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[EE] Evening Poster | A (Atmospheric and Hydrospheric Sciences) | A-CG Complex & General

## [A-CG36]Satellite Earth Environment Observation

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Thu. May 24, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

In recent years, we cannot avoid facing issues on global environmental changes that occur in various spatiotemporal scales. The earth environmental observation data by satellites became the necessary basic data to tackle and solve those issues. Due to the recent advancement in the observation sensor technique and the data processing technique, the satellite observation has been showing rapid progress, and the time is changing from examining the accuracy of the observation sensor data to the advancement of the data application, leading to broaden potential users. In these days application became synergetic, so we comprehensively pick

up this topic in the Atmospheric and Hydrospheric Sciences Session of this Union Meeting that enables to comprise the atmospheric, oceanic and land sciences; by combining the intelligence and the knowledge of the party, we propose a session that aims to prompt further studies towards the issues on earth environmental change, the advancement in the data application and future plans of Earth Observation missions.

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## [ACG36-P05]Simultaneous Detection of Water Vapor and Raindrop during Heavy Rain Episodes by Interferometric Synthetic Aperture Radar: A New Aspect of InSAR Meteorology

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Keywords:InSAR, heavy rain, water vapor, ALOS

Precipitable water vapor data are now operationally derived by GNSS (GPS) meteorology, based on non-dispersive phase delay data. In the actual GNSS phase measurement, dual-frequency measurements are performed to separate dispersive phase due to ionosphere and non-dispersive phases such as water vapor and crustal deformation. GNSS meteorology has developed from one of the latter "noisy" phase for GNSS geodesy.

While GNSS geodesy provides us with the receivers' position data and their changes, satellite-based interferometric synthetic aperture radar (InSAR) has been growing over the past two decades as another powerful technique to detect surface deformation signal with unprecedented spatial resolution. JAXA has launched ALOS1 in 2006 and its follow-on ALOS2 in 2014, both of which carries L-band SAR sensor, PALSAR1/2. Crustal deformation signals due to world-wide earthquakes and volcanic eruptions as well as glacier/ice sheet motion have been detected by InSAR based on PALSAR1/2.

Taking advantage of its extraordinary high spatial resolution, InSAR meteorological study has been gradually in progress. Kinoshita and Furuya (2017, SOLA) detected phase anomaly in ALOS/PALSAR InSAR data associated with a heavy rain over Niigata-Yamagata area, Japan, and performed numerical weather model simulations to reproduce the signals.

In contrast to GNSS precision positioning, however, SAR imaging is based on a single carrier frequency,

and thus no operational ionospheric corrections have been performed in the InSAR data analyses, which is particularly important in L-band system because of lower frequency. Gomba et al (2016) detailed the split-spectrum method (SSM) for InSAR, which splits the finite bandwidth of the range spectrum and virtually allows for dual-frequency measurements. Furuya et al (2017, Earth Planets Space) applied the SSM to InSAR images that detected ionospheric sporadic-E episodes to separate dispersive and non-dispersive phases.

Here, we apply the SSM to the L-band InSAR data that detected heavy rain episodes. Originally, we expected no anomalies in the dispersive phase that is associated with heavy rain, even though there remained ionospheric effect. However, we noticed the presence of phase anomalies in both dispersive and non-dispersive phases, which were both localized and seemed unlikely due to ionospheric signals. The non-dispersive phase is apparently due to the water vapor anomaly associated with the heavy rain episodes, whereas the origin of the localized dispersive phase was not clear. Examining the frequency dependence of refractivity during heavy rain, we now interpret that the dispersive phase will indicate the locations of extreme heavy rain whose rain rate is greater than 50 mm/hour or so. This would be the first simultaneous detection of water vapor and raindrop during heavy rain by a single satellite radar sensor, suggesting a new possibility of InSAR for meteorological application.