

Near real-time global auroral observations and their application to IRI

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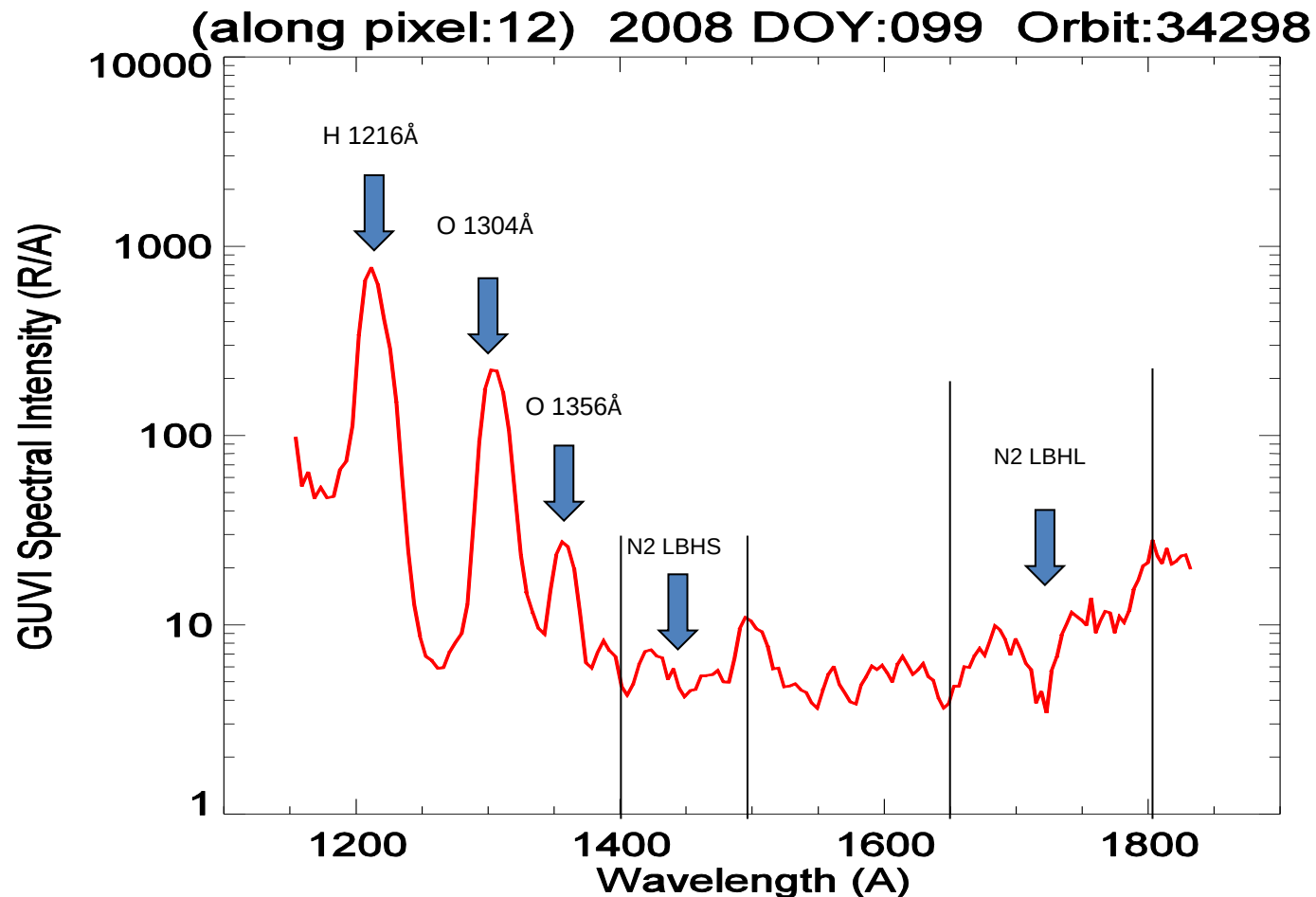
Outline

- Aurora observations in FUV
- TIMED/GUVI and DMSP/SSUSI
- Auroral products (E0,Q, NmE, HmE, boundary)
- Application to IRI
- Near real time Observations

FUV Observations:

Polar/UVI, IMAGE/FUV, TIMED/GUVI (1) and DMSP/SSUSI (4)

