

Evaluation of surface warming impact to the environment of subsurface temperature

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Subsurface temperature distribution is usually determined by surface temperature and heat advection due to the groundwater flow. The vertical and horizontal profiles of subsurface temperature records the history of urbanization including the change of groundwater flow. The epoch change of the surface like urbanization makes a change of temp-depth gradient in the profile. Inversion is one of typical phenomena of the urbanization recording.

In the Kanto Plain, temperature inversion reaches to the depth of GL-50m to -100m in the Musashino Upland where is a typical groundwater recharge area (Miyakoshi et.al, 2003). The purpose of this study is to evaluate the effects of urbanization that exert on subsurface temperature environment in Chiba and Ichihara areas. In these areas, it is expected that the effects of surface warming reach to depth deeper than GL-50m, because almost all observation wells are located on the Shimousa Upland where is also a recharge area.

All observed T-D profiles showed that the temperature increased at the shallow part (in GL-30m). And the temperature inversion were observed in some wells located in the urban area.. Inversion depths were from GL-75m to -100m, and these value were correspond with results in the Musashino Upland. However, there are some exceptions in the green area like parkland.

The temperature increasing at the shallow part were 2.5 degree Celsius in the central part of Chiba City and 1.0 degree in the periphery part of Chiba City and Ichihara City. From the comparison of T-D profiles between 1998 (Chiba and Ichihara) and 2002 (Ichihara) and 2005 (Chiba), the temperature increasing of 0.2 to 0.4 degree were confirmed at the shallow part. Also, this effect reached the depth between GL-50m to -75m in even the urban green space. Air temperature in recent 28 years (1976 to 2004) increased by 0.05 to 0.06 degree/year. The result corresponds to the increasing tendency of subsurface temperature at the shallow part. The subsurface temperature distribution tells us the impact of surface warming, caused by not only urbanization but also the global warming, already expanded to a periphery part of the city.