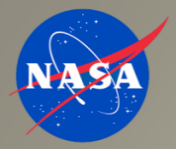


A photograph taken from the International Space Station (ISS) showing a vibrant green aurora (Aurora Borealis) in the Earth's atmosphere. The aurora appears as a bright, horizontal band of light stretching across the horizon. The Earth's surface, with visible cloud patterns, is below the aurora. Parts of the ISS structure, including solar panel arrays, are visible in the foreground on the left side.

DMSP and ISS Auroral Charging Events 17-18 March 2013 GEM-CEDAR Storm

Joseph I Minow
NASA Technical Fellow for Space Environments

GEM Mini-Workshop
CEDAR-GEM Modeling Challenge Session
San Francisco, CA
13 December 2015
joseph.minow@nasa.gov



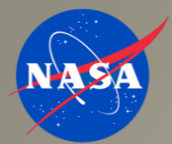
17-18 March 2013 Storm Period

- Equinox period is not conducive to strong DMSP auroral charging
 - Only a few weak auroral charging events during period
- Weak ISS charging, strongest events (few volts) in southern hemisphere

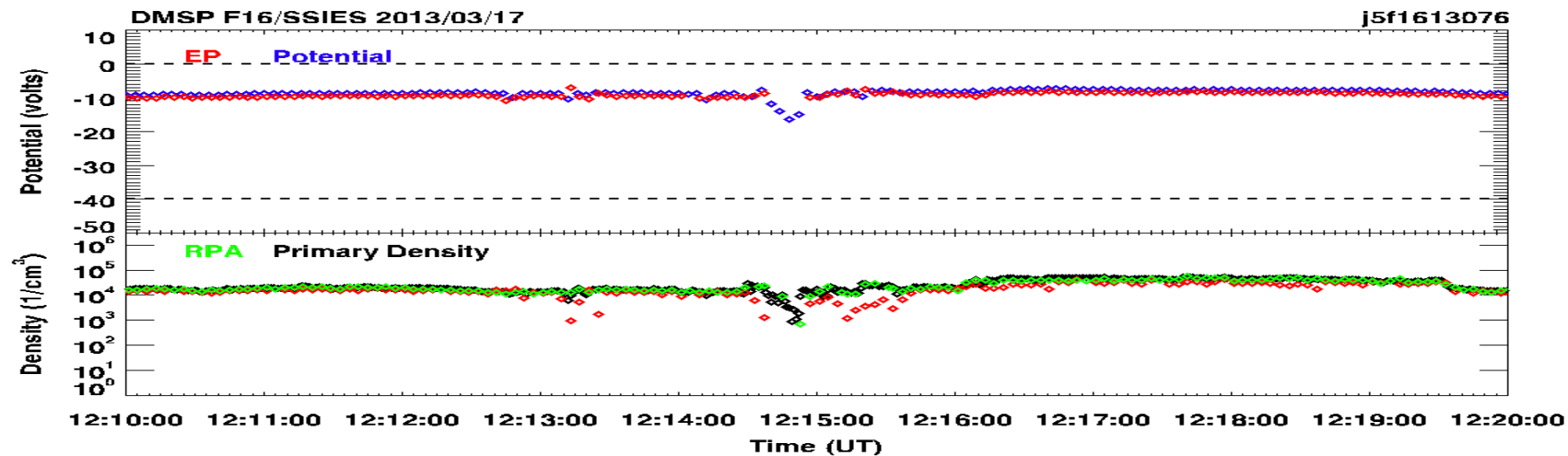
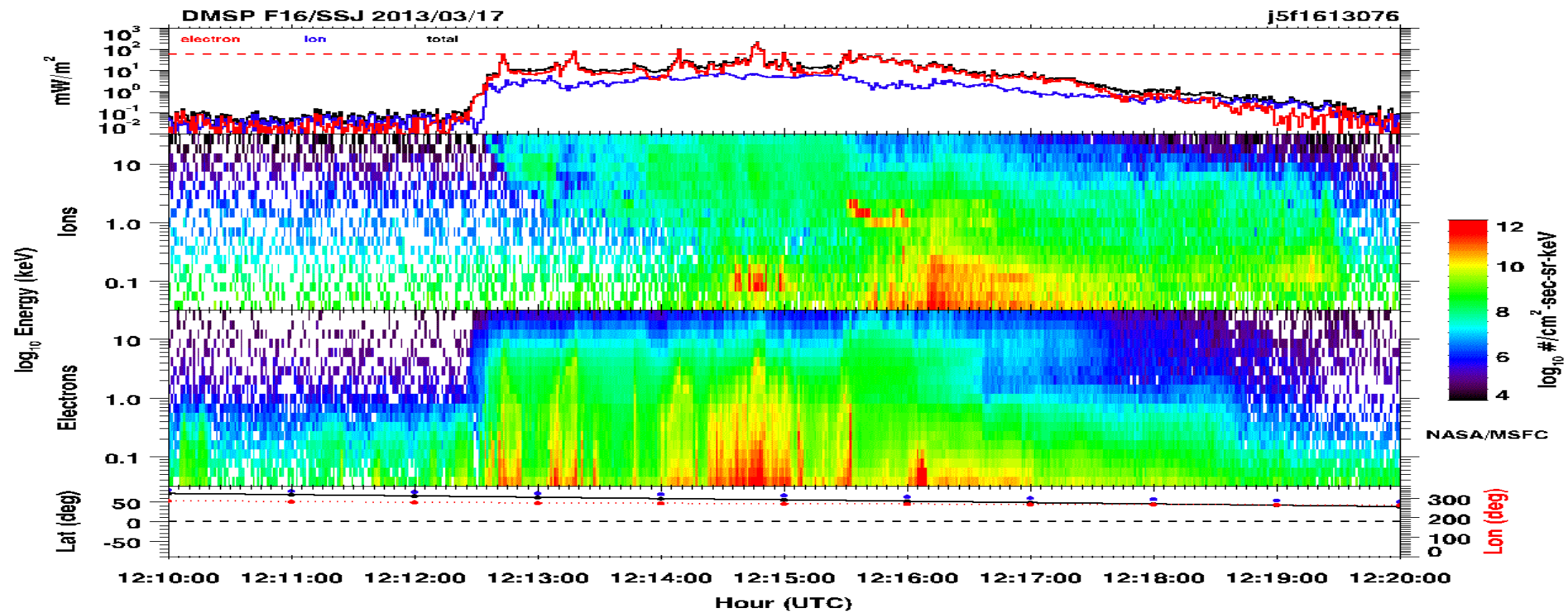
Date	Satellite	Charging Event Time	Potential	
			$\phi_{s/c}$, volt	$d\phi_{s/c}$, volt
17 March 2013	F16	12:15 UT	-18	8
	F16	16:14 UT	-26	14
	F18	19:49 UT	-28	10
	ISS	Multiple orbits ~11 – 19 UT		few volts

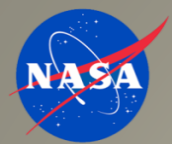
Acknowledgements:

DMSP SSJ, SSIES records are provided courtesy of the US Air Force and NOAA's National Geophysical Data Center.

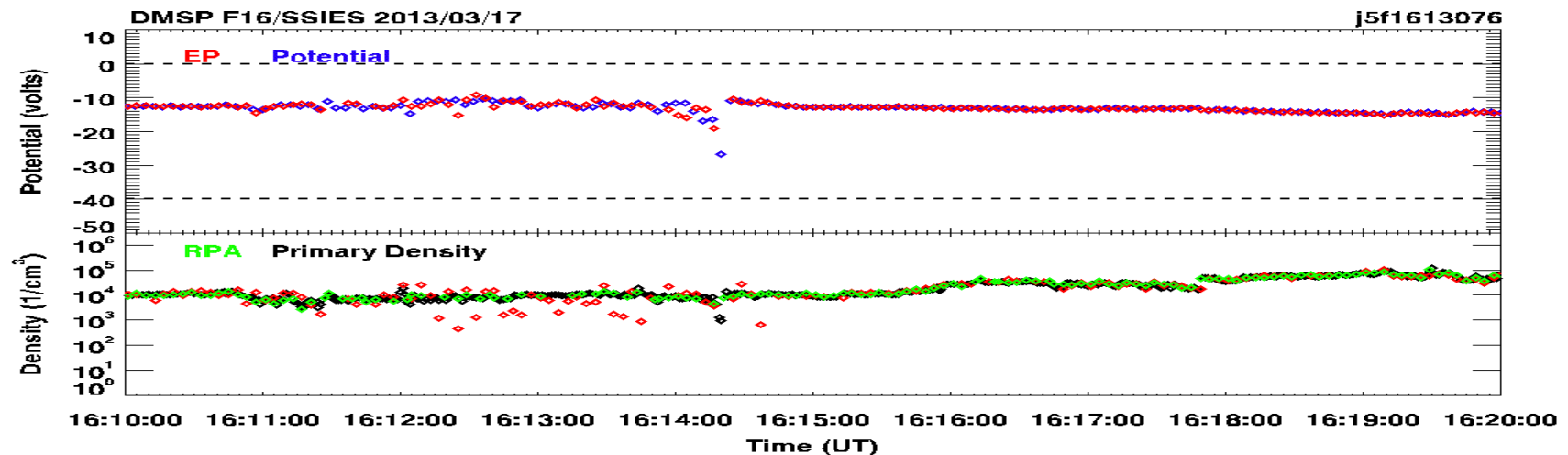
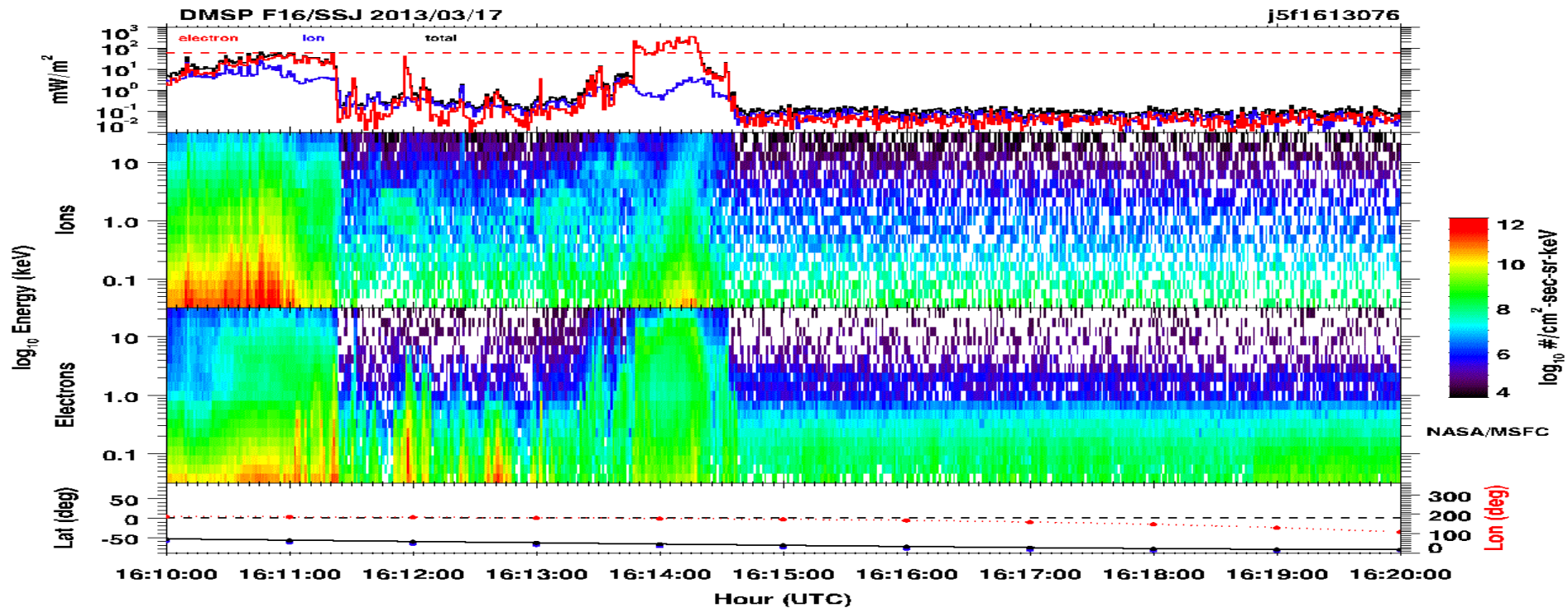


