# An Evaluation of Tropospheric Gradient using Water Vapor Radiometers at VLBI Stations

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Anisotropic mapping functions have been used for the purpose of removing the propagation delays of radio signals from VLBI and GPS observables. However, the assumption of simple linear form of atmosphere is not always appropriate in the context of intense mesoscale convective systems in Japan. A field experiment for characterizing water vapor variations using water vapor radiometers(WVRs) have been carried out in the Kanto district of central Japan so far. According to the results of the experiment, there is no significant correlation between atmospheric gradient obtained by WVR and that estimated from GPS data. In this study we evaluate the tropospheric gradient estimated by VLBI observables using WVRs during the domestic VLBI campaigns by Geographical Survey Institute(GSI) in JAPAN

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). Recently, anisotropic mapping functions have been used for the purpose of improving the repeatability of horizontal site coordinates(MacMillan, 1995; Chen and Herring, 1997). Atmospheric gradients are assumed to have a simple linear form in the anisotropic mapping function. However, it suggested that this assumption is not always appropriate in the context of intense mesoscale phenomena such as the passing of cold front, heavy rainfall events, and severe storms in Japan. Thus, in June 1998 we initiated a field experiment for detecting and characterizing water vapor variations using water vapor radiometers(WVRs) in the Kanto district of central Japan. We estimate atmospheric gradients using WVR slant delays at Tsukuba and Kashima.

Day-to-day repeatability of horizontal site positions by GPS are significantly improved by a factor of 2 using a anisotropic mapping function during 1998 and 1999. Moreover, comparison of the mean characteristics of the gradients between GPS data and the WVR observations in the same period shows common mean southeast gradient. However, comparison of the day-to-day characteristics reveals inconsistency of the phase and amplitude of the time series between both estimated vectors.

We carried out WVR observations at the VLBI sites of the Geographical Survey Institute(GSI) during the GSI domestic VLBI campaigns at Kashima, Shintotsugawa (September 2000)and Chichijima (February 2001) sites in order to evaluate the tropospheric gradient. In addition, 3m VLBI antenna of the Gifu University was included in the GSI campaign on the September 2000. In that campaign a WVR of the Nagoya University was equipped nearby the 3m antenna. There are two advantages in this evaluation using VLBI data; (1) No uncertainties due to the satellite orbit error, and (2) Efficiency of the elevation cut off test in term of the low minimum elevation angle (i.e. 5 or 10 degrees). In this meeting we will present comparison between tropospheric gradient parameters using WVRs and those estimated by the VLBI analysis.