❖ CSSTEAP Newsletter ❖

Quarterly Newsletter of Centre for Space Science and Technology Education in Asia and the Pacific (affiliated to UN)

Volume 4 Issue 4 **December, 2001**

From Transistors to Teraflop Computing and Beyond *

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The last fifty plus years have witnessed phenomenal advances in the areas of electronics, telecommunications, and computing. Two of the striking developments, which had remarkable impact on technological developments in these areas, are the inventions of the transistor, and the stored program concept for computers. The talk traces the chronological development starting from this stage right upto the current status in VLSI fabrication and its consequent impact on the design of high performance computers based on the principles of parallel and distributed computing and later on the cluster and grid computing paradigms. We also discuss about the limits of predictions made through Moore's law, which states that, the number of transistors integrated on VLSI circuits would continue to double every 18 months until fundamental physical limits are reached. We present a quick overview of the recent developments in the areas of processor architecture, memories, and communication technology. After a synthesizing overview of various parallel computing paradigms, we analyse the challenges involved in building high performance computers yielding teraflop and petaop speeds. The recent interest in non-silicon based approaches such as photonics, quantum and molecular computing is also discussed.

Though high performance computers can efficiently solve compute-intensive problems, which have good appetite for numeric and non-numeric computation, they do not possess several features present in human beings. These are the abilities classification and recognition, decision making in a fuzzy and noisy environment, associative memory, and generalisation. Recent efforts in the area of Artificial Neural Networks have yielded interesting results in terms of building machines with the above features. Coupled with this concept, fuzzy logic has yielded systems based on neuro-fuzzy principles. Evolutionary computing concepts such as genetic algorithms and genetic programming have demonstrated the merits of problem solving paradigms inspired by biological principles such as evolution and Darwin's survival of the fittest principles. All these concepts broadly focus towards the soft computing model.

Though the present day computers are gifted with several features yielding improved performance, they are far from being user-friendly for a common man. This is an important aspect if the information revolution has to bring out widespread changes in the society like the industrial and agrarian revolutions did. Such an impact can be felt if the future computers possess speech, vision, and perception abilities. We briefly present the challenges involved in building such computers gifted with natural language understanding capability.

Inside this issue

** This is summary of the talk delivered at the CSSTEAP Day celebration function on November 1, 2001, at SAC, Ahmedabad*

We also conclude by raising and discussing a fundamental question whether the recent developments witnessed in the broad area of Information Technology are really technological breakthroughs or only clever tricks. If the answer is the latter one, where does the former come from?

On the Sixth Anniversary of CSSTEAP

R.R. Navalgund* and R.Sudarshana**
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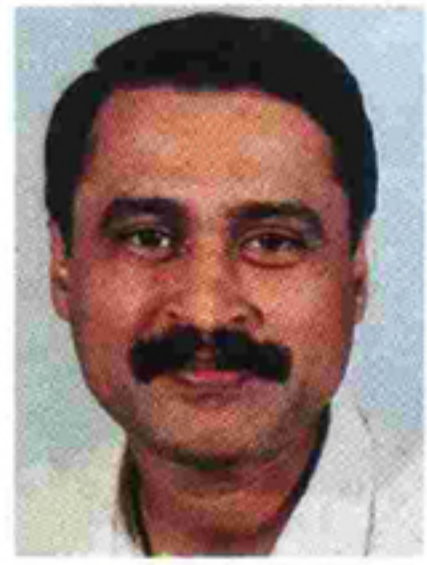
It is great pleasure to see that the Centre for Space Science and Technology Education in Asia and the Pacific has completed six years. The forum of CSSTEAP, whenever convened, brings about an interesting congregation of a variety of people, viz., students and teachers, scientists and managers, young and old and citizens of many countries. It always cuts across the boundaries -boundaries of age, countries and to some extent the scientific disciplines. In view of the spirit of foundation of the centre, this cross cutting is apt and appropriate. The National Remote Sensing Agency (NRSA) is one of the premier institutions of the region that has continued significant support to CSSTEAP through IIRS by conducting various academic programmes and providing other necessary facilities. The-progress at the Centre is of relevance to NRSA IIRS NRSA extends the greetings and best wishes to CSSTEAP at its anniversary. At the outset, it is unbelievable that 6 years have passed under the CSSTEAP bridge. The leadership of the centre has kept the organization young and vibrant. There has never been a dull day, activities have been in full schedule and the centre has presented an enviable model to the world for emulation. There is alround adulation and at six, the Centre is already a young adult. It has maintained its special power to attract and enthuse people from all walks of life.


