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eWaterCycle: Developing a hyper resolution global hydrological model

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The development of a high resolution global hydrological model has recently been put forward as Grand Challenge for the hydrological community (Wood et al., 2011). The current version of the global hydrological model PCR-GLOBWB (van Beek et al., 2011) runs at a relatively coarse spatial grid (i.e. 0.1° or about 10 km at the equator), which is well above the hyper resolution envisioned in the Grand Challenge (i.e. 100 m).

The eWaterCycle project aims at developing a high resolution global hydrological model allowing for a better representation of the effects of spatial heterogeneity in topography, soil, and vegetation on hydrological dynamics. Here we modify PCR-GLOBWB so that it runs at much higher resolution, on the order of 1 km or finer, that will be relevant for addressing critical water cycle science questions and many hydrological applications such as assessing water resources sustainability, flood and drought frequency under climate change.

The development of such a hyper resolution model requires utilizing recent computational advances and massive parallel computer systems. So far, the hydrological community has not yet made full use of such possibilities. The eWaterCycle is a close cooperation between hydrologists (Delft University of Technology and Utrecht University) and the Netherlands eScience Center (NleSC) – that intends to supports and reinforce data-intensive research through creative and innovative use of information and communication technology (ICT).

The hyper resolution model built in this project will contribute to the current scientific state-of-the-art by combining hydrological knowledge with ICT challenges. The refinement of the current model would be a huge step forward, because increasing resolution also requires adding an explicit spatial representation of local processes (groundwater flow, water diversions, glaciers, etc.) that will greatly enhance the regional to local applicability of global models. We also argue that the result envisions a qualitative jump in the quality of existing hydrological models. The scientific community will benefit in the field of hydrology, as well as in the fields of ICT and mathematics. As the results will be shared, the novel hydrological model will be available for other researchers and other organizations in order to elaborate further and to enrich and extend the model.