Value of ecmwf ensemble rainfall forecasts for forecasting catchment spatially distributed soil moisture

J.M. Schuurmans[1], and M.F.P. Bierkens[1,2]

1. Department of Physical Geography, Faculty of Geosciences, Utrecht University, P.O. Box 80115, 3508 TC, Utrecht, The Netherlands
2. TNO Built Environment and Geosciences, P.O. Box 80015, 3508 TA Utrecht, The Netherlands

Abstract Accurate short to medium range forecast (up to 10 days) of soil moisture content is of practical importance for a variety of fields. It allows farmers have to decide when to start irrigation; waterboards to start water inlet and it helps meteorologists to forecast fog. We studied the value of rainfall forecasts of the European Center for Medium range Weather Forecasting (ECMWF) ensemble prediction system (EPS) for forecasting the spatially distributed soil moisture in a catchment (300 km^2) in The Netherlands. Promising results of using the EPS in a hydrological model for streamflow prediction are already available (Roulin, 2007)

The ECMWF uses a numerical weather prediction (NWP) model, of which the initial conditions and model physics are perturbed. This results in an ensemble of 50 different model realisations, all of these realisations being equally probable. The spread of the ensembles indicates the uncertainty about the future rainfall amounts (Molteni et al., 1996). We use archived precipitation forecasts of 3 years, starting in 2004. This period includes a resolution change of the NWP from ~80 km to ~50 km (1 February 2006). First we perform a validation of the forecast skill of the EPS 24h accumulated rainfall forecasts using upscaled raingauge measurements and meteorological radar. We evaluate the forecasts and implement a simple bias filter.

Within the catchment we have a high-density raingauge network as well as 5 measurement locations where we measure the soil moisture content at various depths. The improved 24h rainfall forecasts are compared to the rainfall within the catchment and are used as input data for our distributed hydrological model. The forecasted soil moisture content is compared to the model run that uses the catchment rainfall as input and the use of the Kalman filter is evaluated. The forecast skill is presented as function of lead time.

References

Molteni, F., R. Buizza, T.N. Palmer and T. Petrogliatis, 1996: The ECMWF Ensemble Prediction System: methodology and validation, Q.J.R. Meteorol. Soc., **122**, 73-119

Roulin, E., 2007. Skill and relative economic value of medium-range hydrological ensemble predictions, HESS, **11**, 725-737