

# Models of the Plasmasphere and the Radiation Belts

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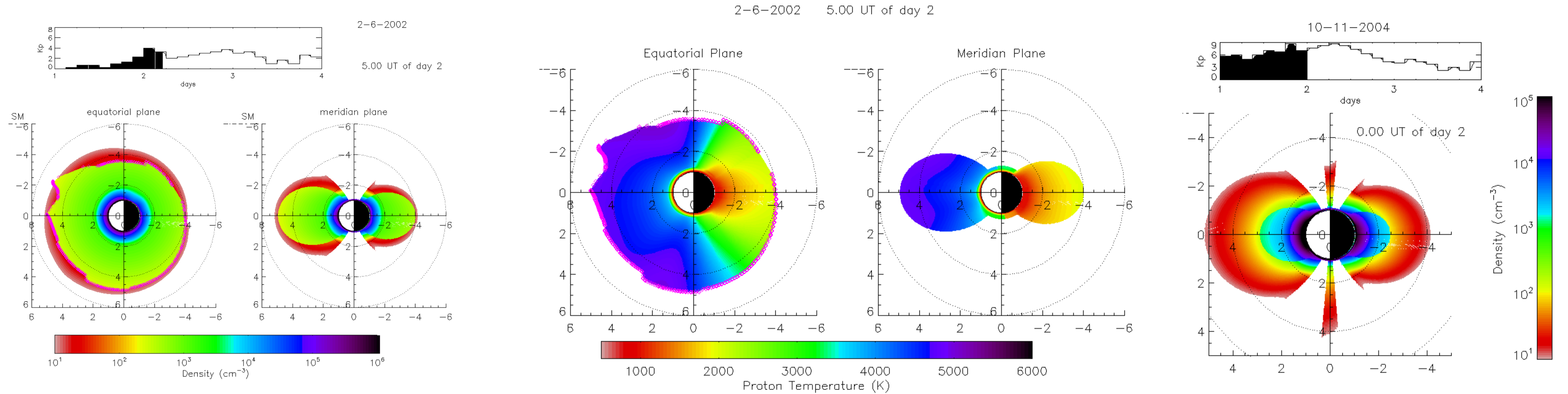
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**Abstract:**

On [www.spaceweather.eu](http://www.spaceweather.eu) we provide a dynamic 3D plasmasphere model, that can be used to forecast the plasmasphere. We analyzed Cluster/RAPID data to determine the dynamics of the electron radiation belts during geomagnetic quiet and disturbed periods. A radiation belt model is in development and will be available on the spaceweather portal.