The newest F19 DMSP/SSUSI was launched on April 3



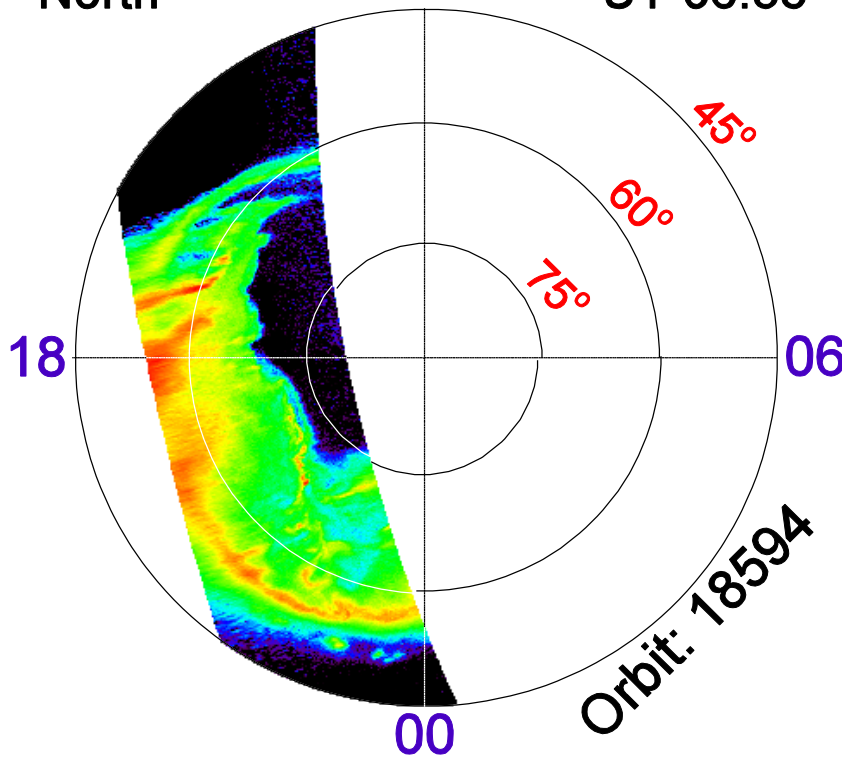
TIMED/GUVI

May 15, 2005

12

UT 06:53

North

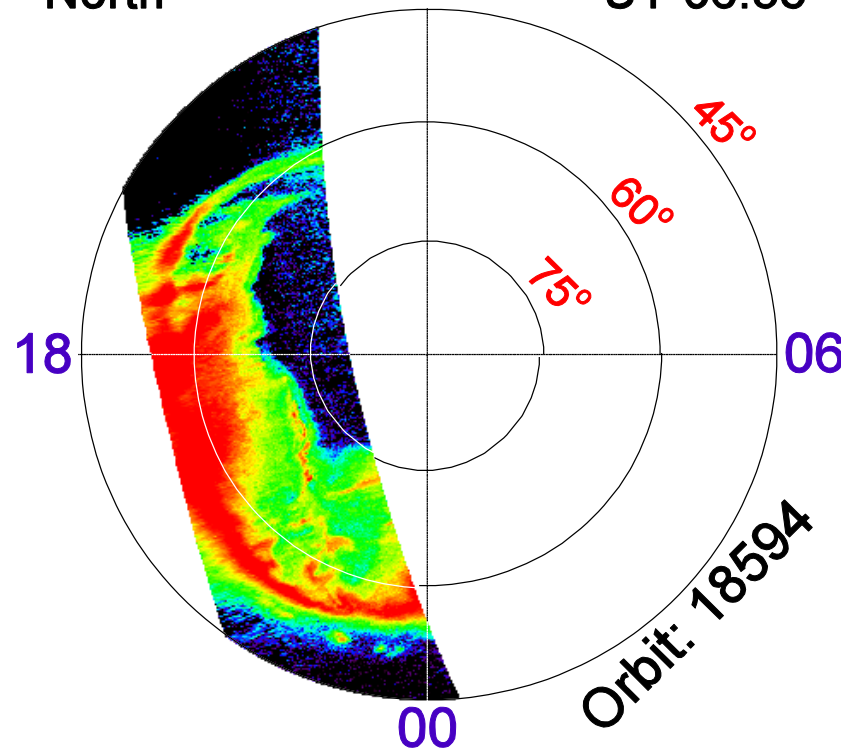


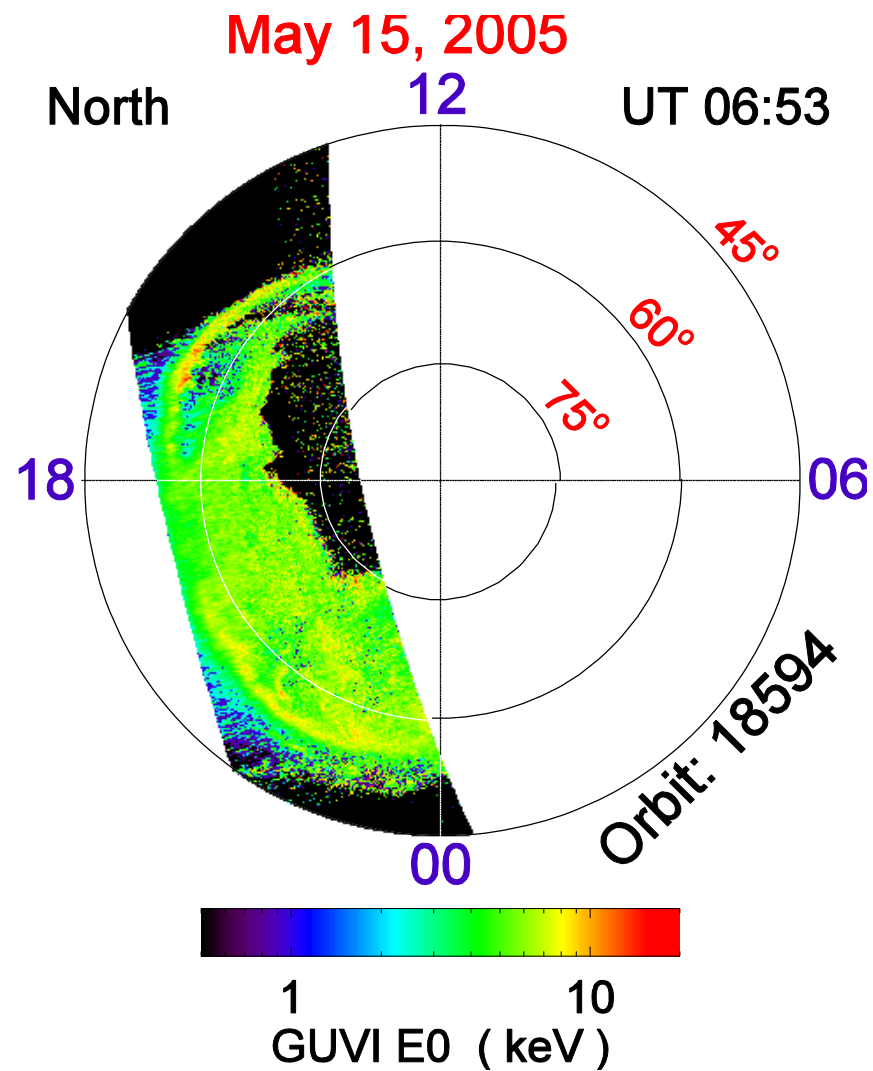
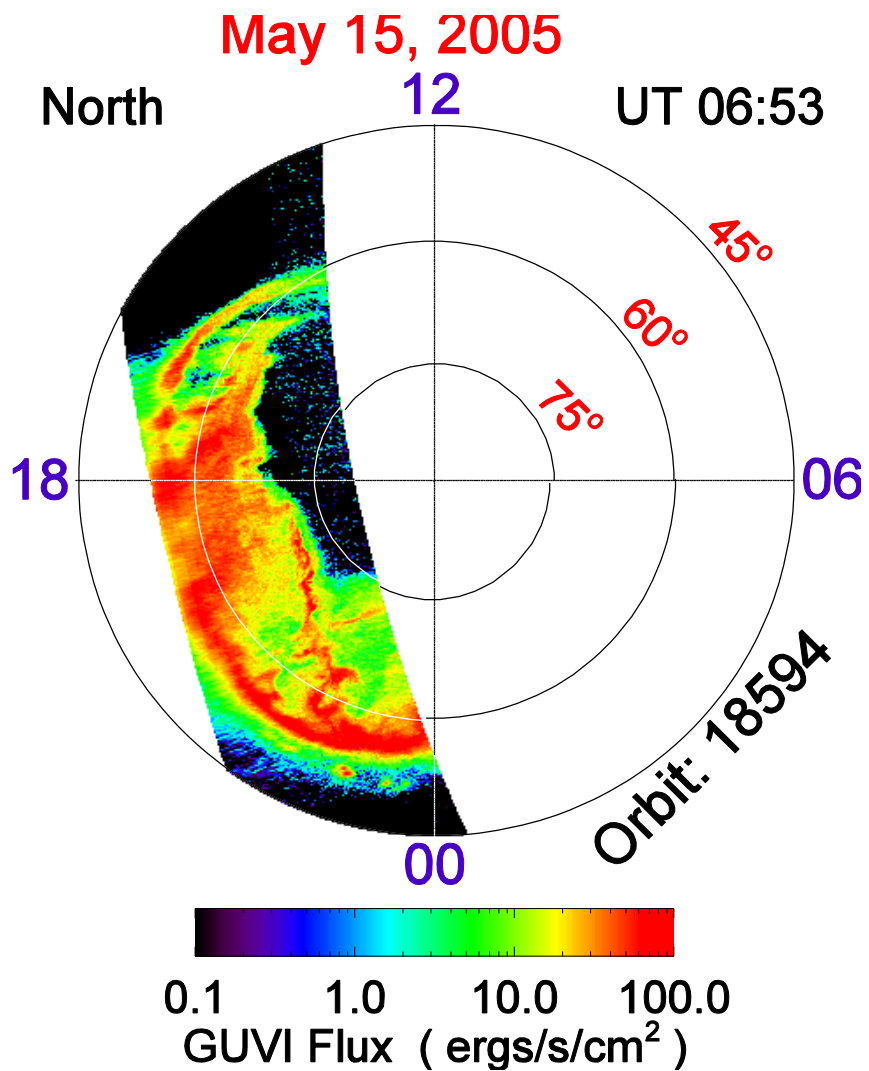
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12

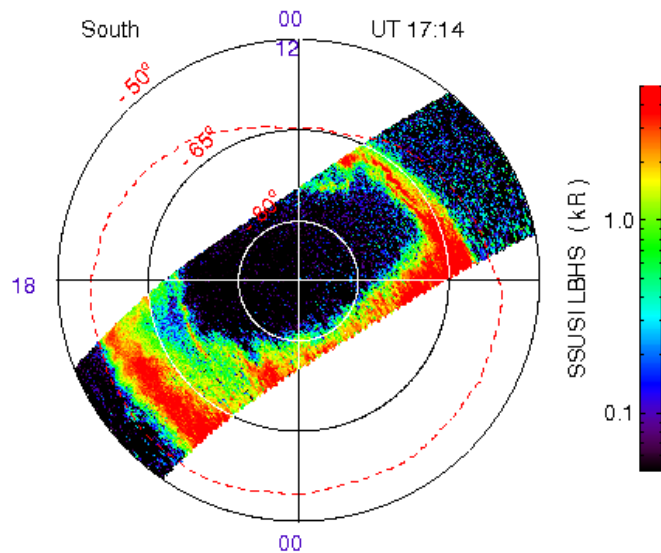
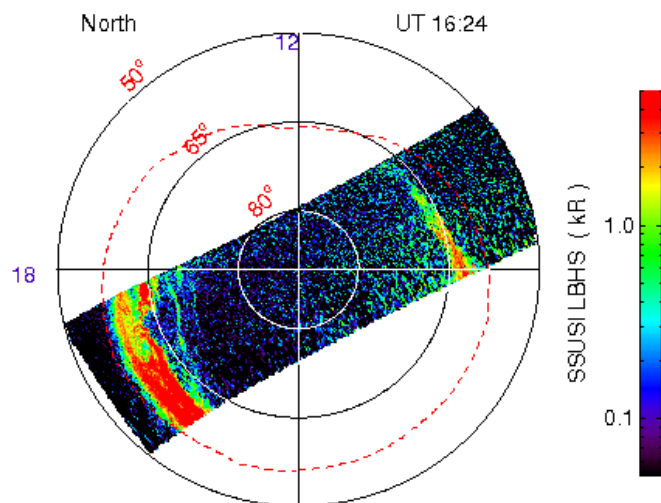
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North



