Global Scale Groundwater Flow Model

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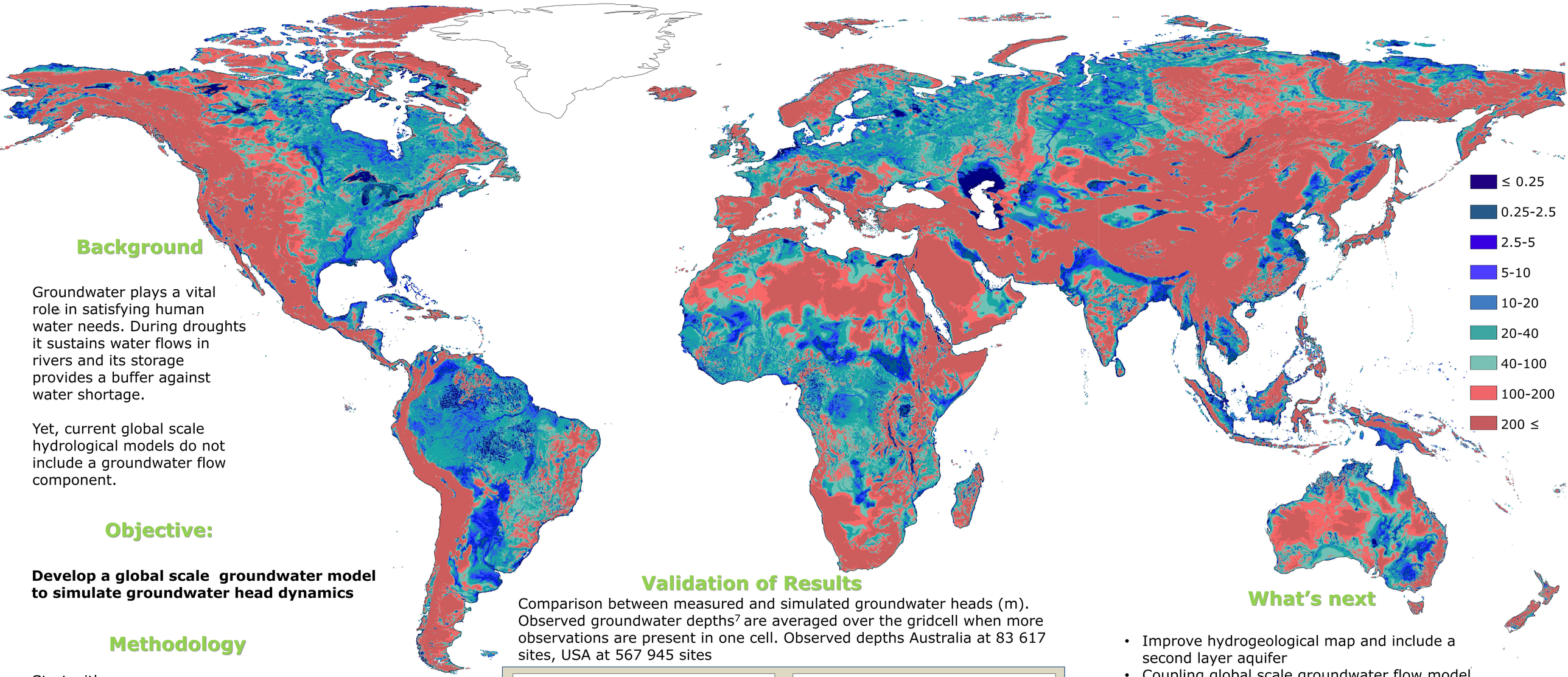
SIMULATED WATER TABLE DEPTH (m below land surface)



Background

Groundwater plays a vital role in satisfying human water needs. During droughts it sustains water flows in rivers and its storage provides a buffer against water shortage.

Yet, current global scale hydrological models do not include a groundwater flow component.

Objective:

Develop a global scale groundwater model to simulate groundwater head dynamics

Methodology

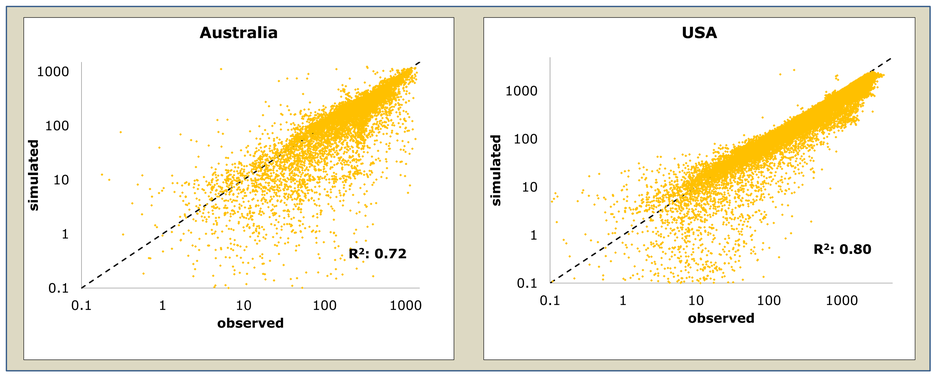
Start with:

- Steady-state MODFLOW[1], 6-arc-minutes (10 km at the equator)
- Land elevation based on HydroSHEDS [2] and Hydro1k[3] data-sets
- 1 layer aquifer schematization based on existing lithology map[4] and corresponding aquifer properties[5]
- Forced with recharge and river discharge from global scale hydrological model[6]

A simplified lithology map is used for the presented water table depths

Validation of Results

Comparison between measured and simulated groundwater heads (m). Observed groundwater depths[7] are averaged over the gridcell when more observations are present in one cell. Observed depths Australia at 83 617 sites, USA at 567 945 sites



What's next

- Improve hydrogeological map and include a second layer aquifer
- Coupling global scale groundwater flow model with hydrological model
- Include water abstractions for 1960-2010
- Analysis of effects of water abstractions on groundwater levels and river discharges

References

1) McDonald, M. and A. Harbaugh (1988), A modular three-dimentional finite-difference ground-water flow model: Techniques of Water-Resources Investigations of the United States Geological Survey, Book 6.
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3) Hydro1k *lta.cr.usgs.gov/HYDRO1K*
4) Hartmann, J. and N. Moorsdorf (2012), The new global lithological map database GLim: A representation of rock properties at the Earth surface, Geochemistry, Geophysics, Geosystems 13, 12
5) Gleeson, T. *et al.* (2011), Mapping permeability over the surface of the earth, Geophys. Res. Lett 38.
6) Van Beek, L. P. H. *et al.* (2011) Global monthly water stress:1 Water balance and water availability, Water Resource Research 47
7) Glowasis *Glowasis.eu*