CSSTEAP Newsletter

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

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..... 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.

SIXTH POST GRADUATE COURSE ON SATELLITE METEOROLOGY & GLOBAL CLIMATE

The Sixth Post Graduate Course on Satellite Meteorology & Global Climate, under the aegis of CSSTEAP (affiliated to UN) was conducted during August 1, 2008 to April 30, 2009 at the Bopal Campus of Space Applications Centre, Ahmedabad. Sixteen participants from 13 countries in Asia-Pacific region with representation from Azberbaijan-1; Bangladesh-1; India-2; Indonesia-1; Kazakhstan-2; Malaysia-1; Mongolia- 1; Nepal-2; Papua New Guinea -1; Sri Lanka-1; Tajikistan- 1; Thailand-1; Vietnam- 1.

The total syllabus was divide into three units, each of 3 months duration. Unit-1 consisted of lectures covering concepts on General and satellite meteorology, satellite and ground systems, applications related to mainly qualitative interpretation of satellite imageries etc. Unit-2 dealt with radiative transfer, parametrer retrieval, applications in meteorology, oceanography and climate studies using digital data besides numerical modeling and environment problems. Unit-3 consisted of pilot project which started from February 1, 2009 and completed on June 30 2009. The students learnt a lot during the 3 months project. The broad topics of the pilot projects under taken by the course participants were- tropical cyclone studies with TRMM data and model, CO studies using satellite data sets and their validation with ground measurements, Meso-scale studies using MM5 and WRF models, MODIS data utilization and validation, drought monitoring using MW data, Tree ring analysis and climate

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reconstruction, Agromet studies using model and RS data.

The valedictory function of the SATMET-6 Course was held on April 29, 2009. Prof. U.R. Rao, Former Chairman, ISRO and Chairman, PRL Council (ISRO-DOS) was the Chief Guest. The CSSTEAP PG diploma certificates to all successful course participants and the merit certificates to the rank holders were distributed by the Chief Guest. Dr. George Joseph, Director, CSSTEAP, Dr. R.R. Navalgund, Director, SAC, Prof. J.N. Goswami, Director, PRL, faculty members, senior scientists of SAC & PRL attended the function.

Dr. B.M. Rao, Course Director, SATMET made a detailed presentation on the various activities carried out during the nine months course. He mentioned that till date 106 participants from 22 countries in the region have been benefited from the course. This 39-week course had three modules, each of 13 weeks duration, having lectures, practical, tutorials, weather discussion, seminars etc. Two technical tours were conducted to important SATMET and space technology facilities and infrastructure across India. He also mentioned about the continued efforts will be made to enhance the facilities for the benefit of the participants. Some of these are, video recording of the class room lecture proceedings, access to the past and present course materials, creation of the CSSTEAP Network and extension of the network to the hostel (computer room) to access class room lectures any time during the day etc. During the course, internet facilities both at the office and hostel were provided to the participants. These were extensively used by the participants for the seminar/weather discussion with special emphasis on web-site based satellite data (imagery/geophysical products), weather charts etc. The course participants were provided to access the Meteorological and Oceanographic Satellite Data Archival System (MOSDAC) of SAC. This helped them in browsing and downloading large volume of satellite data, particularly during the pilot project phase (Module III).

Out of the sixteen participants, four passed with Distinction, ten in First class and two in second class. The first rank (Gold medal) was bagged by Mr. Edward Joseph, IAF, India; second rank (Silver medal) was awarded to Mr. Mugni Hadi Hariadi of Indonesia and third rank (Bronze medal) was awarded to Mr. Vinay Tiwari (Indian Navy), India. Prof. U.R. Rao in his valedictory address called upon the successful participants to exploit the advanced technologies and apply the knowledge gained during the course and contribute to the national economy and progress of their countries. He congratulated the faculty members for conducting the courses and thus contributing to the augmentation of the national capabilities in the Asia-Pacific region.

Prof. U.R. Rao, Chief Guest addressing the gathering

On behalf of the course participants, two of their representatives presented their impressions about the course and their stay in India. They felt that the overall conduct of the course was good with high quality teaching, practical and technical tours; class room and laboratory arrangements and the hostel stay was comfortable.

A CD containing the lecture notes of the course, pilot project reports, practical and Experiment reports and

Course participants alongwith dignitaries during the valedictory function

other related activities was brought out on this occasion. The CD was released by Dr. Navalgund, Director, SAC. Prof. Rao also released a printed "Memoirs" describing the important events of the 6th SATMET Course on this occasion.

A number of dignitaries from India and abroad had sent their greetings to CSSTEAP on this important occasion.

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SIXTH POST GRADUATE COURSE ON SPACE AND ATMOSPHERIC SCIENCE

The sixth PG Course on Space and Atmospheric Science of CSSTEAP, was conducted by Physical Research Laboratory Ahmedabad, the host institution, during August 1, 2008 to April 30 2009. Seven participants from Asia Pacific countries namely Mongolia-2, Lao PDR-1 and India-4 attended the course. The course was conducted from Space Science area at Bopal campus of Space Application Centre (SAC) and participants were accommodated in a well furnished International Hostel near the same campus.

