EGU23-4573, updated on 27 Apr 2024
https://doi.org/10.5194/egusphere-egu23-4573
EGU General Assembly 2023

How long can offshore fresh groundwater support onshore abstractions?

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Where onshore and offshore groundwater systems are connected, onshore abstraction may access offshore fresh groundwater (Knight et al., 2018; Post et al., 2013). This draws seawater into the offshore system and may eventually lead to onshore salinization and changes to submarine groundwater discharge. The rate of salinization with respect to changes in onshore conditions is understudied. We analysed the salinization of a range of idealized coastal groundwater systems using numerical models, aiming to identify salinization regimes, characteristic timescales, and tipping points. Our cross-sectional semiconfined aquifer models were simulated using FloPy and SEAWAT. We simulated transient conditions leading to the emplacement of offshore fresh groundwater and post-development salinization. We systematically varied geometric properties like aquifer and aquitard thicknesses and slope, and hydraulic properties like hydraulic conductivities, dispersivity, and anisotropy. Our results show the influence of these properties on salinization rates, under a range of levels of onshore abstraction, and interactions between properties. This provides insight into offshore groundwater systems most at risk of salinization and guidance for parameter analysis during modelling studies.

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