

Tidal Effects on Salinity Transport in Unconfined Aquifers - A Field Study

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1. Introduction

This study is concerned with beach groundwater environments that may be affected by seawater intrusion under conditions of event-accentuated tidal forcing.

The spatio-temporal variations of Electrical Conductivity (EC) of groundwater in an unconfined coastal aquifer were observed. The observations were emphasized on investigating development of freshwater-saltwater interface as well as the expansion of mixing zone of freshwater and seawater due to tidal fluctuations.

2. Spatial variations of groundwater EC

Approximately monthly profiles of groundwater EC is presented in figure 1. Generally, two regimes of freshwater and saltwater are evident from the EC profiles at H20-1 (the most landward well).

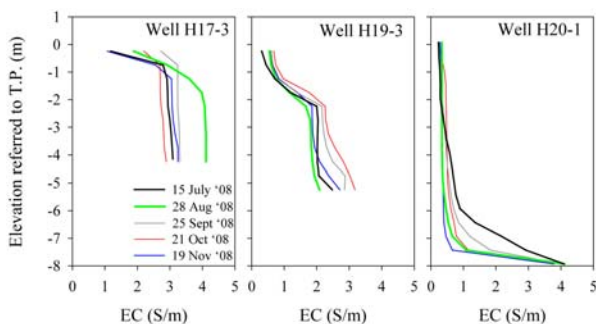


Figure 1. Vertical profiles of groundwater EC measured from 15 July-19 November 2008.

More complex profiles of groundwater EC are shown from EC profiles at H17-3 and H19-3. Note these two wells are located closer to the shoreline. Unlike at H20-1, the sharp freshwater and seawater interface is not clear from the profiles at H17-3 and H19-3. The freshwater and saltwater is likely to form a mixing zone (also known as dispersion or diffusion zone) rather than a sharp interface between two fluids.

2. Temporal variations of groundwater EC

Temporal variations of groundwater EC were observed by means of electromagnetic-inductance devices for continuously monitor groundwater EC changes. The sensors were installed in well H19-3 and in well H20-1 and programmed to log data in every 10 minute.

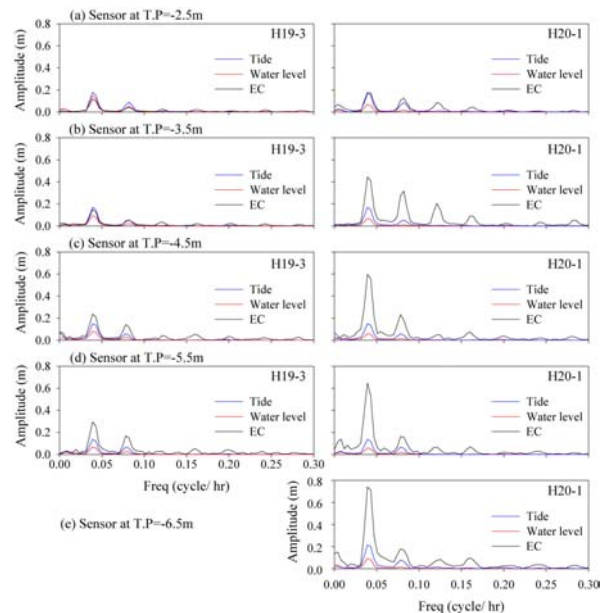


Figure 2. Spectral analysis for tidal fluctuation, groundwater fluctuation and groundwater EC at each measurement depth

Spectral analysis was used to interpret the relationship between tidal fluctuations, groundwater levels and groundwater EC changes (figure 2). As seen, the behaviors of tidal fluctuation, groundwater fluctuation and groundwater EC were closely correlated each other. The fluctuations observed on tidal data have similar trend to those of groundwater level and groundwater EC. Two most dominant fluctuations observed have fluctuation period of 25 hour and 12 hour, which is related with diurnal and semidiurnal tidal fluctuation.