[JJ] Evening Poster | A (Atmospheric and Hydrospheric Sciences) | A-HW Hydrology & Water Environment

# [A-HW26]Water Environment and Geology in Urban Areas

convener:Takeshi Hayashi(Faculty of Education and Human Studies, Akita University), Kei Nishida(Interdisciplinary Centre for River Basin Environment, Interdisciplinary Graduate School, University of Yamanashi), Hiroaki SUZUKI(日本工営株式会社　中央研究所, 共同)
Wed. May 23, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
The scope of this session is to create an interdisciplinary forum on the most recent advances in water environment and environmental geology research in urban areas. Various kinds of studies concerning environmental issues on water and geology in urban areas (e.g. water balance, water cycle, water resource development and management, inundations, hydrogeology, pollution and remediation, geohazard, basic law on the water cycle) are welcome from academia, industry, and government as well as wider geographic diversity.

# [AHW26-P03]Ground surface deformation induced by groundwater development in the central part of Saitama Prefecture, Japan, detected by ALOS/PALSAR

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Ground subsidence in Saitama Prefecture, located in the central part of the Kanto Plain, Japan, began to be recognized in the mid-1950s, and a remarkable increase in displacement was noticed in the southern parts of the Arakawa Lowland and Nakagawa Lowland in late 1950s. Subsequently, in the middle of the 1970s, groundwater levels (hydraulic heads) of aquifers have started to recover dramatically and subsidence rates have abated in the almost all part of the prefecture, because of regulation of groundwater abstraction for industries and buildings. The tendencies of recovery have been ongoing today. As an effort to monitor the ground subsidence in this region, the Geospatial Information Authority of Japan and two local governments (Saitama Prefecture and the city of Saitama) have conducted the first-order leveling. In the case of the result in 2015, they leveled with a total of 596 benchmarks and a survey distance of 1,127 km. The survey results have been summarized as ground subsidence maps which compile annual, units of five years and ten years of deformation dataset. However, these data were not sufficient to discuss relationships between local ground deformation and groundwater withdrawal.

On the other hand, analytical techniques for assessing ground deformation using interferometric synthetic aperture radar (InSAR) onboard satellites or airplanes have been achieving great results in various fields. Thus, in this research, we examined local characteristics of ground surface deformation through interferometric analysis of persistent scatterer InSAR (PSI) using ALOS/PALSAR data obtained from 2006 to 2011. The PSI method is an analytical technique that allows the calculation of rates of displacement of a target on the ground surface through the extraction of points that have stable phase characteristics over time (PS), such as buildings. As an external digital elevation model, we used digital base map with an interval of 10 m constructed and distributed freely by the Geospatial Information Authority of Japan (GSI). The synthetic aperture radar (SAR) can detect only one-dimensional displacements between the satellite and a target on the land surface in the direction of the line of sight

(LOS). However, in the SAR observations, it is possible to observe the same location on the ground surface from the two directions of the ascending orbit and the descending orbit. We could calculate quasi-vertical and quasi-east–west components of a displacement rate on a plane determined by the ascending and descending LOS vectors from the two LOS displacement rates. Because a very large number of PS points were detected in this area, we thinned out the data at 200 m intervals. Tropospheric noise reduction using a numerical weather model provided by the Japan Meteorological Agency was applied. To reduce the influences of any orbital errors, a correction to flatten the phase inclination of the entire study area was applied. The average of the phases in the area where no displacement was seen was set to zero as a reference.

According to the distribution maps of quasi-vertical displacement rates from 2006 to 2011, the districts showing subsiding tendency were confirmed in the southern part of the Omiya Upland, the downstream area of the Arakawa Lowland, the southern part of the Kawagoe Upland, and some other locations. On the contrary, the districts showing stable or uplifting tendencies were confirmed in the northern part of the Omiya Upland, the midstream area of the Arakawa Lowland, the northern part of the Iruma Upland, and in the Kawagoe Upland. In the areas showing subsiding tendency, we confirmed that an increase in the amount of groundwater withdrawals from several years before and through the analysis period had been observed. Conversely, in the areas showing stable or uplifting tendencies, we were able to confirm a fixed or decreasing amount of groundwater withdrawals through the period.

In our presentation, we will examine relationships between ground deformation tendency, geological conditions, and groundwater withdrawals with the goal of helping to solve the ground subsidence problems in the urban areas.