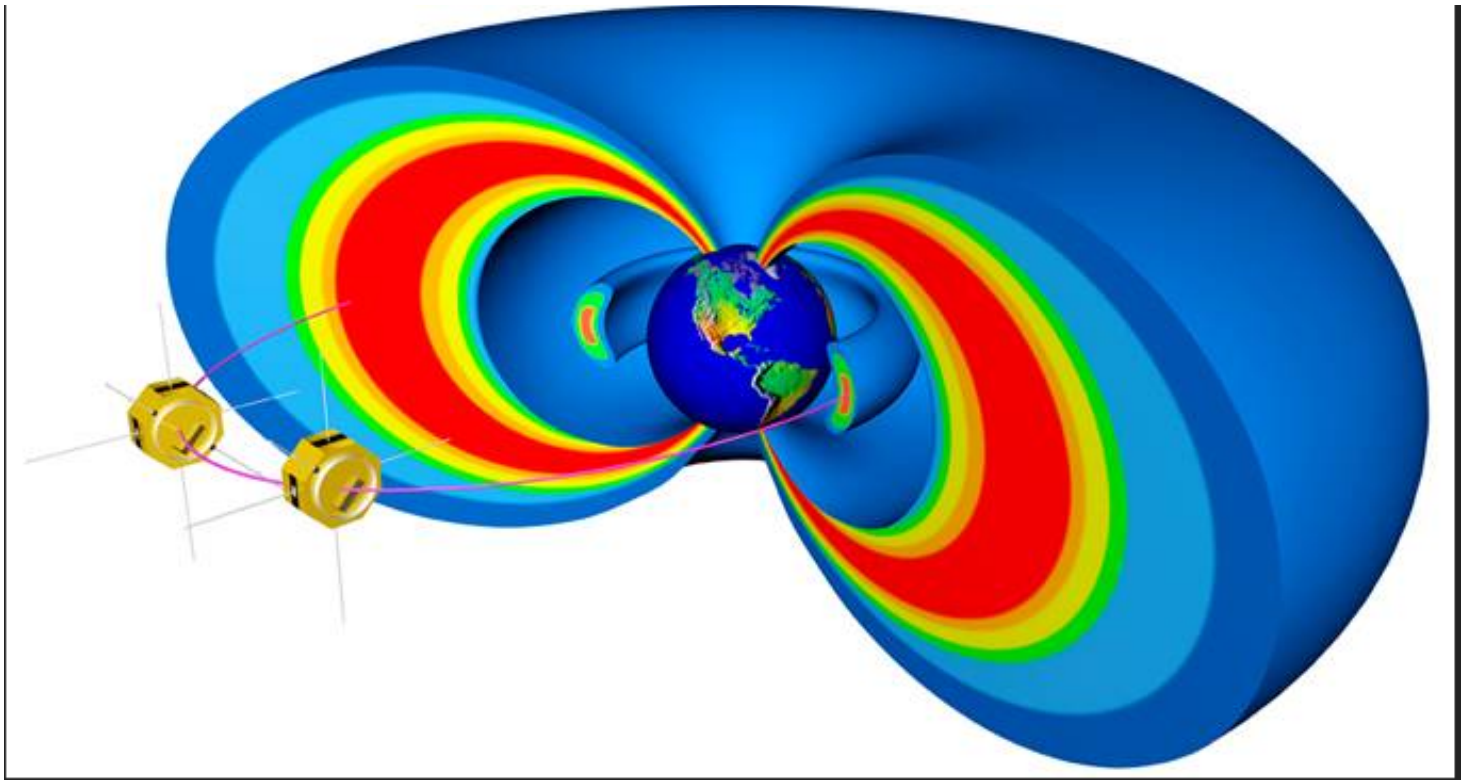
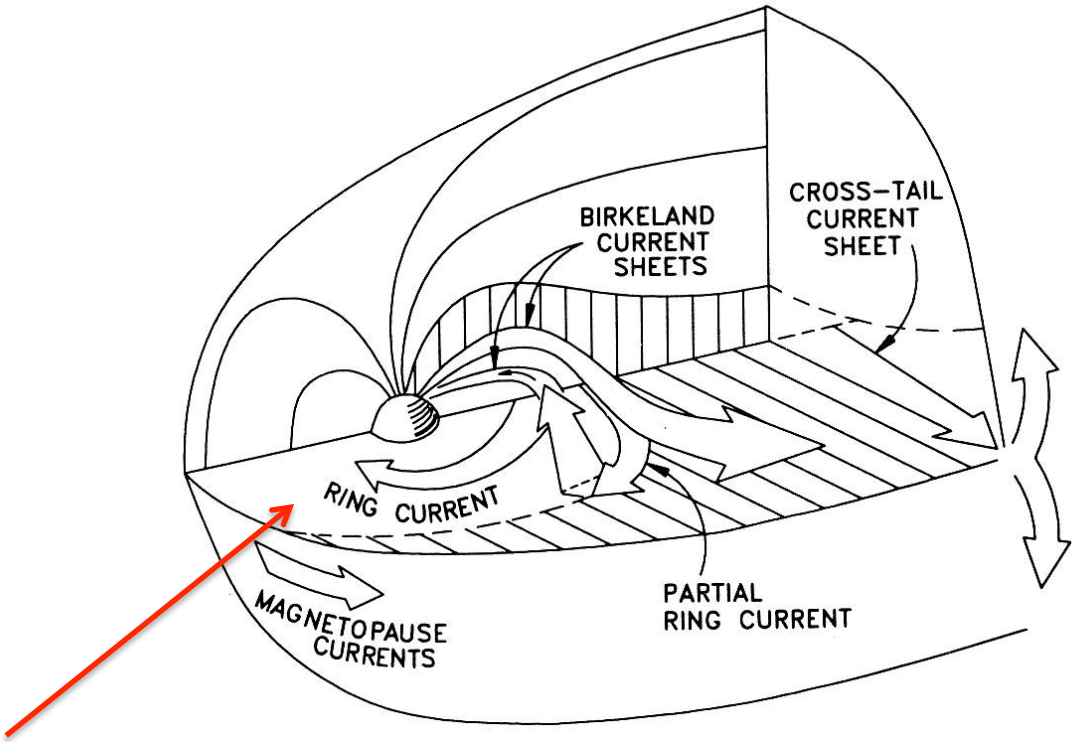
On-Line Visualization

