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Self-Organizing Maps as a tool for model time series evaluation

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Basically, any statement on model behaviour depends on our possibilities to differentiate between model time series. The prevalent means for the evaluation and differentiation of model time series in the course of Monte-Carlo experiments are statistical performance measures. However the reduction of information contained in model time series through the use of aggregating statistical measures is very high compared to the amount of information that one would like to draw from it for model evaluation and calibration purposes. Applied within a model identification context, the performance measures [e.g. Legates and McCabe Jr., 1999] are inadequate to capture details on time series characteristics as essentially different model results can be produced with close to identical performance measure values. It has been readily shown that the loss of information on the residuals imposes important limitations on model identification and -diagnostics and thus constitutes an element of the overall model uncertainty [Yapo et al., 1998; Gupta et al., 2003; Wagener et al., 2003]. In this contribution we present an approach using an unsupervised neural network (Self-Organizing Map, SOM) [Kohonen, 2001] to circumvent the identifiability problem induced by the low discriminatory power of aggregating performance measures. The Self-Organizing Map is used to differentiate and classify the output time series obtained from Monte-Carlo simulations with a distributed conceptual watershed model, based on the recognition of different patterns in time series. In this contribution the same SOM is used to gain insights into the operation of the model structure/parameters and to identify the model realizations among the Monte-Carlo simulations that most closely approximate the pattern of the measured discharge time series. The results are analyzed and compared with the man-

ually calibrated model as well as with the results of the Shuffled Complex Evolution algorithm (SCE-UA) [Duan et al., 1993].

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