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Hydrology and Earth System Sciences
Discussions

Interactive comment on "A high resolution global scale groundwater model" *by* I. E. M. de Graaf et al.

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The work presented here involves a global simulation of steady-state groundwater movement that employs the popular groundwater model MODFLOW, which is usually used in basin-scale and regional studies. Global datasets of lithology and permeability are combined with some assumptions and calibration to observed groundwater levels. While this work is interesting and valuable in that it moves in the direction of expanding the capabilities of groundwater models and integrating them with land surface models over large domains, there are some changes that could be made to render it of wider applicability.

The authors should mention new work by Krakauer et al. (ERL 9:034003 2014) on the

relationship between model spatial resolution and lateral flow volume and by Gleeson et al. (GRL, in press) on higher-resolution global permeability and porosity maps.

The water level observation database needs a citation (probably Fan et al. 2013), not just a URL.

It will be very difficult for anyone else to reproduce the global configuration of MODFLOW developed, particularly given the reliance on stochastic methods for parameter estimation. Therefore, I strongly recommend that the authors post their MODFLOW input files and control scripts under an open-source license in a suitable repository such as GLOWASIS, so that they can be evaluated and improved on by the hydrology community.

Figure 3: It is not clear what "cumulative probability" means.

Figure 5: Most of the land area has a beige tone in all 4 panels. What does this indicate?

Figure 6: What is the criterion for considering a water table to be "local and perched"?

Figure 7: I am not sure if displaying "relative residuals" makes sense here. Would this quantity be infinite when the observed water level is zero?

Figure 8: The long groundwater flow paths, for example around the Gulf of Bothnia and Gulf of Finland, are remarkable. I am not very familiar with these areas, but maps such as http://www.ymparisto.fi/en-US/Waters_and_sea/Hydrological_situation_and_forecasts/Hydrological_forecasts_and_maps/Hydrological_forecasts_and_maps(26174) for Finland show them to be fairly well drained. Is the simulation resolving the river network in such regions as a groundwater sink?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 5217, 2014.