Estimation of residence time of groundwater at Shinhama area, Sendai city –discussion using the concentration of SF_6 and CFCs –

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The tsunami caused by the 11 March 2011 earthquake flooded large area near the coastal area, and water salinization occurred in many wells at those area. It is important to determine the water quality and groundwater flow for sustainable groundwater use in these areas.
The objective of this study is 1) to make clear the concentration of dissolved inorganic materials, trace elements, and stable isotopes in shallow and deep groundwater, 2) to estimate the groundwater residence time and groundwater flow system at Shinhama area, Sendai city. The observation and water sampling have been doing since December 2018 at one shallow well, five deep wells, and one channel in Shinhama area.
As a result of this observation, following things were revealed; 1) Water quality of channel is Na-Cl, EC (electrical conductivity) is very high, and seasonal variation exists, 2) Water quality of shallow groundwater is (Na+Ca)-HCO_3, EC is relatively low, and water quality related with the variation of the groundwater level, 3) Water quality of deep groundwater is Na-HCO_3 and Na+(Cl+HCO_3), EC is high, no seasonal variation of water quality, and it is considered that the residence time of deep groundwater is relatively long than that of shallow groundwater, 4) In the case of trace elements, concentration of Mn and Fe is relatively high, which is affected by the geological conditions, 5) Stable isotope values of oxygen and hydrogen are channel > shallow groundwater > deep groundwater, and isotope values of No.3 well (deep well) which is located near the coast are lower than those of other deep wells, so the recharge area of No.3 well is relatively high (about 200 m higher) than that of other deep wells is considered, 6) As a result of CFCs and SF_6 concentration, the residence time of deep groundwater is estimated to be about 70 years.
In future, we will do the continuous observation at Shinhama area, and the new observation wells will be installed near Shinhama area for estimating the residence time and groundwater flow system.

Keywords: Shinhama area, Sendai city, groundwater, stable isotopes, residence time, CFCs, SF6

