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InSAR で捉えた局所的水蒸気シグナルの再現に向けた WRF による数値シミュレーション
Numerical simulations using WRF model for reproducing localized delay signals derived from InSAR

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For elucidating the mechanism of meso-scale phenomena involving a phase change of water molecule, water vapor is one of the most important but poorly understood parameter in meteorology. Recently, the Global Navigation Satellite System (GNSS) are routinely used to provide near-real-time estimates of PWV (Foster et al., 2005) and to assimilate routine weather forecasts (e.g. Nakamura et al., 2004). However, the limitation using GNSS atmospheric delay for meteorology is its spatial resolution, for example about 20 km for the Japanese GNSS network (GEONET). Interferometric Synthetic Aperture Radar (InSAR) phase signals, which can detect surface deformations with high-spatial resolution, are affected by earth's atmosphere like GNSS. Therefore, InSAR can detect water vapor distribution with high spatial resolution without any surface deformation signals or other errors and thus is potentially useful for meteorological applications. In previous studies, Hanssen et al. (1999) showed the coincidence between water vapor signals detected by InSAR and spatial distributions of rainfall echo detected by a weather radar (WR), indicating the possibility of InSAR as a water vapor sensor. Kinoshita et al. (2013) showed the water vapor distribution during the heavy rain event using ALOS/PALSAR emergency observation data. They conducted the estimation of the three-dimensional (3D) water vapor distribution and performed numerical simulations by means of the Weather Research and Forecast (WRF) model, which could reproduce a convective system observed as a localized signal in the InSAR image. However, there were still few cases detecting localized water vapor signals with InSAR and few studies using InSAR for meteorological applications.

In our past presentations, we reported several case studies detecting localized water vapor signals associated with deep convective systems with InSAR derived from ALOS/PALSAR data (Kinoshita et al., JpGU 2013), some of which reached over 20 cm in the line-of-sight direction within 10 km square. Observed locations of these interferograms are at Niigata (two cases), Shizuoka, Kyoto, Saga and Miyazaki. These signals are equivalent to about 21 mm in the precipitable water vapor, and are higher than that around each signal. Each signal located at the very location of high rainfall intensity in the WR data, and is regarded as including few ionospheric effects because of the use of PALSAR data with descending orbit. Such localized signals strongly suggest the existence of developed convective systems at SAR observation time. However, it is difficult to elucidate mechanisms of phenomena that caused these localized signals.

In this study, we will perform numerical simulations using the WRF model for the purpose of investigate mechanisms of these phenomena and compare simulation results with derived InSAR data. At the presentation, we will show these results and discuss them.

キーワード: InSAR, 水蒸気, WRF, 伝搬遅延, Numerical simulation
Keywords: InSAR, Water vapor, WRF, Propagation delay, Numerical simulation