



How the Rain Falls ?

All life on earth depends on rainfall for their fresh water needs. In India, we know the consequences of delayed or reduced monsoon. A few decades back, that would have led to famine and death at least in some parts of the country. Heavy rainfall also leads to major problems, like floods and landslides, that cause huge losses of life and property. Thus, rainfall is a phenomenon that influences our lives very strongly. Rainfall is also an important process as far as the atmosphere is concerned, since it contributes to the transfer of energy between the surface and upper layers of the atmosphere. Water absorbs heat in the form of latent heat during evaporation and releases the heat at a higher altitude during condensation. It is becoming important to study this process in the context of global warming.



The Science Quiz Trophy being given away by Dr. E.P. Yesodharan, the Executive Vice-President of the KSCSTE during the Science Day 2007 celebrations in the presence of Dr. M. Baba, Director, CESS (Report on page 4)

**Dr. E.P YESODHARAN:
NEW EXECUTIVE VICE-
PRESIDENT OF KSCSTE**

Dr.E.P.Yesodharan assumed charge as the Executive Vice-President of the Kerala State Council for Science, Technology and Environment (KSCSTE).



Dr.Yesodharan was the Chief Inspector of the UN Organization for Prohibition of Chemical Weapons, based in The Hague, for about a decade. He had also served as advisor to the Government of India on chemical weapons and Deputy Head of the UN Special Commission on Iraq for inspection of chemical warfare facilities.

Why study rainfall properties?

Rainfall is commonly measured using a manual rain gauge that gives the total amount of rain over the duration between two consecutive measurements. This gives us no indication of how the rain has fallen: a 20 mm rain that falls in 20 minutes is very different from the same amount of rain falling in one day. Heavy, or high intensity, rainfall leads to more runoff. That is, most of the water flows over the surface into rivers or streams and causes greater soil erosion and possibly, floods. But, the water from light rainfall percolates into the soil and replenishes ground water. Landslides are usually related to heavy rainfall. Moreover, heavy rainfall usually contains large drops which help to breakup soil agglomerates and aggravate soil erosion. Thus, it is important to understand how rainfall is distributed in terms of intensity and drop sizes. There are other reasons for studying how the raindrop sizes are distributed. One of them being that much of our communication depends on microwave links.

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ICZM Training Course for Coastal Zone Management Authorities

CESS conducted a short-term training course during 20-24 February 2007, on Integrated Coastal Zone Management (ICZM) for the members of the Coastal Zone Management Authorities belonging to Gujarat, Maharashtra, Goa, Daman, Diu, Karnataka, Kerala and Lakshadweep islands. Sixteen participants were given intensive training in this course, which was approved by the Ministry of Environment and Forests, Government of India. CESS is the nodal institution in Kerala dealing with Coastal Zone Management (CZM) issues, including training and capacity building of officials and local communities.

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From the Director's Desk



Earth is one of the most beautiful and resourcerich planets in the whole universe as per the information available to man. The bounties of the earth are so rich and diverse that it is sufficient for all the 'needs' of man. Even our scriptures have underlined the interdependence of man and other living/non-living things on earth. However, we may recall at this point that these resources are definitely not sufficient to meet our 'greed'. Hence, there is a limit upto which man can exploit the nature. Though the self-assigned limits are different for different stakeholders, no definite demarcation could be made without a proper understanding of the earth and its resources. It is here that the importance of earth sciences comes into play. An improper understanding of the earth system leads to degradation and even extinction of the resources in many parts of the world. The over consumption on one side and poverty on the other, play an important role in this process. The over consumption of all the resources by rich nations deprive the poor in many parts of the world. This leads to marginalization of the poor, exposing them even to other types of disasters. It is said that poverty, as well, is a likely cause. This vicious circle of poverty, hazards and vulnerability leads to further poverty. Here again, the proper understanding of the resources and its equitable distribution can be ensured to a great extent by improving earth sciences knowledge. Similarly, in the case of natural hazards management, an understanding of the earth's natural systems is very important. This is essential not only to adopt necessary prevention and mitigation measures, but also to reduce the cost of interventions. Thus, the knowledge of earth sciences helps in reducing human suffering and economic loss during natural disasters.

