Japan Geoscience Union Meeting 2014
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STT59-P01 Room:Poster Time:April 29 18:15-19:30

Research on the characteristics of ionospheric disturbance around Japan by GPS-TEC for ionospheric correction to InSAR

NAKAGAWA, Hiroyuki[1*] ; MUNEKANE, Hiroshi[1] ; KUROISHI, Yuki[1] ; KAMIHARA, Masashi[2]

[1]GSI of Japan, [2]Pascalia Co.,Ltd

In the monitoring surface deformation using SAR interferometry (InSAR), it is a serious problem that the long-wavelength noise caused by ionospheric disturbance degrades accuracy of the detection of deformation. Since 2013, Geospatial Information Authority of Japan (GSI) have conducted a research project on the method for ionospheric correction to satellite InSAR based on TEC information obtained from two-wavelength observation data of GEONET.

For the first step, in order to understand the characteristics of ionospheric disturbance around Japan, we identified ionospheric disturbance of the period between 2000 and 2011 by GPS-TEC of GEONET and estimate characteristic values of each event.

In the manner in Munekane (2013), we first estimate zenith TEC and TEC gradient in north-south and east-west component every thirty second during the period from GEONET thirty-second RINEX data. Then, we adopted high pass filter of 3600s to remove low frequency component.

Next, based on this GPS-TEC time series, we identified ionospheric disturbance event in the period. In this step, we focus rather on revealing overall trend of ionospheric disturbance than inspecting accuracy of the characteristic value of each event.

The process of identification is as follows. First hourly RMS of TEC was calculated every hour, and, if the number of sites which hourly TEC-RMS is over threshold is more than a certain criterion, regard the epoch as a part of ionospheric disturbance event. Then, viewing the ”GEONET GPS-TEC maps over Japan” on the web site of NICT, each disturbance event was divided visually into three category according to the pattern of TEC distribution, ”traveling ionospheric disturbance (TID) ”, ”plasma bubble” and ”other”.

After the identification of event category, we decided characteristics such as event start and end time, affected area and its temporal transition based on ten-minute RMS of TEC. Also, we estimate characteristic values associated with event category such as wavelength of a TID or northernmost latitude of a plasma bubble etc. Finally, we derived characteristics of the ionospheric disturbance around Japan statistically.

We identified 8,815 ionospheric disturbance in the period, reaching maximum of 967 events in 2001, decreasing gradually to minimum of 471 in 2007, and having increasing tendency afterwards. This trend is consistent with solar cycle. The occurrence of TID and plasma bubble is found to be consistent with solar cycle, too.

Also, it appears that TID occurs commonly from May to August, in summer season. TID occurrence also concentrates before and after two hours around 22 o’clock in local time. As for plasma bubble, the occurrence is high from the sunset to midnight in local time. These results are consistent with earlier studies.

References

Munekane, H., (2013): On ionospheric correction of ALOS/PALSAR interferograms using GEONET data (preliminary report) , STT57-09, Japan Geoscience Union Meeting 2013

National Institute of Information and Communications Technology: GEONET GPS-TEC maps over Japan, http://seg-web.nict.go.jp/GPS/GEONET/index_e.html

Keywords: InSAR, ionospheric disturbance, TEC, GEONET

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APPLICATION OF DINSAR TIME SERIES ANALYSIS USING ALOS PALSAR TO EXTERIOR DEFORMATION MONITORING OF DAMS

HONDA, Kenichi[1*] ; MUSHIAKE, Naruo[1] ; SATOH, Wataru[1] ; SATOH, Hiroyuki[2] ; KOBORI, Toshihide[2] ; SASAKI, Takashi[3] ; YAMAGUCHI, Yoshikazu[4] ; SHIMIZU, Norikazu[5]

[1]Kokusai Kogyo Co., Ltd., [2]Public Works Research Institute, [3]National Institute for Land and Infrastructure Management, [4]Japan Dam Engineering Center, [5]Yamaguchi University

The number of aging civil engineering structures is rapidly increasing in Japan. As for dams, it is estimated that 58% of existing dams in the year 2020 will be 50 years old or over after completion. This situation increasingly requires not only efficient deformation monitoring systems for safety management of civil structures but also safe and rapid methods in case of emergencies such as earthquakes.

