



# CSSTEAP Newsletter

Quarterly Newsletter of Centre for Space Science and Technology Education in Asia and the Pacific (Affiliated to UN)

Volume 9 Issue 1

March, 2006

## APPLICATIONS OF PROPAGATION MODELS TO DESIGN GEOSTATIONARY SATELLITE LINKS OPERATING IN KA-BAND OVER INDIAN RAIN ZONES

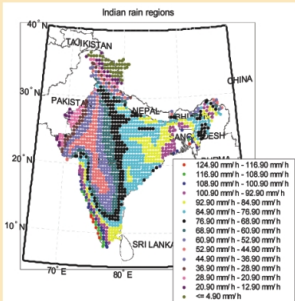
Mr. Damodar Magdum, India,

The frequency spectrum below 15 GHz is in extensive use in communications through satellite and terrestrial links. The 20-30 GHz radio-

frequency band offers three major advantages for satellite communications over the lower frequencies. These advantages are spectrum availability, reduced interference potential and reduced equipment size. However, beyond a Ka band, propagation impairments strongly limit the quality and availability of satellite communication links. Attenuation due to rain plays a significant role in tropical regions especially countries like India, where great diversity of climatic conditions exist.

Currently in Indian region C and Ku-band frequencies are being used for commercial satellite communications. In near future Ka band will be used in satellite communications links for wideband applications. Propagation studies are essential for estimation of attenuation and other effects, so that Ka-band satellite links operating in different parts of Indian region can be designed appropriately.

In this project, "Applications of



(A) Proposed new Indian rain regions map



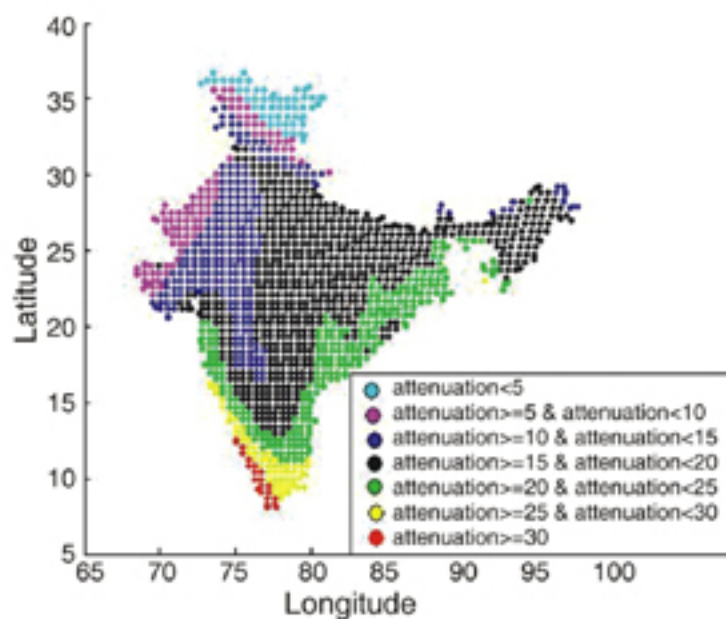
Inside this issue

✓ Applications of propagation models to design Geostationary satellite links operating in Ka-band over Indian rain zones

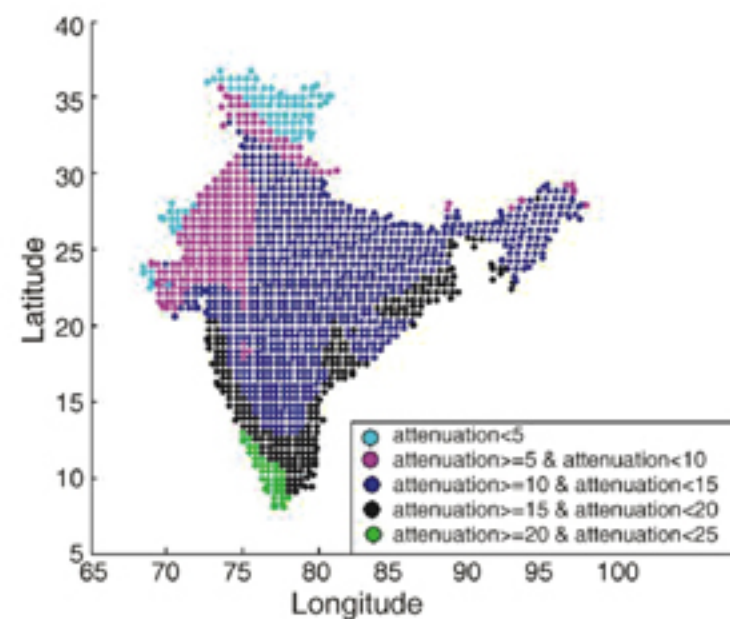
✓ Fifth Post Graduate course on Satellite Communications