Dr. M. Baba

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Microwave is absorbed by water (a property used in microwave ovens) and also scattered by water drops. Thus, if there is heavy rainfall in the path of a microwave link, the transmitted signal can get attenuated, and if the rainfall is sufficiently heavy, the intensity at the receiving end could be too low for clear reception. Therefore, when we design a microwave link, it would be useful to know the properties of rainfall in that region so that one can design the link that overcomes the losses due to rainfall. Another reason for studying the properties of rainfall is to calculate rainfall intensities from data obtained from meteorological radars. These radars make it possible to obtain information about rainfall over a large area, as opposed to rain gauges that measure the rainfall only at one spot.

Measurements at CESS

The measurement of rain drop size distribution was started at CESS about five years ago. The instrument used is called disdrometer, which stands for distribution of drop size meter. This is an instrument that converts the momentum of rain drops into electrical signals, separates them into different classes depending on magnitude, and counts the number in each class. The counts are sent to a computer, where a software collects the data. The computer calculates the drop size distribution and certain additional values from the data, and stores them along with date and time. Drop size distribution is defined as the number of



Fig.1 Disdrometer

drops in each size class per cubic metre of air per millimetre interval of drop diameter. The additional parameters that the instrument gives include rainfall rate (or intensity), total rainfall and radar reflectivity.

The instrument being used at CESS (Fig. 1) was procured from M/

Distromet Ltd., Switzerland and it measures the number of drops in twenty size classes from 0.3 mm to 5.3 mm.

We have made measurements at three locations in the state, namely at Thiruvananthapuram, Kochi and Munnar and Sriharikota. Measurements have been made during both south-west and north-east monsoon seasons and during pre-monsoon months. We found that the number of drops of small diameters is usually less. The number then increases as the diameter increases and reaches a maximum, and then decreases.

We studied how the drop size distribution varies with rainfall intensity. When the rainfall intensity is low, there are only small drops and the range of drop diameter is also small. For higher intensities, the range becomes larger and there are greater number of larger drops. A typical graph that shows the distribution for different rainfall intensities is given in Fig. 2. These measurements were taken at Thiruvananthapuram during the month of June 2005. Notice, how the distribution changes when the rainfall intensity increases. When the rainfall intensity increases, we also find that the diameter at which the number of drops is maximum - that is, the peak of the distribution, or mode - also increases. This indicates that the presence of larger drops and the average drop size increase rapidly with increasing intensity.

The distribution of drops is not always as described (Fig. 2). On rare occasions, we find that the number of small drops is very large and this number decreases with increasing rainfall intensity.

Rainfall intensity characteristics

It is interesting to see how the rainfall intensity is distributed at different places. If we look at the intensity distribution with time, we find that rainfall is below 5 mm/hr, most of the time, in all the four places. At Thiruvananthapuram and Kochi, the rainfall intensity is above 75% most of the time and above 90% in some months. In Munnar, the intensity is below 5 mm/hr in more than 90% of the time, during the four months of measurements. Interestingly, rainfall intensities greater than 100 mm/hr are observed every month at Thiruvananthapuram and Kochi, whereas similar intensities were seen in Munnar, only once in four months. In July 2002, we found that rainfall intensity was < 5 mm/hr for more than 95% of the time in Kochi, which

was a month of serious deficiency in rainfall.

Another way to look at intensity distribution was to observe the amount of rain water each intensity range provides. Interestingly, we see a very different picture from what we saw earlier. In general, the contribution to total rainfall is higher for lower intensity, but no single intensity dominates

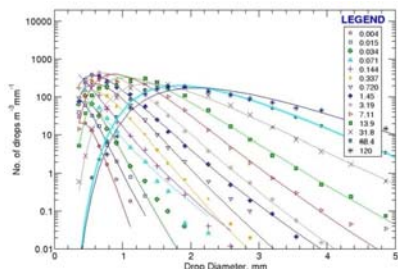


Fig.2 Rain drop size distribution for different rainfall intensities as shown in the legend

the rainfall. The maximum contribution to total rainfall from any intensity range is less than 20% during the southwest monsoon in Thiruvananthapuram and Kochi. In Munnar, however, the contribution from the lowest intensity range of 0-5 mm/hr was generally around 40% and could go up to 60% in some months. What we find here is that the rainfall in Munnar is of low intensity, most of the time. Nevertheless, this contributes to a good chunk of the total rain water. Interestingly, the rainfall in July 2002 at Kochi showed almost a similar behaviour, with about 35% of the water coming from rainfall of intensity below 5 mm/hr. It is known that high intensity rainfall is produced by a kind of cloud formation that grows tall, known as cumuliform (cumulus-like) clouds. Our results indicate that the deficiency in rainfall in July 2002 was probably due to the lack of cumuliform clouds.

