A meeting of national committee is held at
NGRI, Hyderabad on
26th and 27th October 2006.

All the members and invitees highlighted
the Indian research and outreach program
that can be included as India's contribution
to these International years.

Schedule of the INSA meeting on 26th and 27th 2006

26th October 2006		
Introduction	Prof. H. K. Gupta	10:30 to 11:30
About International Year of Planet Earth	Dr. Ed. Mulder	
Indian solid earth research -National Scenario	**Prof. V. P. Dimri**	
Tea Break	11:30 –12:00	
Indian research initiatives in Solar-Terrestrial Relations during IHY	Prof. Archana Bhattacharya	12:00 to 1300
Phase transformation and variations in the physical properties	Prof. Alok K.Gupta	
Traps to Core and important geophysical problems of India region	Prof. R.N. Singh	
Lunch	13:00 –14:00	
New Advances in global significance of the crystalline complexes of northern and eastern India	Prof. Abhijit Bhattacharya	14:15 –16:00
Suggestion on Indian science and outreach program	Prof. D. Nayak	
DST out reach program	Dr. A. Sinha	
GPS research and proposal for International workshop	Prof. Madhav. N. Kulkarni	
Tea Break	16:00 –16:30	
Development and Management of Ground Water: Status in India	Dr. S.N. Rai	16:30 – 18:00
Seismic Hazard: Initiatives and Plans	Dr. R.K. Chadha	
Insights into Crustal Evolution: Current perspectives from zircon Geochronology and Geochemistry	Dr. Y.J. Bhaskar Rao	
Exploration for Platinum Group Elements (PGE) in Peninsular India – Status, Problems and Scope	Dr. V. Balaram	
Dinner	19:30	
27th October 2006		
Indian initiatives to International Polar Year	Dr. Rasik Ravindra	10:00 to 12:00
Paleao-climate and soil research	Prof. A.K. Singhvi	
Discussion & Direction of future course of action	All Members & Invitees	
Signing of MoU between Indian National Committee of INSA and International Year of Planet Earth		
Vote of Thanks	Dr.V.M.Tiwari	
Lunch	13:00 –14:00	

The International Year of Planet Earth

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Abstract:
Natural disasters like the 2004 tsunami provide graphic testimony of the Earth's incredible power. More effective use of geoscientific knowledge can save lives and protect property. Such knowledge also enables us to satisfy the growing needs for Earth's resources for an expanding human population in a sustainable manner. Such knowledge is readily available in the practical experience and publications of some 500,000 Earth scientists all over the world, a professional community that is ready and willing to contribute to a safer, healthier and wealthier society if called upon by politicians and decision makers.
The International Year of Planet Earth (2007 - 2009) aims to contribute to the improvement of everyday life by promoting the societal potential of the world's Earth scientists, as expressed in the Year's subtitle *Earth sciences for Society*. Ambitious outreach and science programmes constitute the backbone of the International Year, politically endorsed by all 191 member states of the United Nations Organisation when it proclaimed 2008, the central year of the triennium, as the UN Year of Planet Earth. This has been an initiative of the International Union of Geological Sciences (IUGS) and UNESCO. It is supported by 12 Founding and 26 Associate Partners covering almost the entire international geoscientific community.
The International Year of Planet Earth has a science and an outreach programme. In the science programme, ten science themes are identified, all with a strong focus on addressing societal needs. These include: Groundwater: reservoir for a thirsty planet? Hazards: minimizing risks, maximizing awareness, Earth and Health: building a safer environment, Climate Change: the 'stone' tape, Resources: towards sustainable use, Megacities: our global urban future, Deep Earth: from crust to core, Ocean: abyss of time, Soil: Earth's living skin, Earth and Life: origins of diversity. For all science themes easily accessible brochures have been printed, also available via the website (www.yearofplanetearth.org).
The website gives also access to our two outreach brochures describing how proposals for science and outreach projects can be submitted. As of today, 26 nations, including India, developed National Committees to implement the Year of Planet Earth in their own countries. The Indian National Committee is invited to develop coherent national science and outreach plans, to organise a major launching event, to identify potential sponsors, partners and a Patron, and to explore options to organise a Regional Top Conference on 'Earth Sciences for Society'.