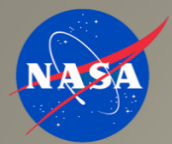
F16: 17 March 2013 ~12:15 UT event



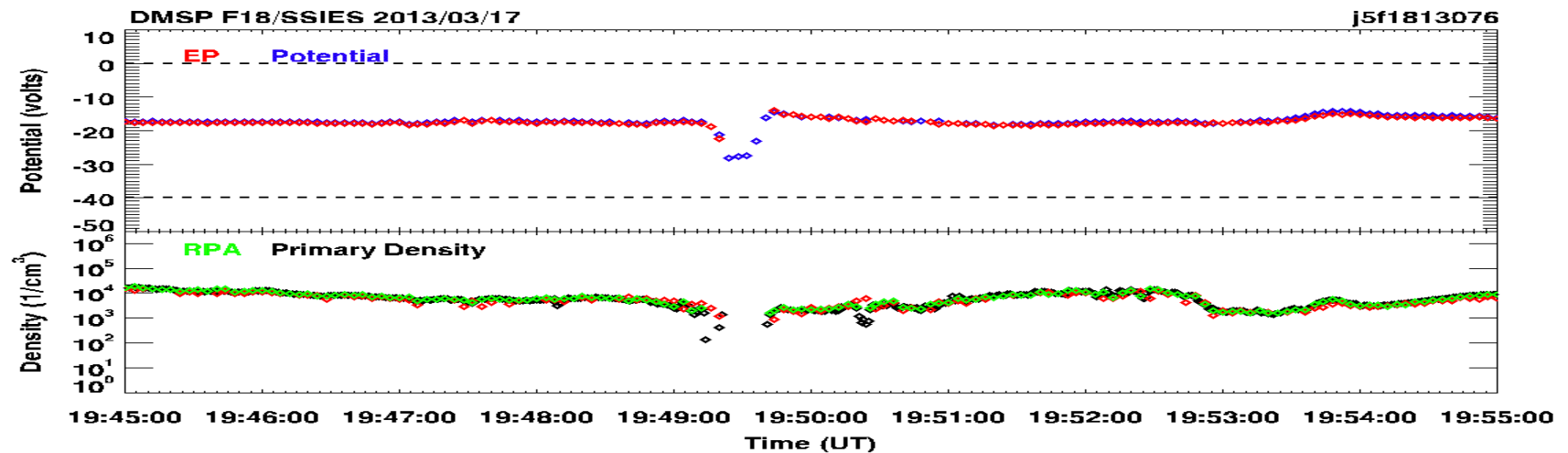
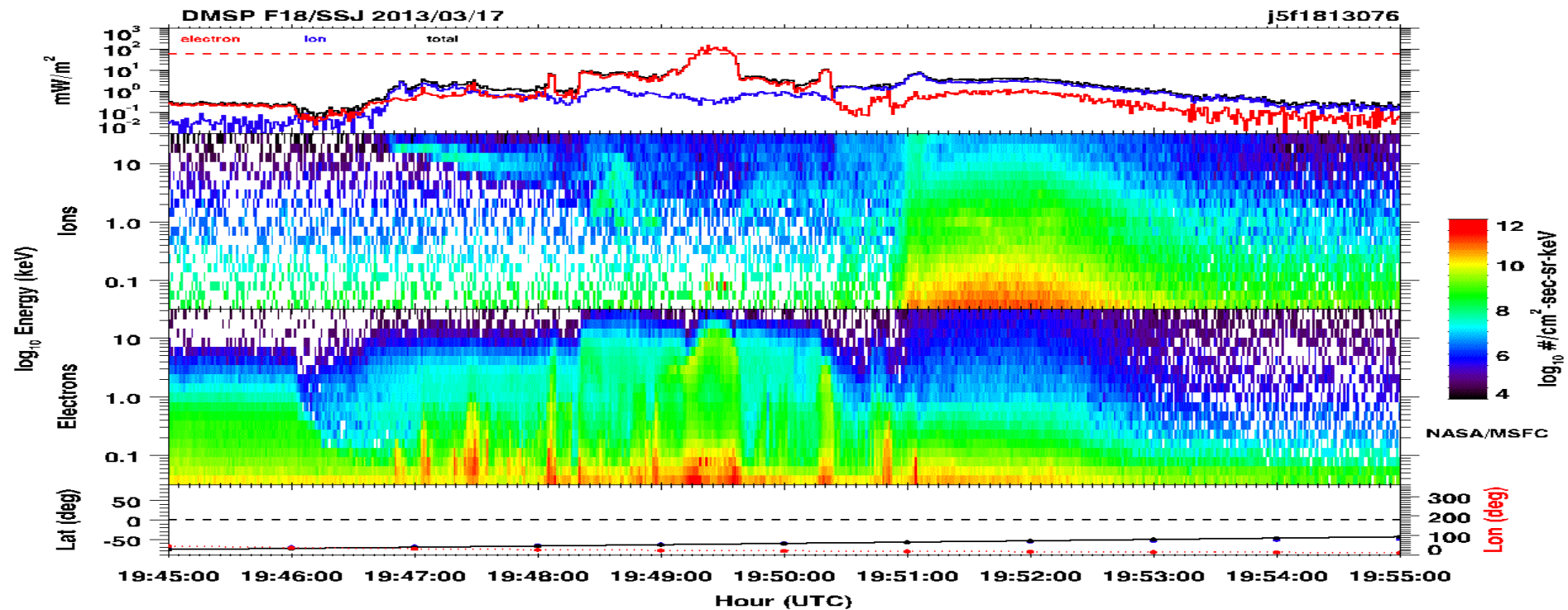


