



Ionospheric Plasma Irregularities Characterized by the Swarm satellites

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The Earth's ionosphere is often characterized by irregularities and turbulence, which are the result of instabilities reflecting complex interactions in the near Earth space environment. Ionospheric irregularities can be present at all latitudes. They can be, for example, associated with the plasma bubbles or blobs at equatorial and low geomagnetic latitudes, and the polar cap patches at high-latitudes. Even though the physical processes and instability modes associated with these plasma irregularities at different latitudes are distinct, they all show irregularities at multiple scales that have similar statistical properties and impacts on the near-Earth environment. A comprehensive characterization of ionospheric irregularities over all geomagnetic latitudes is important for both research and operations that rely on trans-ionospheric radio signals. In this study, we develop a new high-level data product that characterizes ionospheric plasma irregularities by using the measurements from the Swarm satellites along the whole satellite track. The data product combines complementary datasets from Swarm satellites, i.e. the electron density from the electric field instrument, the GPS data from the onboard GPS receiver, and the magnetic data from the vector field magnetometer, as well as level 2 Swarm data products. We derive new parameters in addition to the existing datasets and provide comprehensive information on plasma irregularities and fluctuations at all latitudes. In this work, we present the first dataset, which is validated against ground-based measurements. The finalized data product will be a new useful tool for the global studies of ionospheric irregularities and turbulence.