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Roles of surface water areas for water and solute cycle in Hanoi city, Viet Nam

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Hanoi city, the capital of Viet Nam, has developed beside the Red river. Recent rapid urbanization of this city has reduced a large number of natural water areas such as lakes, ponds and canals not only in the central area but the suburban area. Contrary, the urbanization has increased artificial water areas such as pond for fish cultivation and landscaping. On the other hand, the urbanization has induced the inflow of waste water from households and various kinds of factories to these water areas because of delay of sewerage system development. Inflow of the waste water has induced eutrophication and pollution of these water areas. Also, there is a possibility of groundwater pollution by infiltration of polluted surface water. However, the role of these water areas for water cycle and solute transport is not clarified. Therefore, this study focuses on the interaction between surface water areas and groundwater in Hanoi city to evaluate appropriate land development and groundwater resource management. We are carrying out three approaches: a) understanding of geochemical characteristics of surface water and groundwater, b) monitoring of water levels of pond and groundwater, c) sampling of soil and pond sediment.

Correlation between d18O and dD of precipitation (after GNIP), the Red River (after GNIR) and the water samples of this study showed that the groundwater is composed of precipitation, the Red River and surface water that has evaporation process. Contribution of the surface water with evaporation process was widely found in the study area. As for groundwater monitoring, the Holocene aquifers at two sites were in unconfined condition in dry season and the groundwater levels in the aquifer continued to increase through rainy season. The results of isotopic analysis and groundwater level monitoring showed that the surface water areas are one of the major groundwater sources. On the other hand, concentrations of dissolved Arsenic (filtered by 0.45um) in the pore water of the pond sediments were much higher than the pond water and closed to that of groundwater. Also, other metal elements showed the same trend. This result suggested that Arsenic and other metal elements recharged to these ponds is probably adsorbed and removed by sediments (including organic matters). That is, pond sediment plays an important role for solute transport as a filter of Arsenic and metal elements.

The results of this study strongly suggest that the natural and artificial surface water areas have important roles for water cycle and solute transport in Hanoi city. Although the number of the natural water areas is decreasing, dredging of artificial water areas increases the infiltration from the surface to aquifers. Therefore, qualitative and quantitative preservation of the surface water areas is important for conservation of groundwater environment and contribute to sustainable groundwater management in Hanoi city.