Course participant receiving medal from Prof. U.R. Rao

The nine months Space and Atmospheric Science Course was covered in two semesters of 20 & 19 weeks duration. Out of six theory papers, four were covered in semester I and two in semester II. Subjects covered in semester I included Atmospheric Science and Ionospheric Physics, Measurement and Data Analysis Techniques as well as Space Technology and Instrumentation. Astronomy and Astrophysics, along with Solar Physics, Magnetospheric Physics and Space Weather were dealt in semester II. Six experiments were also done in each of the two semesters. Apart from the theory papers and laboratory sessions, course participants undertook a pilot project, during semester II. A common module to be taught to all the four courses of CSSTEAP, was introduced from this year and lectures on this module were also arranged. The syllabus for the common module is designed to give a broader coverage of all aspects of space science and technology. The course participants also did a pilot project in the second semester on the topic of their interest, which could be continued in their respective institutions as phase-II of the programme. Semesters and examinations were conducted in first week of December 2008 for semester-I and in the third week of February 2009 for semester-II. The participants were also evaluated for the seminar presentations , viva voice on laboratory sessions and pilot project. The broad topics of the pilot projects under taken by the course participants were - spectral aerosol optical depth measurement, aerosol size distribution, time series of rainfall and temperature data, ionospheric scintillation and its effect on radio communications, spectrograph, solar coronal plasma through SOXS and EIS/Hinode missions.

Faculty members included eminent Scientists/ Engineers, retired from active service at PRL/DOS, and one faculty per subject delivered lectures to the extent possible in order to reduce the ratio of faculty to subject. Scientists from other Institutions/University in India were also invited to deliver the lectures. Prof. Tom Gehrels from USA and Prof. K.I. Oyama from Japan were invited to cover a few specialized topics. A meeting of the Board of Studies for the course was convened on April 24, 2009. Suggestions given by the board of studies, by and large, related to laboratory sessions and distribution of lectures on different subjects within a semester.

Educational tours were arranged for Mount Abu and

Udaipur to familiarize with instruments in Astronomy and conduct some experiments. The participants visited Andhra University, Visakhapatnam, for verification of qualification, visited important experimental laboratories, NARL Tirupati and TIFR Mumbai on the way.

The course was concluded with Pilot Project presentation on April 24, 2009. A valedictory function was held on April 29, 2009 for Space Science together with SATMET course. Prof. U.R. Rao, Chairman, PRL council, kindly agreed to be the Chief Guest and distributed the Post Graduate diploma certificates to the successful course participants.

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Course participants after receiving their PG diploma certificates

THIRTEENTH POST GRADUATE COURSE ON REMOTE SENSING & GIS

The Thirteenth Post-Graduate Course on "Remote Sensing and Geographic Information System (RS & GIS)" of CSSTEAP, was commenced on October 1, 2008 at Indian Institute of Remote Sensing, (NRSC), Dehradun, one of the host institutions of CSSTEAP and ended on June 30, 2009. Total 15 participants from 10 countries of Asia-Pacific Region viz. Bangladesh-1; DPR Korea-2; India-1; Iran-1; Kazakhstan-1; Kyrgyzstan-2; Mongolia- 2; Myanmar - 1; Tajikistan- 2; Uzbekistan- 2 attended this course.

The entire course was divided into three semester. The semester-I focused on the principles of RS, GIS, GPS, image analysis, recent trends in RS & GIS technology, environmental analysis, monitoring and management. Semester-II dealt with several optional electives viz., advances in RS & GIS technology, Agriculture and soils, Forestry and Ecology, Geosciences, Water resources and Marine science. The major components of course syllabus was covered by the faculty of IIRS and additional Guest lectures by National and international Guest faculty on specialized topics were also arranged for the academic benefit of the course participants. The guest lecturers were from various Indian Organizations/ Institutes/Universities such as IMD, Dehradun; DEAL, Dehradun; RRSSC-Bangalore, CGWB, GSI, ONGC, WIGH, FSI, WII Dehradun; NIH, Roorkee; NRSC, Hyderabad; SAC, Ahmedabad, Andhra University, Visakhapatnam etc. The academic program of the course was organized through class room lectures, tutorials, practical, multimedia self learning packages, field excursion, seminar etc. Academic performance of the course participants was evaluated through periodic internal, semester and external examinations in form of written and practical examinations, class test, tutorials seminar. An educational visit to Andhra University, Visakhapatnam and National Remote Sensing Centre (NRSC), Hyderabad was organized in the second week of January, 2009. During their visit the course participants were exposed to academic activities of geoengineering department of Andhra university which included deliberation of lectures and field visit to coastal environment of Visakhapatnam. Participants also visited cyclone warning centre at Visakhapatnam. At NRSC, Hyderabad they were able to see the live satellite data acquisition at Shadnagar as well as various data processing and dissemination facilities. During this visit, the course participants also got opportunity to experience Indian rich historic, cultural and social heritage during the visits to various Indian cities such as Hyderabad and Visakhapatnam.

The third and final module with duration of three months started from April 01, 2009 and completed on

Course-participants during valedictory function

Mr. N Pant addressing the audience

June 26, 2009 with valedictory function. This module is basically designed to carry out pilot project work by the course participants. The objective of this module is to make the course participants capable to carry out research on their own, towards natural resources inventory, monitoring and management using RS & GIS techniques. The broad topics of the pilot projects under taken by the course participants during Module III were: soil erosion risk assessment; agroforestry systems and carbon-pool assessment; hyperspectral mapping of tree species; geoenvironmental mapping using SAR interferometry and multipolarization; mineral targeting using hyperspectral data; tectonic geomorphology; study of hydrological process using macroscale mdoel; snow melt runoff modeling; automated road extraction; location based services in GIS; land cover change detection using SPOT NDVI series data; remote sensing in monitoring sea ice; GIS customization of land information system.