Solid Earth Research in India: Contribution to International Year of Planet Earth

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Abstract:
Indian solid earth research is also concentrated around most of the objectives mentioned in the theme of International Planet Earth Year, International polar year and to some extent other Years too. Several national research institutes involved in the solid earth research i.e. NGRI, NIO, WIHG, IIG, NCAOR, GSI etc are actively involved new data collection their modelling to understand the interior of the Earth and explore nature resources. Apart from the national institutions, state departments, universities and IITs are also playing an important role to meet the challenges of understanding the Earth system. In addition to solid Earth research many programmes, such as exploration and management of ground water, gas hydrates exploration, seismic micro-zonation of cities and 4 D seismic are oriented to meet the demand of man kind and sustain ecosystems.

Some of the programme initiated at different level and planned to be initiated in the next five year plan, qualify to be included as the Indian contribution to these years.
Few of these programmes are:
Structure and geodynamics of India plate
Geochemical mapping
Seismic Hazard and micro-zonation
Earthquake prediction
Kinematics of Indian plate through GPS measurements
Exploration and management of ground water
Ground water pollution
Exploration of Gas Hydrates
Exploration of radioactive and platinum group of minerals
Geomagnetic mapping
Electro-magnetic mapping
Gravity mapping

In the 11^{th} five year plan some new initiatives are:
Mapping of Active Indian plate Margin
Carbon Sequestration
Multi- parametric observatories
4 D Seismic

Indian Contribution in International Polar Year

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Abstract :
International Polar Year (IPY) is going to be launched officially on 1st March 2007 at Paris. Several nations, participating in this historical event, have already begun preparations. Outreach programmes have been formulated to involve younger generation, common man and school students. The Edinburgh declaration on IPY, made public during XXIX Antarctic Treaty Consultative Meeting, has already been hailed as an important document of far reaching significance in advancing international cooperation in advancement of polar science for the benefit of mankind.
Indian initiative for IPY focuses mainly on the atmospheric science, palaeoclimate and marine biology of the southern oceans. Three of the proposals have already found international linkages and have been accorded ID numbers. These programmes are titled :
Monitoring of the upper ocean circulation transport and water masses between Africa and Antarctica (ID No.924)
Short term Holocene climate variability in Antarctica and the southern latitudes utilizing sediment cores from the Indian ocean sector of the Southern Ocean, the cores from the periglacial lakes and the shallow ice cores from Antarctica (ID No.850)
Land based anthropogenic impact of coarse particles on Antarctic shelf (Activity ID No.129)
Apart from these projects India has been included in the Steering Group of IPICS, (International Partnerships in ice core sciences), NCAOR in collaboration with GSI, has planned to drill several short holes to retrieve ice core from ice shelf between DG and Maitri (distance of ~ 100 km) to contribute towards understanding of Holocene palaeoclimate.
India also intends to initiate a programme on functional and taxonomic diversity of bacteria from the Indian Ocean sector of Southern Oceans as also from the part of Antarctic Ocean adjustment to eastern Antarctic margin.

Indian research initiatives in Solar-Terrestrial relations during IHY

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Abstract:
The year 2007 has been designated as the International Heliosphysical Year (IHY) to mark the 50th anniversary of the International Geophysical Year (IGY) by extending the domain of study to include the connections from Earth to Sun and interplanetary space. An important aspect of these connections is 'space weather', which may have substantial influence on the performance and reliability of space-borne and ground-based technological systems. The IHY-India programme plans to utilize data from various observational facilities together with modeling to study some important aspects of the Sun-Earth relationship. Archiving and dissemination of data, and public outreach are other important components of this programme. In India, Radio Heliographs are being used to study pre-event signatures of solar flares and coronal mass ejections (CMEs), a variety of telescopes provide information on magnetic and velocity field evolution in active regions of the Sun, flares and CMEs, and helioseismology, and radio telescopes yield valuable data on interplanetary scintillations. A network of twelve magnetic observatories in different parts of India, extending from the dip equator to the focus of the solar quiet ionospheric current system, monitors the geomagnetic field continuously and provides inputs for quantifying space weather. This data has shown how the dayside ionospheric currents are modified within a few minutes by X-ray emissions associated with solar flares reaching Earth at the speed of light, whereas an Earth-directed CME generally takes more than a day to reach Earth's magnetopause. Importance of a southward orientation of the interplanetary magnetic field (IMF) for a CME to be geo-effective and cause a significant magnetic storm is also seen from this data used in conjunction with IMF data. Coupling of the magnetosphere with the ionosphere and thermosphere leads to magnetic activity related changes even in the equatorial and low latitude ionosphere. One of the most severe space weather phenomena in the Indian region is the occurrence of irregularities in the nighttime ionosphere which are capable of strongly scattering even L-band signals from satellites used for communication and navigation, as in the case of GPS signals, thus degrading the signals. Changes in the electric field in the equatorial ionosphere caused by magnetic storms or substorms can trigger the growth of these irregularities. In the IHY-India programme, radars, ionosondes, scintillation and airglow techniques shall be used to monitor the ionospheric effects of transient events on the Sun. A major goal of the programme is to study the solar sources of geo-effective structures, their evolution during propagation to Earth's magnetosphere and the processes involved in the transfer of solar wind energy to the magnetosphere-ionosphere-thermosphere coupled system. In the context of the International year of Planet Earth, the IHY-Indian programme is also expected to contribute towards unambiguous identification of the origin of electromagnetic signals and other ionospheric effects observed on earth and by satellites, in studies of earthquake precursors.