Ring Current / Radiation Belt

Radiation Belts

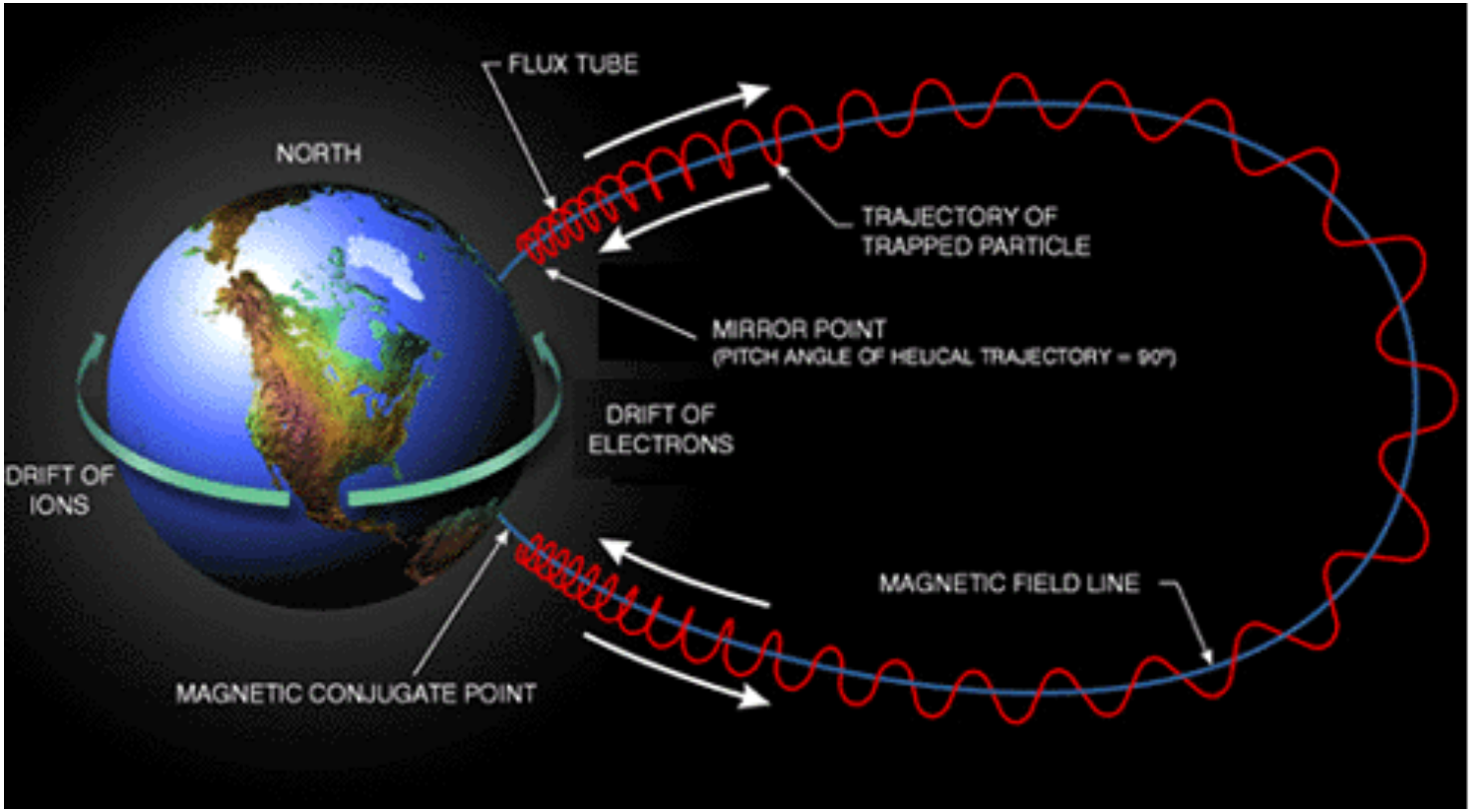


Magnetosphere Current Systems



The **ring current** is one of the major current systems in the Earth's magnetosphere. It circles the Earth in the equatorial plane and is generated by the longitudinal drift of energetic (10 to 200 keV) charged particles trapped on field lines between ~ 2 and 7 Earth's radii.

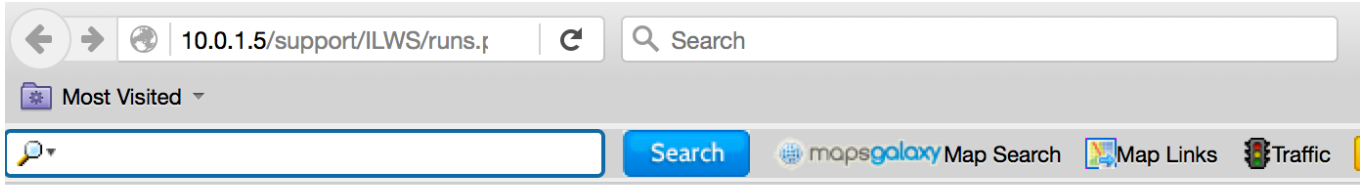
The charged particles that make up the **ring current** and **radiation belts** are trapped in the Earth's magnetic field, bouncing back and forth along the magnetic field lines between "mirror points" in the northern and southern hemispheres.



