Change of subsurface thermal regime in Tokyo, Japan.

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Recently, mean annual temperatures of each city have been increasing in Japan due to global and urban warming. Especially, in the center of Tokyo, it has been increased about 2.8 degree during last 100 years. On the other hand, the subsurface environment has been complicated by artificial subsurface construction, pumping for industrial and drinking use and land cover. Therefore, the purpose of this study is to estimate the subsurface thermal regimes in highly urbanized area and rural area.

The topography in Tokyo is divided into two sections, which are upland located in the west and lowland located in the east. The eastern part of the upland and the western part of lowland have developed to urban area.

Subsurface temperatures in 23 boreholes and water levels in 55 boreholes were measured in May, October and November 2001. The institute of civil engineering of Tokyo metropolitan government has managed these boreholes.

From the distribution of hydraulic heads, groundwater can be estimated to recharge in western upland and discharge in eastern lowland.

From Taniguchi et al (1999), surface warming has caused subsurface temperature regime inversion. Because of groundwater flow, inversion depth was assumed to be deep in recharge area and to be shallow in discharge area.

He observed inversion depth ranged from 85m to 125m in western upland (recharge area) and 25m in eastern lowland (discharge area). These facts suggest the evaluation by Taniguchi et al (1999). However, in the center of Tokyo, which is located between recharge and discharge area, the inversion depth ranged from 82 to 90m. These were the similar depths to recharge area. This is due to high temperature in the urban area and its conductive heat transfer to the subsurface.

Comparing to the temperature depth profiles in 1991 and 2001, subsurface temperatures under isothermal layer have increased in the most places. Therefore, it becomes clear that subsurface thermal regime has changed significantly during last 10 years.