Traps to Core and important geophysical problems of India region

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Abstract :
The most important concern now is how we are being affected now and here. How much is it natural and how much it is because of us? How much which is natural can be controlled by us. Next question which comes immediately to our mind is how this 'now and here' is affected by others: places, times and them. What is reality and what is myth and heresy? Society now demands answers to these questions. How can we arrive at rational understanding of what is happening and what will happen? A significant question for earth scientist appears to define chemical and physical changes happening in and around us in near surface region both external and internal to solid earth. Changes in the topography and transformations of rocks and air ,due to both natural and anthropogenic causes, needs to be established. We need to monitor physical and chemical (biological) changes which have taken place and are taking place and use physical and chemical (biological) principles to understand them and use this knowledge for prediction purposes. Materials behave at various space-time scales and no longer can their linear deterministic behaviour be enough for current uses. Monitoring will thus involve from molecular scale to global scales and nonlinear stochastic modeling of the processes. We need to look these developments where we can have results in short terms. Thus we should look for program where faster changes are occurring both in internal and external environments and also there are significant societal impacts. International programs using transacts across continents and deep bore holes have been done earlier. There are also attempts to combine whole earth data sets and whole earth models to find more useful knowledge of the earth. One is then looking for local events in larger workings of whole earth. What are problems of solid earth-Indian region which will have global consequences? Himalaya, Deccan traps, Achaean crust, deep sedimentary basins, ancient landforms, intraplate earthquakes, geoidal lows, equatorial geomagnetic fields,… to name a few?
India's solid-earth program should have its primary focus on societal benefits, in terms of material resources and hazard mitigations, and also towards broader understanding of earth' behavior, connecting to global endeavors.
Fine chemical and physical structure and composition from surface/satellite observations added by a deep borehole in Deccan traps region with laboratory, regional field and theoretical investigations can be one such program(Deccan: Traps to Core).
Its target can be:
Natural resources (diamond, hydrocarbon, water etc); geophysical structure/fields
Earthquake hazards (natural and induced); Stress evolution
Melting phenomena in mantle/crust and emplacement, geochemical/isotopic consequences
Landform evolution; erosion/sedimentation; internal geodynamics
Geoidal and geomagnetic (paleomagnetic) consequences,
Fluid migration, ore generation
Global geodynamical and geobiological consequences
Climate implications, CO2 problem
High urban/built environment
This program will link with" here and now "issues of this region and associated phenomena with "large space/time scale" phenomenal globally.

Suggestions for Outreach and Science Programmes: International Year for the Planet Earth

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Outreach Programme:

Indian efforts towards outreach activities should include promotion of scientific conferences/seminars on any of the 10 major themes identified for the Year of the Planet Earth. Funding agencies should list out the themes of the International Year of Planet Earth as the key areas for funding support. Attempts should be made to collect and reproduce excellent Earth-science researches and published/unpublished material by Indian authors on a specially designed website. Attempts may be made to support Earth-Science exhibitions that aim at demystifying the works of Science in general and Earth Science in particular congruent with the Year's scientific themes. Print and electronic media in India could be approached to highlight the significance of Earth science on a continual basis and may be encouraged to select Earth-Science related programmes for generating greater awareness. Congruent with the theme of the Year, awards may be sponsored for Science communication, photo competitions. Most importantly, the themes of the Year of Planet Earth should be given due publicity to wider public through a specially created website, print and electronic media and by linking the website to all major Government websites as also of the Scientific wings. Available programmes may be listed on the website and there should be international exchange of programmes on Earth sciences.