R.R. Navalgund

Usually on an occasion like this, it is customary to look back and review the progress made. However, the progress of CSSTEAP is well known and widely acclaimed to be impressive. People who have sculpted the progress of CSSTEAP have also provided it with a framework of vision.

The CSSTEAP has stood for building capacity in the four major areas of space sciences and technology in one third of the world. Hundreds of students from dozens of countries have been taught, hundreds of professionals from dozens of institutions have been brought to teach, several large scale facilities and programme frameworks have been harmonized into its purpose and there is a well established scheduled activity profile. In all these, beyond the finite elements of science and technology, one can recognise some virtues and principles that percolate constantly and guide the progress.


R. Sudarshana

Firstly, there is a purpose of connectivity. The natural resources that are delineated from space, infrastructure of communication that are established from space gadgets, change of climate that are studied from space and the exploration of unknown through astronomy are all connected to our common destiny, irrespective of the time and countries that we inhabit. So, the efforts of CSSTEAP are towards establishing this connectivity at a broader. In fact, this is where the specialized domain of the Centre lies. In the melee of universities and institutions, the CSSTEAP strives to connect sciences, skills, institutions, countries and facilities around a purpose that connects us all in destiny.

Secondly, what is visible from the experiment of CSSTEAP is an unmistaken demonstration of the virtue of sharing. By following the framework of principles expounded at UNISPACE and by readily wading into the hitherto unknown waters CSSTEAP has demonstrated the will of its benefactors to share the exclusive knowledge and facilities of individuals and institutions with the world. "If a particular science and technology has benefited a society and generated prosperity it should be shared with the world". This has been the lofty Ideal and is a guiding spirit. The virtue to share is of profound nature and is trans-cultural in dimension. It is hoped that the Centre would not only strengthen its Intension to 'share' but will also motivate others to do so In the region.

Thirdly, in the activities and programmes of the Centre, one sees its enormous capacity of empathy. One of the underlining strengths of this young Institution is its power to understand and address the common concerns of a large number of countries in the region. Be it. food security, water harvesting, environmental purity, ecological reconstruction, infrastructure development, demographic problems & prospects, battle

against hazards, abuse of knowledge or peoples empowerment with necessary information, the concerns of the region are identical and exchangeable. The Centre offers a continued forum for investigation by its students and constituents and empathises with the focused concerns by way of facilitating guidance and capacity to address them. In the long run of the Centre's service, capitalization of this factor of empathy and seeing the evolution of more harmonized regional efforts in mitigating our common evils, must emerge. Science and technology are only a means, institutions & individuals are only symbolic but the virtues that are dreamt about at the centre are the core of co-existence in this part of the world.

The character of CSSTEAP is an interesting one. It symbolizes the emergence of a virtual world. Here was a center which did not, in its model, command anything and yet was a force of commanding nature. In this predicament, it has found a very suitable leadership, guidance and support system. It did establish a few things in the past six years, but when we look at them, they are only the few essential elements, but the centre is still a nucleus of the virtual world of Capacity building on the subject in Asia-Pacific. This is one strong reason why virtues are more important in the context of the centre. But at the end of six years, it is expected that the concepts are being rationally reviewed and like any six year old, a debate on what kind of schooling the dynamic being should undergo, may emerge. While at a ground level, the activities that are ongoing may firm up, strengthen and diversify within their academic domain, it may be necessary to dream about a Centre that is much more than an educational institution of excellence. Should it enter the school of information warehousing and clearhousing towards solving the regional problems? Should it enter the school of social spokesmanship that can safeguard the cumulative interests of diverse stakeholders with the use of high technology? Should it enter the scholarly world of science documentation? Should it evolve into a forum of intellectual scientific exchange? Should it enter a schooling of space science policy and civic framework ? OR should the centre enlarge its character in all these directions around the present core of its activities? In fact, all these dreams are quite realizable since the Centre is based on fundamental virtues and not on just physical facilities. It commands the needed dignity to enter into any of these or all of these schoolings.

