Geophysical Research Abstracts, Vol. 9, 11541, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-11541


# Predictive probability assessment in hydrological modelling using a formal Bayesian inferential approach

**E. Todini** (1), M.L.V. Martina (1) and P. Mantovan (2)

(1) Dipartimento di Scienze della Terra e Geologico Ambientali - Università di Bologna. Bologna., (2) Dipartimento di Statistica - Università Cà Foscari - Venezia

Predictive probability assessment in hydrological modelling and forecasting is still an open problem. While several attempts have been made to overcome the problems generated by the complex nature and structure of the various types of errors (model, parameters, observations, boundary conditions) embedded in hydrological forecasts, only recently the problem has been thoroughly tackled due to its implication in the decision process. Beven and Binley, (1992) suggested a procedure (GLUE), which was supposed to overcome these problems, while, unfortunately it was shown (Mantovan and Todini, 2006) that GLUE is not capable of efficiently extracting information from the observations. Moreover, the definition of predictive uncertainty in GLUE does not correspond to the widely accepted definition of predictive uncertainty (de Finetti, 1975). In particular, Krzysztofowicz (1999) clarified the difference between predictive probability, defined as the uncertainty of a true, albeit unknown quantity of interest (such as the water stage or discharge), conditional to the model forecast, as opposed to the model forecast uncertainty, which, unfortunately, is commonly used by hydrologists to represent it instead. Following the work of Krzysztofowicz (1999), by taking advantage of the Normal Quantile Transform, which allows to transform both observations and model predictions into a Normal space where their joint distribution, together with the distribution of errors, is known, this paper introduces a formal Bayesian approach to the predictive uncertainty assessment. This allows to apply the formal Bayesian inferential approach without the need of making assumptions on the probability distribution of errors, given that in the Normal space their distribution is fully known. In this approach, starting from a uniform prior on the model parameters, via Montecarlo sampling of parameters, one is able to obtain a posterior parameter density which is finally used to marginalise the parameter uncertainty from

the predictive probability. Results are given for a simple test based on the a,b,c model (Fiering, 1967, Mantovan and Todini, 2006) and for a real world case based on a complex hydrological model (TOPKAPI) applied to a Chinese catchment (Liu, Martina and Todini, 2005). The improvement of the approach are shown in terms of reduction of predictive uncertainty with respect to the use of a parameter prior and of its consistency as opposed to what can be obtained by using GLUE.