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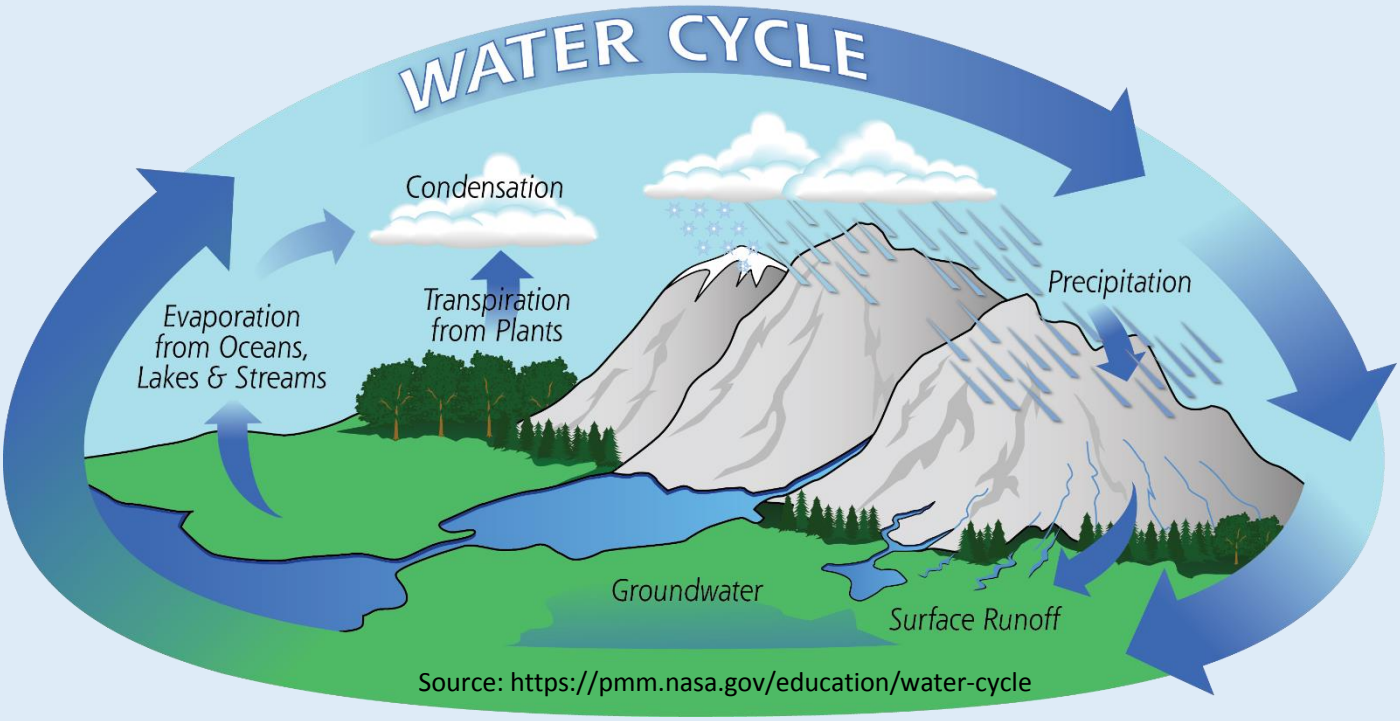
Remote Sensing and GIS Applications in Hydrological Modeling

April 20- May 01, 2020



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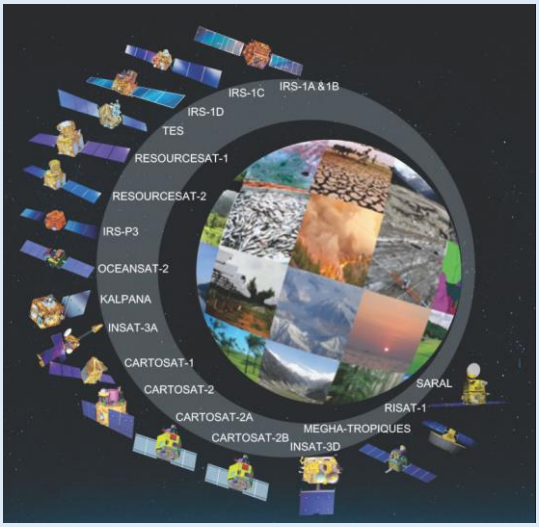

