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A high resolution (1 km) groundwater model for Indonesia

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Groundwater is important in many parts of Indonesia. It serves as a primary source of drinking water and industrial activities. During times of drought, it sustains water flows in streams, rivers, lakes and wetlands, and thus support ecosystem habitat and biodiversity as well as preventing hazardous forest fire. Besides its importance, groundwater is known as a vulnerable resource as unsustainable groundwater exploitation and management occurs in many areas of the country. Therefore, in order to ensure sustainable management of groundwater resources, monitoring and predicting groundwater changes in Indonesia are imperative. However, large extent groundwater models to assess these changes on a regional scale are almost non-existent and are hampered by the strong topographical and lithological transitions that characterize Indonesia.

In this study, we built an 1 km resolution groundwater model for the entire Indonesian archipelago (total inland area: about 2 million km2). We adopted the approaches of Sutanudjaja et al. (2011, 2014a) and de Graaf et al. (2014) in order to make a MODFLOW (Harbaugh et al., 2000) groundwater model by using only global datasets. Aquifer schematization and properties of the groundwater model were developed from available global lithological maps (e.g. Dürr et al., 2005; Gleeson et al., 2011; Hartmann & Moorsdorf, 2012; Gleeson et al., 2014). We forced the groundwater model with the recent output of global hydrological model PCR-GLOBWB version 2.0 (Sutanudjaja et al., 2014b; van Beek et al., 2011), specifically the long term average of groundwater recharge and average surface water levels derived from channel discharge. Simulation results were promising. The MODFLOW model converged with realistic aquifer properties (i.e. transmissivities) and produced reasonable groundwater head spatial distribution reflecting the positions of major groundwater bodies and surface water bodies in the country.

In Vienna, we aim to show and demonstrate these results. Also we discuss fundamental challenges in high resolution groundwater modeling and address various issues that range from computational challenges – e.g. computational time, memory, and parallelization issues – to lack of sufficient detail/fine information for model validation and parameterization – including atmospheric forcing and emergent scaling problems.

References:

de Graaf et al., Hydrology & Earth System Sciences (2014), http://dx.doi.org/10.5194/hessd-11-5217-2014

Dürr et al., Global Biogeochemical Cycles (2005), http://dx.doi.org/10.1029/2005GB002515

Gleeson et al., Geophysical Research Letter (2011), http://dx.doi.org/10.1029/2010GL045565

Gleeson et al., Geophysical Research Letter (2014), http://dx.doi.org/10.1002/2014GL059856

Harbaugh et al., MODFLOW-2000 (2000), http://water.usgs.gov/nrp/gwsoftware/modflow2000/ofr00-92.pdf

Hartmann & Moosdorf, Geochemistry Geophysics Geosystems (2012), http://dx.doi.org/10.1029/2012GC004370

Sutanudjaja et al., Hydrology & Earth System Sciences (2011), http://dx.doi.org/10.5194/hess-15-2913-2011

Sutanudjaja et al., Water Resources Research (2014a), http://dx.doi.org/10.1002/2013WR013807

Sutanudjaja et al., AGU Fall Meeting (2014b), see: http://globalhydrology.nl/models/pcr-globwb-2-0/

van Beek et al., Water Resources Research (2011), http://dx.doi.org/10.1029/2010WR009791