Development of InSAR tropospheric phase delay correction system at MRI (2nd report)

*Okuyama Satoshi[1], Shinobu Ando[1], Toshiki Shimbori[1]

1. Meteorological Research Institute

Introduction

SAR Interferometry is a technique which utilize the phase information of the SAR images to detect surface displacement which took place between two observations. However, its result contains the effect of medium between the antenna and the target such as tropospheric delay. Conventional method to correct tropospheric delay is proposed by Fujiwara et al. (1999), which assumes that the delay is a function of topographic height. On the other hand, correction using numerical weather model, which is independent data from SAR interferogram, is also proposed (Hobiger et al., 2008; Ozawa and Shimizu, 2010). We started the development of tropospheric delay correction system in MRI and reported our preliminary result (Okuyama et al., 2018). In our preliminary analysis, we calculated zenith delay and projected it on line-of-sight of the SAR observation. As an improvement, we replaced this by the integration of refractivity along line-of-sight of the SAR observation.

System composition

Our correction system consists of three units: 1) read grid point values (NuSDaS format) and interpolate in time to generate gridded data at the observation time, 2) calculate refractivity at each gridpoint, and 3) integrate refractivity to calculate the delay at each pixel in the interferogram. This composition allows us to replace each unit separately. For example, when new weather model is released, we replace unit 1) only, leaving the rest of the units unchanged.

Difference from preliminary result

We corrected interferogram of PALSAR-2 (path125/frame660, 2015/1/4 - 2015/8/16) using JMA-MA (Meso Analysis) data by both (A) projecting zenith delay on line-of-sight and (B) integrating the refractivity along line-of-sight. As stated above, tropospheric delay tends to have strong correlation between topography. Thus, we use correlation coefficient between phase and topographic height as a measure of correction quality. We obtained correlation coefficient of -0.431 for original interferogram, -0.097 for correction (A), and -0.047 for correction (B).
The difference between (A) and (B) shows correlation between delay and topography, however its factor shows horizontal variation. This is caused by the horizontal variation of the refractivity. The maximum difference between (A) and (B) is -2.1 radians.

Future direction

We will develop the support for other model types such as JMA-LA (Local Analysis) or JMA-GA (Global Analysis) as next step and validate the algorithm of interpolation/refractivity.

Acknowledgement

PALSAR-2 level 1.1 data are shared among PIXEL (PALSAR Interferometry Consortium to Study our Evolving Land surface) and provided from JAXA under a cooperative research contract with ERI, Univ., Tokyo. The ownership of PALSAR-2 data belongs to JAXA.

Keywords: SAR interferometry, atmospheric delay, numerical weather model

