On the importance of solar eclipse geometry in the interpretation of ionospheric observations

S. Stankov, T. Verhulst

Royal Meteorological Institute (RMI), Ringlaan 3, B-1180 Brussels, Belgium

A reliable interpretation of solar eclipse effects on the geospace environment, and on the ionosphere in particular, necessitates a careful consideration of the so-called eclipse geometry. A solar eclipse is a relatively rare astronomical phenomenon, which geometry is rather complex, specific for each event, and fast changing in time. The standard, most popular way to look at the eclipse geometry is via the two-dimensional representation (map) of the solar obscuration on the Earth's surface, in which the path of eclipse totality is drawn together with isolines of the gradually-decreasing eclipse magnitude farther away from this path. Such "surface maps" are widely used to readily explain some of the solar eclipse effects including, for example, the well-known decrease in total ionisation (due to the substantial decrease in solar irradiation), usually presented by the popular and easy to understand ionospheric characteristic of Total Electron Content (TEC). However, many other effects, especially those taking place at higher altitudes, cannot be explained in this fashion. Instead, a complete, four-dimensional (4D) description of the umbra (and penumbra), would be required. This presentation will address the issue of eclipse geometry effects on various ionospheric observations carried out during the total solar eclipse of August 21, 2017. In particular, GPS-based TEC and ionosonde measurements will be analysed and the eclipse effects on the ionosphere will be interpreted with respect to the actual eclipse geometry at ionospheric heights. Whenever possible, a comparison will be made with results from previous events, such as the ones from March 20, 2015 and October 3, 2005.