Remote sensing techniques, especially Synthetic Aperture Radar (SAR), can play an important role to conduct deformation monitoring of civil structures such as dams. Differential Interferometric SAR (DInSAR) analysis using SAR satellite data can be suitable to deformation monitoring in broad areas.

To investigate the applicability of DInSAR analysis for the deformation monitoring, the Taiho Subdam, which is located in the Okinawa Prefecture, Japan, was selected as a study area because the deformation monitoring using GPS have been rigorously conducted since the completion of the dam from December 2006. In this study area, at maximum 114 mm of deformation was measured from December 2006 to December 2010, which corresponds to the observation period by SAR satellite. ALOS PALSAR data, L-band SAR, was used for DInSAR analysis and the results of deformations calculated by DInSAR analysis were compared with the results of the GPS deformation measurements. 28 scenes of ALOS PALSAR data were used: 14 scenes of descending data from December 6, 2006 to December 17, 2010, and 14 scenes of ascending data from January 12, 2007 to January 23, 2011, respectively.

The values of deformations calculated by DInSAR analysis were about 70 or 80% of those measured by GPS during observation period about four years. Although the DInSAR analysis results were expected to have some errors and were different from the GPS measurement results to some extent, DInSAR deformation monitoring is sufficient enough to monitor few-centimeter deformations. Additionally time series changes by DInSAR analysis can well reproduced the tendency of the settlement of the dam. This indicates a possibility that DInSAR analysis is useful for the deformation monitoring for civil structures.

Keywords: Dam, Exterior deformation monitoring, DInSAR, SBAS, GPS

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Approach for monitoring ground deformation around the active volcanoes in Japan by InSAR time series analysis

MIURA, Yuji[1*] ; ANDO, Shinobu[2] ; NAKAMURA, Masamichi[1]

[1]Volcanological Division, JMA, [2]MRI

In previous studies, we have reported the analysis results about domestic active volcanic areas using D-InSAR of ALOS since 2007. In recent years, InSAR time series analysis technique has been developed. Therefore various studies have been reported for monitoring ground deformation using InSAR time series analysis. In this study, we have applied this procedure to the analysis of the data of ALOS/PALSAR for monitoring ground deformation of the active volcanoes in Japan.

As a result, we can detect ground deformations associated with volcanic activities of Tokachidake, Azumayama, Izu-Oshima, Miyakejima, Satsuma-Iojima and others. These obtained ground deformations by InSAR time series analysis were basically consistent with the results of GPS.

Keywords: InSAR time series analysis, ground deformation, ALOS/PALSAR, active volcano

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Surface displacement around Hachobaru geothermal field inferred from persistent scatterer SAR interferometry

ISHITSUKA, Kazuya[1*] ; TSUJI, Takeshi[2] ; MATSUOKA, Toshifumi[1] ; FUJIMITSU, Yasuhiro[3] ; NISHIJIMA, Jun[3]

[1]Graduate School of Engineering, Kyoto University, [2]International Institute for Carbon-Neutral Energy Research (I2CNER), Kyushu University, [3]Faculty of Engineering, Kyushu University

Fluid migration around geothermal field can cause surface displacement. Leveling campaign and GPS measurement has been used to estimate surface displacement and shown the usefulness for reservoir monitoring at geothermal field. Recently, persistent scatterer SAR interferometry (PS-InSAR) analysis has been developed as a practical tool for surface displacement monitoring. By making use of the advantage of wide data coverage of satellite image, the analysis enables us to estimate surface displacement at the whole geothermal field with high spatial density. In this study, we applied PS-InSAR analysis on areas around Hachobaru geothermal field, the largest geothermal field in Japan, located Kyushu Island. For the analysis, we used 18 ALOS/PALSAR images acquired from July 2007 to December 2010 from an ascending orbit.

As a result of the analysis, we estimated secular surface displacement with the maximum rate of 15 mm/year opposite to satellite direction, which can be inferred as ground subsidence. We also found temporally irregular displacement along with the secular displacement. This irregular displacement has occurred all of Mt. Kuju, suggesting that displacement at Mt. Kuju has influenced displacement at the geothermal field. Moreover, we found that the secular displacement has decayed over time and has clear boundaries which possibly correspond to fault locations.