## Plasmasphere

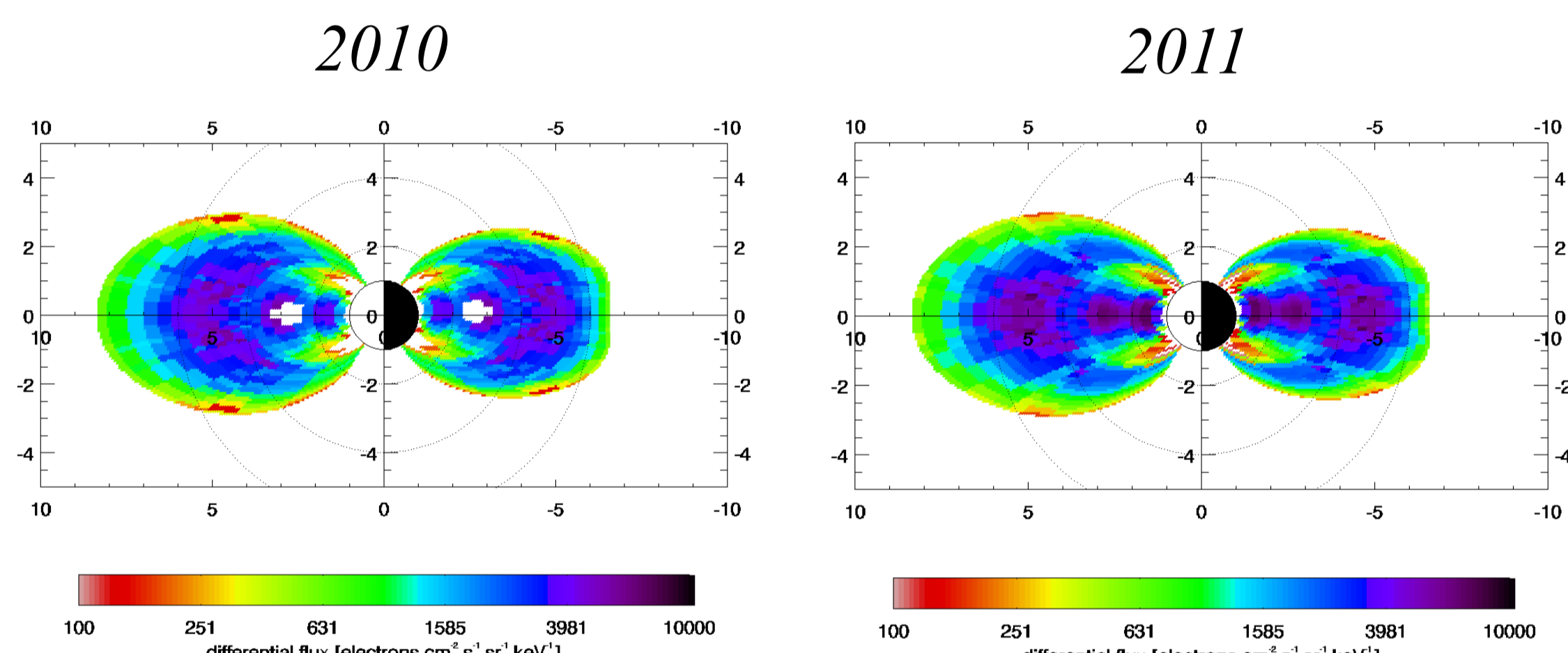


We developed a plasmasphere model that is available on the spaceweather portal. We provide the density and temperature of the electrons, protons, and helium ions in the ionosphere, plasmasphere, plasmaplumes, plasmatrail, and polar wind.

## Radiation Belts

1-year average electron omni-directional differential flux in the range [244.1.-406.5 keV] measured by the instrument RAPID onboard the CLUSTER satellites.