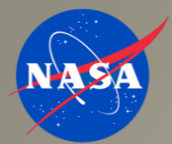
F16: 17 March 2013 ~16:14 UT event



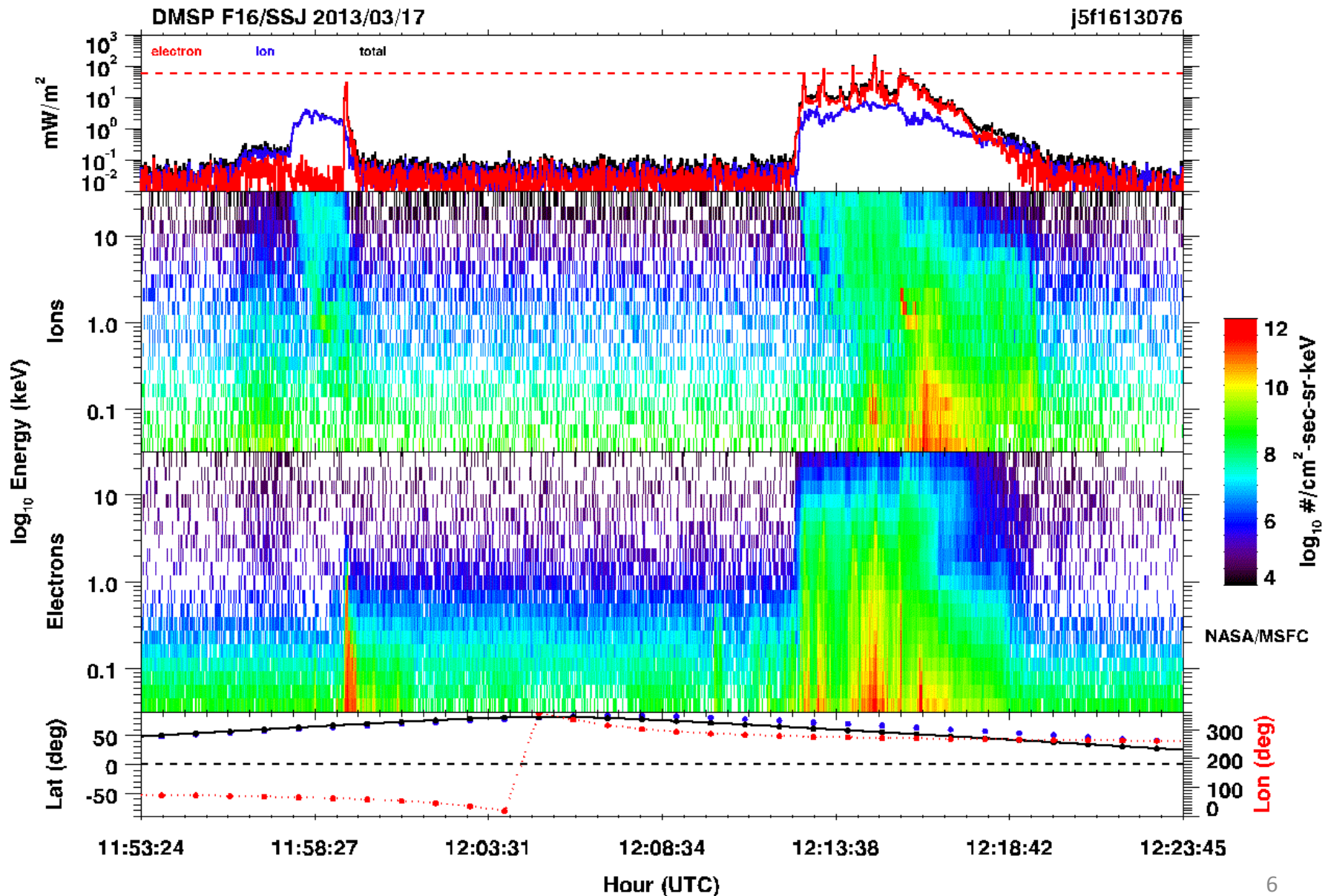


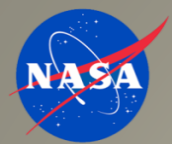
F18: 17 March 2013 ~19:49 UT event



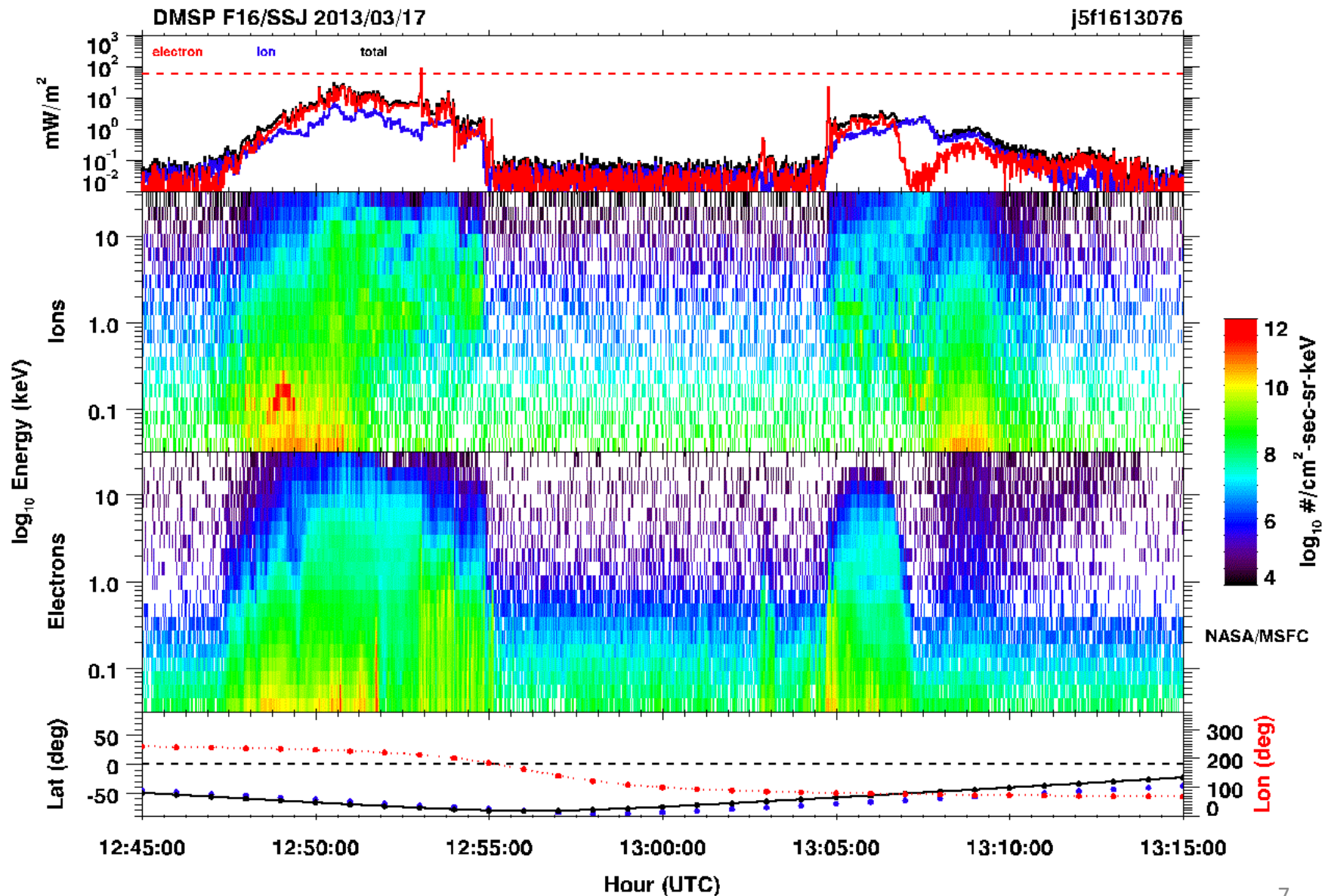


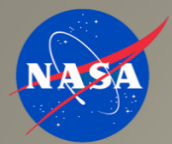
F16: 17 March 2013 N Hemisphere Oval



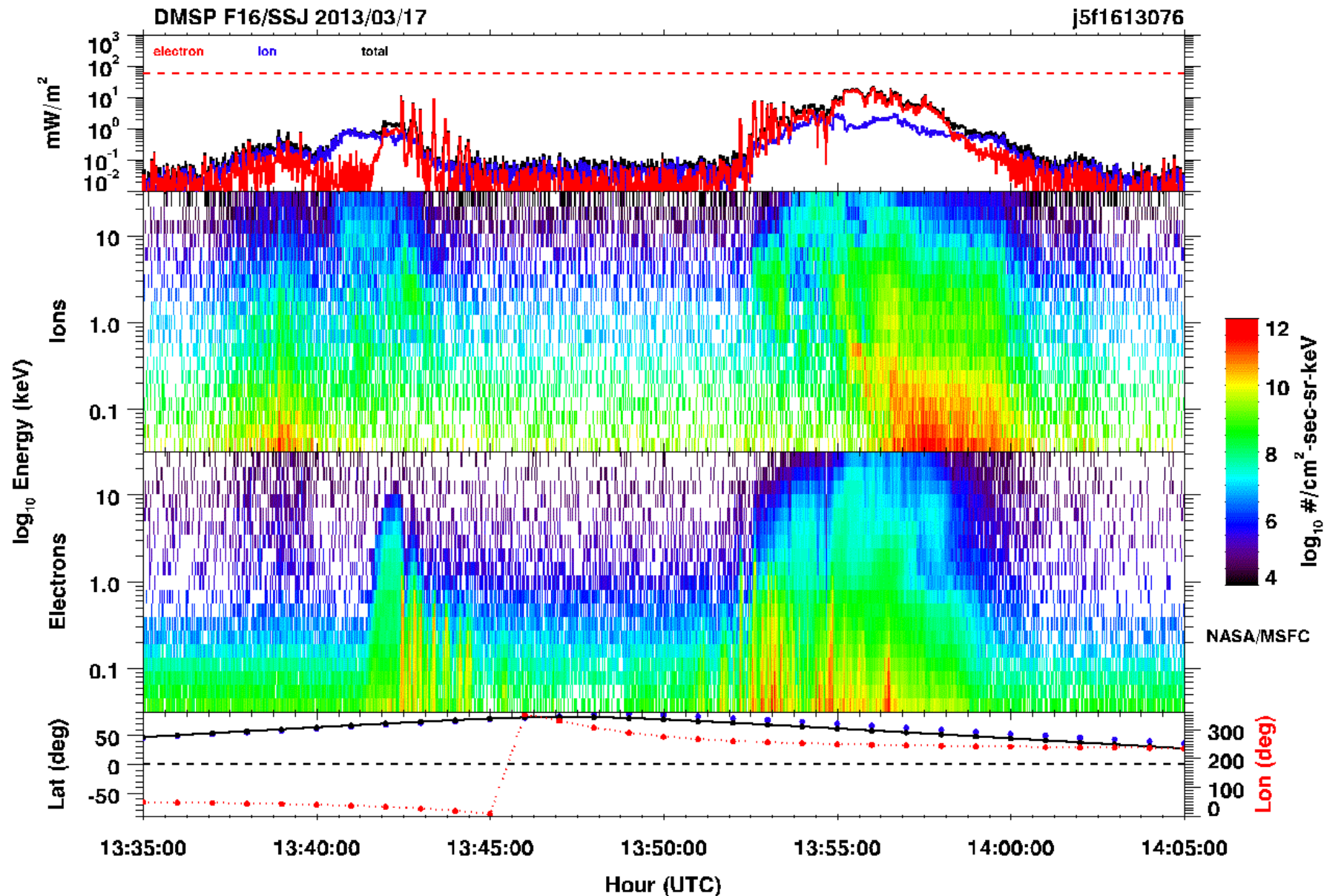


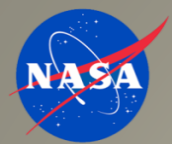
F16: 17 March 2013 S Hemisphere Oval



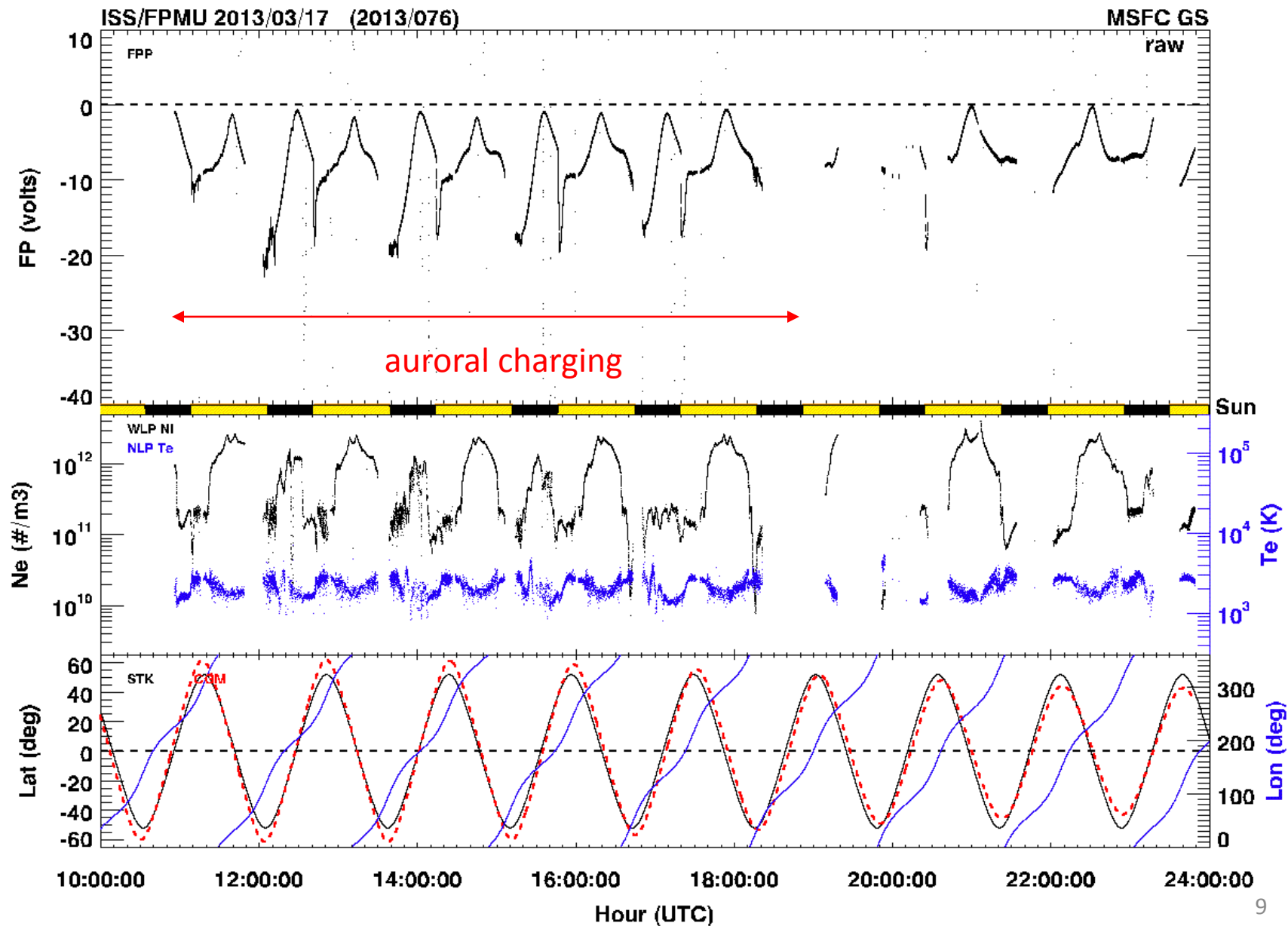


