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Correction for the atmospheric propagation delay in InSAR using numerical weather model and ray-tracing tool KARAT Part2

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Interferometric Synthetic Aperture Radar (InSAR) is an effective technique to measure a distribution of crustal movement over wide area. However, the derived phase signals include not only those due to crustal movements but also the effect of atmospheric propagation through troposphere. Since water vapor significantly changes not only spatially but also temporally, it is not straightforward to isolate its distribution, and thus difficult to extract only the signal due to crustal movement. Tropospheric water vapor signals are thus one of the issues of InSAR-based crustal deformation measurement.
In order to correct for tropospheric effects in InSAR data, we take advantage of the output results from high-resolution numerical weather model WRF (Weather Research and Forecasting model, Skamarockert et al., 2008) and high-speed ray-tracing tool KARAT (Hobiger et al., 2008). We have been investigating how much they are able to correct for the errors due to the troposphere and which approaches are better. In the previous report(Kinoshita et al., Geodetic Society of Japan 2009 meeting) we considered the computed value derived from WRF and KARAT as a model, and proposed 'a Hybrid method', using the model output and topography-correlated delay correction program atm_mod, and we verified it. The concept of topography-correlated delay correction is based on the idea that a signal correlated with topography (DEM) appears in unwrapped data and subtracting the model made by multiplying DEM by a factor from unwrapped data (Fujiwara et al., 1999). We hope to remove the residual phase error with the computed value based on WRF and KARAT. Although the calculated value derived from WRF and KARAT doesn't strictly reproduce the effect of atmospheric delay derived from InSAR, they should be more or less correlated with each other. Assuming above, we newly separate the calculated value derived from WRF and KARAT into the part correlated with topography (DEM) and the part uncorrelated with topography. In addition, we divide the latter into some more elements using two-dimensional Fourier transform from low degree to high degree. As a result, we divide the amount of atmospheric delay into some elements as one component correlated with topography and other components uncorrelated with topography; the latter part consists of a couple of topography-uncorrelated components. Then considering these separated values as models and assuming that the sum of each models multiplied by factors is equivalent to the amount of atmospheric delay in InSAR, we tried to correct the atmospheric delay in InSAR with the calculated value obtained by determining these factors by least square method. At the lecture, the result of all kinds of method and the comparison of those will be discussed.

Keywords: InSAR, atmosphric propergation delay, high-resolution numerical weather model, high-speed ray-tracing tool