CSSTEAP Newsletter

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Utilization of New Satellite data for Meso-scale Weather Systems MODIS onboard TERRA/AQUA

Three dimensional meteorological data are needed to nowcast and forecast weather systems. Soundings of the atmosphere by balloon-borne radiosonde are available on a limited temporal and spatial scale over land areas but are practically absent over vast ocean areas. However with the advent of satellite sounding, data of better spatial and temporal resolution can be obtained. Satellite sounding data were available from Polar orbiting satellite like NOAA from 1975 onwards. With launch of GOES 8/9 the the sounding data were available from Geostationary platforms. However the spatial resolution of the sounding data were limited to 16-40 Km.

MODIS (Moderate resolution imaging spectro radiometer) sensor on board TERRA and AQUA Satellites can give the Temperature and Humidity profile with 1 Km resolution . This can give an insight into the Thermodynamic Structure of the meso scale system , something which was not possible with the earlier satellite data. However the temporal resolution is only about ~6 hours when compared to less than an hour from geostionary platforms.

MODIS , a passive imaging spectro-radiometer , is the key instrument on onboard Terra (EOS AM) and Aqua (EOS PM) satellites launched in 1999 and 2002 respectively. MODIS scans a swath width of 2330 km that is sufficiently wide to provide nearly complete coverage every two days from polar-orbiting, sun-synchronous, platform at an altitude of 705 km.

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NEW CHAIRMAN OF CSSTEAP GOVERNING BOARD

Mr G Madhavan Nair, Distinguished Scientist, Member, Space Commission and Director, Vikram Sarabhai Space Centre (VSSC) Thiruvananthapuram, has taken over as Secretary, Department of Space and Chairman, Space Commission and Chairman, Indian Space Research Organisation (ISRO).

Shri G Madhavan Nair is a leading technologist in the field of Rocket Systems and has made significant contributions to the development of multistage Satellite Launch Vehicles for the National Space Programme. Shri Madhavan Nair has worked at various positions posting illustrious milestones on the way. Impressed with his numerous contributions to the first Indian launcher SLV-3, he was tasked with the responsibility of developing the PSLV. During his Directorship of the Liquid Propulsion Systems Centre from 1995-99, the Indian efforts towards indigenous development of cryogenic technology took concrete shape and vital infrastructures were built. Shri Madhavan Nair has been showered with many prestigious awards. The prestigious "Padma Bhushan" awarded to Shri Madhavan Nair in 1998 is a attribute to his technological excellence and leadership

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MODIS provides images in 36 discrete spectral bands (visible , near and thermal infra red) between 0.415 and 14.235 μm with spatial resolutions of 250m (two bands), 500 m (five bands), and 1000m (29bands). It provides a comprehensive series of the earth, land, oceans and atmospheric parameters in the VIS and IR regions of the Spectrum. MODIS Temperature and Water Vapor Profile Product consists of 30 gridded parameters related to atmospheric stability, atmospheric temperature and moisture profiles, total atmospheric water vapor, and total ozone. All of these parameters are produced for both daytime and nighttime conditions at 5-km pixel resolution when at least 9 FOVs are cloud free.

Due to the importance of meso-scale system, national and international efforts have been made for special studies of meso-scale system in limited region for limited period of time. The knowledge gained through these experiments is used for understanding, analysis and weather forecasting throughout the world. Some of the experiments are:

The atmospheric profile product data from MODIS sensor on board Terra and Aqua Satellites was used to study the meso scale processes embedded in the large scale atmospheric systems ,in the South East Arabian Sea . This satellite data was processed for validation of Temperature and Humidity profiles with concurrent ARMEX Radiosonde data (Fig-1). It was found that

Fig1: Comparison of Temperature profiles from MODIS and ARMEX Data
Modis (28 July02 0525h) 15.35N , 72.13E
RS (28 July02 0008h) 15.38N, 72.18 E

