SA018-07

Observations and Modeling of the Ionospheric Topside Response to the Moon's Shadow During Solar Eclipses

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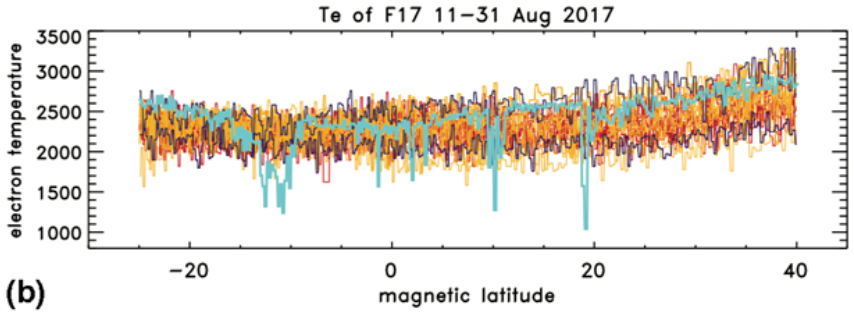
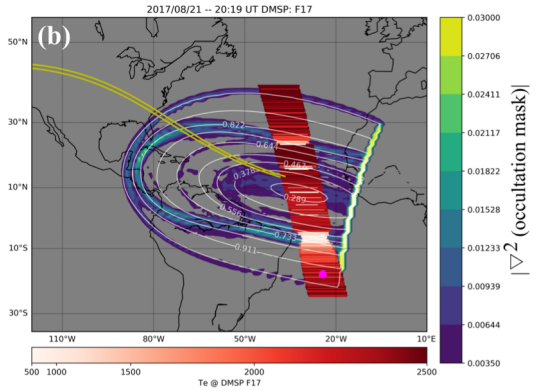
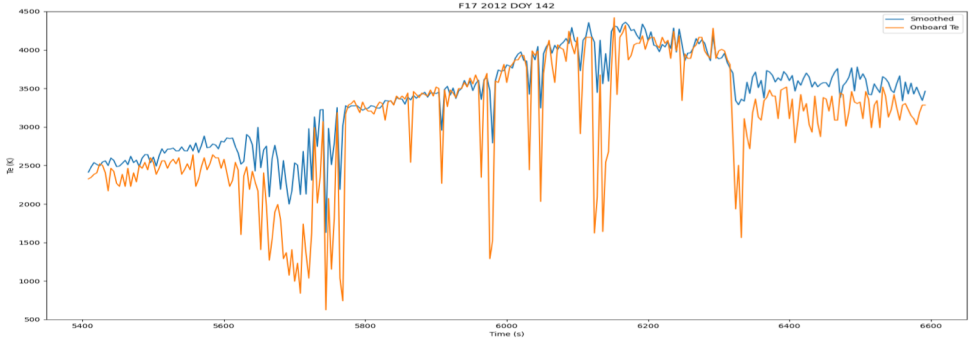
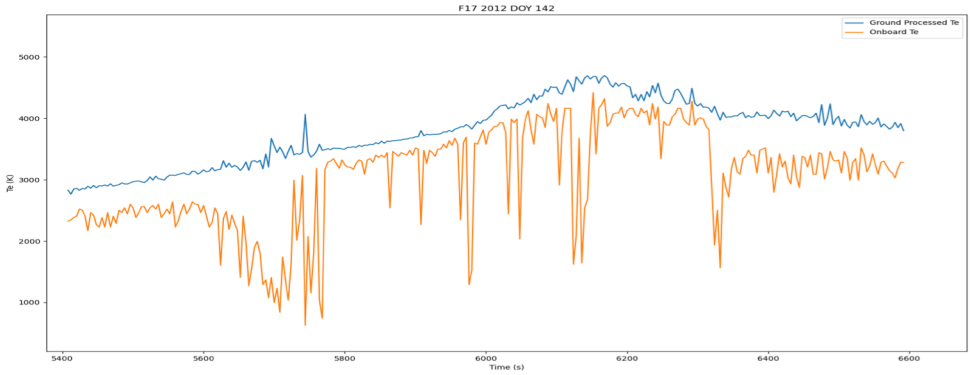








