Geophysical Research Abstracts
Vol. 14, EGU2012-12243-1, 2012
EGU General Assembly 2012


# Using large multi-basin models for hypothesis testing

G. Lindström, C. Donnelly, and B. Arheimer
SMHI, 60176 Norrköping, Sweden

Recently large areas have been modelled with high spatial resolution using process-based models. This has become possible thanks to internet access to readily available global databases, increased computational capacity, and stakeholder demand for high spatial resolution of water information. Such large, multi-basin models cover, for instance, the nation of Sweden (S-HYPE) with 450 000 km2 and the continent of Europe (E-HYPE) with about 10 8.5 million km2. The modelled domains cover a large number of monitoring sites, which can be used for evaluating model performance when introducing changes in the model concept. Each monitoring site can be therefore be considered to be one experiment at which hypotheses on parameterization and/or process descriptions can be tested simultaneously for a large range of independent catchments in a domain.
This presentation illustrates recent use of large multi-basin domains for testing of hypotheses, for instance, linkage of calibration parameters to soil/land-use characteristics in the landscape, dominant flow-paths, generalized lake rating curves, evapotranspiration algorithms, and biochemical process rates in various hydrological compartments for Sweden. Moreover, several hypotheses regarding evapotranspiration algorithms, water balance and meteorological precipitation re-analysis have been tested for Europe. Some of these hypotheses were tested both within the Swedish domain and the European domain, increasing the number of independent experiments for which each hypothesis was tested.
An advantage of having the comprehensive model set-ups available is that hypotheses can be tested in many different subsets of catchments. Catchments can be combined, without having to rely on heavily instrumented research sites, where a large number of variables are measured. The simple HYPE model file structure makes it easy to extract subsets, e.g. small basins with a particular characteristic or available data type.
For example, we wanted to test the hypothesis that including solar radiation in the evapotranspiration algorithm would improve our estimates. The new algorithm was first tested against available measurements of evapotranspiration, and then the updated model code was used and calibrated in both the S-HYPE and E-HYPE models. Evaluation was made towards discharge both for the old and new algorithms and each gauging station was then an experiment on the hypothesis. Some further examples of hypothesis testing using the S-HYPE include snow modelling, where the efficiency of different snow accumulation formulations was evaluated using observed snow depth from 30 observation sites. Another hypothesis was that the same model formulation could be used across many scales, and this was tested in simultaneous calibration of small and large catchments as the water courses link the landscape from small to large scales. Moreover, similarities and dissimilarities between catchments of different characteristics were studied by model calibration, with the hypothesis that different geology and land-use need to be reflected in different model parameters.

The presentation will focus on the concept and procedures for using large domain, multi-basin models for hypothesis testing rather than on the actual results from the tests, even though these also will be given.