International Training Course On Application Of Space Technology For Disaster Management Support With Emphasis On Drought Monitoring, Desertification And Crop Yield Prediction

(July 14 August 08, 2008)

ORGANISED BY

CSSTEAP

Centre for Space Science and Technology Education In Asia and The Pacific (CSSTEAP)

(Affiliated to the United Nations) IIRS Campus, Dehra Dun 248001, India

COURSE REPORT

Conducted By

Indian Institute of Remote Sensing (National Remote Sensing Agency) Department of Space, Govt. of India Dehradun, India
www.iirs-nrsa.gov.in

International Institute for Geo-information Science & Earth Observation (ITC) The Netherlands
www.itc.nl

United Nations University - ITC School for Disaster Geo-Information Management ITC, The Netherlands
www.itc.nl/unu/dgim

Venue : Indian Institute of Remote Sensing, Dehradun, India

Inauguration of course by Dr. S. M

Scientist, ICRISAT

Course participants with Direc

tor, CSSTEAP and Dean IIRS

Name : **Endarwin**
Country : **Indonesia**
Email address : **endarwin_bmg@yahoo.com**

I will utilize the course material and knowledge that gained during the course by add considering factor or parameter that has not been included. Because I work in meteorological field, I am more concentration to new knowledge in meteorological field or the that support my job, like utilize the ERDAS or IDV software that can process satellite image, rainfall estimation and global product from satellite, etc.

Name : **Akhmetova Dinara**
Country : **Kazakhstan**
E mail address : **Dinara_1983.83@mail.ru**

I have got a lot of information about remote sensing from this course.The knowledge gained during this course will be very useful in my work. I will try to explain software to my colleagues and also to students as practical exercises.

Name : **Kurbanova Rekhangul**
Country : **Kazakhstan**
E mail address : **rehana@mail.ru**

First of all, I would like to thank the CSSTEAP (affiliated to UN) and Indian Institute of Remote Sensing for giving me a good chance o attend the International training course on "Application of Space Technology for Disaster management support with Emphasis on Drought Monitoring, Desertification and Crop Yield Prediction". Attending this training program helps me in many ways. I have got some experience on space technology application in the desertification and crop yield prediction problems. I can utilize the course material as a reference for our department and share the knowledge gained during this course to my colleague

Name : **Mrs. Svetlana Zyskova**
Country : **Kyrgyzstan**
e-mai : **svetlana_zyskova@mail.ru**

We are planning to establish RS and GIS laboratory for supporting our research projects. I'm going to use my knowledge and experience gained during this course to teach on RS principles and GIS possibilities at my university and some national research institutions.

Name : **M. Regzedmaa**
Country : **Mongolia**
E-mail : **m.regzedmaa@yahoo.com**

I will be able to work more efficiently with more knowledge and understanding of remote sensing, communication satellites, and drought monitoring, desertification. The course material and knowledge gained from this course are very useful for application in my office. Because satellite data's application has started in the local level of Mongolia. I will continue to practice this course material, to contribute to my colleagues and to get knowledge of drought monitoring especially in desertification, crop yield predication, which I learnt from this course

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Indian Institute of Remote Sensing
(National Remote Sensing Agency)
Department of Space, Govt. of India
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www.iirs-nrsa.gov.in

International Institute for
Geo-information Science &
Earth Observation (ITC)
The Netherlands
www.itc.nl

UNITED NATIONS UNIVERSITY

United Nations University - ITC
School for Disaster Geoi-
information Management
ITC, The Netherlands
www.itc.nl/unu/dgim

Venue : Indian Institute of Remote Sensing, Dehradun, India

FOREWORD

The **"Regional Centres for Space Science and Technology Education"** are established by the efforts of United Nations Office for Outer Space Affairs (UN-OOSA), to assist in the development of indigenous capacity of each country of the region to apply space science and technology to enhance social & economic development. The first such centre was established for the AsiaPacific region with India as host country Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP) educational programme to train middle level managers to get in depth theoretical knowledge and on-the-job training in applying Space Science and Technology Education for developmental activities.