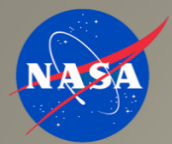
F16: 17 March 2013 N Hemisphere Oval



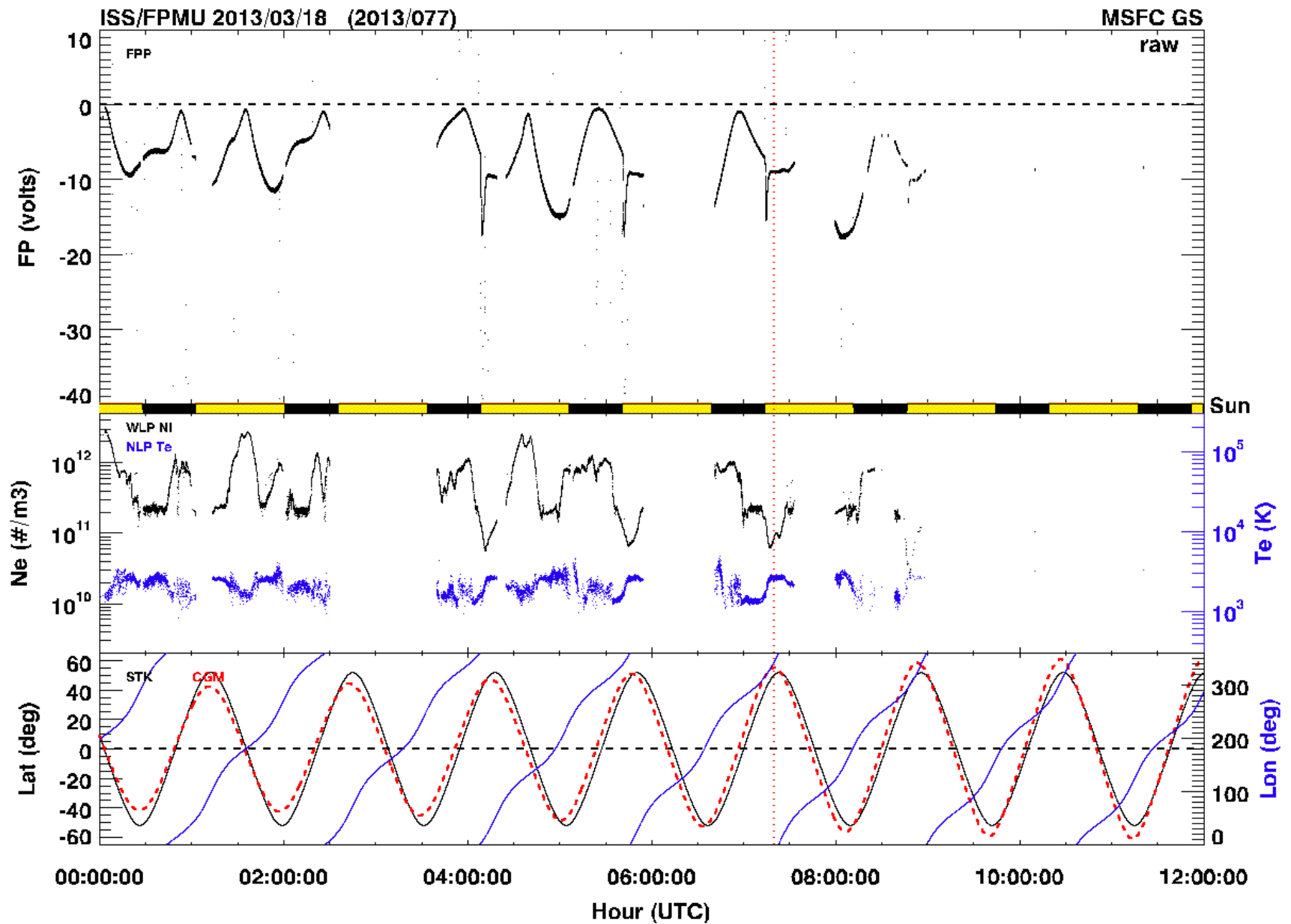


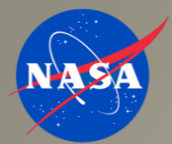
ISS: 17 March 2013 ~12 – 18 UT events



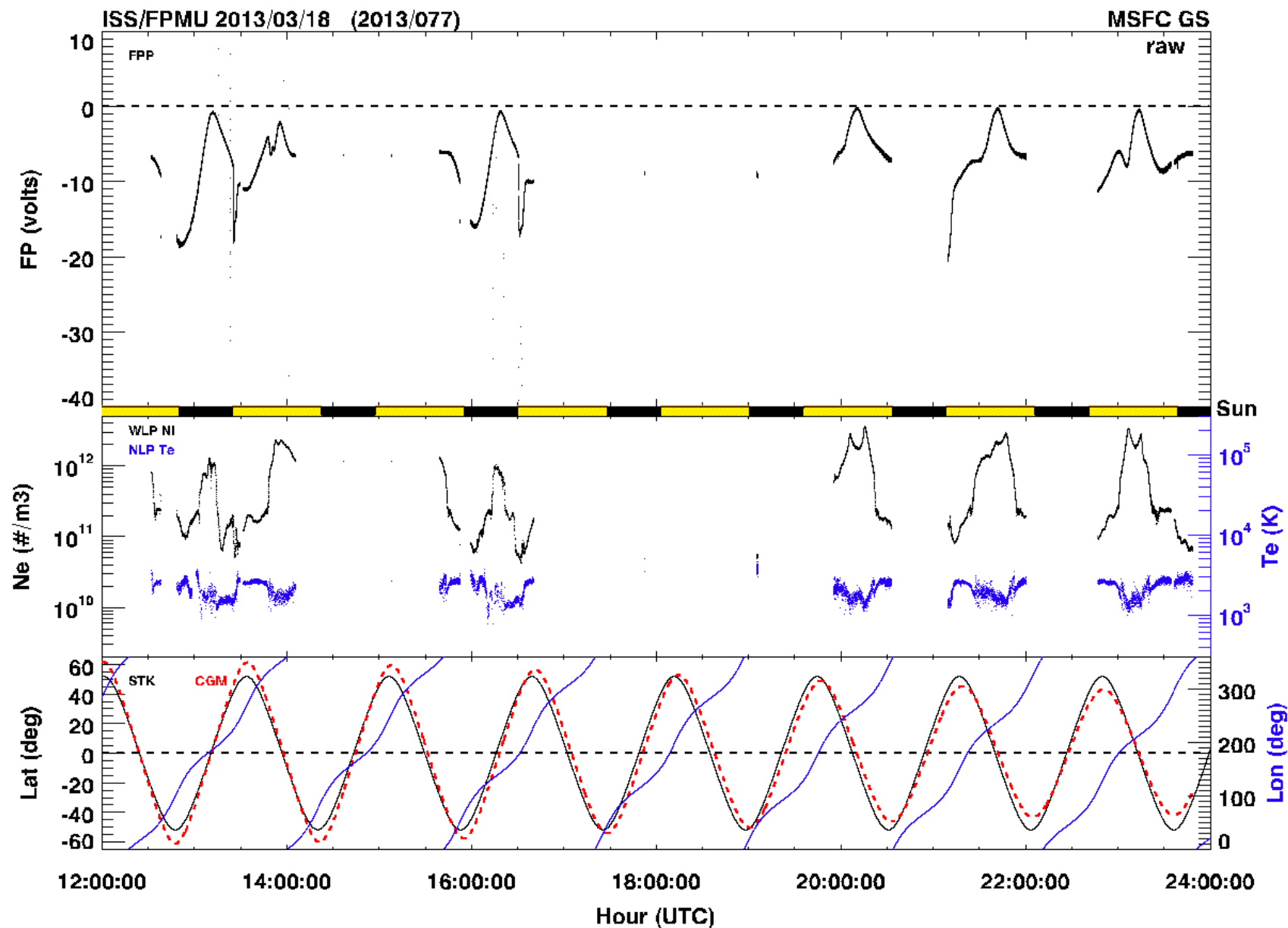


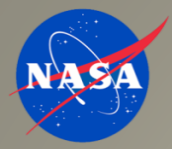
ISS: 18 March 2013





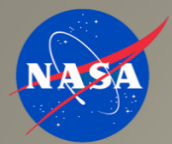
ISS: 18 March 2013



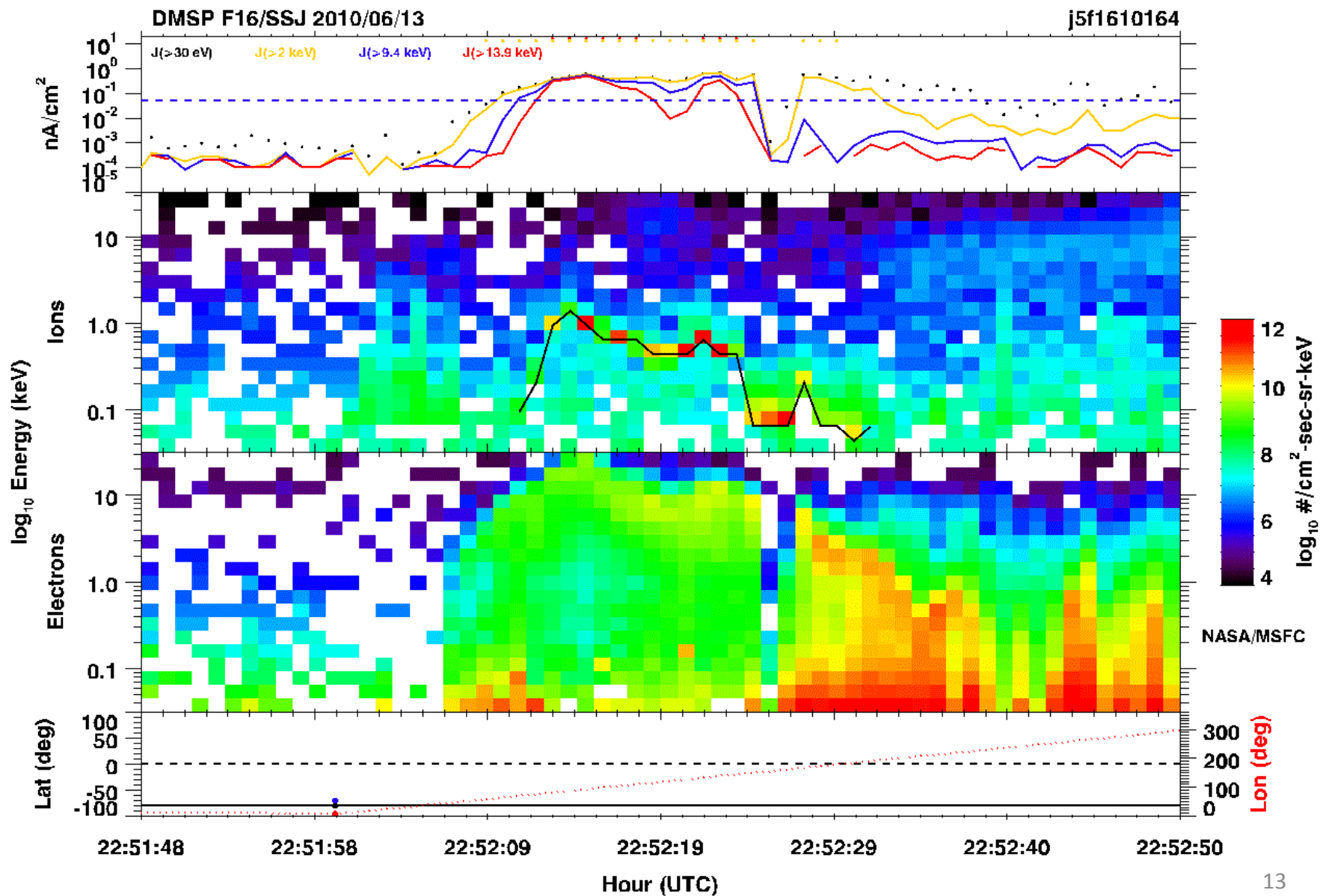


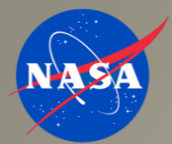
