ISRS

SIGNATURES

NEWSLETTER OF THE INDIAN SOCIETY OF REMOTE SENSING –AHMEDABAD CHAPTER

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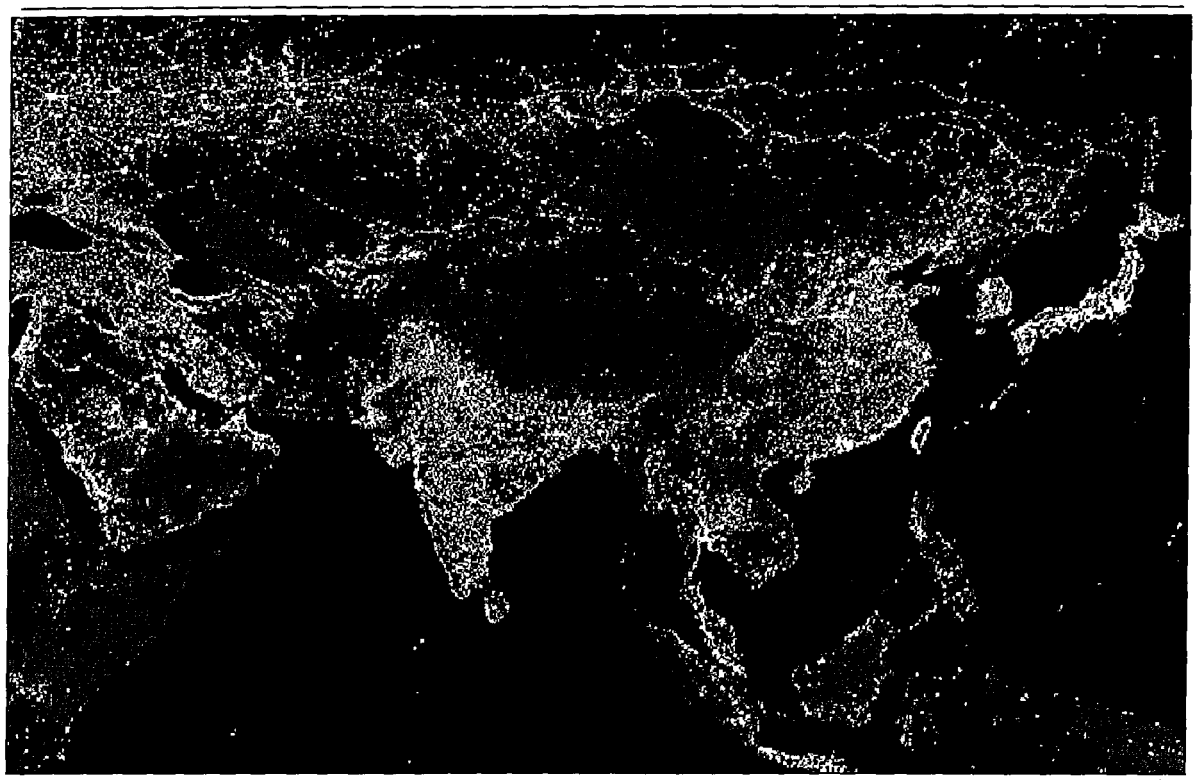

NIGHT LIGHTS OF INDIA AND ITS NEIGHBORS AS SEEN BY DMSP

IN THIS ISSUE

Front cover

Image of Earth's city lights was created by NASA, with data from the Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS). Originally designed to view clouds by moonlight, the OLS is also used to map the locations of permanent lights on the Earth's surface.

The brightest areas of the Earth are the most populated, but not necessarily the most urbanized. Cities tend to grow along coastlines and transportation networks. Even without the underlying map, the outlines of many countries are still be visible. Indian capital town New Delhi is seen as a bright spot in the picture and lights along the highways are also prominent.

Even more than 100 years after the invention of the electric light, some regions remain thinly populated and unlit. Deserts in Arabia, Thar and Mongolia are poorly lit along with the great mountains of the Himalaya.

Indian Society of Remote Sensing- Ahmedabad Chapter update

The Ahmedabad chapter of Indian society of Remote Sensing has got additional strength in terms of new membership during 2002-2003. Seventy-two life members and 7 annual members have been enrolled during 2002-03. This also includes 43 life members who are enrolled for the regions outside the ISRS-AC jurisdiction. The table below shows the details of the membership.

Life members	371
Annual members	07
Sustaining members	04
Patron members	07

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Dear Readers,

New Year greetings. We are happy to place the new year issue of 'Signatures" in your hands. This issue is specially devoted to the new and upcoming research frontiers in remote sensing arena. The article on satellite view of aerosols highlights the importance of aerosol remote sensing in climate system. Newer research applications in the field of microwave remote sensing are going to unfold with the launch of Indian RISAT satellite. The article on RISAT gives an overview of these activities. India has started receiving MODIS-TERRA data at NRSA, Hyderabad. This has opened up a new frontier for earth system science studies for better understanding of our planet earth. The article on MODIS data potential should help in understanding the MODIS science series satellites. Number of chapter activities were carried out during the period (2002-2003). We are happy to provide glimpses of these activities in this issue of "Signatures".

We are thankful to the readers for their support, co-operation and suggestions that helped us to bring out this issue of the News Letter.

With best wishes.

-Editor

A satellite view of aerosols in the climate system

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Anthropogenic aerosols are intricately linked to the climate system and to the hydrologic cycle. The net effect of aerosols is to cool the climate system by reflecting sunlight. Depending on their composition, aerosols can also absorb sunlight in the atmosphere, further cooling the surface but warming the atmosphere in the process. To accurately study aerosol distribution and composition requires continuous observations from satellites, networks of ground-based instruments and dedicated field experiments. Increases in aerosol concentration and changes in their composition, driven by industrialization and an expanding population, may adversely affect the Earth's climate and water supply.

Aerosols are solid or liquid particles suspended in the air. It is a trace substance in the atmosphere and the amount of aerosols vary from place to place and from time to time. They have size ranging from ~ 10^{-3} to 10^{2} μm with the number density decreasing with increasing size. The size range of aerosols is further subdivided into three classes: Aitken particles (~10^{-3} to 10^{-1} μm), large particles (10^{-1} to 1.0 μm) and giant particles (1.0 to 10^{2} μm). In the atmosphere, aerosols are mostly confined to lower troposphere (that is, up to boundary layer heights ~2-3 kms) except on occasions of strong volcanic eruptions when they can be injected into the stratospheric altitudes.

Large quantities of aerosol particles are continually being put into the atmosphere by natural as well as man made (anthropogenic) activities. Dust particles, soot particles, water-soluble particles, industrially produced sulphuric acid droplets, volcanic ash, etc. are some examples of aerosols (WCP, 1984). Wind blowing over deserts or over dry and loose agricultural top soil, large scale forest fires, ocean waves breaking on the beaches, major industrial centres are all sources of aerosol production. They have a wide variety of chemical compositions related to their generation mechanism. Table 1 shows the chemical compositions of different types of aerosols and their generation sources.

Table 1. Aerosol generation sources and their chemical compositions

Generation source	*Type of aerosols*
Wind over the deserts and loose soil	Silicate, minerals, clay and carbonaceous particles
Forest and man made fires	Soot particles
Volcanic eruptions	Sulphate particles
Large scale vegetation	Organic particles produced through photo chemical reactions of biogenic gases
Ocean surface waves	Salt (sodium chloride) particles
Industrial activities	Sulphates, nitrates, metallic particles
Oceanic phytoplankton	Sulphate particles produced through the oxidation of dimethyl sulphide released during the blooms

Residence time of aerosols

Once released into the atmosphere, aerosols remain airborne for long periods of time. The residence times of different particles are decided by their coagulation behaviour, cloud forming properties, gravitational settling velocity and fragmentation characteristics. The particles of size ~ 0.3μm have the longest residence time in the troposphere (~ 10days). The particles smaller than ~ 0.1μm remain in air only for ~ 1 – 2 days. They are lost as individual particles through

coagulation among themselves or recombination with larger particles due to their Brownian motion. The shorter residence times for particles bigger than ~ 1μm is because of faster gravitational settling. In the case of aerosols injected into the stratosphere by strong volcanic eruptions, they remain there for months to years.

Physical effects of aerosols

Aerosols are responsible for a number of physical effects in the atmosphere ranging from reducing the visibility, causing air pollution and influencing the microphysics of cloud formation (acting as cloud condensation nuclei) to modifying the weather and the climate on a regional and global scale by changing the atmospheric radiation balance. Aerosols interact with the incoming solar radiation and the outgoing terrestrial radiation through scattering and absorption. The radiative energy absorbed by aerosols can warm the atmosphere and change the vertical temperature profile thereby affecting the strength of atmospheric convective motions. Aerosols also interfere with the remote sensing data requiring their radiative interferences to be removed for the correct retrieval of geophysical parameters.

The most important among all the aerosol effects is their role in the atmospheric radiation balance because of their interaction with the incoming solar radiation (albedo effect) and the outgoing terrestrial radiation (green house effect). Besides this, through their role in cloud formation, they also indirectly influence the atmospheric radiation budget via the radiative properties of clouds. Their concentration, size distribution and chemical composition determine the droplet concentrations precipitation rate and life time of clouds.