Keywords: surface displacement, persistent scatterer SAR interferometry, Hachobaru geothermal area

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The Steady Crustal Deformation Analysis in Tokai region by InSAR

ANDO, Shinobu[1*] ; IWAKIRI, Kazuhiro[2] ; AOKI, Gen[2]

[1]MRI, [2]JMA

ALOS has an L-band SAR (PALSAR), which is of help to understand of a ground surface state, and its interferometric coherence is highly effective for the crustal deformation observation.

We analyzed the ALOS/PALSAR data around Omaezaki and Kakegawa cities in Shizuoka Prefecture, and tried to detect steady crustal deformation due to the subduction of the Philippine Sea plate. In this study, in order to obtain steady-state deformation (time series), we subjected to interference processing on the image pairs of a number of different imaging date interval. Then, using a variation of the satellite line-of-sight direction in the interference each images and we were calculated the average variation of the 46 days (stacking process). However, to reduce noise, we analysed except for some interferograms with obvious noise. This method can be expected to improve detection accuracy, because of able to reduce the influence of noise caused by the ionosphere.

We used 23 ascending data acquired from January 2007 to October 2010 and 19 descending data acquired from October 2006 to September 2010. Before solving for the displacement time series, we corrected the atmosphere phase delay by Japan Meteorological Agency nonhydrostatic model (JMA-NHM), and calculated the displacement of the satellite line-of-sight direction of the pair of all. The average displacement of the satellite line-of-sight direction of the 46 days was calculated under the assumption that the variation in the period of each pair is constant. The distance between the imaging date is different for each pair, but we did not weight during the averaging process.

As a result, steady-state deformation was hardly observed in the analysis of the ascending orbit data, but in the analysis of the descending orbit data, were observed the steady-state deformation the away from the satellite in the radar line-of-sight direction. This crustal deformation was significant in Omaezaki area, especially. These results are consistent with the displacement vector by GNSS. In this report, we also reported about InSAR time series analysis using *StaMPS* program was developed by the Stanford Institute of Technology.

Some of PALSAR data were prepared by the Japan Aerospace Exploration Agency (JAXA) via the Geospatial Information Authority of Japan (GSI) as part of the project ”ALOS Domestic Demonstration on Disaster Management Application” of the Earth Working Group. Also, we used some of PALSAR data that are shared within PALSAR Interferometry Consortium to Study our Evolving Land surface (PIXEL). PALSAR data belongs to Ministry of Economy Trade and Industry (METI) and JAXA. We would like to thank Dr. Shimada (JAXA) for the use of his *SIGMA-SAR* software. In the process of the InSAR, we used ”the digital elevation map 50m-mesh” provided by GSI, and Generic Mapping Tools (P.Wessel and W.H.F.Smith, 1999) to prepare illustrations.

Keywords: InSAR, Ground deformation, ALOS/PALSAR, Tokai region

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Monitoring of Sakurajima Volcano using Cosmo-SkyMed

MIYAGI, Yosuke[1*] ; OZAWA, Taku[1] ; SHIMADA, Masanobu[2]

[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, Deformation

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Volume Increase of Lava within the Kirishima, Shinmoe-dake Crater, Detected by TerraSAR-X/DInSAR

MIYAGI, Yosuke[1*] ; OZAWA, Taku[1] ; KOZONO, Tomofumi[2] ; SHIMADA, Masanobu[3]

[1]National Research Institute for Earth Science and Disaster Prevention, [2]Department of Geophysics, Graduate School of Science, Tohoku University, [3]Japan Aerospace Exploration Agency

Shinmoe-dake in the Kirishima volcano group is located in southwestern part of Japan. In January 2011, eruptive activities started from the Shinmoe-dake crater with a rapid accumulation of lava within the crater. The eruption phase ceased by the beginning of September, and the post-eruptive inflation also ceased by November 2011. After the 2011 eruption, monitoring by TerraSAR-X have continued and revealed a continuous shortening of satellite-ground distance even after the end of the main activity. This LOS shortening means uplifts of the lava surface. We estimated the volume increase of the lava after November 2011, using DInSAR processing of TerraSAR-X data, and concluded that the volume increase still continued in January 2014. The volume change rate has exponentially decreased with a small fluctuation as an overall trend. PSInSAR and long-term DInSAR results show LOS elongation including a subsidence in the northeast flank of the crater. It is interpreted that the subsidence is caused by deflation of a shallow deformation source located just beneath the crater. A total amount of effused lava after November 2011 is comparable to a volume decrease of the shallow source estimated from the deflation deformation. This long-term continuous lava extrusion suggests a possibility of an additional injection from the deeper source.

