eWaterCycle: Developing a hyper resolution global hydrological model

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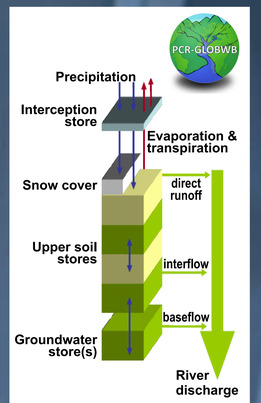
Model structure:

The global hydrological model used and refined is **PCR-GLOBWB** developed at the Department of Physical Geography, Utrecht University (van Beek et al., 2011). It is a leaky bucket type of model and gives a **cell-based** representation of the terrestrial hydrological cycle.

For each grid, it computes soil moisture storage in vertically stacked layers as well as **vertical water exchange** fluxes between the soil and the atmosphere (precipitation, snow-melt, evaporation & transpiration) and fluxes between the soil and the underlying groundwater reservoir (percolation & capillary rise).



Model concept of PCR-GLOBWB. *Left: layers describing soil hydrology including the canopy, snow cover, soil layers and groundwater reservoir, as well as the exchange between them. Right: the total local gains from all cells are routed along the drainage direction to yield channel discharge*

Runoff components consist of saturation-excess overland flow, interflow along hillslope and baseflow from groundwater reservoir. **River discharge** is calculated by accumulating and routing specific runoff along the drainage network.

Model refinement:

The refinement of the model grid would be a huge step forward because **increasing resolution requires adding an explicit representation of local processes** (e.g. lateral groundwater flow (Sutanudjaja et al., 2011), water use (Wada et al., 2011), glacier (Immerzeel et al., 2012), etc.) that will greatly enhance the regional to local applicability of global models.

Data-intensive modeling of the global water cycle:

Bringing the 4th paradigm to hydrology

The development of a hyper resolution global hydrological model has recently been put forward as **Grand Challenge** for the hydrological community (Wood et al., 2011). The eWaterCycle aims at developing **a very high resolution** global hydrological model, **on the order of 1 km or finer**, that will be relevant for addressing critical water cycle question.

Applications:

We expect that from 2015 onwards, the hyper resolution global hydrological model will help to fight **floods**, mitigate **droughts**, support water management decisions on **navigation**, **hydro-power**, **irrigation** and **nature conservation** around the world. The following link (QR code) provides a movie showing some possibilities of the eWaterCycle's project.

For more information please visit: **http://ewatercycle.org/**

Moreover, the outcome of the project envisions a qualitative jump in the quality of existing hydrological models. It will benefit the scientific community in the hydrology field, as well as in the ICT and mathematics fields. As the results will be shared, the novel hydrological model will be available for other partners in order to elaborate further and to enrich the model.

The **eWaterCycle** is a close cooperation between **hydrologists** at the Department of Physical Geography, Utrecht University[1] and the Department of Water Management, Delft University of Technology[2] and the Netherlands eScience Center[3] - that intends to support and reinforce data-intensive research through creative and innovative use of **information and communication technology (ICT)**.

Integrated model with data assimilation:

Even more challenging than the refinement of the grid will be the **assimilation of massive amounts of satellite data**. The ultimate goal of this project is to run the hyper resolution model operationally with a special data assimilation (DA) scheme that incorporates satellite soil moisture observations and other relevant variables. Updating global hydrological model with Earth observations will be a major computational challenge that demands close cooperation between the fields of hydrology and ICT.

References:

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