Backup

- Slides 13 – 14: Examples of kilovolt level DMSP charging
- Slides 15 – 20: DMSP 17-18 March 2015 summary plots
- Slide 21: Extreme DMSP charging levels as function of integral electron flux for three energy thresholds (>30 eV, >9.4 keV, >13.9 keV)

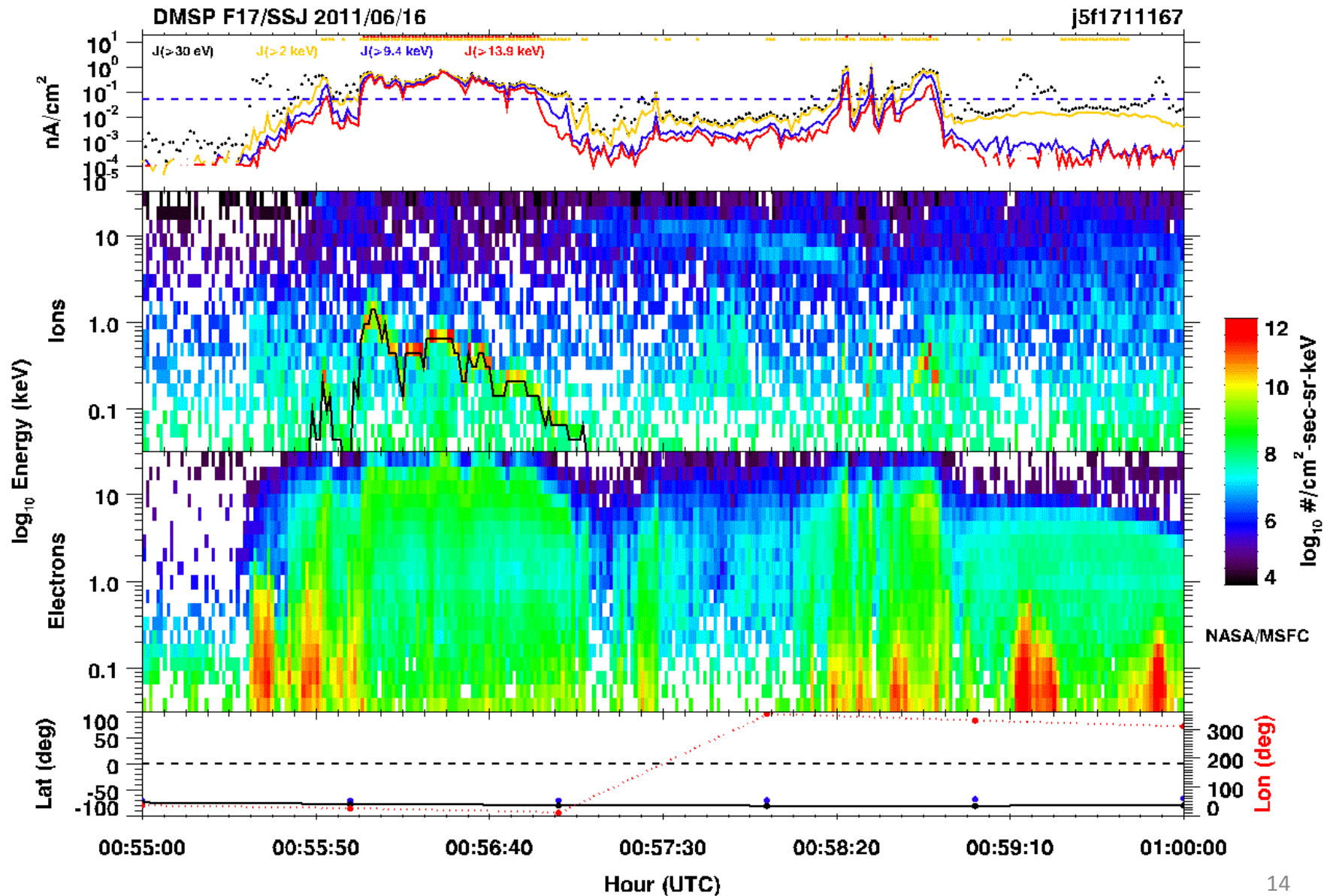


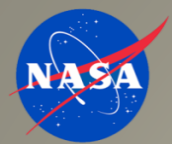
F16: 13 June 2010 ~1000 V charging



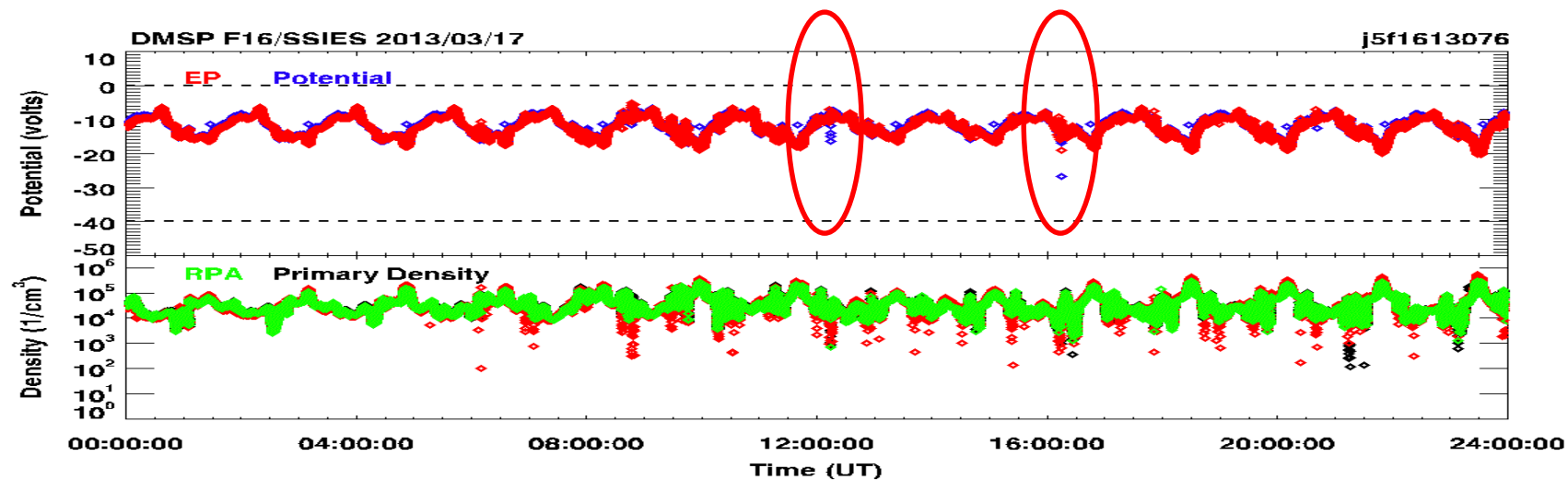
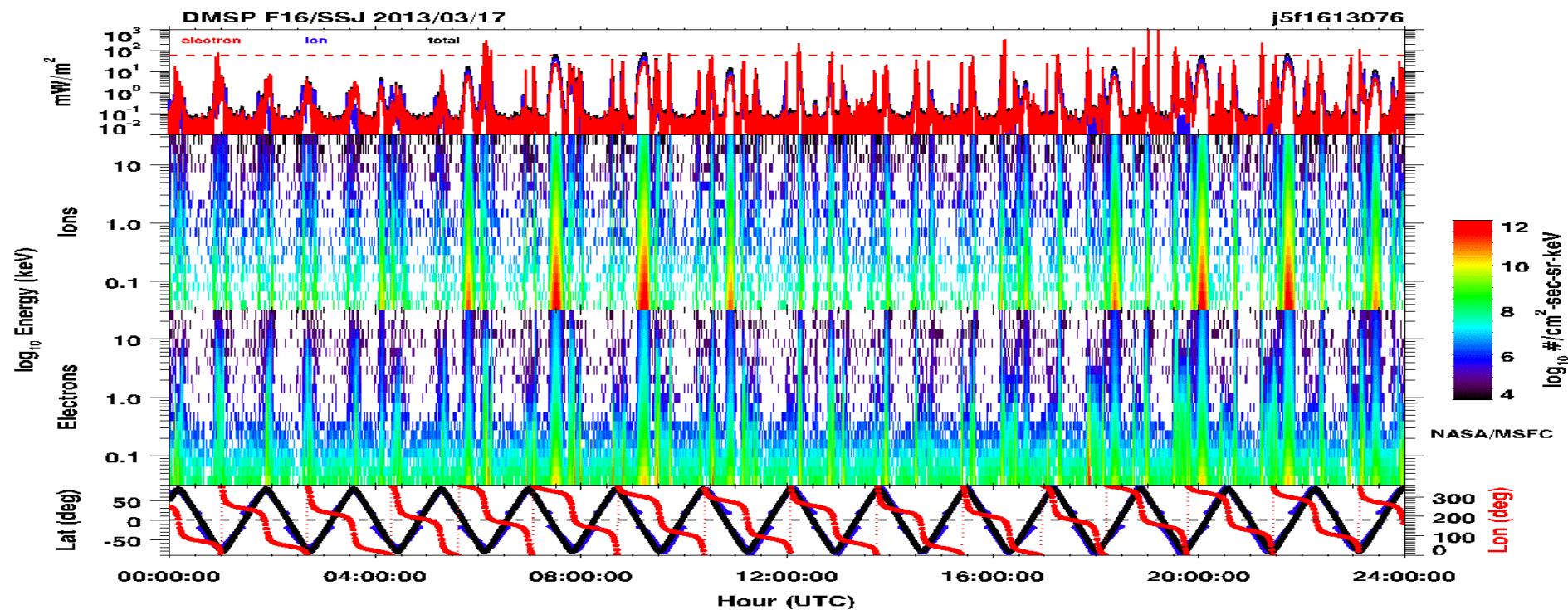