Science Programme:

The Science programmes where geographical sciences can make contributions include mapping and quantifying fresh ground water resources in dry areas of India and finding out how the pollution of ground water can be checked. A major emphasis can be laid on Wet-Lands of India. Rain water harvesting potential can be assessed. Mapping of areas in India likely to be affected due to sea level rise as a consequence of global warming may be another area of research. Effects of mining, impact of arsenic elements, radon exposure, iodine deficiencies in India are some of the most important causes of poor health in India. Identification and mapping of these areas may be of crucial significance to human health. Identification and mapping of geo-hazard zones and settlement structures both at macro and micro scale is an important theme for future planning and present risk assessment. Inter-state relations based on resource availability, resource use and consequent conflicts may constitute another significant area of research. Soil conservation and agricultural practices, particularly in the hilly and mountainous regions should be given prominence. Growth of Mega cities in India, sustainability and safety of underground urban development in Mega cities of India can be pursued. Researches may be undertaken to assess the extent of underground development already taken place and potential for doing so in future

Indian National Programme on GPS Studies for Earthquake Hazard Monitoring, and Proposal to Organize APSG-2007 International Symposium at IIT Bombay

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Abstract :
With the recent major earthquakes in the South East Asian region, and the devastation caused by the tsunami effect, the importance of earthquake prediction has been re-emphasized. The efforts of the Indian earth scientists in this direction have now been augmented through the launch of an extensive National Programme on GPS and Geodetic Studies for Earthquake Hazard Estimation, by the Department of Science & Technology (DST), Government of India, since 1998. The programme, being implemented in a phased-manner by DST has now reached a significant stage, with the GPS network consisting of about 50 permanent, 700 semi-permanent, and several hundred campaign-mode field GPS stations. Several GPS research groups are engaged in studies of specific regions under this national programme.
The Asia Pacific Space Geodynamics (APSG) Society is a scientific forum to address the activities in the region related to plate tectonics, crustal motion and deformation, sea level change, etc. The APSG, chaired by Prof. Ye Shuhua, of Shanghai Astronomical Observatory, China, with its headquarters at Shanghai, organizes an international Conference / Workshop every year. The APSG-2005 was organized at Hong Kong, and APSG-2006 was organized at S. Korea (Conference announcement enclosed). As India has been contributing to this important scientific activity through the GPS and other research groups at various Institutes, including IIT Bombay, during APSG-2005, it was proposed that APSG-2007 may be organized by IIT Bombay, at Mumbai. The proposal has since been accepted by the APSG Bureau.
We propose to organize the APSG-2007 International Conference at IIT Bombay, during the **International Planet Earth Year**, which also coincides with the **IITB Golden Jubilee Year**. The tentative details are as follows:
Conference Title: Asia Pacific Space Geodynamics International Conference: APSG-2007
Conference Dates: 6-8 November, 2007
Total delegates expected: approx. 80 (approx. 50 from abroad and 30 from India (10 local))
Financial Support: Will be requested from APSG, DST, MHRD, AICTE, IUGG, INSA, etc.
Organizing Secretary: Prof. Madhav N. Kulkarni, Civil Engg. Dept., IIT Bombay

Exploration for Platinum Group Elements (PGE) in Peninsular India – Status, Problems and Scope

