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CSSTEAP Newsletter

January, 2016

Centre for Space Science & Technology Education in Asia & the Pacific (CSSTEAP) (Affiliated to the United Nations)

..... on a mission of capacity building, under the initiative of the United Nations, for Asia and the Pacific Region in Space Science and Technology, through Excellence in Education, Training, and Research.

New Chairman of CSSTEAP Governing Board.

Dr. A.S. Kiran Kumar, Chairman, ISRO and Secretary, Department of Space, Govt. of India, has been elected as chairman Governing Board CSSTEAP with effect from May 11, 2015. Dr. Kiran Kumar is a highly accomplished space scientist and engineer with over four decades of experience and contribution in Indian Space Research Organisation (ISRO).

He has actively contributed to development of satellite payloads and applications including design and development of electro-optical imaging sensors starting from Bhaskara to Mars Orbital Missions. He was instrumental in evolving the successful strategy for steering the Mars orbital spacecraft and its orbit insertion.

Dr. Kiran Kumar has Master's degree in electronics and M. Tech in Physical engineering from Indian Institute of Science, Bangalore. Prior to his present post as Chairman, Indian Space Research Organisation (ISRO), he has led Space Application Centre, Ahmedabad as its Director. He is recipient of many national and international laurels/awards, including the Padma Shri Award conferred by the President of India in 2014. He has represented ISRO in international forums viz., World Meteorological Organization (WMO), Committee on Earth Observation Satellites (CEOS) and Indo-US Joint Working Group on Civil Space Cooperation. CSSTEAP is highly honoured to have Dr. A.S. Kiran Kumar as its

New Director of CSSTEAP.

Dr. A. Senthil Kumar, Director of Indian Institute of Remote Sensing (IIRS), Dehradun has taken over charge as Director, CSSTEAP from Dr. Y.V.N. Krishna Murthy w.e.f. December 31, 2015.

He received M.Sc. (Engg.) and Ph.D. from the IISc , Bangalore in the field of Image Processing in 1985 and 1990 respectively. He joined ISRO in 1991 at Space Applications Centre, Ahmedabad and has actively contributed in the fields of sensor characterization, gain settings, radiometric data processing of IRS satellites, image restoration data fusion techniques and artificial neural networks for remote sensing data classification.

He was focal point for NRSC calibration-validation (Cal-Val) activities, he has established ISRO's first Radiometric Calibration Site development at Shadnagar. He is involved in CEOS working groups namely Cal-Val and WGCapD. Currently, he is Vice Chairman of WGCapD. He had been involved in Chandrayaan-1 data quality assessment of ISRO's electro-optical payloads and also co-principal investigator for Moon Mineral Mapper (M-cube) developed by NASA. He is recipient of Team awards for his contributions in Chandrayaan-1 Mission and Cartosat-1 Mission. CSSTEAP welcomes Dr. A. Senthil Kumar, as the new Director of CSSTEAP.

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Launch of GSLV3

Recent Launches of ISRO

PSLV-C28: On July 10, 2015, ISRO launched PSLV-C28 from Satish Dhawan Space Centre. It successfully deployed 5 satellites in the Sun-synchronous orbit. The C28 was the heaviest commercial mission undertaken by Indian Space Research Organisation and Antrix Corporation with a payload mass of 1,440 kilograms. The PSLV-C28 carried three identical optical earth observation satellites (DMC3-1, DMC3-2 & DMC3-3)built by Surrey Satellite Technology Limited (SSTL) of the United Kingdom (UK), an optical earth observation technology demonstrator micro satellite (CBNT-1) built by SSTL and an experimental nano satellite (De-orbitSail) built by Surrey Space Centre UK.

GSLV-D6 : ISRO successfully launched GSLV-D6 which is the ninth flight of India's Geosynchronous Satellite Launch Vehicle (GSLV) on August 27, 2015. GSLV-D6 flight is significant since it intends to continue the testing of indigenously developed Cryogenic Upper Stage (CUS). GSLV-D6 launched GSAT-6, an advanced communication satellite, into a GTO. The satellite will provide S-band communication services in the country.

PSLV C-29: On December 16, 2015, ISRO launched PSLV-C29, a commercial launch of PSLV the workhorse of ISRO for six Singaporean satellites. The main highlight of the launch was fourth stage re-ignition demonstration after payload deployment.

PSLV C30: With this launch ISRO put into orbit India's first dedicated Astronomical satellite – ASTROSAT which is a multi-wavelength space observatory. This was launched along with 6 satellites: one each from Indonesia and Canada and four nano-satellites from US using the more powerful launcher PSLV-XL.

www.isro.gov.in

Meeting of CSSTEAP Advisory Committee

Twelveth meeting of CSSTEAP Advisory Committee (AC) was held on July 29, 2015 in New Delhi under the Chairmanship of Dr. Shirish Ravan, Head, UN-SPIDER Beijing, who represented Director UNOOSA. The AC members are subject specialists and experts those who attended were Dr. Pramod Kale (Pune University, India); Prof. Dr. Ugur Guven (Unv. of Petroleum & Energy studies, India); Dr. L.S. Rathore (IMD, India); Dr. P. Sreekumar (IIA, India); Maj. Gen (Dr.) B. Nagarajan (IIT-Kanpur, India); Prof. Dr. A.D. Sarma (CBIT, India); Dr. G.S. Rao (Andhra University, India); Dr. P.K Pal (SAC, India); Dr. A. Senthil Kumar (IIRS, India). Other members included Dr. K.S Parikh, SAC, Ahmedabad, Dr. S.K Saha, Emeritus Professor, CSSTEAP, Mr. Shantanu Bhatawdekar, ISRO Hqrs., Dr. Sarnam Singh, Programme Coordinator, CSSTEAP, all Course Directors and Course Coordinators attended the meeting. The committee took a review of the Centre's technical and academic activities since last meeting.

