Characteristics of Kelvin Waves Observed with Radiosondes and simultaneous CHAMP/GPS radio occultation measurements

M. Venkat Ratnam (1), T. Tsuda (1), T. Kozu (2), and S. Mori (3)

(1) Research Institute for Sustainable Humanosphere (RISH), Kyoto University, Japan, (2) Faculty of Science and Engineering, Shimane University, Japan, (3) Institute of Observational Research for Global Change (IORGC), Japan (vratnam@rish.kyoto-u.ac.jp)

As a part of the Coupling Processes in Equatorial Atmosphere (CPEA) program, an intensive radiosonde sounding was conducted for 30 days from April 10 to May 9, 2004, coinciding with the eastward phase of QBO, at seven stations over the Indonesian maritime-continent including the Equatorial Atmosphere Radar (EAR) site in Koto Tabang (0.2^oS, 100.32^oE), west Sumatra. Using radiosonde profiles we studied the behavior of equatorial Kelvin waves with the period of 10-12 days and vertical wavelength of 6-7 km. The global feature of the Kelvin wave was also analyzed with simultaneous CHAMP/GPS (CHAllenging Mini satellite Payload/Global Positioning System) radio occultation (RO) data. The Kelvin wave characteristics delineated by the GPS RO analysis, assuming zonal wave number 1 and 2 components only shows a good agreement with radiosonde results in the stratosphere, although the wave amplitudes were estimated as somewhat smaller for GPS RO. However, discrepancy in the Kelvin wave characteristics was recognized around and below the tropopause probably because higher zonal wave number (>2) components were dominant in the troposphere. The Kelvin wave amplitudes were enhanced around the tropopause and in the lower stratosphere between 17 and 25 km, and dissipated above consistent with earlier results. GPS RO results show eastward phase propagation with wave number 1 during first half of the CPEA campaign, while a mixture of wave numbers 1 and 2 appeared during second half. We also report the modulation of the tropopause structure by these Kelvin waves.

We report another case study of the modulation of tropopause structure due to local (smaller horizontal scales) and partly due to global-scale variations using intensive radiosonde campaign conducted during November 2002 at Koto Tabang. The cold point tropopause (at 16.5 km) jumped up to the height (19 km) with minimum temperature phase of the global-scale Kelvin wave. All the features observed during CPEA campaign is also noticed during this campaign. Longitude-time section of CHAMP GPS RO data reveals the existence of smaller horizontal scale perturbations below the tropopause. Clear eastward motion of this local phenomenon is seen from the Indian Ocean approaching the Koto Tabang during 18-19 November 2002 without having global structure. Since all the major properties of Kelvin waves have been found es-

pecially in upper troposphere and lower stratospheric (UTLS) region, it is suggested that these higher zonal wave number ($\sim$3) components are responsible for the modification of the tropopause structure. Thus caution is advised in relating the tropopause variations observed with radiosonde observations with the large-scale Kelvin waves.