Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

AHW25-P01 Room:Convention Hall Time:May 27 18:15-19:30

Water balance analysis for assessing groundwater resources in Kofu basin

ICHIKAWA, Yutaka[1*] ; TAKABE, Yuya[2] ; NAKAMURA, Takashi[3] ; MAGOME, Jun[3] ; ISHIDAIRA, Hiroshi[3]

[1]Graduate School of Engineering, Kyoto University, [2]Graduate School of Medicine and Engineering, University of Yamanashi, [3]International Centre for River Basin Environment, University of Yamanashi

Water use in Yamanashi Prefecture is highly dependent on groundwater resources, and a number of groundwater investigations have been carried out. However, groundwater recharge, which is the most crucial factor for its proper management, remains uncertain. This study conducted a water balance analysis of Kofu basin aiming at assessment of its groundwater resources. The water balance of Kofu basin consists of temporal change of groundwater and surface water amount, precipitation, river and groundwater discharge coming from the surrounding mountain regions, evapotranspiration and river discharge going out from the outlet of the basin. The observation datasets were utilized to estimate precipitation and river discharge. An advection-aridity approach was used to estimate actual evapotranspiration. The temporal change of groundwater amount was found to be small enough to be ignored compared other components based on groundwater level observations and the temporal change of surface water was assumed to be negligible. Groundwater inflow from the surrounding areas was estimated as difference of other inflow and outflow components. The annual amounts of each components per unit area of Kofu basin were estimated as follows; precipitation: 1090mm, river inflow: 5090mm, evapotranspiration: 340mm, river outflow: 6500mm, groundwater inflow: 650mm.

Keywords: water balance, groundwater resources, Kofu basin

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Distribution of ground water quality in South gobi area

NAKAZAWA, Koyomi[1*] ; NAGAFUCHI, Osamu[1] ; OKANO, Kanji[1] ; OSAKA, Ken'ichi[1] ; HAMABATA, Etsuji[1] ; IKEDA, Keisuke[1] ; YOSHIDA, Akifumi[1] ; CHOIJIL, Javzan[2] ; TSUGTBAATAR, Jamstram[2]

[1]University of Shiga prefecture, [2]Institute of Geography Mongolian academy of sciences

39 ground water samples were collected from wells in August to September 2013 in South gobi, Mongolia. Sampling sites were located in Oyu tolgoi (Cu mine and Au mine), Tavan tolgoi (coal mine) which were large-mining activity has been conducted. In addition, samples are collected in northern area of Mongolia for comparison. PH, EC, the concentration of fluoride ($F^?$), chloride ($Cl^?$), sulfate ($SO_4{}^{2?}$), nitrate ($NO_3{}^?$), sodium (Na^+), potassium (K^+), calcium (Ca2+), magnesium (Mg2+), mercury (Hg), manganese (Mn), nickel (Ni), zinc (Zn), cadmium (Cd), lead (Pb), chromium (Cr), arsenic (As), selenium (Se), lithium (Li), aluminium (Al), vanadium (V), cobalt (Co), molybdenum (Mo), indium (In), antimony (Sb) and tellurium (Te) were measured. We charactrize the water quality and human helath risk. In Tavan tolgoi and Oyu tolgoi, HQ (Hazard Qoutient) showed >1, which is considered at risk. In Oyu tolgoi, HQ of NO3- (29.6+-20.1 mg/l) and As (6.63+-5.69ug/l) showed >1. In Tavan tolgoi, HQ of NO3- (47.1+-36.2 mg/l) showed >1 and it contribute the most (44 %) to the average HI, followed by As (17 %, 2.57+-3.72ug/l) and Mo (17 %, 17.8 +-11.1ug/l). On the other hand neither HQ nor HI not showed >1 in Northern area. Result from the nitrogen and oxygen stable isotope ratio, NO3- contamination in Oyu tolgoi and Tavan tolgoi was caused from livestock waste.

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Evaluation of subsurface warming in the Tokyo metropolitan area, Japan

MIYAKOSHI, Akinobu[1*] ; HAYASHI, Takeshi[2] ; KAWAI, Masafumi[3] ; KAWASHIMA, Shinichi[3] ; KOKUBUN, Kuniki[3] ; HAMAMOTO, Hideki[4] ; HACHINOHE, Shoichi[4]

[1]Geological Survey of Japan, AIST, [2]Faculty of Education and Human Studies, Akita University, [3]Civil Engineering Support and Training Center, Tokyo Metropolitan Government, [4]Center for Environmental Science in Saitama

Three-dimensional subsurface temperature distribution and its long-term change were examined by repeated observations of temperature-depth profiles at monitoring wells from 2000 to 2014 in groundwater temperature monitoring from 2007 2012, to evaluate effects of regional groundwater flow and environmental changes due to urbanization on subsurface thermal environment in the Tokyo metropolitan area, Japan.

