

Implementing the EU water framework directive in Sweden.

The European Water Framework Directive (WFD) was launched in December 2000 to achieve a more integrated management of water-related environmental objectives in the EU. The implementation of the WFD is a big challenge in many of the member states. The Swedish Meteorological and Hydrological Institute SMHI had recently developed the Hydrological Predictions for the Environment (HYPE) model when a request from the Swedish government came in 2008 to deliver high-resolution data of water and nutrients to support the WFD work. Information with a resolution defined by five newly established water authorities was required. Sweden is rich in surface water and the authorities requested data (e.g. river discharge) for 17 000 sites in 2009 and 35 000 sites in 2011. Only some 400 gauging stations for river runoff were available and even though mobile stations were introduced, methods for regionalisation had to be applied. Thus, a national hydrological model system, called S-HYPE, with high resolution was set-up, in which most of the predictions were done for ungauged basins. The HYPE model is a dynamic, semi-distributed and process-based model based on well-known hydrological and nutrient transport concepts. In the model, the landscape is divided into hydrological response units according to soil type, vegetation and altitude. The nation-wide calibration was made manually using the whole domain simultaneously (i.e. multi-basin approach), but for specific or groups of parameters represented by the gauging stations chosen for each part of the model (i.e. a step-wise approach). In particular, soil and land-use related parameters were established using data from lake-free basins. Soft information and knowledge of the dominant hydrological features in the region were applied rather than numerical estimates of model performance. Visual inspection of interaction of multiple variables was used to judge overall model credibility. At the outlets of the 27 largest, partly regulated, basins that drain to the sea the median NSE was 0.77. In basins less than 200 km², the NSE was still typically 0.67, but the errors were considerably larger in some small basins, which is a common phenomenon as both catchment area and the meteorological data may be less representative at the small scale. The results from the S-HYPE model are very appreciated by end-users in the WFD. Daily and monthly time-series can be downloaded for free from <http://vattenweb.smhi.se/>.