<http://www.spaceweather.eu>

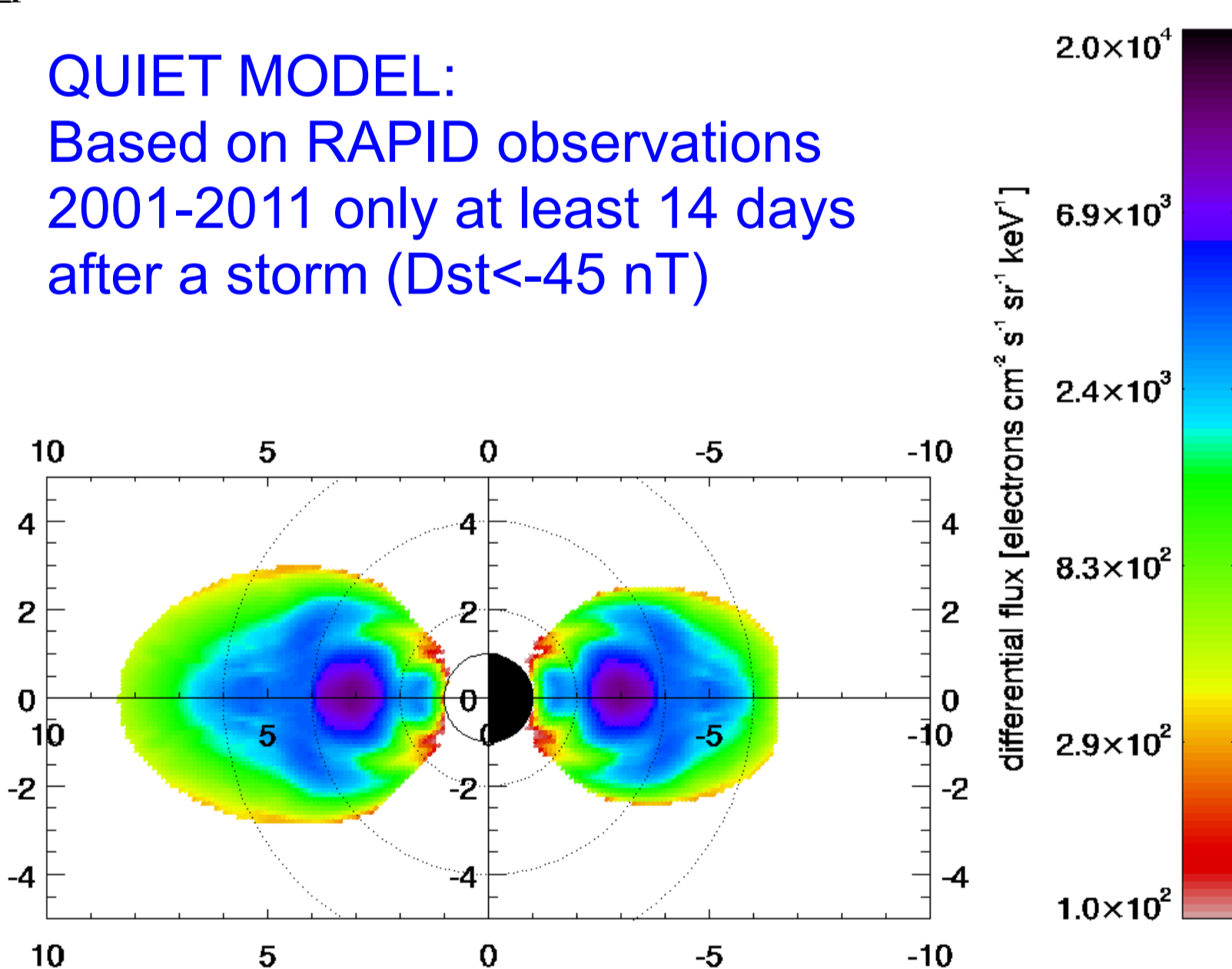


Since 2007, the perigee of the Cluster orbit has moved closer to the Earth, down to about 1.3 R<sub>E</sub> in the year 2010, deep inside the radiations belts.

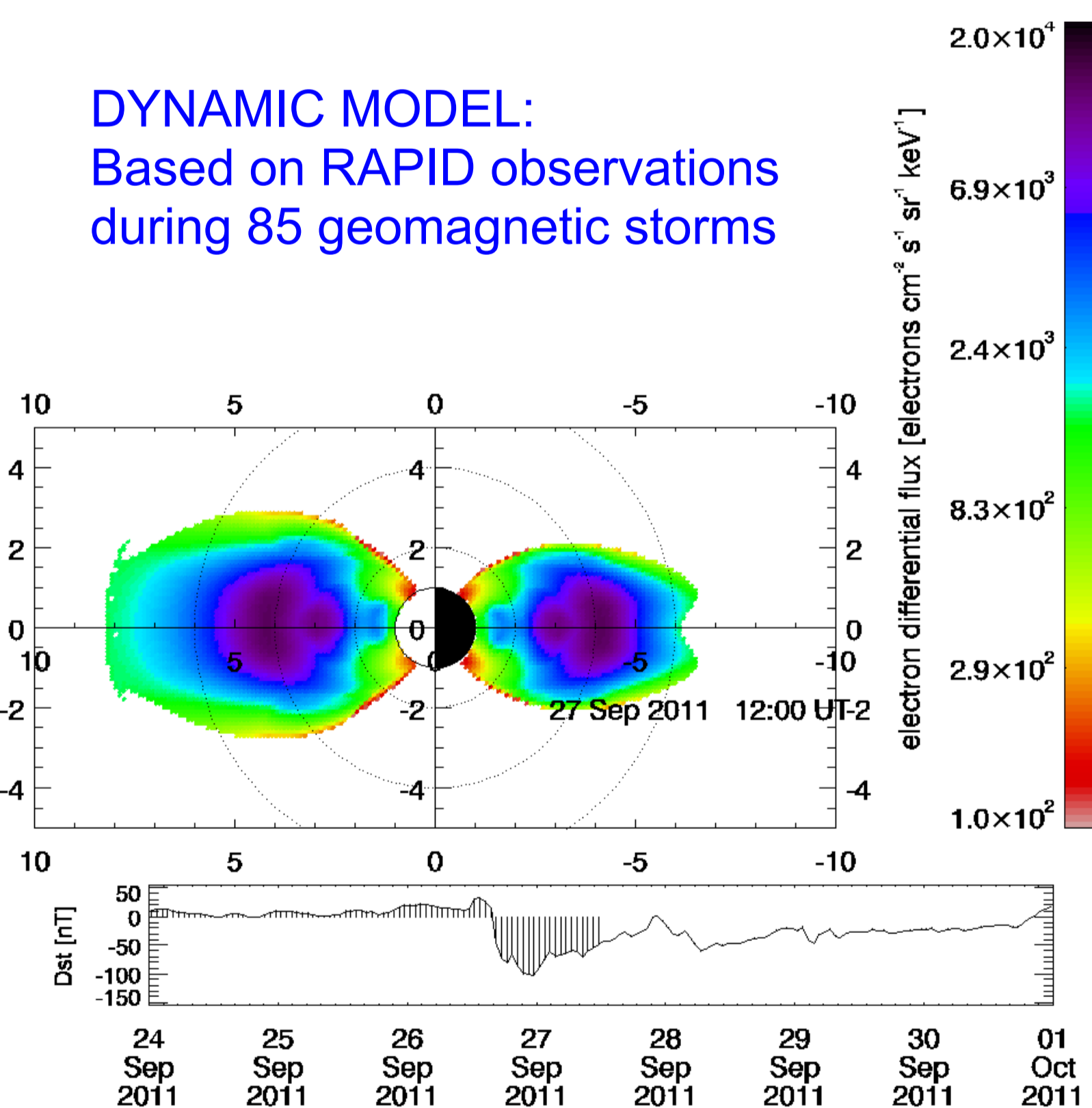
RAPID measures the electron omni-directional differential fluxes for 6 energy channels:

