

Extremely large longitudinal variation of ionospheric bubble generation and its possible relationship with ITCZ

*Guozhu Li¹, Yuichi Otsuka², M. A. Abdu³, Mamoru Yamamoto⁴, Prayitno Abadi⁵

1.Institute of Geology and Geophysics, Chinese Academy of Sciences, 2.Institute for Space-Earth Environmental Research, Nagoya University, Nagoya, Japan, 3.Instituto Nacional de Pesquisas Espaciais (INPE), Sao Jose dos Campos, SP, Brazil, 4.Research Institute for Sustainable Humanosphere, Kyoto University, Uji, Japan, 5.Space Science Center, the Indonesian National Institute of Aeronautics and Space (LAPAN), Bandung, Jawa Barat, Indonesia

A close link between the atmospheric inter-tropical convergence zone (ITCZ) and ionospheric plasma bubble has been proposed since the last century. But this relationship has often appeared to be less than convincing due to the simultaneous roles played by several other factors, most importantly by the evening pre-reversal enhancement of eastward electric field (PRE) and its associated velocity shear, in shaping the global distribution of ionospheric bubbles. From simultaneous collaborative radar multi-beam steering measurements at Kototabang (0.2°S, 100.3°E) and Sanya (18.4°N, 109.6°E), conducted during September–October of 2012 and 2013, we find that there exists extremely large longitudinal variation in bubble generation but not in bubble occurrence. The total numbers of nights with bubble (i.e., occurrence rates) over the two stations are comparable, but the total number of nights with locally generated bubble (i.e., generation rate) over Kototabang is clearly more than that over Sanya. Further analysis reveals that a more active ITCZ is situated around the longitude of Kototabang. Considering that the two stations are separated only by 9.3° in longitude where the magnetic declination and the magnetic equator offset from the geographic equator are almost the same, the enhanced ionospheric bubble generation over Kototabang may be explained by upward propagating gravity waves (GWs) which could be generated frequently in the more active ITCZ and provide the seeding source for bubble development.

Keywords: ionospheric plasma bubble, atmospheric inter-tropical convergence zone, gravity wave