In recent years, a number of attempts have been made to assess the impact of aerosols on the earth's weather and climate with the help of numerical prediction models. Some of these studies have indicated that on a global scale, the albedo effect aerosols can offset the greenhouse forcing by about 20-40%. Whereas the regional scale experiments show the aerosols to reduce the vertical mixing in the tropical atmosphere (through modification of the vertical temperature profile), narrow down the ITCZ (Inter Tropical Convergence Zone) and weaken the trade winds, cool the north Atlantic atmosphere, weaken the monsoon by reducing the land - sea temperature contrast, etc.

All these studies have brought out the important role of aerosols in the atmospheric dynamics. But to account for the physical effects of aerosols in the atmospheric dynamics, one need to have quantitative information on the aerosol parameters on regional as well as on global scales at frequent intervals.

Measurement of aerosol parameters

The most appropriate way of detecting aerosols is through their property of scattering and absorption of light from a known source. The combined effect of scattering and absorption of aerosols can be expressed through a parameter called - aerosol optical depth (AOD in short). With a sun photometer, one can measure the columnar AOD of the atmosphere from the ground, ship, aircraft or a remote controlled balloon by pointing this instrument towards the sun. Another technique of estimating aerosols is to shoot a pulse of laser beam into the atmosphere and to record the radiation scattered back as a function of time. From the time history of the intensity of return signal, one can determine the profile aerosol distribution in the direction of laser beam. This is the principle employed in the Lidar sounding of the atmosphere.

Satellites, with their capability for large area coverage and frequent repeativity, are the most ideal means for acquiring global information on aerosols. The satellites SAM-I&II (Stratospheric Aerosol Measurement) and SAGE-I&II (Stratospheric Aerosol and Gas Experiment) have for several years (from late 70's to early 90's) monitored stratospheric aerosols through limb viewing sun occultation technique. The currently orbiting ocean colour satellites like IRS P3-

MOS-B, IRS P4-OCM, SeaWiFS and MODIS-TERRA/AQUA, though primarily meant for monitoring ocean water constituents, can also be used to detect atmospheric aerosols over the oceans with a global coverage of one or two days. The channels 1 and 2 of NOAA AVHRR sensor are also used for the operational mapping of marine aerosols on a routine basis.

The MOS-A sensor of the IRS P3-MOS satellite has the capability to detect aerosols in two or three atmospheric layers through the differential scattering /absorption of solar radiation in four narrow band channels within the O_2A (Oxygen) absorption band around 760 nm.

Scattering in the atmosphere

Scattering is a process in which a particle in the path of the electromagnetic radiation takes energy from the incident ray and reradiates in all the directions. In the atmosphere, all the particles ranging from gas molecules (size $\sim 10^{-8}$cm) to aerosols (size $\sim 10^{-3}$ to $10^{2}\mu$m) to large rain drops (size ~ a few mm) to hail particles (size ~ 1cm), scatter radiation. Among these, aerosols is a major agent responsible for scattering in the visible to infrared region of the spectrum

The intensity of scattered radiation as a function of scattering angle (angle between the incident and the scattered rays) known as scattering phase function, depends strongly on the ratio of particle size to the wave length of the radiation. This ratio, known as the size parameter is expressed as $\chi = 2\pi r/\lambda$ where r is the radius of the particle. For particles whose sizes are very small compared to the wave length, χ is very small (say, less than ~ 0.1) and the scattering pattern is independent of the shape of the particle and is symmetrical in the forward and the backward directions. This is known as Rayleigh scattering. Scattering of light by air molecules in the atmosphere falls in this regime. But as the particle size increases and becomes comparable to the wave length, the scattering gets more and more concentrated in the forward direction. The exact angular distribution will then depend on the size, shape and orientation of the particle. If the scattering particle is spherical in shape, the scattering is known as Mie scattering and the phase function is determined by Mie theory. Besides scattering, the radiation energy can also be lost through absorption in the medium.

Aerosol parameters from ocean colour sensors

As mentioned earlier, ocean colour sensors, though meant for the remote sensing of ocean water constituents, have the additional capability for the detection of marine atmospheric aerosols. This is achieved by making use of radiance data in the atmospheric correction bands which have wavelengths above ~700nm, where, because of high infrared absorption by water, the ocean surface acts as a dark background. Ocean colour sensors can provide two aerosol parameters: AOD and aerosol particle size. Figure 1 shows the dust plumes in early December 2002, strong winds were blowing dust and sand from the Makran Mountains in southern Pakistan and Iran out over the Arabian Sea. The image of the dust plumes was acquired by the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument, flying aboard NASA's Aqua spacecraft.

Figure 2 is an IRS P4-OCM image showing the total column AOD distribution near Trivandrum in the month on October 15, 1999. One can notice in this image streaks of aerosols extending from the land to the oceans in various directions caused by the prevailing winds at the time of satellite pass. The dark patches are areas masked for the highly reflecting land and cloud surfaces. While land surface has sharp edges, the clouds have optically thin parts near the edges which have not been masked. Taking the logarithm of the Angstrom's turbidity formula and eliminating β using two atmospheric correction bands at wavelengths λ_1 and λ_2, one can determine the Angstrom exponent (or

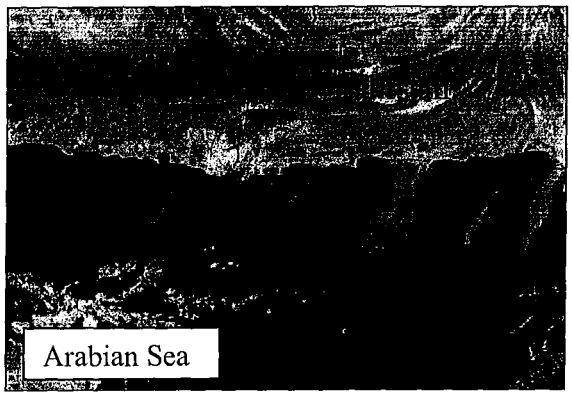

Fig1

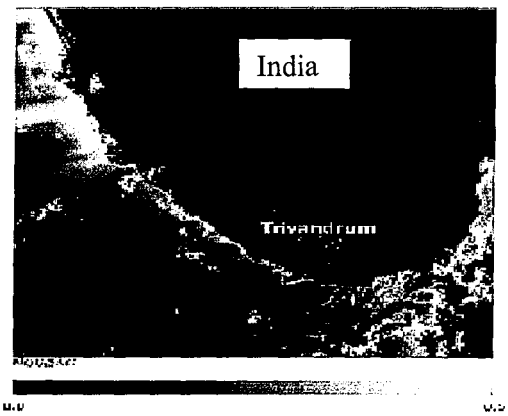

Fig.2

aerosol particle size index) α. With increasing value of α, the particle size distribution gets steeper indicating more amount of smaller particles in comparison with larger particles. Thus, larger Angstrom exponent can be taken to mean a predominance of smaller particles and therefore, a smaller value for the average particle size while smaller Angstrom exponent would mean a larger value for the average particle size.

Aerosols in climate change

The cooling influence of aerosols on climate, directly through the reflection of sunlight to space and indirectly through changes in cloud properties, has been appreciated for over a decade, and has triggered a large number of observations, simulations and analyses. The effect of anthropogenic aerosols is not limited to cooling by sulphates. Instead, carbonaceous compounds that include light absorbing black carbon can be an important warming agent, and the sign of the temperature change from aerosols can vary depending on the aerosols' radiative properties and their distribution over the dark ocean and reflective land. The cooling of the Earth's surface from absorbing aerosols (compared with the top of the atmosphere) and consequential warming of the atmosphere causes a flattened vertical temperature profile in the troposphere, which is expected to slow the hydrologic cycle, reduce evaporation from the surface and reduce cloud formation. It has also been suggested that as aerosols tend to reduce cloud droplet sizes, and hence precipitation, rain and snow may be shifted from highly polluted populated areas to the more pristine oceanic regions. This raises the question of whether there has been or will be a change in the availability of fresh water due to aerosols.

Future research will need to unravel the magnitude of the aerosol effect on clouds and precipitation, on regional and global scales, and its sensitivity to aerosol chemistry and cloud dynamics. Given the importance of the absorption of sunlight by black carbon, a quantitative assessment of black carbon sources, its lifetime in the atmosphere, its distribution around the globe and its impact on the hydrologic cycle will need to be explored. To associate the aerosol impact with human activity, we need to distinguish natural from anthropogenic aerosols. By measuring separately fine and coarse particles, remote sensors distinguish the emission and transport of dust (mostly from natural sources) from pollution and smoke aerosols (mostly anthropogenic) around the planet. Remote sensors also map the distribution and properties of clouds precipitation and the Earth's reflected solar and emitted thermal energy to space as these atmospheric constituents are impacted by the aerosol. These global data and source characterization feed aerosol models to show us an increasingly realistic picture of aerosols around the world and their impact on the environment. To achieve these ends, ground-based and *in situ* measurements, models and satellite observation have to be each improved and integrated.