The valedictory function of the Course was held on June 26, 2009. Mr. N. Pant, Member, Space Commission was the Chief Guest of the function. Dr. V.K. Dadhwal, Dean IIRS welcome the Chief Guest and other dignitaries. Dr. George Joseph, Director CSSTEAP presented a brief outline of the CSSTEAP. The Course report was presented by Course Director, Dr. S.K. Saha. The post graduate diploma certificates were awarded to the Course participants by the Chief Guest. He also delivered valedictory address on this auspicious occasion. He spoke about the role of satellite in the development of a country. Mr. Pant mentioned about the societal benefits of the Space technology. To mark the occasion a memoir was also released by Chief Guest.

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Dr. George Joseph Director, CSSTEAP attended the 52nd session of the committee on peaceful uses of outer space (COPUOS) meeting and presented the activities of CSSTEAP.

UN-OOSA also held a meeting with Directors of all the Regional Centres. It was attended by Dr. George Joseph, Director, CSSTEAP in addition to Dr. Joseph O. Akinyede, Executive Director, ARCSSTE-E, Nigeria; Prof. Abderrahmane Touzani, Director, CRASTE-LF, Morocco; Dr. Sergio Camacho Lara, Secretary General, CRECTEALC, Mexico; Dr. Tania Maria Sausen, Director, CRECTEALC Campus, Brazil and the officials of UN-OOSA.

Dr. George Joseph presented an assessment of the performance of CSSTEAP and outlook for the future, including possible organizational structure to enhance the performance of regional centres.

SATELLITES GAZE INTO PAST

Archaeology literally means 'study of ancient things'. It is concerned with human history and prehistory through recovery, documentation and analysis of physical remains including architecture, artefacts, human remains, and cultural land-scapes.

The exact origin of the discipline of archaeology is uncertain; however the interest in ancient monuments and the collection of antiquities have been taking place for thousands of years. The Greek historian Herrodotus (4th century BC) has speculated on monuments and remains that were already ancient at his time. Early archaeological work began as part of the Renaissance movement in Europe (14th to 17th centuries) when scholars embarked to study and collect the relics of classical antiquity. A systematic and documented guide to the ruins and topography of ancient Rome was made by Flavio Biondo an Italian Renaissance historian in the early 15th century for which he has been called one of the first archaeologists. Britain was one of the first countries to develop a systematic approach to archaeology and to recognise it as a discipline in its own right. Initial interest was from Clergymen, who recorded local landmarks within their parishes, documenting details of the landscape and ancient monuments. During the eighteenth and nineteenth centuries the speculative phase of archaeology transitioned into excavation phase involving scientific methodology. The pioneering effort of Thomas Jefferson (who latter became the 3rd President of USA) in 1784 was characterized by logical detection by carefully excavated evidence, an important basis for modern archaeological excavation.

During early nineteenth century an important realization in the thought of archaeological studies was the input that can be got from the works of ethnographers. The studies of the living communities in different part of the world could become starting point for archaeologists seeking to understand the lifestyle of early inhabitant or ancestors of the same communities. Many such ideas were developing in the evolving subject of knowing our past, but what put archaeology on the world map was the major discoveries in the nineteenth century of ancient civilizations in the old world and new world. Nepolean's military expedition of 1798-1800 to Egypt had brought public's attention to the magnificence of Egyptian civilization and discovery of the Rosetta Stone by one of his soldiers provided the key to understand the hieroglyphic writing in Egyptian and Greek scripts. This bilingual inscription helped Jean-Francois Champolian to finally decipher the hieroglyphs in 1822. Few French scholars collected and studied objects from the Mesopotamian ruins which lead to unlocking the secrets of another ancient script the Cuneiform writing. The travels of John Lloyd Stephens, American Lawyer and diplomat, to Yucatan revealed to the public the ruined cities of ancient Maya. Homer's account of the Trojan war in his narrative poem the Iliad, inspired the German banker Heinrich Schliemann to search for the city of Troy, which he succeeded in a series of field campaigns in western Turkey in 1870-80s.

New approaches

In the 20th century careful and systematic method of excavation were developed which improved the quality of evidence that could be obtained. Mortimer Wheeler developed and introduced new approaches to stratigraphic excavation. It is based on the principle of superimposition where layers or strata are overlain or buried by progressively younger deposits so that the oldest deposits are the deepest while the youngest are nearest the surface. This layering of soils one above another allows archaeologists to trace the development of a site and to place a range of archaeological remains (e.g. artefacts) within the layers into a time sequence.

Twentieth century also witenessed development of Archaeometry, a field of study that aims to systematize archaeological measurement. It emphasizes the application of analytical techniques from physics, chemistry, and engineering, focusing on the definition of the physical and chemical composition of archaeological remains for deriving information leading to better understanding of the past. Ascertaining the date of archaeological object has been possible by techniques such as: Radio carbon dating, by measuring the amount of carbon 14 an organic specimen contains; Thermoluminescence (TL) dating, by measuring the accumulated radiation dose of the time elapsed since material containing crystalline minerals was either heated (lava, ceramics) or exposed to sunlight (sediments) and Dendrochronology, by comparing the successive annual growth rings of trees

or old timber. Archaeometallurgy addresses the study of the history and prehistory of metals and their use through humans and lithic analysis deals with stone tools, carvings and other chipped stone artifacts. With these methods archaeologists found means of scientifically analysing objects of the past. The major break-through has been in determining the age of undated sites and finds anywhere in the world without recourse to complicated cross cultural comparisons with areas already dated usually by written records. Egyptian remains were one of the earliest to be dated using radiocarbon method and later this method was applied on many kinds of objects all over the world. Radiocarbon dating is also the most widely used dating technique.