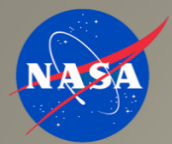
F17: 16 June 2011 ~1000 V charging



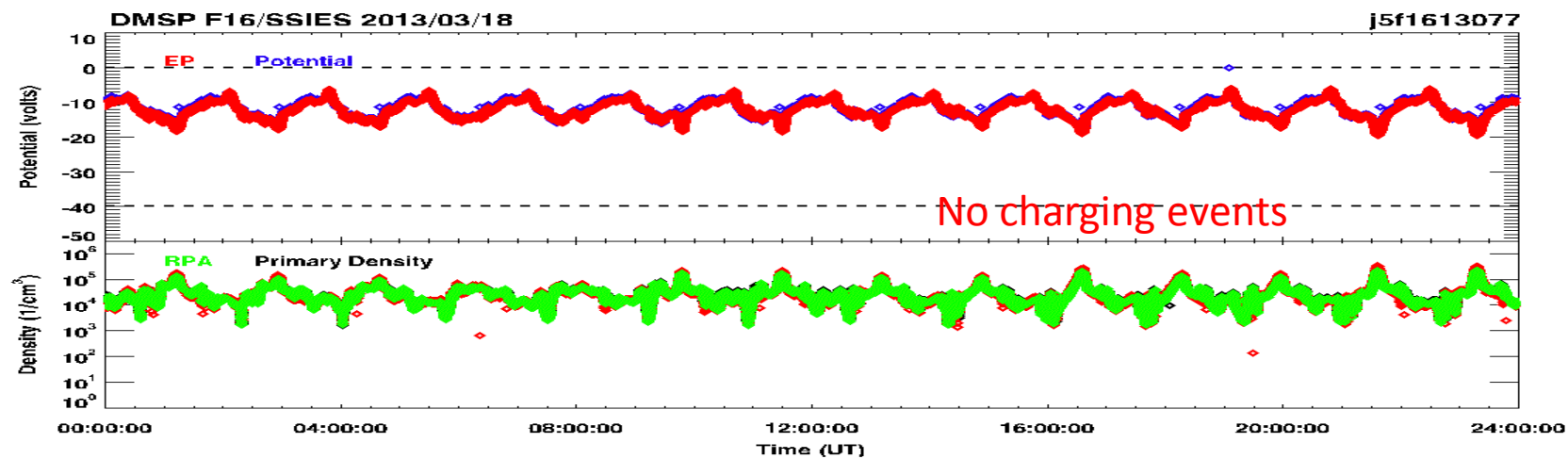
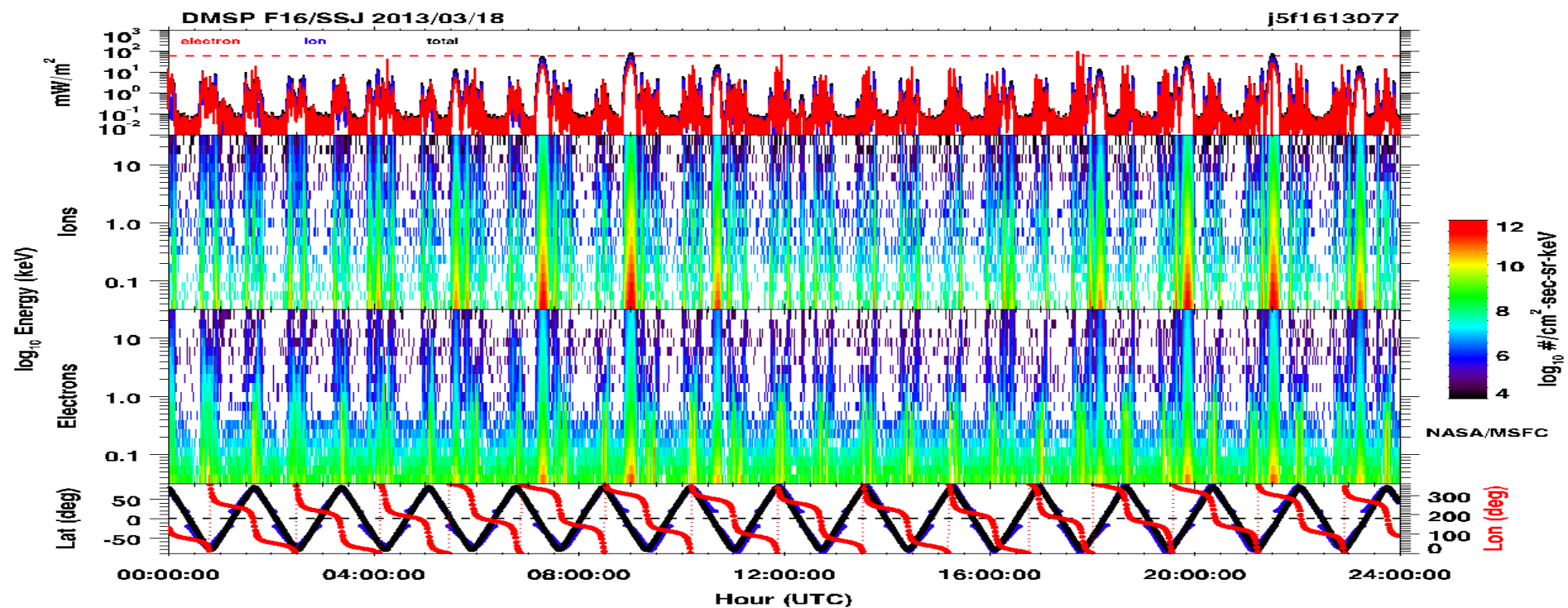


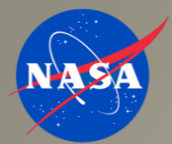
F16: 17 March 2013



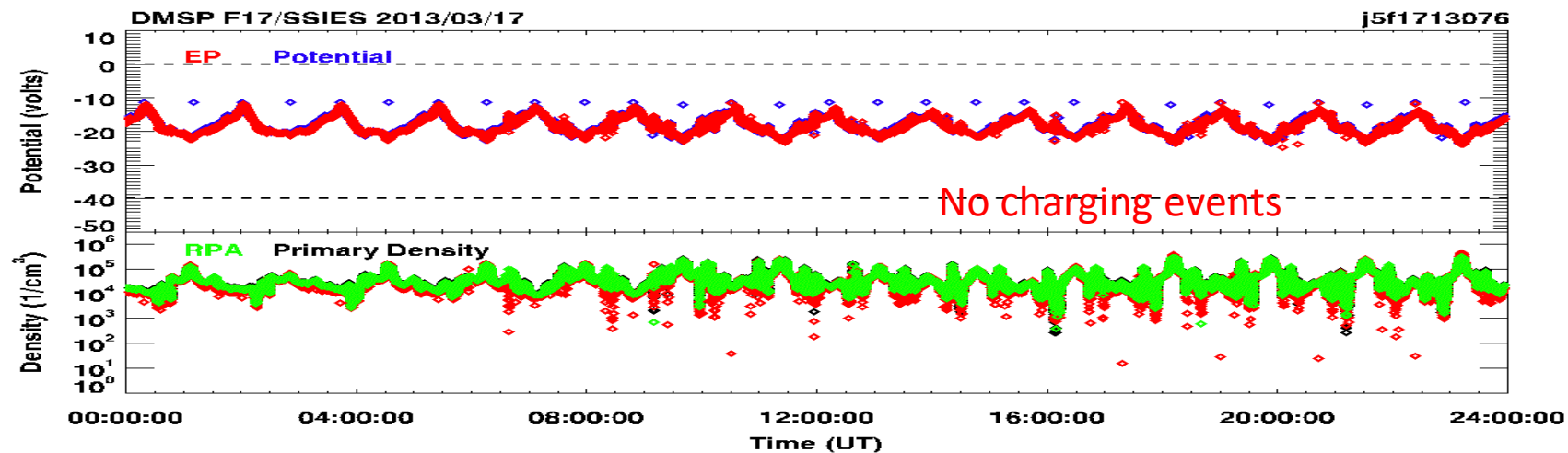
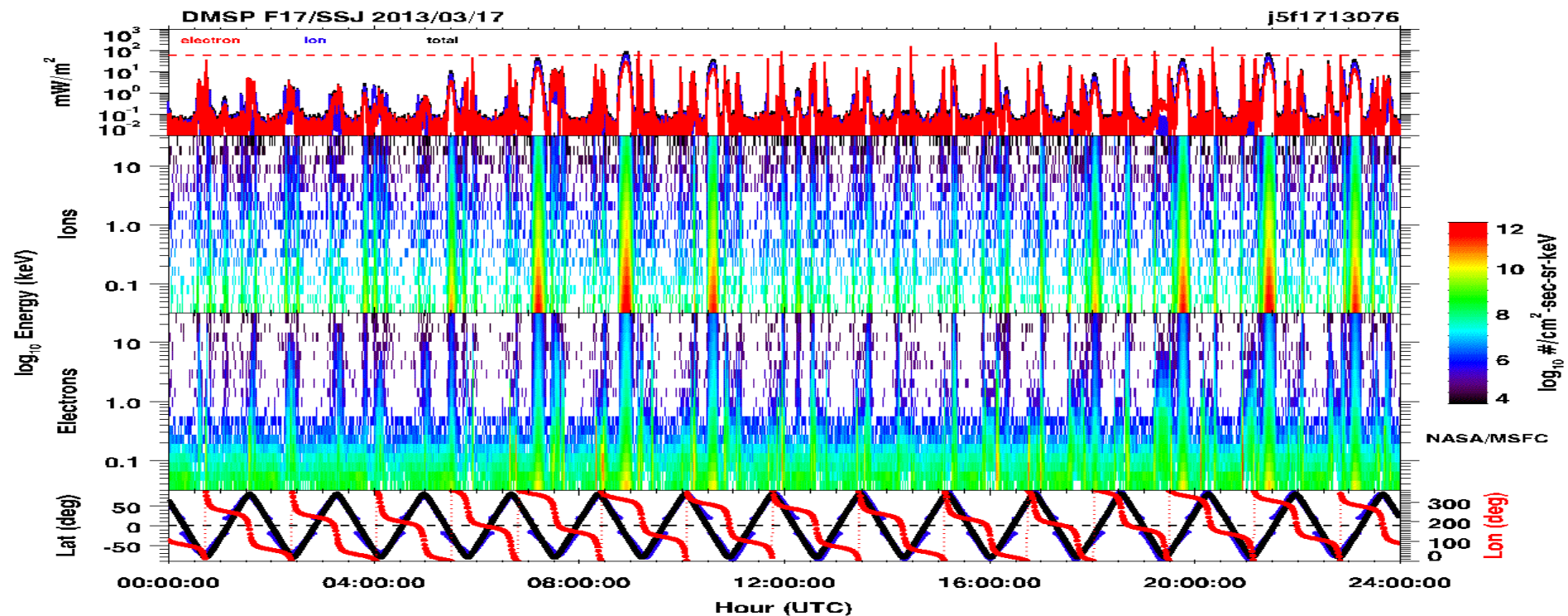