Ring current circles the Earth in the equatorial plane and is generated by the longitudinal drift of energetic (10 to 200 keV) charged particles trapped on field lines.

Physical Variable Written by Ring Current and Radiation Belt Simulations

- All variables are **averaged over particle bounce motion** along magnetic field lines between “mirror points”.
- Magnetic field lines are identified by the location of their crossing of the equatorial plane (X, Y).
- Particle Fluxes are presented in spatial coordinates in the equatorial plane at (X, Y), equatorial pitch anlge, and 12 **energy levels.**
- Fluxes **F** for electrons (**e-**) and hydrogen ions (**H+**): identified by the (sine of the) equatorial pitch angle (F_PA=?.???)
- Pitch-angle-integrated fluxes identified by:
  - **_tot**: **Total flux for species** (all pitch angles),
  - **_par**: Fluxes along magnetic field B (Pitch angle <60 deg, "PA" <0.866),
  - **_perp**: Fluxes perpendicular to B (Pitch angle >60 deg, "PA" >0.866),
  - **_anis**: Pitch-angle anisotropy *(F_perp-F_par)/F_tot*.



CCMC Runs-on-request system: demo and hands-on

Sun to L1:

Heliosphere

Results of WSA-ENLIL Cone model simulations:

- Demo run and tutorial
- Runs

Local Network:
http://10.0.1.5/support/ILWS/runs.php

L1 to Geospace:

Magnetosphere

Internet:
http:/ccmc.gsfc.nas.agov/support/ILWS/runs.php

Results of SWMF model simulations:

- Demo run and tutorial
- Runs with artificial conditions
- Real event simulations

Inner Magnetosphere

Results of inner magnetospheric models simulations (Ring Current, Radiation Belt and CIMI models)

- Demo run and tutorial
- CIMI model run

Click here

Ionosphere

Results of CTIPe model simulations:

- Demo run and tutorial
- Runs with artificial conditions
- Real event simulations

Local Physics

Results of PIC-Hesse model simulation:

- Demo run

Demo run and tutorial

Click here

Demo (practice) run

Run Number	Key Words	Model	Model Version	Start Time	End Time	Dipole Tilt (in the X-Z Plane) at Start deg	N	V_x
HSS2012_SWMF_052212_1	HSS2012, North-South IMF turning, SSW16	SWMF	v20110131	2000/01/01 00:00	2000/01/01 05:00	0.00	5.00000	-400.00000

Tutorial

- **Ring Current / Radiation Belt Visualization Tutorial**
- Ring Current En 22keV Movie
- Ring Current Midnight Movie

On-Line Visualization: Ring Current Electrons

HSS2012_SWMF_052212_1

Title/Introduction:

Key Word: HSS2012, North-South IMF turning

Model Type: GM
Model: SWMF version v20110131

Click here

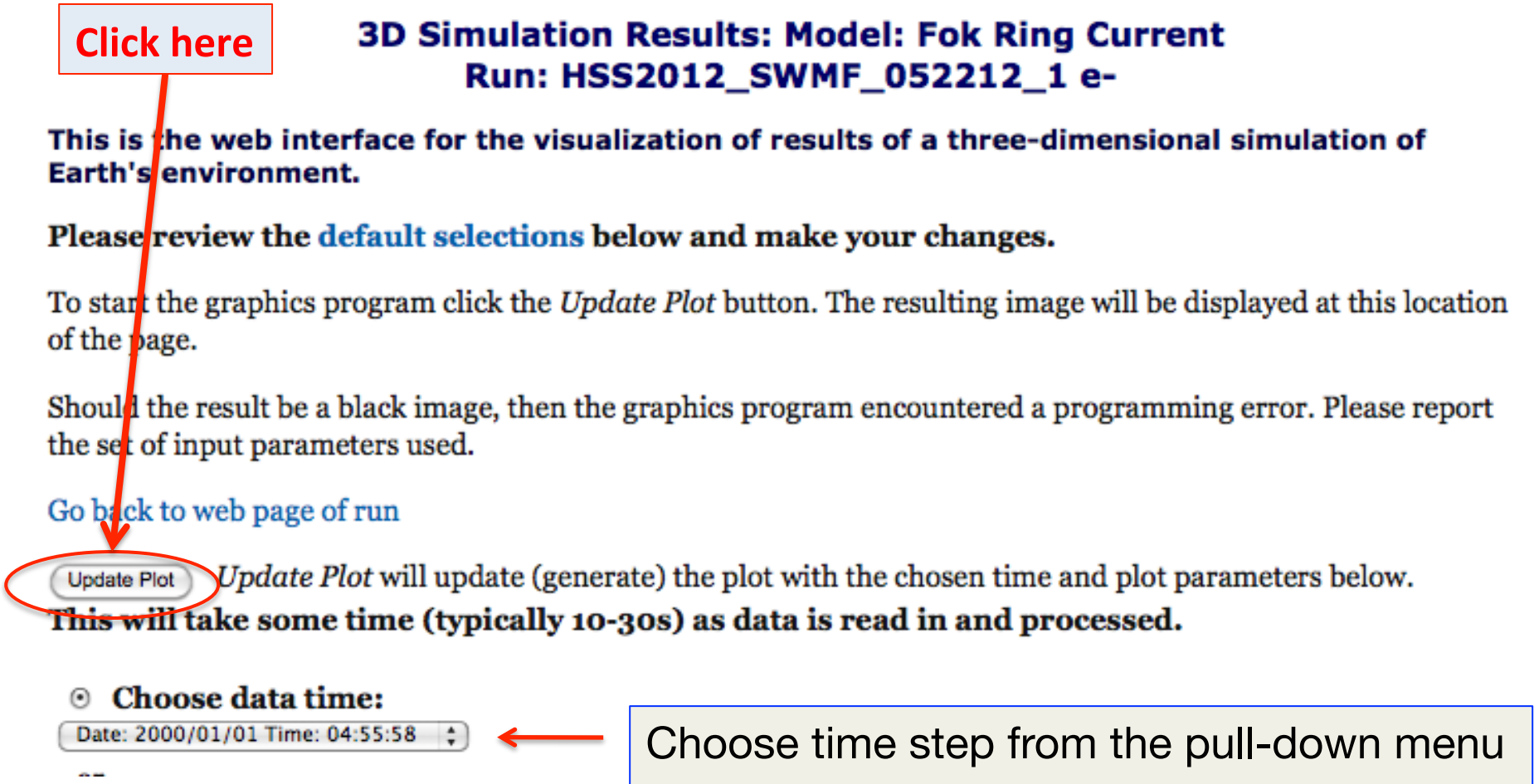
- View solar wind input data
- List solar wind input data in ASCII format (see format description here).
- View Magnetosphere
- Create Timeseries in Magnetosphere
- View Ionosphere