Remote sensing whether from ground, aerial and space platform has indeed brought a whole new persepective to archaeological research. They have made possible to "see" the evidences that are not observable otherwise. Geophysical methods such as magnetometric survey, electric resistivity and Ground Penetrating Radar are used for subsurface mapping of archaeological sites. Geophysical instruments can detect buried archaeological features when their electrical or magnetic properties contrast measurably with their surroundings. Geophysical surveys may be able to give an idea of the subsurface feature without having to carry out excavation.

Usage and interpretations of imagery taken from aerial or space platform for archaeological purposes have been explored in many parts of the world. Its origin can be traced back to military reconnaissance during the first and second World wars. British archaeologists were among the earliest enthusiasts in this field. The advantage of seeing an archaeological site from above in the context of its surroundings was almost accidentally discovered by pilots like Lieutenant-Colonel G.A.Beazeley who was a sapper of the Royal Engineers in Mesopotamia during the first World war. He spotted distinct outlines of ancient canals in the course of his repeated flights over the Tigris-Euphrates plain (enemy territory at the time). He was charged with a survey of contested area beyond Baghdad, as a result of which ancient city known as 'Old Samarra' was discovered some sixty-five miles north-west of Baghdad.

It is often difficult to see an overall design in an archaeological site since most of them survive only in a ruinous state. Images taken from above gives an overall view of the landscape, the area covered by the site, its geographical context and natural environment, and also factors that have preserved archaeological evidence can be seen at a distance from above. By seeing from an elevated platform, scattered features come together as a unified whole and fragments acquire an identifiable pattern.

Remote sensing: a unique tool for archaeology

Aerial and space photography have shown their utility for archaeological purposes in many parts of the world. Human history can be traced also through the impacts of human actions upon the environment. The use of remote sensing technology offers archaeologist opportunity to detect impacts of human actions upon the environment, which are often invisible to the naked eye or from the ground. This technology has been successfully applied to study and monitor diverse aspects of earth's surface and sub-surface such as in forestry, agriculture, geology, urban plan, land use, land cover, ocean, climatology and coastal and riverine dynamics. Similar to these fields archaeology also has a land dimension and therefore archaeology is a potential application for remote sensing. Remote sensing data together with GPS for accurate ground-location could be used in determining and recognising features of historical significance for detecting, inventorying, and prioritising surface and shallow-depth archaeological information in a rapid, accurate, and quantified manner.

The techniques made available by space technology can be used for archaeological investigations in order to explore this new dimension to extract additional information. The unique characteristics of remote sensing techniques - which facilitates observation in multiple spatial resolutions, spectral bands and dates providing synoptic view where the site and its environs can be holistically studied - has lead to extracting exclusive information, which hitherto has not been possible with conventional methods of exploration. Remote Sensing provides different kinds of imagery based on varied parameters of the sensors aboard satellites. May it be of multiple spectral bands, spatial resolutions, repetivity of observation, stereo viewing to name a few. These various types of imagery can be selectively applied to a site depending on its nature and geography. Space-based remote sensing can be used for identifying archaeological sites as an alternative method analogous to the conventional survey that identifies

archaeological sites. The information derived from RS can be complementary or supplementary, subject to specific cases, to already known archaeological and historical knowledge of the site.

Remote sensing can be used as a tool for large-scale survey of archaeological sites and selection of individual sites for detailed study and to have broader understanding of site in context of its environment without the laborious task of physically surveying. Remote sensing can pinpoint to most productive areas for excavation. Looking from above one sees the sites in the context of their surroundings, and structural or layout features invisible from the ground become conspicuous. Therefore synoptic view readily facilitates making accurate maps and plans of sites marking all the surface features.

Apart from structures on the surface, remote sensing images also reveal buried structures through the difference in the growth of vegetation caused by them, which form patterns over ground following the lines of buried features, revealing their plan and layout. These are caused by disturbance of subsoil in the past such as ditches, drainage, isolation or defence, foundations, tanks, wells and pits of all kinds. If the effect of these underground archaeological features on the vegetation is favourable, then the vegetation grows taller and more copious. This is caused by archaeological features formed by subtraction of subsoil, for example ditches for drainage, isolation or defence and tanks, wells and pits of all kinds. These become silted over the years and the greater depth of soil encourages roots to penetrate further to utilize moisture and nutrients that are exhausted in the upper levels. If the subsurface features effect vegetation unfavourably it results in restrained growth where tightly packed features (such as stonewalled foundations, buried streets and solid floors) obstruct the roots. In either case they form patterns over the ground. These patterns are subtle and are not readily visible on ground. A synoptic view is vital to see these patterns over a large area in totality. Image processing transforms the image by enhancing features for human recognition, and analysis of satellite images leads to recognising features of significance to on-site archaeologists.