I am happy that the course on ***"Application of Space-Technology for Disaster Management Support with Emphasis on Drought Monitoring, Desertification and Crop Yield Prediction"*** has been successfully conducted, wherein 16 scholars from 9 countries could participate. Apart from the lectures, they were also given hands-on training on applying space technology for various phases of Drought Management. On behalf of CSSTEAP, I wish to thank Dr. V.K. Dadhwal, Dean, IIRS for organizing the course at IIRS and Dr. N.R. Patel, Course Coordinator for doing an excellent job in conducting the course.

This booklet contains the details of the curriculum followed, the list of faculty, and the course participants. The recommendations made by the participants are also included.

I hope this booklet will be of use to others who wish to organize similar training courses.

(George Joseph)
Director, CSSTEAP

After I finish this course, I will create a small pilot project using some very simple RS technology fore me and my colleague. On the job, I will transfer my knowledge to them.

Finally, I want to create a decision support system for irrigation management. It seem to be a very big job, and I am not sure that I can finish it before I retry. Anyway, it is not a big problem to me. What I want to do now id just start it.

If possible, after training for my colleague by pilot project, I would like to ask for them to join the same course in the future.

Name : **Mrs.Natalya Shulgina**
Country : **UZBEKISTAN**
E-mail address : **nigmi@albatros.uz**

- Scientists of my Institute involved in research activities on disaster management, and environmental problem addressing.
- This material will help in planning and development of Information System in the scope of Central Asian Countries Initiative for Land Management which main goal is to develop information system to support an integrated approach to land use planning and management with using computer databases and analytical programs, including geographic information systems, for storing and analyzing data and information including RS data.
- Indian experience in Desertification Issues management will be very useful for using it in work of Drought Management Centre in Central Asia, which is establishing at the nearest future and will be located in Uzhydromet, Tashkent, Uzbekistan.

Name : **Nguyen Ngoc Bich Phuong**
Country : **VIETNAM**
E-mai l : **nn.bichphuong@gmail.com or bichphuong@vkttv.edu.vn**

- The first I will share all documents that I have had through this course when I come back my country.
- After that I will use knowledge that I gained during this course to apply to managing drought using remotely sensed images in my project that began three months ago.

Name : **NGO DUC ANH**
Country : **Vietnam**
E-mail : **ndda_sti@yahoo.com, stiducanh@gmail.com**

- Satellite communication system may be used for natural resource management with the focus on drought monitoring, desertification and crop yield prediction.
- Promoting the use of the space technology is one of the main task of my department. The practical knowledge of how space technology can support at various phases of disaster management with respect to draught, desertification and it impacts on crop failure /crop yield reduction and environment gained from the course surely will help me much in my work in Vietnam.

PREFACE

The Asia and Pacific developing countries are in the midst of the world's most hazardous belt and are subject to floods, droughts, cyclones, earthquakes, windstorms, tidal waves and land slides etc. The major natural disasters that occur periodically in this region are largely due to climatic and seismic factors. The region has suffered 50 per cent of the world's major natural disasters. Among these disasters, drought has been a problem affecting food security throughout the course of human history. Like other countries in Asia-Pacific region, large parts of India perennially reel under recurring drought. Over 68% of India is vulnerable to drought. Recently the impact of 2002 drought in India was felt by a very wide group of society as the drought spread was over 56% of the landmass and threatened the livelihoods and food security of 300 million people across 18 states.

As vulnerability to drought has increased globally including Asia-Pacific region, greater attention has been directed to reducing the risks associated with its occurrence through the introduction of advanced operational capabilities of monitoring climatic causes of drought and building institutional capacity and mitigation measures that are aimed at reducing impact of short-term and prolonged drought. There is also an associated link between drought and desertification in semi-arid regions. Additionally, the United Nations General Assembly declared 2006 as International Year of Desertification (IYOD) and felt that issues of drought and desertification are global in nature and need to be addressed more concertedly and effectively for achieving food security and sustainable agricultural development. To achieve this common goal of reducing drought risk and food security globally, a major emphasis being stressed upon use of space technology for developing early warning systems at national and sub-national scale.

To communicate the developments in geospatial technology such as Remote Sensing and Geoinformation to various agencies involved in disaster management support and capacity bulding for mitigation and preparedness, Indian Institute of Remote Sensing (NRSA) has introduced a number of training programs at certificate, diploma and post-graduate level and also short courses for Asia-Pacific Region for Centre for Space Science and Technology Education in Asia & Pacific (CSSTEAP).

