

Modeling the Ionospheric Effects of Eclipses in South America: 2nd of July 2019 and 14th of December 2020 Cases

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Solar eclipses are rare astronomical events that impact the terrestrial atmospheric layers by the reduction of the incident solar irradiation along their obscuration path, particularly modifying the ionosphere. Recently, two total solar eclipses occurred in the South American region in just over a year, the so-called “South American Eclipse Season” period. During those extraordinary events, the gradual shadowing of the Moon blocks the main source of ionization production in a predictable manner, producing a large-scale experiment that provides us relevant information of the ionospheric characteristics and dynamics. Nevertheless, the radiation reduction of an eclipse has different effects on the different layers of the ionosphere located at distinct altitudes. Moreover, ionospheric responses are also highly dependent on the eclipse geometry, the geomagnetic latitude, its previous status, the plasma electrodynamics, and external forcing (such as space weather activity or lower atmospheric interactions). In this study we present the simulation results from the analysis of these two eclipses obtained with the Sheffield University Plasmasphere-Ionosphere Model (SUPIM) adapted at the Instituto Nacional de Pesquisas Espaciais (INPE). Additionally, simulation results are compared with Total Electron Content (TEC) measurements obtained from multiple networks of GNSS receivers located along the continent and ionosondes with different eclipse obscuration levels. The results of the model show

a good agreement with the experimental measurements, providing a detailed representation of eclipse effects at the low-latitudinal ionosphere.

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