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Operational flood forecasting and warning services at the sub catchment scale over the whole of Sweden

Anna Kuentz, Elinor Andersson, and Sara-Sofia Asp
Swedish Meteorological and Hydrological Institute, Norrköping, Sweden (anna.kuentz@smhi.se)

The Swedish Meteorological and Hydrological Institute (SMHI) has the responsibility of producing forecasts and warnings regarding meteorological, hydrological and oceanographic risk events at the national scale. Forecasting and warning of flood events in particular, is vital to support local authorities in risk management and the information provided needs to be reliable and well-matched to user needs. This presentation describes the function, structure and challenges of the flood forecasting warning system at SMHI, which combines meteorological and hydrological expertise in a web based interface, used by experts to provide warnings and risks to local authorities.

At SMHI, operational meteorologists and hydrologists are working in close collaboration, which allows a better understanding of the meteorological forecasts and related uncertainties by those working on hydrological forecasts. The meteorological forecasts produced by SMHI are directly used as input for the hydrological models. These are complemented by deterministic and ensemble forecasts from ECMWF to produce a range of hydrological forecasts.

To allow forecasts to be produced over the whole country, a semi-distributed hydrological model (S-HYPE, Strömqvist et al., 2012) has been set up and regionally calibrated. S-HYPE is used to provide information on water quantity and quality for national applications, including flood forecasting. Sweden is divided into about 37000 sub catchments with an average area around 15 km2. The hydrological model is automatically run at a daily time-step by a system that reads and reformats meteorological forecasts, runs the hydrological models and post-processes outputs.

The hydrological forecasts are presented in a web-based interface, which the operational hydrologist on duty uses as a basis to issue warnings for floods. Forecasts are visualized both as maps showing absolute values, return periods and probabilities of warning; and as hydrographs for each sub catchment. Hydrological and meteorological observations are presented in the same interface. Hydrological warnings are given based on return periods of streamflow, and are issued manually and communicated through the SMHI website (www.smhi.se) and through media.

Current work on existing and new challenges includes decreasing the warning reaction time and improving the forecast quality of quick flooding events through a 1-hour-based hydrological model; issuing impact-based warnings for better matching between warnings and user needs; developing model and methods for operational low flow forecasting; and developing tools for improved forecast evaluation.

Reference:
Johan Strömqvist, Berit Arheimer, Joel Dahné, Chantal Donnelly & Göran Lindström (2012): Water and nutrient predictions in ungauged basins: set-up and evaluation of a model at the national scale, Hydrological Sciences Journal, 57:2, 229-247