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On the Response of Equatorial Thermosphere-Ionosphere System to the Annular Solar Eclipse on 26 December 2019: Preliminary Results

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Solar eclipse

Solar eclipses are rare transient events which helps to understand the role of coupling between thermosphere and ionosphere.

- A major transient event happened in 26 December 2019 is an annular solar eclipse (obscurity ~85% at Trivandrum, India).
- It provided noteworthy opportunity to study the upper atmospheric response to sudden decrease in solar insolation during the onset of equatorial electrodynamics.
 It has implications in the distribution of plasma from equatorial to low latitudes.

Eclipse Path



Figure 1



4

F (10.7) cm

Magnetic field from different INTERMAGNET and MAGDAS stations during the event day



The role of eclipse in modulating the zonal winds in the MLT region



Eclipse day

Zonal neutral winds from TIMED (Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics) Doppler Interferometer (TIDI)





TIDI datasets (zonal winds) has been analyzed during the period. The wind plays significant role in the distribution of plasma, causing different neutral and electrodynamical processes.











Figure 16

The onset of equatorial electrodynamics got upset by the eclipse; the ionospheric electron density decreased up to ~30%.

The additional layering has been observed in the upper and lower altitudes namely $F_{0.5}$ layer and F_3 layers respectively over Trivandrum.





Conclusions

✓ The zonal winds have been found to be eastward at all latitudes (~100
°E) and have similar velocities from equator to low latitudes while the eclipse shadow crossed the equator.

 \checkmark The disappearance of additional stratification in the lower MLT region is caused by the changes in horizontal drift in the region alongwith fast recombination.

✓ The presence of an additional topside layer for a short period (F_3 layer) is caused by the piling up of charges by the upward drift, which helped in the sustenance of the plasma for a longer time.

✓ The EIA has also been reduced.

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- 5. DST index from https://wdc.kugi.kyoto-u.ac.jp/dstdir/
- 6. F 10.7 cm data from <u>https://omniweb.gsfc.nasa.gov</u>
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