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Global operational hydrological forecasts through eWaterCycle

Nick van de Giesen (1), Marc Bierkens (2,3), Gennadii Donchyts (3,1), Niels Drost (4), Rolf Hut (1), and Edwin Sutanudjaja (2)

(1) Delft University of Technology, Netherlands, (2) Utrecht University, Netherlands, (3) Deltares, Netherlands, (4) Netherlands eScienceCenter, Netherlands

Central goal of the eWaterCycle project (www.ewatercycle.org) is the development of an operational hyper-resolution hydrological global model. This model is able to produce 14 day ensemble forecasts based on a hydrological model and operational weather data (presently NOAA's Global Ensemble Forecast System). Special attention is paid to prediction of situations in which water related issues are relevant, such as floods, droughts, navigation, hydropower generation, and irrigation stress. Near-real time satellite data will be assimilated in the hydrological simulations, which is a feature that will be presented for the first time at EGU 2015.

First, we address challenges that are mainly computer science oriented but have direct practical hydrological implications. An important feature in this is the use of existing standards and open-source software to the maximum extent possible. For example, we use the Community Surface Dynamics Modeling System (CSDMS) approach to coupling models (Basic Model Interface (BMI)). The hydrological model underlying the project is PCR-GLOBWB, built by Utrecht University. This is the motor behind the predictions and state estimations. Parts of PCR-GLOBWB have been re-engineered to facilitate running it in a High Performance Computing (HPC) environment, run parallel on multiple nodes, as well as to use BMI.

Hydrological models are not very CPU intensive compared to, say, atmospheric models. They are, however, memory hungry due to the localized processes and associated effective parameters. To accommodate this memory need, especially in an ensemble setting, a variation on the traditional Ensemble Kalman Filter was developed that needs much less on-chip memory.

Due to the operational nature, the coupling of the hydrological model with hydraulic models is very important. The idea is not to run detailed hydraulic routing schemes over the complete globe but to have on-demand simulation prepared off-line with respect to topography and parameterizations. This allows for very detailed simulations at hectare to meter scales, where and when this is needed.

At EGU 2015, the operational global eWaterCycle model will be presented for the first time, including forecasts at high resolution, the innovative data assimilation approach, and on-demand coupling with hydraulic models.