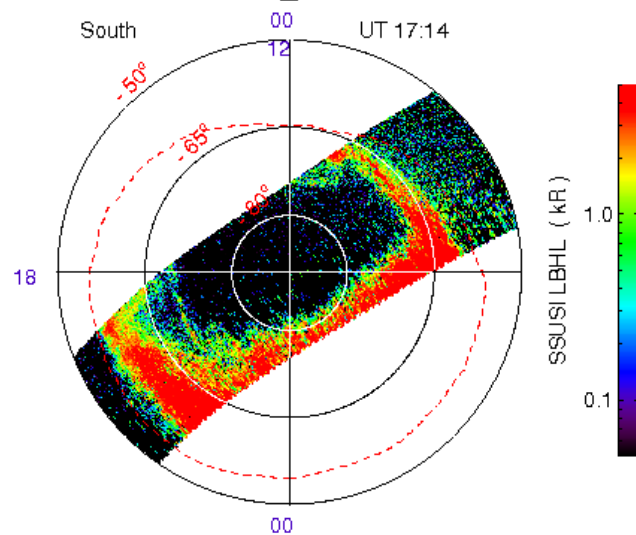
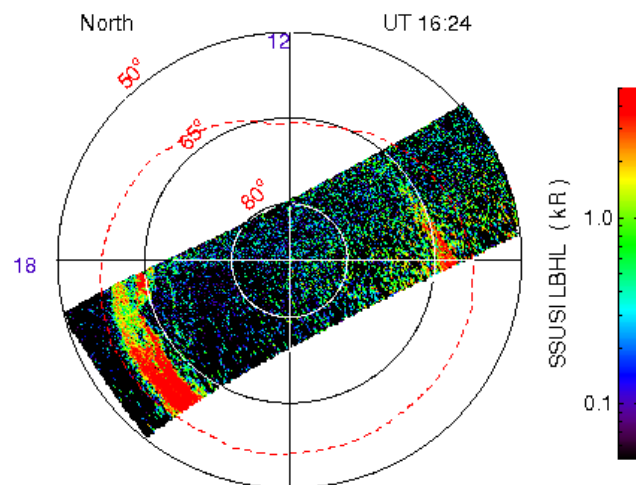


September 26, 2011 DOY:269 Orbit: 09996 (DMSPF18)



N2 LBHS (140-150 nm)

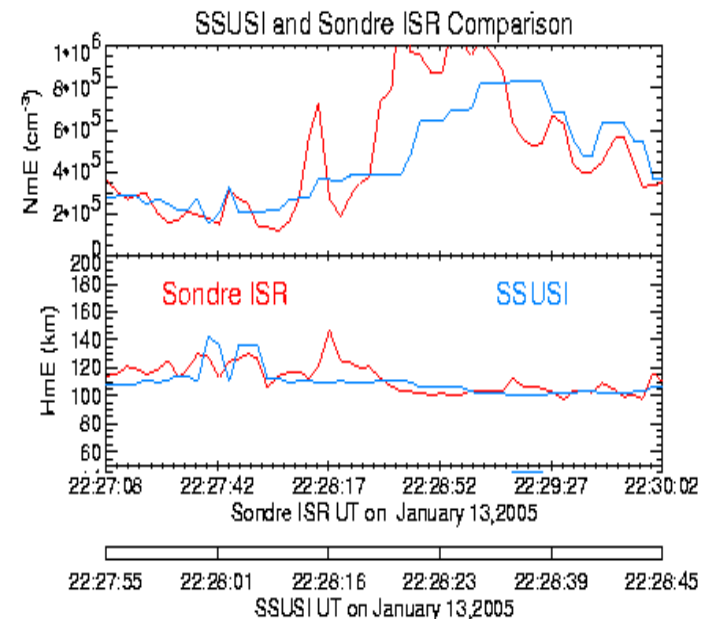
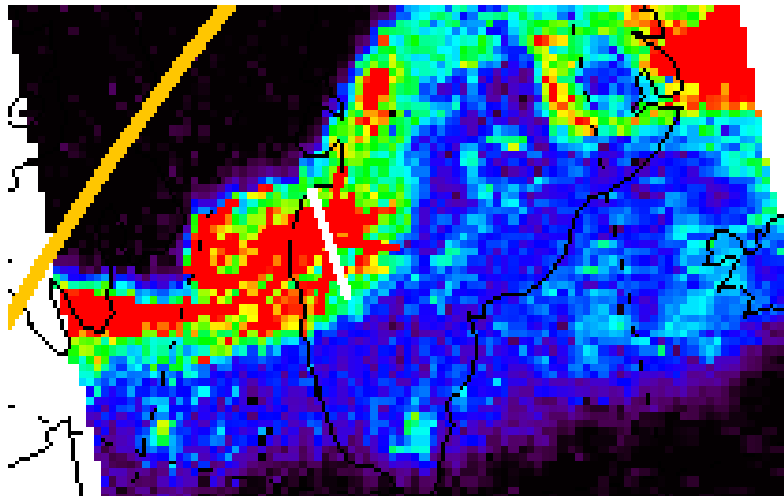
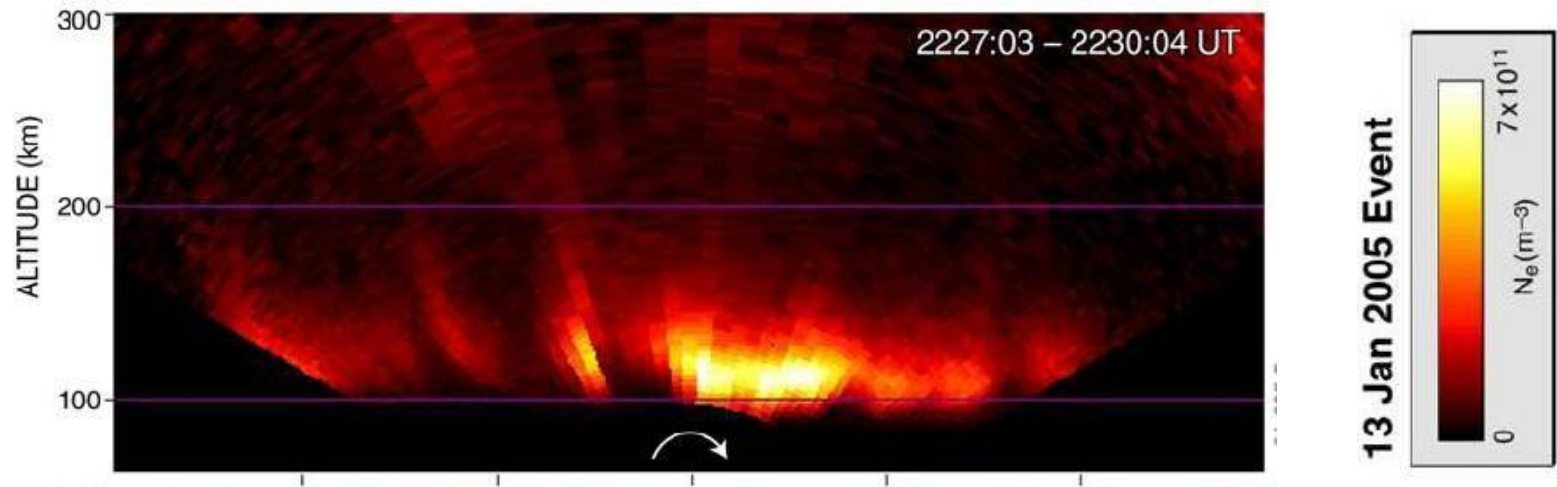
September 26, 2011 DOY:269 Orbit: 09996 (DMSPF18)



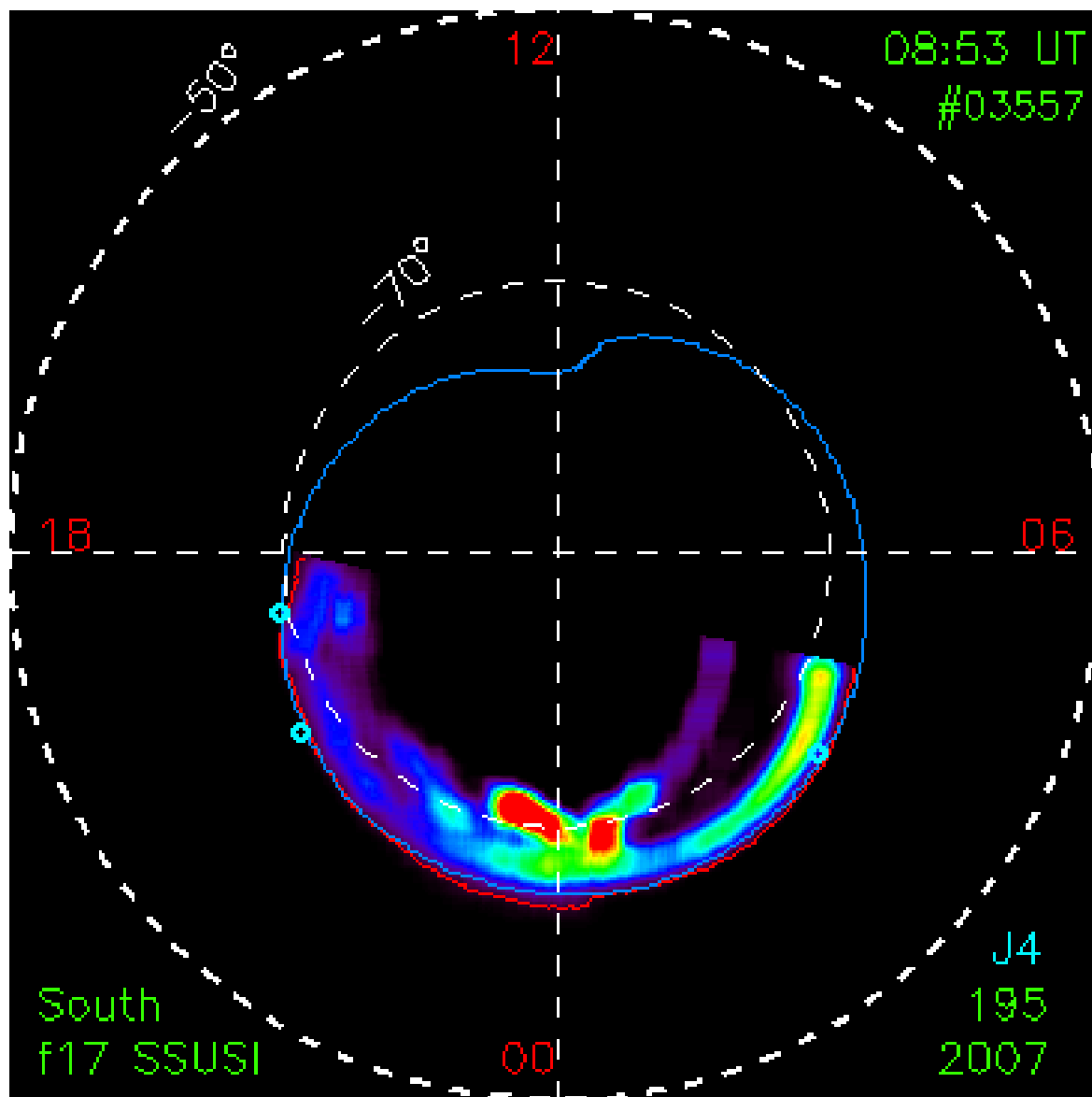
N2 LBHL (165-180 nm)

