Heat dissipation test to estimate groundwater fluxes- test case at an unconsolidated coastal aquifer
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Estimation of groundwater flow is a key element for the quantitative and qualitative monitoring of groundwater resources. Continued monitoring of groundwater flux should help to manage unconsolidated coastal aquifers, which is our motivation. We propose using Fiber-Optic Distributed Temperature Sensing (FODTS) as a new approach to measure groundwater flux with a high temporal and spatial resolution, so as to characterize seawater intrusion and processes occurring at the fresh-salt water interface. FODTS has already proved to be a useful cost-effective tool to get detail monitoring of environmental processes. Armoured fiber-optic cable was installed outside the casing of several piezometers located close to the coast. Heat dissipation tests were carried out by heating the cableEs armouring alternatively at the pumping and observation piezometers, under different pumping rates and heating powers. The same cable was used to monitor the heating and dissipation phases in both piezometers. Heat dissipation rate at the buried cable is governed by thermal advection and diffusion. Thermal advection is proportional to groundwater flux, which varies in space and time. Thermal diffusion is essentially proportional to thermal conductivity, which is constant in time and varies little in space. Therefore, the latter can be used to for quality assurance, whereas the observed change in temperature at different pumping rates allows us to validate the mathematical model. The resulting empiric relationship between flux and heat dissipation will be used to estimate groundwater flux under natural conditions.