Prior to this course, IIRS had conducted a short-tem training in application of space technology and geoinformation for "disaster management support" in 2002 & 2004 and also specifically on "flood Risk Management" in 2007. Based on the earlier experiences, a special emphasis has been given on making use of integrated technology components such as remote sensing, ground observations, and modeling as well as forecasting techniques that are aimed at addressing issues Drought monitoring, Desertification and crop yield prediction.

Although the course duration was short, course was designed in such a way that it offered a blend of lectures, discussion, practical exercises and actual case studies done in India and abroad on various aspects of mapping and monitoring of drought and desertification, and forecasting crop output.

I congratulate all the faculty members of IIRS and also guest faculty from India and abroad, especially from ITC, Netherlands for rich contribution to this course. I also congratulate all the course participants for showing sincerity and dedication in learning the modern tools.

(Dr. V. K. Dadhwal)
Dean, IIRS

ACKNOWLEDGMENTS

An international Training Course on "Application of Space technology for Disaster Management Support with Emphasis on Drought Monitoring, Desertification and Crop Yield prediction" was organized by Indian Institute of Remote Sensing (NRSA) during July 14 August 08, 2008 for Centre of Space Technology and Education in Asia and Pacific (CSSTEAP)-Affiliated to United Nations.

This international course owes its success to the numerous individuals and institutions within India and abroad. The organisers acknowledge the partly financial support received from the Ministry of Finance, Govt. of India (TCS Colombo Plan), UN-ESCAP and International Institute for Geo-information Science and Earth Observation (ITC), The Netherlands. I thank the head of organizations of course participants from various countries for deputing their staff to undergo this training program.

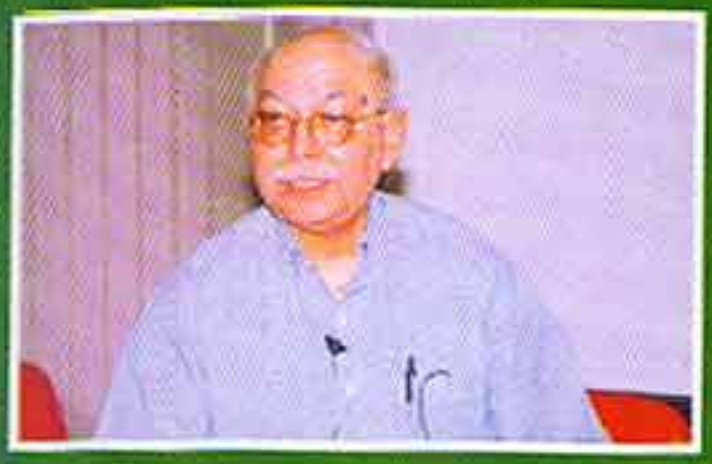
On the behalf of the organizer, we also duly acknowledge the rich contribution and cooperation received from Space Application Centre (SAC), Ahmedabad, National Remote Sensing Agency (NRSA), Hyderabad and India Meteorological Department (Ministry of Earth Sciences) in India. Faculties from International Institute for Geoinformation Science and Earth Observation (ITC) deserved appreciation and thanks for conducting series of lectures and practical for consecutively four days.

Organizing the course requires support from both technical and administrative professionals. We thank all the faculty and staff of IIRS for providing full cooperation and support in successfully organizing this course.

We are grateful to Dr. George Joseph, Director, CSSTEAP and Dr. V. K. Dadhwal, Dean, IIRS for giving us an opportunity to coordinate this course of large interest to wider group of scientific community and providing guidance beginning from designing course structure to its successful implementation.

(Dr. SK Saha)
Head, Agriculture & Soils Division &
Course Director (RS & GIS CSSTEAP)

Dr. N. R. Patel
Course coordinator



Inauguration lecture by
Dr. S. M. Virmani
Retd. Scientist, ICRISAT

Participants in Class Room

Mussorie Field Visit

ITC Faculties
(Mr. V. Venus & Ms. Pedra)

Course participants with chief guest
Dr. V. N. Sharda and course organizers

CONTENTS

INTERNATIONAL TRAINING COURSE ON

"Application of Space Technology for Disaster Management Support with Emphasis on Drought Monitoring, Desertification and Crop Yield Prediction"

1.0 BACKGROUND

Natural disasters causing immense suffering, loss of life and property every year in developing countries, including Asia-Pacific region. According to the Office of United Nations Disaster Relief Coordinator (UNDRO), approximately 90 percent of all reported disasters occur in Third World countries.