View pre-computed timeseries data:

- Northern hemisphere polar cap flux and area
- Southern hemisphere polar cap flux and area
- Magnetopause standoff and closest approach within 30 deg. of Sun-Earth line (local noon)
- Polar cap boundary at 24 magnetic local times
- Ionospheric dissipation

- View Fok Ring Current Electrons
- View Fok Ring Current Protons

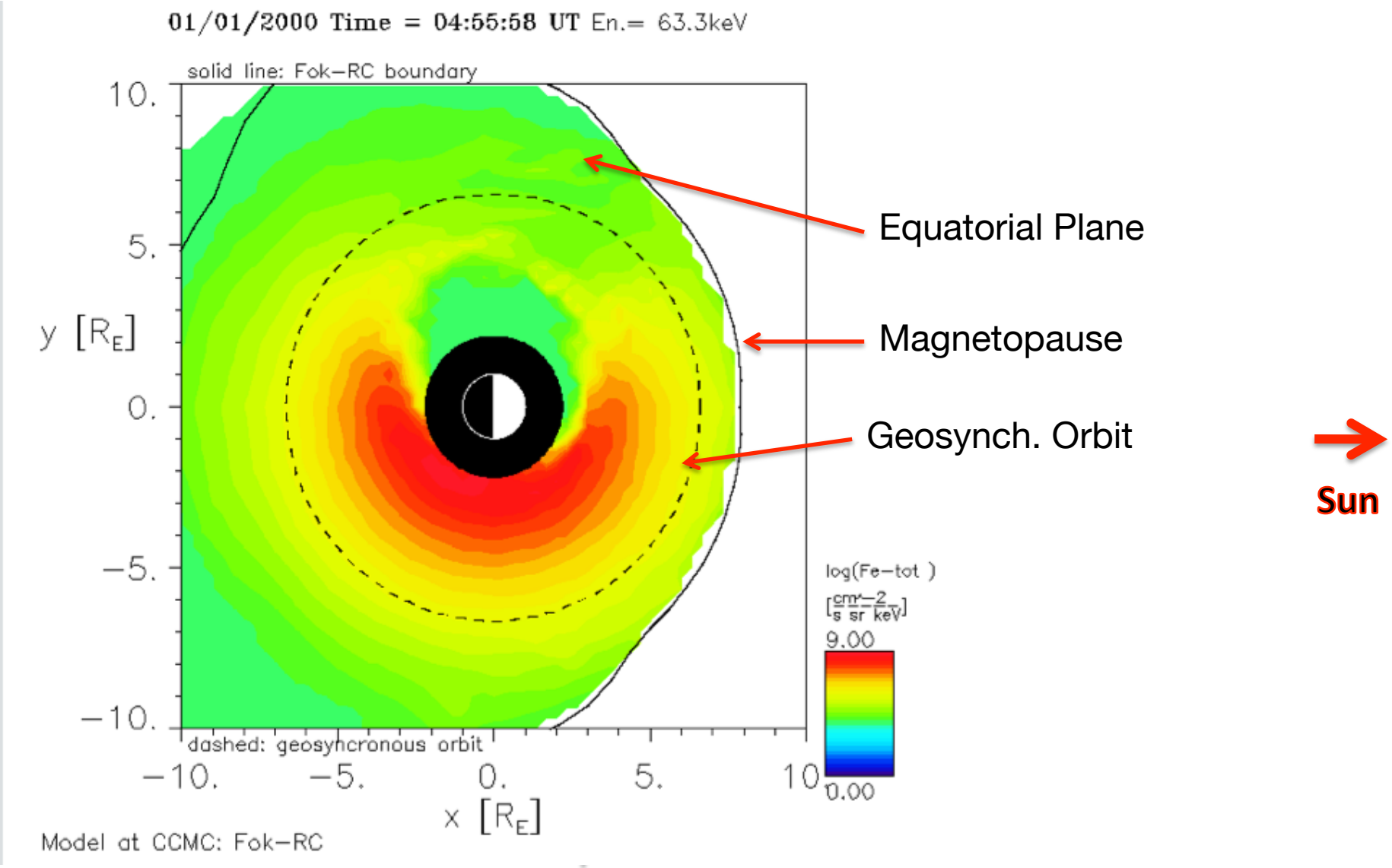
Make a First Plot with Default Selections