During the meeting, issues like revision of course curricula,

implementation of recommendations of Board of Studies (BOS), research activities in the form of M.Tech at the centre, designing of short courses were discussed. The AC reviewed the syllabi of all the Post Graduate (PG) and Short Courses which were presented by the respective Course Directors. All the experts and AC members expressed satisfaction with the overall course structure and technical contents of the Post Graduate courses and expressed that the Centre should continue the existing PG courses. AC endorsed the course syllabus for new PG course on Global Navigation and Satellite System (GNSS) and suggested to consider inclusion of sections on mobile communications, Galileo system, importance of dynamics of mobile platforms, and commercial applications of navigation/ communication systems, fundamentals, processing and science applications like basics of geodesy, precise ephemeris, geodetic coordinate system, source localization, area specific location forecasting, and open source software.

Considering the demand and response by the users in the past, Centre may work out feasibility of continuing NAVSAT short course every alternate year for the benefit of senior decision makers and technologists who cannot come for longer duration course like GNSS. Centre may build linkages with other international organizations, universities and regional institutions with the support of UNOOSA to facilitate partnership under One UN initiative linkages for exchange of subject experts and research activities. AC suggested to organize short courses in the areas of: (a) Numerical weather prediction/modeling for benefit of operational forecasters; (b) Disaster damage and loss assessment using satellite data including natural heritage and cultural sites with UNESCO C2C established in India; (c) Capacity building of SAARC satellite users on satellite communications and core applications and (d) Space Weather.

AC suggested organization of theme and country specific short courses in different countries of the region with technical support of CSSTEAP and support from local institutions/organizations for hosting such initiative. AC appreciated the efforts made by the Centre towards organizing alumni meets in countries of Asia-Pacific region. This has been important in obtaining first hand feedback and understanding the alumni role in promoting space science and technology in their home country. Advisory committee also recommended that efforts should be made to provide support in the form of satellite data, software and technical guidance by the Centre to the course participants for continuation of Phase-II research activity. The AC appreciated the efforts of the Centre for excellent progress made, and expressed satisfaction at the achievements and also for the support from the host country. The AC also noted the committed efforts of the Centre, in particular Director, CSSTEAP for his excellent vision and the host institutions namely IIRS, NRSC, SAC, PRL and ISAC who have made the centre to gain high level of excellence. The AC also endorsed the courses, future programmes and technical activities of the Centre.

Dr. Shirish Ravan, Chairman of AC meeting in discussion with members

Dr. A. Senthil Kumar, Director IIRS interacting with AC members

Course Directors, invitees & officials of ISRO attending the meeting

AC members alongwith Course Directors & Other officials during meeting on July 29, 2015

CSSTEAP Advisory Committee

(reconstituted vide OO No. EOS:CN:UN:2015 dated June 09, 2015)

Ms. Simonetta Di Pippo
Director, UN Office for Outer Space Affairs

Dr. A. Senthil Kumar
Director, IIRS & CSSTEAP

Dr. Tom Veldkamp
Rector, ITC

Dr. Volker Gaertner
Head of user services EUMETSAT

Dr. L.S. Rathore
Director General, India Meteorological Department

Prof. Iain Reid, PhD, DSc, FAIP, FInstP, SMIEEE
Executive Dean, Roseworthy Campus

Prof P. Sreekumar
Director, Indian Institute of Astrophysics Koramangala

Dr. Ugur Guven
Aerospace & Nuclear Engineer, Academician,
International Professor working in India

Dr. Pramod Kale
Director
Integrated Circuit and Information Technology Pvt. Ltd

Maj Gen (Dr.) B. Nagarajan
Visiting Professor (Department of Civil Engineering)
Indian Institute of Technology Kanpur

Prof. A.D. Sarma
Electronics and Communication Engineering Dept.
Chaitanya Bharathi Institute of Technology, Hyderabad

Prof. G.S. Rao
Professor & Head, Dept. of Electronics & Communications Engineering
University Engineering College, Andhra University

Prof. G.S.N. Raju
Vice Chancellor, Andhra University

Dr. Tapan Misra
Director, Space Applications Centre, Jodhpur , Ahmedabad

Dr. Utpal Sarkar
Director-Incharge
Physical Research Laboratory, Navarangapura Ahmedabad

Dr. M. Annadurai
Director, ISRO Satellite Centre, Bengaluru

Dr. Y.V.N. Krishna Murthy
Scientific Secretary, ISRO

Mr, Shantanu Bhatawdekar
Associate Director (Applications),
Earth Observations System , ISRO

