Abstract #492984

Combining near-surface electromagnetic methods to characterize the hydrogeology of braided alluvial deposits: Canterbury Coast, New Zealand

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Abstract Text:

Groundwater resources in coastal regions are facing enormous stress caused by population growth and climate change. Few studies have investigated whether offshore aquifers (OAs) are active; entailing a modern, permeable connection with a terrestrial aquifer recharged by meteoric water, or fossil; paleo-groundwater systems that are no longer associated with a terrestrial aquifer. Distinguishing between the two has important implications for potential extraction to alleviate water stress for many coastal communities, yet very little is known about these connections mainly because it is difficult to acquire continuous subsurface information across the coastal zone. This study presents a first attempt to bridge this gap by combining three complementary near-surface electromagnetic methods to image groundwater pathways within braided alluvial gravels along the Canterbury coast, South Island, New Zealand. We show that co-located electromagnetic induction, ground penetrating radar, and transient electromagnetic measurements, which are sensitive to detecting electrical contrasts between fresh (high resistivity) and saline (low resistivity) groundwater, adequately characterize hydrogeologic variations beneath a mixed sand gravel beach close to the Ashburton River mouth. The combined measurements - providing information at three different depths of investigation and resolution - show several zones of high electrical resistivity that are related to variations in subsurface hydrogeology. We interpret the high resistivity zones as high permeability conduits that are lenses of well-sorted gravels and likely secondary channel fill deposits within the braided river deposit architecture. The geophysical surveys provide the basis for a discharge model that fits our observations, namely that there is evidence of a multilayered system focusing groundwater flow through stacked high-permeability gravel layers. Coincident geophysical surveys in a region further offshore indicate the presence of a large, newly discovered offshore groundwater system, suggesting that the aquifer system in the Canterbury Bight is active and connected with the terrestrial aquifer system.

Session Selection:
H005-II. Advances in Coastal Hydrology: Processes and Impacts II Poster

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