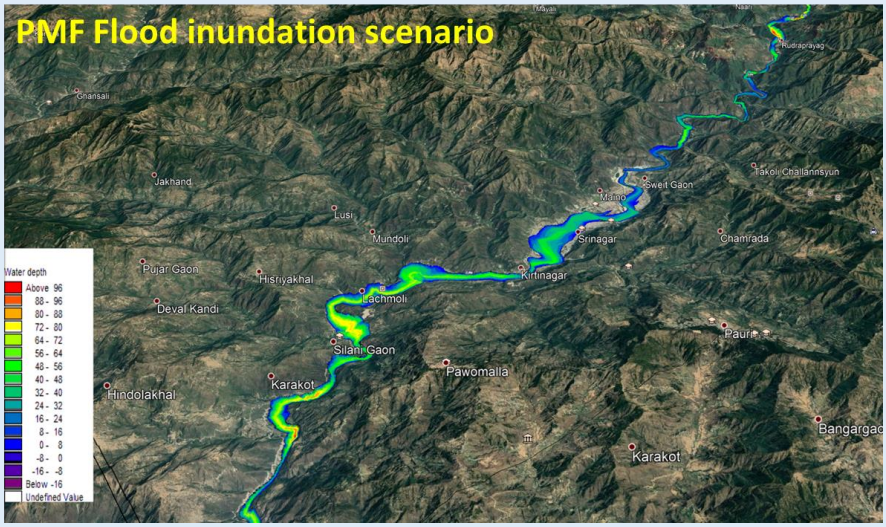

Organised by

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 (EO), open EO data, global positioning and navigation systems (GPS/GNSS), geographical information system (GIS) and geospatial data compatible hydrological models has opened a new avenues of research and operational applications of hydrological modeling in various issues and domains of water resources and hydrological investigations. With the advancements in geo-spatial data and technology, hydrological modeling has become an effective and essential tool for assessment, prediction and management of water resources, hydrological parameters and water movement/demand/use scenarios.

The hydrological models requires basic geo-referenced data such as, land use land cover (LULC), soil maps, and digital elevation models etc., for capturing the spatio-temporal variations of these thematic layers. Most of these datasets can be easily derived from remote sensing images and limited ground truth. The hydro-meteorological data such as precipitation, air and land surface temperature, solar radiation, evapotranspiration, soil moisture, river and lakes water levels, river discharge, and terrestrial water storage can be also be derived from remote sensing as well as from point based ground instruments. The GIS based platforms, both commercial and open source, provides an excellent interface for integration of all such geospatial and hydro-meteorological data to accomplish the hydrological modeling. Such modeling studies can be done at various spatio-temporal scales, ranging from city, watershed to basin level and at time scale of few hours used for urban and flood studies to daily time step based yearly long term climatic simulations.

In this course, detailed lecture and practical demos would be given on how to integrate geo-spatial data in various hydrological models. Practical applicability and basic knowledge of many popular and useful hydrological models such as; hydrological modeling system, soil and water assessment tool, variable infiltration capacity model, river analysis system and 1 & 2 dimensional hydrodynamic (1/2 HD) models, would be a part of this training. In addition, overview and sources of various satellite based hydrological parameters along with demo of field instruments required for hydrological ground data collection would also be imparted in this training. One day field work is also planned in nearby Asan and Aglar sub-watersheds of river Yamuna.