Pre-launch activities towards utilization of the Synthetic Aperture Radar (SAR) data from Indian Radar Imaging Satellite

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Space Applications Centre, Ahmedabad

India has established its position in satellite remote sensing with the launch of a series of satellites like IRS 1A, 1B, 1C, 1D, IRS P3, P4 that provide a wide range of optical sensor data. A number of applications in the field of natural resources survey and monitoring have been demonstrated and carried out in an operational manner for national development. Each and every satellite launched in the country is based on careful research, survey and scientific analysis to fulfill specific need of the nation. This has enabled to evolve a long-term remote sensing programme in the country. Time is ripe now to integrate the benefits of the other sensors, particularly that of the microwave in the remote sensing applications programme of India. Microwave region extends from frequency 0.3 GHz to 300 GHz (1m to 1 mm). The most common imaging Radars operate at frequency between 1.25 to 35.2 GHz (24cm to 0.8 cm). Due to the unique sensitivity of microwave to the dielectric and geometrical properties of the feature being sensed, these sensors provide a set of information that are complementary to the information provided by the visible or infrared waves. Besides this, because they have their own illumination (the radar pulses), they can image at any time of day or night, regardless of sun illumination. The radar wavelengths being much longer than those of visible or infrared light, SAR can also "see" through cloudy and dusty conditions that visible and infrared instruments cannot. This is of particular relevance to the time critical and assured data requirement programmes not met by the optical sensors.

The work related to Microwave Imaging Radar systems in India has been initiated few decades ago at Space Application Centre (SAC), ISRO, Ahmedabad, The first in this series was X-band Airborne Side Looking Airborne Radar (SLAR), which was a Real Aperture Radar (RAR) and was developed during the late eighties. The C-band Airborne Synthetic Aperture Radar (ASAR) system was taken up in early nineties that provided data in both VV and HH polarisation. During the past few decades, the world is witnessing numerous improvements in microwave solid-state technology, data recording, computer processing. This has led to the successful launch and operation of a variety of SAR sensors internationally like SeaSAT, SIR-A, SIR-B, SIR-C, IFSAR, ERS, JERS, and RADARSAT etc. Limited use of data from many of these sensors has given insight to the possible use of SAR in various natural resource inventory and survey programmes in our country. For example, the feasibility of rice crop monitoring established with the ERS sensor is now an operational programme being carried out every year since 1998 using data from the RADARSAT SAR.

The experience gained so far has given confidence to venture into having our own space borne Synthetic Aperture Radar sensor in order to exploit the full potential of SAR data. The proposed sensor is a highly advanced C band Synthetic Aperture Radar called Radar Imaging Satellite (RISAT). A number of advanced state of the art features such as high-resolution Spotlight mode, Strip mode, wide swath SCANSAR modes, Quad Polarisation mode selectable anywhere over 400 Km swath is proposed. The system proposed is also capable of imaging on either side of the orbit to provide more opportunities for data gathering. The system is expected to be realized sometime during 2004-2005. Table-1 gives a tentative proposed plan of RISAT beam modes.

Table 1: Proposed RISAT SAR Modes

Data Acquisition Mode / Polarization Type	Spotlight Mode (HRS)	Fine Resoln. Mode (FRS)	Wide Swath I (MRS)	Wide Swath II (CRS)
Single Polarization (VV/HH/HV/VH)	A	A	A	A
Dual Polarization (HH&HV /VV&VH)	A	A	A	A
Polarimetric (HH&VV&HV&VH)	NA	A	NA	NA

* A = Available, NA = Not Available

(source; RISAT Data Utilisation Programme Document, SAC, 2001)

One of the most important RISAT pre-launch activities is a programme called " Joint Experiments for RISAT data utilization." The major goal of this pre-launch programme is capacity building and user preparedness for effective use of RISAT data utilization. To achieve this goal, the following objectives are set;

- To explore the potential of C band SAR for various application fields in collaboration with user agencies.
- To carry out research/ investigative studies in collaboration with research/educational Institutes to develop thorough understanding of SAR interaction with targets.
- To identify specific software and algorithm required for SAR data analysis and interpretation.
- Studies using multi-parameter SAR is also proposed to identify optimum sensor parameters (application specific) for future space programme.

As mentioned above, the project activities are planned under two categories:

1. User collaboration studies: Experimental and semi-operational studies which require either experimental planning, intense field data collection, accuracy and validation are envisaged to be carried out in collaboration with central and state user departments.

2. Academic collaboration studies: Activities related to specific model developments, softwares and basic research to undrstand SAR interation are envisaged to be carried out in collaboration with academic institues of excellence.

The investigations are planned to be carried on with the help of available SAR data from airborne and space borne sources. Indigenous AirSAR (C band) developed at SAC is envisaged

to be used extensively for exploratory studies. Available space borne SAR data from RADARSAT-1,2, ENVISAT and ERS will be used to gain experience on C band polarimetric, and interoferometry data. Limited use of ground experiments with scatterometer data is also envisaged.

Among the applications themes, high priority is given to the agricultural crop monitoring, particularly to the major Kharif crops other than rice like ground nut, cotton, sorghum, pearl millet, soybean etc. C band polarimetric data is expected to accentuate some of the characteristic properties of each crop that may improve its identification accuracy. Other important themes are snow and glacier studies, where C band polarimetric data can be useful in identifying wet and dry condition, thickness of the deposits, identify the hidden crevasses etc. These parameters are some of the important inputs to study the glacier mass balance and snow melt run off estimation. Interoferometry is another unique SAR technique, which will be used to quantify the land surface subsidence like that happening in Jharia coalfield, geological displacements due to earthquake etc. Use of polarimetric interferometry is envisaged for tree height/volume studies that are the crucial input to estimate forest biomass, timber harvest etc. In the field of Oceanography, the focus is for shallow water bathymetry; wind and wave spectra and oil spill detection. The other investigations proposed are detection of buried channels/features, detection of aeoline-covered minerals, mostly found in Rajasthan. Soil moisture and hydrology is another important application. Investigations towards semi-empirical models for surface moisture, profile moisture, application to simulation of flood, drought, run off etc. are envisaged.

Space Application Centre is taking a lead role in giving a final shape to this programme. The Centre has the advantage of the hardware, software and the applications groups, all having enough expertise in the respective area of Imaging Radar. Thus, a well coordinated and planned programme is assured that will lead to gainful utilization of RISAT data in future.

(For further information readers are requested to contact Shri N S Pillai, Dy Programme Director (RISAT), SAC and Shri J S Parihar, Mission Director, RSAM, SAC).

Crossword Solution

Across: 1. Aerosol, 4. Retina, 8. IRSAT, 10. AMIE, 11. HIV, 12. INSAR, 13. KBPS, 14. PE&RS, 15. O.D. (Optical Depth) 17. CNES/ESA, 19. EVI, 22. FAO, 24. EURO, 27. Carto, 28. Row, 30. Emit, 31. IOC, 34. Absorption, 35. EOS

Down: 1. Atmosphere, 2. SARVI, 3. LISS/Sensor, 5. Track, 6. ADEOS, 7. VHRR, 9. TIROS, 16. detection , 18. ATSR, 20. IPR, 21. RF, 23. Cosmos, 25. UTM, 26. ORTHO, 29. ENVI, 30. EIA, 32. CEE, 33. IP

SOME COMMON COMPUTER TERMS:
We Ought To Know

*(Compiled by **C. Patnaik**, Space Applications Centre, Ahmedabad)*

100Base-T - refers to a maximum network transmission speed of 100,000,000 bits per second (100Mbps). Sometimes referred to as fast Ethernet.

Auto-sensing - the ability of a hub or switch to automatically determine the maximum speed that it can communicate to a device that is connected to one of its ports Auto-switching - the ability of a hub or switch to change speeds on any one of its ports to match the maximum speed of a connected device

Backbone - In a hierarchically arranged distributed system, the backbone is the top level, or central, connection path shared by the nodes or networks connected to it. The backbone manages the bulk of the traffic, and it may connect several different locations, and even smaller networks. It often uses a higher-speed protocol than the individual local-area network (LAN) segments.

Backbone Network - Is one with a central cabling scheme (the backbone) to which other networks are attached. Nodes in one network can talk to nodes in other networks by sending packets across the backbone network.

Client - refers to a computer that is reliant upon another computer for some kind of data or service (files, printer, internet).

Client/server - refers to a network relationship where an actual server and clients exist, as opposed to peer/peers.

Collisions - refers to what happens when two data packets arrive at the same time at the destination. In an Ethernet network, the two sending nodes "back off" for a random number of milliseconds and then re-transmit.

Domain Name System-The Internet protocol for mapping host names, domain (a unique name used to identify an Internet network) names and aliases to IP addresses.

Domain name server - A repository of addressing information for specific Internet hosts. Name servers use the domain name system to map IP addresses to Internet hosts by name resolution.

Firewall - A firewall is a program that protects the resources of one network from users from other networks. Typically, an enterprise with an intranet that allows its workers access to the wider Internet will want a firewall to prevent outsiders from accessing its own private data resources.

Gateway - A gateway is a network point that acts as an entrance to another network. A gateway may also be any machine or service that passes packets from one network to another network in their trip across the Internet.

Hub - a central connection point in a star topology network. This is a broadcast device where all transmitted data is send to all nodes. Can be very inefficient and cause excessive collisions when a lot of data is being sent over the network. It is referred to by the number of ports it has ("an 8 port hub") and can be auto-sensing and auto-switching.