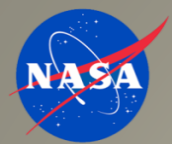
F16: 18 March 2013



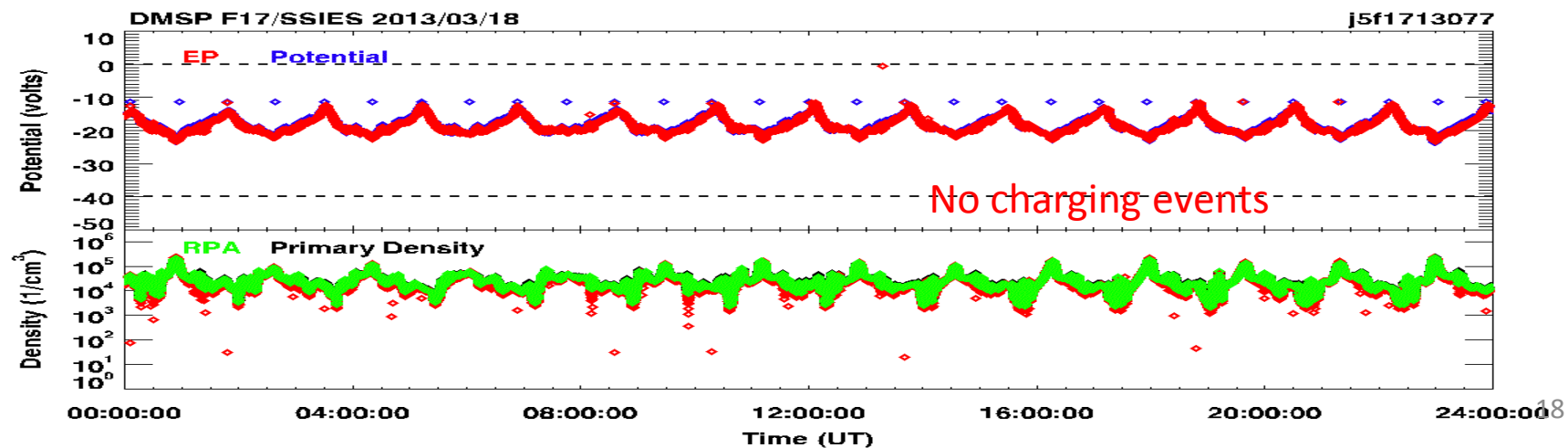
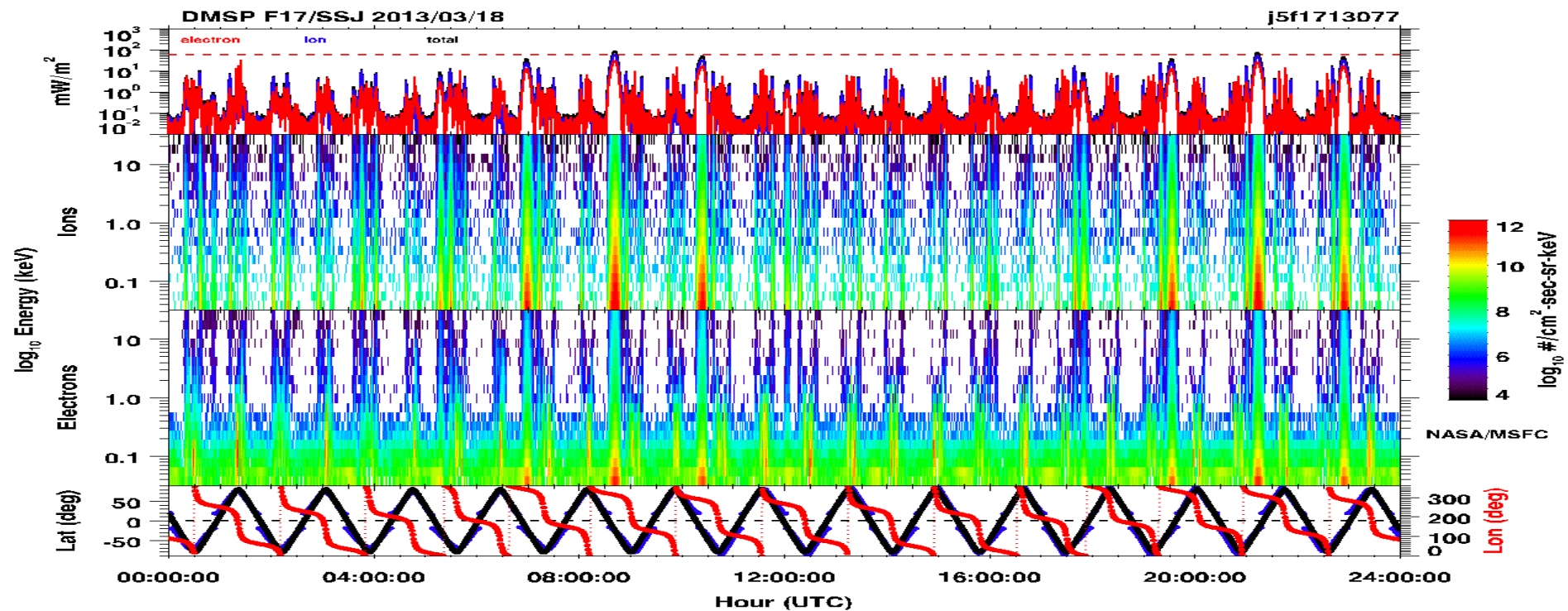


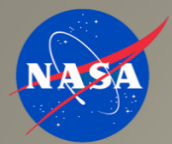
F17: 17 March 2013



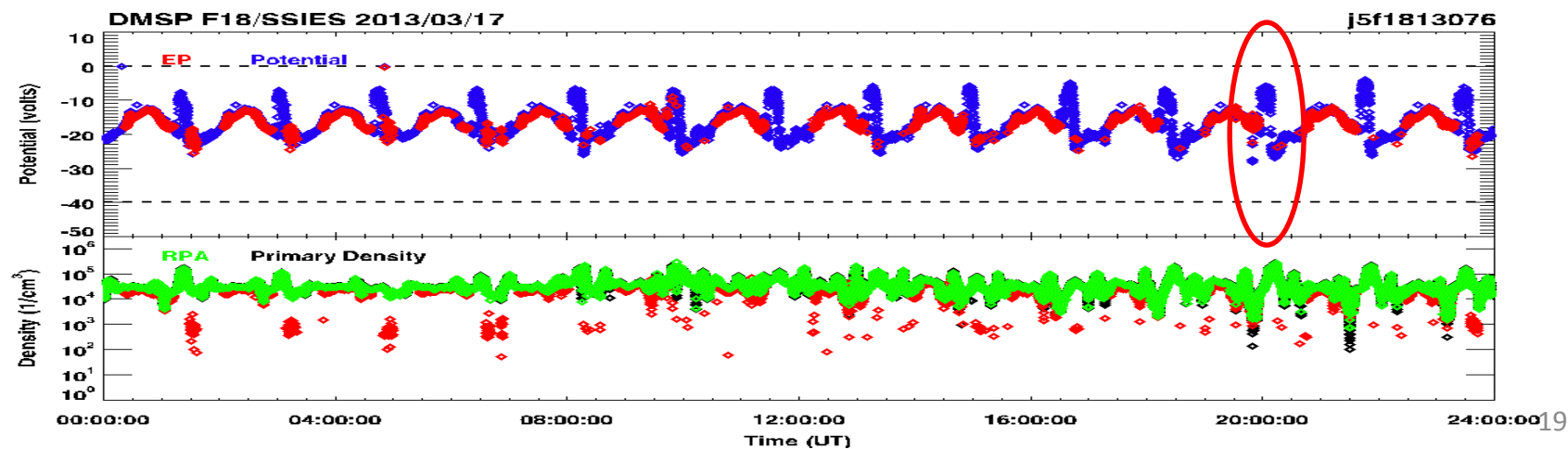
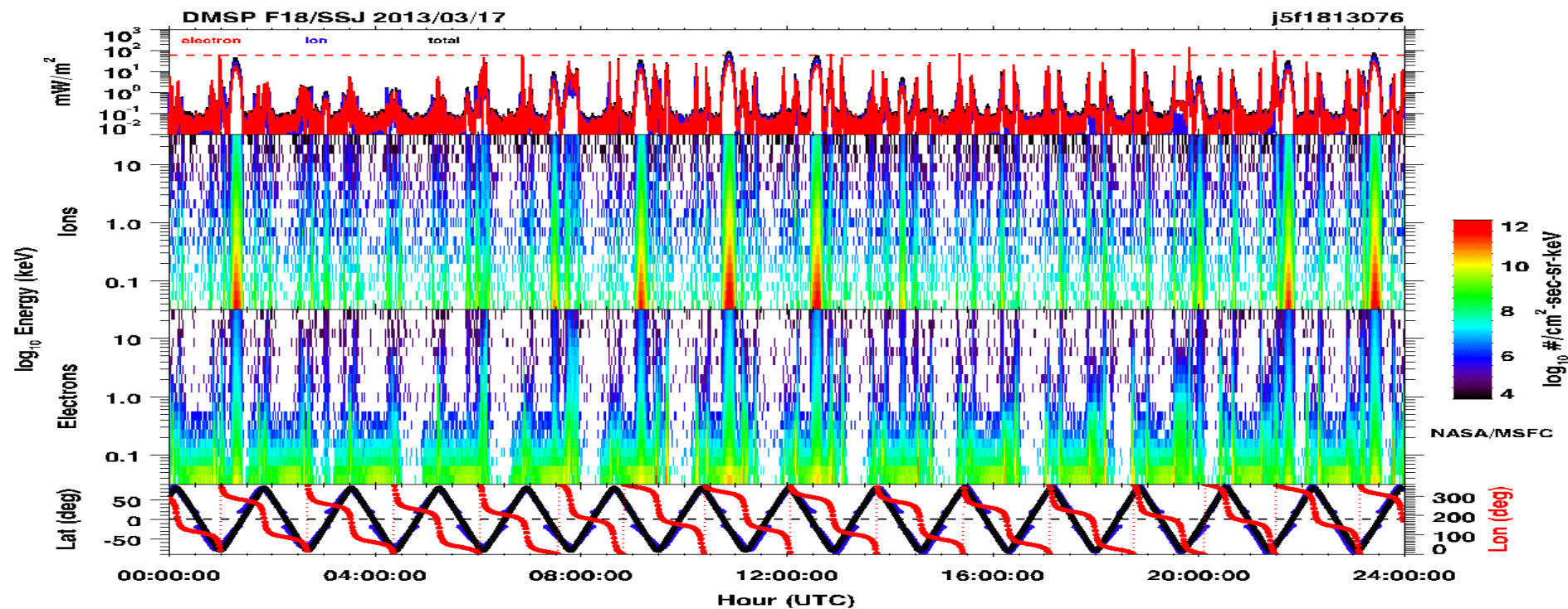