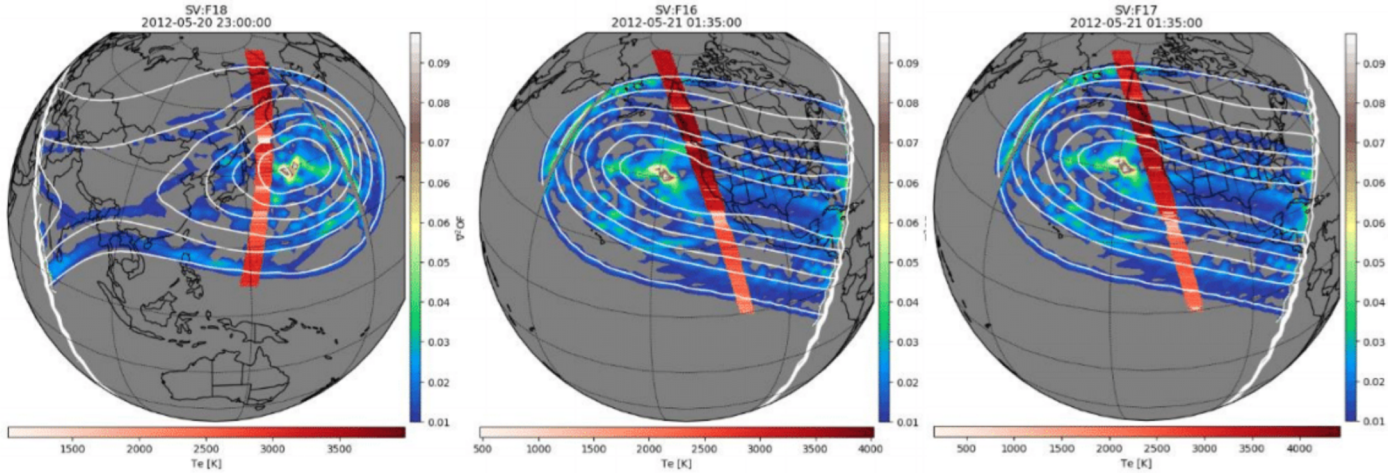
This worked started with the 21 August 2017 eclipse (above) where DMSP observed strange dips in the electron temperatures at 850 km that matched the regions of large gradient in the EUV from the moon's shadow.

Further examination of over a dozen eclipses showed similar patterns in the electron temperature in the moon's shadow.

Work on these other eclipses (right) showed that the dips in the electron temperatures were likely an artifact of the data reduction algorithm dealing with noisy sweeps from the Langmuir probe.

F17 eclipse pass on 21 May 2012

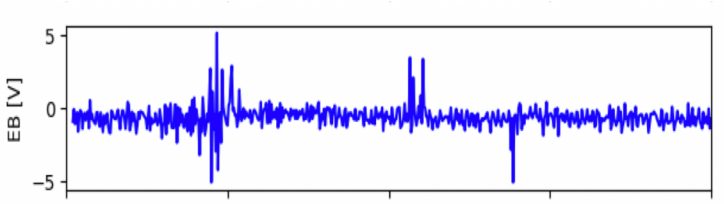
The temperature “dips” were caused by noisy data in the Langmuir probe sweeps and these regions of still correspond to the regions of large gradients in the EUV from the sun caused by the moon’s shadow (seen here in the May 2012 eclipse). We identified three types of anomalous behavior of the plasma instruments that occurred during the eclipse.



Noisy data in the Langmuir probe sweeps

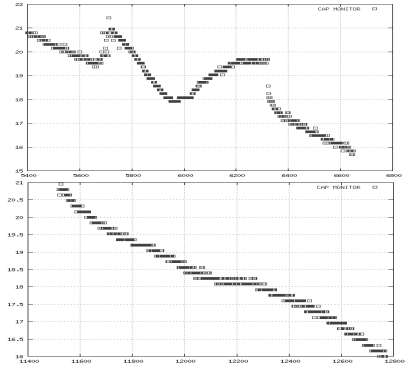
Normal smooth Langmuir probe sweep (left) gives nominal electron temperatures. The slightly noisy (center) and very noisy (right) sweeps in the EUV gradient region give the erroneous low electron temperatures.