Validation of FUV based HmE and NmE using radar data

Sondrestrom Incoherent Scattering Radar (ISR), Jan 13, 2005

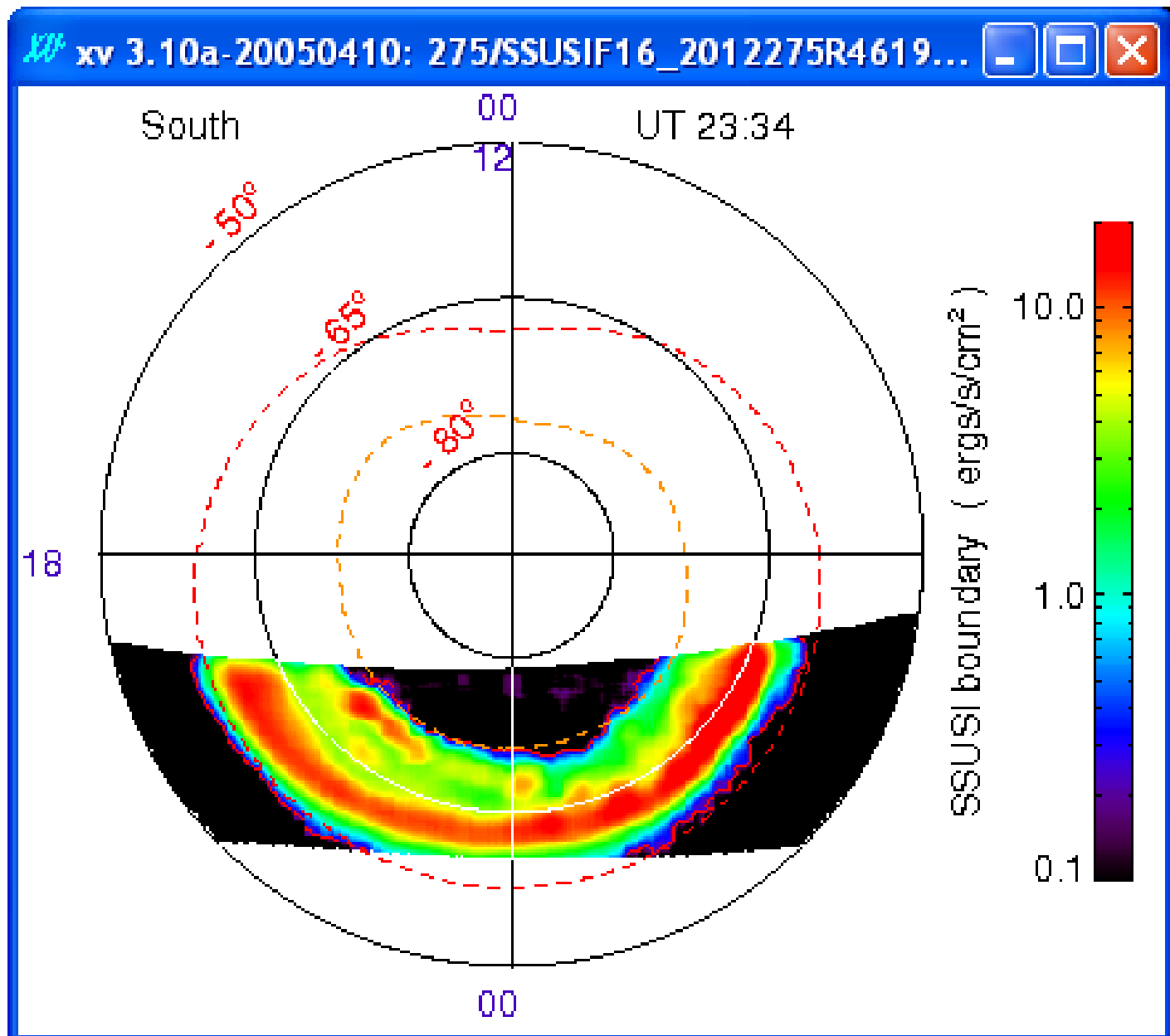


Equatorward auroral boundary



The FUV based auroral model can be driven by Kp or boundary

Poleward boundary



Assimilating Auroral NmE in IRI

Plasma continuity equation

$$\frac{\partial N_e}{\partial t} + \nabla \bullet (N_e \vec{V}_e) = P_{euv} + P_e - \alpha N_e^2$$

In ionosphere E-region (local equilibrium)