Choose time step from the pull-down menu

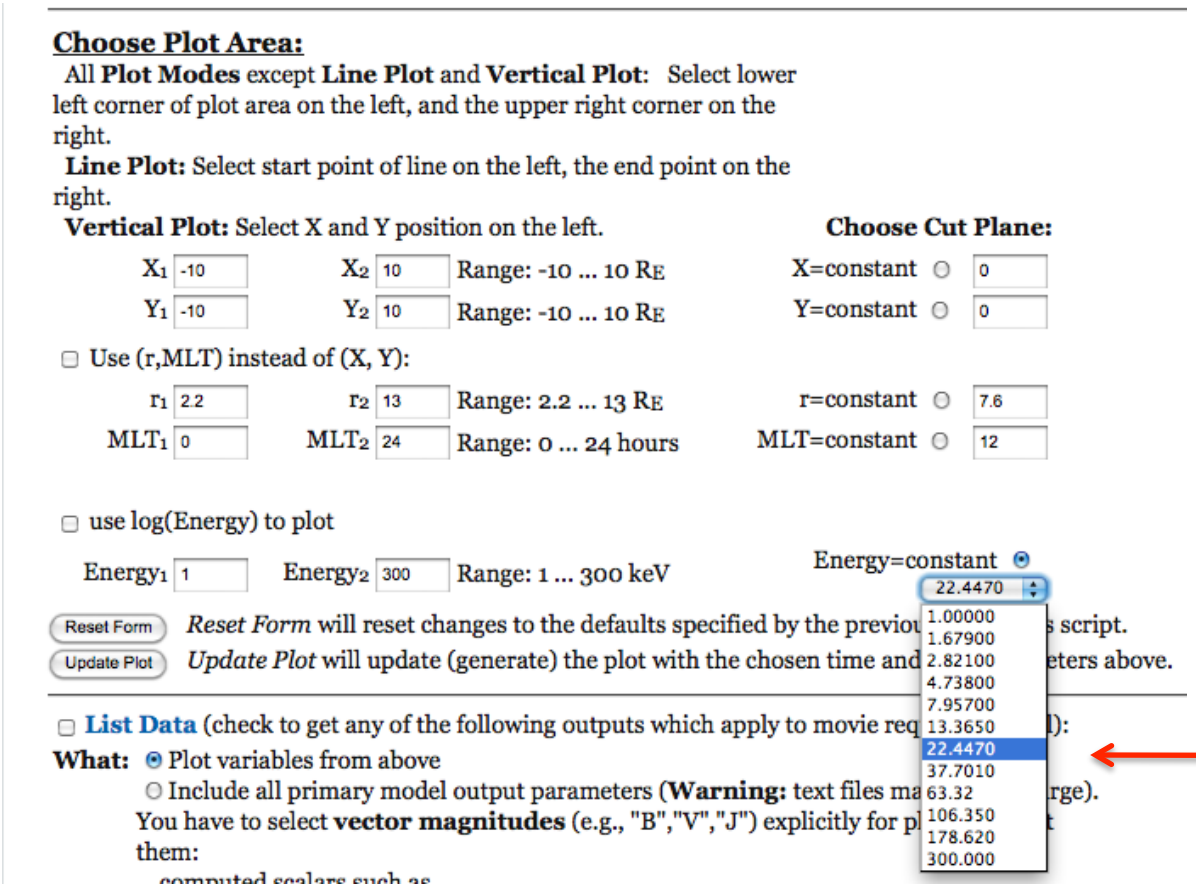
Click "**Update Plot**" to make a plot with default selections

