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The use of propagation effects from diverse instruments allows the retrieval of more information about irregularities forming in the ionosphere

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Effects of the propagation of radio waves through spatial inhomogeneities (or irregularities) forming and occurring in the Earth's ionosphere depend on the combination of various aspects: the radio wave frequency (or wavelength), the propagation geometry, the detection strategy utilized to extract information from received signals.

Ionospheric irregularities form as a consequence of magnetohydrodynamic instability processes and mechanisms that take place under various geomagnetic conditions. The propagation of radio waves through ionospheric irregularities can produce effects that can be described at various orders of approximation: for example, a phase advance induced by the average bulk ionization, the rate of change of such an advance.

Propagation effects introduced by ionospheric irregularities vary in space and time with the presence of irregularities and with the combination of the aspects above, in response to different space weather conditions. When radio waves are utilized by specific applications, then the presence of ionospheric propagation disturbances can cascade to manifest a wider implication to the particular application concerned. For example, satellite positioning, navigation, and timing (PNT) experience degradation in the presence of ionospheric propagation disturbances that is related to propagation effects at various orders of approximation as well as to specific ionospheric and geomagnetic conditions.

This contribution illustrates examples of how ionospheric propagation disturbances can be quantified by using different and diverse instruments (e.g., satellite radio receivers such as from Global Navigation Satellite Systems, radio interferometers such as used in radio astronomy) and how more information about ionospheric irregularities can be extracted. The discussion also analyses the effect of the particular detection strategy used by diverse instruments and how this can affect the retrieval of information about ionospheric irregularities.