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Column-like EED extending from equatorial topside ionosphere toward plasmasphere retrieved from IGS and LEO/GPS observations with 3-D CT inversion

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The electron density distributions in the equatorial ionosphere are retrieved from GPS observations of joint ground-based IGS and onboard CHAMP/GRACE satellites during November 2004 super-storm by 3-D tomography technique. For LEO satellite-based GPS receiving, both the occultation TEC data and that along the radio propagation paths above the LEO are used and assimilated into the huge IGS TEC dataset. The electron density images are reconstructed for different sectors of America, Asia and Europe and produced for every hour. The retrieved electron densities are validated by satellite in situ measurements of CHAMP Langmuir probe and GRACE Ka-band SST (low-low satellite-to-satellite tracking) derived electron density averaged between the two satellites, as well as by numerical simulations. It reveals some very interesting storm-time structures of Ne distributions, such as top-hat-like F2-3 double layer and column-like enhanced electron densities (CEED). The CEED are found during the main phase of the storm near the minimum of Dst and in the longitudinal sector centered at 157E. They extend from the topside ionosphere toward to plasmasphere, reaching at least about 2000 km as high. The footprints of the CEED stand on the two peaks of the EIA. The forming mechanism of CEED and its relationship with SED and plasmaspheric plumes are worthy of further study.

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