Dr. Sarnam Singh
Member Secretary, Dean (A), IIRS Dehradun

Meeting of CSSTEAP Governing Board

The 20th meeting of CSSTEAP Governing Board (GB) was held at New Delhi on November 16, 2015. The meeting was chaired by Dr. A.S Kiran Kumar, Chairman CSSTEAP GB and Secretary, Department of Space and participated by Mr. Hong Pong Gi, First Secretary DPR Korea; Mr. Afif Budiyono, Dy. Chairman, LAPAN, Indonesia; Mr. Agus Hidayat, Head cooperation & Public Relations Bureau, Indonesia, Mr. Hojat Mousazadeh, Head Technology Cooperation Section, Embassy of Iran, New Delhi; Prof. A.A. Abdykalykovich, President, International University for Innovation Technologies, Kyrgyz Republic; Mr. Ulugbeg Begaliev, Rector International University for Innovation Technologies, Kyrgyz Republic; Mr. Muhammad Azfar Abdullah, Second Secretary, Malaysian High Commissioner, New Delhi; Mr. Tsenddavaa Davaadori, Deputy Director, Mongolian Academy of Sciences, Mongolia; Mr. Thirta Raj Wagle, Minister-Counsellor, Embassy of Nepal, New Delhi; H.E. (Mrs.) Ma Teresita C. Daza, Charge d' Affairs, Embassy of Philippines, New Delhi; Mr. S. Panawennage, Director General & CEO, Arthur C Clarke Institute for Modern Technologies, Sri Lanka; Mr. Avaz Khodjiev, Counsellor, Embassy of Uzbekistan, New Delhi; Dr. Shirish A Ravan, Head, UN-SPIDER, Beijing, representative of UN-OOSA; Dr. Y.V.N. Krishna Murthy, Director CSSTEAP and Secretary GB. Others who participated included Dr. A. Senthil Kumar, Director IIRS Dehradun; Dr. D. Raghava Murthy, Director EOS, ISRO Hqrs Bengaluru; Mr. Shantanu Bhatawdekar, Asst. Scientific Secretary, ISRO Hqrs; Mr. G.R.K. Murthy, Chief Controller of Accounts, DOS; Dr. Sarnam Singh, Programmer Coordinator, CSSTEAP; Mr. C.A Prabhakar, Course Director, Small Satellite Missions, ISAC, Bengaluru; Dr. B. Simon, Course Director SATMET; Dr. Hari Om Vats, Course Director, Space & Atmospheric Science; Dr. Raghunadh K. Bhattar, Course Director, SATCOM and GNSS; Mr. Vivek Singh OSD, DOS, New Delhi; Dr. Yogesh Kant, Course Coordinator RS & GIS; Dr. Harish Karnatak, Scientist IIRS; Dr. Puneet Swaroop, Scientist IIRS and other officials.

The resolution of electing Dr. A.S. Kiran Kumar, Chairman, ISRO (as Representative of Government of India on the Governing Board) as the Chairman of Governing Board, CSSTEAP was passed by GB unanimously for a period of four years, starting from May 11, 2015.

While welcoming the GB members, representatives, Directors of host institutions and special invitees, Dr. Kiran Kumar, Chairman, GB apprised the members about the recent activities of the Centre and ISRO's current and future space programmes. Chairman, GB informed the members that under the leadership of Dr. Y.V.N. Krishna Murthy, Director CSSTEAP in the last one year the Centre conducted regular PG programmes on RS & GIS, SATCOM, SATMET, SAS and initiated a new PG course on GNSS. He mentioned about increased student's intake and collaboration with UN particularly UNSPIDER and UNESCAP and other international agencies in Asia Pacific region.The Centre had organized two such programmes, one on Coastal and Marine Disaster Management &

GB members in close discussion during the meeting

Dr. A. S. Kiran Kumar, Chairman ISRO & GB during the Governing Board Meeting

Dr. A. Senthil Kumar, Director IIRS alongwith officials of ISRO during the GB meeting

Governing Board members interacting during the meeting

Climate Change in collaboration with UNESCAP, Bangkok in May 2015 and the other in collaboration with UNSPIDER, Beijing and UNDP, Bhutan on Disaster Risk and Emergency Response for Bhutanese officials in April, 2015 at IIRS, Dehradun funded by UNDP, Bhutan. He also informed that short course on Weather forecasting using numerical weather prediction models in April 2016, Advances in geospatial tools in forestry & ecology applications May 2016, Disaster damage and loss assessment in natural heritage & cultural sites using geospatial tools in September 2016 and short course on Small Satellite Missions is to start in November 2016.Chairman GB highlighted the significant achievements of Indian Space Programme and missions since last GB meeting. Chairman GB urged GB members to consider submitting proposals for organizing need based short courses for member countries in collaboration with CSSTEAP & ISRO. Dr. Kiran Kumar informed GB that reconstituted Advisory Committee, with more subject experts in the areas of Satellite Navigation, Astrophysics, Aerospace and Digital Photogrammetry, etc., has met on July 29, 2015 and reviewed the syllabus and recommendation of the Board of Studies of all the courses. The committee appreciated the course contents and was satisfied with revision of the syllabus for different courses.

Dr. Y.V.N Krishna Murthy, Director CSSTEAP presented brief report on Centre's programmes, activities, host country support, etc in the past one year. He mentioned that M. Tech. fellowships has increased and are being awarded to deserving candidates. He informed that Advisory Committee meeting was held in July 29, 2015 to evaluate the syllabi of all the PG courses. He also highlighted the successfull completion of 19th RS&GIS, 9th SATMET, 9th SAS PG Courses; Short courses on 'Geospatial Technologies for Coastal & Marine Disaster Management & Climate Change'. He also apprised about joint special course with UNDP Bhutan and UN-SPIDER Beijing and CSSTEAP on 'Earth Observation for Disaster Response and Recovery Preparedness' for Bhutan Officials. He also informed that short course on 'Small Satellite Missions' starts on November 16, 2015 with 20 participants from eight countries. Dr. Krishna Murthy also mentioned that Centre had so far conducted 46 PG and 41 short-term courses during the last 20 years benefitting 1475 participants from 34 countries of AP region; and 29 participants from 18 countries outside AP Region. A total of 131 students from 16 countries were awarded M.Tech. degree by Andhra University. He also mentioned that during the last one year, seven students have been awarded M. Tech. degree. He also apprised the GB that currently 24 students from 14 countries are participating in 20th RS & GIS which is the highest number of students in any PG course, while 16 students from 4 countries in the 10th SATCOM and 09 students from 04 countries in the first GNSS course are participating. Dr. Krishna Murthy presented planned academic activities for 2016 and mentioned that PG courses planned are: 21st RS&GIS, 10th SATMET, 10th SAS and short courses are on 'Weather forecasting using numerical weather prediction models'; 'Recent

trends RS &GIS applications in Forestry & Ecology'; 'Disaster damage and loss assessment in natural heritage & cultural sites'; 'Navigation Satellite Positioning System' (NAVSAT) and 'Small Satellite Missions' (SSM). He informed that CSSTEAP would be collaborating with IIRS and UNESACP to conduct theme-based short courses, mainly related to disasters. He also highlighted that AC has recommended to continue NAVSAT short course every even year.

