IST – EPFL Joint doctoral Initiative

Thesis Topic Proposal Form

TITLE: Application of MPS to surface hydrology

FOCUS AREA: Environmental Hydraulics

Short Description

In recent years the non-parametric modelling technique based on multiple-point statistics, MPS, emerged, including in its application to the hydrological field (initially spatial data and more recently, also temporal data).

This method uses a statistical model of variability that consists of an example of the phenomenon under study, known as training data (TD), from which high order statistics or patterns are borrowed. When applied to time or to spatial-series (multivariate or not) it allows preserving the linear and the non-linear dependences between variables. One of the MPS algorithms is the direct sampling (DS) algorithm which repeatedly and randomly scans the TD searching for patterns that are re-introduced in the interfered/affected data based on the similarity between patterns, identified based on a distance function.

The research theme proposed intends to explore the capabilities of the MPS-DS in its applications to surface hydrology that can encompass: (a) filtering procedures to remove interferences or to fill gaps both in spatial or temporal series; (b) water resources modelling combining remote sensing and satellite imaging; (c) integration of different data type in groundwater and surface hydrology; (d) exploitation of nonparametric relationships between variables of different nature (e.g., categorical and continuous, such as risk vulnerability class and rainfall); and simulation of snow/ice patterns from satellite to forecast snowmelt, among others.

Because MPS-DS may support different developments and applications, once a candidate is selected it will be possible to adjust the scope of the research according to his profile and preference.

Keywords: Multiple point statistics, direct sampling, surface hydrology

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