Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

AHW024-P01 Room:Convention Hall Time:May 27 10:30-13:00

Spatial distribution characteristics of stable isotopes in groundwater, spring water and precipitation samples at Kyoto

Shiho Yabusaki[1*], Tadashi Kono[1], Midori Hara[1], Michihisa Suzuki[2]

[1]Rissho University, [2]Water-culture specialist

Kyoto is an old city in Japan which has more than 1000 year's history. Kyoto basin spreads from Kyoto to Osaka Prefecture. The area of the basin is about 18 km from north to south and about 10 km from east to west. An alluvial fan is formed in the basin by the Kamo and Katsura river. The sand and gravel are deposit thickly at the alluvial fan, and the thickness is about 100 m at the fan head and from 300 to 400 m at the fan end. There is some aquifer in the basin and a large quantity of groundwater is stored in this basin, so many people who live in the Kyoto city have used the groundwater a long period.

In the Kyoto basin, the stable isotope of oxygen changes from -8.9 to -5.3 per mill and hydrogen changes from -58 to 35 per mill. The stable isotopes are relatively low with the high elevation and relatively high with the low elevation in the mountainous area. The stable isotopes in groundwater around Kamo river are constant (d^{18}O: -7.8 per mill, dD: -50 per mill) and don't depend on the groundwater level. Thus the isotopes of groundwater around Kamo river are almost corresponding to isotopes of Kamo river, it is assumed that the groundwater is recharged from Kamo river in this area. The SiO_2 concentration and water quality in groundwater and river water suggest this result.

The precipitation samples have been sampled every two months at three points of P-1 (32.5 m a.s.l.), P-2 (100 m a.s.l.) and P-3 (310 m a.s.l.) since September 2009. The water quality, stable isotopes of oxygen and hydrogen were analyzed for all precipitation samples. The amount-weighted value of d^{18}O is -7.9 per mill at P-1, -8.1 per mill at P-2 and -8.4 per mill at P-3. The altitude effect of precipitation in this area is -0.17 per mill /100 m for d^{18}O (r^2=0.981) and -0.7 per mill / 100 m for dD (r^2=0.819). The altitude effect of the groundwater and spring water near the precipitation sampling points also exists. In the future, we will estimate the groundwater flow and recharge area in Kyoto basin by using the stable isotopes in groundwater and precipitation samples.

Keywords: Kyoto basin, groundwater, spring water, precipitation, water quality, stable isotope

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

AHW024-P02 Room:Convention Hall Time:May 27 10:30-13:00

Origin of chloride ion in groundwater in Kanto plain, Japan

Kazuhiro Amita[1*], Kiyohide Mizuno[2], Takeshi Hayashi[1], Masaya Yasuhara[3]

[1]Akita Univ., [2]Institute of Geology and Geoinform, AIST, [3]Geological Survey of Japan, AIST

The Kanto Plain is the largest groundwater basin in Japan. There is the groundwater area with high Cl concentration (from 10 to 150 mg/l) in the depth of GL-100 to -300 m of the central part of the plain. This ground water area is thought to be made by regional groundwater flow, from the viewpoint of three-dimensional observations of groundwater quality, stable isotopes, and subsurface temperature. We performed a leaching experiment of chloride ion which used bowling core block drilling at Kasukabe. In the experiments, powdery sample (20g) made from piece of drilling core and pure water (100 mL) are mixed at a plastic container. And 24 hours later, chloride ion is measured by electrode. The experiments provided interesting results as follow: (1) The sample which showed highest concentration (95.2 mg/L) of chloride ion is collected from the core piece about 330m depth. (2) Range of chloride ion concentrations in the pore water estimated by an experimental result is from 13.2 mg/L to 2113 mg/L.

Keywords: Kanto Plain, Chloride ion, Leaching experiment

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

AHW024-P03 Room:Convention Hall Time:May 27 10:30-13:00

Regional subsurface temperature profiles and the temporal variations in Saitama prefecture

Hideki Hamamoto[1*], Shoichi Hachinohe[1], Kouki Sasaka[1], Takashi Ishiyama[1], Hidetaka Shiraishi[1], Akinobu Miyakoshi[2], Makoto Yamano[3]

[1]Cent. for Env. Sci. in Saitama, [2]AIST, [3]Earthquake Res. Ins., Univ. of Tokyo

Ground heat exchanger system is spreading as the promising system as natural energy system in Japan. Subsurface environmental basic information (subsurface temperature , geological feature, hydraulic property) is essential for a design of ground heat exchanger system and an estimation of the energy efficiency. The final purpose of the study is to be useful for spreading of ground heat exchanger system through investigation of subsurface environmental information. In the presentation, we mainly talk about investigation method about subsurface temperature measurements and the result in Saitama prefecture.

