Saltwater intrusion in delta regions around the globe

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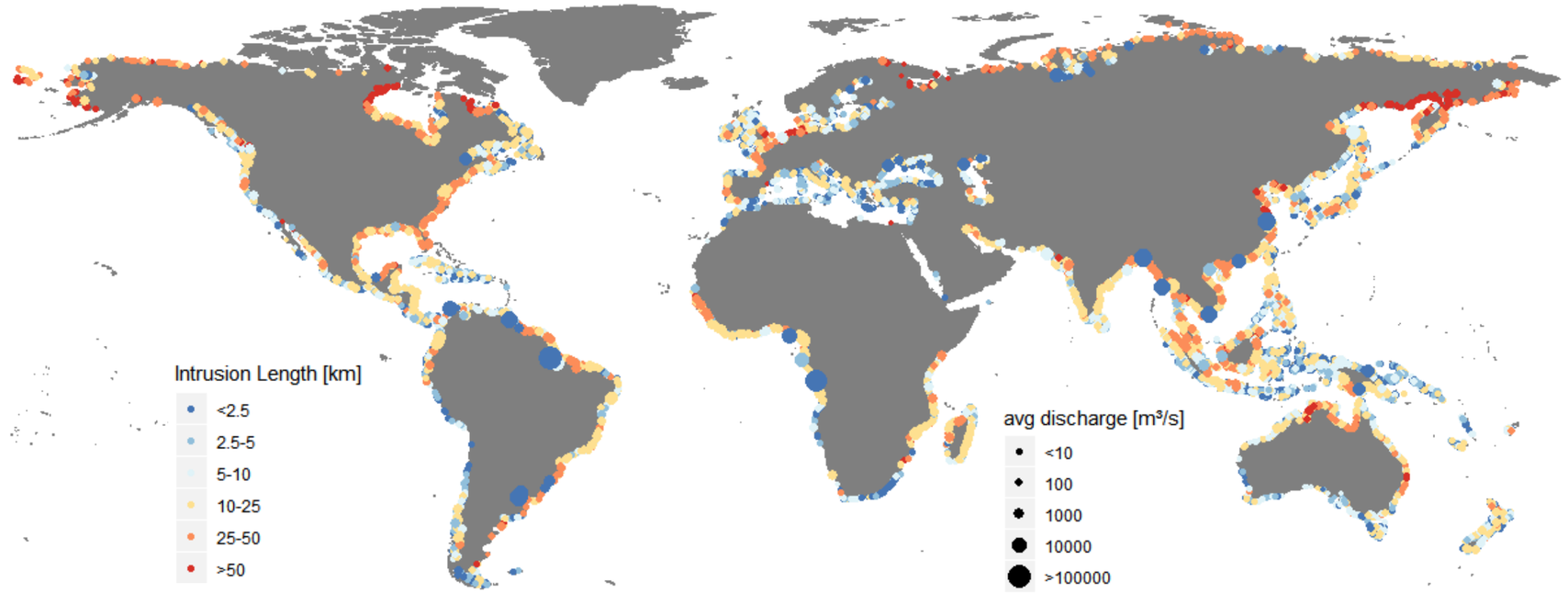
Introduction

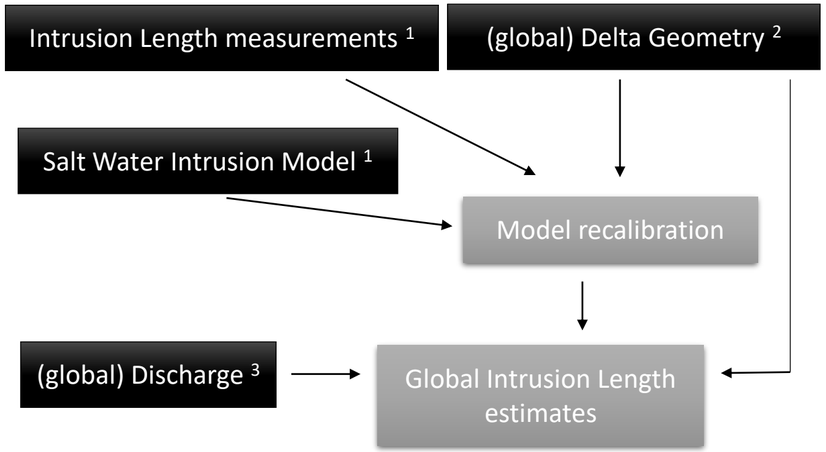
Saltwater intrusion into estuaries is a natural phenomenon which is likely to be influenced by global change and impacts freshwater availability for irrigation and human consumption. The intrusion length is dependent on the river discharge, sea level fluctuation and deltaic shape. In this study we provide a first estimate on the salt water intrusion length around the globe.



(map is based on calibration "a")

Methodology

An existing and empirically calibrated salt water intrusion model[1] is used with global delta shape[2] and discharge[3] datasets. The model requires re-calibration due to different definitions of delta geometry from the original methodology and geometries available via the global dataset.

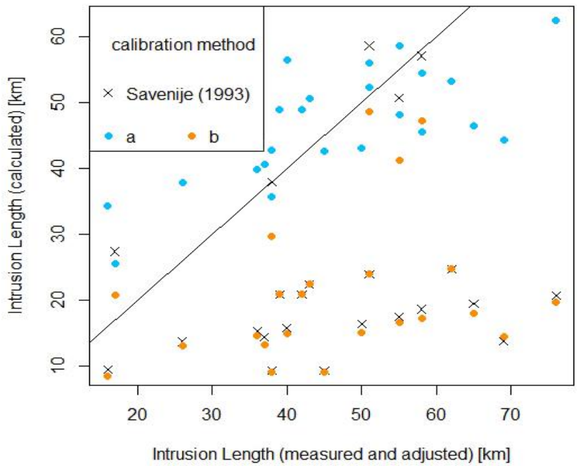


Future steps will include the implementation of projected changes in discharge regimes and sea levels to assess the effect of global change on the saltwater intrusion length.

Results (calibration)

Calibration is done in two ways:
a) simultaneously with all parameters
b) stepwise against "diffusion" and "Van der Burgh's K" (~ delta geometry)

→ "brute-force" calibration (a) gives better calibration results, **but relies less on delta geometry and more on river discharge**



Conclusions / Outlook

- First order estimate of global saltwater intrusion modelling shows hotspots of saltwater intrusion
- Improvements can be made when more input data becomes available and observations for independent validation increase
- Current estimates are made with a simplified model, that allows for rapid changes, without the need of global hydrodynamic modelling

References:

1) Savenije, H. Predictive model for salt intrusion in estuaries. *Journal of Hydrology* 148, 203-218
2) Nienhuis, J. et al. Global-scale human impact on delta morphology has led to net land area gain. *Nature* 577, 514-518 (2020).
3) Sutanudjaja, E. et al. PCR-GLOBWB 2: a 5 arcmin global hydrological and water resources model. *Geoscientific Model Development* 11, 2429-2453 (2018).