MAS21-2021-000016

Abstract for an Invited Paper
for the MAS21 Meeting of
the American Physical Society

The ionosphere-thermosphere system's response to a total solar eclipse: looking forward to December 4, 2021[1]

GARETH PERRY, New Jersey Inst of Tech

The topic of this presentation will be the upcoming December 4, 2021 total solar eclipse and planned experiments to study the eclipse's effects on the ionosphere-thermosphere (IT) system. A total solar eclipse offers a unique opportunity to study the impulse response of the coupled IT system as the relatively sudden onset of the obscuration of the solar disc is comparable to a delta-function impulse acting on the system. Starting at 07:00:01 UT on December 4, 2021, just west of the South Georgia and South Sandwich Islands in the South Atlantic Ocean, the umbra of the eclipse will begin its southerly and westerly journey, traverse the Weddell Sea, Ronne Ice Shelf, and Palmer Land, and finish at the day/night terminator in the Bellingshausen Sea at approximately 08:06:29 UT. The remoteness of this eclipse's path makes it difficult to study with ground-based instruments; however, the path of totality is close to several populated scientific installations in Antarctica, including McMurdo Station, allowing for some opportunity to study the event from the ground. Several spacecraft, including CASSIOPE, the Canadian low-Earth orbit satellite carrying the Enhanced Polar Outflow Probe (e-POP), will be well positioned to study the eclipse. The probe will cross the umbral path within 30 minutes of totality, at approximately 800 km altitude. In preparation for the December eclipse, we will discuss past eclipse studies, focusing on the IT system's response to each event, including results from the 2017 "Great American Eclipse", which is arguably one of the most heavily studied eclipses from an IT perspective. We will outline outstanding questions concerning the effects of an eclipse on the IT system which remain unresolved, including whether travelling ionospheric disturbances (TIDs) are a byproduct of an eclipse. These outstanding questions form the foundation of our upcoming e-POP Antarctica Eclipse Campaign, which is scheduled to commence in mid-November 2021. We will provide details of the e-POP campaign as well as other international efforts underway to observe the eclipse, despite the complexity of instrument deployment during the COVID-19 pandemic.

[1]This work is supported by NASA grant number 80NSSC21K1774