



Spring School on Water Systems, Science & Practice Lahore University of Management Sciences

Module 1: Water Science and Hydrology

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Description

Hydrology is the study of the processes, which cycle water between the oceans, atmosphere, and land surface. Water in the landscape is not only a necessary component for life, it is the fundamental driver of landscape and landform development. In the Upper Indus Basin, rainfall runoff is relatively scarce with most precipitation falling as snow at high altitudes. As a result, water has been diverted literally through mountains in order to feed the downstream communities. This session will focus on understanding the physical processes which dictate the interaction of water with the landscape and thus fundamental to managing our resources in the face of mounting environmental challenges and natural resource pressures.

Objectives

This session is designed to present: (a) hydrologic data and modeling resources in public domain, (b) hydrologic data management and analysis using GIS and (c) hydrologic modeling simulations.

Participants will be able to learn how to: (i) obtain, process and analyze hydrologic data; (ii) develop commonly used hydrologic model (SRM) for simulating natural processes; (iii) understand different options available with computer programs and their implications in simulating natural processes.

Session 1: Introduction to hydrology and hydro-climatic datasets (Asif Khan)

The module is structured around the hydrologic cycle, which is a set of linked processes that cycle water between the ocean, atmosphere, and land surface. We will examine the individual components of the hydrologic cycle, as well as interactions between these components. The session will also focus on how to use digital elevation data together with geo-morphological data for the development of watershed parameters that are required by most commonly used in hydro-climatic modelling.

Session 2: Hydro-climatic datasets and hydrological modelling (Asif Khan)

This session will discuss various publicly available datasets (required for hydro-climatic studies), their sources, mapping and analysis. There will also be introduction to the concept of hydrologic modeling (i.e. conceptual vs. physical; lumped vs. distributed); Hydrologic simulations using Snowmelt Runoff Model (SRM). This session will provide attendees with the knowledge and tools necessary to use data derived from geographical information



systems (GIS) and to develop hydrologic estimates and model runoff from the Upper Indus Basin's sub-basins.

Session 3: Introduction to snow and glacier data and their rectification (Asif Khan)

Snow and glacier melt produces 60-80% of flows in the Upper Indus Basin. Use of precise and accurate snow and glacier data is vital for policy making and water resource management. Therefore, this session will provide introduction to various snow and glacier datasets, their constraints identification (using multiple datasets) and methods for rectification, using state of the art tools. Importance of raw and rectified datasets will be explained using simple hydrological modelling examples. Historic hydro-climatic data analysis will also be discussed.

TARGET AUDIENCE:

The session is for anyone who is interested in learning basic concepts of hydrology, data analysis, snow and glacier-melt hydrologic modeling and GIS with no formal education in hydrology. The session would also be beneficial for participants interested in complex hydro-climatology of the Northern Pakistan (Hindukush-Karakoram-Himalayas). While local hydrologic/hydraulic engineers may participant, it should be recognized that basic principles will be discussed. Experience with any GIS tools would be helpful.