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Abstract :
Discovery of new platinum group of elements (PGE) deposits/mineralized zones is of great economic importance for the country. An account of the formation mechanisms of different PGE deposits and their reported occurrences across the world are presented. In India till date only the i) Baula-Nuasahi layered Complex in Orissa, ii) mafic-ultramafic Hanmalapura Complex in Karnataka, and iii) the layered Sittampundi Anorthosite Complex in Tamil Nadu, are the three known promising PGE occurrences. Recent studies show that there is a tremendous potential for PGE-mineralisation in mafic-ultramafic complexes, ophiolite complexes and the fine grained sediments such as sulfide bearing black shales , occurring in different parts of our country. Determination of PGE at extremely low concentrations with the accuracy and precision and at high throughputs required for exploration studies needs optimization of critical steps such as selection of a representative sample and application of sensitive analytical techniques, etc. For identifying economically viable deposits and their mining, detailed geological, petrological and geochemical studies are essential on massive potential areas. These aspects are discussed in detail with examples. An international Workshop entitled " Magmatic Cu-Ni-PGE Sulphide Deposits" with a Pre-Workshop Short Course and Post-Workshop Field Visits, is planned in the International year of Planet Earth, 2008. It is hoped that this endeavour would be well supported by the concerned national and international organizations. It is also hoped that this activity would give the required impetus to the PGE exploration studies in India.

Status of Development and Management of Groundwater in India

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Abstract:

Since last four decades the great socio-economic benefits in the form of food security, safe drinking water supply, livelihoods etc. were generated in India from low cost, drought resilient and high quality groundwater supply for domestic, industrial and agricultural uses. The single largest consumer of groundwater supply since the onset of green revolution in late 60s is and will continue to be agriculture sector. In India, groundwater irrigated areas witnessed a spectacular increase from around 11.9 million hectare in 1971 to 33.1 million hectare in 1998-99 an increase over 178 %. According to an estimate, the number of groundwater extraction structures rose from less than one million in 1960 to almost 26-28 million in 2002. Although, groundwater storage in aquifer is vast representing more than 98 % of global fresh water reserves, its replenishment is finite. The lack of proper understanding of the local groundwater resource behaviour and demand driven inappropriate development schemes without scientific planning have resulted continuous declining of groundwater level and under certain circumstances deterioration in its quality. Based on information available from Central Ground Water Board (CGWB), a continuous declining trend in groundwater levels has been recorded in pockets of more than 370 districts. Around 673 blocks are categorized as over-exploited where withdrawal of groundwater is in excess of replenishment. Approximately 425 blocks are declared as critical, where groundwater development had reached to a high level. Another dark face of groundwater resources development is the practice of flooding irrigation without taking into consideration of elevated position of groundwater level. This often resulted in water logging and soil salinity. Around 2.46 million hectare of the area under irrigation is water logged. Deterioration of water quality due to presence of hazardous substances like Arsenic, Fluoride, Nitrate, etc. has been reported from different parts of the country. Keeping in view the increasing thrust on groundwater resources and the present scenario of availability and demand, there is an urgent need for reorientation of our development approach for sustainable groundwater resource management. Several Government and non-government organizations like CGWB, National Institute of Hydrology, National Geophysical Research Institute, Tarun Bharat Sangh, etc., are engaged in sustainable development and management of groundwater resources. Based on the site specific problems, some measures like artificial recharging of groundwater to arrest the declining trend of water level and conjunctive use of surface and groundwater to control the water logging and soil salinity have been executed by these organizations. The results are found to be favourable. In addition to this mass awareness programs to educate the stakeholders about the limitation of groundwater resources and their optimal uses have been organized by several organizations. An important strategy of management is to regulate the development of groundwater resources in order to protect their quality and quantity. The Central Ground Water Authority (CGWA) is constituted in 2000 for this purpose. In a similar manner several States have enacted legislation to protect the quantity and quality of groundwater resources.

Insights into Crustal Evolution: Current Perspectives from Zircon Geochronology and Geochemistry

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Abstract:
Nearly 2/3rds of the exposed crust of the The Indian subcontinent comprises Precambrian rock formations. Although geological maps on 1:50000 scale are available for nearly the entire region, precise age data are generally sparse. This not only hampers our understanding of the crust and lithospheric evolution of the Indian shield but also leads to less precise correlations of the Indian Precambrians with those elsewhere. In my presentation, the significance of certain recent cost-effective analytical technologies that are useful in dating zircons by the U-Pb method and also determining the trace element composition and Hf –isotopic systematics of the zircons insitu for extracting valuable information of the both age and genesis of the source rocks are highlighted. Current approaches such as the Terrane Chron^{TM} which stands out as a comprehensive new tool for tracing the crustal evolution as well as for regional exploration for minerals developed by ARC National Key Centre for Geochemical Evolution and Metallogeny of Continents (GEMOC), Australia is explained. The methodology provides for rapid, cost-effective characterization of crustal history on a regional scale (10-10000 km^2) based on U-Pb, Hf-isotope and trace element analysis of single zircon grains by a combination of Electron Probe Micro Analysis (EPMA) and laser-ablation ICPMS (both Quadrupole- and Multi-Collector) methods.Foremost, an important application of the approach is interms of prioritization of targets for mineral exploration based on (1) rapid assessment of the geology in difficult or poorly mapped terrains, (2) “Event Signatures” for comparison of crustal histories from different areas and (3) Identify presence or absence of possible mineralized rock types such as Cu/Au porphyries, A-type granites etc. Results from preliminary study of the Dharwar craton were also presented and discussed briefly.