Finally, the world sees this institution as one major experiment of a virtual society, that is a place of learning, fascination and virtual sanctity. NRSA is a proud participant and supporter of the experiment and pledges to continue the support in all appropriateness.

A six year old can only be beautiful and vibrant on whom one loves to weave dreams. It is the fond dream of Indian remote sensing community that the Centre would emerge strongly on the central stage of space science and technology education in the world, through its virtuous forays in the region.

Celebration of CSSTEAP Annual Day

The Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP) came into existence on November I, 1995, when 10 countries from the Asia Pacific region signed the Memorandum for its establishment. Since then it has made a steady progress in its programmes and never looked back.

It completed six years of its fruitful existence on November 1, 2001 and stepped into a maturing seventh year. The day was celebrated at the Space Applications Centre (SAC), Ahmedabad. A function was organized to mark the occasion. It was attended by senior Scientists, Engineers and functionaries associated with the programme in Ahroedabad. Prof. L.M. Patnaik from the Indian Institute of Sciences, Bangalore was the Chief Guest. Participants of the Third nine months SATCOM programme, being held at SAC, also attended.

Prof. B.L. Deekshatulu, Director, CSSTEAP vividly described the maturing of the Centre and how its various programmes had benefited 340 participants from 39 countries. He also mentioned about the

linkages which the centre has established in the process. He also highlighted the contribution from Govt. of India through the various organisations of Dept. of space (DOS) viz. IIRS, Dehra Dun (RS & GIS); SAC, Ahmedabad (SATMET & SATCOM) and PRL, Ahmedabad (Space Science) right from inception of the centre. Prof. G.S. Agarwal, Director, Physical Research Laboratory (PRL), Ahmedabad and Dr. A.K.S. Gopalan, Director, SAC underlined the role played by these key organizations of the Dept. of Space, Govt of India in organizing the Space Sciences (PRL) and SATCOM and SATMET courses (SAC) for CSSTEAP.

Prof. L.M. Patnaik, the Chief Guest, delivered an invited talk on "From Transistor to Terraflop computing and Beyond", which was very well received by the audience. All those present wished the Centre a very bright and eventful future.

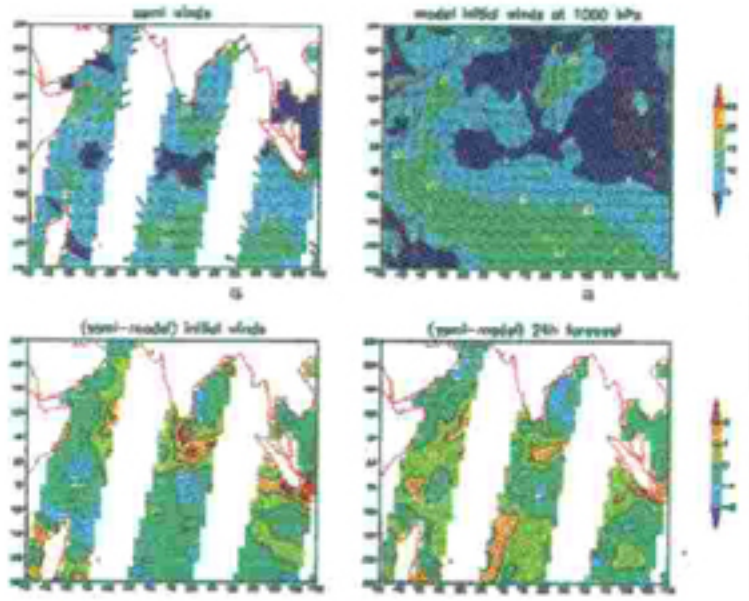
Comparison of Satellite Derived Sea Surface Winds with NWP Model Analysis and forecast