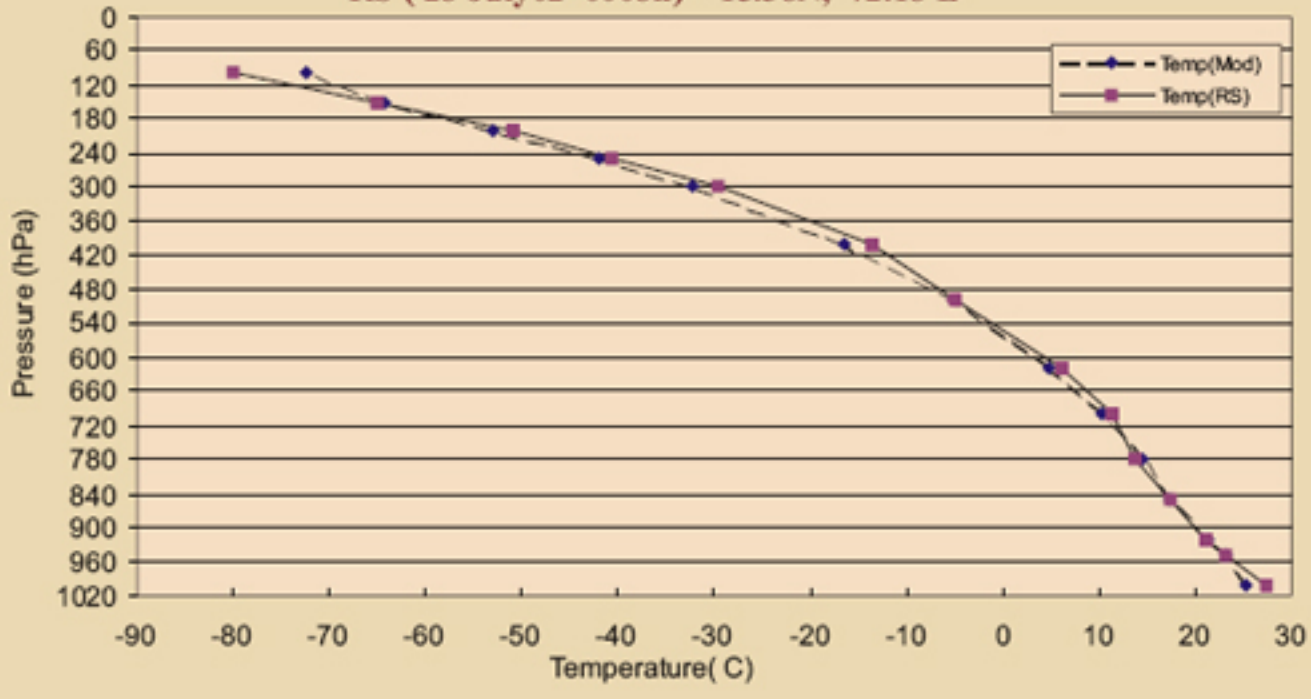
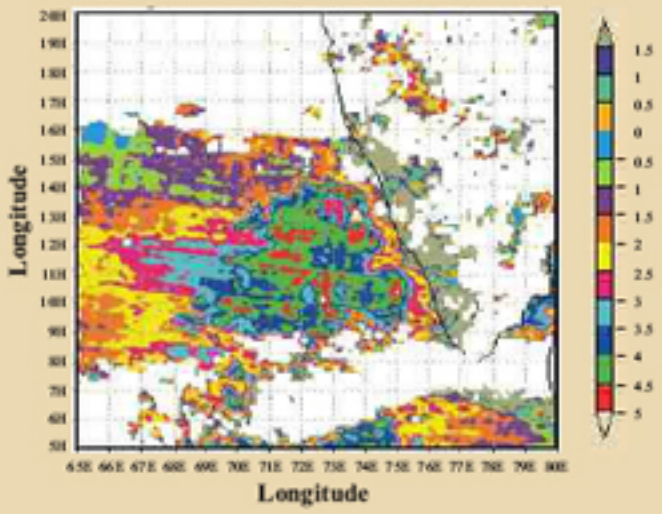


Fig2: Stability Index (lifted index) over South East Arabian Sea on 26 July 2002 at 0540 Hrs.



the RMS error of Temperature below 500 hPa was in the range 1-2.5 K which is very encouraging considering the level 2 product grid is of 5 KM resolution . In the case of Dew Point Temperature the RMS error upto 780 hPa was in the range of 1.5-3.5 K . The results obtained for specific humidity profiles were most encouraging as the RMS error was less than 2g/ kg even in the lower levels . These have wide implications for meso scale models as the level 1 data is available at a grid of 1km. Similarly the comparisons of stability index (Total totals index) showed encouraging results .