Governing Board members unanimously endorsed the proposal of Dr. A. Senthil Kumar currently Director IIRS for an additional charge of Director, CSSTEAP. Several important issues like expansion of CSSTEAP in Asia-Pacific region, review of action items, centre's strategy and themes for future courses, research program, short courses, budget allocation for centre activities and audit report were discussed.

Dr. A.S Kiran Kumar thanked all the GB members & UN-OOSA for their valuable comments, fruitful discussion, for their continued support & cooperation in the Centre activities and growth of Centre. Also thanked Directors of ISRO/DOS, Course Director(s), Course Coordinator(s), ISRO-DOS staff for their dedicated support.

TWENTIETH POST GRADUATE COURSE ON REMOTE SENSING & GEOGRAPHIC INFORMATION SYSTEM

The twentieth Post Graduate Course on Remote Sensing and Geographic Information System (RS&GIS) of CSSTEAP commenced on July 1, 2015 at Indian Institute of Remote Sensing (IIRS), ISRO, Dehradun, one of the host institutions of CSSTEAP. Total 24 participants from 15 countries of Asia-Pacific Region viz. three participants from Mongolia, two each from Bangladesh, DPR Korea, India, Kazakhstan, Kyrgyzstan, Nepal, Sri Lanka and one participant each from Fiji, Indonesia, Myanmar, Tajikistan, Thailand, Uzbekistan and Viet Nam have joined the course. The participants were mainly from Hydrology, Watershed Management, Environment, Meteorology, Urban and Regional Planning, Geoinformatics, Surveying, Cartography and Agriculture, Forestry, Geology and Marine Sciences background.

The entire period of 9 months is divided into two semesters. Semester-I was further divided into two modules. The Module-1A and 1B were of three and one month duration, respectively. Similarly Semester-II also has two modules – Module-II and Module-III of two and three months, respectively. Due to personal reasons one of the participant from Fiji had to leave the course in between after completing four months of the course.

The course started with an 'Induction week' (Module-0) during first week after joining the course where the participants are exposed to geographic perspective of India, social systems, customs and festivals of India, overview of space science, technology and applications, etc. Module-1A covered basically the fundamentals of RS&GIS: Principles of RS, Photogrammetry, Image Analysis

Partcipants of 20th GB meeting of CSSTEAP

RS & GIS Course partcipants with VC & other officials at Andhra University, Visakhapatnam

Course Participants at Taj Mahal, Agra

Course participants during field work and data collection

(included both visual and digital techniques), basics concepts of GIS and GPS. The module also covered theory, practical and tutorials on principal of Remote Sensing, photogrammetry, image analysis, GPS, GPS & GIS. Several field excursions were taken up during this module for ground truth collection and for interpretation and analysis of satellite data. In GIS the broad topics covered were concepts of GIS, databases, data entry and editing, principles of cartography, map projections, vector and raster geodatabases, network, DEM, concepts of GPS, types of GPS, constellation, GPS application in surveys, mapping and navigation. Module-1B Semester-I, was of one month on recent trends in RS & GIS and environmental analysis & management and the topics covered were, introduction to hyperspectral satellite data, microwave data, interferrometry, etc and in topics on environmental significance like satellite meteorology, Earth processes, natural disaster analysis, biodiversity conservation, monitoring & management. Guest lectures were organized on 'Metrological satellite and sensors', 'Weather analysis, forecasting and modelling', 'Earth observation system for climate and climate change','Forest fire & forest information system' on 'Climate change dynamics' and 'EO satellite for climate change'.

In semester-II, the course participants chose one of the eight optional electives. Optional electives are Agriculture & soils, Forest & Ecology, Geosciences & geo-hazards, Marine & Atmospheric Science, Water Resources, Urban & regional planning, Satellite image analysis & photogrammetry and Geo-informatics were taken by the participants. Out of 23 participants, 5 participants have opted Satellite image analysis & photogrammetry; 3 each for Agriculture & Soils, Geosciences & Geo-hazards, Urban & Regional Planning and Water Resources; 2 each for Forestry & Ecology, Marine & Atmospheric Science and Geoinformatics disciplines.They opted the disciplines by considering his/her academic qualification, professional experience, and technical requirement of their parent organization. Again considering their interest they were assisted to choose specific topics in Module III- Pilot project.

The major components of course syllabus were covered by the faculty of IIRS and additional guest lectures by guest faculty on specialized topics was also arranged for the academic benefit of the course participants. The subject experts were invited from various Indian Organizations/Institutes/Universities such as India Meteorological Department (IMD); Indian Institute of Technology (IIT), Roorkee; National Remote Sensing Centre (NRSC), Hyderabad; Aryabhatta Research Institute of Observational Research (ARIES), Nainital; Space Applications Centre (SAC), Ahmedabad; Andhra University, Visakhapatnam etc to deliver specialized lectures.

The academic activities like theory, guest lectures, practical, etc. were organized in smart-class rooms. Multi-media self-learning packages, field excursion, seminars, etc. were also organized. All the participants learnt operationalization of software for digital satellite

image processing for mapping natural resources for management and planning during computer-based practical exercises. Local field-tours were very effective in understand different ecosystems, phenomenon, and earth surface features using RS data. They were also taught GIS using latest software, concept of datum, projections, database creation, analysis and modeling for understanding earth processes and natural resources management. They applied this knowledge in analyzing and solving problems during pilot project in Module-III. Lecture notes in the form of printed books and supplementary reading materials were distributed well in advance to all the course participants to help easy assimilation of the subject in the class and also for future reading. Soft-copy of the lecture notes were also distributed. Access to audio-visual recording of all the lectures by IIRS faculty and guest lecturers was provided all the time to them to listen again and again to understand the subject. Academic performance of the course participants was evaluated in each semester through periodic internal and external examinations in the form of written and practical examinations; class test, tutorials, seminar etc. The Semester-I external examinations were held from October 12-16, 2015 and Semester-II external examination were held from December17-23, 2015.