Mr. R.M. Khaladkar, India

Sea Surface winds play a major role in various phenomena and ocean-atmospheric processes. However, due to the limited number of conventional observations over the oceans, the information of sea surface winds is quite insufficient for carrying out many studies. During last few years, the satellites are providing this information by microwave remote sensing technique In present study, sea surface winds retrieved from Special Sensor Microwave Imagers (SSM/I) onboard DMSP satellites are compared with NWP model analysis and forecast over Indian summer monsoon region. The period of study is 1-10 June 1996 which is the onset phase of summer monsoon over peninsular India. Global spectral model (T -80 L-18) is adopted for his purpose. Comparative study is carried out in qualitative, quantitative and statistical sense and in both the hemispheres separately. The results show that the SSM/I derived sea surface winds constitute an important set of additional data to fill up the data-gap regions surrounding India for many applications relating to ocean-atmospheric phenomena.

The figure shows comparison of the initial condition and 24-hrs model forecast for sea surface winds with SSMI derived sea surface winds. Model is integrated from the initial data of 3 June 1996 and the forecast is valid for 00UTC of 4 June 1996.

Comparison of SSMI and NWP Model sea surface winds
Date : 3 June 1996 at 00 UTC



This is a summary of 1Year follow up project of M.Tech. degree awarded to the students of SATMET course (1998), Under supervision of Dr. Pramod M. Mahajan, Indian Institute of Tropical Meteorology, Pune, India and Dr. Pradeep K. Pal, MOG, Space Application Centre, Ahmedabad, India.

Third SATCOM Course

The Third Post Graduate Course on Satellite Communications (SATCOM) which has started at Space Applications Centre, ISRO, Ahmedabad on August 01, 2001 is being attended by 14 participants from 8 countries including India.

This course is now running in its fifth month. During this period the subjects like Satellite Communication Systems, Earth Station Technology, Broadcasting using Communication Satellites, Communication Network Planning & Management etc. have been intensely covered.

In October 2001, the participants were taken on educational tour to ISRO Satellite Centre, ISTRAC, Liquid Propulsion Systems Centre & Indian Institute of Science in Bangalore,

Course participants at MST Radar, Gadanki (A.P.)

Master Control Facility at Hassan and MST Radar at GADANKI (Andhra Pradesh). The participants also made a short visit to Mysore & Ooty.

Currently, participants are on a Study-visit to Delhi Earth Station, India Met. Deptt. & ESSEL Shyam (V SA T Service Provider) at Delhi and Indian Institute of Remote Sensing & CSSTEAP Headquarters at Dehradun.

Now onwards, the subjects like Specialised Applications, Future Trends in Satellite Communications & Satellite Communication for Development, Education & Training will be taken-up. A two weeks special module on MA TLAB based Digital Signal Processing is also planned.

Sixth RS & GIS Course

The sixth Post Graduate Course on Remote Sensing and GIS (RS & GIS) of CSSTEAP commenced on October 01, 2001 at Indian Institute of Remote Sensing (IIRS), Dehradun. Twenty participants from thirteen countries of Asia-Pacific region are attending this course (Bangladesh - 2; China - 1; DPR Korea - 2; Indonesia - 1; Lao PDR - 1; Kazakhasthan - 2; Nepal - 3; Mongolia - 2; Myanmar - 1; Sri Lanka - 1; Uzbekistan - 1; Vietnam - 1 and India - 2). The inaugural function of the course was held on October 2, 2001. Prof. V.S. Ramamurthy, Secretary, Department of Science and Technology (DST), Govt. of India, inaugurated the course and delivered inaugural address. Dr. R. R. Navalgund, Director, National Remote Sensing Agency, Hyderabad, also graced the function as Guest of Honour and addressed the gathering.

