.1 and Fig.2 respectively. Web links to some of the visuals caught by the media are given below:

https://www.youtube.com/watch?v=wOMPeD1Hbuo
https://www.youtube.com/watch?v=J-mECcNFGo8
https://www.youtube.com/watch?v=QZZ9Q54IXBI
https://www.youtube.com/watch?v=HuSK9RsSQ2s
https://www.youtube.com/watch?v=mWTjuZ5N1tU
https://www.youtube.com/watch?v=tnh-fnvpN40
https://www.youtube.com/watch?v=Er6Bl4iopEw
https://www.youtube.com/watch?v=3TZi6F1TJyI&index=13&list=PLkxaWlcy2XUHZCWEo3Xwpbg8MSXSGK3D9

Certainly, the emerging role of electronic media in providing crucial visual evidences for understanding the landfall process as well as for assessing the impact due to landfall need to be acknowledged.



http://www.india.com/buzz/cyclone-vardah-photos-and-videos-see-the-raging-cyclone-that-has-caused-havoc-in-south-india-1704531/

Fig.1 Sample damages due to landfall of VSCS VARDAH as caught by the electronic media

12/14/2016

Home States Tamil Nadu

18 people killed due to Cyclone Vardah related incidents in TN

By PTI | Published: 13th December 2016 10:48 PM |
Last Updated: 14th December 2016 12:12 AM | A+ A A- |

Fallen trees in Ambattur as Cyclone Vardah makes landfall. | EPS

CHENNAI: Eighteen people were killed in six districts of Tamil Nadu in rain-related incidents linked to Cyclone Vardah that crossed the coast, as Chief Minister O Panneerselvam held a meeting of top officials today to speed up work to ensure return of normalcy in storm-hit regions.

The government said it is taking all steps to ensure that the jammed mobile phone networks are restored and a meeting of telecom operators and officials was held.

"A total of 18 persons were killed in rain-related incidents linked to Cyclone Vardah," a top Tamil Nadu government official monitoring the situation told PTI.

He said five each were killed in Chennai and Tiruvallur districts. Four persons died in Kancheepuram district, one each in Villupuram and Nagapattinam districts and two in Tiruvannamali district, the officials added.

All these deaths were in the revenue districts.

He said as expected districts like Tiruvannamalai, Vellore and the Western belt of Dharmapuri too witnessed heavy rains that began with the commencement of the cyclone Vardah's landfall.

"Chief Minister Panneerselvam held a meeting of top officials today. Our priority is to restore power supply which has been hit due to fallen trees, clear clogged roads which have fallen trees," the official said.

He said traffic has already been cleared in all arterial roads in all of the affected districts and efforts were now on to clear the roads and restore power in other neighbourhoods.

"TANGEDO (State-run power undertaking) itself has deployed about 4,000 personnel to ensure quick restoration of power supply," he said.

Personnel from multiple government departments including Revenue, Police, Fisheries, Animal Husbandry and other state agencies from Ariyalur, Perambalur, Tiruvallur, Cuddalore, Salem and Thanjavur districts were being deployed to handle the situation in the cyclone-hit regions, he said.

On the number of people now housed in relief centres, he said more than 13,000 people are being sheltered in over 100 centres. All vulnerable areas were identified in advance and teams of officials are on the job, he said.

To a question on clogged mobile phone networks, he said a meeting of telecom officials and operators was being held to address the situation and ensure expeditious return of normalcy.

