Geophysical Research Abstracts
Vol. 12, EGU2010-12478-1, 2010
EGU General Assembly 2010

Uncertainty analysis of an inflow forecasting model: extension of the UNEEC machine learning-based method

Francesca Pianosi (1), Durga Lal Shrestha (2), Dimitri Solomatine (2,3)

(1) Dipartimento di Elettronica e Informazione, Politecnico di Milano, (2) Unesco-IHE Institute for Water Education, Hydroinformarmatics & Knowedlge Management, Delft DA, Netherlands (d.solomatine@unesco-ihe.org, +31-(0)15-2122921), (3) Water Resources Section, Delft University of Technology, Delft, Netherlands

This research presents an extension of UNEEC (Uncertainty Estimation based on Local Errors and Clustering, Shrestha and Solomatine, 2006, 2008 & Solomatine and Shrestha, 2009) method in the direction of explicit inclusion of parameter uncertainty. UNEEC method assumes that there is an optimal model and the residuals of the model can be used to assess the uncertainty of the model prediction. It is assumed that all sources of uncertainty including input, parameter and model structure uncertainty are explicitly manifested in the model residuals. In this research, theses assumptions are relaxed, and the UNEEC method is extended to consider parameter uncertainty as well (abbreviated as UNEEC-P).

In UNEEC-P, first we use Monte Carlo (MC) sampling in parameter space to generate N model realizations (each of which is a time series), estimate the prediction quantiles based on the empirical distribution functions of the model residuals considering all the residual realizations, and only then apply the standard UNEEC method that encapsulates the uncertainty of a hydrologic model (expressed by quantiles of the error distribution) in a machine learning model (e.g., ANN).

UNEEC-P is applied first to a linear regression model of synthetic data, and then to a real case study of forecasting inflow to lake Lugano in northern Italy. The inflow forecasting model is a stochastic heteroscedastic model (Pianosi and Soncini-Sessa, 2009). The preliminary results show that the UNEEC-P method produces wider uncertainty bounds, which is consistent with the fact that the method considers also parameter uncertainty of the optimal model. In the future UNEEC method will be further extended to consider input and structure uncertainty which will provide more realistic estimation of model predictions.