

CSSTEAP Newsletter

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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.

MINI-SAR ON CHANDRAYAAN-1 FINDS ICE DEPOSITS AT MOON'S NORTH POLE

Analysis of data obtained by the Miniature Synthetic Aperture Radar (Mini-SAR) onboard Chandrayaan-1 spacecraft has provided evidence for the presence of ice deposits near the moon's North pole. The Mini-SAR instrument found more than 40 small craters (2-15 km in diameter) with sub-surface water ice located at their base. The interior of these craters is in permanent sun shadow.

Prof. Paul Spudis, Principal Investigator of the Mini-SAR experiment said "The new discoveries by Chandrayaan-1 and other lunar missions show that the moon is an even more interesting and attractive scientific, exploration and operational destination than people had previously thought."

The Mini-SAR mapped the moon's permanently shadowed polar craters that are not visible from Earth. The radar uses the polarisation properties of reflected radio waves to characterise surface properties. Results from the mapping showed deposits having radar characteristics similar to ice. The emerging picture from the multiple measurements and resulting data of the instruments, Moon Mineralogy Mapper and Mini-SAR on Chandrayaan-1 and NASA's Lunar Crater Observation and Sensing Satellite (LCROSS), indicates that water creation, migration, deposition and retention are occurring on the moon.

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The Mini-SAR's findings have just been published in the Journal, Geophysical Research Letters authored by scientists from 13 agencies from USA and India, including Prof. J. N. Goswami, Principal Scientist, Chandrayaan-1 from Physical Research Laboratory, Ahmedabad and Dr M. Chakrabarty of Space Applications Centre, Ahmedabad. The new findings add to the growing scientific understanding of the multiple forms of water on the moon.

Mini-SAR and Moon Mineralogy Mapper are two of the 11 instruments on Chandrayaan-1, which was launched on October 22, 2008, and began orbiting the moon on November 8, 2008. The Applied Physics Laboratory, USA performed the final integration and testing on Mini-SAR. It was developed and built by the Naval Air Warfare Center and several other commercial and government agencies in USA.

(Source - www.isro.gov.in)

FOURTEENTH POST GRADUATE COURSE ON REMOTE SENSING & GIS

The Fourteenth Post-Graduate Course on "Remote Sensing and Geographic Information System (RS & GIS)" of CSSTEAP, was commenced on July 1, 2009 at Indian Institute of Remote Sensing, (NRSC), Dehradun, one of the host institutions of CSSTEAP and concluded on March 30, 2010. Total 17 participants from 11 countries of Asia-Pacific Region viz. China 1; Cambodia-1; India-1; Kyrgyzstan-2; Mongolia- 2; Myanmar - 2; Nepal-1, Sri Lanka-1, Thailand-2, Uzbekistan-1 and Vietnam-3 attended this course.

The entire course was divided into two semester. Semester-I consist of principles of RS, GIS, GPS, image analysis, recent trends in RS & GIS technology, environmental analysis, monitoring and management. Semester-II dealt with 4 optional electives viz., Advances in RS & GIS, Agriculture and soils, Water resources mangement 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; TIFR Mumbai; IIT Kharagpur; IIT Roorkee; CSWCR & TI, Dehradun; NTRO, Delhi; RRSC-N, NRSC, Hyderabad; IASRI, New Delhi; SAC, Ahmedabad; Andhra University, Visakhapatnam etc. International Guest faculty from Mc. Gill University, Canada and ITC, The Netherlands delivered lectures during the course. The academic program of the course was organized through class room lectures, tutorials, practical, multimedia self learning packages, field excursion, seminar etc. State of art software and hardware for digital image processing, GIS analysis and earth processes & natural resources management modeling were used for computer based practical exercises and also for execution of pilot project work. Lecture notes in the form of printed books and



Dr. VJayaraman, Chief Guest addressing the gathering

supplementary reading materials were distributed well in advance to 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. 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 of about two weeks duration to Andhra University, Visakhapatnam and National Remote Sensing Centre (NRSC), Hyderabad was also organized. During this visit the course participants were exposed to academic activities of geo-engineering 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 at NRSC, hyderabad. 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.

In order to provide a wider exposure in the field of geoinformatics, all the participants were given opportunity to attend international conference and exhibition on geospatial information Technology and application (Map India 2010) held from 19-21 January, 2010 at Gurgaon, India. In addition to this, two of the course participants from Agriculture and soil background also attended workshop on "Impact of Climate change on agriculture" at SAC, Ahmedabad organized by ISPRS workshop VIII 8/6 from December 17-18, 2009.

The third and final module with duration of three months started from January 01, 2010 and completed on March 30 2010 with valedictory function. This module is basically designed for 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 cropping pattern inventory, multi annual temporal data for forest types classification, circulation pattern and its transport in tropical Indian ocean, water and energy balance studies, snow melt modeling, topographic database extraction, study of Gangotri glacier dynamics, automatic tree line extraction, building reconstruction using satellite and ground based techniques, assessment of surface and sub-surface water logging in irrigated command area, Geospatial weather information system, mobile mapping in updating urban infrastructure information, hyperspectral data for mapping surface features,



Participants with dignitaries during valedictory function

multicriteria decision modeling, study of wave spectra using SAR data, soil erosion risk assessment.

The valedictory function of the Course was held on March 29, 2010. Dr. V. Jayaraman, Director, NRSC was the Chief Guest of the function. Dr. S.K. Saha, Course Director welcomed the Chief Guest and other dignitaries, Dr. V.K. Dadhwal, Dean IIRS and Director, CSSTEAP presented the brief outline of the CSSTEAP. The Course report was presented by Course Coordinator Dr. S.P. Aggarwal. The post graduate diploma certificate was awarded to the Course participants by Chief Guest. He also delivered valedictory address on this auspicious occasion. To mark the occasion a memoir was also released by Chief Guest.