The major applications of geospatial data and its use in hydrological models are listed below;

a) Computation and assessment of water balance of an geographical area.
b) Retrieval of hydro-metrological parameters using remote sensing and integration in hydrological models
c) Mapping and monitoring snow cover, glaciers, and surface water using remote sensing and its use in snow-glacier melt and rainfall-runoff models
d) Surface runoff computation using rainfall – runoff modeling
e) Hydrological modeling approach for flood peak estimation and design flood computation
f) Groundwater and urban hydrological/hydrodynamic modeling studies
g) Long term water and energy balance computations at river basin scale using macro scale, grid based, fully distributed hydrological models
h) Geo-spatial data creation, integration and assimilation for flood simulation in 1/2 D HD models, including dam break and early warning systems

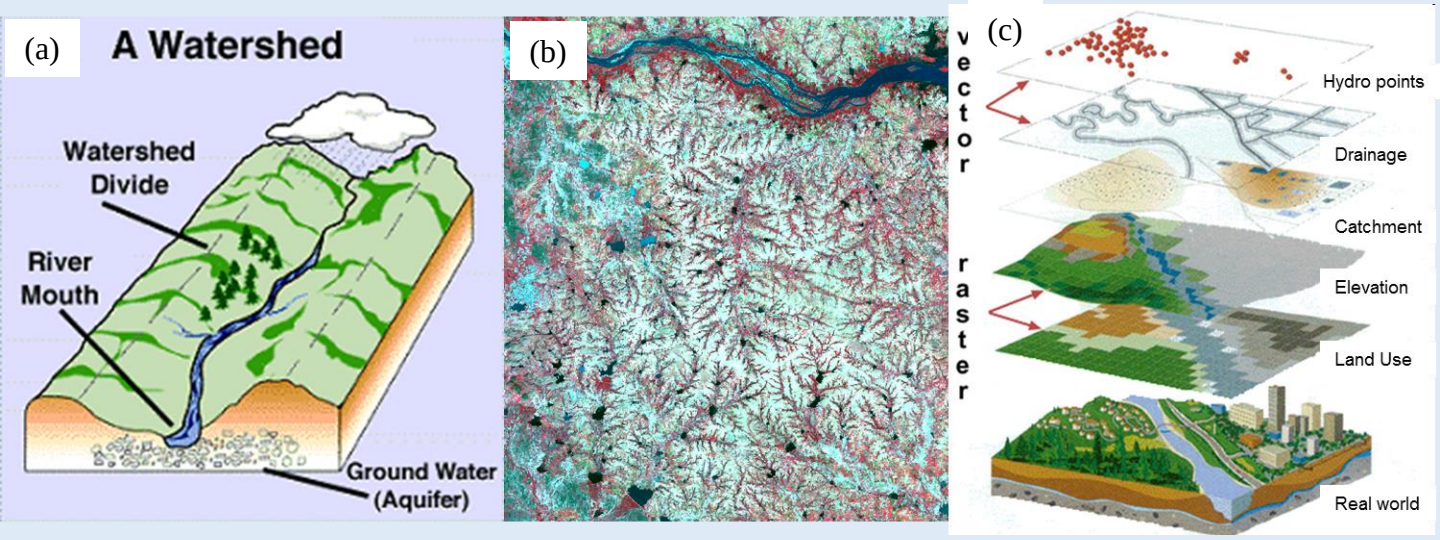

Fig. 2. a) A typical representation of watershed **b)** An example of watershed as seen in remote sensing multispectral image color composite **c)** Integration of vector and raster layers in GIS for representation of real world scenarios and hydrological features