Training cum field workshop on 'Geo-information for Landslide Hazard and Risk Assessment'

CESS along with the Institute of Land Management (ILM) have hosted a Training cum Field Workshop on 'Geo-information for Landslide Hazard and Risk Assessment' during Jan. 15-27, 2007. The programme was organized by the United Nations University-International Institute for Geo-information

Science and Earth Observation (UNU-ITC) School for Disaster Geo-information Management, Enschede, the Netherlands and Geological Survey of India Training Institute (GSI TI), Hyderabad. Prof. Dr. V.G. Jetten, Dr. C.J. Van Westen and Dr. Santiago Begueria from UNU-ITC, Mr. G. Sankar and John Mathai from CESS and Dr. P. K. Thampi (retired scientist from CESS) along with scientists from GSI conducted the lectures and gave hands on training to the participants of the workshop. The target group for the workshop was Geologists, Physical Geographers and Environmental scientists working on landslides from various research institutions in India. 20 participants drawn from organizations such as NHPC, GSI, CESS, Universities such as Kerala Agricultural University, MG University, Jiwaji University, and colleges such as Chirst College, Irinjalakuda, Thyagaraja College of Engg, Madurai, participated. The field session was conducted in the Munnar area where a number of landslide incidents have occurred during the monsoon season of 2005. The participants also visited the famous Idukki arch dam during this trip. The course enabled the participants to understand the process of landslides in a holistic manner and the skills acquired would be useful to reduce revenue losses to various state governments in the long run.

G.Sankar, Scientist E II



Participants of the Training cum Field Workshop at CESS Trivandrum

CESS WINS ESRI NATIONAL QUIZ

The team from the Geomatics Laboratory of CESS has won ESRI technical quiz on GIS, conducted during the ESRI Users' Meet held on 18 January 2007. The team led by Sri. B.K.Jayaprasad won the competition pushing back formidable teams from the National Informatics Centre (NIC), New Delhi and the Regional Remote Sensing Centre (RRSC), Delhi.

CONSULTANCY PROJECTS COMPLETED

CRZ status reports for sites at Mararikulam north, Alappuzha; Murud, Maharashtra; Thekkumbhagam, Kollam; Sasthamkari, Panavalli, Alappuzha and Adichanalloor, Kollam and for the gelatine development plant at Cuddalore, Tamilnadu were prepared and submitted.

EXHIBITIONS

CESS participated in the exhibition organized as part of the 19th Kerala Science Congress at Kannur from January 29-31, 2007 and in the exhibition organized by the Revenue Department of the Government of Kerala in connection with the one day seminar cum exhibition on 'Natural Disasters and their Mitigation Measures' at KKTM College, Kodungallur on February 11, 2007.

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ICZM Training

During the workshop the following lectures were delivered:

Dr.Srikumar Chattopadhyay on 'Geomorphology for coastal zone management', Dr.R.Ajaykumar Varma on 'Carrying capacity based development planning for coastal areas with special reference to Thinnakkara Island', Dr.M.Baba on 'ICZM and CRZ on a National/State level perspective', Dr.C.N.Mohanan on 'Coastal ecosystems', Dr. N.P.Kurian on 'Shoreline changes', Dr. K.K.Ramachandran on 'Mapping principles & GPS', Sri. B.K. Jayaprasad on 'Application of GIS in CZM', Dr.Samsuddin on 'Remote Sensing Applications', and Dr.K.V.Thomas on 'CRZ Notification & demarcation of HTL and implementation mechanisms in CRZ'.