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SEVENTH POST GRADUATE COURSE IN SATELLITE COMMUNICATIONS

The Seventh Post Graduate course on Satellite Communications started on 1st August 2009 at Bopal Campus of Space Applications Centre Ahmedabad. Seventeen participants from nine countries are attending this course. Total 17 participants from 9 countries namely Bhutan-1; India-4; DPR Korea-2; Maldives-1; Mongolia-2; Myanmar-3; Nepal-2; Sri Lanka-1; Tajikistan-1.

The syllabus of the SACOM-7 course was adopted on the basis of Grenada and Frascati documents of UN-OOSA and are based on the recommendations of the Board of studies held in 2007. The course curriculum was divided into two semesters covering different

aspects of satellite communications and a pilot project. Participants were also required to make seminar presentations periodically on various topics given to them. This exercise was carried out to improve their presentation skills.

The Semester II commenced from November 30, 2009 and had the following papers.

- ? Digital Signal Processing.
- ? Broadcasting using communications Satellites
- ? Applications and trends in Satellite Communications
- ? Operational Communication Satellite Systems, Network Planning, Management and Operational



Dr. George Joseph delivering valedictory address

Issues.

- ? Pilot projects, the topics covered in the pilot project will be oriented towards the one year project to be carried out in the Home country.

The faculty for these subjects were drawn from Organisations like Door Darshan, Department of Telecommunication (NOCC) and commercial SATCOM Organisation like MeaSAT apart from ISRO Centres. The students during their educational tour to North India were exposed to operational systems at Door Darshan, NOCC, Delhi Earth Station and IGNOU tele-educations systems. Apart from the educational visit, the students also visited place of historic importance like Taj Mahal, Qutub Minar, Red fort, etc. Students were allotted pilot projects on various SATCOM applications and technologies relevant to their country. Semester-II examinations were conducted between February 15, 2010 to February 19, 2010. After the examinations students with close interaction with CSSTEAP guides carried out their pilot project work, prepared report and a viva-voce was conducted as an internal assessment on their project work. The students were taken to Andhra university on April 21, 2010 and final viva-voce was conducted by a expert team nominated by Andhra University on April 24, 2010.

Detailed lecture notes, subject references and reading materials were distributed to the participants. Library facilities of SAC and internet facilities were made available to the participants. Laboratories and earth station facilities of SAC were provides for hands on experience in working with different communication systems. Question bank on each paper was made available to the participants for preparation of examination. A separate CSSTEAP network was installed with access from classroom, laboratory and

hostel. Some of the expert lectures from other ISRO centres were conducted through video conference. To evaluate the progress of participants, internal assessment through tutorials, tests and viva voce was carried out at periodic intervals apart from the semester examination.

As a part of the nine months PG course, each participant is required to work on a pilot project. This project is oriented towards the 12 months project work at their own country done after the PG course. The topics for the pilot project were identified after several sessions of discussions with the participants. Project guides from SAC were identified for providing technical guidance. Each of the participants submitted the report on the selected topic of the pilot project. Some of the topics selected for the project were : Transportable SATCOM terminals for multimedia applications; multi programme ground station based on software radio technology; study and design of FPGA based GMSK modem; Network management for return link of DVB-RCS system; study and design of a stabilized Ku band antenna for ships; satellite based telemetry control and video downlink for UAV; Ka-band antenna for aero-mobile platforms; design of interactive service model using DVB-MHP technology; study and analysis of adjacent satellite interferences; design of intelligent step track system for SATCOM ground station; realization of GSM technology over satellite for disaster management; satellite based distress alert system; simulation of various binary offset carrier modulation signals; enhancement of radio broadcasting for regional services via satellite; reliability study of earth station; design of train tracking system; satellite based weather data collection system.

Course Director in his report mentioned that the Post graduate course was divided into four semesters out of which two semesters of nine month duration was conducted at SAC leading to Post Graduate Diploma while the remaining two semesters will be at their own country perusing the project work which was initiated as part of PG Diploma. The 'module' concept during earlier SATCOM course was replaced by 'Paper' concept in which both theory and practical were taken as separate papers as recommended by Board of studies committee. The faculty were drawn from premier educational institutions, retired ISRO scientist, existing ISRO staff and lecturers from other government departments with vast experience. Seminars on topics related to societal applications were conducted which



Participants with dignitaries during valedictory function

improved the participants awareness of various societal problems and also improved their presentation skills. Educational tours were conducted across the country to important SATCOM and Space technology facilities and infrastructure. Apart from the educational tours, visits were also conducted to give the participants a glimpse of Indian heritage and culture. The Course Director also briefly mentioned about the continued effort by the organisers to enhance the smooth conduct of the course. Some of them listed by him are, Video recording of the lecture proceedings, archival and access to the archival of all the course material of past, present materials in multimedia form, creation of question bank. Creation of CSSTEAP network and extension of the network to the hostel rooms to access archival any time, etc. The topics of the project work were arrived after lot of discussions and the students had shown lot of interest on the topics given to them which was appreciated by Andhra University during their presentation as part of viva voce.

The seventh Post Graduate Diploma Course on Satellite Communications was completed on April 30 2010. The Passing out ceremony and the valedictory function for this course was held on the same day. Chief Guest, former CSSTEAP Director Dr. George Joseph distributed the PG Diploma certificates to all the participants. 14 of them passed with distinction and 3

were placed in first Class. The first three Rank holders received medals and certificates from Chief Guest, Director, CSSTEAP and Director SAC respectively. On this occasion Director CSSTEAP released the CD containing the syllabus and the course materials. The Memoirs of this course was released by the Director, SAC.

At the beginning Director SAC welcomed Chief Guest, other dignitaries, participants, and other invitees. Director CSSTEAP in his address congratulated the students on their successful completion of the course with flying colours and advised the students to use the knowledge gained for growth of their organization and asked the students to pursue the project work after they go back to their organisations.