The maps of various parameters and Stability Indices (Fig-2) were able to reveal the convective regions in the South East Arabian Sea The values of lifted index (LI) in the region are in the range 4.0 to -4.5. More the negative value of Lifted index, more is the instability in the atmosphere. By evening the lifted index lies in the range of 2.0 to 2.5. This pattern is indicative of the small scale or convective development and subsequent dissipation by evening hours. The MODIS data can give an insight into the thermodynamic structure of the meso scale systems , something which was not possible with the earlier satellite data .

B Simon and P.C Joshi
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Space Application Centre,

Training Workshop (RAII) on Satellite Remote Sensing & GIS Applications in Agricultural Meteorology

A Training Workshop (RA II) on "Satellite Remote Sensing & GIS Applications in Agricultural Meteorology" was organized during 7 11 July, 2003 at Indian Institute of Remote Sensing (IIRS), Dehradun. This workshop was jointly organized by World Meteorological Organization (WMO), Indian Meteorological Department (IMD), Centre for Space Science & Technology Education in Asia and the Pacific (CSSTEAP), Indian Institute of Remote Sensing (IIRS), National Remote Sensing Agency (NRSA) and Space Applications Centre (SAC).

This training workshop is organized in response to the recommendations of World Meteorological Organization (WMO) - Commission for Agricultural Meteorology (CAgM) session in Ljublijana, Slovenia in 2002. The objective of this training workshop is to make the participants (Meteorologists from Asian countries) familiar with technology and applications of Satellite Remote Sensing and GIS in Agricultural Meteorology.

The workshop has been attended by 16 participants from 13 countries, namely Bangladesh, China, Kazakhstan, Laos, Maldives, Mongolia, Nepal, Saudi Arabia, Sri Lanka, Tajakistan, Thailand, India and UAE.

Remotely sensed data and automatic weather station (AWS) systems provide, in many ways, an enhanced and very feasible alternative to manual observation with a very short time delay between data collection and transmission. Due to the availability of new tools, such as Geographic Information Systems (GIS), management of an incredible quantity of data, such as traditional digital maps, database, models, etc., is now possible. The advantages are manifold and highly important, especially for the fast cross-sector interactions and the production of synthetic and lucid information for decision makers. Remote sensing provides the most important informative contribution to GIS, which furnishes basic informative layers in optimal time and space resolutions.

Lectures as well as practical demonstration on various topics were delivered during the training workshop. They are :

- Principles of Remote Sensing
- Earth Resource Satellites
- Meteorological Satellites
- Digital Image Processing
- Fundamentals of GIS & GPS
- Spatial Data Analysis
- Retrieval of Agro-meteorological Parameters using Satellite Remote Sensing Data (Surface Albedo, Evapotranspiration, fraction PAR etc.)
- Retrieval of Agro-meteorological Parameters from Satellites (Rainfall, Solar Radiation)
- Remote Sensing & GIS Application in Agro-ecological Zoning
- Crop Growth Modelling and Applications in Agricultural Meteorology
- Crop Growth & Productivity Monitoring and Simulation using RS & GIS
- Drought & Floods Assessment and Monitoring using RS & GIS
- Water & Wind Induced Soil Erosion Assessment & Monitoring using RS & GIS
- Satellite Based Weather Forecasting
- Satellite-based Agro-advisory Service
- Desert Locust Monitoring System RS & GIS based Approach
- Forest Fire and Degradation Assessment using RS & GIS

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In addition to several lectures delivered by experienced faculty of IIRS, number of guest speakers from several organizations viz. WMO, Geneva; SAC, Ahmedabad; NRSA and APAU, Hyderabad; IMD, Delhi and Pune and RRSSC, Jodhpur delivered the lectures on the specialized topics on the theme of training workshop.

