Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

STT57-P01 Room:Convention Hall Time:May 22 18:15-19:30

Monitoring of Sakurajima Volcano using Cosmo-SkyMed

Yosuke Miyagi[1*], Taku Ozawa[1], Masanobu Shimada[1]

[1]National Research Institute for Earth Science and Disaster Prevention, [2]Japan Aerospace Exploration Agency

Sakurajima volcano is located in southwestern part of Japan, and currently a most active volcano in Japan. Eruptive activities from Showa-crater have activated since 2009, and several explosive eruptions occurred in 2012. On July 24, 2012, another large eruption occurred from Minamidake-crater after a lapse of 18 months. To understand current condition and future unrest of Sakurajima, periodic monitoring is required. Although it is generally difficult to make a field observation in dangerous active volcanoes, a satellite remote sensing can make observations of even ongoing volcanoes periodically. Especially, Synthetic Aperture Radar (SAR) sensor is well-suited for monitoring active volcanoes because it can penetrate ash clouds and can observe targets like an active vent. Moreover, SAR data are applicable to use a Differential Interferometric SAR (DInSAR) technique to detect crustal movement associated with the magmatic activities. In this study, we used COSMO-SkyMed data for monitoring Sakurajima volcano and tried DInSAR processing. Monitoring using high-resolution amplitude images revealed changes of backscattering intensity probably due to some kind of surface change within or around the crater. DInSAR processing suffered from low coherence, therefore we acquired quite limited geodetic information.

Keywords: SAR, Sakurajima, DInSAR, Cosmo-SkyMed

STT57-P02 Room:Convention Hall Time:May 22 18:15-19:30

Flow velocity measurements of an ice stream using SAR interferometry and GPS

Koichiro Doi[1*], Hideaki Hayakawa[1], Yuichi Aoyama[1], Tsutomu Yamanokuchi[2], Kazuki, NAKAMURA[3], Susumu, TAKAGISHI[4]

[1]National Institute of Polar Research, [2]RESTEC, [3]Nihon University, [4]PASCO Corp.

Synthetic Aperture Radar (SAR) interferometry (InSAR) is an effective tool to measure flow rate of ice stream on Antarctic continent. We applied the InSAR technique to X band SAR data acquired by German X band SAR satellite TerraSAR-X, and tried to measure flow rate of an ice stream Flattunga, which flows out to Prince Olav coast, East Antarctica. The used two scenes are in the StripMAP mode, and observed at March 21 and April 1, 2011 in the descending orbit 166. The perpendicular baseline length between the two observations was -96.9 m. In order to make differential InSAR (DInSAR) image, we also used ASTER GDEM.

Starting point of an inner Antarctic continent route of Japanese Antarctic Research Expedition (JARE) is located in the upper stream region of Flattunga. We implemented GPS measurements from the end of April to the beginning of May, 2012 in the wintering period of JARE53 at S19 (69 00’28.6”S, 40 08’22.6”E, ellipsoidal height: 615.0m) in the route. From a preliminary analysis of the data, we obtained a flow rate of 15 cm/day and a flow direction of N44 W at the site.

Obtained displacement by DInSAR from TerraSAR-X data was approximately 40 cm for 11 days at around S19 site. The displacement is smaller than the above value from GPS measurement. We will compare the displacement by DInSAR with that by GPS by projecting the direction to ice flow direction of Flattunga.

In the presentation, we also intend to show a result obtained by a differential InSAR analysis of ALOS/PALSAR data.

Keywords: Differential SAR interferometry, GPS, ice stream, Antarctica

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

STT57-P03 Room:Convention Hall Time:May 22 18:15-19:30

Development of InSAR processing tools in NIED

Taku Ozawa[1*], Yosuke Miyagi[1]

[1]National Research Institute for Earth Science and Disaster Prevention

Synthetic aperture radar (SAR) became one of the useful tools for crustal deformation detection. Recently, InSAR processors which can be used freely in scientific research (e.g., ROI_PAC, GMTSAR, and Doris) were released, and enabled anyone to do crustal deformation detection by InSAR. Especially, algorithm of two-pass differential InSAR analysis matured, and it enabled anyone to obtain almost same results. On the other hand, advanced InSAR analysis methods, e.g., time-series analysis, have been recently used to detect precise crustal deformation. However, many issues to improve remains in such analyses. In order to research on improvements for such analysis, we are developing InSAR processor.

In this InSAR processor, general procedure is adopted. (1) Format conversion of SLC and creation of parameter files. (2) Rough co-registration of two SLCs considering parallel shift only. (3) Estimation of affine transformation coefficients using the accurate matching method by Tobita et al. (1999). (4) Resampling of SLC. (5) Generation of the initial interferogram. (6) Simulation of a SAR intensity image and estimation of translation tables between geodetic and radar coordinates based on DEM. (7) Co-registration between simulated and observed SAR intensity images. (8) Correction of translation tables. (9) Simulation of the orbital and the topographic phase components. (10) Generation of differential interferogram. (11) Applying interferogram filter (Goldstein and Werner (1998) or Baran et al. (2003)). (12) Geocodeing.

Test analysis for this processor was carried out using PALSAR data pair about the earthquake which occurred in the south-eastern Iran (Path:559, Frame:550, 2010/9/30 - 2010/12/31). In this analysis, we used SLC images generated from SIGMA-SAR which was developed by Dr. Shimada of JAXA. Analyzing this data pair using SIGMA-SAR and GAMMA processor, results that the orbital and the topographic phase components don't remain were obtained. The result by this processor was almost consistent with them about crustal deformation component for the earthquake. Furthermore, it seems that coherence is almost the same. However, the orbital phase component with phase change of one cycle in the full scene remained.

Some issues which need to improve of algorithm remain in this processor, and improvement of them is next issue. Additionally, we are planning integration of some algorithms which were developed in NIED, the atmospheric delay simulation (Ozawa and Shimizu, 2010), time-series analysis using multi-track interferograms (Ozawa and Ueda, 2011), and so on.

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

STT57-P04 Room:Convention Hall Time:May 22 18:15-19:30

Localized water-level and ground surface changes at Kushiro basin detected by InSAR

Atsushi Saito[1], Masato Furuya[1*]

[1]Hokkaido University, Graduate School of Science

Kushiro plain is the largest wetland in Japan, which plays an important role as water storage. In recent years, the environment of the wetland are changing rapidly. The local government and some organizations make efforts to preserve the environment.

InSAR (Interferometric Synthetic Aperture Radar) is a method that can detect surface deformation by using SAR data. In general, we cannot apply InSAR technique over areas covered with water, because the reflected microwaves at different acquisition times do not correlate with each other. However, Wdowinski et al (2004) reported that InSAR could measure water level changes at some wetlands, because of double bounce reflection at the point where stable reflectors such as shrubs stick out of water. Following Wdowinski et al, we have applied InSAR technique to detect localized water level changes in Kushiro wetland.

We use ALOS/PALSAR data, which was launched by JAXA in 2006, to observe Kushiro plain. Then, the larger changes were detected at Kayanuma (the northern part of Kushiro plain) and near Setsuri river (the western point of the plain). Moreover, we could detect ground surface displacements in the Kushiro city, which reveal clear deformation boundaries along the city area. The sign detected displacements indicate both negative and positive, which means both upward and downward changes, and thus they are not simply a so-called ground subsidence.

The wetland change will reflect water level changes because the upward change corresponding some heavy rain. On the other hand, we have currently no idea how we can explain the ground displacements that indicate clear boundaries in the populated areas of Kushiro city.

Keywords: Kushiro wetland, water level change, ground deformation, InSAR, ALOS