

Now-Casting Space Weather Using Conjugate Point Observations

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In this paper, we describe our initial results of ionospheric observations using optical instruments in one hemisphere to describe conditions in the other hemisphere where diagnostics are not available.

All-Sky-Imagers (ASIs) can record the airglow signatures of ionospheric irregularities that affect radio communications and navigation, e.g., from global navigational satellite systems. The airglow measured originates in the F-region and corresponds to an emission in 630.0 nm, known as the 'red line'. The ionospheric irregularities are detected as depletions in 630.0 nm airglow. At equatorial and low latitudes, the type of disturbances and irregularities known as equatorial spread-F (ESF) involves electrodynamic processes governed by the morphology of the Earth's geomagnetic field. Data from a single ASI allows the study of these irregularities in an area of about 10^6 km². Having ASI systems at both ends of a geomagnetic field line ("conjugate points") allows for tests of disturbance-coherence using one data set (e.g., in the southern hemisphere) to predict simultaneous conditions at its conjugate location (in the northern hemisphere). Our tests used ASI data from El Leoncito, Argentina (31.8° S, 69.3° W, - 19.6° mag lat) that exhibit airglow depletions associated with ESF to predict perturbed conditions at its conjugate point location in Villa de Leyva, Colombia (5.6° N, 73.52° W, - 16.3° mag lat). We find a high degree of now-casting success for broad temporal and spatial scales, but with significant differences at finer spatial scales.

Our preliminary conclusion is that ESF space weather now-casting using conjugate point data offers a realistic way to make predictions for "area-denied" observational sites.