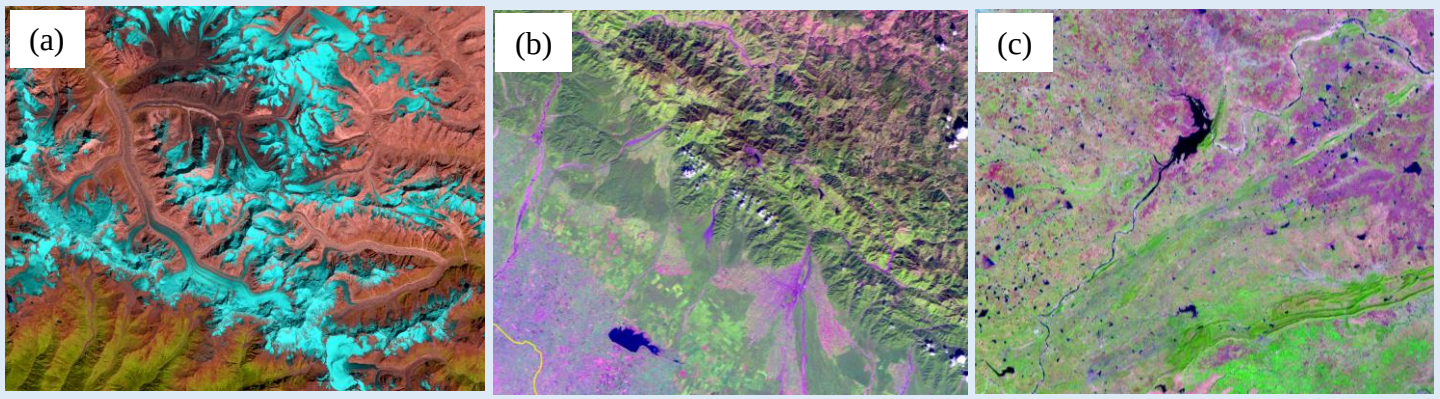

Fig. 3. Hydrological complexities as seen in RS data of various regions **a)** Remote sensing images of snow-glacier dominated Gangotri area; **b)** Forested and Tarai agriculture/urban regions of Nainitital and Rudrapur, UK **c)** Central India near Bisalpur reservoir and surrounding area dominated by small man made water bodies and agricultural area

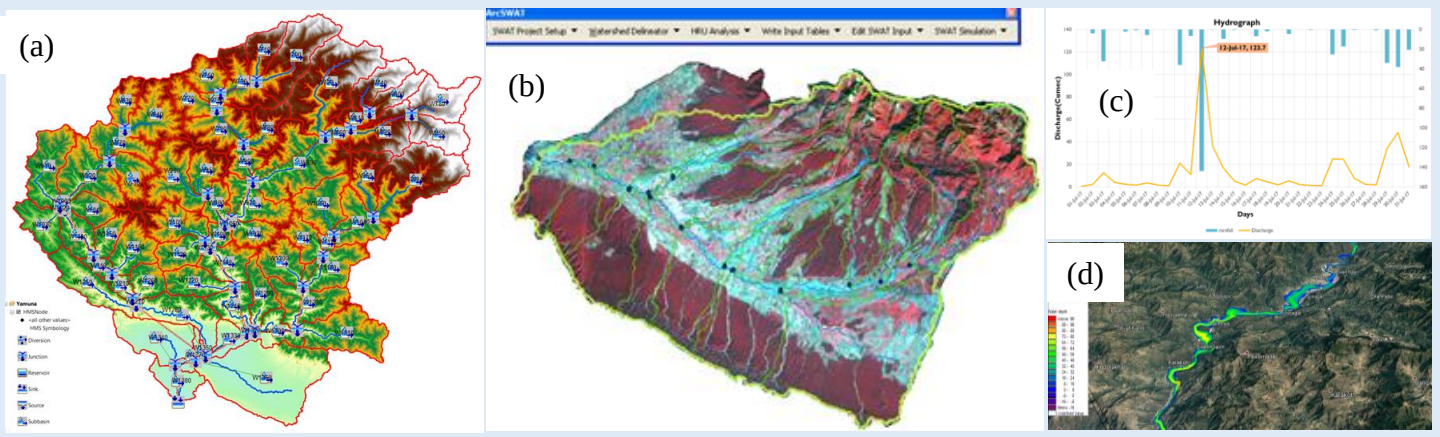

Fig. 4. Hydrological modeling and results **a)** HMS model set up for Yamuna basin; **b)** SWAT model for ASAN watershed **c)** Hydrological modeling results for peak flood of 12 July 2017 in Dehradun city **d)** PMF flood inundation scenario for Alakhnanda river from Rudraprayag to Devprayag river, Uttarakhand based on 1-D HD model