For interested participants English language class after office hours was organized during the first three months during Module-IA for improving communication, understanding and writing skills in English. English coaching was imparted to all students to improve spoken and written English proficiency with more emphasis on pronunciation/accent, grammar and vocabulary. Significant progress has been observed in proficiency of the students.

Technical and educational visits to Andhra University, Visakhapatnam, SDSC SHAR and National Remote Sensing Centre, Hyderabad were undertaken during December 24, 2015-January 3, 2016. Field visits to urban and rural landscape of East coast, Eastern Ghats and seascape were also organized. The participants had opportunity to visit the Satellite launch station and visit the facilities at Sriharikota and Integrated Multi-mission Ground Segment for Earth Observation Satellites (IMGEOS) which is a state-of-art multi-mission ground segment processing enterprise for earth observation satellites and watched the real time acquisition of EO data at Shadnagar, Hyderabad. IMGEOS provides emergency data products in hours, most of standard products in less than a day, significantly ramp up product throughput per day. The participants has opportunity to visit the technical facilities at NRSC, Hyderabad. At Andhra University, the educational records of all participants were scrutinized for fixing their M.Tech. eligibility. At Andhra University the participants attended nine lectures on specialized topics on environmental analysis & management, marine, weather forecasting, watershed etc. A field visit in and around Visakhapatnam was also organized for the benefit of the participants. During technical visit, the course participants explored Indian rich heritage and cultural diversity. On the social front, the participants had glimpses of Indian festivities by their active

Students during laboratory exercises

Students partcipanting in cultural programme

SATCOM-10 Participants with Dignitaries

GNSS-1 Participants with Dignitaries

participation in various festivals such as Dussehra, Diwali, Id-ul-Fitr, Christmas, New Year, Holi, etc.

The participants of the course also participated in the IIRS user Interaction Meet 2016 held on February 18, 2016 at IIRS Dehradun. The Meet had 264 delegates from all over India from ISRO, various Govt. Departments, Universities, NGO & other scientific organizations.

The third and final module of three months started from January 4, 2016 and would be completing on March 31, 2016. This module is basically designed to carry out pilot project work by the course participants. Course participants have developed pilot project proposals with the help of project supervisors.

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Inaugural Function of SATCOM-10 & GNSS-1 Courses

The Joint Inaugural function of Tenth Satellite Communications (SATCOM-10) and First Global Navigation Satellite System was held on August 03, 2015 at Bopal Campus, SAC. Dr. YVN Krishna Murthy, Director CSSTEAP, SS, DOS, Shri. Tapan Mishra, Director, SAC, Shri. K S Parikh, DD, SNAA and SMC members, Course Directors / Course Coordinators, Focal Points, Faculty and other staff members attended the Inaugural Function.

The Course Director introduced both courses and said that the day remains a special day in the history of CSSTEAP as probably we are the first regional centre affiliated to United Nations to start the GNSS course. Shri. K.S.Parikh, DD, SNAA in his welcome address, welcomed all the participants of both courses and he wished that the both courses will be great success.

Dr. YVN Krishna Murthy, Director, CSSTEAP, introduced the courses and how they started. He emphasized the uniqueness of the courses and said that Scientists/ Engineers who make the payload constitute the faculty. He also highlighted the importance of Navigation application in day to day life. Keeping these developments in view, he said that developing countries need to equip with Navigation Technology. In this direction, he said that CSSTEAP is starting the new 9 month GNSS Course.

Shri. Tapan Mishra, Director, SAC, in his address commented that the faculties for the participants are the Scientists/Engineers who build the systems. He also asked the participants to ask many questions, as simple questions triggered by students pave way to solutions to many problems.

Short course on Small Satellite Missions
16th – 27th November, 2015

Small satellites have already created a niche in developing communication infrastructure and tools for natural resource management, infrastructure development, environmental monitoring sustainable development, etc. The increasing capability of small satellites and their use in building space infrastructure for disaster monitoring and resource management have encouraged the small and developing countries to envisage building such capabilities within. UNOOSA under BSTI initiative is also encouraging the capacity building programmes for small satellites with an objective to create awareness among the decision/policy-makers/planners and technologists who are involved in space programme of these developing countries. Under this initiative, the 4th short course of 2 weeks duration on Small Satellite Missions was organized by CSSTEAP from 16th – 27th November, 2015, jointly conducted by Indian Institute of Remote Sensing (IIRS) and ISRO Satellite Centre (ISAC) at IIRS, Dehradun to

- Create an awareness of the potential of space technology, small satellites and its opportunities
- Create an awareness about the technology involved in small satellites and to encourage researchers and professionals in making, launching and utilizing the benefits of small satellites.

The course commenced on November 16, 2015 with 20 participants from 08 countries (Bhutan-2, India-4, Indonesia-1, Kazakhstan-3, Kyrgyzstan-1, Mongolia-5, Nepal-1, Vietnam-3).

The syllabus covered various applications of space technology, small satellites, different orbits suitable for small satellites, Details of subsystems of the satellites like structure, thermal, mechanism, power, RF systems, onboard computers, launch vehicle interface, data quality aspects, applications etc. Lectures were delivered by faculty from ISAC, ISTRAC, SAC and IIRS. The course was a blend of theory lectures, video sessions, interactive sessions and demonstration with exhibits. As a part of the course, participants also carried out assignments on various aspects designing of small satellites and presented their nature of work in the space related fields and the benefit of this course. A formal feedback was taken at the end of the course. In general all the participants expressed their satisfaction and appreciation for the course. The Valedictory function was held on November 27 , 2015.

