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An introduction to FY3 GNOS in-orbit performance and preliminary validation results

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The FY3 GNOS (GNSS Occultation Sounder) mission is a GNSS (Global Navigation Satellite System) radio occultation mission of China for remote sensing of Earth's neutral atmosphere and the ionosphere. A key feature is GNOS will use both the Global Positioning System (GPS) and the Beidou navigation satellite systems. GNOS mission will be implemented by GNOS (GNSS Occultation Sounder) instrument, as a GNSS-based radio occultation explorer, on China FengYun-3 (FY3) 02 series satellites, the first of which FY3-C was launched at 03:03 UTC 23 September 2013. GNOS payload is developed by Center for Space Science and Applied Research, Chinese Academy of Sciences (CSSAR) and currently (January, 2014), more than 550 (400 GPS + 150 Beidou) high-quality sounding profiles are being retrieved daily on a global basis. By measuring the phase delay of radio waves from GNSS satellites as they are occulted by the Earth's atmosphere, GNOS is able to probe global atmospheric temperature, pressure, and humidity and also to investigate ionospheric electron density profiles. Then, the data will be finally used for numerical weather prediction, climate research and space science studies. This paper describes the FY3 GNOS mission and GNOS instrument characteristics. The inversion methods for GNOS data processing are presented. And then, this paper presents some of the early results from GNOS in the in-orbit validation testing period (Oct. 2013 – Jan. 2014). GNOS neutral atmosphere data have been compared to data from the radiosonde. We find that the refractivity profiles obtained by GNOS are reasonable and consistent with those of radiosonde with standard deviations lower than 2%. The GNOS has as well as generated many ionospheric vertical profiles of electron density. The ionospheric profiles have already been compared to ground-based ionosonde data and show that the peak electron density (NmF2) of GNOS ionopheric products are consistent with the measurement of ionosonde, and the correlation coefficient is greater than 0.9, and the standard deviation of their relative differences is about 20%.