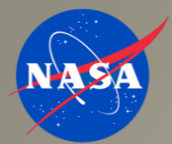
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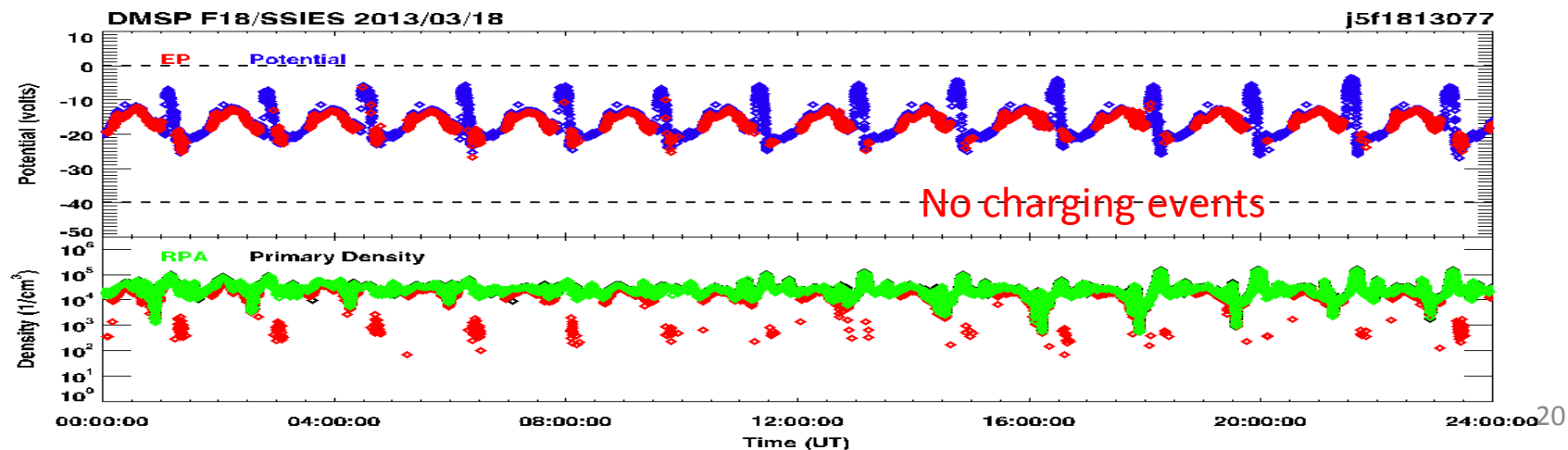
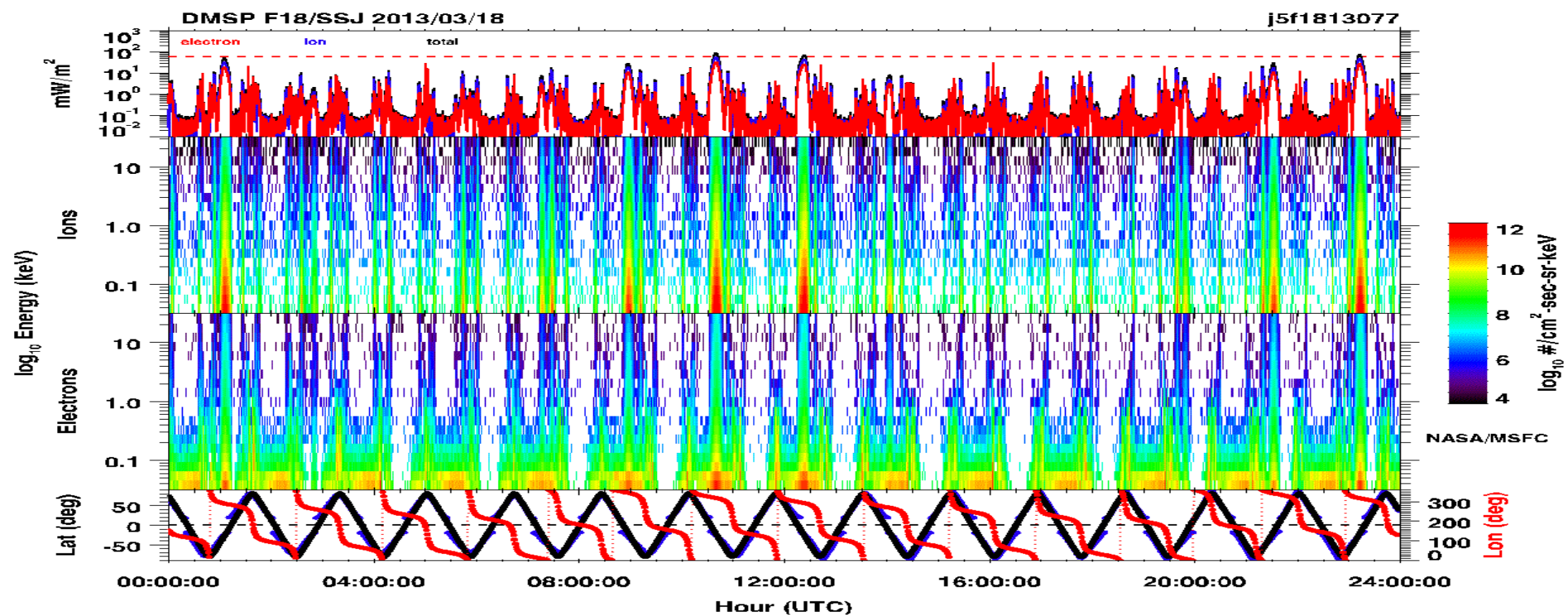


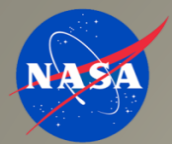
F18: 17 March 2013





F18: 18 March 2013





Correlation with Integral Number Flux

All potentials in event

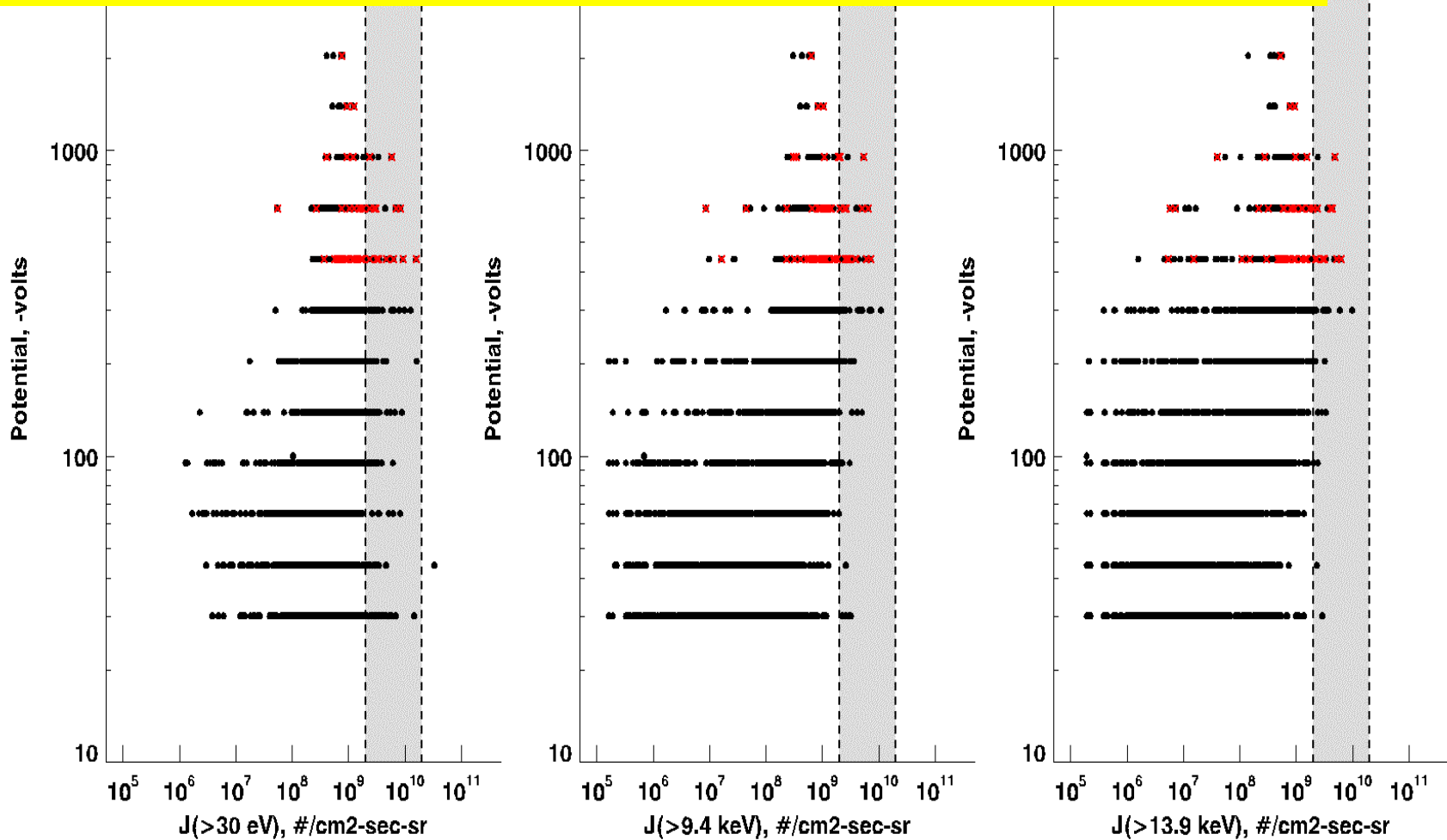
Maximum Potential

1-10 nA/cm²

Gussenhoven et al. 1985 criteria for auroral charging:

$E_{crit} \geq 14$ keV and $F_{crit} > 10^8$ e-/cm²-sec-sr

Critical energy is somewhat arbitrary and flux threshold is lower if a lower energy of 5 keV to 14 keV is used



from Minow et al., 2014



Thank You