Applications in Hydrology

25

Measurements in a freshwater/saltwater transition zone with an automated electrical resistivity tomography system

Grinat Michael[1], Südekum Wolfgang[1], Epping Dieter[1], Meyer Robert[1]
[1]*Leibniz Institute for Applied Geophysics, Hannover, Germany*

At the North Sea island Borkum the required drinking water is provided by a freshwater lens. In 2009 two vertical electrode systems were installed in the water catchment areas Waterdelle and Ostland to monitor possible changes in the freshwater/saltwater transition zone below the pumps (part of the Interreg project CLIWAT). Each of the two vertical electrode chains is about 20 m long and includes 78 stainless steel ring electrodes (spacing 0.25 m). These systems were installed between about 45 m and 65 m depth. The ongoing measurements are carried out using a modification of the commercial resistivity meter 4point light 10W (Lippmann). The power is supplied by batteries recharged by solar panels. Since end of December 2009 the data are regularly transmitted to Hannover by telemetry.
For the measurements a Wenner-alpha array is used. The data show a clear transition from apparent resistivities of about 80 Ohmm in the upper part of the measuring section around 45 m depth (freshwater) to about 2 Ohmm (saltwater) in the lower part around 65 m depth (spacing a = 0.25 m). Large changes occurred only within the first year of the measurements, i.e. between September 2009 and September 2010; these are due to the readjustment of the local conditions (disturbed by drilling) to the undisturbed situation. Between September 2010 and April 2013 only small changes occurred in all depths, although the resistivity variations in time are different in different depths. Within the last years a very stable situation of the transition zone between freshwater and saltwater has been observed at both locations.