Among all natural disasters, drought is the most commonly experienced disasters causing major social and economic disruption, resulting in famine, human suffering, death, and abandonment of whole geographic regions. During 1967-91; drought affected 51% of the 2.8 billion people who were affected by natural disasters. In just the last ten years of the 20th century (declared by the United Nations as the International Decade for Natural Disaster Reduction), widespread intensive droughts claimed 50-150 million tons of grain (FAO, 2000). Drought is recurrent feature of earth's climate and occurs every year without recognizing borders or economic and political differences. For example, recent 2002 drought affected more than 100 million people with severe impact felt in western India, Pakistan's Sind as well as parts of Iran and Afghanistan. Furthermore, extended period of droughts and resulting desertification is also now major concern for human welfare and food security in developing countries. The United Nations General Assembly also recently declared 2006 as International Year of Deserts and Desertification (IYDD) and strongly conveyed message that the issues of drought, desertification and food security are global problems that must be addressed through sound monitoring and mitigation actions

Several countries have some type of monitoring and early warning system for drought and food in place, but these systems are not comprehensive and have very limited hydro-meteorological observation network and human resource inputs. Internationally several commitments and declarations (The Rome declaration (1996) on World Food Security, The millennium declaration (2000) of the UN and Johannesburg declaration (2002) on Sustainable development) made to strengthen national early warning systems with major emphasis stressed upon use of space technology for drought/desertification risk mapping, monitoring, and developing multidisciplinary crop forecasting techniques.

Space technologies can play important roles in the reduction of disasters. The use of such technologies can be particularly useful in the risk assessment, mitigation and preparedness phases of disaster management. Space technologies such as Earth Observation, Communications, Navigation etc. can provide long term monitoring and warning capabilities, while at the same time being able to rapidly deploy observation and communications system during a hazard.

Since early eighties, space technology have shown enormous potential for many issues of early drought warning and efficient monitoring. Earth observation satellites by virtue of large area coverage and rapid refresh capabilities have improved timely

- Rainfall climatology and drought over India
- Desertification: Concept, causes and status in developing countries and world
- Meteorological Drought indices for drought monitoring
- Agrometeorological crop modeling

Principles of RS & GIS

- Overview of Indian Space Programme
- Principles of Remote Sensing
- Characteristics of earth resource satellites and their imageries (VIS / IR / microwave)
- Satellite image processing algorithms and techniques
- Basic Principles of GIS and Spatial Modeling