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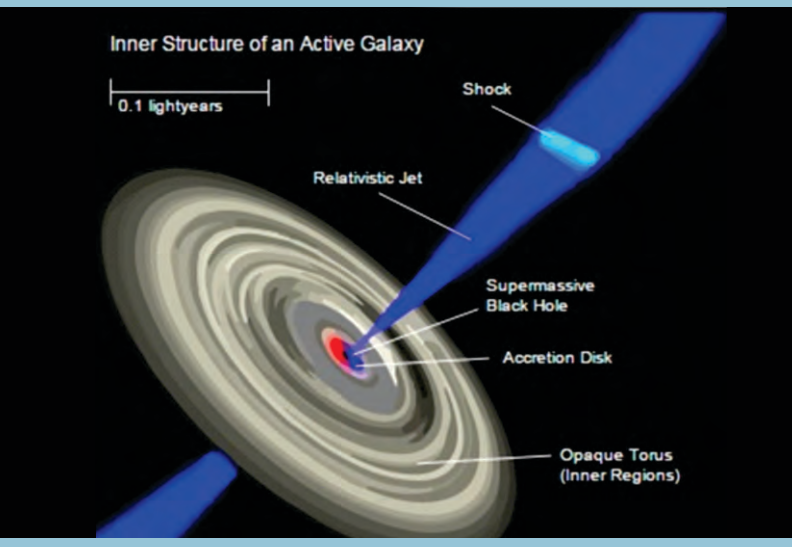
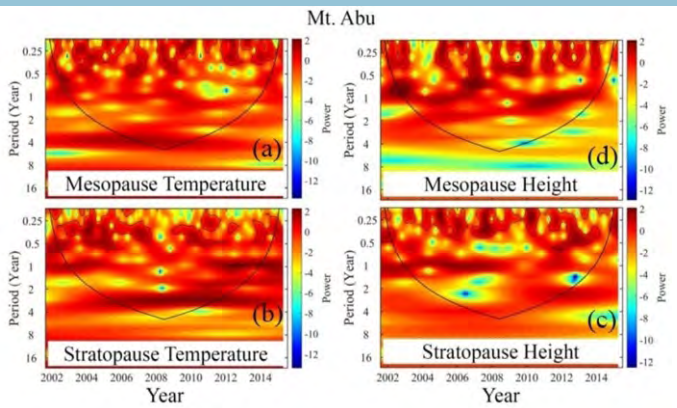
Students of Small Satellite Missions course with model

Group Photograph of Small Satellite Missions course participants



Model of Relativistic Jet of AGN's

By Ms. Taranpreet Kaur



Continuous Wavelet Transform of (a) Mesopause Temperature, (b) Stratopause Tempearature, (c) Stratopause Height, (d) Mesopause Height.

By Mr. Chintan Jethva

Space and Atmospheric Science Program July – Dec. 2015

During July to December 2015 period three M. Tech. participants of CSSTEAP Space and Atmospheric Science course had carried out their dissertation work. These CSSTEAP M Tech Scholars were Ms Taranpreet Kaur, Mr Chintan Jethva and Ms Dilpreet Kaur. They worked on the research projects under the supervision of Prof A K Singal, Dr Som Kumar Sharma and Dr Shashikiran Ganesh of PRL. All of them carried out very good quality advanced research in the following topics:

Can Jets showing bends and wiggles be relativistically beamed?

Ms. Taranpreet Kaur

Active Galactic Nuclei (AGN) show relativistically moving jets, which many times show bends and wiggles on many scales. It is in general believed that these jets appear very bright because they are relativistic and oriented close to the line of sight of the observer. Factors like Doppler boosting and relativistic beaming makes them look much brighter than they are in their rest frame.

Now any change in the orientation angle caused by bends or wiggles would cause a large change in beaming factor. But the expected change is not seen in the observed bending. In order to explain this we examine jets at different orientation angles with respect to the observer with different Doppler factors and imposed different changes in the jet directions to see their effect on the observed flux densities. We also included projection effects as sometimes a small change in angle in the intrinsic frame might appear larger due to such effects.

Atmospheric investigation using LIDAR and Satellite Observations

Mr. Chintan Jethva

Middle atmospheric region plays very vital role in deciphering various geophysical phenomena taking place in the Earth's atmosphere. Middle atmospheric temperature at Mt. Abu (24.5oN, 72.7oE) located in sub-tropics have been studied using Nd-YAG laser based Rayleigh Lidar observations from the year 2002 to 2014 which measures the vertical profile of neutral density and temperature in the middle and upper atmosphere with high time and height resolutions over a height range of 30-80 km. The derived monthly mean Lidar temperature profiles are compared with the several satellite viz., HALOE (Halogen Occultation Experiment) onboard UARS, SABER (Sounding of the Atmosphere using Broadband Emission Radiometry) onboard TIMED, COSMIC (Constellation Observing System for Meteorology, Ionosphere, and Climate), CHAMP (Challenging Mini-satellite Payload) and also compared with different atmospheric models like CIRA-86, MSISE-90 and NRLMSISE -00 which are good reference model for the middle atmospheric temperature.