The workshop was formally inaugurated on July 5, 2003 though opening lecture by Dr. M.V.K. Sivakumar, Chief Agricultural Meteorology Division, WMO, Geneva. The workshop ended on July 11, 2003 with a Valedictory function. Shri Anil Sinha, Executive Director, National Centre of

Fourth Post Graduate Course on Satellite Communications at Space Applications Centre ISRO, Ahmedabad.

Fourth SATCOM course of CSSTEAP, commenced on the August 1, 2003 at the New SAC Campus, Bopal, of Space Applications Centre (SAC), Ahmedabad. The participants were welcomed by Dr. K.N. Shankara, Director, SAC and Mr. B.S. Bhatia, Director, DECU and the Faculty Members of the SATCOM-4 course. The course was inaugurated on August 8, 2003 by Padmashri. K. Narayana, Director, Satish Dhawan Space Centre, Shri Hari Kota. Shri K. Narayana in his inaugural address gave a presentation on launch vehicles used for satellite communication satellites. Dr. K.N Shankara Director SAC welcomed the Chief Guest and Dr. Karl Harmsen, Director CSSTEAP gave a brief introduction of CSSTEAP, its activities and its achievements. Mr. S.K. Sharma, Controller SAC and Programme coordinator, CSSTEAP gave a brief about the facilities and the arrangements at the New SAC Campus, Bopal. Mr. R.K. Gupta, Course Director gave the details of the course.

The orientation course for the participants (Module #0) was conducted from August 4 - 8, 2003 where participants were given a brief introduction on the geography, social customs, and the festivals of India. The participants were also introduced to some commonly spoke Hindi words and their usage.

Module-01 on Communication Systems was conducted from August 11 - 22, 2003 the module covered various aspects on General communication techniques, Information theory and Data communications including the introduction to computers. The lectures were delivered by eminent

Inaugural function of the course

faculty, working in the field, from industries and universities.

Module-02 on Satellite communication has been continuing after starting on August 25, 2003. The lectures were delivered by Padmashri P. P. Kale, Ex-director, SAC/VSSC, ISRO on basic satellite communication including launch vehicles and orbits etc. The lecture on Satellite Payload Systems where delivered by faculty drawn form Space Application Centre. Further Prof. G.N.S Raju (CSSTEAP coordinator form Andhra university) delivered lecture on EMI/EMC related issues and standards.

The first technical study time of participants started from 12th September, to ISRO satellite centre, ISRO, Bangalore, Master Control Facility, ISRO, Hassan ISRO Tracking Station (ISTRAC), Bangalore. Mr.Abdul Nazir Sab State Institute of Development, Mysore etc. The Lectures on Satellite sub-systems have been arranged in ISAC, Bangalore where all the design & developments of sub systems are carried out.

The participants will also be taken to places of historical importance, museums etc. during the tour.

International Short Course on Geoinformatics for Biodiversity Assessment

Biodiversity characterization deals with identifying biologically rich areas and their disturbance levels for conservation prioritization for long term planning and sustainable management at a higher level than that of a species. Developing nations in the Asia and the Pacific have to strike balance between the development and conservation of their bioresources. It is in this context an International Short Course on 'Geoinformatics for Biodiversity Assessment' was organized from 18th August to 12th September 2003 at Indian Institute of Remote Sensing (NRSA), Dehradun for Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP). The objectives of the course were to apprise the forest managers, researchers, stakeholders etc. about the new technological advancements. Twenty one participants from 12 nations (Azerbaijan-1, Bangladesh-2, Cambodia-2, Iran-2, Mongolia-1, Myanmar-1, Maldives-1, Nepal-

Course Inauguration by Sri. J. K. Rawat, Director, Forest Survey of India

Group photo of the participants during the valedictory function

1, SriLanka-1 Uzbekistan-1, Vietnam-2, India-6) participated The course was supported financially by UNESCAP (6 participants), under TCS plan, Ministry of Finance, Government of India (5 participants) and 10 participants were supported by CSSTEAP.

