Total Electron Content above South-America during the 14 December 2020 Total Solar Eclipse

Sylvain Blunier[1], Manuel Bravo[2,3], Juan Alejandro Valdivia[1,4]

[1]Departamento de Física, Facultad de Ciencias, Universidad de Chile
[2]Departamento de Geofísica, Universidad de Concepción
[3]Centro Interuniversitario de Física de la Alta Atmósfera
[4]Center for the Development of Nanoscience and Nanotechnology

Abstract:

The wide seismologic Chilean network contains about one hundred GNSS receivers that provide dual-frequency GNSS measurement with high temporal resolution (<1min). From this information, we can indirectly deduce the Total Electron Content (TEC) for the Chilean ionosphere with good spatial and temporal resolution. We built a new code that computes TEC based on several algorithms that reconstruct the signal from the RINEX files generated at the GNSS receivers. This code takes particular care of the cycle-slips that are common when satellites' elevation is low and compute biases of the receivers. It also calculates the bias of antennas which generally account for several TEC units.

On December 14, 2020, the Southern-American continent witnessed a total solar eclipse, which presents an excellent opportunity for the validation of this code. The totality path of the eclipse crossed Chile and Argentina between latitudes -37° and -40°. The ionospheric response of this event has been predicted in [1] using the SUPIM-INPE model. In this study, we propose to deepen this analysis with 2D maps of TEC from GNSS observations. Specifically, we study the spatio-temporal variation of 2D TEC patterns around the time of the eclipse, with particular emphasis on the passage of the shadow of the Moon in the South-American ionosphere. In order to validate this code, we have compared it with other codes of TEC determination.

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