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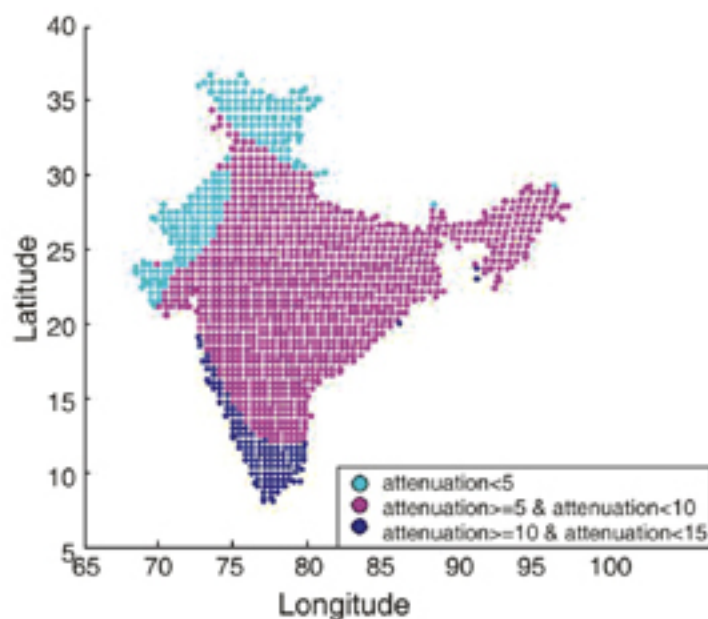


(a)

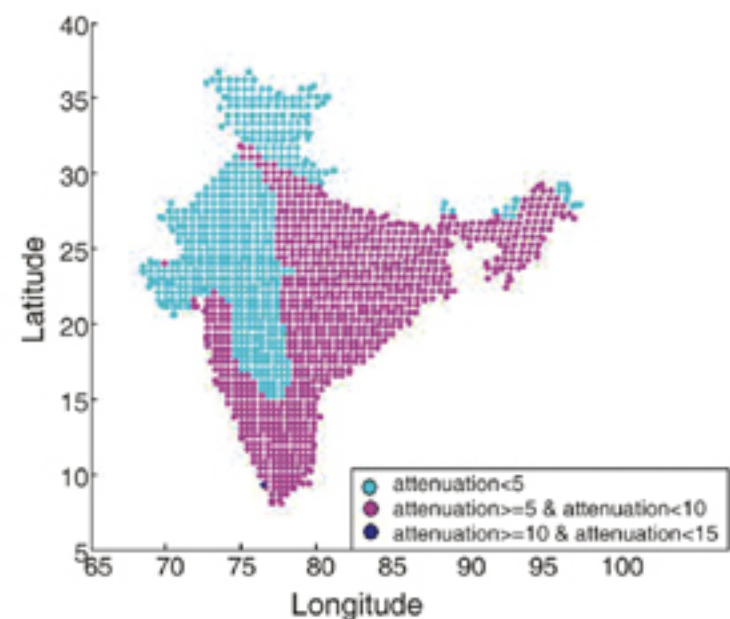


(b)

**(B) Total rain attenuation at frequency 30GHz (horizontal polarization) (a) 99.7% (b) 99.5%**



**(C) Total attenuation at frequency 20GHz (horizontal polarization) (a) 99.7% (b) 99.5%**



Propagation Models to Design Geostationary Satellite Links Operating in Ka-Band Over Indian Rain zones”, rain data over finer grid have been calculated over Indian region, which is long-term data measured by European Centre for Medium Range Weather Forecasts (ECMWF) U.K., for more than 20 years. European Center for Medium Range Weather Forecasts has been making global numerical forecasts since 1979. In parallel with the forecast and research activities, extensive data archives are created both for observations and numerical products (analysis and forecasts).

The surface water vapour densities and integrated liquid water contents have been calculated using data

from National Centre for Environmental Prediction (NCEP), NOAA, U.S.A. National Oceanic & Atmospheric Administration (NOAA), part of the US Department of Commerce, monitoring and predicting the global data from oceans and the atmosphere since 1970.

By analyzing this data, rain zones have been modified and attenuation due to rain, gas, clouds and scintillation over Indian region are calculated using ITU models. Accordingly satellite links at different regions have been designed. This work is useful for prediction of attenuation over Indian region.



## FIFTH POST GRADUATE COURSE ON SATELLITE COMMUNICATIONS

The SATCOM participants having learnt the essential aspects of satellite communications were introduced to Operational Communications Satellite Systems by Mr. R.N. Wadhwa, Head DES/SAC, and Focal point for the module No. 7. A variety of experts from INSAT, INMARSAT, World Space, INTELSAT, PANAMSAT and ESSEL-Shyam were invited as faculty to share real-life experiences. Experts from SAC and WPC,



*SATCOM Participants at Forest Research Institute (FRI), during their education excursion & visit to CSSTEAP Hqrs. Dehradun*

Ministry of Communications gave the details of ITU and the importance of International Regulations.

After the end of Module No. 7, the participants left for the study tour of the North India. During this tour the participants visited ESSEL and NOCC Earth Stations and got a glimpse of the various aspects of an operational earth station. During this period, they also visited the capital city of India, Delhi and visited all the places of tourist importance including the newly built Swaminarayan Temple. Later, they set out to visit Agra, Fatehpur Sikri & other place of historic importance.