The Chief Guest in his address mentioned about how the communication technology plays an important role in the development of society in the all major fields like education, disaster management, healthcare etc. He spoke about the past and present technologies and gave a broad overview of what is expected in coming days. He advised the students to be the ambassadors for promoting CSSTEAP activities so that more and more people get benefit out of it.

On behalf of the participants two students gave their feedback on the conduct of the course. All the students expressed their views that the overall conduct of the course was extremely good with good quality teaching, practical and educational visits. The classroom arrangements and hostel stay was comfortable.

The valedictory function was concluded with vote of thanks from the P.Satyanarayana, Course Coordinator.

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INTERNATIONAL SHORT TRAINING COURSE ON "HIGH RESOLUTION AEROSPACE IMAGE ANALYSIS FOR GEOHAZARD ASSESSMENT"

Three weeks International Training Course on "High Resolution Aerospace Image Analysis for Geohazard Assessment" was jointly conducted by Indian Institute

of Remote Sensing (IIRS) and Faculty of Geo-Information Science and Earth Observation (ITC), of the University of Twente, The Netherlands under



Participants alongwith Faculty and Dean, IIRS

sponsorship of United Nation University (UNU) and Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP), India at IIRS, Dehradun during 25th January to 12 February, 2010. It was a unique course which has been integrated as one module of 10 months P.G. Diploma course in Geohazards. The course was attended by total of 26 participants comprising 8 Nos. of P.G. Diploma course participants, 5 Nos. of International participants from Uzbekistan, Nepal, Bangladesh, Sri Lanka and Nigeria and 13 Nos. participants from various state and Central Government organizations of the country.

The training course was aimed at developing skills in interpretation of high resolution satellite (HRS) images (IRS Resourcesat-1 and Cartosat-1 satellite data) in extracting information on the earth's surface features and processes of natural hazards such as land slides, neotectonics, land degradation, forest degradation, flood, coastal, and urban related hazards. Dr. Robert Voskuil and Michiel Damen faculty of ITC, The Netherlands and IIRS faculty demonstrated image interpretation techniques and terrain analysis using high resolution satellite data. Special attention of the course was to combine satellite derived DEM with HRS data to generate Anaglyph and stereo pair for 3-D visualization of terrain and on screen image interpretation for various natural hazards using anaglyph glasses and screen scope mounted on computer monitor. Adequate exposure was given to participants by conducting lectures, interactive demonstration and practical exercises. Two days field excursions were also conducted in Doon valley area to demonstrate and validate image interpretation of HRS for soil erosion features, landslide, main boundary thrust and neotectonic features.

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SHORT COURSE ON "APPLICATION OF SPACE TECHNOLOGY FOR DISASTER MANAGEMENT SUPPORT WITH EMPHASIS ON GEOLOGICAL RISK MANAGEMENT (DMS-GRM)"

An International training course on "Application of Space Technology for Disaster Management Support with emphasis on Geological Risk Management (DMS-GRM)" was organized by Centre for Space Science and



Participants alongwith Faculty, Course Coordinator and Director, CSSTEAP

Technology Education in Asia and the Pacific (CSSTEAP) at Indian Institute of Remote Sensing (IIRS), NRSC, Dehradun during April 12 May 07, 2010. The course was inaugurated on April 12, 2010 by Padhma Bhushan Dr. George Joseph, former Director CSSTEAP, Dehradun, who had conceptualized the program during his tenure as Director, CSSTEAP. This course was also supported by Faculty of Geoinformation Science and Earth Observation of the University of Twente and UN University ITC School, the Netherlands.

Fourteen professionals from 10 countries, i.e. India, Kazakhstan, Kyrgyzstan, Lao PDR, Maldives, Mongolia, Nepal, Sri Lanka, Uzbekistan and Vietnam participated in this program. The participants came

from different organizations such as operational agencies, research institutes, Universities etc. The course was designed keeping in view of the background of the course participants and utilization of space technology using remote sensing and also communication technology effectively for Disaster Management Support with emphasis on Geological Risk Management.

The lectures were delivered by expert faculty drawn from various ISRO centers such as Space Applications Centre (SAC), Indian Institute of Remote Sensing (IIRS) and also from various other national organizations and International NGO.

Topics related to Landslides, Earthquake, Glacial Lake Outburst, Mining and Volcanic hazards etc. were presented by experts. At the end of this training program, the participants were provided with a CD ROM consisting of the lectures notes, presentations

materials and public domain software (PostgreSQL, QGIS, ms4w) for their future use.

As a part of the program, the participants visited Wadia Institute of Himalayan Geology, Dehradun to see advance instrumentation and for interaction with Himalayan geology experts. They were also taken for a field trip to Dehradun-Mussoorie and adjoining areas to get an understanding of Himalayan geology, neotectonic features and related hazards. The course was successfully concluded with valedictory address and distribution of certificates by Prof. S K Bhattacharyya, Director, Central Building Research Institute (CBRI), CSIR, Roorkee. Overall, the course has received very good feedback and suggestions on improvement in future.