Remote sensing can be used for identifying neglected sites for fieldwork and sites that have potential to yield better understanding of the past. It can also be used to uncover certain mysteries in history. There could be legends or historical records which mention structures that once existed in the past. Remote sensing can be used to find them. One such example is finding the enclosure wall of the medieval township of Somanathapura.

Somanathapura is a town located 30 km from Mysore, Karnataka, India. This town is famous for Kesava temple built in thirteenth century during the reign of Narasimha III who was a king of Hoysala dynasty. At that time Hoysalas were the major power in South India. The Kesava temple is one of the best examples of Hoysala architecture built with steatite and is in a very well preserved condition. The temple is maintained by Archaeological Survey of India under the category of protected heritage sites. Historical records mention that the temple was once surrounded by a protective wall and a deep moat. At present it is difficult if not impossible to find vestiges of this wall or moat on ground. But when we analyse a remotely sensed image taken from space, the temple and its alignments with the surrounding land cover features reveals a pattern that befits a bounding wall. Fugure-1 is a multispectral FCC image taken by IRSP-6 LISS-IV on 24th March 2005 which gives an overall perspective of the landscape of Somanathapura including the temple, river, canal,

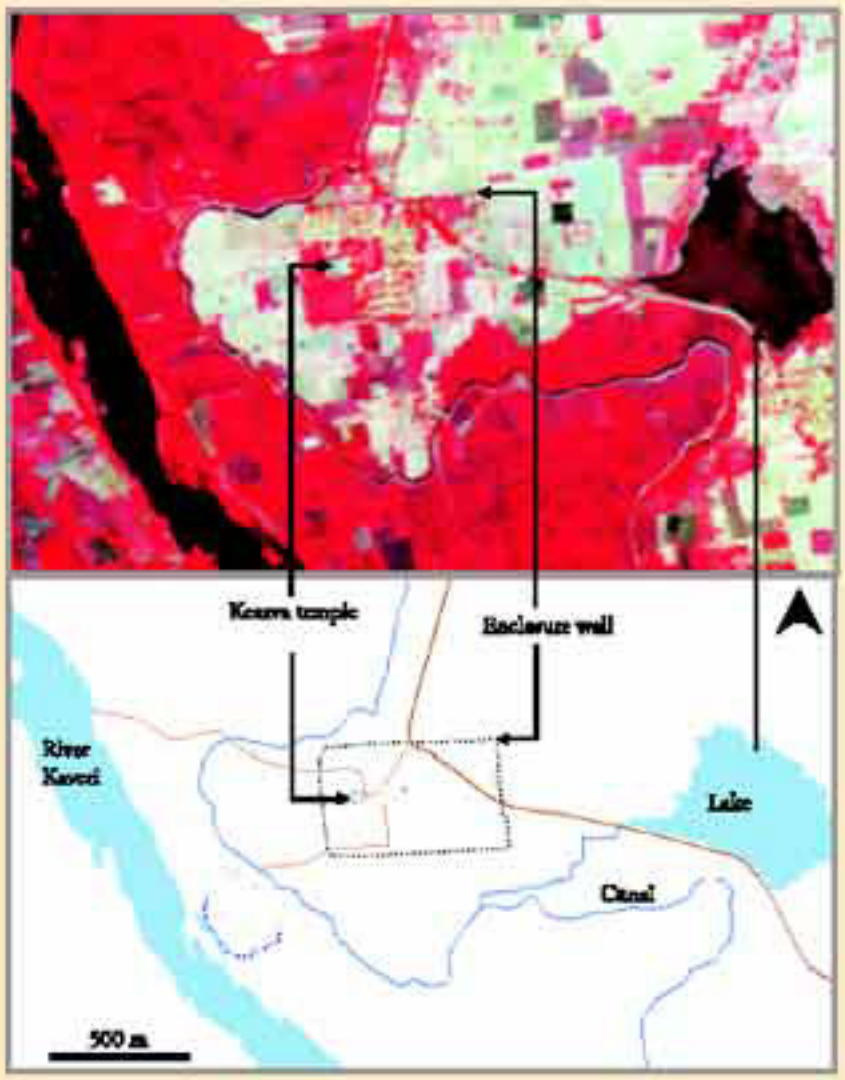

Figure 1: IRSP-6 LISS-IV (24 March, 2005) showing Somanathapura and environs

roads and the subtle signature where once stood a wall. The dark features that are almost black are water bodies; river Kaveri on the left and a lake to the right. A canal skirts around Somanathapura and the region between canal and river is the catchments area of the canal and is showing a high NIR reflectance due to the cultivation thereof. A small grey rectangular feature in the centre of the image is the Kesava temple. Synoptic view of this region reveals a much larger rectangle whose proportions are nearly similar to the temple and the temple is placed in a position that suggests some symmetry and harmonious arrangement of the whole layout. Most of the outer rectangle is vegetation-mark, which probably is the manifestation of the moisture retained in what was once a moat. The rest of the rectangle is connected with field boundaries and divisions between settlement and fields. This is probably due to the hard subsurface composed of remnants of the foundation of stone fort, which hinders vegetation and obstructs fresh construction on them. Therefore these lines become separators between two fields or two types of land cover. These lines together with vegetation marks collectively show the shape of a near complete rectangle. This pattern also suggests that the planning of the outer rectangle was in concordance with the temple or vice versa, which suggests that both belong to the same time period. The analysis on Somanathapura illustrates the usefulness of a multispectral RS images for identifying archaeological information.

