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Combining Airbone geophysics and hydrogeologic modeling to determine the hydrologic boundary condition below the sea.

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Groundwater models in coastal aquifers are often used to predict the effect of hydrological changes (climate change, sea level rise, and etcetera) on groundwater heads and seawater intrusion. The results can be very sensitive to the boundary condition that is used for the coastal edge of the model, even when the main interest is in groundwater heads only. This is especially the case when models are calibrated, because groundwater heads from monitoring wells are often the only calibration data available. The lack of offshore data is a complicating factor that consequently decreases the reliability of the entire model.
Using Airborne electromagnetic geophysics (e.g., SkyTEM) we can determine the extent of the fresh groundwater wedge below the sea. However, the low resistive seawater and subsequent geo-electrical equivalence makes it difficult to determine the thickness and resistivity of the resistive zone. Furthermore, it can be impossible to separate lithology and water-quality based on the resistivity model only, for example in concurrent presence of clays and saline aquifers.
In this study we combined the resistivity model and the hydrological model in a number of cross sections perpendicular to the coast. We use data from the SKYTEM survey that was done in 2011 along the coast at the dune area of PWN water supply. Additionally we have continuous vertical electrical sounding (CVES) profiles and electrical cone penetration (CPT) tests on the beach. We will show the benefits of combining both hydrogeological modeling and airborne geophysical measurements to determine a good boundary condition and the matching lithology and water quality. We will also determine the effect of commonly used boundary conditions that were derived without the geophysical information. Comparing these results we demonstrate the benefit of the combination and give practical recommendations for future applications.