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EXCERPTS OF INAUGURAL ADDRESS - CSSTEAP SHORT COURSE (DMS-GRM)

Short course on Application of space technology for disaster management-Geological Risk was organized from April 12-May 7th 2010 at IIRS, Dehradun. Inauguration of the course was held on April 12, 2010 and Dr. George Joseph was Chief Guest. On this occasion, he addressed to the participants. Some of the excerpts are :

Natural hazards are part of our life. These hazards become a concern to us when it turns to be disaster affecting people's life and livelihood. Many of the Asia and Pacific developing countries are situated in the world's hazard belts and are subject to floods, droughts, cyclones, earthquakes, windstorms, tidal waves, land slides, etc. According to a report by ADPC loss of life from natural hazards in Asia amounted 2/3 of the total global mortality due to natural hazards. Vulnerability to hazards has increased due to the increased aggregation of people in urban centers, environmental degradation, and a lack of planning and preparedness. The developing countries suffer more because of the poor socio-economic conditions, lack of awareness and inadequate proactive administrative intervention. Besides the usual natural forces, we should recognize there is an extremely important human factor which amplifies the level of destruction and thereby transforms events of natural hazards into major disasters

A geologic hazard is a natural geologic or earth processes or phenomena which includes internal earth processes, such as earthquakes, tsunami, volcanic activity and emissions as well as external processes such as landslides, surfaces collapses etc. Geology-related disasters are generally some of the most destructive natural disasters in terms of human lives lost and property and infrastructure damaged. Our region covers many areas of high seismic activity. It has been estimated that during the last 300 years over 2.5 million have died around the world as a result of earthquakes and that nearly 75 per cent of these fatalities occurred in Asia and the western Pacific. In addition to loss of life the national economies of developing countries in Asia and the Pacific are significantly affected by the loss of scarce resources that could otherwise have been used for social and economic development. Thus in many cases the development process has been set back years or decades. Thus our insensitivity to take appropriate action for hazard mitigation not only affects the present generation but also creates hardship to the future generation.

Though it is almost impossible to completely neutralize the damage due to these disasters, it is possible to reduce the impact of disasters by adopting suitable disaster management and mitigation strategies such as:

- pre-disaster planning, preparedness
- minimize the potential risks by developing disaster early warning strategies
- prepare and implement developmental plans to provide resilience to such disasters,
- mobilize resources including communication and tele-medical services
- damage assessment and relief management to help in post-disaster rehabilitation.

These activities require rapid and continuous data and information generation or gathering. The mitigation of the effects of disasters requires relevant information regarding the disaster in real time. Since disasters that cause huge social and economic disruptions normally affect large areas or territories it is not possible to effectively collect continuous data on them using conventional methods.

Space systems from their vantage position have unambiguously demonstrated their capability in providing vital information and services for disaster management. The Earth Observation satellites provide comprehensive, synoptic and multi temporal coverage of large areas in real time and at frequent intervals and provides continuous monitoring of atmospheric as well as surface parameters related to natural disasters. For example Geo-stationary satellites provide continuous and synoptic observations over large areas on weather including cyclone-monitoring. Polar orbiting satellites have the advantage of providing much higher spatial resolution imageries, though at a lower temporal frequency, which could be used for detailed monitoring, damage assessment and long-term relief management.

The vast capabilities of communication satellites are available for timely dissemination of early warning and real-time coordination of relief operations. The advent of Very Small Aperture Terminals (VSAT) and Ultra Small Aperture Terminals (USAT) etc. have enhanced the capability of using satellite based communication by offering low cost, viable technological solutions towards management and mitigation of disasters. Communication satellites capabilities-fixed and mobile are vital for effective communication, especially in data collection, distress alerting, position location and coordinating relief operations in the field. In addition, Search and Rescue satellites provide capabilities such as position determination facilities onboard which could be useful in a variety of land, sea and air distress situations.

World community has realized the importance of using space technology to reduce vulnerability due to disasters. In recognition of the need to increase support to deal with increasing disasters the United Nations General Assembly, by a resolution in December 2006, acknowledged that the use of existing space technologies, such as earth observation and meteorological satellites, communication and navigation satellites can play a major role in supporting risk and disaster management by providing accurate and timely information for decision-making. This led to the establishment of the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER), implemented by the United Nations Office for Outer Space Affairs (UNOOSA). The programme aims at providing universal access to all types of space-based information relevant to disaster management at all stages of the disaster management.

Some of the possible areas wherein space technology can be effectively used include:

1. In-time satellite images of disaster affected areas for the support of relief forces' logistics,
2. long term series of satellite images for trend analysis and risk assessment,
3. Transmission via satellite of in-situ data e.g. in early warning systems,
4. Satellite-based navigation and telecommunication systems to support relief forces in the field, and
5. Specific telecommunication support for medical aid in remote disaster areas (telemedicine).

So there is a broad application potential of the space technology to cater to the needs on the disaster management. But in order for developing countries to be able to incorporate the use of space technology-based solutions there is a need to increase awareness, build national capacity and also develop solutions that are customized and appropriate to the needs of the developing world. I sincerely hope the various courses



organized by CSSTEAP will cater to such needs. I wish and hope that the knowledge gained from the course will be fruitfully utilized for the welfare of your respective countries.

Dr. George Joseph
Former Director, CSSTEAP

UNDERSTANDING HYDROGEOLOGIC FRAMEWORK AND ASSESSING GROUND WATER QUALITY AND RESOURCES AROUND AYADAW TOWNSHIP (MU WATERSHED) IN MYANMAR USING GEOSPATIAL TECHNOLOGY

(This is a summary of the one year followup project of M.Tech degree awarded to the student of RS & GIS PG Course year 2007-2008.)

The present study deals with groundwater investigations in the northwestern part of Central Dry Zone of Myanmar using geospatial technology. The specific objectives are: (1) to understand the hydrogeologic framework of the area; (2) to characterize the aquifer parameters; (3) to evaluate the groundwater quality in different aquifers; and (4) to estimate the groundwater recharge in the study area.

Part of the watershed of Mu-River around Ayadaw township forms the study area. Dry climatic conditions and intensive agriculture practices prevail in the area. In the past, water supply for domestic and agricultural uses was mainly dependent on surface water resources. However, due to limited availability of surface water resources, groundwater resources are being developed to meet the water requirement. The systematic study of groundwater resources in the study area using geospatial technology (Remote Sensing and Geographic Information System) has not been taken yet.

