



## **eWaterCycle: A high resolution global hydrological model**

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In 2013, the eWaterCycle project was started, which has the ambitious goal to run a high resolution global hydrological model. Starting point was the PCR-GLOBWB built by Utrecht University. The software behind this model will partially be re-engineered in order to enable to run it in a High Performance Computing (HPC) environment. The aim is to have a spatial resolution of 1km x 1km. The idea is also to run the model in real-time and forecasting mode, using data assimilation. An on-demand hydraulic model will be available for detailed flow and flood forecasting in support of navigation and disaster management.

The project faces a set of scientific challenges. First, to enable the model to run in a HPC environment, model runs were analyzed to examine on which parts of the program most CPU time was spent. These parts were re-coded in Open MPI to allow for parallel processing. Different parallelization strategies are thinkable. In our case, it was decided to use watershed logic as a first step to distribute the analysis.

There is rather limited recent experience with HPC in hydrology and there is much to be learned and adjusted, both on the hydrological modeling side and the computer science side. For example, an interesting early observation was that hydrological models are, due to their localized parameterization, much more memory intensive than models of sister-disciplines such as meteorology and oceanography. Because it would be deadly to have to swap information between CPU and hard drive, memory management becomes crucial. A standard Ensemble Kalman Filter (enKF) would, for example, have excessive memory demands. To circumvent these problems, an alternative to the enKF was developed that produces equivalent results.

This presentation shows the most recent results from the model, including a 5km x 5km simulation and a proof of concept for the new data assimilation approach. Finally, some early ideas about financial sustainability of an operational global hydrological model are presented.