$$\alpha N_e^2 = P_{euv} + P_e$$

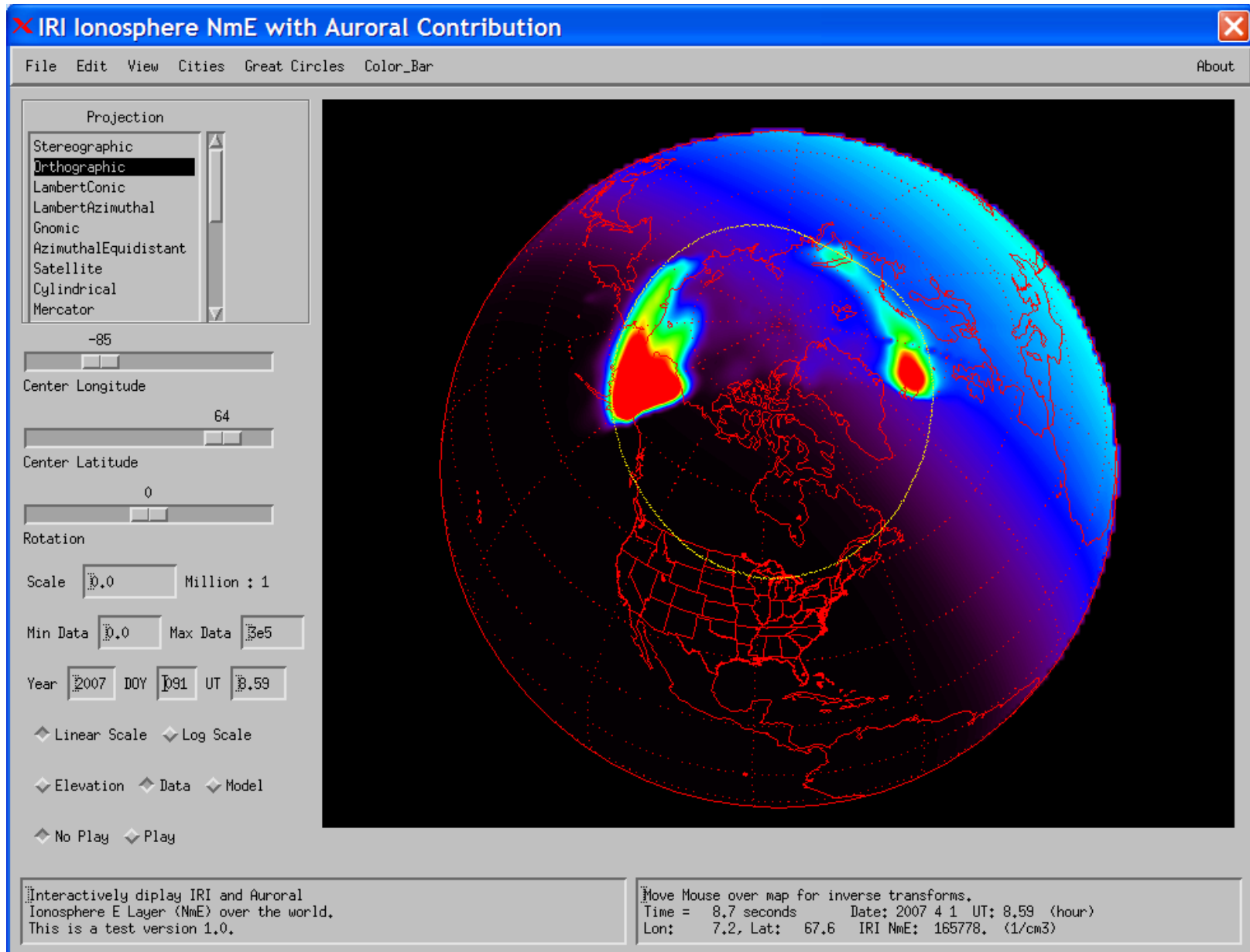
Assumption

$$\alpha (N_e^{euv})^2 = P_{euv} \qquad \alpha (N_e^e)^2 = P_e$$

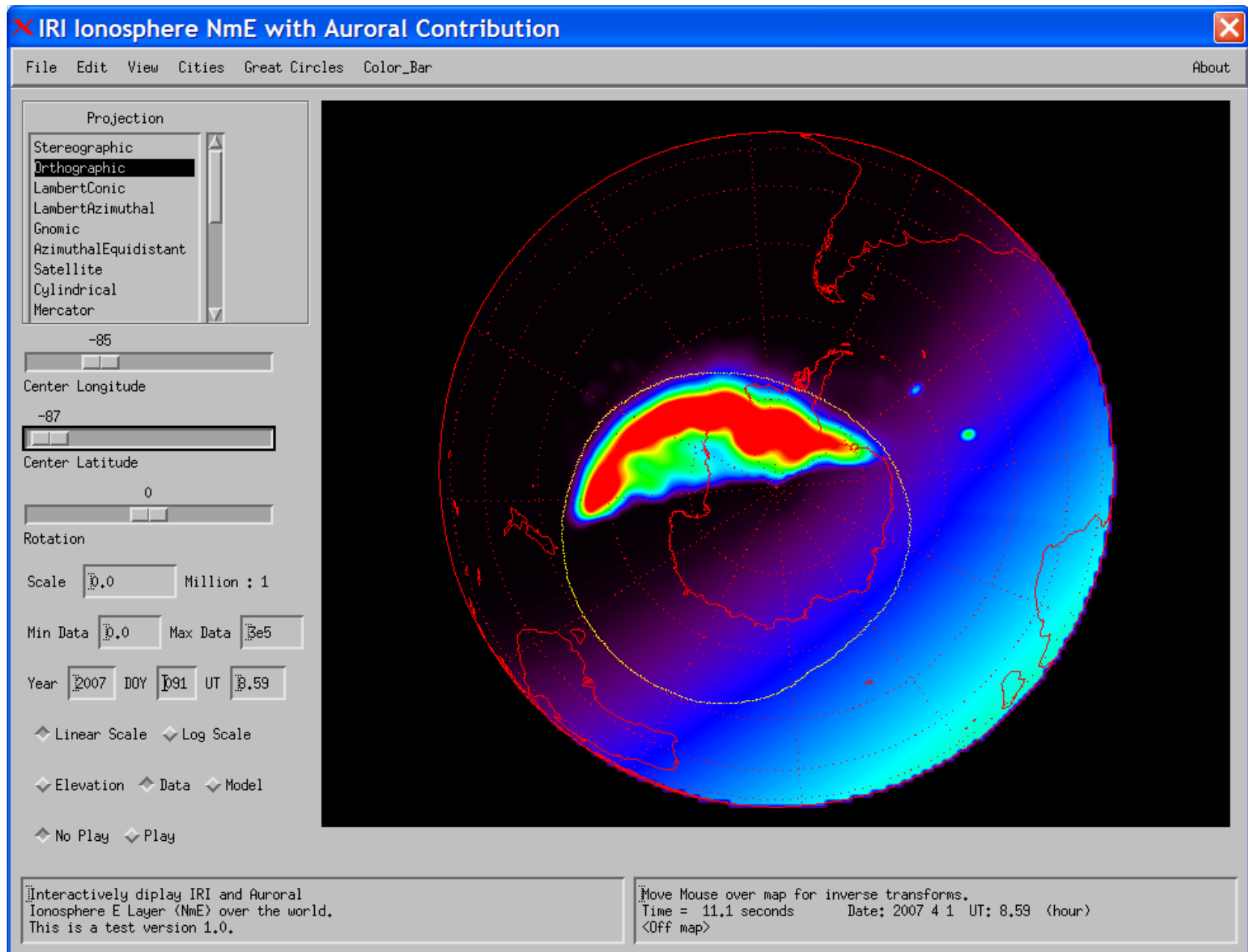
Assimilation Equation

$$N_e = \sqrt{(N_e^{euv})^2 + (N_e^e)^2}$$

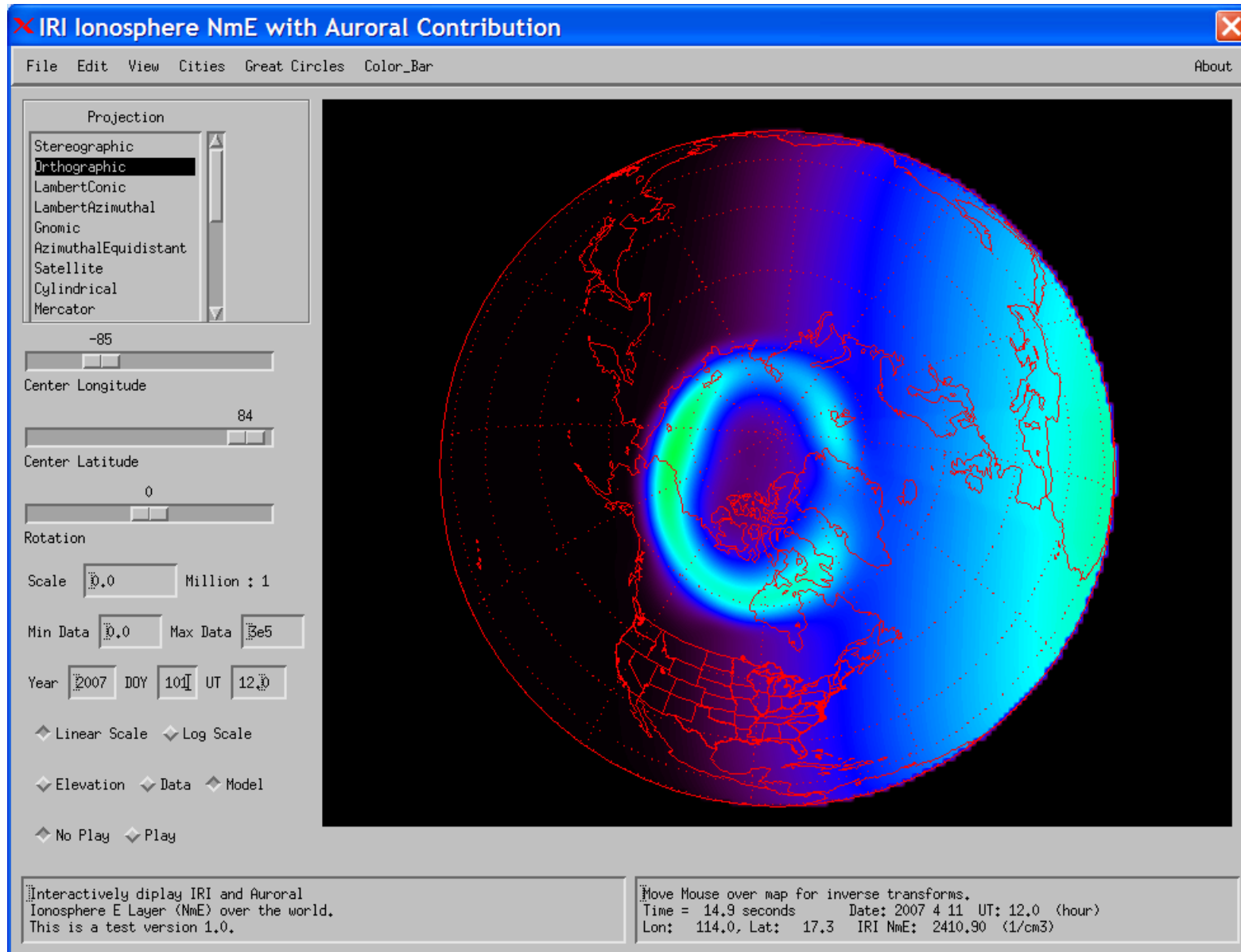
Assimilation of measured SSUSI NmE and boundary in IRI (Kp =4.3, April 1, 2007, 8:59UT)



