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Troposphere delay modeling using ray-traced delays around Tsukuba during a 14-days typhoon period in September 2007

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Accurate modeling of the tropospheric delay of microwave signals is of great importance for space geodetic techniques, such as Very Long Baseline Interferometry (VLBI) and the Global Navigation Satellite Systems (GNSS). In state-of-the-art VLBI analysis tropospheric zenith delays are estimated using mapping functions, and gradients are applied in order to account for azimuthal asymmetries. Monte Carlo simulations carried out within the International VLBI Service for Geodesy and Astrometry (IVS) to design the next generation VLBI system, VLBI2010, have clearly shown that the tropospheric delay is the limiting factor in VLBI analysis and that a simple gradient model, as currently applied, might be insufficient for VLBI2010 which will provide a much higher observation density.

The Japan Meteorological Agency (JMA) provides high resolution numerical weather models. With KARAT, the Kashima Ray-Tracing Tools, we computed tropospheric slant delays around the VLBI site in Tsukuba for a 14-days typhoon period in September 2007. The resolution of these ray-traced delays is 1° in both azimuth and elevation, and three hours in time. The delays exhibit significant azimuthally asymmetric characteristics. We fit spherical harmonic functions of different degrees and orders to the ray-traced delays in order to test their ability of modeling the spatial structures of the troposphere, and we investigate whether further continuation of the continued fraction form, i.e. estimating more coefficients, might improve troposphere modeling.