

Investigation of ionosphere space weather effects using FORMOSAT-7/COSMIC-2 based global ionosphere specification

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After operating more than one year in the orbit, radio occultation soundings of the low latitude ionosphere from FORMOSAT-7/COSMIC-2 have shown unexpected ionosphere variations under the extreme solar minimum condition. First of all, it is discovered that a category-1 minor geomagnetic storm triggered ionospheric electron density modifications could be more than 200% in respected to the background electron density level, which previous could only be seen under severe geomagnetic storm conditions. Secondly, observations show that the rare Antarctica stratospheric sudden warming (SSW) event occurred in September 2019 could produce a complex quasi 6-day oscillation (Q6DO) in the ionosphere possibly resulting from interactions between the migrating (sun-synchronized) atmospheric tides and the quasi 6-day waves (Q6DW) in the mesosphere and lower thermosphere (MLT) regions. The SSW driven Q6DO contributes as large as 30% of electron density oscillations, much greater than the usual Q6DO effect. Most recently, by using 1-year day-to-day observations, it is shown that under the deep solar minimum conditions, the daily electron density measurements reveal significant day-to-day variations over low latitudes, yielding about 10-20% percentage deviation in equinoxes during daytime, which increases to 20-30% in solstices, with largest variation of 40-50% in winter. These day-to-day ionosphere variabilities driven by the effects of solar and lower atmosphere origins and the climatological variations reveal the complex nature of the ionosphere variabilities and challenges to make the ionosphere forecast operational.

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