Subsurface warming has been found at shallow depths in the whole study area by our previous study (Miyakoshi et al., 2010). Especially, subsurface temperature beneath the city center was particularly high not only at shallow part but also deep part. In contrast, relatively low temperatures were found beneath the suburban area. Comparison result between past subsurface temperature data (2004 to 2005, previous study) and present subsurface temperature data (2013 to 2014, this study) showed that subsurface warming was found at the shallow part in the last 9 to 10 years. Subsurface temperature increase in the city center was larger than the suburban area, and the temperature difference between both areas showed an increasing tendency. Additionally, subsurface warming in the present data was recognized deeper than the past data. This result suggests that distribution of subsurface warming is expanding toward the deeper part.

Moreover, results of subsurface temperature monitoring showed difference of subsurface warming tendency by area and depths. The difference suggests that subsurface warming is affected by not only surface warming but also many factors such as geological condition, groundwater flow and waste heat from subsurface structure. Results of this study suggest that mechanism of subsurface warming is able to be evaluated by combined analysis of geological condition, groundwater flow and subsurface temperature changes.

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Keywords: subsurface temperature, groundwater flow, subsurface warming, urbanization, Tokyo metropolitan area

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Long-term monitoring for groundwater temperature at closed loop GSHPs installed site

PARK, Youngyun[1*] ; MOK, Jong-koo[2] ; JANG, Bum-ju[2] ; LEE, Seung-jin[2] ; PARK, Yu-chul[3] ; LEE, Jin-yong[1]

[1]Department of Geology, Kangwon National University, Republic of Korea, [2]Geo3eco Co. Ltd., Chuncheon, Republic of Korea, [3]Department of Geophysics, Kangwon National University, Republic of Korea

This study was performed to evaluate the influence of closed loop ground source heat pumps (GSHPs) on groundwater temperature. The closed loop ground source heat pumps was installed in 2009 and their capacity is 6,952 kW. The monitoring well was installed between wells used to closed loop GSHP and was located approximately 3.5 m away from well used to closed loop GSHP. The groundwater temperature were hourly measured from May 2010 to June 2013. The air temperature had ranged from -15.7 to 30.4^{o}C and showed significant seasonal variations. The water temperature at monitoring well ranged from 13.3 to 16.3^{o}C and their fluctuation trend was similar to air temperature. However, background of groundwater temperature showed narrow range (12.8 to 14.7^{o}C) compared with that at monitoring well. In addition, background of groundwater temperature showed relatively weak seasonal variations. The phase difference between air and groundwater temperature at monitoring well was from approximately 4 to 5 months. The slope of regression line for air and background groundwater temperature was -0.006 and -0.01 ^{o}C/day, respectively. In contrast, the slope of regression line for groundwater temperature at monitoring well was 0.05 ^{o}C/day. These results indicate that thermal energy is cumulated in groundwater owing to operation of closed loop GSHPs in the study area. These trends can keep going. Therefore, the influence of closed loop GSHPs on groundwater temperature has to be evaluated to conserve groundwater from thermal contamination by operation of closed loop GSHPs and to keep energy efficiency. This work is supported by the Korean Ministry of Environment under ”The GAIA project (2014000530001)”.

Keywords: Open loop, Ground source heat pump, Groundwater temperature, Korea

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On the origins of nitrate and sulphate ions in urban shallow groundwater of Shakujii-gawa basin, Tokyo

YASUHARA, Masaya[1*] ; INAMURA, Akihiko[1] ; NAKAMURA, Takashi[2] ; HAYASHI, Takeshi[3] ; ASAI, Kazuyoshi[4]

[1]Geological Survey of Japan, AIST, [2]University of Yamanashi, [3]Akita University, [4]Geo Science Laboratory

A nitrogen and sulfur isotope study was carried out for both groundwater samples, and various kinds of fertilizers and detergents, to discuss possible origins of nitrate and sulfate ions in shallow groundwater of the highly-urbanized Shakujii-gawa basin on the Musashino plateau, Tokyo, Japan. Nitrogen and sulfur isotope measurements suggest contribution of the end-member with high isotopic values such as organic fertilizers used in field cropping, miscellaneous household waste water once infiltrated into the soils, and/or leaking sewage from aging, deteriorated sewer pipes, accounting for high nitrate and sulfate concentrations in shallow groundwater of the Shakujii-gawa basin.

Keywords: urban groundwater, nitrate ion, sulfate ion, origin of ions, isotopes