Similar feature can be identified around Qin Shi Huang Di's Mousoleum near Xian in China, where traces of enclosure walls are preserved by field boundaries. Emperor Qin Shi Huang Di was the first Emperor of all China. He ascended the throne at the age of 13 in 246 BC. After conquering the last independent Chinese state in 221 BC, Qin Shi Huang was the king of a state of Qin ruling over the whole of China, an unprecedented accomplishment. Qin Shi Huang Di constructed a huge mausoleum for himself as he believed that life under ground after death was a continuation of life on earth. Construction of this mausoleum began in 246 BC and is believed to have taken 700,000 workers and craftsmen 38 years to complete. The Emperor Qin died in 210 BC while on the fifth tour of his empire. The construction of the tomb was not complete when he was buried. The tomb, as yet excavated, must have been magnificent, and the hillock marking its site can be seen from afar. Qin's mausoleum was like an underground treasure house, a subterranean palace with a protective outer wall of perimeter 6,210 m at ground level. On the southern half is the burial mound surrounded by an inner wall. Both walls had watch towers and gates leading out in all four directions. According to Chinese records the burial mound was 115m high when it was built and over the centuries has decreased to 76 m due to subsidence and erosion. With the emperor's tomb at the centre, some 600 satellite pits and tombs have been found within the area of 56.25 sq km and more continue to be discovered. The complex was constructed to serve as an imperial compound or palace. According to the Historian Sima Qian, the First Emperor was buried along with great amounts of treasure and objects of craftsmanship. The remains of the craftsmen working in the tomb may also be found within its confines, as it is believed they were sealed inside alive to keep them from divulging any secrets about the tombs riches or entrance. It was only fitting, therefore, to have this compound protected by the massive terracotta army interred nearby. Lifesize terracotta figures of warriors and horses arranged in battle formations are preserved and exhibited at the museum nearby which is set up on the site that was accidentally discovered in 1974 by local farmers while they were digging wells.

With such scattered treasure of great heritage significance one can think of using tools that will allow us to look at and survey swaths of several kilometres at once. This can be achieved with the help of the "eyes" in space. Figure 2 is an image taken by India's high resolution remote sensing satellite CARTOSAT-1 with a spatial resolution of 2.5m on 27 March 2007, which

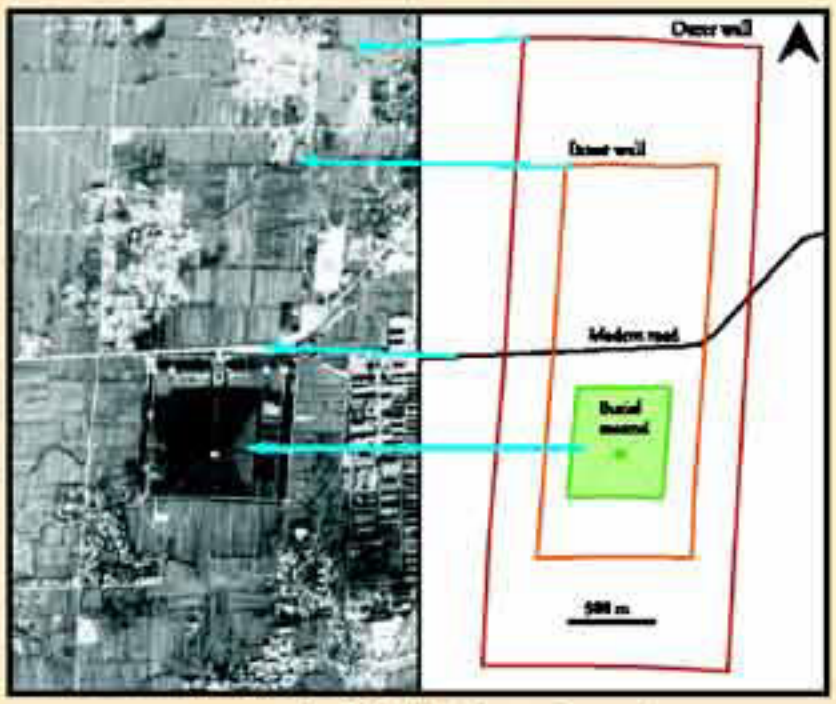

Figure 2: CARTOSAT-1 (27 March, 2007) Showing Emperor Qin's Mausoleum. Courtesy: National Remote Sensing Centre (NRSC), Hyderabad

gives an overall view of the whole area showing the mausoleum. The square pyramid of the mausoleum can be easily identified on the image because of its shape and the uniform vegetative cover over the pyramid. Identifying such uniformly coloured geometric shapes could be used as keys to find more. The protective outer wall, which surrounds the pyramid in a rectangular shape with length around 2km, width around 1km and the inner wall, can be identified as linear features in the image. These features are preserved on the ground as field boundaries or footpaths and roads, an example for a historical setting altering the landcape. This study can be further extended to multispectral data analysis as presence of artifacts and construction underground would apply a stress on the vegetation that grows over it. This would affect the spectral reflectance of the area and in turn may result in that area becoming easily identifiable in contrast with its surrounding.