Inaugural function of 6th RS & GIS course at IIRS, Dehra Dun

The RS & GIS course is of nine months duration and is divided into three Modules each of three months duration. In the first week of the course, a introductory program consisting lecturers on Geographic Perspective of India; Social Systems, Custom and Festivals of India; Overview of Space Science–Technology & Applications; Natural Resources & Environmental assessment was organised. At present, the course participants are going through Module-I which deals with fundamentals of Remote Sensing, GIS and GPS technologies. This Module is ending on December 31, 2001. The core faculty consists of experienced faculty of IIRS. Several internatioally reputed scientists viz. Prof. K. Jacobsen, University of Hannover (Germany); Dr.Rene Thomas, GDTA (France) and Prof. Shirouchi, Institute of Industrial Technology, Tokyo University (Japan) were also invited to deliver lectures on specialised topics. In this Module an educational visit to Agra and Delhi cities was also organised, to give exposure to the participants about rich historic and cultural heritage of India.

Third Short Term Course on RS & GIS

The valedictory function of third short term (4 weeks) course on "Remote Sensing and GIS Technology and Applications in National Resources and Environmental Management" of CSSTEAP, conducted during August 27, 2001 to September 21, 2001 was held on September 21, 2001 at Indian Institute of Remote Sensing, Dehra Dun. Dr. J.K. Rawat, Director, Forest Survey of India (Dehra Dun), the chief guest of the function, distributed certificates to the course participants and delivered the valedictory addresses. Dean, IIRS and Director, CSSTEAP also addressed the gathering. Two course participants, one each from Papua New Guinea (PNG) and Indonesia, presented feed back of the course. Course report and vote of thanks were presented by Course Co-ordinator and Course Officers respectively.

Valedictory function of 3rd Short Term Course on RS & GIS at IIRS, Dehra Dun

Short Course for Social Scientists

A two week short term course on "Applications of Space Science and Technology for Social Scientists" of CSSTEAP was successfully conducted jointly by National Remote Sensing Agency (NRSA), Hyderabad and Space Applications Centre (SAC), ISRO, Ahmedabad, during November 26 to December 7, 2001 First week (Nov. 26 to Dec 01, 2001) and second week (Dec. 02 to Dec. 07, 2001) of the course were organised at NRSA, Hyderabad and SAC, Ahmedabad, respectively. Thirteen participants representing seven countries of Asia-Pacific region attended the course. The course participants were from Bhutan (2), Indonesia (3), Iran(1), India (4), Maldives (1), Nepal (1), Thailand (1).

Inaugural function of Short Course for Social Scientists - 2nd week at SAC, Ahmedabad

The objectives of the course were to impart knowledge of RS & GIS techniques in the area of natural resources for planning and management for socio-economic development, to share the experiences of India and other countries in the use of satellite communication for education and socio-economic development, to give exposure to the importance and understanding of the impact of global climate on socio-economic development and the application of Satellite Meteorology for studying global climate, to expose to the importance of Space Sciences and its understanding for the general benefit of humankind.

Board of Studies Meeting for the Space and Atmospheric Science Course

A meeting of the Board of Studies was held in Ahmedabad during October 10-11, 2001 to finalize the details of the syllabus for the 3rd Space Science Course to be held at the Physical Research laboratory, Ahmedabad during August 2002 to April 2003. Prior to this meeting, a special "United Nations Expert Committee Meeting on the Regional Centres for Space Science and Technology Education in Asia and the Pacific, Africa, Latin America and the Caribbean and Western Asia: Status and Future Developments", was held during 3-7 September 2001 at Frascati, Italy. The recommendations of this UN meeting were used as a base line document for finalizing the syllabus for the 3rd Space Science Course of the CSSTEAP . The final syllabus for the 3rd course will be as given below.

