

Study of gravity waves generated from strong tropospheric convection over Brazil by using multi-point GPS-TEC data

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It has been suggested that gravity waves causing the ionospheric disturbances were secondary waves generated by dissipation of primary gravity waves in the mesopause region or lower thermosphere. Vadas and Liu (submitted to JGR, 2013) simulated primary gravity waves generated from deep convection over Brazil after 18 UT on 1 October, 2005. They showed that the primary gravity waves generated secondary gravity waves through their dissipation in the thermosphere. The horizontal phase velocity, period, and horizontal wavelength of the secondary gravity waves were 500-600 m/s, 2-3 hours, and 4000-5000 km, respectively. They propagated even to Antarctica, Africa, and Europe.

In this study, we investigated whether these simulated gravity waves were actually observed or not, by using the total electron content (TEC) observed by the multi-point GPS receivers in South America. TEC perturbations which are likely to be caused by the gravity waves were seen around 4 UT on 2 October, 2005 in the TEC data at Brasilia, Brazil. The period of the observed TEC perturbation is slightly different from the original gravity-wave period since the observed period contains the effect of the GPS satellite motion, which varies depending on satellites. Based on multi-satellite analysis, we infer that the phase front of the observed gravity wave is east-west direction. The horizontal phase velocity, period, and horizontal wavelength of the gravity wave calculated by using the difference of the apparent periods were 660 m/s, 2 hours, and 4600 km, respectively. These parameters are similar to those of simulated secondary gravity waves described above. In the presentation, we discuss the comparison between the observed and simulated gravity waves.

Keywords: gravity wave, GPS-TEC, tropospheric convection