Satellite images of Landsat-7 ETM+ and ASTER are used for the understanding and mapping the geology, geomorphology and land use/land cover with the help of ancillary data and ground checks. The configuration of different aquifers, water table contour maps, well discharge maps, groundwater quality maps and related outputs are mainly based on the existing tube well logs and ground and lab based investigations. Ground water recharge is estimated as a residual of rainfall minus actual evapotranspiration (AET) and direct runoff. Thornthwaite water balance model is used to estimate the AET and SCSCurve Number is used to estimate the direct runoff. Various functionalities of image processing softwares (ERDAS Imagine and ENVI) and GIS softwares (ArcGIS and ArcView) are used to process and analyze various datasets and generate outputs. Groundwater Chart software (developed by USGS) is used for graphical presentation of groundwater quality data.

The area is covered by the clastic sedimentary rocks of sandstones and shales of Middle Miocene to Recent age. Five major hydrogeomorphic units characterize the area: (1) highly dissected structural hills with rocks of Pegu Group and Irrawaddy Formation (2) moderately dissected structural hills covered by rocks of Irrawaddy Formation (3) upper piedmont plain formed by

sediments of Older Alluvium (4) lower piedmont plain formed by the sediments of Older and Younger Alluvium and (5) flood plain formed by Recent Alluvium. The highly dissected structural hills and moderately dissected structural hills form runoff zones, upper piedmont plain unit and lower piedmont plain unit act as a recharge zone, while flood plain forms recharge-cum-discharge zone.



Figure 1: Location Map

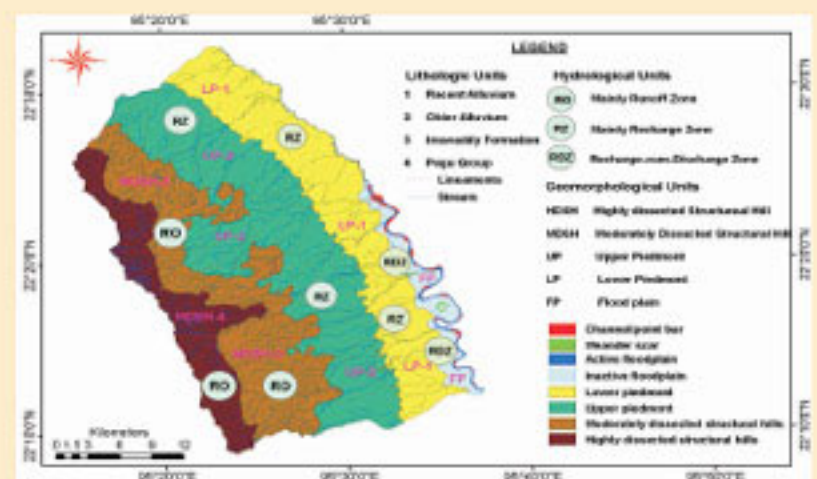


Figure 2: Hydrogeomorphological Map

The lithologies of drilled wells suggest the presence of multi-aquifer system of unconfined to confined types which can be mainly divided into three major aquifers shallow, medium and deep aquifers. The shallow aquifer is of unconfined nature, medium aquifer is of semi-confined to confined nature and deep aquifer is of confined nature. The potentiometric surface varies

from about 55m to 180m above mean sea level (AMSL) for shallow unconfined aquifer; 55m to 176m AMSL for medium-depth aquifer; and 127m to 162m AMSL for deep aquifer. Some of the wells tapping medium-depth and deep aquifers are of artesian type. Discharge of 4 inches diameter tubewells in the study area ranges from about 150 lpm to 1750 lpm. The specific capacity of different aquifers ranges from about 0.3 lpm/m to 380 lpm/m. The transmissivity of alluvial aquifer is about 700 m²/day and of Irrawaddy Formation is about 200 m²/day.

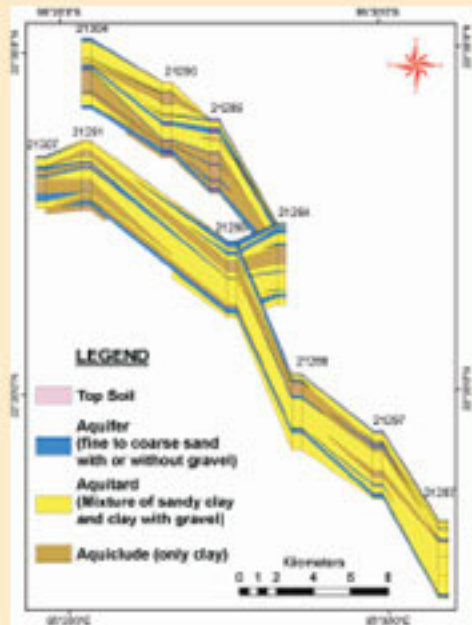


Figure 3: Lithologic Fence Diagram

The chemical analysis of groundwater in different aquifers indicates two groundwater types: (1) Na-HCO₃ type, and (2) Ca-HCO₃ type. The Na-HCO₃ type is observed as major groundwater type in the study area, mainly because of silicate nature of rocks. The studied water quality parameters, except Na⁺, are found to be within the permissible limits for drinking water purpose; 3 samples out of 10 samples from dug wells, 7 samples out of 15 samples from shallow tubewells and 8

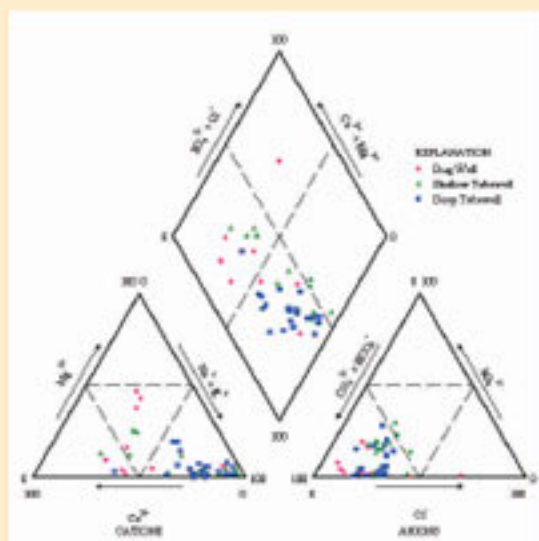


Figure 4: Piper Diagram Showing Groundwater Types of different Aquifers

samples out of 24 samples from deep tubewells indicate poor quality for irrigation purpose as per USDA irrigation water quality classification.

