

Isotopic evaluation of groundwater balance components in urban areas

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Groundwater in urban areas is generally under-used in Japan, mainly because of worries about the potential progress of land subsidence and sea water intrusion, and the risks of pollution. Reduced use of urban groundwater results in rising water tables, which in turn cause geotechnical problems such as flooding of tunnels and basements, chemical attack, and hydrostatic uplift of underground structures. In order to make full and wise use of the groundwater resources, a clear understanding of its water balance is needed. As is widely known, urbanization accompanies the decrease in direct groundwater recharge by infiltrated precipitation. In addition, two artificial components, leakage from water mains and groundwater infiltration to the sewer system, may exert a large influence on groundwater balance in urban areas. This paper is a review of the existing papers available on the application of isotope techniques to quantify the roles of these two components as well as direct recharge by precipitation in groundwater balance. Special reference will be made to the case studies carried out in Yamagata, Kobe, and Tokyo cities in Japan based on stable oxygen/hydrogen and carbon isotopes.