Title: Ionospheric Impacts of Solar Eclipse: Observation and Sami3 Model Simulation

Presented by: Rajesh Kumar Barad

Abstract:

We present a case study of the impact of the 26 December 2019 solar eclipse on the ionosphere using ground and space-based observations as well as the Sami3 model simulation. Solar eclipse observation gives a unique opportunity to study the impact of solar radiation on the atmosphere-ionosphere coupled system. The high-resolution Ionosonde observations at Tirunelveli, GPS TEC observations from a chain of GPS receivers along and across the eclipse path, TIMED-SABER, and Ionospheric Connection Explorer (ICON) satellites were utilized to investigate the eclipse-induced variations in electron density and thermospheric cooling. We noticed a tremendous increase and decrease in the base height of the F-layer, resembling the nighttime Pre-Reversal Enhancement (PRE). Near the eclipse maximum, a strong blanketing sporadic E layer was observed at Tirunelveli with a top frequency of ~18 MHz for 1 hour and 26 minutes. Satellite traces (STs) and 'U' shaped ionograms were noticed for the first time over Tirunelveli during eclipse maximum and end phases. The 'STs' and 'U' shaped traces indicate the presence of short-period gravity waves or TID type of wave perturbations over the Indian region. A maximum of ~5–7 TECU (30–40%) decrease in TEC is observed on the eclipse day for iisc, hyde, and tiru stations. Periodogram analyses of TEC data showed the presence of wavelike structures with periodicities of 18–24 minutes for different stations. Simultaneous observations from the ICON satellite showed an increase and decrease in hmF2 and NmF2 which matches well with the ionosonde observations from Tirunelveli. The temperature profiles from TIMED-SABER and ICON satellites showed a reduction and enhancement in the lower and upper E regions respectively. Our simulation results indicate that in the vicinity of the eclipse (1) the total electron content (TEC) decreases by up to ∼ 5-7 TEC units (TECU; 1 TECU = $\times 10^{16}$ m^{-2}) which is a ∼ 30-40 % decrease in TEC, (2) the electron density decreases by a factor of ∼ 50% in the *F* region. Interestingly, the eclipse-time changes in the ionospheric conductivity led to significant changes in the equatorial electrojet