We conducted to measure at 24 stations in 2009 (Jul 2009- Oct 2011) and 15 stations in 2010(Oct 2010- Jan 2011) using subsurface water observation well located in the plains of Saitama.

The observation well measured in 2010 is same as 2009, but the seasons are different (Summer season in 2009, and Winter season in 2010. Thermal gradient due to heat from deep part is about 20-30mK/m in Saitama area. The values are consistent with past reported results. Most stations have temperature inflection point at about 50m depth and rise toward ground surface. This temperature rises may be caused by global warming and/or the heat island effect of the city for a last century. Most temperature profiles are stable in time in the deeper than 100m depth. On the other hand, several profiles change. The stations are located in the agricultural region. The large amount of groundwater is pumped up in summer season. As one interpretation, seasonal pumping affects groundwater flow, and it may change subsurface temperature. For the understanding of temperature change, it is effective to perform temperature monitoring in the depth. We have a plan such a monitoring.

On the other hand, it is general known that the ground surface seasonal temperature variations are propagated into subsurface by thermal diffusion. As the propagated depth depends on subsurface thermal properties, and the depths are different in region For the measurements of the propagated depth, we made observation wells of 15m depth and 30m depth in CESS (Center for Environmental Science in Saitama). The 15m observation well made in March, 2010, and the 30m observation well made in January, 2011). We measured the temperature distribution of the 15m observation well in October, 2010 and January, 2011. As a result, seasonal temperature variation propagate shallower than about 8m at the station.

It is important that the regional characteristic of subsurface temperature distribution and subsurface temporal temperature variation for understanding of subsurface environment.

Our study is significant model case for applying to other areas.

Keywords: Subsurface temperature, Seasonal temperature variations, thermal gradient, Kanto plain, Saitama

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

AHW024-P04 Room:Convention Hall Time:May 27 10:30-13:00

Study on development of potential map for geothermal heat pump system

Mayumi Yoshioka[1*], Youhei Uchida[1]

[1]Geological survey of Japan, AIST

Geothermal heat pump (GeoHP) system, which utilizes the shallow geothermal energy for cooling and heating, hot water supply and snow melting, is one of the energy saving systems. The system is widely used in Europe and the United States for years, and recently, in China and Korea, the installations spread rapidly. In Japan, however, its use is limited because of the lack of information on the advantage and the high initial most during installation. The promotion of the GeoHP system requires evaluating the effective utilization of the geothermal energy, verifying the stability of the system in long-term running and designing the environmentally friendly system. For these purposes, the potential of the geothermal heat pump system should be evaluate quantitatively and the suitable utilization of the energy also should be proposed. The aim of this study is to develop the potential map for the geothermal heat pump system. In this presentation, we review the previous studies about the geothermal heat pump potential (and potential map) and propose the approaches for the development of the potential map.

There are 2 main types of GeoHP systems, one is the system using groundwater directly and the other is the system using the heat exchanger. Both systems can be used as the ground heat storage system. The efficiencies of those systems are influenced by the geological and hydrogeological setting, but the contributions of each condition for it have not been demonstrated enough. There are some studies about the geothermal potential in Japan. In those studies, the geological settings, the groundwater level, the thickness of aquifer, the groundwater yield, the quality of groundwater, the groundwater velocity and the regulation of the pumping were applied for the system using groundwater directly as the indexes for the potential evaluation. On the other hand, for the system using heat exchanger, the geological settings, the groundwater level, the thickness of aquifer, the temperature of subsurface and the groundwater velocity were also applied. Few studies, however, about the quantitative evaluations of each index for the efficiency were performed. As future works, the organizing the previous studies and the quantitative evaluating the indexes empirically and analytically are required for the practical potential map for GeoHP systems.

Keywords: Geothermal heat pump system, Groundwater, Potential map, Geological information