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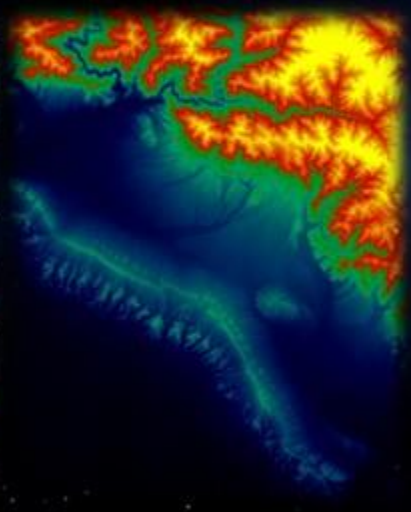
Polarimetric SAR Remote Sensing for Characterization of Manmade and Natural Features

March 16-27, 2020



Organised by

Indian Institute of Remote Sensing

Indian Space Research Organisation

Department of Space, Govt. of India Dehradun

www.iirs.gov.in

About IIRS

The Indian Institute of Remote Sensing (IIRS) is a constituent unit of Indian Space Research Organisation (ISRO), Department of Space, Govt. of India. Since its establishment in 1966, IIRS is a key player for training and capacity building in geospatial technology and its applications through training, education and research in Southeast Asia. The training, education and capacity building programmes of the Institute are designed to meet the requirements of Professionals at working levels, fresh graduates, researchers, academia, and decision makers. IIRS is also one of the most sought after Institute for conducting specially designed courses for the officers from Central and State Government Ministries and stakeholder departments for the effective utilization of Earth Observation (EO) data. IIRS is also empaneled under Indian Technical and Economic Cooperation (ITEC) programme of Ministry of External Affairs, Government of India providing short term regular and special courses to international participants from ITEC member countries since 2001.

Fig. 1. IIRS Main Building

IIRS hosts headquarters of Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP), affiliated to the United Nations and provides support in conducting the Remote Sensing and GIS training and education programmes. IIRS also plays a key role in the activities of Indian Society of Remote Sensing (ISRS), which is one of the largest non-governmental Scientific Societies in the country. To widen its outreach, IIRS has started live and interactive Distance Learning Programme (DLP) since 2007. IIRS has also launched e-learning course on Remote Sensing and Geo-information Science since August, 2014.

IIRS is located in Dehradun and well connected to major cities via, air/rail/road. The city is famous for its picturesque landscape, pleasant climate, high quality school education and several scientific organizations of national & international repute. Places of religious & tourist importance like Haridwar, Rishikesh and Mussoorie etc. are located in the vicinity of Dehradun.

About the Course

The advancement of earth observation has opened new avenues of research in the field of earth sciences. With the technological advancements in geo-information sciences, remote sensing has become an effective method for detection and investigation of various factors. The visible and infra-red regions are known as optical regions, and the microwave region (1mm - 1m) is considered as non-optical region. Systems operating in optical region are being used for several decades and therefore, are more advanced and widely employed. However, their use is limited by availability of sunlight and interference of the atmospheric conditions such as haze and cloud cover especially in the tropical regions. Therefore, the use of microwave or radar remote sensing is preferred in such areas. Radar imaging through Synthetic Aperture Radar (SAR) systems has revolutionized and expanded the technology of Microwave remote sensing especially in thematic applications using different techniques like SAR Polarimetry (PolSAR), SAR Interferometry (InSAR), Persistent Scatterer Interferometric Synthetic Aperture Radar (PSInSAR) and Polarimetric SAR Interferometry (PolInSAR).

After interaction with any object, the energy associated with the electromagnetic wave gets distributed in two components: (i) some part of the electromagnetic energy is absorbed by the interacting object itself and (ii) the rest is reradiated in all possible directions. Due to re-radiation in different directions, only a part of electromagnetic energy is received by the SAR system. Thus, absorption and the partial capture of reradiated energy by the SAR leads to the loss of valuable information that needs to be compensated. To overcome this problem and to extract the maximum information, multi-polarized polarimetric data has been widely used.

