Development of InSAR tropospheric phase delay correction system at MRI (4th report)

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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. To correct the tropospheric delay, method which utilizes numerical weather model has been proposed (Hobiger et al., 2008; Ozawa and Shimizu, 2010). We have been developing a tropospheric delay correction system since 2018 and obtained good result (Okuyama et al., 2019). This version, hereinafter called “version 1”, had problem in computation efficiency. We have improved the efficiency by replacing the coordinate system for calculation of the tropospheric delay.

Changes

Version 1 calculates tropospheric delay in ECEF coordinate system for the best accuracy. However, SAR interferograms is in geographic coordinate system, while numerical weather model we used, NuSDaS-format JMA-MA (Meso-Analysis), is a gridded data in Lambert conformal conic (LCC) projection. The difference of coordinate system of the input data forced us to calculate numerous times of coordinate transformation. Our new version, “Version 2” computes tropospheric delay in LCC projection. This reduce the number of coordinate transformation to just once per point. As a result, computation time reduced greatly, from 5 hours to 3 minutes. Calculation in LCC projection assumes flat Earth and may result in inaccurate estimation, however, the difference between Version 1 and 2 is around 1.5mm. This is small enough compared to the phase stability of the interferograms.

Future direction

Version 2 calculates tropospheric delay at the ground surface by extrapolating values from bottom 2 planes. We will introduce Land Surface data to eliminate extrapolation.

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