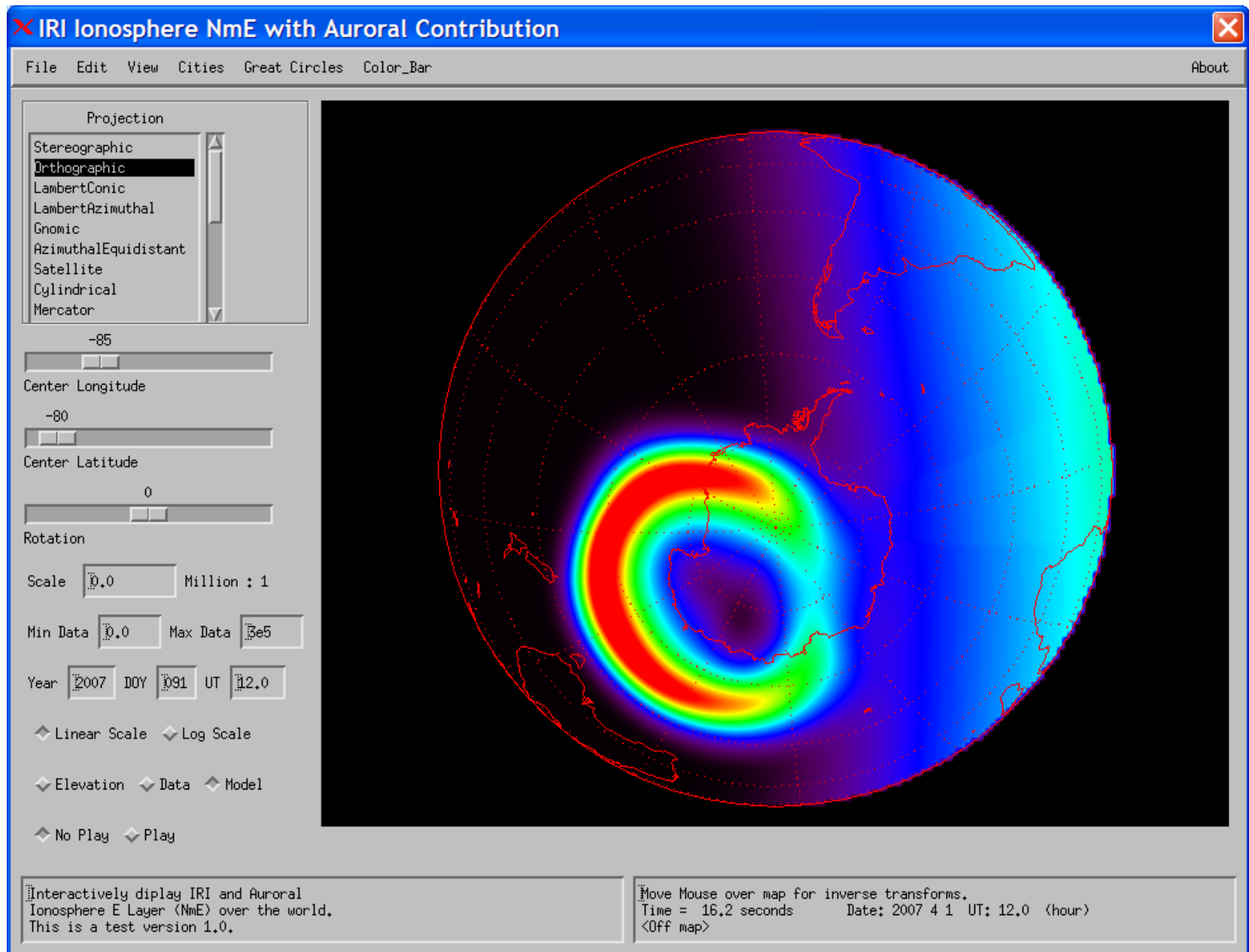
SSUSI data in southern hemisphere



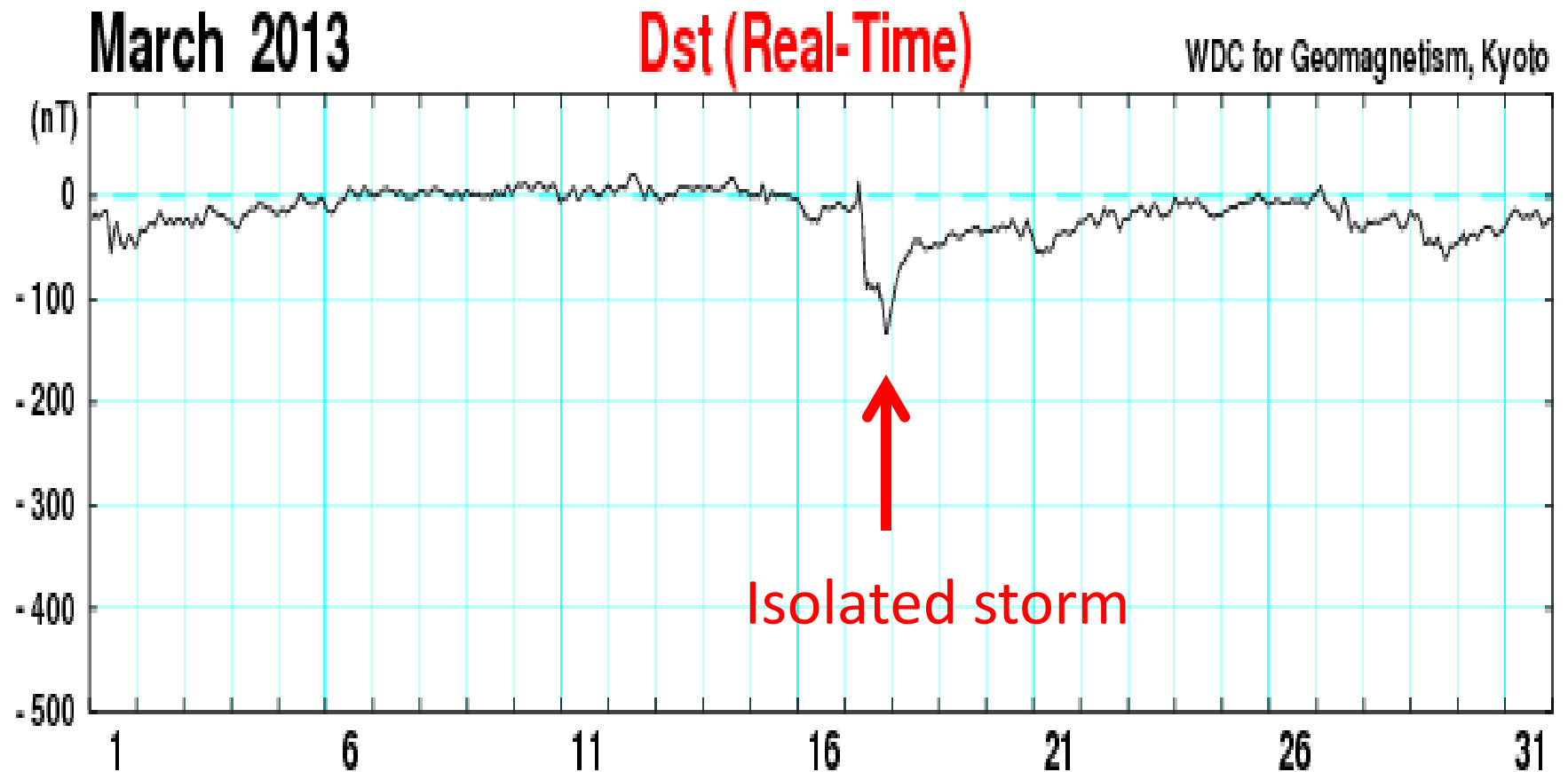
Assimilation of model NmE in IRI (Quiet time Kp =0.7)



Assimilation of model NmE in IRI (Moderate Active time Kp =4.0)