Polarimetric SAR data has been used for several applications and few of them have been listed below;

a) Classification of manmade and natural features.
b) Modelling for forest height, stem volume and aboveground biomass estimation
c) Crop monitoring and soil moisture estimation
d) Monitoring of ice sheet and glacier surface
e) Retrieval of snow physical parameters
f) Flood mapping and monitoring
f) Mapping of lava flow and volcanic eruption.
g) Oil spill mapping and ship detection
h) Geological structure identification and sub-surface feature detection
i) PolSAR-based urban area extraction to improve the Land use classification

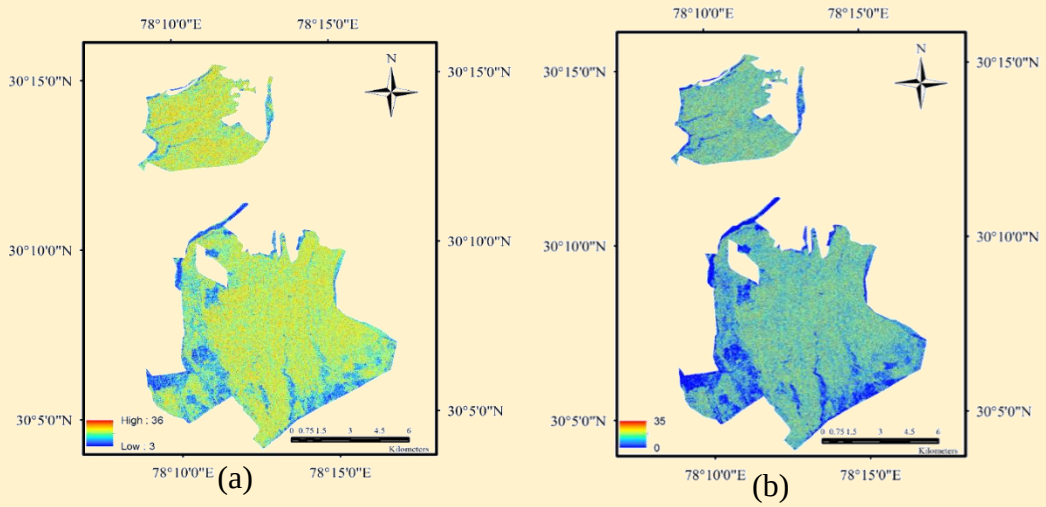


Fig. 2. PolInSAR inversion-based modelled output forest height map of Barkot and Thano forest ranges of Doon Valley forest area using (a) CAI and (b) TSI-based models.

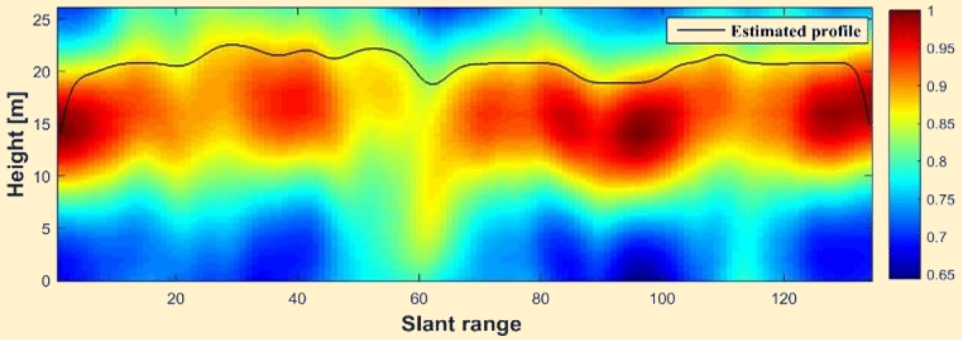


Fig. 3. RADARSAT-2 PolSAR tomographic-based vegetation profile of a forest area.

