Geophysical Research Abstracts
Vol. 12, EGU2010-14442, 2010
EGU General Assembly 2010

Improved national modelling by short-term measurement campaigns

Berit Arheimer, Göran Lindström, Johan Strömqvist, and Henrik Spångmyr
SMHI, Norrköping, SWEDEN

The Swedish Meteorological and Hydrological Institute (SMHI) produces hydrological predictions in Sweden both within the national early warning services and to the waterpower industry. SMHI is also responsible for delivering high-resolution data to water authorities. Most of the waterbodies of interest to the European Water Framework Directive (WFD) in Sweden do not have monitoring programmes. Thus, modelled data has to be used for expert judgments. Recently, SMHI got a new request from the government to support water authorities with relevant data to fulfill the reporting and assist implementation of environmental goals within the WFD. SMHI then started the internal "Water management programme" in cooperation with water authorities, to better harmonise and develop SMHI databases, monitoring, model systems and internet services for efficient data delivery free of charge.

Since the early 70's operational flood forecasts in Sweden has been based on the HBV model, but the environmental sector has other needs which has promoted a new model concept, called HYPE. The model is applied according to the Swedish water authorities classification of waterbodies (at present 17 313 limnic systems), and will be up-dated annually following water authorities requests. The model system delivers a large amount of hydrological, chemical, and physico-chemical variables. However, national monitoring programmes for calibration and validation is only available for 300 discharge stations and 900 grab sampling sites for nutrient concentrations.

The HYPE model is a semi-distributed processed-based hydrological model for small-scale and large-scale assessments of water resources and water quality. In the model, the landscape is divided into classes according to soil type, land-use and altitude. In agricultural lands, the soil is divided into three layers, each with individual computations of soil wetness and nutrient processes. The model simulates water flows, and flow and turnover of nitrogen and phosphorus. Nutrients follow the same pathways as water in the model: surface runoff, macropore flow, tile drainage and groundwater outflow from the individual soil layers. Rivers and lakes are described separately with routines for turnover of nutrients in each environment. Model parameters are global, or related to soil type or land-use. Internal model components are checked using corresponding observations from different sites. Calibration criteria may differ depending on which variables to be extracted from the model results, which must thus be considered in the model setup.

For the whole of Sweden, the volume error of water discharge is 6% (R2=0.8 when unregulated and R2=0.6 in presence of waterpower dams) and the concentrations are within a 25% error range. The presentation will show ongoing efforts to reduce uncertainties by assimilation of observed data from a few sites, though campaign measurements in key-sites and regional up-dating procedures for snow and discharge, and for specific lakes with effects on downstream rivers. New mobile monitoring techniques (totally 50 divers) have been introduced and only a few months of measurements was found to reduce the error by half in the test catchment. Moreover, sporadic observations of peak flow was also found useful, and finally, measurement campaigns of momental monitoring of spatial nutrient patterns was tried out with good results for model validation in another site. Several examples of quantified improvements by linking the national hydrological model to new observations will be given.