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Real-time monitoring and short-term forecasting of drought in Norway

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Drought is considered to be one of the most costly natural disasters. Drought monitoring and forecasting are thus important for sound water management. In this study hydrological drought characteristics applicable for real-time monitoring and short-term forecasting of drought in Norway were developed. A spatially distributed hydrological model (HBV) implemented in a Web-based GIS framework provides a platform for drought analyses and visualizations. A number of national drought maps can be produced, which is a simple and effective way to communicate drought conditions to decision makers and the public. The HBV model is driven by precipitation and air temperature data. On a daily time step it calculates the water balance for 1 x 1 km2 grid cells characterized by their elevation and land use. Drought duration and areal drought coverage for runoff and subsurface storage (sum of soil moisture and groundwater) were derived. The threshold level method was used to specify drought conditions on a grid cell basis. The daily 10th percentile thresholds were derived from seven-day windows centered on that calendar day from the reference period 1981-2010 (threshold not exceeded 10% of the time). Each individual grid cell was examined to determine if it was below its respective threshold level. Daily drought-stricken areas can then be easily identified when visualized on a map. The drought duration can also be tracked and calculated by a retrospective analysis. Real-time observations from synoptic stations interpolated to a regular grid of 1 km resolution constituted the forcing data for the current situation. 9-day meteorological forecasts were used as input to the HBV model to obtain short-term hydrological drought forecasts. Downscaled precipitation and temperature fields from two different atmospheric models were applied. The first two days of the forecast period adopted the forecasts from Unified Model (UM4) while the following seven days were based on the 9-day forecasts from ECMWF. The approach has been tested and is now available on the Web for operational water management.