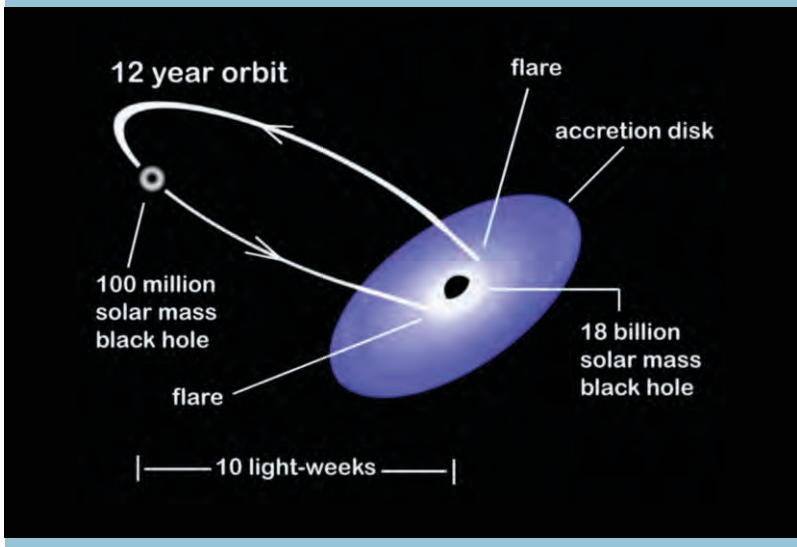
Temperature climatology over Mt. Abu has been studied using ground based Lidar observations from 2002-2014 and strong

signatures of Semi Annual Oscillations (SAO), Annual Oscillations (AO) and Quasi Biennial Oscillations (QBO) have been found at every 5 km in the stratospheric and mesospheric temperatures. These features along with Planetary Waves (PW) and Gravity waves (GW) activity over Mt. Abu have been investigated using FFT, Wavelet and Lomb scargle periodogram techniques. Temporal variation of Stratopause and Mesopause temperature reveals a decreasing trend from year 2002 to 2008 and beyond this, an increasing trend is found. The occurrence frequency of Mesopause and Stratopause height show that the maximum occurrence frequency at ~100 km and ~ 47 km respectively.

Blazar OJ 287: A Photometric variability study

Ms. Dilpreet Kaur

The unified model of Active Galactic Nuclei (AGN) postulates that radio galaxies, seyferts, quasars, blazars are different manifestations of the same kind of object with the difference being due to the relative orientation of an accretion disk (and jet), surrounding a supermassive black hole, with the line of sight. The most interesting class of AGN are blazars, which are thought to be AGN with the axis of the jet pointed towards the observer. One of the prominent characteristics of AGN is variability in flux and polarization properties at various timescales ranging from minutes to years. The study of variability is one of the important tools to probe the inner regions of AGN. Variability at short timescales provide constraints on the size of the emitting region and the mass contained within that region. Thus important physical characteristics of the central engine can be obtained by studying the variability pattern of the AGN. Blazar OJ287 is thought to be a two black hole system based on the long term periodicity noticed in it's light curve. A smaller supermassive black hole with a mass of only 100 million MSun orbits the larger one with an observed 11-12 year orbital period was inferred from nearly periodic variation of 11-12 years. We have been monitoring OJ 287 over a long time using the 1.2m telescope with LN2 CCD at Mount Abu IR Observatory (MIRO).



Model of OJ287 with two black holes
By Ms. Dilpreet Kaur

National Meet on promoting Space Technology based tools and Applications on Governance & Development

The one day National Meet on promoting Space Technology based tools and Applications on Governance & Development was organized on September 07, 2015 at Vigyan Bhavan, New Delhi to deliberate on the action plans for various Ministries/Departments of Govt. of India. The National Meet received an overwhelming response with participation of more than 1200 delegates across 60 Central Ministries/Departments, 28 States and 5 Union Territories. Secretaries, Additional Secretaries, Joint Secretaries to Government of India, Chief Secretaries, Principal Secretaries of the States and senior functionaries of Central and State Governments, officials from Prime Minister Office & Cabinet Secretariat, young administrators (the fresh batch of 2013 IAS officers), experts from academia and institutions have actively participated in this meet. The National Meet comprised of nine theme sessions (Agriculture,

Hon. Prime Minister of India Shri Narendra Modi addressing the delegates during National Meet

Continuous Wavelet Transform of (a) Mesopause Temperature, (b) Stratopause Tempearature, (c) Stratopause Height, (d) Mesopause Height.

Energy & Environment, Infrastructure Planning, Water Resources, Technology Diffusion, Developmental Planning, Communication & Navigation, Weather & Disaster Management and Health & Education) addressing different domains of national development. Secretaries of 58 Ministries/Departments have presented the joint action plans to enhance functional effectiveness, facilitate planning and decision making. Chief Secretaries/ Principal Secretaries of 9 States have also made presentations on use of space technology in specific sectors.

A Special Session was conducted in the presence of the Prime Minister of India Shri Narendra Modi. In his remarks, the Prime Minister emphasized the need for new initiatives in all the areas of governance, using the space technology and applications. He asserted that technology is the most powerful medium that the Government has to utilize to ensure good governance, transparency and accountability.

India's first multi-wavelength Observatory in Space ASTROSAT:

ASTROSAT is India's first dedicated multi wavelength space observatory. This scientific satellite mission endeavors for a more detailed understanding of our universe. One of the unique features of ASTROSAT mission is that it enables the simultaneous multi-wavelength observations of various astronomical objects with a single satellite.

ASTROSAT will observe universe in the optical, ultraviolet, low and high energy X-ray regions of the electromagnetic spectrum, whereas most other scientific satellites are capable of observing a narrow range of wavelength band. Multi-wavelength observations of ASTROSAT can be further extended with coordinated observations using other spacecraft and ground based observations. All major astronomy Institutions and some universities in India will participate in these observations.

ASTROSAT has a lift-off mass of about 1513 kg. It will be launched into a 650 km orbit inclined at an angle of 6 deg to the equator by PSLV-C30. After injection into Orbit, the two solar panels of ASTROSAT are automatically deployed in quick succession. The spacecraft control centre at Mission Operations Complex (MOX) of ISRO Telemetry, Tracking and Command Network (ISTRAC) at Bangalore will manage the satellite during its mission life.

