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Assimilating data from remote sensing into a high-resolution global hydrological model

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This study is focused on the challenges of assimilating current and planned remote sensing data into the modified PCR-GLOB-WB model to yield optimal results. The development of a high-resolution (1 km or finer) global hydrological model has been put forward as 'Grand Challenge' for the hydrological community. Extensive assimilation of remote sensing data is a promising route to constrain and ensure the accuracy of such a hydrological model, but it poses a great challenge in many aspects.

Over the last 30 years, advances in remote sensing techniques have triggered the exponential growth of hydrologically useful data from remote sensing. Aside from the ICT challenge of streaming and handing the sheer volume of data, and selecting an appropriate assimilation algorithm, the fundamental questions of which datasets contain the most useful information and how to use them must be addressed.

The first task is to divide the candidate datasets into those that will be assimilated and those that will be used to parameterize or force the model. As the time step is reduced from daily to ∼hourly, remote sensing data may play a crucial role in providing a more dynamic description of the land surface, or in downscaling the forcing data. Here, we will present a outline of the key processes in the PCR-GLOB-WB and a summary of which states and fluxes will benefit most from assimilation, and which model parameters can be modified to incorporate real-time information from remote sensing. Finally, we need to consider the gap in spatial scales. The PCR-GLOB-WB model is now running at 10 km resolution and will be modified to run at 1 km scale, while the spatial resolution of many remote sensing products is considerably coarser. We will present an overview of the downscaling approaches under consideration for key state variables.

The eWaterCycle project is a collaboration between Delft University of Technology, Utrecht University and the Netherlands eScience Center. The final aim is to establish a high-resolution global hydrological model at near-realtime to better represent the effects of spatial heterogeneity in topography, vegetation and soil moisture on hydrological processes around the globe. Together we will explore existing and novel methodologies in data assimilation to yield better results as well as ICT technologies to address the computational requirements.