The course was inaugurated by Dr. J.K. Rawat, Director, Forest Survey of India on 18th August 2003. The course was designed to give an overview to the participants with newer techniques and concept in the field of geoinformatics and forest management for biodiversity conservation. Lecture on 31 topics related to theme spreading to 47 lecture hours were delivered. First week was devoted to the lectures on Remote Sensing, Photogrammetry and GPS. The topics covered dealt with the basics of remote sensing concepts, technologies and advance topics like Digital Photogrammetry, Terrain characteristics, Ortho images and global positioning systems (GPS). The second week was devoted to GIS. Since GIS is an emerging science therefore participants were given idea about the Internet GIS, database management, decision support systems etc. with practical exercises.

The last two weeks covered the topics on natural ecosystems and issues related to biodiversity conservation. Sufficient discussion was held on mapping using various satellite data sets and scales, viz. ecosystem, habitat and biome levels. Sufficient time also spend to discuss the causative factors like, deforestation, forest degradation, fire, possible climate change etc. and their impact on biodiversity. Modern conservation management is focusing on the larger landscape. Ecological principles were discussed in details and emphasis to conserve the large landscape was stressed. Impact of human dimension on biodiversity and other factors like fragmentation, porosity, patchiness, interspersion, juxtaposition etc. were dealt in great details. Case studies were presented dealing with different ecological conditions from dry deciduous to temperate forests. The concept

of biodiversity characterization was introduced to the participants and parameters like landscape characteristics and ground knowledge and their integration were also discussed. Database organization and sharing is one of the major problems in the developing countries. The participants were exposed to the concept of Biodiversity Information System, which included web-enabled GIS. The practical exercises were designed as per the lecture topics. Demonstrations of case studies were also given. Subject experts were also invited from outside.

Two volumes of lecture note volume and CD covering the overall theme of the course were brought and distributed to the participants. The course ended with a valedictory function on September 12, 2003. Padmashri Dr. A.N Purohit, was the Chief Guest.

Background of CSSTEAP

In response to the UN General Assembly Resolution (45/72 of 11th December, 1990) endorsing the recommendations of UNISPACE-82 the United Nations Office for Outer Space Affairs (UN-OOSA) prepared a project document (A/AC.105/534) envisaging the establishment of Centres for Space Science & Technology Education in the developing countries. The Objective of the Centres is to enhance the capablities of the member states indifferent areas of space science and technoloy that could advance their social and economic development. The first of such centres, named as Centre for Space Science & Technology Education in Asia & the Pacific (CSSTEAP) was established in India in November 1995. Government of India has made available appropriate facilities and expertise to the Centre through the Indian Institute of Remote Sensing (IIRS) Dehradun, Space Applications Centre (SAC) & Physical Research Laboratory (PRL) Ahmedabad. The Centre is an education and training institution that is capable of high attainments in the development and transfer of knowledge in the fields of space science & technology. The emphasis of the Centre is on in-depth education, training and application programmes, linkage to global programmes / databases; execution of pilot projects, continuing education and awareness and appraisal programmes. The Centre offers Post Graduate level and short courses in the fields of (a) Remote Sensing and Geographic Information Systems, (b) Satellite Communications and GPS, (c) Satellite Meteorology and Global Climate, (d) Space and Atmospheric Sciences. A set of standard curricula developed by the United Nations is adapted for the educational programmes.

The Centre is affiliated to the United Nations and its education programmes are recognised by Andhra University, Visakhapatnam, India for awarding M.Tech degree. (after completing of 1 year project).

Ongoing Course

Fourth 9 month Post Graduate Course in Satellite communications at SAC, Ahmedabad from August 1, 2003

Forthcoming Course

Eight 9 month Post Graduate course in Remote Sensing & GIS at IIRS, Dehradun from October 1, 2003

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CSSTEAP welcomes the view and options of the readers of newsletter. Short Communications on space science and technology education which may be relevant to Asia Pacific Region are also welcome. Views expressed in the articles of the newsletter are those of the author

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