2017 Workshop: 2017 Solar Eclipse

Long title
Coordinated observation and analysis of the 21 August 2017 solar eclipse effect on the upper atmosphere
Conveners
Shunrong Zhang
Phil Erickson
Description

For the first time in 26 years, a total solar eclipse will occur in the North American longitude sector on 21 August 2017, with partial and/or total eclipse occurring between ~16:00 and 20:00 UT depending on location. During the eclipse-induced sudden (in a few minutes) interruption in solar illumination, the neutral and charged particles in the upper atmosphere will undergo significant changes beyond what a normal sunset and sunrise process would generate. Although eclipse effects have been studied for more than 50 years, recent major advances in sensitivity and spatial/temporal resolution using modern observational techniques can provide timely new information on eclipse ionosphere - thermosphere - mesosphere (ITM) system response. The purpose of this session is to (1) discuss potential scientific eclipse-related topics that are of significant community interest, (2) discuss current availability and observing plans of ground-based and in situ instruments for the 21 August 2017 observation of the upper atmospheric responses; and (3) to coordinate community observation, analysis, and modeling efforts. We welcome contributions to address broad topics of the solar eclipse effect on the upper atmosphere, ranging from ground-based-based and in situ observations, analysis, to modeling. In particular, we welcome short presentations on observational and data sharing plans for the upcoming 21 August 2017 event.

Agenda

- Doug Drob: The 2017 Solar Eclipse; Influence on the Thermosphere/Ionosphere
- Joe Huba: SAMI3 prediction of the impact of the August 21, 2017 total solar eclipse on the ionosphere-plasmasphere system
- Robert Marshal: Studying the D-region ionosphere response to the total solar eclipse through data and modeling

- Nathaniel Frissel: HamSCI and the 2017 Total Solar Eclipse
- Anthea Coster: Differential Total Electron Content as observed by past solar eclipses
- Louise Gentile: Solar eclipse campaigns conducted by AFRL
- Shunrong Zhang: Incoherent scatter radar observations of solar eclipses (pdf)

Justification

This session will address science questions related to how the upper atmosphere system responds to the rapid reduction and recovery of solar irradiation. Research indicates these solar irradiation changes lead to not only changes in ionospheric photochemistry but also the energetics and dynamics in the upper atmosphere, all of which are fundamental CEDAR themes. Some of the challenging science and observational questions include photoelectron variations and eclipse caused atmospheric and ionospheric waves. The session will address these and other relevant questions and discuss coordinated community observational and analysis plans. This session will address CEDAR Strategic Thrust #2: Explore Exchange Processes at Interfaces and Boundaries (Characterize sources and sinks internally and externally to the SAIR and their possible variations due to the coupling and complexity of the Sun-Earth system).

Summary

This solar eclipse session provided a forum to discuss the science, observation and coordination for the August 21, 2017 solar eclipse over the continental US. 7 talks were presented and a roomful audience attended to the presentations and discussions. Shunrong Zhang provided a brief introduction to the session as well as to the eclipse event. Doug Drop gave a comprehensive talk addressing the variations of EUV and TIEGCM simulation results, focusing more on thermospheric changes associated the solar eclipse.Joe Huba reported his simulation for the August 21, 2017 eclipse, and highlighted changes in the plasmasphere and in particular, in the conjugate hemisphere. Rober Marshal talked about D-region solar eclipse observations using VLF technique as well as simulation of the complicated D-region chemistry. Nathaniel Frissel talked about the HamSCI network and the potential application of monitoring eclipse induced radio propagation changes to ionospheric study. Anthea Coster showed a few sample variations of GPS TEC caused by past solar eclipses. Louise Gentile shared information of the AFRL field campaigns using radio equipments during the eclipse period. Shunrong Zhang focused on past ISR

measurements of the solar eclipse effects and observational plans for the August 21, 2017 event. Shunrong Zhang also mentioned about the 2017 AGU session on solar eclipse.

It was a very informative session, and drew significant community attention to this major solar-terrestrial phenomenon.

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