Optical observation of ionospheric plasma bubbles and mesospheric gravity waves

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During the SpreadFEx campaign, under NASA Living with a star(ILWS) program, carried out in the South American Magnetic Equator region from September 22 to November 8, 2005, two airglow CCD imagers, one located at Cariri (7.4S, 36.5W, Mag.9S) and the other at near Brasilia (14.8S, 47.6W, Mag.10S) were operated simultaneously and measured the equatorial plasma bubbles by the airglow OI 6300 intensity depletions. Simultaneous observation of the mesospheric OH emission wave structures made it possible to investigate relationship between the bubbles and gravity waves at around 90 km. From a total of 17 nights of observation, a good correlation of mesospheric gravity wave horizontal wavelength and ionospheric bubble inter-distance was found. On the evening of September 30, 2005, for example, comb-like bubble structures with a distance of ~130 km between them were observed. During the same period, mesospheric gravity wave with the horizontal wavelength of ~130 km was observed, suggesting possible seeding of the bubbles. Simultaneously observed ionospheric parameters (F-layer uplifting and scintillation) by ionosonde and VHF radar support the present hypothesis. Present work will therefore discuss a possible coupling mechanism between the ionosphere and mesosphere.

Relationship between GPS ionospheric scintillation occurrence over Indonesia and equatorial atmospheric waves!

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Equatorial Ionospheric scintillation observations using 1.6-GHz GPS radio waves have been made at Kototabang, Indonesia (0.20°S, 100.32°E; dip lat. 10.36°S) since January 2003: Scintillations due to plasma bubbles appear between 2000 and 0100 LT in equinoctial months with a seasonal asymmetry, and their activity decreases with decreasing solar activity. Scintillation index (S4) is compared with Earth's brightness temperature (Tbb) to find that the scintillation activity can be related to tropospheric disturbances to the west of Kototabang. The scintillation (plasma bubble) occurrences exhibit clear day-to-day variability. To investigate the reasons of this variability, we analyze data of S4, Tbb and lower thermospheric neutral wind over Kototabang. The results show that S4 fluctuates with periods of about 2.5, 5, 8, 14 and 25 days, maybe due to atmospheric waves from below, and that similar periods are also found in the Tbb and wind variations. Then, numerical simulations using the Kyushu University General Circulation Model are conducted to know the behavior of neutral wind in the equatorial thermosphere. The results indicate the following: (1) waves with periods of 2-20 days dissipate rapidly above about 125