It is estimated that about 70% of total annual rainfall is lost by evapotranspiration. The direct runoff estimated using Arc-CN runoff tool (an ArcGIS extension) is about 15% of annual rainfall. Therefore, the groundwater recharge is estimated to be about 15% of annual rainfall (i.e. about 120 million cubic meters per annum).

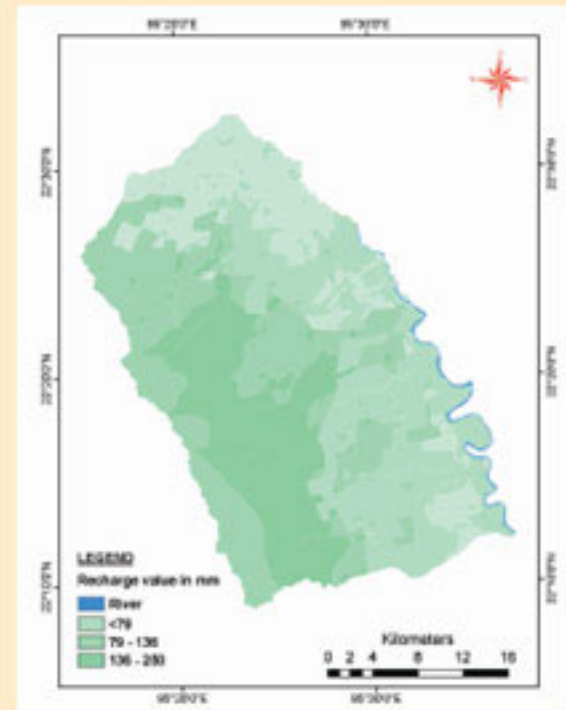


Figure 5: Rainfall Recharge Map (2007)

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FROM UN-OOSA

BRIEF NOTE: LAUNCH OF THE INTERNATIONAL SPACE WEATHER INITIATIVE (ISWI)

United Nations Basic Space Science Initiative (UNBSSI) will implement the International Space Weather Initiative (ISWI) starting in 2010 based on a three-year workplan of UNCOPUOS

The UN/ESA/NASA/JAXA Workshops on Basic Space Science was a long-term effort for the development of astronomy and space science and regional and international cooperation in this field on a worldwide basis, particularly in developing nations. The first series of such workshops was held from 1991 to 2004 (India 1991, Costa Rica and Colombia 1992, Nigeria 1993, Egypt 1994, Sri Lanka 1995, Germany 1996, Honduras 1997, Jordan 1999, France 2000, Mauritius 2001, Argentina 2002, and China 2004; <http://www.seas.columbia.edu/~ah297/un-esa/>) and addressed the status of astronomy in Asia and the Pacific, Latin America and the Caribbean, Africa, and Western Asia, respectively. One major recommendation that emanated from these workshops was that small astronomical facilities should be established in developing nations for research and education programmes at the university level. Subsequently, material for teaching and observing programmes for small optical telescopes were developed or recommended and astronomical telescope facilities have been inaugurated in a number of nations. Such Workshops on Basic Space Science emphasized the particular importance of astrophysical data systems and the virtual observatory concept for the development of astronomy on a world wide basis.

Since 2005 the basic space science workshops focused on the International Heliophysical Year 2007 and on the International Year of Astronomy 2009 (UAE 2005, India 2006, Japan 2007, Bulgaria 2008, South Korea 2009; <http://www.unoosa.org/oosa/SAP/bss/ihy2007/index.html>). Results of these workshops have been

reported in detail in ST/SPACE/43 and ST/SPACE/43/Corr.1.

Starting in 2010, a new series of workshops will focus on the International Space Weather Initiative (ISWI) as requested by a three-year-workplan as part of the deliberations of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS); <http://www.stil.bas.bg/ISWI/>. The first UN/ESA/NASA/JAXA workshop on the ISWI will be held in Luxor, Egypt, 16-20 October 2010, for the benefit of member States in the region of Western Asia (<http://un.cu.edu.eg>). As agreed by UNCOPUOS, solar-terrestrial physics is important in exploring solar-terrestrial interaction; understanding the effects that the variability in the Sun can have on the Earth's magnetosphere, environment and climate. As society becomes increasingly dependent on space-based systems, it is vital to understand how space weather, caused by solar variability, does affect, among other things, space systems and human space flight, electric power transmission, high-frequency radio communications, global navigation satellite system (GNSS) signals and long-range radar, as well as the well-being of passengers in high altitude aircraft. The ISWI will fully utilize and expand as fast as feasible the world-wide, ground-based instrument arrays that have been deployed in five years of IHY campaign.

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FORTHCOMING SYMPOSIUM/WORKSHOP IN AREA OF SPACE SCIENCE & TECHNOLOGY