The science data gathered by five payloads of ASTROSAT will be telemetered to the ground station at MOX. The data is then processed, archived and distributed by Indian Space Science Data Centre (ISSDC) located at Byalalu, near Bangalore.

The scientific objectives of ASTROSAT mission are:

- To understand high energy processes in binary star systems containing neutron stars and black holes
- Estimate magnetic fields of neutron stars

- Study star birth regions and high energy processes in star systems lying beyond our galaxy
- Detect new briefly bright X-ray sources in the sky
- Perform a limited deep field survey of the Universe in the Ultraviolet region

Payloads of ASTROSAT:

Five payloads of ASTROSAT are chosen to facilitate a deeper insight into the various astrophysical processes occurring in the various types of astronomical objects constituting our universe. These payloads rely on the visible, Ultraviolet and X-rays coming from distant celestial sources.

On board ASTROSAT are five astronomy payloads for simultaneous multi-band observations:

- Twin 38-cm Ultraviolet Imaging Telescopes (UVIT) covering Far-UV to optical bands.
- Three units of Large Area Xenon Proportional Counters (LAXPC) covering medium energy X-rays from 3 to 80 keV with an effective area of 8000 sq.cm. at 10 keV.
- A Soft X-ray Telescope (SXT) with conical foil mirrors and X-ray CCD detector, covering the energy range 0.3-8 keV. The effective area will be about 120 sq.cm. at 1 keV.
- A Cadmium-Zinc-Telluride coded-mask imager (CZTI), covering hard X-rays from 10 to 150 keV, with about 6 deg field of view and 480 sq.cm effective area.
- A Scanning Sky Monitor (SSM) consisting of three one-dimensional position-sensitive proportional counters with coded masks. The assembly is placed on a rotating platform to scan the available sky once every six hours in order to locate transient X-ray sources.

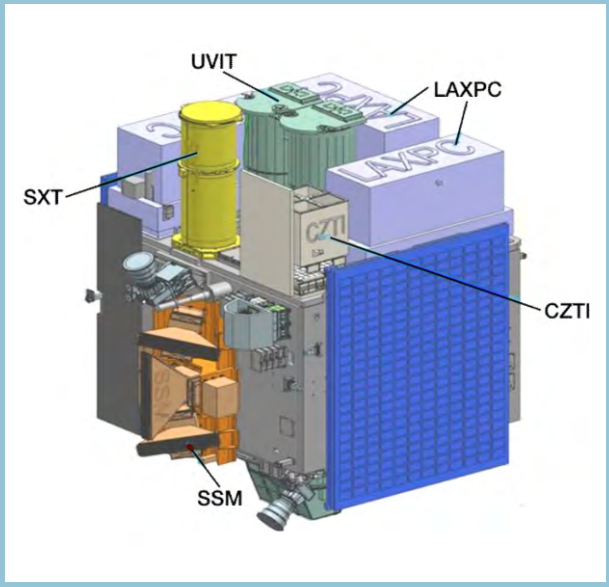
ASTROSAT will operate as a proposal-driven general purpose observatory, with main scientific focus on:

- Simultaneous multi-wavelength monitoring of intensity variations in a broad range of cosmic sources.
- Monitoring the X-ray sky for new transients.
- Sky surveys in the hard X-ray and UV bands.
- Broadband spectroscopic studies of X-ray binaries, AGN, SNRs, clusters of galaxies and stellar coronae.
- Studies of periodic and non-periodic variability of X-ray sources.

Open observing time on ASTROSAT will start one year after launch, for which proposals will be invited from the astronomy community. The primary data archive for ASTROSAT will be located at the Indian Space Science Data Centre (ISSDC) near Bangalore, India.The Ground Command and Control Centre for ASTROSAT is located at ISTRAC, Bangalore, India. Commanding and data download will be possible during every visible pass over Bangalore. Ten out of 14 orbits per day are visible to the ground station for long enough to accomplish full data download.

www.isro.gov.in

Students collecting ground truth using spectroradiometer during field work



Model of OJ287 with two black holes

Ongoing courses

- **20th** Post Graduate Course in **"RS&GIS"** at IIRS, Dehradun from July 1, 2015- March 31, 2016
- **10th** Post Graduate Course in **"Satellite Communication"** at SAC, Ahmedabad from August 1, 2015- April 30, 2016
- **1st** Post Graduate Course in **"Global Navigation Satellite Systems"** at SAC, Ahmedabad from August 1, 2015- April 30, 2016

Future Courses

- Short course on "**Weather forecasting using Numerical Weather Prediction Models**" at IIRS, Dehradun (1 month) from April 18 to May 17, 2016
- Short course on "**Advances in Geospatial tools in Forestry & Ecology Applications**" at IIRS, Dehradun during May 23 – June 21, 2016.
- Short Course on "**Space Weather**" at PRL, Ahmedabad (4 weeks) from May 16 to June 14, 2016.
- 21st Post Graduate Course in **"RS&GIS"** at IIRS, Dehradun from July 1, 2016- March 31, 2017
- 10th Post Graduate course in **"Satellite Meteorology and Global Climate"** at SAC, Ahmedabad from August 1, 2016 – April 30, 2017.
- 10th Post Graduate course in **"Space and Atmospheric Science"** at PRL, Ahmedabad from August 1, 2016 – April 30, 2017.
- Short course on "**Disaster Damage and Loss Assessment Using Satellite Data Including Natural Heritage and Cultural Sites** with **C2C**"at IIRS, Dehradun and WII Dehradun (4 weeks) from September - October 2016.
- Short course on "**Small Satellite Missions**" at IIRS, Dehradun and ISAC, Bengaluru from November 21 - December 2, 2016.

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