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Hydrology and Earth System Sciences Discussions

Interactive comment on "Impacts of soil-aquifer heat and water fluxes on simulated global climate" *by* N. Y. Krakauer et al.

M. Bierkens

bierkens@geo.uu.nl

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Review of Impacts of soil-aquifer heat and water fluxes on simulated global climate

This is a well-written paper in which a GCM experiment is described by which a normal run is compared with runs where the land surface is extended with a simple 1D aquifer model allowing both water and heat exchange between the soil compartments and the underlying groundwater system.

It is not the first of its kind, but a number of these groundwater and global climate experiments are necessary to understand the true importance of including groundwater in land models.

The results show that effects on global average climate are negligible, but there can be

significant regional or zonal effects, particularly on the soil thermal regime and thus the modelling of e.g. permafrost.

As said, the paper is extremely well written and concise (which I like) and the conclusions straight forward. I have only a number of small issues:

Page 1189, line 12: here it is said that bedrock tractions were changes? For what reason? Explain in the text.

Page 1191: I am a bit confused about equation (3) (and (4). Why would one take the gradient over the fixed value dz_n and not over z_n - z_delta. This way, if the groundwater level is very deep, the percolation flux becomes very large, larger than K_N, which is not logical. I expect it to become equal to K_N for very deep water tables and h_n not too negative. Please explain.

Page 1191, line 16: please explain how flows where restricted to avoid numerical instabilities.

Page 1192: line 3: why 1850 conditions? Why not fix the CO2 on average 1980-2010 for instance?

Page 1192: line 19-20: provide more details on how this interpolation is done.

Page 1195, line 22-25. When discussing the heat flux: I wonder how important how important geothermal heat flux is, especially in Nordic areas with a permafrost cover. In other words, should instead of a zero flux lower boundary a fixed non-zero flux or fixed temperature at the lower aquifer boundary be more appropriate?

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