Could AI contribute to improve the quality of detection ionospheric irregularities in radio occultation profiles?

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Abstract

The GNSS radio occultation (RO) technique has been established successfully during the previous two decades. It evolved into a valuable observation tool for precise atmospheric and ionospheric vertical profiling. Radio occultation measurements provide globally distributed precise profiles of the refractivity of the Earth's atmosphere that can be converted into profiles of temperature, pressure, and water vapor in the lower neutral atmosphere and into electron density values in the ionosphere. The main advantage of this technique is that it provides the profiles in a very high vertical resolution covering the whole globe. Until today, there are about 14 million RO recordings available.

GNSS RO signals are very sensitive to vertical electron density gradients in the Earth's ionosphere. This becomes visible as strong fluctuations in, e.g., signal-to-noise ratio recordings, which allow detecting ionospheric disturbances like sporadic E layers in the lower ionospheric E region and equatorial plasma bubbles in the F-layer. Due to the geometry of the GNSS RO technique, it enables for the first time receiving a global and comprehensive picture of the occurrence and the properties of these phenomena in a high spatial resolution.

In this presentation, we like to give an overview on RO data availability. We will review the data analysis to derive information on ionospheric disturbances in the E- and F-layer. Furthermore, we discuss how AI methods could contribute to improving the quality of the detection of ionospheric irregularities.