S.No	Theme	Duration	Location	Web address
1.	UN/Switzerland/ESA/UNEP workshop on Space technology contribution to sustainable development of Andean mountain regions.	June 28-July 2, 2010	La Paz, Bolivia	http://www.osa.unvienna.org/osa/SAP/sched/index.html
2.	GEOBIA 2010 "GEOgraphic Object-Based Image Analysis"	June 29-July 2, 2010	Ghent, BELGIUM	geobia.ugent.be
3.	ISPRS Centenary Celebration framed by ISPRS Commission VII Symposium & German-Austrian-Swiss Conference for photogrammetry, remote sensing, & spatial information science	July 1-7, 2010	Vienna, AUSTRIA	http://www.isprs100vienna.org/
4.	Commission VII Symposium "100 Years ISPRS Advancing Remote Sensing Science"	July 5-7, 2010	Vienna, AUSTRIA	http://www.isprs100vienna.org/
5.	38th Scientific Assembly of the Committee on Space Research (COSPAR) & Associated Events "COSPAR 2010"	July 18-25, 2010	Bremen, GERMANY	www.cospar2010.org
6.	ISARA 9th International Symposium on Spatial Accuracy Assessment in Natural Resources & Environmental Sciences	July 20-23, 2010	Leicester, UK	www.le.ac.uk/geography/accuracy/index.html
7.	IEEE International Geoscience & Remote Sensing Symposium "IGARSS 2010"	July 25-30, 2010	Honolulu, Hawaii, USA	http://www.igarss2010.org/
8.	Map Asia 2010	July 26-28, 2010	Kuala Lumpur, Malaysia	http://www.mapasia.org/2010/home.htm
9.	GeoWeb 2010 - 3D City Modeling Academic Track	July 28-30, 2010	Vancouver, CANADA	http://geowebconference.org/students-academia/3d-modeling-track/
10.	International Remote Sensing Conference	August 1- 3, 2010	Turtle bay, Hawaii, USA	http://www.seaspace.com
11.	19th International SeaSpace Remote Sensing Conference	August 1-3, 2010	Kahuku, Hawaii, USA	www.seaspace.com/?mid=conference
12.	AIAA Guidance, Navigation and control conference	August 2-5, 2010	Toronto, Canada	http://www.aiaa.org/content.cfm?pageid=230&lumeetingid=2109
13.	24th Annual Conference on Small Satellites	August 9-12, 2010	Utah State University, Logan, UT	http://www.smallsat.org/
14.	AIAA Atmospheric and space environments conference	August 2-5, 2010	Toronto, Canada	http://www.aiaa.org/content.cfm?pageid=230&lumeetingid=2109
15.	Commission VIII Symposium "Remote Sensing Applications & Policies"	August 9-12, 2010	Kyoto, JAPAN	www.isprscom8.org/
16.	China satellite conference 2010	August 25-27, 2010	Beijing, China	http://www.china-satellite.org/index.htm
17.	AIAA Space 2010 conference and Exposition	August 30-September 2, 2010	California, USA	http://www.aiaa.org/content.cfm?pageid=230&lumeetingid=2387
18.	28th AIAA International communication satellite systems conference (ICSSC-2010)	August 30-September 2, 2010	California, USA	http://www.aiaa.org/content.cfm?pageid=230&lumeetingid=2387
19.	WG IV/5 1st International Workshop on Pervasive Web Mapping, Geo-processing & Services (WebMGS 2010)	September 1-3, 2010	Paris, France	http://pcv2010.ign.fr/
20.	ISPRS ICWG I/V 3rd International Workshop "The Future of Remote Sensing"	September 2010	Antwerp, BELGIUM	http://isprs.vgt.vito.be/events.html
21.	WG IV/5 FOSS4G 2010 Academic Track "The Conference for Open Source Geospatial Software"	September 6-9, 2010	Barcelona, SPAIN	http://2010.foss4g.org/index.php
22.	15th Australasian Remote Sensing & Conference (15ARSPC)	September 13-17, 2010	Alice Springs, AUSTRALIA	www.15.arspc.com/Photogrammetry

S.No	Theme	Duration	Location	Webaddress
23.	10th International Conference on LiDAR Applications for Assessing Forest Ecosystems (Silvilaser 2010)	September 14-17, 2010	Freiburg GERMANY	www.silvilaser.de/
24.	VSAT2010	September 14-17, 2010	London, UK	http://www.comsys.co.uk/wvc_main.htm
25.	United Nations/Turkey/ESA Workshop on Integrated Space Technology Applications for Socioeconomic Benefits	September 14-17, 2010	Istanbul, Turkey	http://www.oosa.unvienna.org/oosa/SAP/sched/index.html
26.	International conference on spatial data infrastructure 2010	September 15-17, 2010	Skopje, Republic of Macedonia	http://sdi2010.agisee.org
27.	United Nations/Austria/ESA Symposium on Small Satellite Programmes for Sustainable Development: Payloads for Small Satellite Programmes	September 21-24, 2010	Garz, Austria	http://www.oosa.unvienna.org/oosa/SAP/sched/index.html
28.	Tutorial on 3D city modelling	September	Johor Bahru,	http://www.fksg.utm.my
29.	20th United Nations/ International Astronautical Federation Workshop on GNSS Applications for Human Benefit and Development	September 24-25, 2010	Prague, Czech Republic	http://www.oosa.unvienna.org/oosa/SAP/sched/index.html
30.	Remote Sensing & Hydrology Symposium 2010	September 27-30, 2010	Jackson Hole, WY, USA	www.remotesensinghydrology.org/
31.	11th United Nations/International Academy of Astronautics (IAA) Workshop on Small Satellites in the Service of Developing Countries	September 28, 2010	Prague, Czech Republic	http://www.oosa.unvienna.org/oosa/SAP/sched/index.html
32.	APSCC 2010 Satellite conference & Exhibition	October 5-7, 2010	Hilton Hotel, Tokyo, Japan	http://www.apsc.or.kr/event/apsc2010.asp
33.	WG I/4 Workshop on Modeling of Optical Airborne & Space Borne Sensors	October 11-13, 2010	Istanbul TURKEY	www.ipi.uni-hannover.de/ipi-workshop.html
34.	9th Seminar on Remote Sensing & GIS Applications in Forest Engineering	October 19-21, 2010	Curitiba, Paraná, BRASIL	www.9seminarioflorestal.com.br/home/
35.	WG I/3 International Workshop on Multi-platform/Multi-sensor Remote Sensing & Mapping	October 19-22, 2010	Xiamen, CHINA	
36.	3rd international conference on Geo-information Technology for Natural Disaster Management & Rehabilitation	October 19-20, 2010	Chiang Mai, Thailand	
37.	3rd international conference on Geo-information Technology for Natural Disaster Management & Rehabilitation	October 19-20, 2010	Chiang Mai, Thailand	
38.	61st international Astronautical congress	October 27 - November 1, 2010	Prague, Czech Republic	http://www.iac2010.cz/en/welcome
39.	31st Asian Conference on Remote Sensing (ACRS2010)	November 1-5, 2010	Hanoi, VIETNAM	www.a-a-r-s.org/acrs/
40.	Strategic Space symposium	November 2-4, 2010	Colorado Springs, USA	http://www.strategicspacesymposium.org/
41.	UN/ESA/NASA/JAXA Workshop on the International Space Weather Initiative	November 6-10, 2010	Luxor, Egypt	http://www.oosa.unvienna.org/oosa/SAP/sched/index.html
42.	United Nations/Thailand Workshop on Space Law	November 2010	Thailand	http://www.oosa.unvienna.org/oosa/SAP/sched/index.html
43.	Pacific Island GIS&RS User Conference 2010	November 22-27 2010	Suva, FIJI	www.picisoc.org/PacGISRS2010
44.	Map Africa 2010	November 23-25, 2010	Cape Town, South Africa	http://mapafrica.gisdevelopment.net
45.	5th Session of the International Conference Geotunis 2010: The use of GIS & Remote Sensing for Sustainable Development	November 29-December 3, 2010	Tunis, TUNISIA	www.geotunis.org/2010/
46.	Annual convention of ISRS and National Symposium on GIS & RS	December 1-3, 2010	Lonavala, India	www.isrs2010.in

