

Interaction between surface water areas and groundwater in Hanoi area, Viet Nam

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Hanoi is the capital of Viet Nam and the second largest city in this country (population: 6.45 million in 2009). Urbanization of this city has reduced number of natural water areas such as ponds and lakes by reclamation not only in the central area but the suburban area. Rivers also have been reclaimed or cut into pieces. Contrary, number of artificial water areas such as fish cultivation pond has increased. On the other hand, various kind of waste water flow into these natural and artificial water areas and induce pollution and eutrophication. These waste waters also have possibility of pollution of groundwater that is one of major water resources in this city. Therefore, we focus on the interaction between the surface water areas and groundwater. Water samples of ponds and groundwater were collected from four communities in suburban areas and stable isotopes of oxygen and hydrogen were measured.

Correlations between delta-18O and delta-D of precipitation in Hanoi that were compiled by GNIP was shown as $\delta D = 8.2\delta^{18}O + 14.1$ (LMWL). Weighted mean values of precipitation in rainy season were delta-18O: -9.1 permil and delta-D: -60.5 permil, respectively. According to Berg (2007), Red river waters were distributed along GMWL. On the other hand, groundwater samples were mainly distributed along other lines. These lines crossed the LMWL around the weighted mean value of precipitation in rainy season and slope of these lines were from 5.3 to 6.5. Thus, groundwater in these communities is mainly recharged by mixing of precipitation and evaporated water bodies. In addition, Red river water also recharges groundwater near the river. This result suggested that the evaporated water were recharged through the natural/artificial water areas, and surface water and groundwater were widely connected in the suburban area.

Keywords: Hanoi city, surface and ground water interaction, water cycle, environmental isotopes