Keywords: SAR, Kirishima, Shinmoe-dake, Deformation

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Crustal deformation in Izu-Oshima Island detected by PS-InSAR analysis and estimation of volcanic deformation source

HASEGAWA, Yuichi[1*] ; TABEI, Takao[2] ; OZAWA, Taku[3]

[1]Grad. School Int. Arts Sciences, Kochi Univ., [2]Fac. Science, Kochi Univ., [3]National Research Institute for Earth Science and Disaster Prevention

Mt. Mihara in Izu-Oshima Island have erupted 21 times in the last 800 years. The latest eruption occurred in 1986 inside the caldera. Though spatially and temporally dense observation network is desired to continuously monitor volcanic activities, it is not easy to construct such a network in a mountainous region. In this study, we conduct time-series analysis of ALOS/PALSAR images over Izu-Oshima Island using persistent scatter interferometric SAR (PS-InSAR) method to detect volcanic deformation.

From the analysis of 20 images collected from ascending track during the period from October 2007 to February 2011, we detect distance change of about 15 cm extension in the line-of sight (LOS) direction inside the caldera. Similarly the extension of about 14 cm is detected at the same location from the analysis of 18 images from descending track during the period from January 2007 to March 2010. Next we compare the LOS distance changes with those converted from GPS coordinate time-series at four continuous sites in the island. The RMS between them are as large as 1.3-3.2 cm, implying that SAR results are good enough to monitor volcanic deformation over the island.

Combining the LOS distance changes from the ascending and descending tracks, we derive quasi-vertical and quasi-east-west components of the displacement. The most remarkable is the vertical displacement of the caldera where the subsidence of about 16 cm is detected during 2007-2010 with small occasional uplifts. Moreover uplift of about 11 cm is recognized in the eastern coastal area of the island during the same period. Based on the quasi-vertical component of the displacement, we estimate a spherical pressure source model (Mogi, 1958) below the island. We assume two sources with different depth and estimate the optimum model using a grid search method. Horizontal position of the shallower source is fixed to coincide with the location of the caldera and its depth is varied every 0.5 km in a range of 2.0-4.5 km. Horizontal position of the deeper source is varied every 2 km and its depth is checked every 0.5 km in a range of 5.0-10 km. The optimum model shows that the shallower source is located at a depth of 3.0-4.5 km where inflation and deflation are occurring alternatively while the deeper source is located at a depth of 6.0-9.0 km where nearly constant inflation rate of about 8 million m3 per year is expected. These results can be interpreted that the deeper magma reservoir continues to expand due to magma supply from the mantle while the shallower reservoir is affected by magma supply from the deeper source and gravitational load of lava that spreads within the caldera.

Keywords: PS-InSAR method, time-series analysis, Izu-Oshima Island, crustal deformation, volcanic deformation source

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Flow velocity measurements of ice streams in the southern part of Soya Coast, Antarctica, by DInSAR

SHIRAMIZU, Kaoru[1*] ; DOI, Koichiro[2] ; AOYAMA, Yuichi[2]

[1]The Graduate University for Advanced Studies, [2]National Institute of Polar Research

Differential Interferometric Synthetic Aperture Radar (DInSAR) is an effective tool to measure flow rate of ice streams on Antarctic continent. In this study, we applied the DInSAR technique to L band (wavelength 23.6cm) SAR data acquired by ALOS/PALSAR, and tried to measure flow velocity around Skallen, in the southern part of Soya Coast, East Antarctica. We used 9 scenes (Path633, Row 571-572), observed during the period from November 23, 2007 through January 13, 2010. In order to remove topographic fringes in the interferograms, we used a digital elevation model ASTER GDEM.

According to the analysis, ice flow rate of up to 3.5cm/day was obtained in the line of sight direction. Although no displacement is expected in areas of outcrops in general, we found displacements up to 37cm in the outcrops of obtained displacement maps. These displacements are considered to be apparent ones and must contain errors induced in the process of analysis. Therefore, it is possible to use apparent changes as a measure of the error contained in ice flow rate estimation.

In this presentation, we will show the results of flow rate estimation of the ice streams, and discuss the errors included in the flow rate estimation.