IP address - a unique identifier for a node in a TCP/IP based network. This type of address consists of 4 sets of numbers (bytes), which are represented as decimal values separated by periods, as in 123.45.67.89. In order to ensure uniqueness, IP addresses are assigned in part by the Internet Assigned Numbers Authority (IANA).This is a number. IP addresses on the internet can either be static - permanently assigned to a particular hardware device (such as a NIC inside a computer or print server) - or dynamic, which changes with every log on to the internet service. There are Class A, Class B and Class C type IP networks, which can be further broken down by subnetting.

MIME- (Multipurpose Internet Mail Extensions) - MIME is a mail handling standard developed by the IETF (Internet Engineering Task Force) to provide support for multimedia and multipart messages. MIME makes it possible to encode and transmit and receive sound, video, and formatted data in a single message.

Name resolution - the process in which an URL is converted to an IP address. This is

necessary because computers (except for the DNS servers) do not know how to handle the names that we humans use e.g. *http://www.isrsindia-ac.org.*

Packet - A packet is a well-defined block of bytes, which consists of header, data, and trailer. In layered network architecture, packets created at one level may be inserted into another header/trailer envelope at a lower level. Packets can be transmitted across networks or over telephone lines.

Peer to peer - refers to a network relationship where no actual server exists (although there may be a computer acting in the role as a server -- usually referred to as "server", in quotes), as opposed to client/server.

Port (TCP/IP) - Within the *TCP/IP* protocol, there are 65,535 ports. These are like doorways through which different types of data flow. These data types are other protocols that work within TCP/IP. HTTP is on port 80, FTP is 21, and so on.

Protocol - A protocol is a set of predefined rules that govern how two or more processes communicate and interact to exchange data.

Router - The function of a router is to provide a path from a node on one network to a node on another network. The two networks may be separated by several intervening networks over distances.

Switch - a central connection device in a star topology network. Unlike a hub, this is not a broadcast device. This device routes the data to the intended destination. This decreases network noise and increases efficiency and therefore apparent speed. It is referred to by the number of ports it has ("24 port switch") and can be auto-sensing and auto-switching.

Subnet - a way to break a large network into smaller, independent, pieces.

Subnet mask - an IP address that determines what *subnet* a node will be in. For example, 255.0.0.0 will include all address available in a Class A IP network and 255.255.255.249 would be a subnet of a Class C network and would allow only 5 IP address to be assigned.

TCP/IP (Transmission Control Protocol / Internet Protocol)-The underlying "language" of the internet and for most LANs. TCP provides connection- and stream-oriented, transport-layer services. TCP uses the IP to deliver its packets. **IP** provides routing and connectionless delivery services at the network layer.

URL (Universal Resource Locator)-. What you type into you web browser or FTP client to get to that site e.g.: *http://www.isrsindia-ac.org.*

Achievements in Space by India- 2002

The year 2002 was a fruitful year for India not only in terms of launching satellites and launch vehicles but also in taking up new initiatives in space applications. The following are the highlights:

- METSAT, the first exclusive meteorological satellite built by ISRO, was launched by Polar Satellite Launch Vehicle (PSLV-C4) from Satish Dhawan SpaceCentre, SHAR, Sriharikota. ISRO, on September 12, 2002.
- The Tele-medicine Project for Andaman & Nicobar Islands was inaugurated by Prime Minister on July 3, 2002. It links the G B Pant Hospital, Port Blairwith Sri Ramachandra Medical College and Research Institute (SRMC&RI) at Chennai.
- The Government approved in April, the development of an advanced version of ISRO's Geo-Synchronous Satellite Launch Vehicle, GSLV Mk-III, which will have a capability to launch four tons satellites into Geo-synchronous Transfer Orbit (GTO).
- EDUSAT, an exclusive satellite for developmental and educational communication was also initiated. The satellite will be launched by GSLV.
- ISRO's latest satellite in the INSAT-3 series, INSAT- 3C, was launched by an Ariane launch vehicle of Arianespace from Kourou, French Guyana on January 24,2002. After orbit raising operations and in-orbit testing, INSAT-3C was dedicated to the nation by the Prime Minister on July 3, 2002.

NEWS BRIEFS

India dedicates satellites to Dr. Kalpana Chawala: The Prime Minister of India, Mr Atal Bihari Vajpayee, annouced during the condolence meeting held for Dr. Kalpana Chawla at Parliament Annexe, New Delhi, on February 5, 2003 that India's meteorological series of satellites, METSAT, will be named as KALPANA. The first of the series, METSAT-1, launched by India's PSLV on September 12, 2002 by India's PSLV, will be now known as KALPANA-1.

(http://www.isro.org)

PSLV to Launch Singapore University Satellite: Antrix Corporation of Department of Space and Nanyang Technological University, (NTU), Singapore signed an agreement on, January 24, 2003, under which ISRO's PSLV will launch X-Sat of NTU. The 100 kg class X-Sat, which is being developed by NTU, Singapore, is a remote sensing micro-satellite for earth observation and imaging in visible spectral bands. The satellite will be used for land and coastal observations employing multi-spectral imaging. The three-axes stabilized spacecraft will have deployable solar panels.

X-Sat is the fifth satellite for which Antrix Corporation is providing launch service using ISRO's PSLV. The satellites launched earlier are PROBA of Belgium, BIRD and DLR-TUBSAT of Germany and KITSAT-3 of Korea. Under the agreement signed today, besides launching X-Sat on one of the forthcoming launches of PSLV during 2005/06, Antrix will also provide NTU with the necessary support for testing the satellite. (http://www.isro.org/)

India, U.S. in Discussions on possible Space Accord: Both the countries have held preliminary discussions on a bilateral accord that could significantly expand the scope of space cooperation between the nations and their respective industries, according to a US government official. The United States is interested in expanding cooperative activities into areas such as satellite navigation, earth observation, distance learning and space sciences, says Kenneth Hodkins, deputy director of the office of Space and Advance Technology in the US State Department.

(Space News , January 2003)

ISRO proposes Agrisat for crop monitoring: The Indian Space Research Organization (ISRO) is proposing a constellation of remote sensing satellites called AgriSAT for monitoring crops and predicting grain production. ISRO chairman Dr. K. Kastrurirangan said ISRO has adopted a policy of "theme oriented" satellites, each of which will serve a national development goal, such as education, health and poverty elimination.

While Agrisat has yet to receive financial approval from the government, Healthsat, for telemedicine; and Edusat, for linking and beaming educational programs to schools, already have been cleared by government.

(Space News, January 2003)

Survey of India releases first digital map in WGS84: The Survey of India has released the first map in digital format on WGS84 datum for civilian use. On November 20, 2002, Prof. V. Ramamurthy, Secretary, Department of Science and Technology, Government of India released the digital map of Gujarat state at 1:25,000 scale on World Geodetic System (WGS-84). Map was released both in analogue and digital format and is available for sale at Surveyor General's office.

(GIS Development team)

NASA makes preparations for study on Cirrus clouds: NASA is making scientific preparations for a $15 million field study aimed at resolving a key issue in the scientific debate over global warming. An experiment will be conducted by US scientist using two NASA research aircrafts,

a host of ground radars, and several US environmental satellites to determine exactly how billowing, anvil-shaped thunderstorms born over the Florida Everglades end up as wispy, high-altitude cirrus clouds.

Cirrus clouds reflect sunlight, and in doing so have a cooling effect on the atmosphere. But these clouds also reflect and absorb heat emitted by Earth, and this has a warming effect. The net impact of these cirrus clouds on global warming, and the rate of their formation has emerged as great debate among US scientists.

(Space News, September 2002)

NASA funds for new crop of Remote Sensing Instruments: NASA is sowing seeds for a new generation of environmental research satellites that would be positioned beyond low Earth orbit. The US space agency has awarded $22 millions in late December for nine remote sensing technology development projects meant to enable the observation of Earth's atmosphere, land and oceans on a continuous basis rather than at hourly or daily intervals. "We are looking at the enabling capabilities that would help us focus on the time component of our observations" says Ghassem Asrar, NASA associate administrator for Earth Sciences.

(Space News, January 2003)

E-governance in Ahmedabad Municipal Corporation: The Ahmedabad Municipal Corporation (AMC)'s e-governance plan will materialize soon, AMC Commissioner P. Pannerervel said. Under the plan, residents will be able to use Internet to lodge complaints regarding water, drainage and garbage on the net. In addition, people can even submit building plans and pay property tax bills through the net. The plan makes extensive use of GIS, GPS and remote sensing technologies.

(GIS@Development, Sept. 2002)

Tool to improve fish harvest: Using remote sensing, the Coimbatore based Sapience Softwares has developed a fish-forecasting model aimed at tackling problems related to fish stock assessment. The application is understood to have reduced search time of the fisherfolk by 25-40 per cent.

(Business Line, 13 June 2002)

Indian President calls for space force to protect satellites: President his Excellency Dr. A.P.J. Kalam has issued a call for international space force to protect satellites from any war that may spill into space. " I am sure India would contribute its best to the creation and sustenance of such an international space force" Kalem said Jan. 4, 2003 at the space summit hosted by Indian Space Research Organistion.

