

## **Temporal Variations of Salt-Fresh water Interface and Groundwater Flow due to Tidal Effect in Coastal Area: Jeju Island, Korea**

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### **ABSTRACT**

Electrical conductivity logging and direct measurements of groundwater directions and velocities were carried out in the eastern part of Jeju Island, Korea. Three boreholes (HD-1, JD-1, SS-1) were selected which are located at a distance of 0.9 ~ 1.7 km from the coastline. In order to examine the tidal effect on salt-fresh water interface and groundwater flow field, four tidal stages were selected. Stage I is during the low tide, stage II is at mid tide, stage III is at high tide, and stage IV is at mid tide. Figure 1 shows the variations of electrical conductivity with depth at four different tidal stages. In case HD-1, a sharp interface is formed at depth of around 53 m from the top of casing. No significant difference of conductivity was detected during the tidal fluctuations. However, at JD-1, the interface at stage I and II is formed around 47 m, and rises to 30 m at stage III and IV, which shows wide variations due to tidal stages. At SS-1, the interface is formed around 65 m at stage I and rises to 60 m at other stages. In addition, groundwater directions and velocities were measured using 2-D heat pulse flowmeter in order to characterize the flow field variations due to tidal effect. 8 points were selected for each borehole considering geological layer and conductivity profiles. Figure 2 shows some typical results obtained at HD-1. At 35 m depth, the flow is toward the coast at stage I. However, as the tide stage rises, the hydraulic gradient varies, and the flow direction is toward the inland. The velocity ranges from 0.3 to 0.9 cm/hr. At 60 m point, just below the interface, the flow is toward the coast and at 120 m depth, the flow is landward with little change detected in flow directions during tidal variations. However the velocity increases as gradient varies with rising tide stage. In case HD-1, although there is little change of interface, flow field varies in both fresh

water and salt water zone due to tidal effect. At JD-1 and SS-1, temporal variations of interface and flow fields exist and there is a circulation due to density flow at salt water zone.

Key words: salt-fresh water interface, coastal aquifer, tidal effect, flowmeter

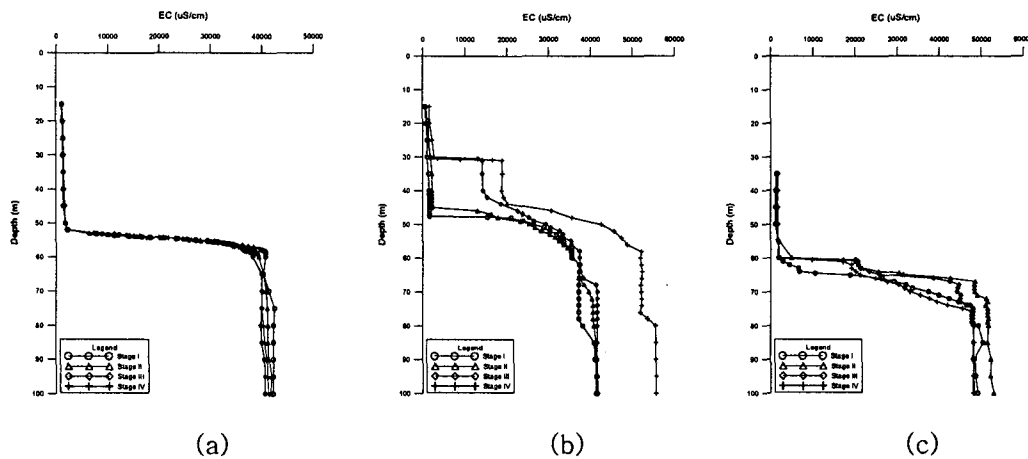


Fig. 1. Variations of electrical conductivity with depth at four different tidal stages: (a) HD-1, (b) JD-1, (c) SS-1.

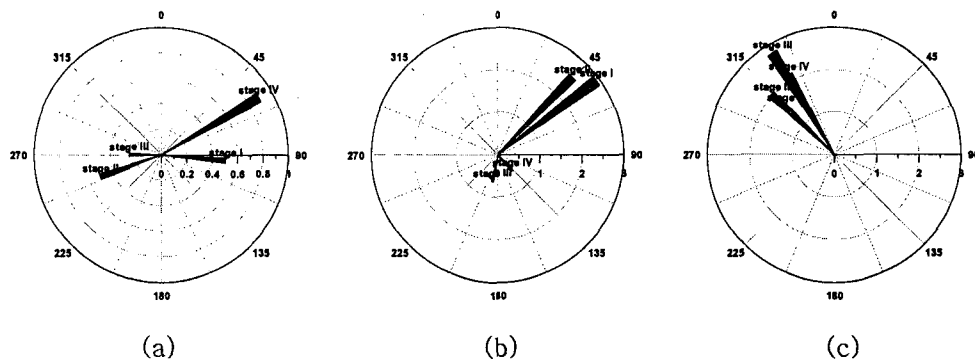


Fig. 2. Flow directions and velocities at four different tidal stages: (a) 35 m, (b) 60 m, (c) 120 m.

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