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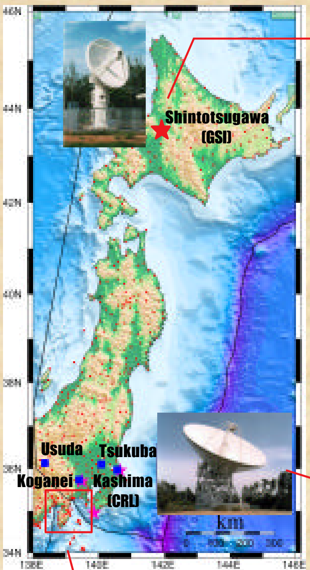
Comparison of Atmospheric Parameters from VLBI, GPS and WVR in the Kanto district, Japan

Ichikawa R.(1), Ohkubo H.(1), Ohsaki H.(1), Sekido M.(1), Nakajima J.(1), Koyama Y.(1), Kondo T.(1), Amagai J.(2), Kiuchi H.(2), Yoshino T.(2), Takahashi F.(2), Aonashi K.(3), Shoji Y.(3), Seko H.(3), Iwabuchi T.(3), Ohtani R.(4), Kurihara S.(5), Takashima K.(5), and Fukuzaki Y.(5)

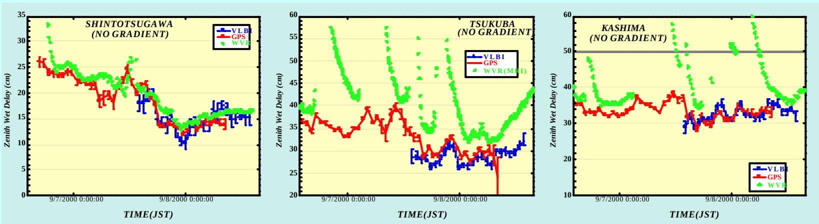
(1) Kashima Space Research Center, Communications Research Laboratory
(2) Communications Research Laboratory
(3) Meteorological Research Institute, Japan Meteorological Agency
(4) Geological Survey of Japan, National Institute of Advanced Industrial Science and Technology
(5) Geographical Survey Institute

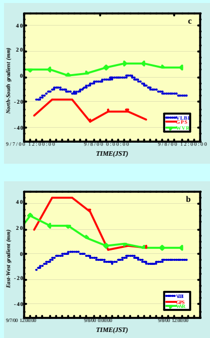
Abstract

Radio signal delay associated with the neutral atmosphere is one of the major error sources for space-based geodetic techniques such as the Global Positioning System (GPS) and Very Long Baseline Interferometry (VLBI). The comparison of atmospheric parameters (equivalent zenith wet delay and linear horizontal delay gradients) derived from VLBI, GPS, and WVR has been carried out to reveal the limitation of the anisotropic mapping functions under the intense mesoscale phenomena. For the four stations of the Key Stone Project(KSP) geodetic VLBI network (Kashima, Koganei, Miura and Tateyama) atmospheric parameters from all these techniques have been analyzed for the summer and autumn season experiments of the year 2000 and 2001. We are also evaluating those parameters by comparing with the ray-traced slant path delay through the two days data sets of the non-hydrostatic numerical weather prediction model with 5 km horizontal resolution. We find estimated weighted RMS differences below the 10-millimeter level and correlation coefficients more than 0.8 for the zenith wet delays derived from GPS and WVR. However, RMS differences between the zenith wet delays derived from VLBI and those from WVR are more than 50 millimeters. In addition, the agreement for the estimated horizontal delay gradients from these three techniques is less clear. The discrepancy between the VLBI results and other techniques is caused by the difficulty to estimate the vertical position, the clock offset and tropospheric parameters independently since the baseline lengths of the KSP VLBI network are relatively short (less than 150km).

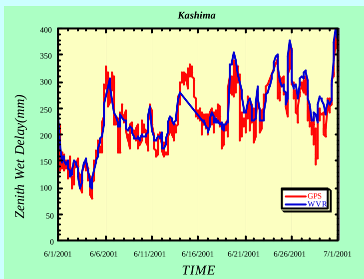


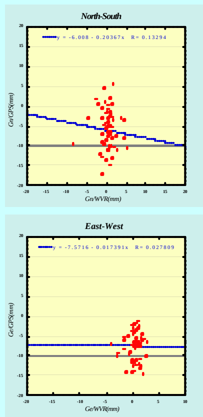
•Comparison #1
- •estimated equivalent zenith wet delay
- •linear horizontal delay gradients
- •simultaneous VLBI, GPS, and WVR observations
- •Long baseline





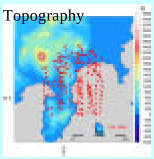
•Comparison #2
- •estimated equivalent zenith wet delay
- •linear horizontal delay gradients
- •simultaneous VLBI, GPS, and WVR observations
- •Short baseline

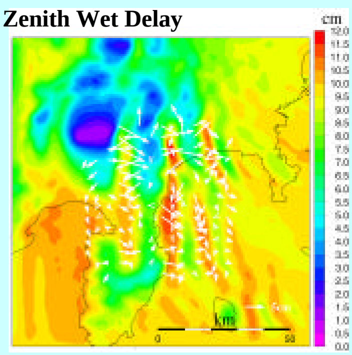




•Estimation of horizontal gradient using ray tracing through the fine-mesh numerical weather prediction (NWP) model

- •JMA 1.5km non-hydrostatic model (NHM)





•**Outlook**:Improvement of atmospheric model based on the NWP model