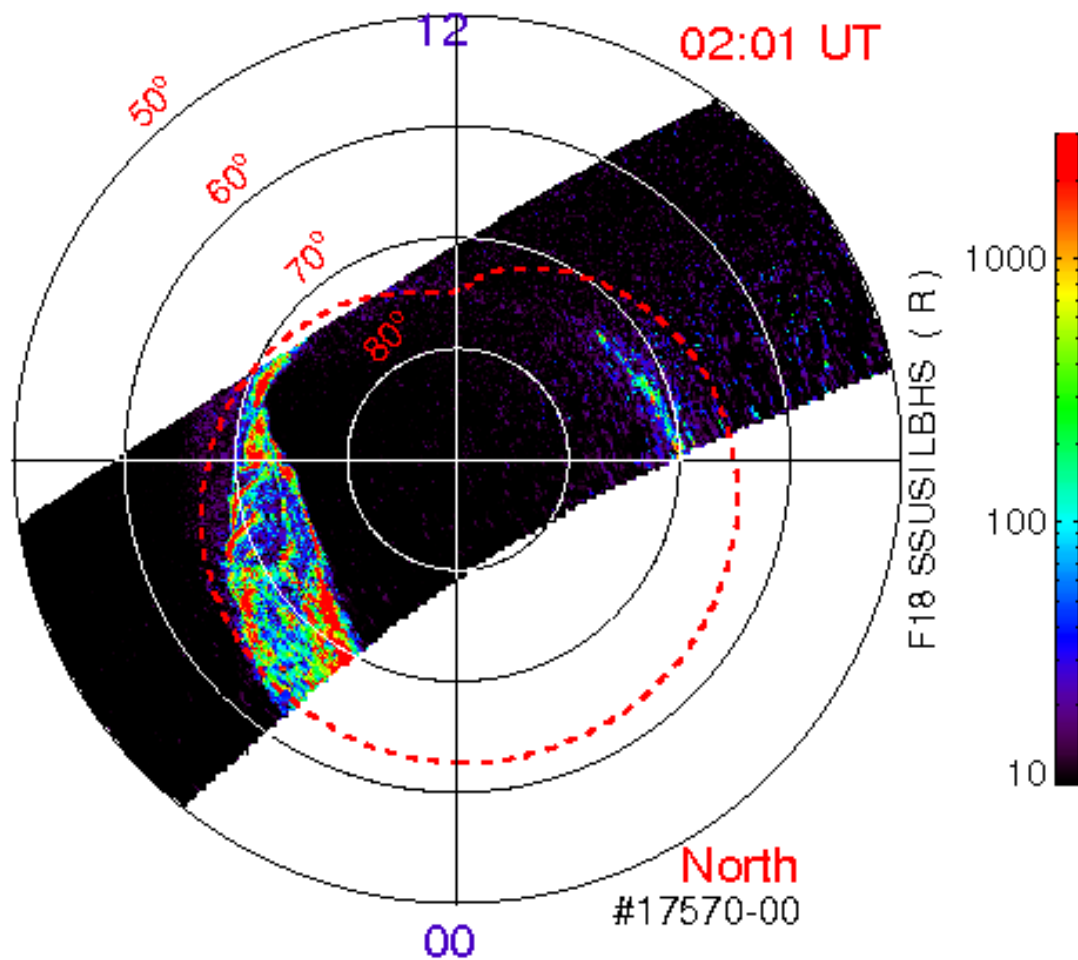
Storm-time boundary variations



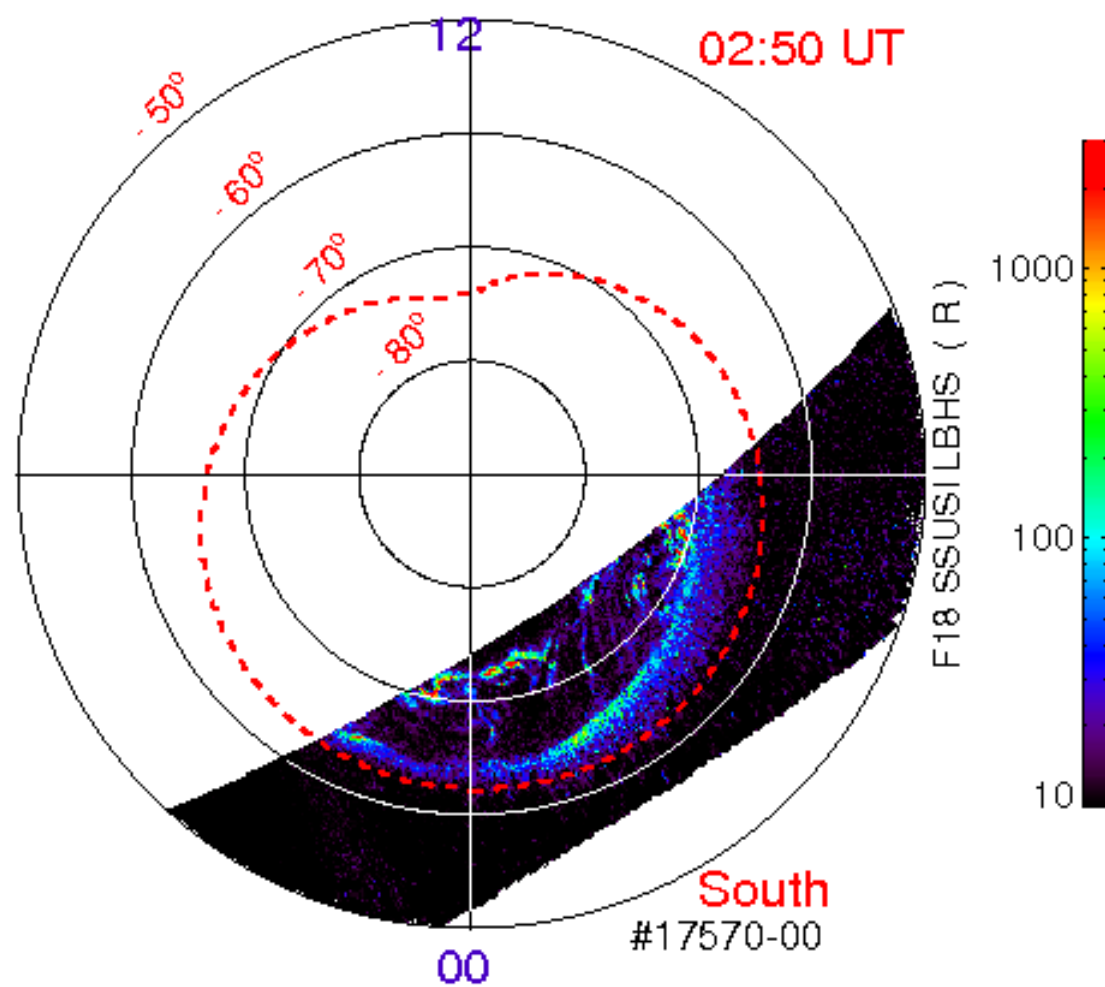
[Created at 2013-08-07 22:00UT]