Drought Monitoring, Desertification & crop yield prediction : RS & GIS Concepts

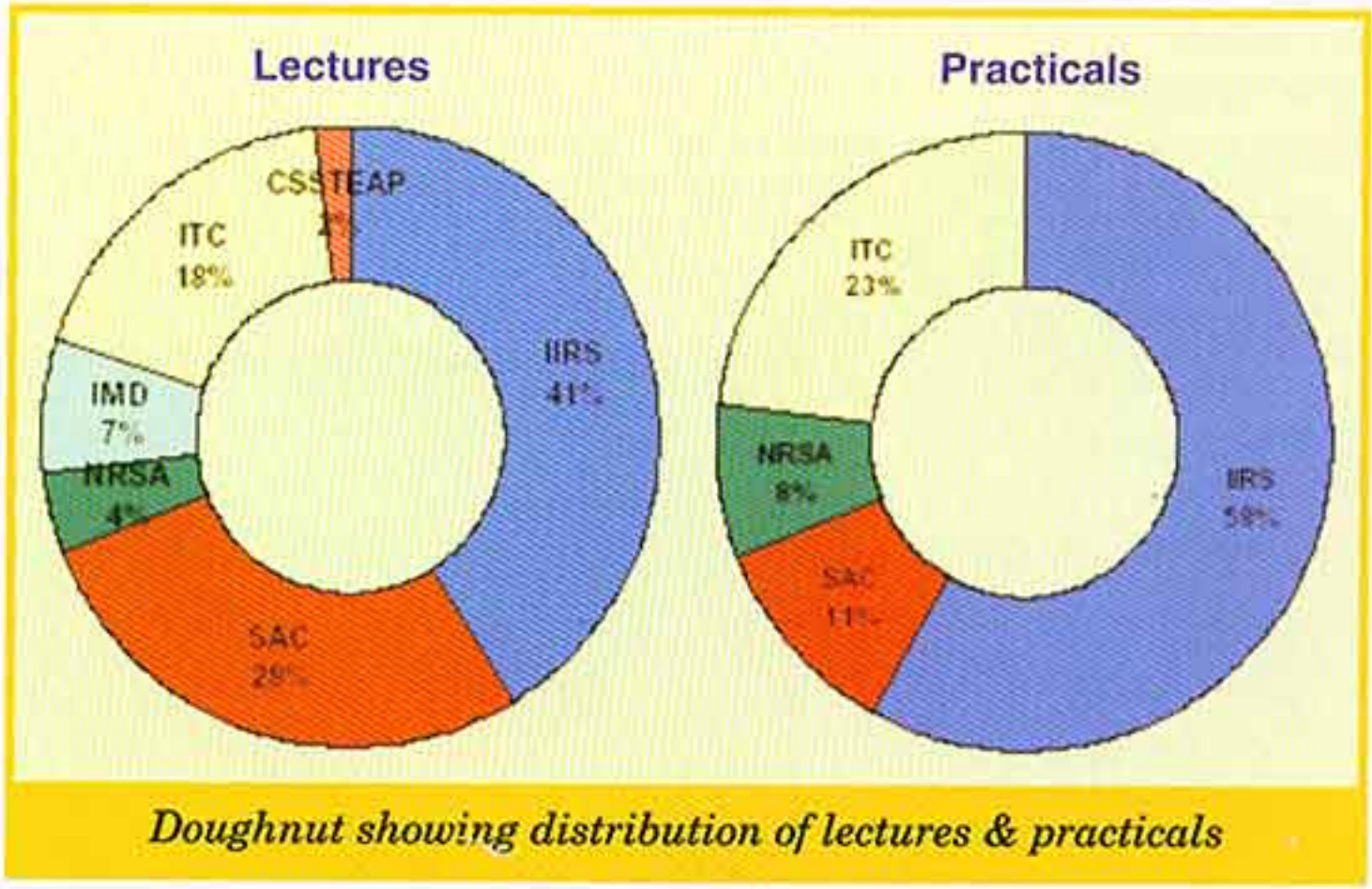
- Rainfall estimation and global products from satellites
- Earth Observation Systems for drought and crop monitoring
- Soil moisture estimation (Optical & Microwave approaches)
- Advances in drought monitoring and crop loss detection
- FASAL : Overview and achievements
- Regional Evapotranspiration estimation for crop forecasting
- Biophysical parameter retrieval from satellites
- Regional production estimation: an overview
- Crop growth models and RS data assimilation
- Operational Drought Monitoring : NADMAS

2002 drought from Space

- Integrated use of METEOSAT satellite and crop models for drought & food security
- Desertification mapping : Indian context
- Desertification hazard zonation
- Drought risk mapping 2002 drought from Space

Advanced Topics

- Crop production forecasting using RS & GIS International Experiences
- Role of weather forecast in drought management
- Satellite communication for disaster management



Doughnut showing distribution of lectures & practicals

5. COURSE OUTCOME AND RECOMMENDATIONS

As a part of feed-back and response survey to understand how the participants will use the knowledge and experience gained through this training course, each participant has been asked to furnish information on how they plan to utilize the expertise gained during this course. The un-edited version of their response is given as **Annexture IV.**

At the end of the course, an interactive session with Director CSSTEAP and followed by Panel Discussion was held to know the perspectives of implementing "**Space Technology for Drought Monitoring, Desertication and Crop yield Prediction**" in countries of each participants. Finally a Group Discussion was held to make brief account of **Recommendations** to strengthen capacity building, research and services related to drought monitoring, desertification and food security in developing countries of Asia-Pacific Region.

Recommendations

Academic Institution

- The training would help in designing course curriculum for introducing a new course on "space technology for agricultural hazards and food security" at graduate and post-graduate level.
- The diversity of topics covered in this course would promote interdisciplinary research involving researchers from branches of agriculture, hydrology and meteorology for a common goal of hazard reduction and food security.
- Hands on experience on online ITC/IDV and crop models would promote collaborative research between Space research organizations and universities in order to extend farm level technology to regional scale.