(Space News, January 2003)

NEW PRODUCTS LAUNCHED

ERDAS Imagine 8.6: ERDAS Imagine 8.6 is the latest release of the ERDAS Inc.'s industrial-strength image processing and geospatial analysis system and its first release since ERDAS became part of Leica Geosystems. Version 8.6 represents a significant upgrades with many new capabilities. One of the most visible changes is in a new (optional) user interface called the Geospatial Light Table (GLT).

ArcGIS 8.3: The new version features rule based Geo-database topology, linear referencing, editing enhancements and disconnected editing. The new extensions to the software are ArcScan, ArcGIS Survey Analyst, ArcGIS Tracking Analyst.

INTERNET RESOURCE FOR GIS: The Idaho State University (ISU) GIS training and research center web site (**http://giscenter.isu.edu**) is designed to help users learn GIS and obtain free geospatial data. Web site offers a wide range of resources, including on line "Principal of GIS" course as well as details about other GIS classes. The GIS center maintains about 11,000 geospatial datasets available for free download.

MODIS AND ITS ROLE IN ESTIMATION OF LAND SURFACE PARAMETERS

R.P.Singh and V.K.Dadhwal

Space Applications Centre (ISRO), Ahmedabad-15

The land surface processes play an important role in regional/ large–scale climate modeling due to their role in providing the surface boundary conditions to energy/water exchange with the atmosphere. Land is a major component of climate system, but inclusion of land biophysical processes in climate models is still relatively simplistic. Remote sensing from satellites provides the only means of obtaining regular global land data to force and validate land surface processes in the climatic models. Land-atmosphere interactions have traditionally been described in terms of four sub-disciplines: biogeophysical fluxes, biogeochemical fluxes, hydrology, and ecosystem dynamics. The land surface parameters such as surface albedos (direct beam and diffuse for visible and near-infrared wavebands), upward longwave radiation, sensible heat flux, latent heat flux, and surface wetness forms some of the important inputs in climate modeling.

Global data available from Earth Observing System (EOS) -Terra and Aqua's instruments have potential to identify the land use and land cover change, including those over which humans exert some influence. Estimation of key land surface parameters will help in global change research by relating the underlying processes of change and their manifestation. High quality, consistent and well-calibrated satellite measurements are needed to detect and monitor changes and trends in these variables. The Moderate Resolution Imaging Spectroradiometer (MODIS) instrument, which was launched on the Terra platform on December 18th, 1999, is designed to observe and monitor the surface of the Earth in a wide spectral range, moderate spatial resolution of 250m to 1km, with near daily global coverage. A brief background to MODIS sensor (Table 1) and the information on the various available land data products is covered in this article.

MODIS Design Concept: The MODIS instrument provides high radiometric sensitivity (12 bit) in 36 spectral bands ranging in wavelength from 0.4 μm to 14.4 μm. The responses are custom tailored to the theme specific needs of users and provide exceptionally low out-of-band response. Two bands are imaged at a nominal resolution of 250 m at nadir, with five bands at 500 m and the remaining 29 bands at 1,000 m. A ±55-degree scanning pattern at the EOS orbit of 705 km achieves a 2,330-km swath and provides global coverage every one to two days. The Scan Mirror Assembly uses a continuously rotating double-sided scan mirror to scan ±55-degree driven by a motor encoder built to operate at 100 percent duty cycle throughout the 6-year instrument design life. The optical system consists of a two-mirror off-axis afocal telescope which directs energy to four refractive objective assemblies; one for each of the VIS, NIR, SWIR/MWIR and LWIR spectral regions.

MODIS Land Surface Products: The data products have been designed by MODIS Land Group (MODLAND) to remove the burden of certain common types of data processing from the user community and meet the more general needs of global-to-regional monitoring, modeling, and assessment. The land surface products have been categorized mainly in three category, viz. Radiation budget variables, Ecosystem variables and Land cover characteristics. The salient point of each product type (along with product no.) is discussed below.

(1) Radiation Budget Variables

Surface Reflectance/Atmospheric Correction Algorithm Products (MOD09): The surface reflectance product is the input for product generation for several land products: Vegetation Indices (VIs), BRDF, thermal anomaly, snow/ice, and Fraction of absorbed Photosynthetically Active Radiation/Leaf Area Index (FPAR/LAI). Simultaneous retrieval of atmospheric characteristics from MODIS channels are used as input for atmospheric correction of reflectance data.

Land Surface Temperature (LST) and Emissivity (MOD11): Surface temperature is a

good indicator of both the energy balance at the Earth's surface and the greenhouse effect because it is one of the key parameters in the physics of the land-surface processes. It is required for a wide variety of climate, hydrological, ecological, and biogeochemical studies. With a number of narrow channels in 8-12 μm region, emissivity retrieval with higher accuracy than many previous sensors like NOAA-AVHRR, LANDSAT- TM is achieved.

Snow and Ice Cover (MOD10): Snow cover, with its high albedo, is a key parameter of the global energy balance, reflecting much of the incident solar radiation back to space. With SWIR channel, both snow mapping & characterization is achieved.

BRDF and Albedo (MOD43): The reflectance of the surface of the Earth depends on the direction of viewing and solar illumination because of the optical and structural properties of the surface elements. The bidirectional reflectance distribution function (BRDF) describes this dependence and may be used to normalize observed reflectances to a standard view and illumination geometry. It may also be interpreted in terms of surface properties. The albedo is closely related to the average surface reflectance over all angles as a function of solar angle. It is a key parameter controlling the global radiative budget. Using multiple view angle generated during a fixed period (i.e. 8 days), a simple semi-empirical fit provides coefficients for BRDF kernel.

(2) Ecosystem Variables

Vegetation Indices (MOD13): Vegetation indices are used for global monitoring of vegetation conditions. The VIs are used as input in the land cover and land cover change products. They also play an important role in the derivation of the FPAR, LAI, and thermal products. An enhanced vegetation index (EVI) which uses blue, red and NIR has been proposed.

Leaf Area Index (LAI) and Fractional Photosynthetically Active Radiation (FPAR) (MOD15): LAI defines an important structural property of a plant canopy which is the one-sided leaf area per unit ground area. FPAR measures the proportion of available radiation in the photosynthetically active wavelengths (400 to 700 nm) that a canopy absorbs.

Vegetation Production, Net Primary Productivity (NPP) (MOD17): This product provides an accurate measure of terrestrial vegetation growth and production activity. It uses LAI/FPAR products over an annual cycle , insolation estimates from other sources and a detailed model on conversion of respiration efficiency to compute NPP.

Evapotranspiration & Surface Resistance (MOD16): These two parameters are essential for global modeling of climate, water balance and gas traces. In addition, they are required in estimating photosynthesis, respiration, and net primary production.

(3) Land Cover Characteristics

Fire and Thermal Anomolies (MOD40): Fire is an important ecosystem process and source of trace gas emissions. This product identifies the location and timing of fires. The product includes fire occurrence (day/night), fire location, the logical criteria used for the fire selection and an energy calculation for each fire.

Land Cover (MOD12): This is a seasonal product important for biophysical and biogeochemical parameterization and is used as input to global and regional scale models of climate, hydrologic processes, and biogeochemical cycling.

Vegetative Cover Conversion (MOD44): This product uses the 250m Surface Reflectance products to detect and label changes in land cover.

Vegetation Continuous Fields: This product produce 1km global fields of percent cover for basic land cover types.

Almost every day over the entire globe, the sensor monitors changes on the land surface, thereby building upon and extending the heritage begun by Landsat. MODIS maps the areal extent of snow and ice brought by winter storms and frigid temperatures. The sensor observes the "green wave" that sweeps across continents as winter gives way to spring and vegetation blooms in response. It sees where and when disasters strike—such as volcanic eruptions, floods, severe storms, droughts, and wildfires. MODIS' bands are particularly sensitive to fires; they can distinguish flaming from smoldering burns and provide better estimates of the amounts of aerosols in the atmosphere.

