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Evaluation of Flood Forecast and Warning in Elbe river basin – Impact of Forecaster's Strategy

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Czech Hydrometeorological Institute (CHMI) is responsible for flood forecasting and warning in the Czech Republic. To meet that issue CHMI operates hydrological forecasting systems and publish flow forecast in selected profiles. Flood forecast and warning is an output of system that links observation (flow and atmosphere), data processing, weather forecast (especially NWP's QPF), hydrological modeling and modeled outputs evaluation and interpretation by forecaster. Forecast users are interested in final output without separating uncertainties of separate steps of described process.
Therefore an evaluation of final operational forecasts was done for profiles within Elbe river basin produced by AquaLog forecasting system during period 2002 to 2008. Effects of uncertainties of observation, data processing and especially meteorological forecasts were not accounted separately.
Forecast of flood levels exceedance (peak over the threshold) during forecasting period was the main criterion as flow increase forecast is of the highest importance. Other evaluation criteria included peak flow and volume difference. In addition Nash-Sutcliffe was computed separately for each time step (1 to 48 h) of forecasting period to identify its change with the lead time.
Textual flood warnings are issued for administrative regions to initiate flood protection actions in danger of flood. Flood warning hit rate was evaluated at regions level and national level.
Evaluation found significant differences of model forecast skill between forecasting profiles, particularly less skill was evaluated at small headwater basins due to domination of QPF uncertainty in these basins. The average hit rate was 0.34 (miss rate = 0.33, false alarm rate = 0.32). However its explored spatial difference is likely to be influenced also by different fit of parameters sets (due to different basin characteristics) and importantly by different impact of human factor. Results suggest that the practice of interactive model operation, experience and forecasting strategy differs between responsible forecasting offices.
Warning is based on model outputs interpretation by hydrologists-forecaster. Warning hit rate reached 0.60 for threshold set to lowest flood stage of which 0.11 was underestimation of flood degree (miss 0.22, false alarm 0.28). Critical success index of model forecast was 0.34, while the same criteria for warning reached 0.55. We assume that the increase accounts not only to change of scale from single forecasting point to region for warning, but partly also to forecaster's added value.
There is no official warning strategy preferred in the Czech Republic (f.e. tolerance towards higher false alarm rate). Therefore forecaster decision and personal strategy is of great importance. Results show quite successful warning for 1st flood level exceedance, over-warning for 2nd flood level, but under-warning for 3rd (highest) flood level. That suggests general forecaster's preference of medium level warning (2nd flood level is legally determined to be the start of the flood and flood protection activities).
In conclusion human forecaster's experience and analysis skill increases flood warning performance notably. However society preference should be specifically addressed in the warning strategy definition to support forecaster's decision making.