Using ensembles in water management: forecasting dry and wet episodes

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Extreme weather situations as droughts and extensive precipitation are becoming more frequent, which makes it more important to obtain accurate weather forecasts for the short and long term. Ensembles can provide a solution in terms of scenario forecasts.

MeteoGroup uses ensembles in a new forecasting technique which presents a number of weather scenarios for a dynamical water management project, called Water-Rijk, in which water storage and water retention plays a large role. The Water-Rijk is part of Park Lingezegen, which is located between Arnhem and Nijmegen in the Netherlands. In collaboration with the University of Wageningen, Alterra and Eijkelkamp a forecasting system is developed for this area which can provide water boards with a number of weather and hydrology scenarios in order to assist in the decision whether or not water retention or water storage is necessary in the near future.

In order to make a forecast for drought and extensive precipitation, the difference 'precipitation- evaporation' is used as a measurement of drought in the weather forecasts. In case of an upcoming drought this difference will take larger negative values. In case of a wet episode, this difference will be positive. The Makkink potential evaporation is used which gives the most accurate potential evaporation values during the summer, when evaporation plays an important role in the availability of surface water. Scenarios are determined by reducing the large number of forecasts in the ensemble to a number of averaged members with each its own likelihood of occurrence. For the Water-Rijk project 5 scenario forecasts are calculated: extreme dry, dry, normal, wet and extreme wet. These scenarios are constructed for two forecasting periods, each using its own ensemble technique: up to 48 hours ahead and up to 15 days ahead. The 48-hour forecast uses an ensemble constructed from forecasts of multiple high-resolution regional models: UKMO's Euro4 model,the ECMWF model, WRF and Hirlam. Using multiple model runs and additional post processing, an ensemble can be created from non-ensemble models. The 15-day forecast uses the ECMWF Ensemble Prediction System forecast from which scenarios can be deduced directly. A combination of the ensembles from the two forecasting periods is used in order to have the highest possible resolution of the forecast for the first 48 hours followed by the lower resolution long term forecast.