Field and numerical study of solute transport under evaporation in a subtropical tidal wetland

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Tidal wetlands are critical intertidal ecosystem which accommodates a large range of flora and fauna species. The intertidal subsurface environment is subjected to continuous groundwater-seawater mixing which results in dynamic solute transport in the aquifer and to the ocean. Salt distribution and transport play a vital role in the wetland ecology and near-shore biogeochemical activities. While many field and simulation studies have been presented to characterize the salt distribution in the intertidal beach aquifer under the influence of tidal inundation, salt distribution in the tidal wetland subsurface system yet requires more investigation. Moreover, the impact of evaporation on porewater salt distribution could be essential in subtropical areas with numerous coastal wetlands as evaporation extracts porewater from the soil surface and leaves salt in the surface and wetland root zone. However, this parameter was commonly ignored by previous studies.

In this study, field monitoring was carried out to map the groundwater level and spatial salt distribution in a subtropical wetland located in Southeastern Queensland, Australia. Two dimensional, variable-density, saturated-unsaturated groundwater flow and solute transport model was used to examine the pore water flow and salt distribution patterns in a cross-shore section of the field site under the influences of the spring-neap tide and evaporation. Field and simulation results consistently showed that salinity is greatly impacted by evaporation and showed different distributions from the saline seawater intrusion patterns displayed by most of the former studies.