Global equatorial plasma bubble growth rates using ionosphere data assimilation

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In this study, Rayleigh-Taylor instability growth rates computed using the results of ionosphere data assimilation are used to investigate global plasma bubble occurrence. Thermosphere ionosphere electrodynamics global circulation model forecast results after assimilating total electron content measurements using ground network of global positioning system receivers are used in this work. The calculated growth rates are compared with rate of change of total electron content index (ROTI), estimated from global network of ground based global positioning system receivers, as well as ground based all sky airglow observations carried out over Taiwan. In contrast to the growth rates estimated using the model control run, the results after data assimilation show remarkable agreement with the ROTI. In addition, the all sky imager observations reveal intense bubble occurrence over Taiwan in the nights when the corresponding assimilated growth rates are significant. In the night of the St. Patrick’ s day storm on 17 March 2015, no plasma bubbles were recorded in the all sky images over Taiwan, which is supported by the smaller growth rates predicted by the assimilation model. The results further reveal that the significant improvement in the calculated growth rates could be achieved by the accurate forecast of zonal electric field in the data assimilation forecast. The results suggest that realistic estimate or prediction of plasma bubble occurrence could be feasible by taking advantage of the data assimilation approach adopted in this work.

Keywords: Equatorial Plasma Bubbles , RTI Growth Rate, Ionosphere Data Assimilation, GPS-ROTI