LIST OF COURSE PARTICIPANT WITH AFFILIATIONS AND DETAILS

S. No.	Name	Affiliations & Email	Photograph
1.	Mr. S.M. Mahmudul Huque **Bangladesh**	Meteorologist Storm Warning Centre Bangladesh Meteorological Department, Agargaon, Dhaka-1207, Bangladesh Ph: +880-2-9135742 Fax: +880-2-8118230 Email: smmhuque63@yahoo.com	
2.	Mr. Ajeet Singh Nain **India**	Associate Professor Dept. of Agrometeorology GB Pant University of Agriculture & Technology, Pantnagar-263145, Uddham singh Nagar, Uttarakhand Ph: 9756514114 Fax: 05944-233473, 233257 Email: nain_ajeet@hotmail.com	
3.	Mr. Manoj K Lunagaria **India**	Asst. Professor, Dept. of Agricultural Meteorology, BACA,Anand Agricultural University, Anand 388110, Gujarat Ph: 2692-261426 Fax: 2692-261426 Email: mlunagaria@gmail.com	
4.	Mr. Sanjay Kumar Dwivedi **India**	Asst. Professor G-3 Residential Campus, Indira Gandhi agricultural University, Raipur, Chhattisgarh Ph: 09009060650 Fax: 0771-2442131 Email: sanjay_dwivedi2000@yahoo.com	
5.	Mr. Dodi Apandi **Indonesia**	Meteorological & Geophysical Agency Jl. Angkasa No. 2, Kemayoran Jakarta, Indonesia Fax: +021-6542983 Email: dodi_kim@yahoo.co.id	

S. No.	Name	Affiliations & Email	Photograph
12.	Ms. B. Enkhtuya **Mongolia**	Plant Science Agricultural Research & Training Institute, Darkhan-Uul Province, Mongolia Ph: +976-99376512 Fax: +976-1372-24132 Email: ider98@yahoo.com	
13.	Mr. Werachai Chupisanyarote **Thailand**	Civil Engineer Ministry of Agriculture & Cooperatives Royal Irrigation Dept. 811 Samsen Road, Pusit District Bangkok Thailand 10300 Ph: +081-7125500, 02-843-6934 Email: werachai_c@operamail.com	
14.	Mrs. Natalya Shulgina **Uzbekistan**	Chief of International Cooperation Dept., Research Hydrometeorological Inst. (NIGMI), Uzhydromet at Cabinet of Ministers of the Republic of Uzbekistan, 72, K. Makhsumov Str., Tashkent 100 052, Uzbekistan Ph: +99871-2786885, +998712337140 (o) Fax: +998712331150 Email: nigmi@albatros.uz	
15.	Ms. Nguyen Ngoc Bich Phuong **Vietnam**	Researcher Research Center of Meteorology & Climatology Vietnam Inst. of Meteorology, Hydrology & Environment 25/62 Nguyen Chi Thanh Str., Dong Da, Hanoi, Vietnam Ph: +84-973100279 Fax: +844-8355993 Email:nn.bichphuong@gmail.com bichphuong@vkttv.edu.vn	
16.	Mr. Ngo Duc Anh **Vietnam**	Researcher Scientist Remote sensing Application Dept., Space Technology Institute, Vietnamese Academy of Science & technology (VAST) Room 304, Building A2, 18 Hoang Quoc Viet St., Cau Giay, Hanoi, Vietnam Ph: +844-7562895 Fax: +844-7914622 Email: ndda_sti@yahoo.com	

ANNEXTURE II

Course Schedule of International Training course on " Application of Space Technology for Disaster Management support with Emphasis on Drought Monitoring, Desertification and Crop Yield Prediction

(July 14 August 08, 2008)

