

Atmospheric and Ionospheric Radio Occultation Measurements Obtained from Spire's Nanosatellite Constellation

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Spire Global, Inc., is a leading player in the nanosatellite sector, and the first to provide commercial, low-cost GNSS radio occultation measurements to support critical weather data for numerical weather prediction. Spire has ambitious goals of collecting over 100,000 radio occultation profiles per day, providing robust coverage of atmospheric measurements over the entire planet.

Each Spire satellite is equipped with an in-house built receiver designed to collect GNSS signals. As the signal passes through the atmosphere to the receiver, it is refracted by an amount dependent on the atmospheric characteristics along its path. This technique referred to as radio occultation can be used to estimate atmospheric properties such as refractivity and temperature with high precision, accuracy and vertical resolution. In this talk, we provide an overview of Spire's radio occultation measurements and how they are processed to produce accurate profiles of the lower atmosphere. Baseline statistics against numerical reanalysis models show that the overall quality of Spire RO profiles is comparable with that of past missions using much larger satellites.

In addition to augmenting the global observing system with a significant amount of high quality vertical atmospheric profiles, collected GNSS signals from Spire's constellation carry a wealth of information about the ionosphere. Similar to atmospheric soundings, the large quantity of spatially diverse and low-latency ionospheric soundings are the first of its kind and will be valuable for the improvement of space weather forecasting capabilities. Spire's ionospheric data capabilities are highlighted in this talk by providing an overview of the types of measurements received and processed including total electron content (TEC), scintillation and electron density, and reviewing recent results describing the current coverage and quality of the constellation data.