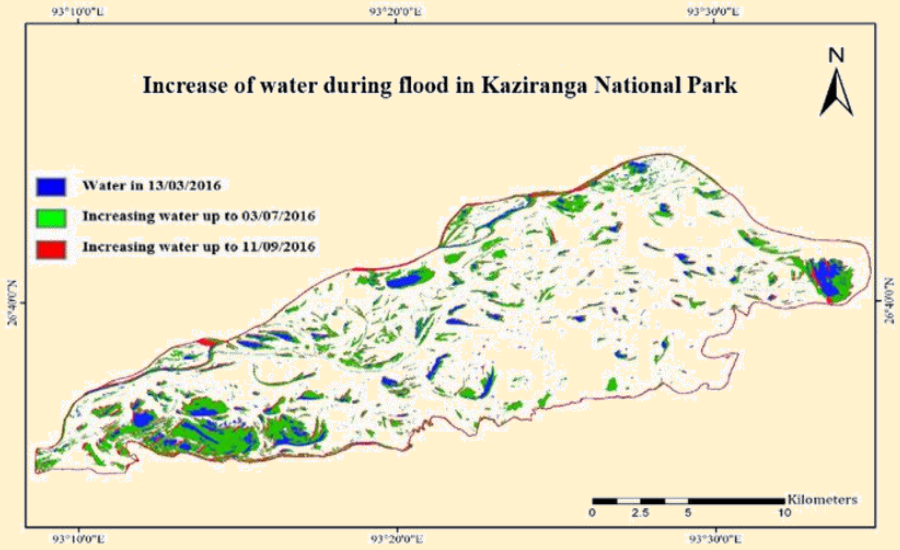


Fig. 4. Sentinel-1 SAR data-based flood mapping

Figures 2, 3 and 4 show the TanDEM-X CoSSC PolInSAR-based inversion for forest height retrieval, PolInSAR tomography for vertical profile retrieval of Terai Central Forest Division, Haldwani, Uttarakhand, India and PolSAR-based decomposition modelling of Sentinel-1 SAR data for flood mapping of Kaziranga National Park, Assam, India.

Objective of the Course/Workshop

The overall objective of this training-cum-workshop is to make the awareness among users/researchers/professionals about the concept of Polarimetric SAR Remote Sensing and disseminate knowledge and practical applications on use of PolSAR data.

Eligibility

The training cum workshop is designed for professionals, faculty, scientists, and researchers (JRF/SRF/RA) in working geospatial technologies. Only Indian nationals can apply for this training cum workshop. Preference will be given to the employees of Govt. and public sector organizations. In case a large number of applications are received, the selection will be done based on the criteria decided by IIRS..

Curriculum

Following topics will be covered in this training cum workshop.

❖ **Basics of SAR remote sensing**

- Overview of SAR Remote Sensing
- An Overview of Airborne & Spaceborne SAR Sensors
- SAR Systems, Image Acquisition Modes and Data Formats
- SAR missions to explore the hidden structures and properties of planetary bodies

❖ **Polarimetric SAR Remote Sensing**

- Basic concept of Polarimetric SAR Remote Sensing
- Current and future PolSAR missions of ISRO and other spaces agencies
- Challenges in Polarimetric Decomposition Modelling-based scattering retrieval of PolSAR data
- Hybrid-/Compact-Pol SAR system based scattering information retrieval (RISAT-1 and Chandrayaan-1)
- Polarimetric Calibration of SAR Data

❖ **PolSAR and PolInSAR Data Processing**

- Radiometric Calibration and Orthorectification/Terrain Correction of SAR & PolSAR Data
- Deep learning methods for PolSAR data classification
- PolInSAR based decomposition modelling for scattering characterization
- SAR Tomography and PolInSAR inversion modelling for manmade and natural features

❖ **Applications of Polarimetric SAR Remote Sensing**

- Thematic applications of PolSAR Remote Sensing.
- Group Case Study

Training Course Duration and Location

The training course will be conducted at Indian Institute of Remote Sensing (IIRS), ISRO, Dehradun, India from March 16-27, 2020.

Language

The working language of the course is English. Proficiency in Written and Spoken English is most essential. Candidates having that the participants should have good working knowledge of English.

Registration Fee

The training cum workshop has a nominal registration fee of ₹ 5,000/- per participant. The registration fee includes the boarding charge. Food (Breakfast, Lunch, and Dinner) will be available in the IIRS student mess on a payment basis. Participants will have to make a payment for their food. Only selected candidates have to send a crossed Demand Draft from any Nationalized Bank drawn in favor of 'Pay and Accounts Officer, Indian Institute of Remote Sensing' payable at Dehradun after selection and before the commencement of the course. A list of selected candidates will be uploaded on the IIRS website www.iirs.gov.in by February 20, 2020.

Important Dates

- Start Date of Online Application: **January 15, 2020**
- Last Date of Online Application: **February 15, 2020**
- List of Shortlisted/Selected Candidates: **February 20, 2020**
- Start Date of the Training cum Workshop: **March 16, 2020**
- Last Day of the Training cum Workshop: **March 27, 2020**

Application Procedure

The aspirant participants may fill the online form available in IIRS website (https://admissions.iirs.gov.in/shortcourse) on or before February 15, 2020.. Applicants are advised to apply well before last date.

Contact Details

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