Electron Total Flux. Energy 63.3 keV. Color Contour



Earth radius

Select Energy Level En = 22.45 keV

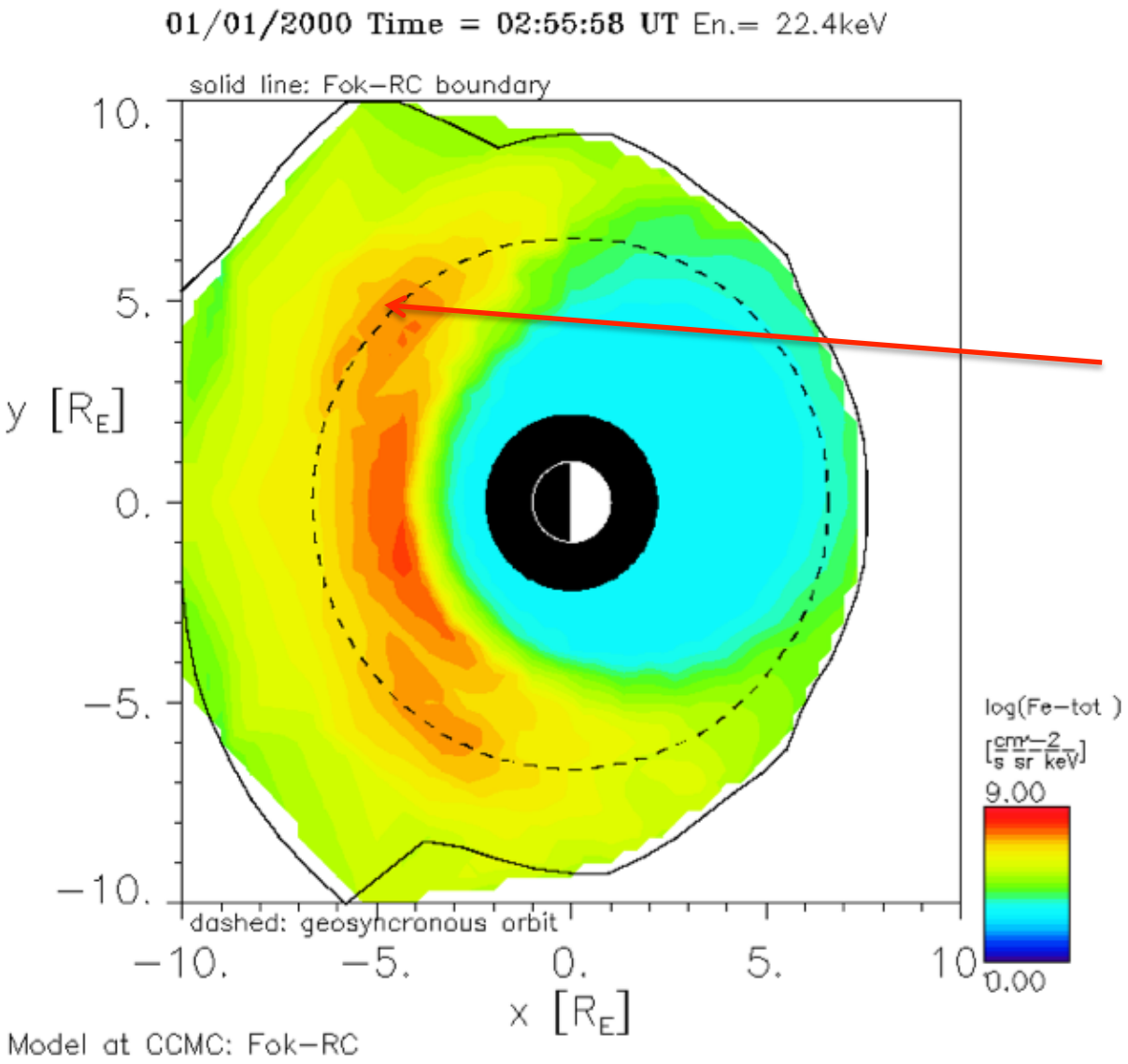


Choose En=22.45 keV from the Energy=constant pull-down menu

Select time 2:56

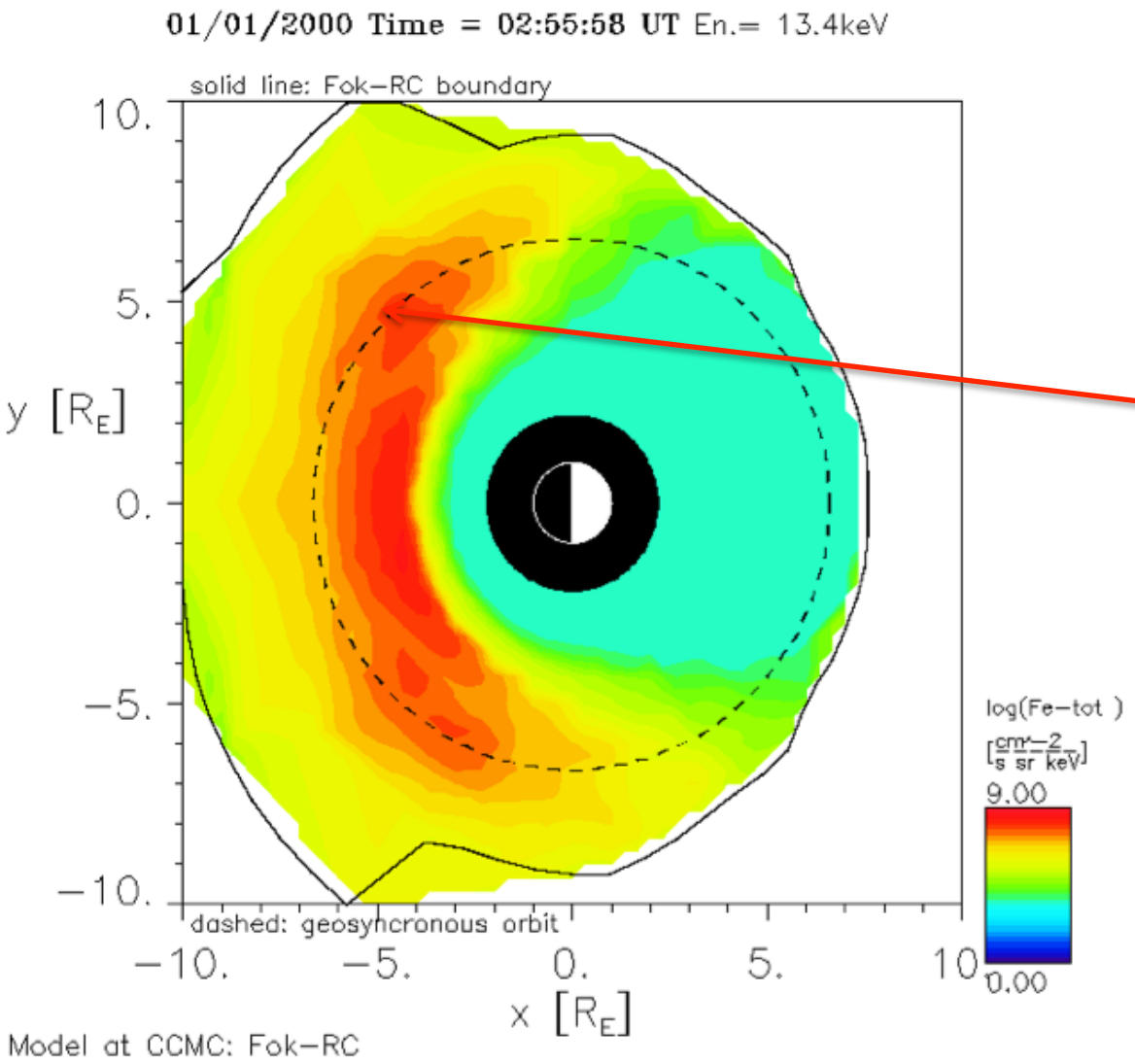
Click "**Update Plot**"

