Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

AAS001-P01 Room:Convention Hall Time:May 25 15:45-16:15

Water vapor distribution during the heavy rain estimated with InSAR and GPS

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Interferometric Synthetic Aperture Radar (InSAR) phase signals allow us to map the Earth's surface deformation, but are also affected by earth's atmosphere. In particular, the heterogeneity of water vapor near the surface causes unpredictable phase changes in InSAR data. InSAR can therefore provide us with a spatial distribution of precipitable water vapor with unprecedented spatial resolution in the absence of deformation signals and other errors. On 2 September 2008, a torrential rain struck wide areas over central Japan, and Japan Aerospace exploration Agency (JAXA) carried out an emergent observation of the heavy rains by PALSAR, an L-band synthetic aperture radar sensor. On January 2010, JAXA has carried out another PALSAR measurement of the very areas, so that we could generate InSAR image of the area and examine the detailed snapshot of the regional troposphere; the weather on January 21 2010 was dry and stable. Near Ibi River, we could detect localized signals, which changed 12.2 cm in radar line-of-sight over a spatial scale on the order of 8 km, and were unlikely to be an artifact of either ground deformation or DEM errors, or ionosphere. In the previous report (Kinoshita et al., 2010 AGU Fall Meeting), we validated this point, having shown other InSAR images as well as azimuth component of pixel-offset data. Then we concluded that the signal was due to neither ground deformation nor DEM errors, and we considered that the signal was probably not due to ionospheric effect.

Now we newly try to model the ionospheric effect using azimuth offset data with the method proposed by Meyer et al. (2006). As a result, we concluded again that the ionospheric effect hardly correlated with the signal (Kinoshita et al., SAR session this meeting). In addition, we compare the tropospheric delay in InSAR data with that derived from the GEONET data, the Japanese GPS network. The principle of atmospheric propagation delay in GPS is inherently same as that of InSAR, therefore it is worth to compare of tropospheric delay between GPS and InSAR. We will discuss what we can learn from the InSAR image and GPS zenith wet delay data.

References

[1] Meyer, F., R. Bamler, N. Jakowski, and T. Fritz (2006): Methods for small scale ionospheric TEC mapping from broadband L-band SAR data, in Proc. IGARSS, Denver, CO, Jul. 31-Aug. 4., 3735-3738.

Keywords: InSAR, heavy rain, propagation delay, GPS