Verification of InSAR time series analysis using ALOS-2 highly frequent observation data in the subsidence area

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Geospatial Information Authority of Japan (GSI) has been conducting Interferometric SAR (InSAR) analysis of Advanced Land Observing Satellite-2 (ALOS-2) images to monitor crustal deformation in Japan. GSI developed a system for InSAR time series analysis (GSITSA) which includes both PSI method and SBAS method to detect temporal transition of crustal deformation with higher accuracy than the conventional InSAR analysis (Kobayashi et al., 2018). Using GSITSA, we have conducted InSAR time series analysis for 38 active volcanoes in Japan (as of February 2022). By applying InSAR time series analysis, we were able to detect the temporal changes in small crustal deformations on some volcanoes that have not been detected sufficiently by the conventional InSAR method (Mikihara et al., 2021; Ichimura et al., 2021). In addition, in the case of Advanced Land Observing Satellite-4 (ALOS-4), which is scheduled to be launched in 2022, the observation frequency will be about five times more than ALOS-2. Therefore, ALOS-4 is expected to enable more accurate measurement of deformations by applying InSAR time series analysis. Based on the above, in order to utilize ALOS-4 data, we have been conducting InSAR time series analysis targeting the land subsidence area in Japan and verifying that we can detect the temporal changes in small crustal deformations. In this presentation, we will mainly report the analysis results in the Boso Peninsula, Chiba Prefecture. In this area, Spirit leveling is conducted every year for monitoring the land subsidence, which enables us comparison of InSAR results with ground-based observations. In addition, since December 2020, SAR observations have been conducted at a high-frequency of about once a month, usually about three times a year. Thus the Boso Peninsula is a suitable area for verification of the advantages of highly frequent observation comparable to that of ALOS-4. Against this background, we report the results of comparison and verification between the InSAR time series analysis and the leveling results.

In the verification, the InSAR time series analysis was performed using the three types of data descending (path 18, right looking) and ascending (path 124, 125, right looking) orbits accumulated from 2014 to 2021, and the 2.5-dimensional analysis was performed by combining these results. The number of images used for the analysis was 32 for path 18, 29 for path 124, and 22 for path 125 (as of February 2022), and path 18 and path 124 were observed at high-frequency; about once a month. We compared quasi-vertical velocity derived from 2.5-dimensional analysis and vertical velocity calculated from the results of leveling surveys published annually by Chiba Prefecture (annual results from 2016 to 2020). As a result, a high correlation was obtained in most of the analysis areas including the area around the Hokuso area, which has the highest subsidence rate in Chiba prefecture. We will report the details of this verification result and discuss the effectiveness of highly frequent observation data.

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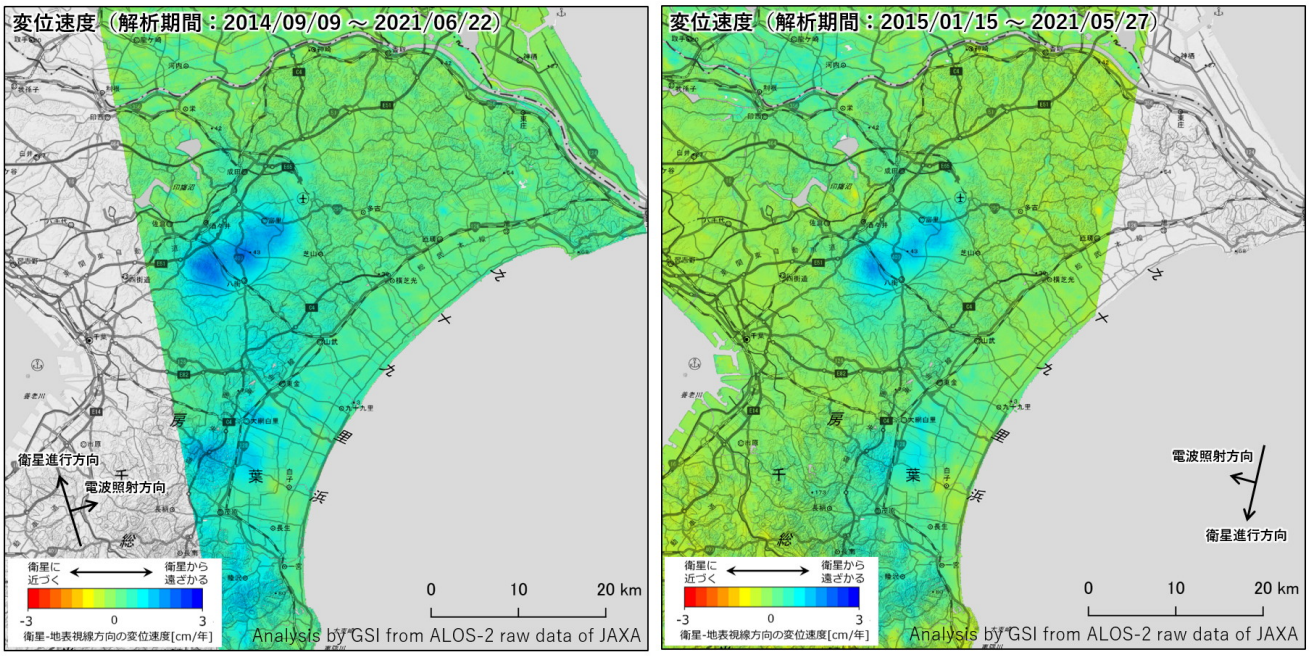
Keywords: ALOS-2, SAR, Land subsidence, Leveling, InSAR time series analysis



図：干渉SAR時系列解析結果（左：パス124、右：パス18）

Figure: InSAR time series analysis results (Left: path 124, Right: path 18)