Electron Total Flux. Energy 22.45 keV. Color Contour



Electron Flux increase at the geosynch. orbit

Electron Total Flux. Energy 13.4 keV. Color Contour



Electron Flux increase
at the geosynch. orbit

Space Weather Effect of Ring Current Electrons: Surface Charging

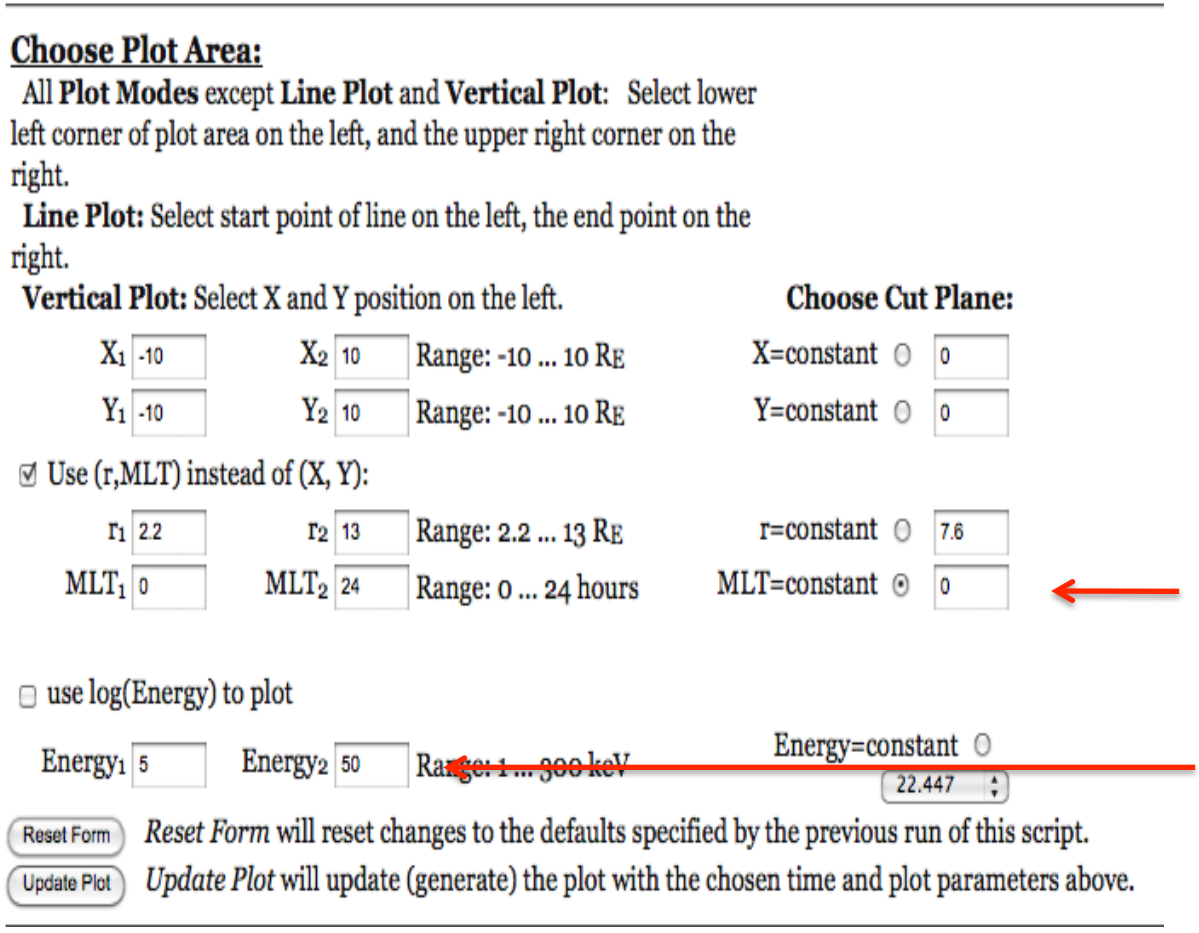
Electrons with energies in the range of several to several tens of keV are responsible for surface charging of spacecrafts in geosynchronous orbit.

The differential charging of spacecraft surfaces can give rise to destructive arc discharges, causing satellite operational anomalies.

Intense fluxes of these electrons can be caused by north-south IMF turning and substorms.

Surface charging occurs more often in the midnight to dawn sector.

Electron Fluxes in Energy Range 5 – 50 keV at the Night Side (Magnetic Local Time MLT = 0)



