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An experiment in reduction of atmospheric phase delay in SAR interferograms using numerical meteorological models

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Interferometric satellite synthetic aperture radar (InSAR) analysis can provide detailed and spatially comprehensive ground deformation in a vast region with a cm-level precision. However, various error noises that are different from actual surface displacements are often included in interferograms with a few cm. Thus the observation accuracy is not so high, compared to other geodetic measurement method. It prevents us from detecting small deformation. One of the causes of noise is a phase delay due to an atmospheric effect. Radar wave transmitted from a SAR sensor is bent and slowed by propagating through the atmosphere. In this study, to reduce the atmospheric noise, we try to simulate the phase delay in the interferograms using numerical meteorological models. We use a numerical meteorological model constructed by CReSS (Cloud Resolving Storm Simulator). This model is calculated using a non-hydrostatic meteorological model with assimilating the Japan Meteorological Agency meso-scale objective analysis (MANAL) model as initial and boundary conditions. We can obtain a finer-meshed model spatiotemporally than the MANAL model. We evaluate the atmospheric phase delays in SAR interferograms with the following steps: 1) calculating atmospheric phase delays with a ray-tracing method for master and slave images using the corresponding numerical meteorological models, 2) subtracting modeled atmospheric phase delays from original interferograms. In this presentation, we will discuss the effectiveness on the reduction of phase delay noises which is done by extrapolating meteorological information.

Keywords: InSAR, Numerical meteorological model, Phase delay