ALUMNI SPEAKS

Mr. M.G.S.D Nilantha from Sri Lanka was a student of CSSTEAP during 2002-2003 RS & GIS PG course. He also completed his research work on "Drought assessment and monitoring using climate and remote sensing data with special emphasis on parts of India, Pakistan and Afghanistan" based on which he was awarded Master of Technology (M.Tech) degree under CSSTEAP-Andhra University Programme. He shares with us how he used the training back home.

I am a agricultural engineer and joined the CSSTEAP 7th RS-GIS postgraduate diploma in 2002-03. After successful completion of the postgraduate diploma concentrating mainly on water resources, I returned back and joined the International Water Management Institute (IWMI), which is a



research centre with its headquarters in Sri Lanka and supported by over 50 governments and international organisations known as Consultative Group on International Agricultural Research (CGIAR). With strong background of Remote Sensing & GIS, Agriculture/Agricultural Engineering and Hydrology I was appointed as a Remote Sensing and GIS Specialist.

I am involved with many water related research programs and specializes in developing methodologies and mechanisms to monitor drought using RS/GIS tools, remote sensing application for water resources development and disaster management and geo-spatial time series data analysis. My research experience extends into hydrological modelling, environmental flow assessment/management, climatic variability analysis, global water availability assessment and irrigation performance assessment with system automation.

I have worked in Sri Lanka, India, Pakistan, Afghanistan and Iran on several large-scale donor funded research projects, including assessment of ecosystem water requirements at the global scale (joint project of IWM, World Resources Institute (USA) and World Conservation Union (Switzerland)), regional drought

assessment and mitigation in Southwest Asia and water scaling up in Pakistan and river linking in India. Currently I am an author and co-author of several research publications, including high-impact papers such as "The use of Remote Sensing data for Drought Assessment and Monitoring in Southwest Asia".

My contribution is not only to research development but to capacity building as well. In this area, I am closely working and serving as a resource person for many national organizations including universities, government departments and authorities.

Also, I am involved in establishing the Geo-informatics Society of Sri Lanka in 2003, which is a national body to populate remote sensing and GIS application among the Sri Lankan community, and served as an executive committee member of the society for several years continuously.

Further, I closely work with relevant regional and international organizations to build up a research agenda and capacity and then transfer this knowledge to a national level and vice versa.

Moreover, all my activities are based on the knowledge gained during the postgraduate diploma and M. Tech program from CSSTEAP, which not only benefited me but also country as well.

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ANTRIX, ISRO BAGS GLOBE SUSTAINABILITY RESEARCH AWARD

ANTRIX Corporation Ltd., ISRO has been conferred with the most prestigious Globe Sustainability Research Award 2010 by the Globe Forum, Stockholm, Sweden. Globe award is an international award founded by Globe Forum, with the purpose of fostering sustainable development in the society. The award was conferred on ANTRIX for its outstanding contribution to improve sustainable livelihoods amongst rural poor while reducing their vulnerability to climate risks. ANTRIX, ISRO demonstrated the use of space technology and Information Technology (IT) solutions to effectively reach out to grassroots through Sujala Watershed development programme in Karnataka which was implemented during 2009 in five districts.

Antrix, ISRO's contribution through innovative use of space technology in watershed management has yielded significant benefits with respect to all the three aspects of sustainable development triangle Economic, Social and Environmental.

"It is an excellent application of the sustainomics framework showing how companies can and must act now to make development more sustainable". As quoted by the jury group chairman professor Mohan Munasinghe, Nobel Peace Laureate 2007 and Vice Chair of the UN Intergovernmental Panel on Climate Change (IPCC).

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 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



CSSTEAP Hqrs. at Dehradun

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) Fifteenth 9 month Post Graduate course in RS & GIS at IIRS, Dehradun from July 1, 2010 to March 31, 2011

FORTHCOMING COURSES

- 1) Seventh Post Graduate course in Satellite Meteorology & Global Climate at SAC, Ahmedabad from August 1, 2010 to April 30, 2011.
- 2) Seventh Post Graduate course in Space and Atmospheric science at PRL, Ahmedabad from August 1, 2010 to April 30, 2011.
- 3) Short course in RS & GIS during April-May, 2011.

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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.

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