Participants after having visited North India and the famous Taj Mahal at Agra were spell bound by its

beauty. They proceeded further north to Dehradun to visit IIRS & CSSTEAP HQs. In Dehradun, the participants were extremely happy to see other participants from their own country and exchanged information about variety of things which concerns their stay in India. Excellent arrangements were made by the CSSTEAP HQs., for the reception of the SATCOM participants and also made elaborate arrangements to make their stay at Dehradun a memorable one. In addition to local sight seeing the participants also visited the famous Mussorie hill station from Dehradun. The participants from the cold country were happy to experience the low temperatures after a long gap.

In the module No. 8 various aspects relating to Network Planning/Management/Operational Issues of Satellite were taught by experts from MCF-Hassan, ISRO- HQS and other agencies.

Mr. B.S. Bhatia, Director, DECU Focal point for the Module No. 9 on Satellite Communication for Development, Education and Training highlighted the needs and the impact of developmental communications. The module was well worked out and was made interesting by devising it to be highly interactive. At the end of the Module each



*Dr. Laurent Castanet of ONERA, Toulouse Research Centre, France conducting a tutorial session*



participant made a presentation about their country. The presentations were highly appreciated by the panel of experts who not only evaluated but also gave valuable suggestions for development.

Dr. K.S. Dasgupta, Group Director, ADCTG/SITAA and Focal point Module No.1 introduced the participants to Digital Signal Processing (DSP) fundamentals and the techniques. Prof. K Ramakrishnan, of Indian Institute of Sciences, Bangalore was invited to deliver lectures on Transform Coding Techniques. While, the experts from SAC described the finer aspects of the

applications of DSPs. This was supported with excellent lab experiments demonstrated by the Engineers of ADCTG.

Dr. Laurent Castanet of ONERA, Toulouse Research Centre, France, an expert on propagation studies was specially invited to deliver lectures on ka-band propagation and the topics included: Link Analysis, link budget, Earth Space Propagation, Propagation Models and Fade Mitigation Techniques. The lectures were well designed and were highly appreciated by the participants. Participants identified their one year project with

## TENTH POST GRADUATE COURSE ON REMOTE SENSING AND GIS

The tenth Post Graduate course on Remote Sensing and GIS (RS & GIS) of CSSTEAP which started at Indian Institute of Remote Sensing, Dehradun on October 1, 2005 is being attended by 19 participants from 13 countries of Asia-Pacific region including India. As a part of Module I educational visit the course participants visited Andhra University from January 13-26, 2006. Various lectures on different thematic applications of RS & GIS by senior faculty of Geo-Engineering department of Andhra University, were delivered. Field excursions and demonstrations were also organized.

The module - II ( Part of Semester - II ) started on



*Prof. Ray Harris from University College London, UK, delivering lecture.*



*Course Participants at Infrared Observatory at Mount Abu during their educational visit.*

February 1, 2006. This module consisted of RS &





*Course Participants with Prof. L. Venugopal Reddy, Vice Chancellor Andhra University during their educational visit to Andhra University*

GIS applications to Thematic optional stream. The thematic optional stream covers several disciplines such as Agriculture and Soils; Forestry and Ecology; Geosciences; Marine Science; Human Settlement & Urban Analysis; Water Resources and Advances in RS & GIS. Each of the course participants has chosen one optional thematic application discipline based on his/her academic qualification, professional experience and

requirements of their parent organizations.

The course curriculum of this module was covered by the faculty of IIRS and additional guest lectures on specialized topics were also arranged for the academic benefit of course participants. The guest lecturers were from various Indian Organizations / Institutes / Universities such as IMD, Dehradun; DEAL, Dehradun; IARI, New Delhi; NIH, Roorkee; NRSA, Hyderabad; SAC, Ahmedabad, Andhra University, Visakhapatnam etc. One international guest faculty Prof. Ray Harris from University College London, London, U.K. delivered series of lectures on Applications of Remote Sensing in agriculture crop mapping, yield prediction and precision agriculture; Radar Remote Sensing and Ethics of Earth Observation.

The performance of course participants was evaluated through periodic theory and practical examinations and tutorial assessment. An educational visit in February 11-22, 2006 to various

## *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 capabilities of the member states in different areas of space science and technology that can 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.



*CSSTEAP Building*

Department of Space, 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 System, (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

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### Ongoing Courses

- Fifth 9 month Post Graduate course in Satellite Communications at SAC, Ahmedabad from August 1, 2005.
- Tenth 9 month Post Graduate course in RS & GIS at IIRS, Dehradun from October 1, 2005.

### Fortcoming Courses

- International Training course on RS & GIS applications in Urban Studies at IIRS, Dehradun during August 14-Sep 15, 2006.
- Fifth 9 month Post Graduate course in Satellite Meteorology & Global Climate at SAC, Ahmedabad from August 1, 2006.
- Fifth 9 month Post Graduate course in Space & Atmospheric

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CSSTEAP welcomes the views and opinions of the readers of Newsletter. Short Communications on space science and technology education which may be relevant to Asia Pacific Region are also