Figures 2, 3 and 4 shows the utility and applications of RS-GIS in hydrological modeling, role of remote sensing to capture spatio-temporal variability of various land use and land cover features in various hydro-climatic and topographical regions of India and example setup and results of various popular hydrological and hydrodynamic models, which rely heavily on geospatial technology based thematic and hydro-meteorological data for its simulations and model output accuracy

Objective of the Course/Workshop

The aim of the this course is to provide basic understanding of remote sensing, satellite image analysis, geographic information system (GIS) and Global Navigation Satellite System (GNSS) technologies and detailed exposure to applications of geospatial technology in hydrological modelling studies.

Eligibility

The training cum workshop is designed for water resources professionals, government officials, faculty, scientists, and researchers (JRF/SRF/RA) in working field of water resources, geospatial technologies and other related disciplines . 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 remote sensing, GIS and GNSS (two days)**
  - Overview of Remote Sensing
  - An Overview of GIS and GNSS technology
  - GIS data models, map projections, datum and GPS survey requirements
  - Overview of advanced EO and hydrological data collections sensors (SAR, LIDAR, TLS, UAV, echo boat and GNSS/IRNSS receivers)
- **Hydrological parameters and thematic layer generation using remote sensing relevant for hydrological modeling (two days)**
  - Surface water and snow mapping and monitoring using remote sensing
  - Precipitation estimation using Remote Sensing
  - Evapotranspiration estimation using Remote Sensing
  - Soil moisture and interception estimation using Remote Sensing
  - Terrain properties estimation using RS-GIS
- **Application of geospatial technology for hydrological modeling (three days)**
  - Type of hydrological models and its application to real world hydrological investigations
  - Surface runoff estimation using rainfall –runoff models (NRCS method) and Snow-melt runoff estimation using temperature index (SRM) models
  - Hydrological modeling using semi-distributed or lumped hydrological models
  - Watershed scale water balance and long term hydrological modeling using hydrological response unit (HRU) based models
  - Basin scale hydrological modeling using macro scale fully distributed hydrological model
  - Overview of groundwater, urban runoff and potable water network distribution models
- **Application of geospatial technology for 1/2 D Hydrodynamic modeling (two days)**
  - Flood peak and design flood estimation using hydrological modeling
  - RS based flood mapping, monitoring and damage assessment
  - 1/2 D HD modeling for flood inundation, dam break and glacier lake outburst modeling
  - Water level and river discharge estimation using RS-GIS and flood early warning systems

Training Course Duration and Location

The training course will be conducted at Indian Institute of Remote Sensing (IIRS), ISRO, Dehradun, India from April 20-May 01, 2020.

Language

The working language of the course is English. The participants should have good working knowledge of both written and spoken English.

Registration Fee

The training cum workshop has a nominal registration fee of ₹ 6,500/- per participant (Rs. 4,000: Course Fee + Rs. 2,500: Registration & Other Charges). Food (Breakfast, Lunch, and Dinner) will be available in the IIRS student mess on a payment basis. Participants will be provided boarding at IIRS hostel at nominal charges as per IIRS hostel rules and rates. 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 March 20, 2020.

Important Dates

- Start Date of Online Application: **January 20, 2020**
- Last Date of Online Application: **March 06, 2020**
- List of Shortlisted/Selected Candidates: **March 20, 2020**
- Start Date of the Training cum Workshop: **April 20, 2020**
- Last Day of the Training cum Workshop: **May 01, 2020**

Application Procedure

The aspirant participants may fill the online form available in IIRS website (https://admissions.iirs.gov.in/shortcourse) on or before March 06, 2020.. Applicants are advised to apply well before last date.

Contact Details

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