Storm-time Boundary behaviors

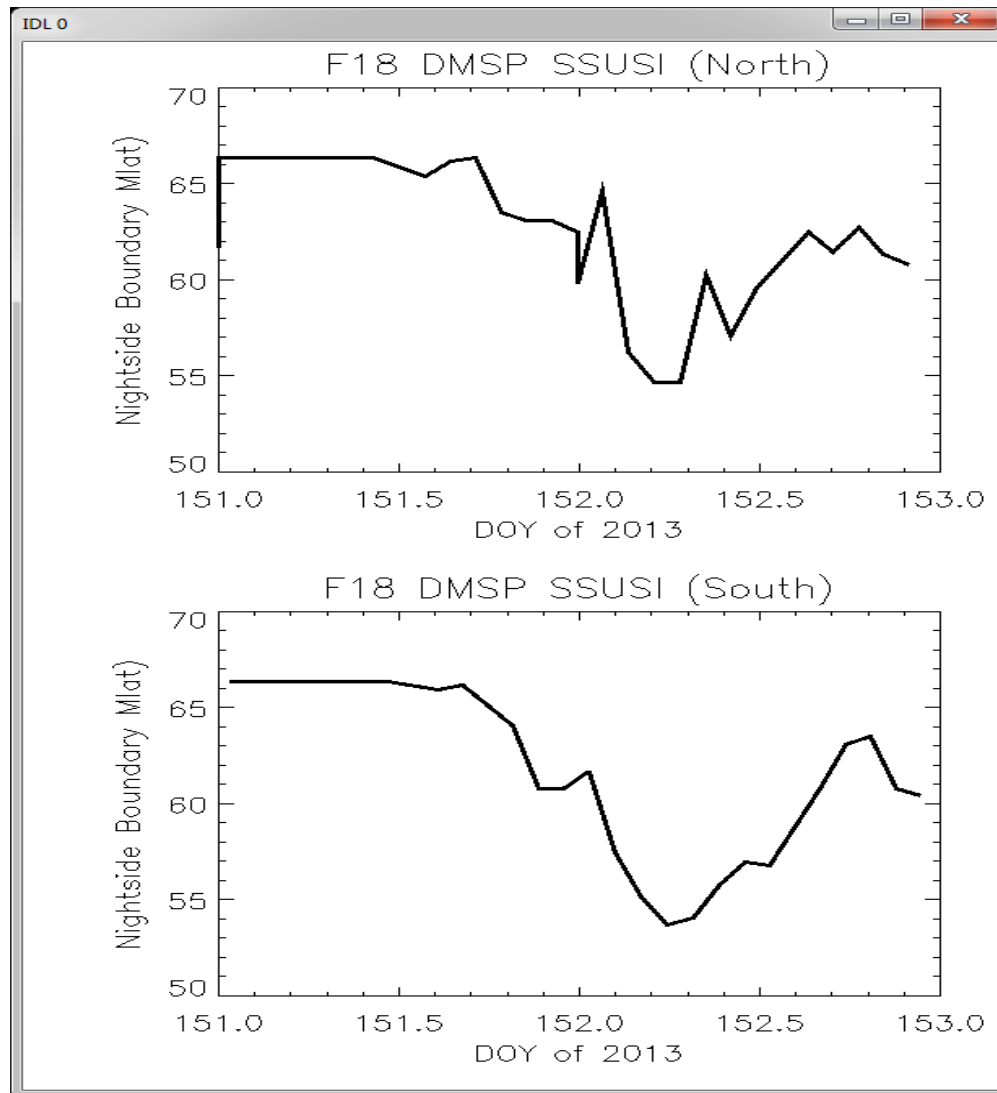
F18 SSUSI March 16, 2013



F18 SSUSI March 16, 2013

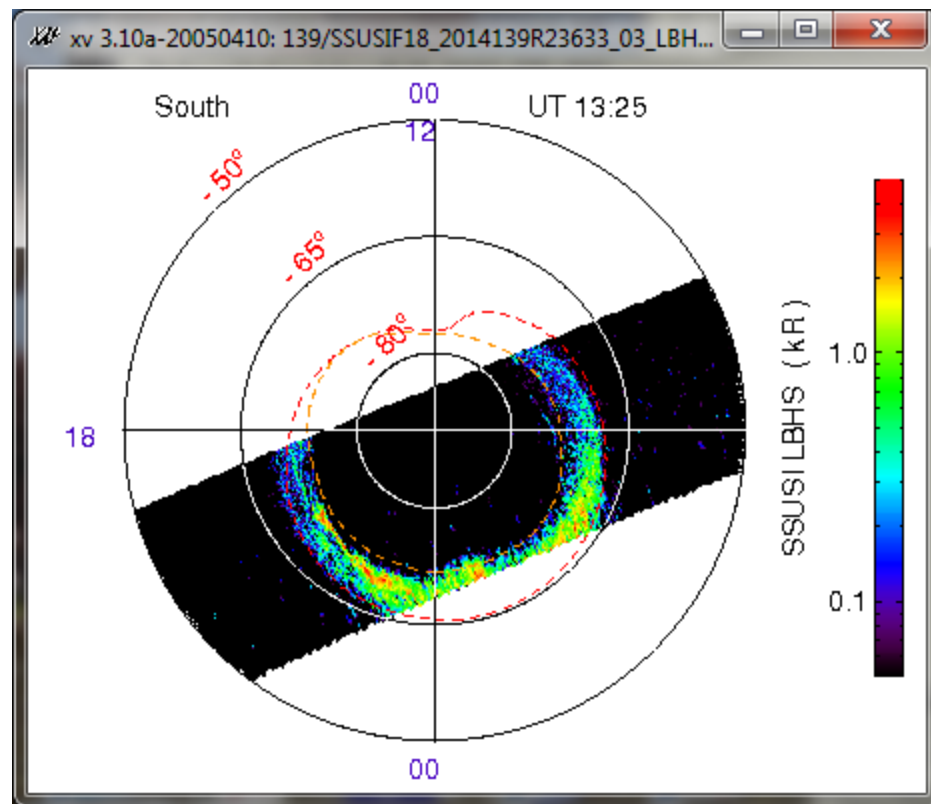
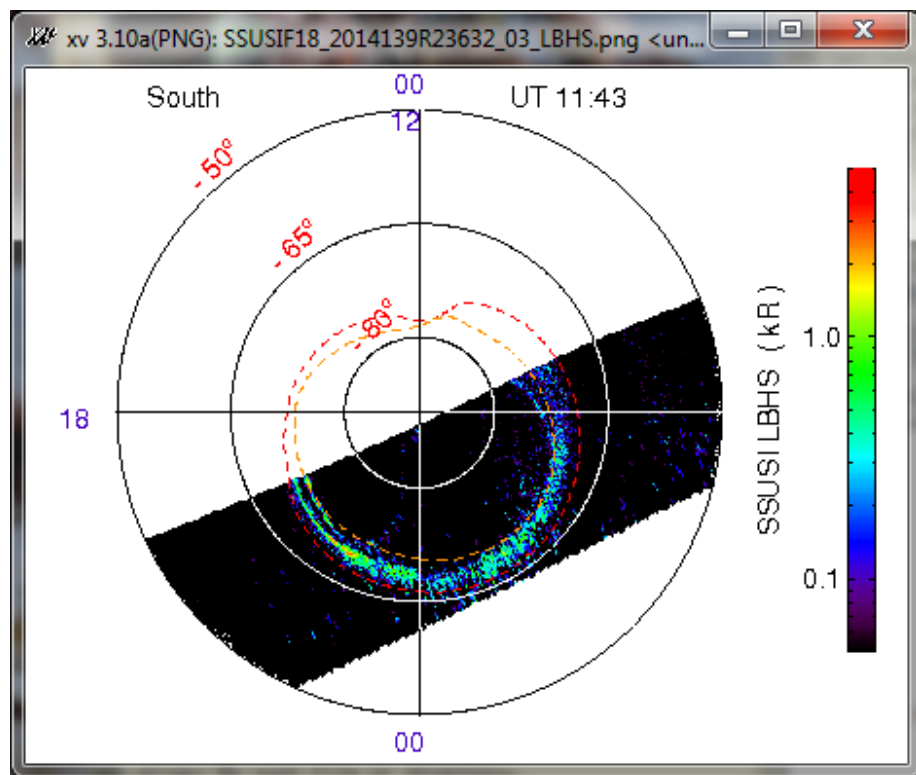


Nightside (00:00MLT) boundary variations

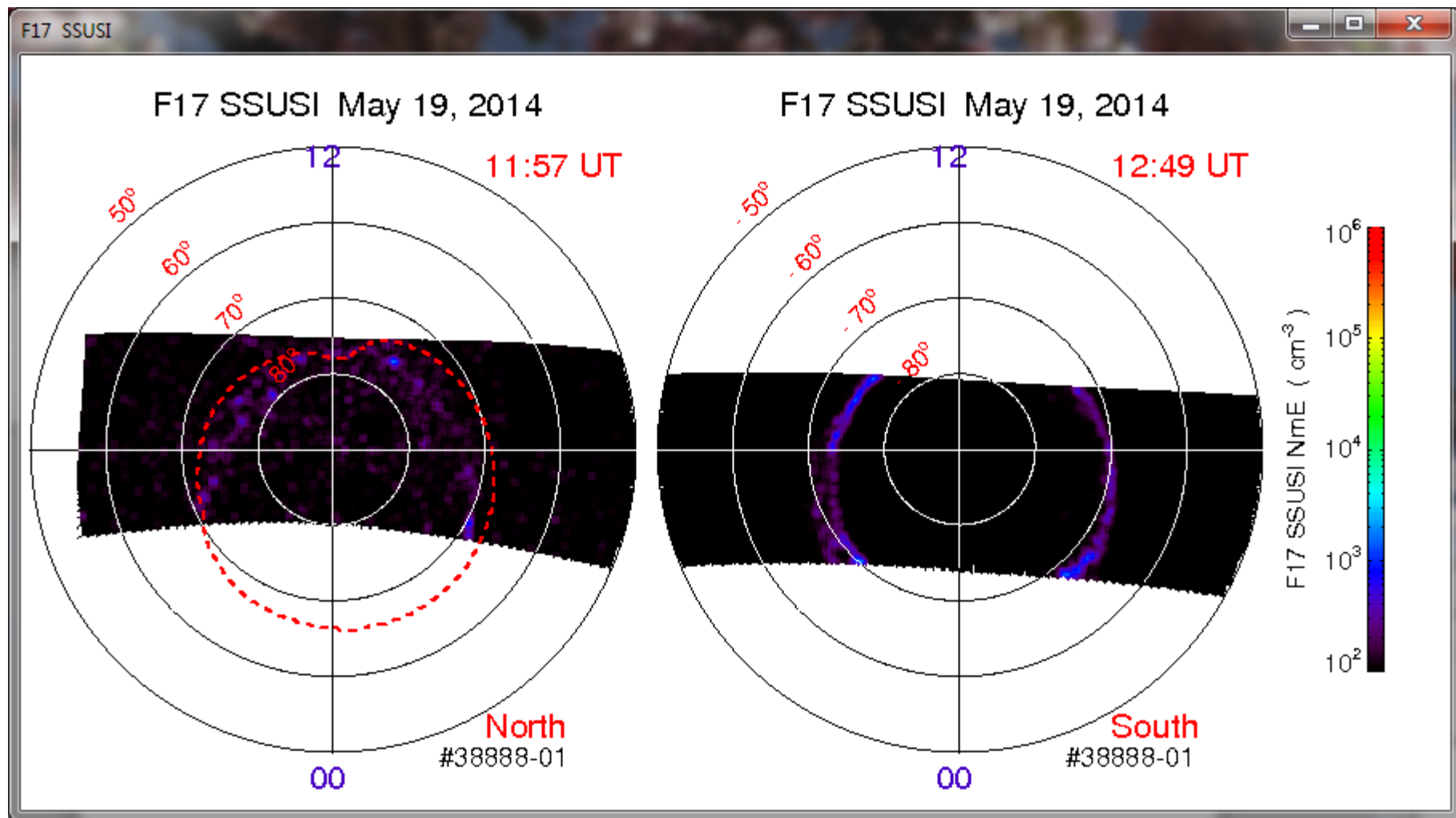


Near real-time SSUSI aurora data

SSUSI F18 (May 19, 2014), 2-3 hour delay from real time



Auroral NmE from F17 SSUSI



Summary

- FUV based global auroral images (nightside and sunlit)
- Auroral products (images, E0,Q, NmE and HmE, boundary)
- Near real-time monitoring (within 2-3 hours)