High energy ions/electrons in the RPA

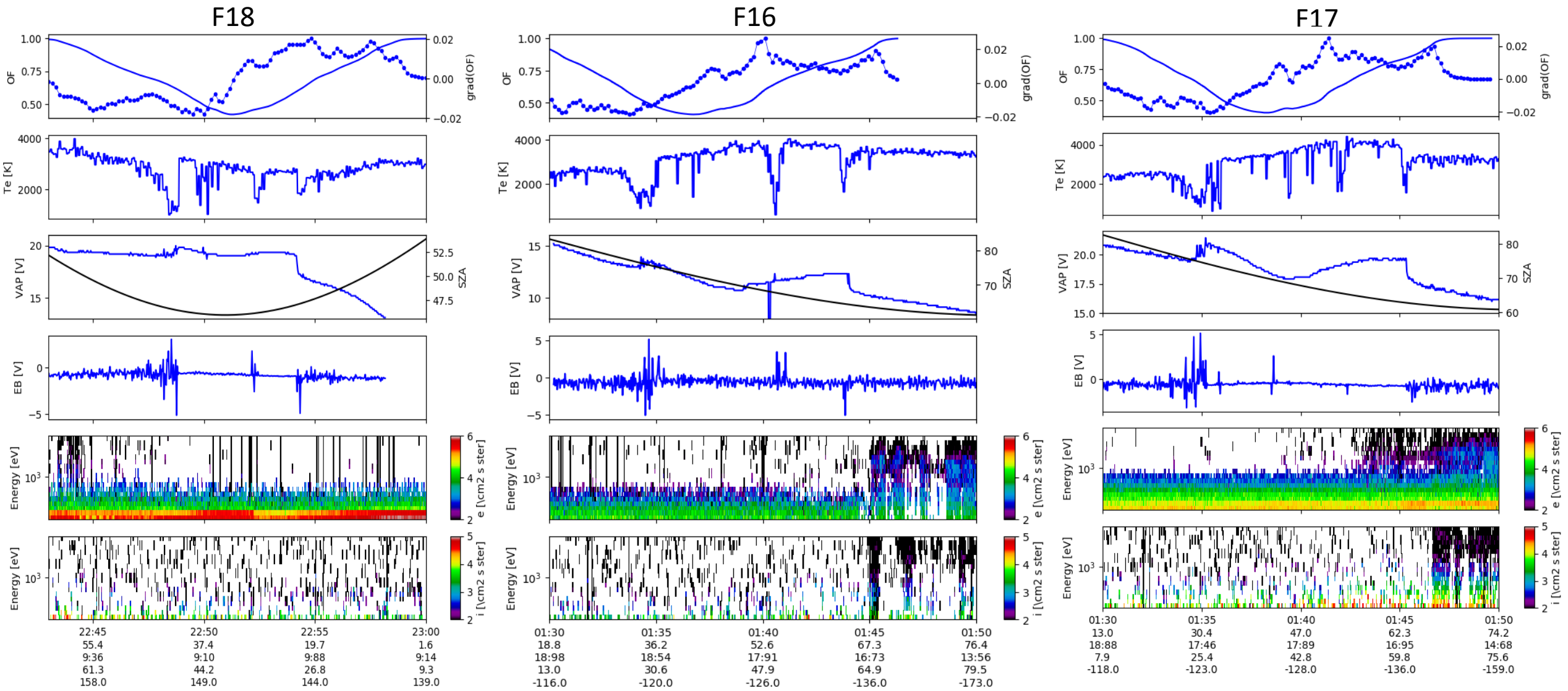


The retarding potential analyzer (RPA) samples high energy ions and electrons every two seconds and it observes high energy bursts in the regions of high EUV gradients.

Anomalous spacecraft charging



Bottom plot shows the spacecraft charges less negative (sign flipped here) as it moves northward in a nominal pass. Top plot shows an unexplained increase in negative charging in the eclipse’s shadow.



Something is affecting the ionosphere in the eclipse shadow, but our instruments are not designed to detect whatever this is directly, so we are puzzled. All three spacecraft observed similar responses as they passed through the May 2012 eclipse shadow at two different times and three different locations. With multiple sets of observations from these and other eclipses we hope to be able to track down the causes.