Table 1: MODIS Technical Specifications

Orbit:	705 km, 10:30 a.m. descending node (Terra) or 1:30 p.m. ascending node (Aqua), sun-synchronous, near-polar, circular
Scan Rate:	20.3 rpm, cross track
Swath Dimensions:	2330 km (cross track) by 10 km (along track at nadir)
Telescope:	17.78 cm diam. off-axis, afocal (collimated), with intermediate field stop
Size:	1.0 x 1.6 x 1.0 m
Weight:	228.7 kg
Power:	162.5 W (single orbit average)
Data Rate:	10.6 Mbps (peak daytime); 6.1 Mbps (orbital average)
Quantization:	12 bits
Spatial Resolution:	250 m (bands 1-2) 500 m (bands 3-7) 1000 m (bands 8-36)
Design Life:	6 years

Primary Use	Band	Bandwidth[1]	Spectral Radiance[2]	Required SNR[3]
Land/Cloud/Aerosols Boundaries	1	620 - 670	21.8	128
	2	841 - 876	24.7	201
Land/Cloud/Aerosols Properties	3	459 - 479	35.3	243
	4	545 - 565	29.0	228
	5	1230 - 1250	5.4	74
	6	1628 - 1652	7.3	275
	7	2105 - 2155	1.0	110
Ocean Color/ Phytoplankton/ Biogeochemistry	8	405 - 420	44.9	880
	9	438 - 448	41.9	838
	10	483 - 493	32.1	802
	11	526 - 536	27.9	754
	12	546 - 556	21.0	750
	13	662 - 672	9.5	910
	14	673 - 683	8.7	1087
	15	743 - 753	10.2	586
	16	862 - 877	6.2	516
Atmospheric Water Vapor	17	890 - 920	10.0	167
	18	931 - 941	3.6	57
	19	915 - 965	15.0	250
Surface/Cloud Temperature	20	3.660 - 3.840	0.45(300K)	0.05
Atmospheric Temperature	21	3.929 - 3.989	2.38(335K)	2.00
	22	3.929 - 3.989	0.67(300K)	0.07
	23	4.020 - 4.080	0.79(300K)	0.07
	24	4.433 - 4.498	0.17(250K)	0.25
Cirrus Clouds Water Vapor	25	4.482 - 4.549	0.59(275K)	0.25
	26	1.360 - 1.390	6.00	150(SNR)
Cloud Properties	27	6.535 - 6.895	1.16(240K)	0.25
	28	7.175 - 7.475	2.18(250K)	0.25
	29	8.400 - 8.700	9.58(300K)	0.05
Ozone	30	9.580 - 9.880	3.69(250K)	0.25
Surface/Cloud Temperature	31	10.780 - 11.280	9.55(300K)	0.05
Cloud Top Altitude	32	11.770 - 12.270	8.94(300K)	0.05
	33	13.185 - 13.485	4.52(260K)	0.25
	34	13.485 - 13.785	3.76(250K)	0.25
	35	13.785 - 14.085	3.11(240K)	0.25
	36	14.085 - 14.385	2.08(220K)	0.35

Satellite Stereo Photogrammetry for Himalayan Glacier Mass Balance Estimation

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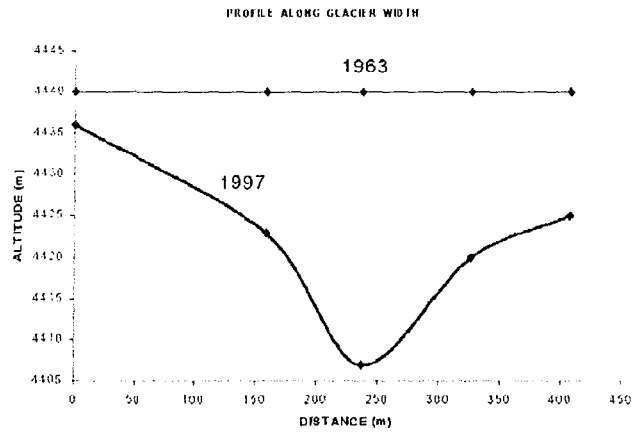
Development of digital satellite stereo photogrammetry from analog and analytical methods has come as a boon for Himalayan glaciological applications. The high altitude zones of Himalayan physiograhic regime in Indian subcontinent are bestowed upon with huge concentration of glaciers. These bodies of snow and ice are the perennial sources of freshwater feeding almost all the north Indian rivers and catering to need of domestic water requirements, micro mini and major hydroelectric projects and irrigation in hills and Indo Gangetic plains.

One of the vital glaciological applications is mass balance of glaciers. Glacial mass balance studies are concerned with change in the mass of a glacier and the distribution of these changes in space and time. Mass balance measurements at points are normally expressed as equivalent volumes of water per unit area. Thus they have dimensions of length. Variations in the rate of accumulation of snow and melting of ice from one year to other effects the mass of the glacier and ultimately in the rates of river flow. However it is not feasible to study all the glaciers by conventional field inventory every year due to rugged terrain and extremely cold climatic conditions in Himalayan region. Therefore stereo photogrammetric method can be conveniently used to monitor this glacial parameter. Satellite stereo data can be processed for automated extraction of digital elevation model (DEM). DEM can be used to make plannimetric and vertical measurements over the glacier surface. Use of satellite Photogrammetry in this application has been demonstrated in monitoring ice masses of Arctic or Antarctic ice sheets. Of course the other techniques such as laser terrain mapping (LTM) and radar interferometry are also gaining momentum in this field.

About seven stereo pairs of IRS 1C PAN sensor acquired covering glaciated region have been processed so far at Earth Sciences and Hydrology Division at Space Application Centre. IRS 1C PAN sensor acquires data in panchromatic range (0.50-0.75 m). It has a spatial resolution of 5.8m and dynamic range of 6 bit (saturation radiance 47 mw/sq. cm/str/micron). It can be tilted across track upto 26° either sides. It has 70 km swath. This capability can be used to generate stereo pair of desired B/H ratio. DEM has been generated using integrated software developed for processing of IRS 1C/1D panchromatic stereo data in digital mode using the softcopy photogrammetric workstation at Satellite Photogrammetry and Digital Cartography Division of Space application Centre.

Though the technique of change detection is simple but the task of generating a good DEM for hilly region is not so. There are mainly two factors, which control a generation of good DEM. First is the collection of good GCPs and the second is automatic image matching or registration of stereo images. Due to lack of man made features in mountainous terrains; identification of good GCPs becomes difficult. Mostly sharp bends of streams or confluences of streams are taken, as GCPs. GCPs can be collected using topographical maps or GPS operated in differential mode in the field. Both the sources are based on different ellipsoids. This causes little difference in the coordinates of Resulting DEM.

Image matching in glaciated region is governed by presence of snow, orientation of slopes of hills in two tilted images of stereo pair and different dates of pass of the satellite. Since snow has very high albedo, the PAN sensor gets saturated. Therefore, image matching is rendered poor in accumulation zone (snow covered part above equilibrium line). This results in poor accuracy of DEM. Glacier ice has substantially lower reflectance than snow, but higher than rocks and soil of the surrounding area. Zone of ice below equilibrium line is known as ablation zone. This



is the region where image matching is relatively not a problem. Therefore, it has a better accuracy than accumulation zone. The other reason for poor image matching in hilly region is because of one of the basic differences in aerial photogrammetry and satellite photogrammetry. In the former case the optical axis of the camera remains vertical or near vertical while taking the overlap of the area. In case of satellites the altitude is so high that overlap of adjacent paths with camera viewing nadir restricts the optimum B/H ratio. In order to compensate for this the camera has to be tilted from other paths to get the overlap and desired B/H ratio (> 0.5). This causes distortion in the images. In the mountainous region, distortion in the images results in poor image matching. Overlap from different paths is possible on different dates of satellite pass. This difference is very crucial in glaciology because different dates result in change in radiometry of the image due to solar elevation effects and melting of ice and snow. This too causes poor image matching.

In order to generate DEM with good accuracy in hilly region, the area of interest should be made as small as possible of course not below a threshold. One of the images should be nadir or near nadir viewing. Stereo pair can be generated in the workstation itself by choosing suitable images from existing pairs. This has been demonstrated for one of the region. Since glacial valleys are very broad and almost flat, the accuracy of DEM with 15 to 20m error can be obtained provided GCPs are well distributed and correctly identified. For this it is recommended that GCPs should not be chosen on high slopes and instead should be identified on riverbeds with gentle slopes. GCPs collected using DGPS in the field can improve the DEM however accessibility to such points in mountainous tracts has to be ascertained first. An example of using stereo data for estimating changes in the mass is presented here. Elevation profiles drawn across the valley of Shaune garang glacier of Basapa valley, Himachal Pradesh are shown here. The reference for this change is Survey of India topographical map of 1962 from where initial elevations of glacier surface are taken. Elevations derived from DEM generated using stereo images of 1998 are compared with SOI elevations. This glacier has been checked for deglaciation during the ground truth. A retreat of about 980m has been observed for this glacier since 1962. A maximum change of 35m in the thickness of ice in the middle of the glacier valley has been observed.

Cartosat –1 satellite is to be launched in near future. The satellite is planned to have sun synchronous orbit with two panchromatic cameras-fore and aft, with a fixed tilt of +26 and –5 degrees with respect to the nadir along the satellite ground track to provide a near real time along track stereo capability. The ground resolution of the above cameras is around 2.5m. The data with 10-bit radiometric quantisation level will not saturate over the areas with very high reflectance characteristics. This will help in better accuracy even in accumulation zone of the glacier.

Chapter's Activities

The Chapter engaged itself in many productive and innovative activities to promote the cause of remote sensing and facilitate exchange of ideas among the remote sensing users and experts. Details of some of the major activities are highlighted for the benefit of the readers.

- **WORLD ENVIRONMENT DAY CELEBRATION**

To bring awareness on environment related issues, June 5th is celebrated as World Environment Day. It was established by the United Nations General Assembly in 1972. It is a people's event with governments, individuals and community groups organizing activities to improve the environment.

On this occasion ISRS-AC and Gujarat Ecological and Educational Research (GEER) Foundation, Government of Gujarat jointly organized a popular lecture and visit to Indroda Nature Park , Gandhinagar on the occasion of World Environment Day on June 05, 2002. Lecture on, "Remote sensing for forestry and environment with special emphasis on forest damage study", was delivered by Dr. R.N. Jadhav, Scientist SG, SAC. Dr. J.P. Aggarwal, PCCF, Government of Gujarat, chaired the programme. The function was attended by around 100 officers of Gujarat Forest Department and members of the Chapter.