Both examples mentioned above have demonstrated potential of optical data, whether multispectral or PAN, in identifying features of archeological significance. Further more, active remote sensors such as radar will be able to penetrate the land surface and vegetation. By using stereo images and generating Digital Elevation Models (DEM) of an archaeological landscape, one can gener-ate perspective views and conduct visibility analysis, which will help in cultural resource management by providing information for maintenance of the site. Perspective views can be used in planning and executing any modern activities or construction in the landscape. DEM can also be used to analyze implications of flood on or around archaeological sites that are located in flood prone regions either on riverbanks or coasts. These are some of the methods that space based remote sensing can be applied for archaeological research. Different sites throw open different kinds of challenges by demanding different analysis based upon the geographical context of the site. It is up to the researchers to carefully understand different dimensions of the site which include history, archaeology, geography and geology, and apply relevant space based remote sensing tools for best results to rediscover and better understand our past.

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FORTHCOMING SYMPOSIUM/WORKSHOP IN AREA OF SPACE SCIENCE & TECHNOLOGY

S.No	Theme	Duration	Location	Web address
1.	The 27th International Symposium on Space Technology and Science (27th ISTS)	July 5-12, 2009	Tsukuba, Japan	http://www.ists.or.jp/index.html
2.	2009 IEEE-RIVF International Conference on Computing and Telecommunication Technologies	July 13-17, 2009	Da Nang, Vietnam	http://hiroshi.motoda.jp@aoard.af.mil
3.	Workshop on Applications of Tele-health to Service Delivery in Public Health and Environment	July 27-30, 2009	Thimphu, Bhutan	http://www.oosa.unvienna.org/oosa/en/SAP/sched/index.html
4.	DAC 2009: IEEE Design Automation Conference	July 26-31, 2009	Anaheim, CA, USA	http://www.dac.com/46th/index.aspx
5.	10th South East Asia Survey Congress (SEASC) 2009	August 4-7, 2009	Bali, Indonesia	http://www.seasc2009.org/
6.	3rd ICA Workshop on Geospatial Analysis and Modeling	August 6-7, 2009	Gävle, Sweden	http://www.hig.se/~bjg/ica/workshop2009/

S.No	Theme	Duration	Location	Web address
7.	Map Asia 2009	August 18-20, 2009	Singapore	http://www.mapasia.org/
8.	Third Central Asia GIS Conference GISCA 2009, GIScience for Environmental and Emergency Management in Central Asia	August 27-28, 2009	Bishkek, Kyrgyzstan	http://www.aca-giscience.org/gisca09
9.	IGeoMAP Conference	August 28-29, 2009	Bangalore, India	http://www.igeomap.org/Home..html
10.	IAG2009 Geodesy for Planet Earth	August 31 - September 4, 2009	Buenos Aries, Argentina	http://www.iag2009.com.ar/
11.	8th IAA International conference on low cost Planetary Missions (LCPM-8)	August 31- September 4, 2009	Goa, India	http://lcpm8.isro.gov.in/UI/Index.aspx
12.	The 8th International Conference on Urban drainage modelling	September 7-11, 2009	Tokyo, Japan	http://www.env.t.u-tokyo.ac.jp/8UDM/
13.	United Nations/Austria/ESA Symposium on Integrated Space Technologies Applications - to Support the Plan of Implementation of the World Summit on Sustainable Development	September 8-11, 2009	Graz, Austria	http://www.oosa.unvienna.org/oosa/en/SAP/sched/index.html
14.	6th International Symposium on digital earth (ISDE6)	September 9-12, 2009	Beijing, China	http://www.isde6.org/index.html
15.	United Nations/Peru/ESA/UNEP/UNESCO Workshop on Integrated Space Technologies Applications for Sustainable Development in the Mountain Regions of Andean Countries	September 14-19, 2009	Lima, Peru	http://www.oosa.unvienna.org/oosa/en/SAP/sched/index.html
16.	International conference on Geo-spatial solutions for Emergency Management (GSEM)	September 14-16, 2009	Beijing, China	http://www.gsem2009.org/welcome.html
17.	Symposium on Advances in Geo-spatial technologies with special emphasis on sustainable rainfed agriculture	September 17-19, 2009	Nagpur, India	http://www.iarsnagpur2009.org
18.	UN/ESA/NASA/JAXA Workshop on Basic Space Science and the International Heliophysical Year 2007	September 22-25, 2009	Jeju, Republic of Korea	http://www.oosa.unvienna.org/oosa/en/SAP/sched/index.html
19.	5th International Conference on Asian and Pacific Coasts (APAC 2009)	September 23-25, 2009	Singapore	http://www.apac2009.org/APAC2009.pdf.
20.	United Nations/ESA/USA Training Course on Satellite Navigation and Location Based Services at the African Centre for Space Science and Technology- in French language (CRASTE-LF)	September 29 - October 24, 2009	Rabat, Morocco	http://www.oosa.unvienna.org/oosa/en/SAP/sched/index.html
21.	APSCC 2009 Satellite Conference & Exhibition	September 29 - October 1, 2009	Kulala Lumpur, Malaysia	http://www.apscc.or.kr/event/apscc2009.asp
22.	COAST GIS 2009	September 30 - October 2, 2009	Santa Catarina, Brazil	http://www.coastgis.com.br/ index.php
23.	19th United Nations/International Astronautical Federation Workshop on Integrated Space Technologies and Space-based information for Analysis and Prediction of Climate Change	October 9-11, 2009	Daejeon, Republic of Korea	http://www.oosa.unvienna.org/oosa/en/SAP/sched/index.html
24.	World Climate Conference-3	October 12-16, 2009	Geneva, Switzerland	http://www.wmo.int/wcc3/
25.	ACRS 2009	October 19-23, 2009	Beijing, China	http://www.cners.org/index.html
26.	Pacific Island countries RS & GIS user conference	December 1-3, 2009	Suva, Fiji	http://www.piciaoc.org/GISRS
27.	APMC 2009 Asia-Pacific Microwave Conference	December 7-10, 2009	Sinagapore	http://www.apmc2009.org/public.asp?page=home.htm

