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Characterization of near-shore fresh water and seawater interactions-the scale issues drawn from the experimental and numerical approaches

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Understanding the dynamics of water and mass interactions in the coastal area is essential to quantify the influences of near-shore land use on the coastal aquifers and water environment. The study aims to integrate innovative experiments and modeling techniques to assess the heat and water exchanges in the coastal aquifer of the Taoyuan Tableland in northwestern Taiwan. The site-specific hydraulic and heat tracer tests are conducted to obtain flow and heat transfer properties for the specific aquifer layers at the site. We then used the SEAWAT numerical model to quantify the freshwater and seawater interactions. The model calibration relies on the groundwater levels and quality obtained from monitoring wells installed perpendicular to the shoreline. The experimental results show that the active heat tracer tests could significantly improve the identification of aquifer layers along a well and allow for the estimations of high-resolution natural groundwater flux toward the sea. The estimated flow rate based on the heat tracer test is approximately 0.2 m/day per unit depth. The numerical model shows good agreement with the observed water levels in wells. In the study area, the location of the seawater/groundwater mixing interface is estimated at approximately 350m seaward from the shoreline, which suggests the submarine groundwater discharge zone for the site. The vertical profile model shows that the flow rate for the 100m depth aquifer varies from 51 to 60 m3/day per unit width, depending on the tidal variations and upstream groundwater levels. The results show a large flow rate discrepancy between experimental and numerical approaches, which the resolution scales of the approaches might induce in the calculations. The water levels obtained from the fully opened screen wells might mix the flow responses in different aquifer layers.