- **TREE PLANTATION PROGRAMME**

ISRS-AC, Gujarat State Forest Department and Ahmedabad Urban Development Authority (AUDA), jointly organized a tree plantation programme on July 27, 2002 to bring awareness regarding urban environment protection among school children, parents and family of ISRS-AC members. The site was along 132 ft ring road between Drive-in road and IIM - Vastrapur cross roads. Students of Kendriya Vidyalaya, SAC, Saint Xaviers, Mount Carmel, Tulip, Delhi Public School, CEPT and Gujarat University participated in the programme. Around 200 students participated in the programme. Around 400 saplings along with tree guards were put. The programme was inaugurated and graced by Dr. J.P. Aggarwal, PCCF, Govt. of Gujarat and Dr. A.K.S. Gopalan, former Director SAC.

- **NATIONAL REMOTE SENSING DAY CELEBRATION**

ISRS-AC and Nirma Institute of Technology, Ahmedabad jointly organized an exhibition on, "Remote sensing applications for natural resources survey and disaster management", for college students at Nirma Institute of Technology on August 12, 2002. Prof. H.V. Trivedi, Director, Nirma Institute of Technology inaugurated the exhibition. Dr. A.K.S. Gopalan, Director SAC and Shri A.R. Dasgupta, Deputy Director SAC also graced the occasion. A wide publicity to the event was given and response from college students was overwhelming. Around 1000 students visited the exhibition.

We provide a glimpse of the event through some the photographs taken during the occasion on the following page.

Tree plantation by School children

Shri J. S. Parihar, Chairman, ISRS-AC, having discussions during National Remote Sensing Day Celebrations with distinguished participants.

EDUCATION/TRAINING:

- **COMMERCIAL APPLICATIONS OF REMOTE SENSING AND GIS (CARG-2002)**

A one day Workshop on, "Commercial Applications of Remote Sensing and GIS" preceded by 4-day tutorials on, "Commercial Applications of RS & GIS with special emphasis on Geoinformatics for Environmental Impact Asessment", was organized jointly by ISRS-AC, Indian Society of Geomatics (ISG) and Value Added Services Cell of Space Applications Centre at State Remote Sensing Applications Centre, Goa. In all 53 participants mostly from corporate sector, participated in the Tutorials and around 100 Delegates attended the Workshop. Lecture notes and Proceedings were brought out as hardcopy prints as well softcopy on CD and were distributed to all participants. ISRS-AC mainly provided local support and technical expertise to organize the event.

- **WORKSHOP ON URBAN PLANNING AND INFRASTRUCTURE DEVELOPMENT**

Indian National Cartographic Association (INCA) organized an International Conference on "Convergence of Imagery, Information Maps" at Ahmedabad from October 30-November 01, 2002. Two days Pre-Conference Workshops on themes viz. I) Urban Planning and Infrastructure Development, ii) National Spatial Data Infrastructure (NSDI) and iii) Information extraction from high resolution imagery were organized. One of these Workshop on "Urban Planning and Infrastructure Development", was organized by ISRS-AC. In all twelve participants attended this Workshop.

- **ISRS-2001 SYMPOSIUM**

Proceedings of the National Symposium of the Indian Society of Remote Sensing (ISRS) on, "Advances in Remote Sensing Technology with Special Emphasis on High Resolution Imagery", hosted jointly by ISRS-AC and Space Applications Centre (ISRO), Ahmedabad during December 11-13, 2001 was brought out on CD. Around 600 copies have been made. This CD is being released during the ISRS & ISPRS-TC-VII International Symposium on, "Resource and Environmental Monitoring" to be held at Hyderabad, India during December 03-06, 2002. Copies of the Proceedings shall be distributed to all the delegates of ISRS-2001 Symposium and shall also be available on sale to interested persons.

We provide a glimpse of the event through some the photographs taken during the CARG-2002 on the following page.

Lecture Session in progress during CARG-2002

Tutorial session in progress during CARG-2002

- **ISRS-AC WEB SITE**

  Web-site namely http: // www.isrs-ac.org is maintained and updated for disseminating information about chapter activities, notices, members profiles, major events of main Society and to increase professional interaction among the members and the remote sensing community at large etc. This has also resulted in minimizing the postal expenses and immediate dissemination of information. As on November 22, 2002 around 1300 hrs 3121 hits are recorded to this Website.

- **SUPPORT TO ISPRS COMMISSION VII**

  Website for ISPRS-Technical Commission VII is being maintained by ISRS-AC.

SCIENTIFIC MEETINGS

- **PROF. P.R. PISHAROTY SERIES LECTURE (April 05, 2002)**

  Prof. P.R. Pisharoty Series Lecture (7th Lecture) was organized on April 05, 2002 at Space Applications Centre (ISRO), Ahmedabad. The lecture was delivered by Prof. Y.K. Alagh, on "Sustainable Economic Policy for Forestry Sector". The lecture was well attended by around 200 members of the Society and invited guests from SAC and PRL.

- **SPECIAL LECTURE (October 22, 2002)**

  Special lecture was organized jointly by ISRS-AC, Indian Society of Geomatics, Ahmedabad Chapter (ISG-AC), Indian Meteorological Society, Ahmedabad Chapter (IMSA) and Gujarat Branch of Indian National Cartographic Association (INCA) on October 22, 2002 at Space Applications Centre (ISRO), Ahmedabad to honor and felicitate Dr. A.K.S. Gopalan, Director SAC on his sixtieth birth-day. The lecture was delivered by Dr. A.K.S. Gopalan, Director, SAC, on "Indian Space Programme: My Experiences and Vision". The lecture was well attended by around 250 members of all four Societies.

- **Shri L.N. Calla Memorial Lecture Series (March 05, 2003)**

  A lecture was jointly organized by ISRS-AC and Centre for Environmental Planning and Technology (CEPT), Ahmedabad for Shri L.N. Calla Memorial Lecture Series on March 5, 2003 by Shri P. Panneerval, IAS, Municipal Commissioner, Ahmedabad Municipal Corporation on "Liveraging Technology for better Governance".

We provide a glimpse of the event through some the photographs taken during the Prof. P.R. Pisharoty lecture series on the following page.

Glimpses of Prof. P.R. Pisharoty lecture series

Prof. Y.K.Alagh delivering the lecture

A token of appreciation from the chapter to Prof. Alagh being handed over by Controller SAC.

Prof. P. R. Pisharoty (1909-2002)

The sad demise of Prof. P.R. Pisharoty, father of Indian remote sensing program and noted meteorologist, on September 24, 2002, had left world scientific community with a sense of great loss as one of its pioneering member had left for his final journey.

Prof. Pisaroty was born at Kollengode village of Palghat district of Kerala, on Febuary 10, 1909. He graduated from University of Madras in 1931 in Physics and subsequently joined research under Prof. C.V. Raman at Indian Institute of Sciences, Bangalore. He got associated with India Meteorological Department, Government of India in 1942. He got his Ph.D. from University of California in 1954 and joined Alibaug Magnetic Observatory at Colaba, Mumbai and later became Director of the Institute of Tropical Meteorology, Pune. Prof. Pisharoty joined Physical Research Laboratory, Ahmedabad in 1967 and later he became Director, Remote Sensing and Satellite Meteorology at Space Applications Centre, Ahmedabad.

The famous experiment on coconut-wilt-root disease in Kerala, which was conducted by Prof. Pisharoty in 1969, became the founding stone of the Indian remote sensing program. His contribution to remote sensing and meteorology is beyond any description. Indian Society of Remote Sensing-Ahemdabad chapter would always draw inspiration from words and deeds of this 'Karmayogi'.

New Satellite Launches

- ADEOS-II, now renamed as Midori-2 was launched on December 14, 2002 from Japan and started working successfully on January 10, 2003. It has got a variety of earth observation sensors on-board such as, POLDER, GLI, SeaWiNDS,ILAS-II and AMSR.
- First dedicated meteorological satellite of India "METSAT" was launched by ISRO on Sept. 12, 2002. (http://www.isro.org)
- MODIS-AQUA was launched on May 4, 2002 by NASA. Find more details on http://aqua.nasa.gov/.
- SPOT-5 with a PAN camera of 5m resolution was launched on May 4, 2002 by CNES. (http://www.spotimage.fr/)
- ENVISAT satellite of ESA was launched on March 1, 2002 it has multiple environmental payloads such as MERIS, ASAR etc. (http://envisat.esa.int)
- Gravity Recovery and climate experiment (GRACE) was launched on March 17, 2002 by NASA the twin satellites will be useful to provide finer details of Earth's gravity field. (http://www.csr.utexas.edu/grace/)

Know more about our Environment

(Complied by Dr. Abha Chhabra, SAC)