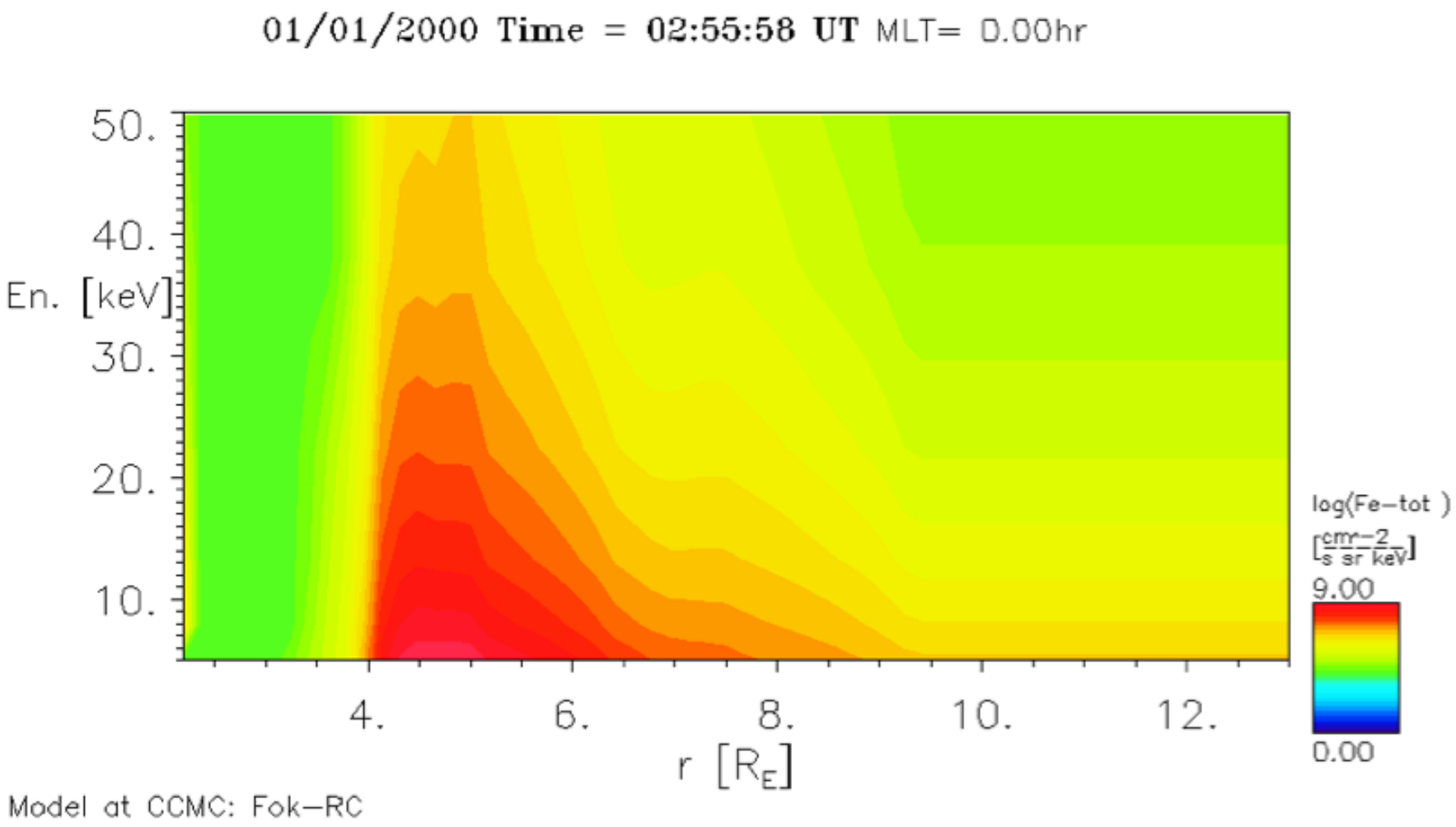
Select MLT=constant instead of Energy=constant

Set MLT=0 (midnight)

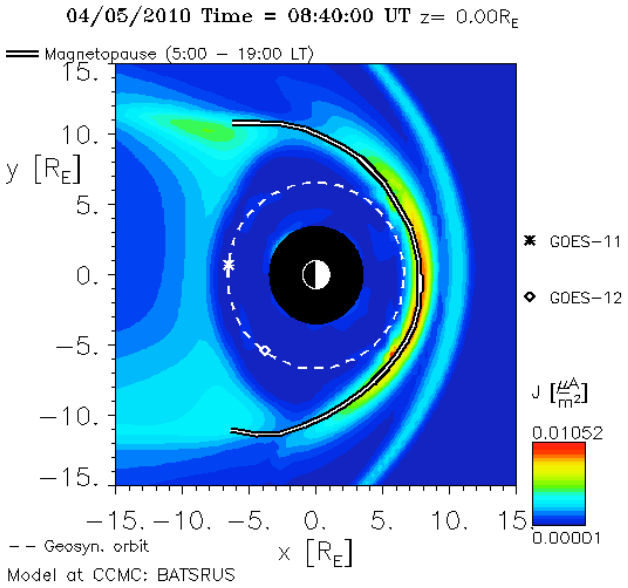
Set Energy range between 5 and 50 kev
Select time 2:56

Click **"Update Plot"**

Electron Fluxes in Energy Range 5 – 50 keV at the Night Side (Magnetic Local Time MLT = 0)

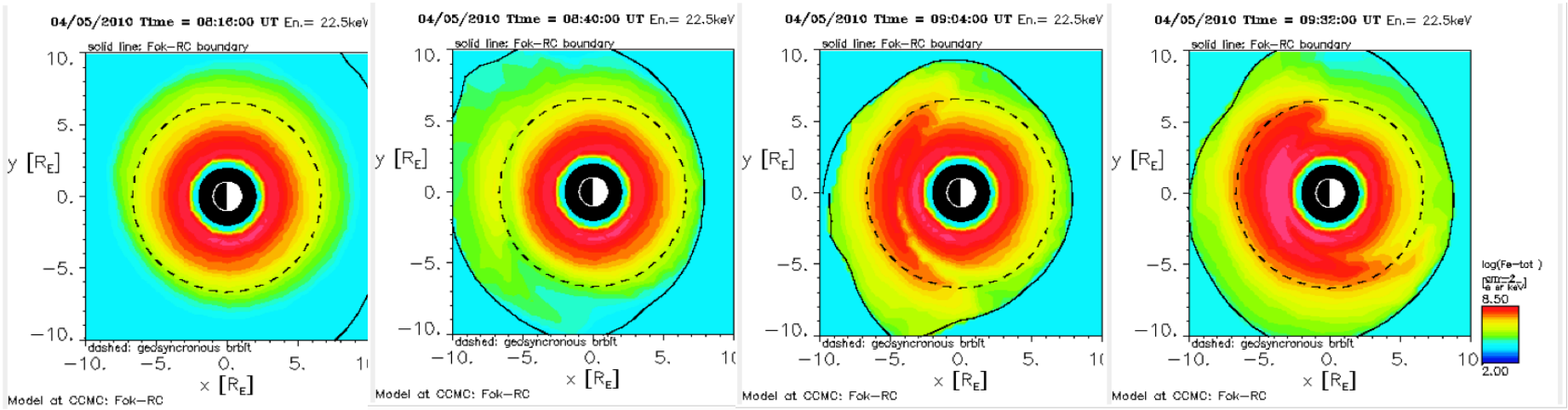


Examples of April 5 event



CME occurred on April 3,2010

Galaxy 15 failed approx 9:48Z

Surface charging

22keV electrons 4/5, 8:16-9:32Z