FROM MEMBER COUNTRIES

ISRO LAUNCHED RADAR IMAGING SATELLITE (RISAT)

RISAT-2 is a Radar Imaging Satellite with the capability to take images of the earth during day and night as well as cloudy conditions. RISAT-2 was launched from Satish Dhawan Space Centre SHAR (SDSC SHAR), Sriharikota on April 20, 2009, ISRO's Polar Satellite Launch Vehicle (PSLV-C12) successfully placed two satellites - RISAT-2 and ANUSAT - in the desired orbit.

RISAT-2 weighing about 300 kg was realised by ISRO in association with Israel Aerospace Industries. The satellite was placed in an orbit of 550 km height with an inclination of 41 deg to the equator and an orbital period of about 90 minutes. This satellite will enhance ISRO's capability for earth observation, especially during floods, cyclones, landslides and in disaster management in a more effective way.

In this mission, in addition to RISAT-2, PSLV also carried A 40 kg micro satellite named ANUSAT, built by Anna University, Chennai. ANUSAT is the first experimental communication satellite built by an Indian University under the over all guidance of ISRO and will demonstrate the technologies related to message store and forward operations.

(Source : www.isro.gov.in)

FOCAL POINTS FROM MEMBER COUNTRIES

Prof. Jo IL Gwang, Institute of RS & GIS (IRSG) has been identified as the focal point from DPR Korea for CSSTEAP education and training activities.

DPR Korea

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In order to have more pro-active role with the activities of the centre, CSSTEAP requests GB members to identify focal points from the member countries which would help in specifying nation specific training needs, identifying the need of training for the candidates. There is a need for identifying focal points from each country to work with CSSTEAP as partners towards capacity building.

ALUMNI SPEAKS

Ms. Tuyatsetseg Badarch from Mongolia was a student of CSSTEAP during 2005-06 SATCOM PG Course. She shares with us about her experience at CSSTEAP how she has used the knowledge gained at CSSTEAP back home.

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Ms. Tuyatsetseg Badarch

Thank you very much for the invitation to contribute for the Alumni speaks column in CSSTEAP newsletter. Of course this is really a wonderful opportunity for me to share my experience at CSSTEAP with others. During the period of my stay at CSSTEAP, I not only got sufficient knowledge in space science but also fulfilled a life long ambition to visit India. I visited and enjoyed a lot visiting places like Ahmedabad, Delhi, Agra, Dehradun, Hyderabad, Visakhapatnam etc. I met excellent professors and very active classmates from many other countries. I gained much from CSSTEAP for my professional, language and career opportunities. The course at CSSTEAP helped my career growth, since after CSSTEAP I joined at National Tsing Hua University for PhD in my professional field, Wireless communications, under Taiwan government scholarship from 2007. I was also invited to become a principal candidate for next year Fulbright Science and Technology Award of USA from Mongolia.

My English language has also improved, as is evident from the impressive high TOEFL score, ibt 113, on 28th February, 2009. I wrote one book namely "TOEFL/IELTS preparation self study book for intermediate level people" in 2006 in English language. I wrote the first edition of my professional book in 2004. This was "Data Communication and Computer Network Technologies" which is of 386 pages. The second edition of the professional book, two series books (first. Fundamentals of Computer Network, data transmission technologies, second, Computer Network Technologies) is under preparation to republish soon.

Since the graduation of CSSTEAP, I have been writing one more book ("Fundamentals of Wireless communications and Space Science Theory") in my professional field including space science and is about to complete.

I also try to do good contribution in my professional field via my students, research papers and professional jobs. These few examples show the improvement of my career, professional and English language proficiency as a result of education at CSSTEAP. My paper of PG thesis using signal processing in Satellite communication from CSSTEAP was presented at the National Young Scientists conference in 2007, Mongolia, and was published in national recognized scientists journal.

The CSSTEAP education not only helps the participants to enhance their own knowledge and experience but also a valuable contribution for their home countries through the participation of the scholars back at home.

I am really happy with the satellite communication course and all associated activities of the course. I especially thank Director, CSSTEAP, all professors, and engineers, staffs who helped us during the course period whole heartedly to enhance the development of Asia and the Pacific Region.

Thank you once again for your kind invitation.

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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. Department of Space, Government of India has made

CSSTEAP Hqrs. at Debradun

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 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 completion of 1 year project).

ONGOING COURSES

1) Fourteenth 9 month Post Graduate course in RS & GIS at IIRS, Dehradun from July 1, 2009.
2) Seventh 9 month Post Graduate course in Satellite Communications at SAC, Ahmedabad from August 1, 2009.

FUTURE COURSES

1) Seventh 9 month Post Graduate Course in Satellite Meteorlogy & Global Climate at SAC, Ahmedabad from August 1, 2010 to April 30, 2011.
2) Seventh 9 month Post Graduate course in Space & Atmospheric Science at Ahmedabad from August 1 2010 to April 30, 2011.

CSSTEAP welcomes 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 welcome. Views expressed in the articles of the newsletter are those of the authors.