# First ionospheric radio occultation measurements from GNSS Occultation Sounder on the Chinese Feng Yun 3C satellite

**Tian Mao[1], Lingfeng Sun*[2], GuanglinYang[1]and Xinan Yue[2]**

[1] Key Laboratory of Space Weather, National Center for Space Weather, China Meteorological Administration, No. 46 Zhongguancun South Str.， Beijing, China
(E-mail: maotian@cma.gov.cn, yglyang@cma.gov.cn)

, [2] Key Laboratory of Earth and Planetary Physics, Institute of Geology and Geophysics, Chinese Academy of Sciences, 19 Beituchengxi Avenue, Beijing, China.
(E-mail: sunlingfeng@mail.iggcas.ac.cn, xinanyue@mail.iggcas.ac.cn)

## ABSTRACT

The Global Navigation Satellite System (GNSS) Occultation Sounder (GNOS) has been planned for the 5 Feng-Yun 3 series (FY3) weather satellites since 2013, the first of which, the FY3C satellite, was launched successfully at 03:07 UTC on 23 Sep 2013 from Taiyuan Satellite Base, Shanxi Province of China, into the orbit of 836 km altitude and 98.75° inclination. In addition to the Global Positioning System (GPS), the FY3C/GNOS is capable of tracking occultation signal of the BeiDou Navigation Satellite System (BDS) (also called COMPASS) from space for the first time. The quality of BDS radio occultation has been verified in terms of signal-to-noise ratio. In this study, the electron density profiles (EDP) observed by FY3C/GNOS from both GPS RO and BDS RO, which were processed and archived in the National Satellite Meteorological Center of China Meteorological Administration (NSMC/CMA), are compared with 32 globally distributed ionosonde observations, And then we compare GPS RO EDPs with ionosonde observations at Mohe (52.0°N, 122.5°E), Beijing (40.3°N, 116.2°E), Wuhan (31.0°N, 114.5°E), and Sanya (18.3°N, 109.6°E). FY3C/GNOS EDPs show good agreement with ionosonde measurements, with larger discrepancies near the equatorial ionization anomaly region at Wuhan and Sanya. The ionospheric peak density (NmF2) and peak height (hmF2), derived from FY3C/GNOS EDPs are also compared with those obtained from the globally distributed ionosondes for the day of year 274-365 in 2013. In generally, NmF2 and hmF2 has a higher correlation coefficient in the middle-high latitude than those in lower latitude region, due to the difference of ionospheric horizontal inhomogeneity. What's more, we compare the NmF2 and hmF2 measured by ionosondes with those obtained by GPS RO and BDS RO from FY3C during from DOY 274-327 in 2013. The correlation coefficients for NmF2 (GPS RO) and (BDS RO) are 0.88 and 0.90, and the correlation coefficients for hmF2 (GPS RO) and (BDS RO) are 0.90 and 0.94. The agreement is a little better for hmF2 than for NmF2. We also compared the NmF2 and hmF2 map between FY3C/GNOS and the International Reference Ionosphere 2012 (IRI-2012) model. However, the wave number 4 structure, which can be indicated clearly from FY3C/GNOS observations, could not be reproduced well by IRI-2012. Further

investigations show that the nighttime EDPs have obvious ionization enhancement around ionospheric E layer over Aurora and the South Atlantic Anomaly region due to the energetic particle precipitation indicated by the Space Environment Monitor (SEM) observations on board FY3C.
Keywords: FY3C/GNOS, GNSS, Radio Occultation, Ionosonde

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