Few relevant environmental websites

http://www.unep.net

- This recently developed website from United Nations Environment Programme (UNEP http://www.unep.org) promotes UNEP's programme of partnership and cooperation in preserving the environment. This site brings together a lot of information and data on current environmental issues, future environmental challenges and at the same time facilitates their exchange through Internet. The site also provides access to remote databases that are constantly updated and generally available free of charge.
  (Source: Down to Earth 31 January, 2003)

http://www.unfccc.de/

- United Nations Framework Convention On Climate Change (UNFCCC)

http://www.foe.co.uk/climatechange/real.html

- The world's top climate scientists now agree that our climate is changing, and probably for the worse.

http://www.ipcc-nggip.iges.or.jp

- Intergovernmental Panel on Climate Change (IPCC) - established by the World Meteorological Organization (WMO)

http://ipcc-ddc.cru.uea.ac.uk/

- The IPCC Data Distribution Centre Gateway

http://www.tip.net.au/~edmonds/greenhouse/whatis.html

- what the greenhouse effect is, and how it is responsible for warming the atmosphere. The greenhouse effect has been described as potentially the most

http://www.iea.org/ipcc.htm

- IPCC/OECD/IEA Programme for National Greenhouse Gas Inventories

http://www.geocities.com/Athens/Parthenon/5173/greenhouse_effect.html

- An overview about the Greenhouse Effect and Global Warming.

http://www.geic.or.jp

- GLOBAL ENVIRONMENTAL INFORMATION CENTRE

http://www.wotr.org

- Watershed Organization Trust (WOTR) instituted under the auspices of the Indo-German Watershed Development Programme provides information and help in all conceivable areas of watershed management. More information on concept and how to implement the concept of water harvesting is available on this site.

Few relevant websites related to Remote Sensing and Environment

http://www.spie.org/info/ae/

- Remote Sensing of the Atmosphere, Environment, and Space

http://ice.ucdavis.edu/echo/remote_sensing.html

- The Information Center for the Environment

http://www.frf.usace.army.mil/duck94/exp7.html

- Airborne Remote Sensing of the Environment in the Littoral Zone

http://rouge.engr.wisc.edu/cee/courses/cee352.html

- Remote Sensing and Forest Monitoring

RECENT NEWS

- **Satellite mapping of India's forests finishes first phase**
  The digital mapping of rich flora spread over an area of about 84, 000 sq kms. Has been finished under a joint programme undertaken by Department of Biotechnology, Department of Space, and Union Ministry of Environment of Forests. The first phase of mapping covered 46 percent of total forest cover in biodiversity hotspots of North East, Western Himalayas, and Western Ghats with the aid of state-of-the-art satellite technology. This research will benefit international scientific community and also expected to facilitate bioprospecting in India.

(Source: Down to Earth 28 February, 2003)

- **Indo-French satellite to help forecast drought**
  Megha Tropiques, a satellite currently under construction by Indian Space Research Organization (ISRO) in collaboration with French Space Agency Centre National d'Etudes Spatiales. The satellite will be placed in low earth orbit by a polar satellite launch vehicle and expected to be launched in 2006. Megha Tropiques will provide frequent measurements of a number of parameters related to the water cycle and energy budgets. Such data is expected to improve invaluable tool for forecasting drought conditions in tropical regions.

(Down To Earth 28 February, 2003)

AMAZING FACT

- In India, over 170 million people do not have access to safe water and 69% of population lack adequate sanitation. Only around 217 towns and cities out of a total of 3, 119 have any kind of treatment for waste water.

(Down to Earth 31 January, 2003

Silver Lining

- Dr. K. N. Shankara, Life Member of ISRS-AC has joined as Director, Space Applications Centre, Ahmedabad. The ISRS-AC family extends hearty welcome to Dr. Shankara at SAC and wishes him a very fruitful tenure as Director, SAC

- Four life members of the chapter have been awarded Astronautical Society of India (ASI) annual awards. Prof. P. D. Bhavsar, Former SAC Director, has been awarded Aryabhata award for the year 1999. Dr. K. N. Shankara, Director, SAC and Dr. A. R. Dasgupta, Dy. Director, SAC has been awarded ASI award for the year 2000. Dr. V.S. Iyengar, Visiting Scientist, SAC and Dr. K.L. Majumdar, Group Director, SIPG/SIIPA, SAC has been awarded ASI award for the year 1999. Many congratulations to all of them.

Prof.P.D.Bhavsar

Dr. A.R. Das Gupta

Dr. K.L.Majumdar

- Dr. Baldev Sahai, senior member of ISRS-AC and former Dy. Director of Remote Sensing Area, Space Applications Centre, Ahmedabad was conferred with ISRS Bhaskara Award for the year 2000 for his life-time contributions to remote sensing at the inaugural function of ISPRS TC VII International Symposium & ISRS Annual Convention held at Hyderabad. ISRS-AC wishes him hearty congratulations.

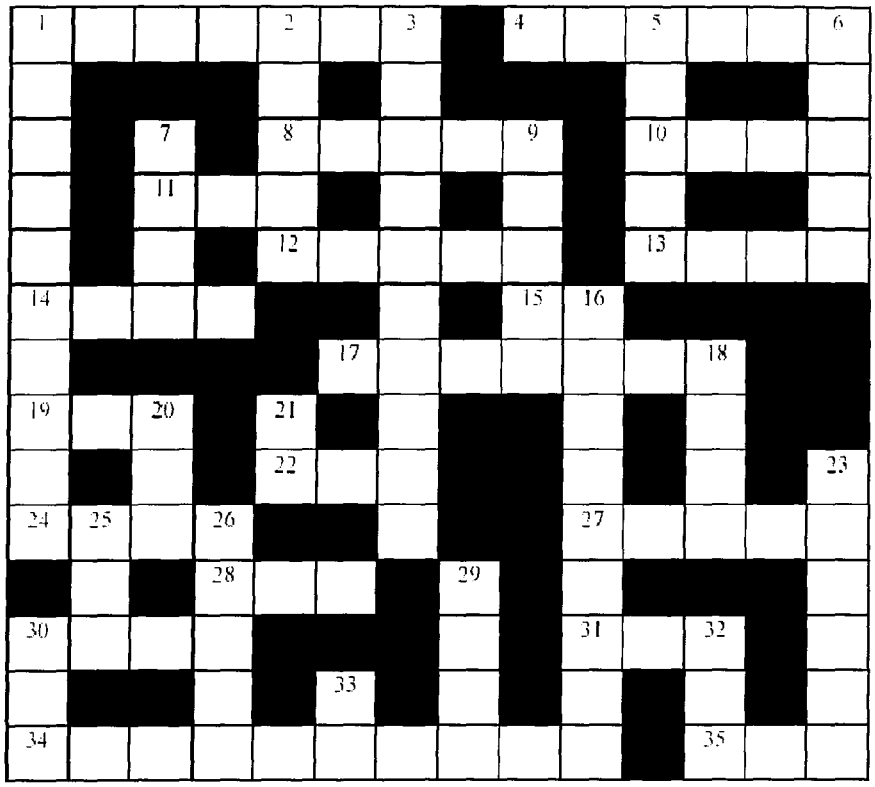
- Dr. Shailesh Nayak, former Chairman of ISRS-AC has been appointed as Chairperson, of ISPRS working group VII/3 on "Integrated monitoring system for resources management. ISRS-AC wishes him many congratulations.

- Shri R.K. Sarangi, Life member of ISRS-AC was awarded best paper award for publication in Journal Indian Society of Remote Sensing (JISRS) for the year 2001, for his contribution entitled "Chlorophyll-a concentration along west coast of India usingISR-P3 MOS-B data". Many Congratulations.

- Ms. Abha Chhabra, life member of ISRS-AC was awarded Doctor of Philosophy (Ph. D.) degree by Maharshi Dayanand Saraswati University, Ajmer on her thesis work on "Spatial Modelling of carbon pools and fluxes of terrestrial biosphere of India". Many Congratulations.

LEISURE CORNER

Crossword



(Designed by R .K. Sarangi, SAC)

Across

1. Atmospheric particles (7)
4. Part of an eye (6)
8. Future Indian Radar Satellite (5)
10. An Indian association of Engineers (4)
11. A deadly virus (3)
12. DEM generation technique (5)
13. Data transfer rate (4)
14. An American Remote Sensing Journal (4)
15. Characteristics of atmospheric attenuation (2)
17. Two space agencies of Europe (4,3)
19. A vegetation index (3)
22. An UN organization for natural resources (3)
24. The new European currency (4)
27. Process of mapping (5)
28. Dimensional parameter (3)
30. Radiate in terms of temperature (4)
31. International Oceanographic Authority (3)
34. The principle of absorbing (10)
35. Global observation program (3)

Down

1. Blanket around the earth (10)
2. A vegetation index-acronym (5)
3. Indian remote sensing camera (4,6)
5. The path of satellite (5)
6. Japanese Space Mission (5)
7. An INSAT payload (4)
9. An American sensor (5)
16. A technical acronym for identification (9)
18. Thermal infrared sensor of ERS (4)
20. An Institute for physical sciences at Gandhinagar (3)
21. Short term of a frequency used for communication purpose (2)
23. A synonym for our universe (6)
25. A projection system (3)
26. True planimetric projection (3)
29. A remote sensing software package (4)
30. Popular term used in ecological assessment (3)
32. Short form of an environmental institute at Ahmedabad (3)
33. Short term used in networking (2)

(Solution to this crossword can be found somewhere on another page of this issue)