Dynasonde analysis of the Lusk, WI – Boulder, CO August 2017 total solar eclipse experiment data

Nikolay Zabotin*[(1)], Huan Song[(1,2)], Terence Bullett[(3,4)], and Justin Mabie[(3,4)]
(1) ECEE, University of Colorado Boulder, Boulder CO, USA
(2) Wuhan University, Wuhan, China
(3) NCEI, NOAA, Boulder CO, USA
(4) CIRES, University of Colorado Boulder, Boulder CO, USA

A unique experiment on synchronous vertical and oblique ionospheric radio sounding was performed at and around the time of the total solar eclipse on August 21, 2017, involving two Dynasonde/VIPIR systems near Lusk, WI and in Boulder, CO. Dynasonde utilizes all capabilities of modern digital phase-based HF sounding systems and provides sensitivity and accuracy of measurements far exceeding that of image-based processing techniques. An integral part of its data analysis package, the inversion routine NeXtYZ, allows revealing plasma density dynamics and structures from the true vertical profile of electron density, from zonal and meridional tilts, and from line-of-sight Doppler speed, all attributed to real altitudes with 1-2 km resolution. The impact of a solar eclipse on the ionosphere is qualitatively known to launch a plasma flux and gravity waves away from the eclipsed region. The predictable occurrence but highly unusual nature of these eclipse ionospheric effects offers the opportunity of a natural test bed for several concepts of the ionospheric physics. The eclipse of August 21, 2017 afforded a unique and nearly ideal geometry of our experiment to monitor the profile dynamics and the gravity waves in the direction perpendicular to the totality path and along the magnetic meridian of the existing Boulder Dynasonde/VIPIR system. Measuring the ionospheric effects at their origin, within the totality region and obliquely at the midpoint between the two vertical incidence systems is the first effort of this kind. In our presentation, we show the initial results of a Dynasonde-style analysis performed with the data.