UNESCO-IHE
Institute for Water Education

Advanced Short Course on
"Where there is little data: how to estimate design variables in poorly gauged basins"

Delft, The Netherlands, 17-28 November 2014

The estimate of design variables, for hydraulic engineering and water management purposes, is a difficult task that practitioners have to face when designing a hydraulic structure, assessing water allocation, addressing river basin planning, managing water resources. This estimate is affected by several sources of uncertainties, the most crucial being the limited availability and reliability of observed data in time and space. This is particularly true when river basins are poorly gauged. Nowadays, several new sources of data acquisition are made available by the recent applications of Remote Sensing and GIS to hydrological processes; furthermore, the scientific literature has provided engineers and practitioners with new statistical and geostatistical methods and tools to best exploit the scarce measured data at a given station and extend the local information to a larger scale.

The aim of the course on "*Where there is little data: how to estimate design variables in poorly gauged basins*" is to provide an advanced theoretical understanding and hands-on practical methods to cope with the estimate of hydrological variables in poorly gauged basins.

Learning objectives
At the end of this course the participants will be able:
- To apply the latest new Open Source GIS and Remote Sensing software and data for deriving hydro-geomorphological and hydro-meteorological information
- To apply an advanced theoretical understanding of selected hydrological variables: flow duration curves, hydrological extremes, mean annual flow
- To evaluate, select and apply different advanced statistical and geo-statistical methods for estimating hydrological variables in poorly gauged basins

Target
This is an advanced course designed for scientists, engineers and water managers involved in water resources management of poorly gauged basins.

Pre-requisites
Working knowledge of Hydrology, and Statistics. A basic knowledge of GIS and Remote Sensing is welcome.

Contents

1. **New methods and tools of hydrological data collection: OS GIS and Remote Sensing.**

During this section you will learn how to use QGIS and GRASS software, to download and analyse two different freely available DEM, derive watershed, sub-basins, drainage network and basic morphometric properties of a basin at a specific outlet. You will also learn how to apply a Remote Sensing based Evapotranspiration model, using ILWIS.

2. **Introduction to the R package**

During this session you will get familiar with the OS statistical package R, based on real-case hydrological examples.

3. **Hydrological variables: annual flows, flow duration curves, hydrological extremes, rainfall-runoff**

During this session you will review and get into the depth of deriving the hydrological variables mentioned above, using R and some real case-studies of drainage basins in Italy.

4. **Geostatistics**

During this session you will review in depth the concepts of Uni- and Bivariate variables, Linear Regression models, Stochastic processes, basics of Geostatistics, Variogram, Ordinary Kriging, Topological Kriging and apply them using R to some real case-studies of medium size basins in Italy

5. **Index Value Methods (Example of regional analysis)**

During this session you will review in depth the concepts of Frequency analysis of hydrological extremes with focus on floods, Estimation of the design-flood with possible approaches, At-site flood-frequency analysis, Regional flood frequency analysis, Setting-up a regional model, L-moments: definition, estimation and use; and apply them using R to some real case-studies.

Methods

Using of state of the art literature coupled with field experience from International professionals and academics.

Frontal lectures in class; individual exercises; case study analysis. This course will make use of open source - freely available- software only.

Lecturers

Paolo Paron (UNESCO-IHE); *Luigia Brandimarte* (UNESCO-IHE); *Hans van der Kwast* (UNESCO-IHE); *Attilio Castellarin* (University of Bologna); *Alberto Viglione* (TU Vienna, Austria); *José Luis Salinas* (TU Vienna, Austria)

Course Coordinator

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Dates and location

17-28 November 2014. The course will be held at UNESCO-IHE (www.unesco-ihe.org) in Delft, NL.

Application procedure and more information

Visit http://www.unesco-ihe.org/Education/Short-courses and follow instructions

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