International Year of Planet Earth: Relevance of India

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Abstarct:

Some of the outstanding geo-science issues of societal import include, 1) a quantitative understanding of the relationship of climate and landscape, 2) time scales of soil formation, 3) impacts of climate change on humans and impact of humans on climate change, 4) how far the marginal eco and geo-systems can be stressed and thresholds beyond which their recovery becomes difficult, 4) how well the abrupt events that occur of decadal scale, get cycled through the landscape, 5) what are the critical threshold and relaxation times of landforms, 5) improved data base for a realistic assessment of seismic hazards, 5) response of rivers and water bodies to climate change and/or tectonics and means to decouple to the effect s of two major forcing functions, 6) newer avenues for fresh water and a basin wide scenario of water transport, etc.

India is one of the most suited regions for studies 0n processes relating to global climate change, seismic/tectonic hazards and for the elucidation of the interaction of humans with geomorphic processes. Simultaneous presence of a tectonically active mountain belt with its direct import on climate, hot and cold deserts regions, oceanic regions with different dynamics, large and small river systems, saline and fresh water lakes of varying dimensions, major sediment transport and dispersal systems, substantive human impact on geomorphology and geomorphic processes, and an exclusive climate system (largely dominated by the south west monsoon). Given the surmise that the tropics may be the drivers of climatic change, it is imperative that the past records of the tropics is understood in all its complexities and India offers, perhaps the best geological locale where a self consistent, process based record can be achieved. India offers the best case for such studies.

The monsoon is the key aspect of Indian climatology. Instrumental and paleo-records indicate that the monsoon never failed but has experienced a variability of ~20% over a mean value of ~80cm/year. This variability determines the food production and hence affects the human sustenance and controls population migration. It is therefore necessary to predict monsoon performance with reasonable accuracy, most notably the onset date, duration and the magnitude. It is also necessary to realize that a high rainfall year may still be a drought year in terms of food production. Refinements of global climate and regional climate models are needed and these in turn need robust paleo-reconstructions. A survey of instrumental and paleorecords shows significant discordance and it has now become necessary that a proper, secured data base is created which can feed into the monsoon prediction models. The impact of humans on geomorphic systems basically deals with changes in sedimentation and erosion rates through time, such that a high resolution record can be obtained and the human impact is decoupled from natural forcing. Such studies have a direct bearing on the changes in the sediment fluxes through time and technology in dating and sediment provenance estimation permits a quantitative study.

In respect of sesimicity and tectonics, recent studies in the Himalaya indicate that the seismic hazard in these regions is underestimated. Studies in the Kachchh basin indicate the prospect of fault-fault interaction leading to enhanced seisimicity. The GPS measurements provide only an instantaneous record and hence long term time series is now possible. The fact that these archives are available in India, there is a need for concerted studies including structural, geomorphic and chronometric studies to elucidate the underlying processes, further.

Another area where India provides an ideal laboratory for studies is the water and its movement. A recent initiative using isotopic studies in Indian waters proposes to do exactly this and will help trace waters through space and time domains. There are other issues relating to energy security. With abundant sunshine India can strive to use this for energy security. This will need high purity silica and perhaps methodologies and technologies will be needed to identify key deposits and mining them for solar cells.

The Indian department of Science and technology and its initiatives in Earth Sciences and the creation of a department of Earth System Science auger well for the growth of earth System science in India and for a substantive Indian contribution to the International initiatives such as the IYPE, IGBP and the like. Indian geology offers enormous scope for process based studies with additional element of human dimension. Such studies can then be translated to other regions. The options are infinite and possibilities are limitless. What is needed is a resolve to achieve tangible, socially beneficial results and synergy in overall scientific endeavor.