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We present the first ground-based observations of daytime cusp in redline (OI 630.0 nm) emission by the High Resolution Imaging Spectrograph using Echelle grating (HIRISE) (Pallamraju et al., 2002) from Sondrestromfjord (67°N, 51°W; 74.5° N Mag. Lat.) made on 21 January 2001.

Figure 1 HIRISE measurements of cusp and F-region arc emissions on 21 January 2001 along the magnetic meridian (333° azimuth) that was chosen to coincide with the ISR meridional scans from Sondrestrom. The dashed black lines in this figure (before 1325 and after 1754 UT) correspond to twilighttime (SZA, on the ground > 90°) 630 nm airglow emissions, while the rest of the data is obtained during daytime (SZA < 90°). During the time interval I (1330–1518 UT, in blue) column emission rates along the 112° elevation angle (22° south of zenith) increased gradually from around 1,200 R to 3,200 R over a dayglow background of around 800 R and showed a sharp southward (equatorward) boundary in the emissions. During this period the emissions northward and southward of this elevation angle do not show any such increase in brightness. We believe that this is a clear signature of cusplike precipitation. After 1518 UT, the peak in the emission during interval II (magenta) shifts poleward until 1542 UT. At the end of interval II, a southward motion in the emissions is observed during interval III (green) until 1745 UT, which is coincident with the movement of an F-region auroral arc as seen in the ISR data (Pallamraju et al., 2004).
Coordinated $N_e$ and $T_e$ measurements were made by the scanning ISR at Sondrestromfjord. Figure 2 shows the OI 630.0 nm emissions modeled using the ISR measured $N_e$ and $T_e$ as inputs. Notice the similarity of these plots with the HIRISE measured cusplike emissions (during interval I) showing a confined enhancement region with a sharp equatorward boundary. The purple and orange plots representing model emissions along the scans tipped 25° towards East and West of magnetic meridian show signatures of poleward moving auroral forms (during interval II) followed by the equatorward movement of F-region auroral arcs during interval III as indicated in Figure 2 (Pallamraju et al., 2004).

We believe that these are the first unambiguous measurements of the magnetospheric cusp in the daytime OI 630.0 nm emissions ever made by a ground-based instrument.

Reference: