Geophysical Research Abstracts
Vol. 16, EGU2014-3905, 2014
EGU General Assembly 2014

Comparison of a Neural Network and a Conceptual Model for Rainfall-Runoff Modelling with Monthly Input

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Rainfall-runoff (RR) models contain parameters that can seldom be directly measured or estimated by expert judgment, but are rather inferred by calibration against a historical record of input–output datasets. Here, a comparison is made between a conceptual model and an Artificial Neural Network (ANN) for efficient modeling of complex hydrological processes. The monthly rainfall, streamflow, and evapotranspiration data from 15 catchments in Crete, Greece are used to compare the proposed methodologies. Genetic Algorithms (GA) are applied for the stochastic calibration of the parameters in the Sacramento Soil Moisture Accounting (SAC-SMA) model yielding R2 values between 0.65 and 0.90. A Feedforward NN (FNN) is trained using a time delay approach, optimized through trial and error for each catchment, yielding R2 values between 0.70 and 0.91. The results obtained show that the ANN models can be superior to the conventional conceptual models due to their ability to handle the non-linearity and dynamic nature of the natural physical processes in a more efficient manner. On the other hand, SAC-SMA depicts high flows with greater accuracy and results suggest that conceptual models can be more robust in extrapolating beyond historical record limits.