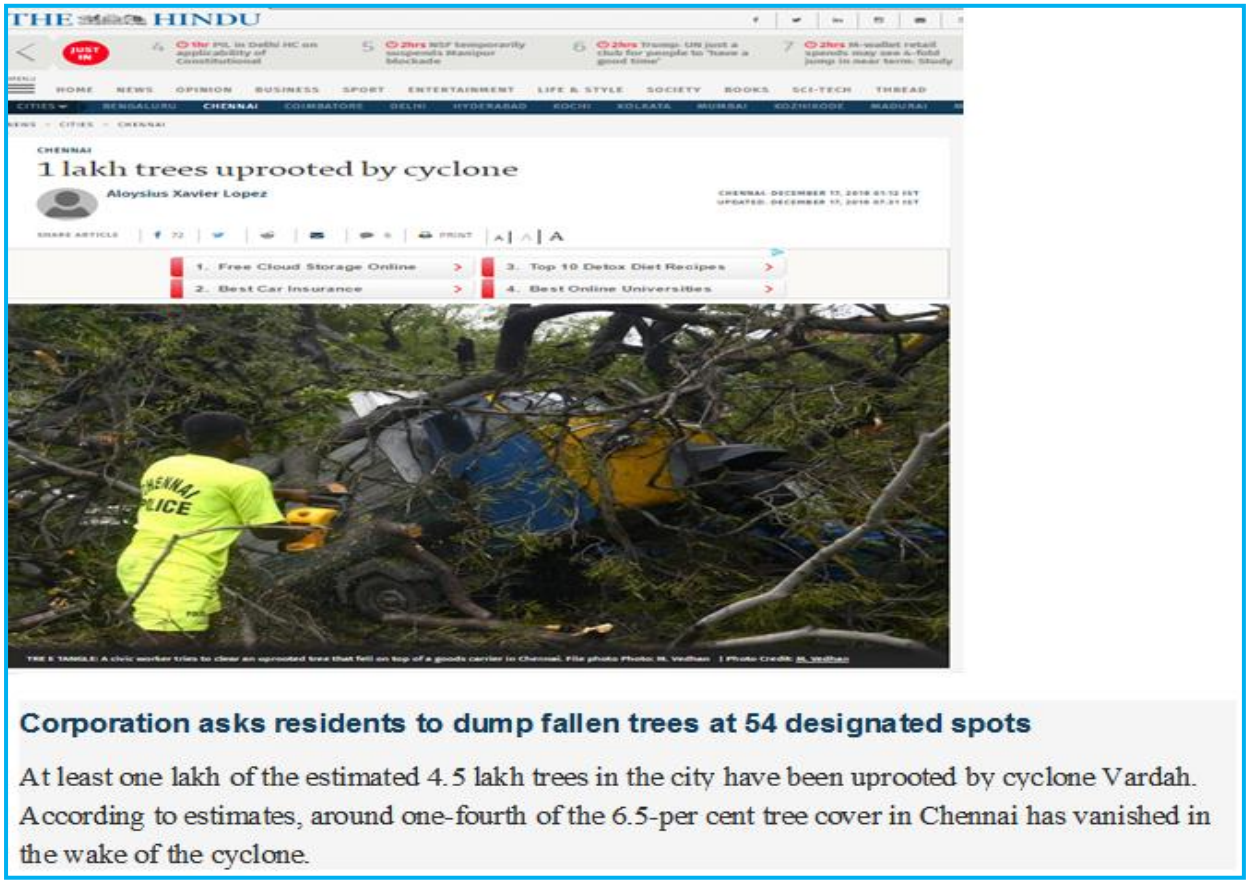
Related Article

- Vardah: Graves in Madras War Cemetery marooned
- Losing steam, Vardah moves to interior TN and Karnataka
- Winged residents lose homes in Chennai
- Home Minister Rajnath reviews relief operations in TN, AP
- Highway mayhem, cashless truckers stranded for over 24 hrs
- Vardah: TN CM seeks Rs 1,000 crore from Centre

TAGS Tamil Nadu death cyclone Vardah

The New Indian Express – 13 Dec 2016

1/1

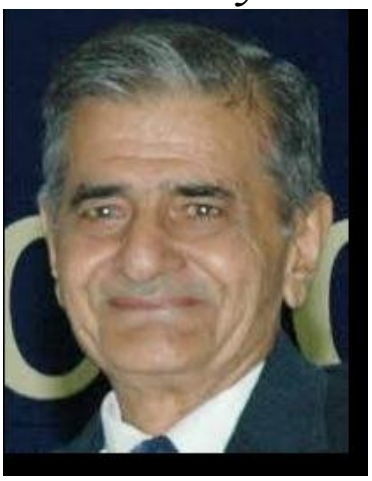


Corporation asks residents to dump fallen trees at 54 designated spots

At least one lakh of the estimated 4.5 lakh trees in the city have been uprooted by cyclone Vardah. According to estimates, around one-fourth of the 6.5-per cent tree cover in Chennai has vanished in the wake of the cyclone.

Fig.2 Sample print media reports on damages due to landfall over VSCS VARDAH

Obituary



Shri DEV RAJ SIKKA, 1932-2017

Born on 1st March 1932 in Jhang Maghiana in Pre-partition India (now in Panjab, Pakistan, Shri Dev Raj Sikka, did his M.Sc. in Physical Chemistry from Agra University with first rank in 1954.

He began his professional career from Indian Meteorological Department (IMD) in 1954. He then joined the Institute of Tropical Meteorology (ITM) in 1964 which was later renamed as Indian Institute of Tropical Meteorology (IITM) and became its Director in 1986. While at IITM, Pune, Shri Sikka was actively engaged in research and development in Monsoon Dynamics, Tropical Meteorology, Prediction of Weather and Climate Variability, Atmospheric Chemistry, Air-Sea Interactions etc. He established strong linkages with scientists and institutions engaged in research and academic activities in Meteorology and allied subjects, both from India and abroad. Shri Sikka has contributed immensely to the growth of meteorology in India in various capacities as highly distinguished research professional. He has been the Chairman of the Monsoon Mission of the Ministry of Earth Sciences. He has also served as the chairman of CSIR committee on Climate Change, Co-Chairman of DST"s Expert committee on Climate Change; and Chairperson of the Research and Advisory Council of the National Centre for Medium Range Weather Forecasting (NCMRWF). Shri Sikka has been a member of International Advisory Panel (IAP) of the Ministry of Earth Sciences. He has published about 200 research papers on different aspects of Meteorology in peer reviewed journals and reports of international repute.

He is a fellow of the Indian Academy of Sciences and the Indian Meteorological Society. He was awarded Sir Gilbert Walker Award for the year 2010 by Indian Meteorological Society. He was also awarded by the Ministry of Earth Sciences the "National Award for Excellence in Atmospheric Sciences & Technology". In recognition of his outstanding contribution to the education – the academic programmes implemented by him at IITM and improved collaboration with the Indian Universities, his research work in Meteorology, especially in Tropical Meteorology, his contribution towards advancement of Monsoon Meteorology and Atmospheric Sciences & Services in India, the Indian Meteorological Society conferred upon Shri Dev Raj Sikka – the Life Time Achievement Award of the Indian Meteorological Society on 20th February 2017.

Meteorological Community has lost an inspiring in the death of Shri Sikka. He Sikka inspired and encouraged young meteorologists throughout his professional career spanning over six decades and his work will continue to inspire future generations.

Shri Sikka passed away on 18th March 2017 at New Delhi. He is survived by two daughters Poonam and Pammi.

Indian Meteorological Society pays it respectful homage to Shri Sikka.

INDIAN METEOROLOGICAL SOCIETY
CHENNAI CHAPTER

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