The 3rd Space and Atmospheric Science Course will have three modules. First two modules will deal with theory and experiments and the third module, which will be of two months duration, will be developed exclusively to the Pilot Project. Out of the eight theory topics available on the menu. It was decided to have the following five topics :

1. Structure, Composition and Dynamics of Planetary Atmospheres
2. Ionospheric Physics
3. Solar Wind, Magnetosphere and Space Weather
4. Astronomy and Astrophysics
5. Basics of Spacecraft Design, Construction and Launch.

There has been some change in the experiments also. Following is the list of the experiments to be performed.

1. Operation of Langmuir Probe
2. Ionospheric Sounding using an Ionosonde
3. Surface Monitoring of Ozone
4. Optical Imaging of Plasma Depletions
5. Photometry of Binary Stars
6. Interferometric Study of Planetary Nebulae or Measurement of Temperature of Outer Planets using m detectors
7. Mass of Suspended Particles using Quartz Crystal Microbalance
8. Optical Depth Measurement: using Filter Photometer
9. Modeling Experiment on Atmosphere /Ionosphere
10. Characterization of Interference Filters
11. Radio Pulsar Studies using GMRT/OSRT
12. Study of Solar Spectrum

The Pilot Project will have a duration of 2 months, during which the participants have to get equipped with all information required to complete there home project of one year.

Board of Studies meeting for Satellite Meteorology course

The second meeting of the Board of Studies (BOS) of CSSTEAP for Satellite Meteorology (SATMET) Course was held on December 5, 2001 at Space Applications Centre (SAC), Ahemadabad. Besides members and a few scientists of SAC, Prof. U.C. Mohanty, Indian Institute of Technology, New Delhi attended the meeting. Prof. B.S.R. Reddy of Department of Meteorology & Oceanography represented Andhra University.

Based on the feedback received from the SATMET 1998 and 2000 course participants, from the course faculty, recommendations of the first BOS meeting (Sept. 2000), appropriate modifications have been made in the syllabus. The guidelines of the Frascati (Italy) meeting held in September 2001 also been considered. Some of the highlights of the modifications include introduction of the Basic module covering lecturers in Mathematics Statics, Dynamic Meteorology and Physical Oceanography. Emphasis is laid on issues related to Global Climate while the stress on Radiative Transfer and Parameter Retrieval has been reduced. Prof. Mohanty suggested few lectures in Regional Climate Models, Land use changes and numerical experiments to assess its impact, Satellite data quality control, Geopshere-Biosphere interaction etc. More hands on experience with satellite data, data bank involving various satellite products, imagery for various synoptic systems. Inter-Satellite-Data comparisons, Regional Climate studies through models and satellite data are some of the features of the syllabus approved by the BOS to be implemented during the third SATMET 2002 course.

Obituary

Dr. (Mrs.) Dipti Rustogi, visiting Scientist and ex. Dy. Director, Space Applications Centre (SAC), Ahmedabad, breathed her last on Decemben 12, 2001. She was 61. She had been associated with CSSTEAP right from its inception and had participated in its various activities even prior to formal establishment of CSSTEAP. Dr. Rustogi had been Course Director of first two Nine months CSSTEAP programmes on Satellite Communication. She had also overseen the first workshop on SATCOM, under the CSSTEAP, held during January-Feb., 1997 and two subsequent short term programmes on "Digital Signal Processing" and "Satellite Communication for development". All the participants of these programmes would definitely miss her with whom she had established a personal rapport.

Dr. Rustogi had actively participated in formulation of Course curriculla and course programmes on Satellite Communication. She was a dedicated person and got fully involved in whatever she undertook. She was one of the very few persons in India, especially women, who got their Ph.D. in Engineering during those time. Her dedication and work would continue to remain as beacon for future CSSTEAP programmes on the subject.