Keywords: Differential Interferometric SAR, Antarctic ice sheet, ice stream

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Flow measurements of ice sheets in Arctic region by differential SAR interferometry

DOI, Koichiro[1*] ; YAMANOKUCHI, Tsutomu[3] ; NAKAMURA, Kazuki[4] ; SHIRAMIZU, Kaoru[2]

[1]National Institute of Polar Research, [2]The Graduate University for Advanced Studies (SOKENDAI), [3]RESTEC, [4]Nihon University

Rapid ice sheet mass losses from ice sheets have been found in Greenland and the Canadian Arctic Archipelago on and after 2000 from the observations by the satellite gravity mission GRACE (Svendsen et al. 2012, Gardner et al. 2011). It is considered to be one of the causes that flow rate of ice sheet and ice stream was accelerated and ice mass outflow into the sea increased.

We aim to measure flow rates of ice sheet and ice streams in the Arctic region by applying differential Synthetic Aperture Radar (SAR) interferometry (DInSAR) with a digital elevation model ASTER GDEM to satellite SAR data. In addition, we intend to explore whether changes in the flow rate happen or not.

We obtained displacement maps along line of sight direction for 46 days of three regions in north eastern Greenland and Ellesmere Island of northern Canadian Arctic Archipelago observed by ALOS/PALSAR by applying differential SAR interferometry. We will show the obtained displacement maps in the presentation, and will also intend to discuss changes in the flow rates by applying three or four pass interferometry.

Keywords: Differential SAR interferometry, flow, ice sheet, Arctic region

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Spatial distribution and classification of rock glaciers in Kyrgyz Ala-Too Range, Central Asia

YAMAMURA, Akiko[1*] ; NARAMA, Chiyuki[1] ; TOMIYAMA, Nobuhiro[2] ; TADONO, Takeo[3]

[1]Niigata University, [2]RESTEC, [3]JAXA

In the arid and semi-arid region of Central Asia, Tien Shan Mountains is known as important water tower in Central Asia. Although the current situation of mountain glaciers and permafrost should be researched for estimate of water resources, mountain permafrost is not clarified in the Tien Shan (Marchenko et al., 2007; Sorg et al., 2012). In recent years, landslides caused by the melting of mountain permafrost in Ak-Shiyrak mountains, show that recent changes of mountain permafrost begin to influence to mountain environment including the disaster. In this study, to clarify mountain permafrost environment, we researched spatial distribution and classification of rock glaciers in Kyrgyz Ala-Too Range, Tien Shan Mountains. In addition, we applied InSAR analysis to the ALOS PALAR data obtained in 2007-2010, to research moving of rock glaciers. We extracted polygon data of rock glaciers based on aerial photo interpretation and ALOS PRISM, using ArcGIS. Rock glaciers were classified an active and inactive-fossil types by NDVI (Normalized Difference Vegetation Index) of ALOS AVNIR-2 and field observation in the summer 2013. The distributions of active rock glaciers show the lower limit of mountain permafrost is 3300m in the northern part and 3500m in the southern part of the Kyrgyz Ala-Too Range. We confirmed moving of some rock glaciers in this mountain area using InSAR analysis. In particularly, the moving of rock glaciers in the southern part of the range is remarkable. The most of these active rock glaciers developed from glacier ice. We report the results in detail in JpGU meeting.

Keywords: mountain permafrost, rock glacier, InSAR, ALOS PALSAR, Tien Shan Mountains

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Development of InSAR processing tools in NIED ?Part3?

OZAWA, Taku[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. (4) SLC resampling. (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. (12) Geocoding.

In JPGU meeting 2013, we showed comparison between results from our processor and from GAMMA SAR processor. Although their results were roughly the same, it indicated that many improvement points remained. In 120th meeting of the Geodetic Society of Japan, we presented about improvement of coherence by the spectrum shift filter (Gatelli et al., 1994), improvement of calculation speed, and correspondence to skewed images. After that, this processor corresponded to the InSAR processing with FBS-FBD image pair of ALOS/PALSAR using SLC over-sampling and band-pass filter. We added DEM resampling function by over-sampling method and by the bi-cubic spline interpolation. Furthermore, we are attempting to improvement of the image matching now. After this correspondence, the first step of this development will be finished. In next step, we will attempt more improvements and additions of other advanced algorithms.

Keywords: SAR, InSAR, software, tool