DATE	TIME IN HOURS				
	0905-1000	1005-1100	1115-1200	1205-1300	1400-1715
14.07.08	Registration	Inaguration		L1	Visit to IIRS Facilities
15.07.08	L2	L3	LIB	L4	P1
16.07.08	L5	L6	LIB	L7	P2
17.07.08	L8	L9	LIB	L10	P3
18.07.08	L11	L12	LIB	L13	P4
19.07.08	SATURDAY				
20.07.08	SUNDAY				
21.07.08	L14	L15	L16	L17	P5
22.07.08	L18	LIB			P6
23.07.08	L19	L20	L21	L22	P7
24.07.08	L23	L24	L25	L26	P8
25.07.08	L27	L28	LIB	LIB	P9
26.07.08	SATURDAY				
27.07.08	SUNDAY				
28.07.08	L29	L30	L31	L32	P10
29.07.08	L33	L34	LIB		P11
30.07.08	L35	L36	LIB		P12
31.07.08	Field Visit (Mussorie)				
	Field visit (Sahaspur)				
02.08.08	SATURDAY				
03.08.08	SUNDAY				
04.08.08	L37	L38	LIB	LIB	P13
05.08.08	L39	L40	LIB	L41	P14
06.08.08	L42	L43	LIB	L44	P15
07.08.08	L45	L46	LIB		P16
08.08.08	Feed Back	Panel Discussion		Passing Out	

Lecture No.	Lecture Topics	Faculty
L25-26	Regional Evapotranspiration estimation and its role in crop forecasting	Dr. BK Bhattacharya, SAC
L27	Role of weather forecast in drought management	Dr. K. K. Singh, IMD
L28	Microwave RS application in soil moisture monitoring	Dr. Shiv Mohan, SAC
L29	Principles and approaches of RS for crop yield modeling	Dr. SK Saha, IIRS
L30	Crop growth parameters from satellites	Dr. NR Patel, IIRS
L31-32	Biophysical parameters retrieval from RS and its assimilation in crop growth simulation models	Dr. SS Ray, SAC
L33	Advances in drought monitoring and crop loss detection	Dr. NR Patel, IIRS
L34	Climate variability and its impact on drought	Dr Anand Sharma, IMD
L35-L36	National Agricultural Drought Monitoring and Assessment in India	Dr. MVR Sheshashai, NRSA
L37	Agrometeorological crop modeling	Mr. V. Venus, ITC
L 38 - 39	Approaches and methods for regional production estimation: an (historical) overview	Mr. V. Venus, ITC
L40 - L41	Crop Growth modeling - PSN	Mr. V. Venus, ITC
L42 - L43	Integrated use of METEOSAT satellite data and crop models for early warning of drought and food	Mr. V. Venus, ITC
L44 -L45	Satellite based indicators of Desertification and hazard zonation	Dr. SK Saha, IIRS
L46	Geoinformatics for drought risk mapping	Dr. V. Venus, ITC

ANNEXTURE III

LIST OF FACULTY AND CONTACT DETAILS

S. No.	Name of the Faculty and Topic Covered	Affiliation and E mail
1.	Dr. SM Virmani *Inauguration Lecture*	Retired ICRISAT Scientist 811A, Road No. 41 Jubilee Hill Hyderabad_500033 E mail :
2.	Dr. George Joseph *Indian Space Programme-Present and Future*	Director, CSSTEAP, IIRS Campus 4, Kalidas Road, P.O. Box 135, DEHRADUN-248001. (INDIA) E-mail: cssteap@iirs.gov.in
3.	Dr. V.K. Dadhwal *Crop forecasting & Early warning Systems-International Scenario*	Dean, Indian Institute of Remote Sensing (NRSA) Dept. of Space, Govt. of India 4, Kalidas Road, P.O. Box 135, DEHRADUN-248001. E-mail: vkdadhwal@iirs.gov.in
4.	Dr. S.K. Saha *Crop modeling and desertication zonation*	Head Agriculture and Soil Division Indian Institute of Remote Sensing (NRSA) Dept. of Space, Govt. of India 4, Kalidas Road, P.O. Box 135, DEHRADUN-248001. E-mail: sksaha@iirs.gov.in
5.	Dr. N.R. Patel *Drought definition & types, Remote of drought and soil moisture, Biophysical parameter estimation*	Scientist-SE Agriculture and Soil Division Indian Institute of Remote Sensing (NRSA) Dept. of Space, Govt. of India 4, Kalidas Road, P.O. Box 135, DEHRADUN-248001. E-mail: nrpatel@iirs.gov.in
6.	Ms. Shefali Aggarwal *Basic of Remote Sensing and Image interpretation*	Scientist-SF Photogrammetry and Remote Sensing Division Indian Institute of Remote Sensing (NRSA) Dept. of Space, Govt. of India 4, Kalidas Road, P.O. Box 135, DEHRADUN-248001. E-mail: shefali_a@iirs.gov.in
7.	Ms. Minakshi Kumar *Satellite image processing*	Scientist-SE Photogrammetry and Remote Sensing Division Indian Institute of Remote Sensing (NRSA) Dept. of Space, Govt. of India 4, Kalidas Road, P.O. Box 135, DEHRADUN-248001. E-mail: minakshi@iirs.gov.in