A view of the Training programme on Integrated Coastal Zone Management (ICZM) conducted at CESS

BOOKLET ON EARTHQUAKE

A Malayalam booklet on earthquakes entitled *Bhoochalanam-Ariyenda Karyangal* authored by Dr. C.P. Rajendran, Dr. Kusala Rajendran and S. Sidharthan was published by CESS for the general public of Kerala State. This short publication is aimed to clear the doubts of the common man on various aspects of tremors. The booklet was officially released by the Hon'ble Minister for Revenue Sri. K.P. Rajendran at a function organised at Wadakkanchery in Trissur district on January 7, 2007. Copies of this publication can be obtained free from the Director, Centre for Earth Science Studies, Akkulam, Thiruvananthapuram, on request.



PUBLICATIONS

Rajendran CP, Kusala Rajendran, Terry Machado, Satyamurthy T, Aravazhi P and Manoj Jaiswal (2006): Evidence of Ancient Sea Surges at the Mamallapuram Coast of India and Implications for Previous Indian Ocean Tsunami Events, *Current Science*, Vol. 91, No. 9. pp. 1242-1246

Sukumar B, Ahalya Sukumar and Devavrathan S (2006): Delineation of drought prone areas in Palakkad district, Kerala using satellite imagery, *The Indian Cartographer*, Vol.25, pp. 175-178.

Ahalya Sukumar, Sukumar B, Devavrathan S (2006): Spatial distribution of sex-ratio and occupational structure of female population of Kerala, *The Indian Cartographer*, Vol.25, pp.273-275.

Devavrathan S, Sukumar B, Ahalya Sukumar and Shrivankumar V (2006): Regional variations of development in Thiruvananthapuram district, *The Indian Cartographer*, Vol.25, pp.285-289.

NOMINATIONS

Dr.M.Baba as member of the Standing Committee on Ocean Resources & Meteorology (SC-OM), constituted by the Department of Space, ISRO, Government of India

Dr. K.V. Thomas as member of the Expert Committee to study the Prevention of sea erosion at Poonthura by Water Resources Department, Govt. of Kerala
Dr. K.V.Thomas as member of the State Level Committee to provide support in the preparation of Integrated Coastal Area Development Project by Fisheries and Port Department, Govt. of Kerala
Dr. K.V. Thomas as member of the Lakshadweep Coastal Zone Management Authority by Ministry of Environment & Forests, Govt. of India .

Mr..S.Sidharthan as member of the Working Group II on Urban Earthquake Vulnerability Reduction Program of Thiruvananthapuram Development Authority.

Dr.K.Soman as Chairman, Working Group on 'Coastal marine and wetland ecosystem' under the Plan Committee-Fisheries, Environment and Ecosystem, December 2006.

TRAINING

Shri. S.Sidharthan has successfully completed web based certification course on National Disaster Risk Management, Training of Trainers conducted by the World Bank Institute, Washington during March-April 2007.

INVITED LECTURES

Dr.M.Baba delivered the Prof. T.C. Madhava Panicker Endowment-cum-Valedictory Lecture in the National Seminar on 'Geoscience for Disaster Management' at the Department of Geology, Government College, Kasaragod, on March 24, 2007.

Dr.Srikumar Chattopadhyay and Dr. Mahamaya Chattopadhyay delivered lectures as resource persons in DST sponsored training programme on 'Modelling in Resource Management and Environment through Geomatics' at Jaipur during December, 2006.

Dr. N.P. Kurian gave an invited talk on 'Coastal process of South West coast of India', on March 16, 2007 in the National workshop on Emerging Trends in Ocean Science & Technology.

SEMINAR/CONFERENCE/WORKSHOP

Dr.Kurian attended NDMA workshop on storm surge, flood and drought during February 1-2, 2007 and made a presentation on CESS activities in the field.

Dr. Srikumar Chattopadhyay delivered a lecture on 'Sustainable Development - Role of Educational institution' at Govt. College of Teacher Education, Trivandrum, as a part of National Conference on Environmental Education, on March 17, 2007.

NATIONAL SCIENCE DAY 2007

National Science Day, 2007 was observed in CESS on 28th February. Talks were conducted for Post Graduate students in Geology and Geography on Geomatics, Applications of GIS and Coastal hazards. Students and teachers interacted with scientists in Remote Sensing and Geographical Information Systems during their visit to the laboratories.