

An Open-Source InSAR Time Series Analysis Package LiCSBAS and Its Application

*Yu Morishita^{1,2}, Milan Lazecky², Tim J. Wright², Jonathan R. Weiss^{3,2}, Yasser Maghsoudi², John R. Elliott², Andy Hooper²

1. Geospatial Information Authority of Japan, 2. University of Leeds, 3. University of Potsdam

For the past five years, C-band Sentinel-1 and L-band ALOS-2 have provided abundant and useful Synthetic Aperture Radar (SAR) data, which have the potential to reveal global ground surface deformation at high spatial and temporal resolutions. However, for most users, fully exploiting the large amount of associated data is challenging, especially over wide areas. Whereas Geospatial Information Authority of Japan (GSI) has been monitoring surface deformations over Japan areas using ALOS-2 data, a sophisticated time series analysis technique has not been implemented for the nationwide scale.

To help address these challenges, we have developed LiCSBAS (<https://github.com/yumorishita/LiCSBAS>, <https://doi.org/10.3390/rs12030424>), an open-source SAR interferometry (InSAR) time series analysis package that integrates with the automated Sentinel-1 InSAR processor (LiCSAR). LiCSBAS utilizes freely available LiCSAR products, and users can save processing time and disk space while obtaining the results of InSAR time series analysis. In the LiCSBAS processing scheme, interferograms with many unwrapping errors are automatically identified by loop closure and removed. Reliable time series and velocities are derived with the aid of masking using several noise indices. The easy implementation of atmospheric corrections to reduce noise is achieved with the Generic Atmospheric Correction Online Service for InSAR (GACOS).

Using case studies in southern Tohoku and the Echigo Plain, Japan, we demonstrate that LiCSBAS applied to LiCSAR products can detect both large-scale (>100 km) and localized (~km) relative displacements with an accuracy of <1 cm/epoch and velocities of ~2 mm/yr with ~60 observations over 2 years. We detect displacements with different temporal characteristics, including linear, periodic, and episodic, in Niigata, Ojiya, and Sanjo City, respectively.

LiCSBAS and LiCSAR products facilitate greater exploitation of globally available and abundant SAR datasets and enhance their applications for scientific research and societal benefit.

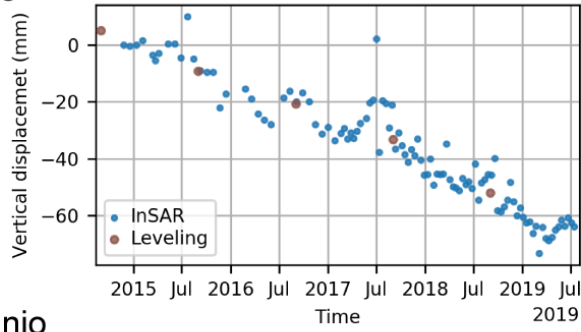
Interferograms from satellites other than Sentinel-1 and generated using a variety of software packages can also be processed by LiCSBAS. The software will enable GSI to improve its monitoring capability and realize robust continuous nationwide monitoring of surface deformation exploiting ALOS-2 and coming ALOS-4 data.

We also present applications of LiCSBAS and LiCSAR products to all major urban areas in Japan and continental-scale Alpine Himalayan Belt in this presentation.

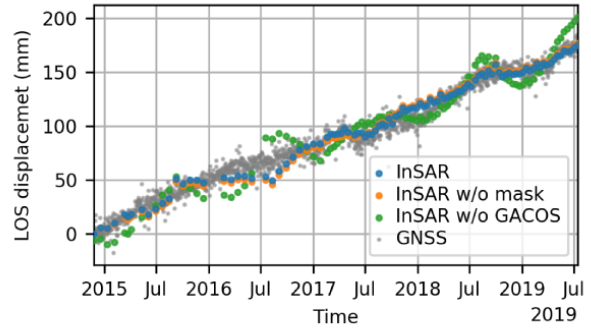
Keywords: InSAR, Sentinel-1, time series analysis, deformation monitoring, subsidence, automatic processing

Processed by LiCSBAS using LiCSAR products

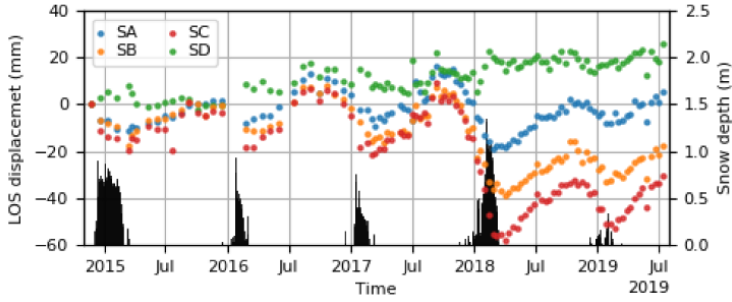
Niigata



GNSS 950179



Sanjo



Ojiya

