

Development of precise/simple salinity sensors and long-term observation of groundwater at a well in a salt water intrusion area

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The 50m-deep Ichimura observation well was dug in 1999 to examine the relationship between the salt water intrusion limit in the Gonokawa River and infiltration into groundwater in the vicinity of the river, by observation of salinity and temperature. The well is located on a river embankment at Ichimura, Gotsu City, Shimane Prefecture, about 8.7km upstream from the mouth of the Gonokawa River. A CT multi-sensor cable (electric conductivity and temperature sensor) based on the XCTD (Expendable Conductivity, Temperature & Depth Profiling) system was improved for the groundwater survey. We carried out precise long-term observations of salinity and water temperature of the groundwater, which consists of fresh and salt water layers. A record of the fluctuation of the fresh-salt water interface could be captured using the CT multi-sensor cable. However, the number of sensors in that are limited, and the sensor interval of about 0.5-1m meant that detailed fluctuations of the fresh-salt water interface could not be determined, although the approximate position could be assessed. Accordingly, the method for detecting the fresh-salt water interface was re-examined, and a simple and improved salinity sensor was produced experimentally. Field trials of this simple salinity sensor were carried out in the observation well. The salinity sensor developed was a multipoint-electrode type conductivity sensor cable. Seventeen electrodes were placed on the surface of the cable at 10cm intervals over a 1.6m length, corresponding to the zone over which salinity usually fluctuated. Measurement of electrical conductivity was carried out by switching the electrode E1-E2, E2-E3, E3-E4, of the cable in order. The measurement system comprises a notebook computer, relay selector, and voltage meter. Voltage values corresponding to the electrical conductivity are input into the A/D card of the notebook computer. Water-level was monitored using a pressure sensor. Observations of salinity fluctuations in the groundwater in the Ichimura well were made using this system over a period of one month, from Feb. 24 to Mar. 24, 2001. The numbers of electrodes in the simple salinity sensor was subsequently increased, enabling measurements over a vertical range of 4m. Changes in the water-level and position of the fresh-salt water interface in the observation well could then be shown graphically. As a result, it became clear that there was a correlation between these data and river flow/tide.