IAHS2017-253
IAHS Scientific Assembly 2017


# Parameter identification and the evolution of uncertainty in hydrological modelling

Valentina Chiarello (1), Enrica Caporali (1), and Hermann Matthies (2)

(1) University of Firenze, Civil and Environmental Engineering, Firenze, Italy (valentina.chiarello@dicea.unifi.it), (2) Institute of Scientific Computing, Technische Universität Braunschweig, Braunschweig, Germany

The application of an hydrological model that describes the key processes of interest during a flood event, means to take into account a set of parameters that represent the physical phenomena and to govern critical processes. As it is becoming increasingly hard to ignore the presence of uncertainty in the hydrologic systems, the main scope of this work is to improve the existing mathematical models of flood phenomena by including the uncertainties into the problem itself. In particular, an effort is done to propose a methodology in which the hydrological modeling is efficiently coupled with the assessment of parameter uncertainty.

The methodology for the Linear Bayesian update approach to inverse problem working in sampling and functional approximation is presented. For the assimilation process numerical implementations via Monte Carlo methods, in other word the Ensemble Kalman filter (EnKF) procedure and Wiener's Polynomial Chaos Expansion (PCE), update without any sampling, are proposed. PC based method, where the unknown Random Variables (RVs) are represented as functions of known RVs, is very recent and may be well combined with the EnKF for the computation of the forward samples. Moreover, as Bayesian update may be numerically very demanding, the PC filter could be helpful to accelerate the update.

The numerical evaluation of the analyzed Bayesian updating methods is carried out with reference to the distributed hydrological model MOBIDIC (MOdello di Bilancio Idrologico DIstribuito e Continuo). Three uncertain MOBIDIC model parameters are described in a Bayesian way through a probabilistic model, the randomness reflecting the uncertainty about the true values.

The methodology is tested for a specific flood event occurred on 28.11.2012 in the Arno river basin, in Tuscany (Italy), using synthetic measurement as well as real measurement of discharges. Even though the considered event is not long enough for a complete identification procedure, the effect of the input uncertainty on the system response is determined.

Probability Density estimates for the prior and posterior for both the EnKF and PCE update are represented for synthetic case and real case. The validation of the results for synthetic case suggests that the methodology can be suitably applied in hydrological modelling, while in real case the detected high error in peak discharge occurrence, suggests to further investigate the model errors.