17.	Dr. Shiv Mohan *Microwave remote sensing of soil moisture*	Head, Advance Technique Development, RESIPA Space Application Centre Ambawadi Vistar P.O. Ahmedabad-380015 E-mail: shivmohan@sac.isro.gov.in
18.	Dr. B.K. Bhattacharya *Regional evapotranspiration for crop forecasting*	Scientist-SE Crop Inventory and Modeling Division Agricultural Resource Group, RESIPA Space Application Centre, Ahmedabad-380015 E-mail: bkbhattacharya@sac.isro.gov.in
19.	Dr. S.S. Ray *Biophysical parameters and its assimilation in crop models*	Scientist-SF Agro-ecology Division Agricultural Resource Group, Space Application Centre Ambawadi Vistar P.O. Ahmedabad-380015 E-mail: ssray@sac.isro.gov.in
20.	Dr. A.K. Srivastav *Rainfall climatology and Drought over India*	Head, National Climatic Data Centre India Meteorological Department, Pune E-mail: aks_ncc2004@yahoo.co.in
21	Dr. K.K. Singh *Role of weather forecast in Drought management*	Scientist- SF India Meteorological Department Mausam Bhavan, Lodi Road, New Delhi-110003 E-mail: kksingh@ncmwrf.gov.in
22.	Dr. A.K. Sharma *Climate Variability and drought*	Director, Meteorological Centre India Meteorological Department, Dehradun-248001. (INDIA) E mail:
23.	Dr. KV Ramanna *Operational Drought Monitoring (NADMAS)t*	Scientist-SF Agriculture Division Land Resource Group National Remote Sensing Agency Balanagar, Hyderabad E mail : kothapalliramana@yahoo.co.in
24.	Mr. Valentin Venus *Crop growth modeling, Geostationary satellite data and role for crop forecasting and drought assessment*	Lecturer Natural Resource Management International Institute of Eartth Observation & Geoinformation (ITC), Enschede, Netherland E mail : venus@itc.nl
25.	Ms. Pedra	Lecturer International Institute of Eartth Observation & Geoinformation (ITC), Enschede, Netherland

FEED -BACK AND RESPONSE BY PARTICIPANTS

A questionnaire was circulated to the participants to get feed back on the course and its utility. One of the question was "How will you utilize the course materials and knowledge gained during this course in your Organization?" The following is the response received from the participants (unedited).

Name : **S.M. Mahmudul Huque**

Country : **Bangladesh**

E-mail Address : **smmhuque63@yahoo.com**

Course materials and knowledge gained in this training course can be utilized in my organization as bellow:

a. R.S. input and Satellite data can be utilized for tropical cyclone prediction and to improve the track prediction of tropical cyclone models and forecasting.

b. Satellite communication system may be used for flood disaster management and to develop warning dissemination system in the remote sensing coastal areas of Bangladesh.

c. Floods, drought and desertification are common in Bangladesh. Remote sensing and GIS mapping are very good modern technology. Course materials can be utilized for flood mapping, identification of flood zonation and flood damage assessment in Bangladesh, it also can be utilized to mitigate disasters, for monitoring drought, desertification and crops yield using remote sensing techniques and GIS mapping. Real time flood mapping can be used for disaster management in my country. I will try to apply my gained knowledge from the course in my office for disaster management.

Name : **Ajeet Singh Nain**

Country : **India**

Email address : **nain_ajeet@hotmail.com**

Being a faculty member of the Agrometeorology, the course contents of the present training are very useful for me. The material and knowledge that I gained here will immensely help me in teaching graduate and postgraduate classes and creating a man force in the field of disaster management. I am also looking forward to assign the thesis problem to postgraduate students related to the drought monitoring / warning, yield prediction, retrieval of crop biophysical parameters, and integration of remote sensing and crop simulation model. Being only agriculture university in the state, the responsibility of advancement of agriculture in the region lie on our shoulders, the space technology will help enormously in formulating the planning related to the development of agriculture and management of different disastrous events specially harmful for agriculture like drought.