Director Speaks

Prof. B.L. Deekshatulu

I participated in a Conference during October 7-12, 2001 in Port Alegre, Brazil, organized by the ISPRS Commission VI-WG1 & 3, Brazilian Cartographic Congress, National Agricultural Engg. Congress, with many promoters and collaborators. Before my participation in the conference, I was invited for a day (October 5, 2001) to visit INPE (the National Institute for Space Research) at Sau Paulo where I delivered a lecture on CSSTEAP status and prospects. INPE is a great organization involved in the building of satellites (SCD1, SCD2, and CBERS-1 with China etc.) besides special purpose payloads. It has also an extensive Remote Sensing application program in many disciplines.

The 6-day conference at Port Alegre was well attended; about 1350 participants from 24 countries. A number of parallel sessions, many in local language, were organized. I presented a paper on "CSSTEAP for meeting the challenges of knowledge based society" at the ISPRS Seminar session on "Education and Technology Transfer in Photogrammetry in Latin America". The grand exhibition by the various cartographic and space companies was worth visiting.

The Brazilians also have taken the remote sensing applications to the farmers through a program called "Agrarian Reforms" organized by the state government of Rio Grande do Sil. I also attended this session. The object being agricultural development based on environmental conditions, social and economic conditions of peasants. These included characteristics

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of the natural resources, soils (main properties, geographic distribution, land capability); flora (species, distribution, areas of conservation); Fauna (species, conservation); Hydrology (demand of water, ways to supply demands); environmental preservation (areas of risk, areas of preservation). The small farmers are informed about the methods being used to describe soils and other environmental characteristics and join the fieldwork.

In 1965 they had 70% of population living in the rural areas. Today 70% of the population live in urban areas; most of them are without employment or underemployed. The objective of the state government is to draw up a program to bring back the ex-farmers/farm workers back to the farm by creating better economical, social and Environmental conditions for them and thus solve the problems of the cities. The scheme initially provides for a few years, a piece of land plus farm equipment plus facilities for the framers to develop the land and recover from them the amount/cost loaned to them, say after 15 years.

Majority of the participants in the conference was Brazilian scientists who have participated actively till the last session in large numbers. GOOD LUCK TO THEM.

My stay was very pleasant though very few speak English in Port Alegre.

As all of you know so far 340 participants representing 39 countries of the Asia Pacific Region have benefited from CSSTEAP programs (11 long term and several short term theme specific courses/workshops). At this juncture, I welcome 14 participants from 8 countries who are attending third PG Course on Satellite Communications at Ahmedabad from August 1, 2001 and also 20 participants from 14 countries attending sixth PG Course on RS and GIS at Dehra Dun from October 1, 2001.

I wish all the readers of the CSSTEAP Newsletter a very happy and prosperous 2002.

To all Directors of UN regional Centres for Education in Space Science and Technology - Please send us information regularly, so that we could publish in the CSSTEAP Newsletter

COURSES IN PROGRESS

- Third 9 months Post Graduate course in Satellite Communications (SATCOM) at SAC, Ahmedabad from August 01, 2001 (14 Participants from 8 countries are participating)
- Sixth 9 months Post Graduate course in Remote Sensing and GIS (RS & GIS) at IIRS, Dehra Dun from October 01, 2001 (20 participants from 13 countries are participating.

FORTHCOMING COURSES

- International short course on Emerging Trends in Satellite Meteorological Applications with special Emphasis on Microwave Remote Sensing at SAC, Ahmedabad during March, 4-15, 2002.
- Third 9 months Post Graduate course in Satellite Meteorology & Global climate at SAC, Ahmedabad from August 1, 2002
- Third 9 months Post Graduate course in Space and Atmospheric Science at PRL, Ahmedabad from August 1, 2002.
- Seventh 9 months Post Graduate Course in RS & GIS at IIRS, Dehra Dun from October 1, 2002.

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CSSTEAP welcomes the views and opinions of the readers of the Newsletter. Short Communications on space science and technology education which may be relevant to Asia Pacific Region are also welcome. Views expressed in the articles of the Newsletter are those of the authors and do not necessarily reflect the official views of the Centre.