	Ch1	Ch2	Ch3	Ch4	Ch5	Ch6
Emin keV	41.2	50.5	68.1	94.5	127.5	244.1
ΔE_plus keV	9.3	17.6	26.4	33	66.6	162.4

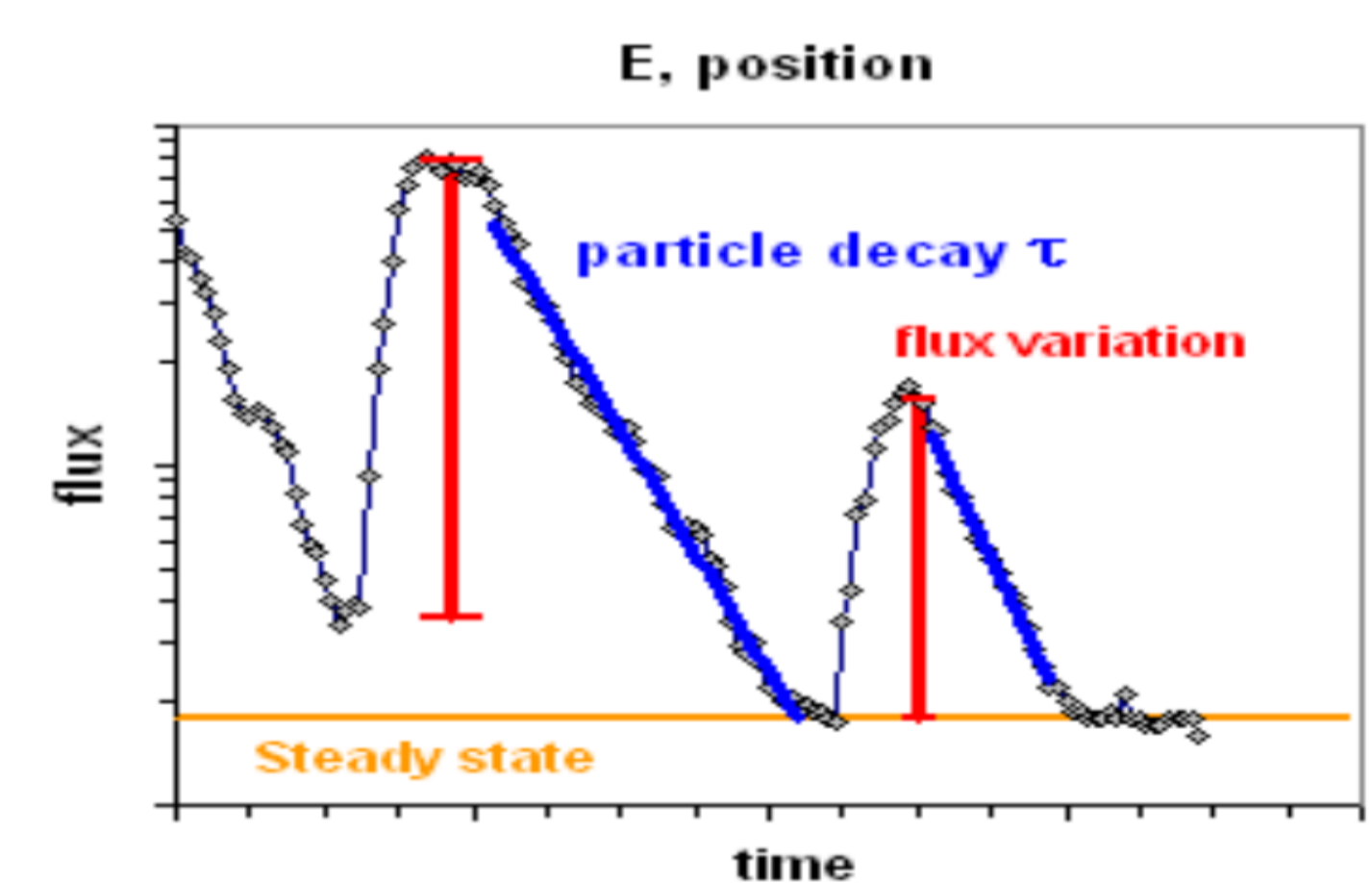
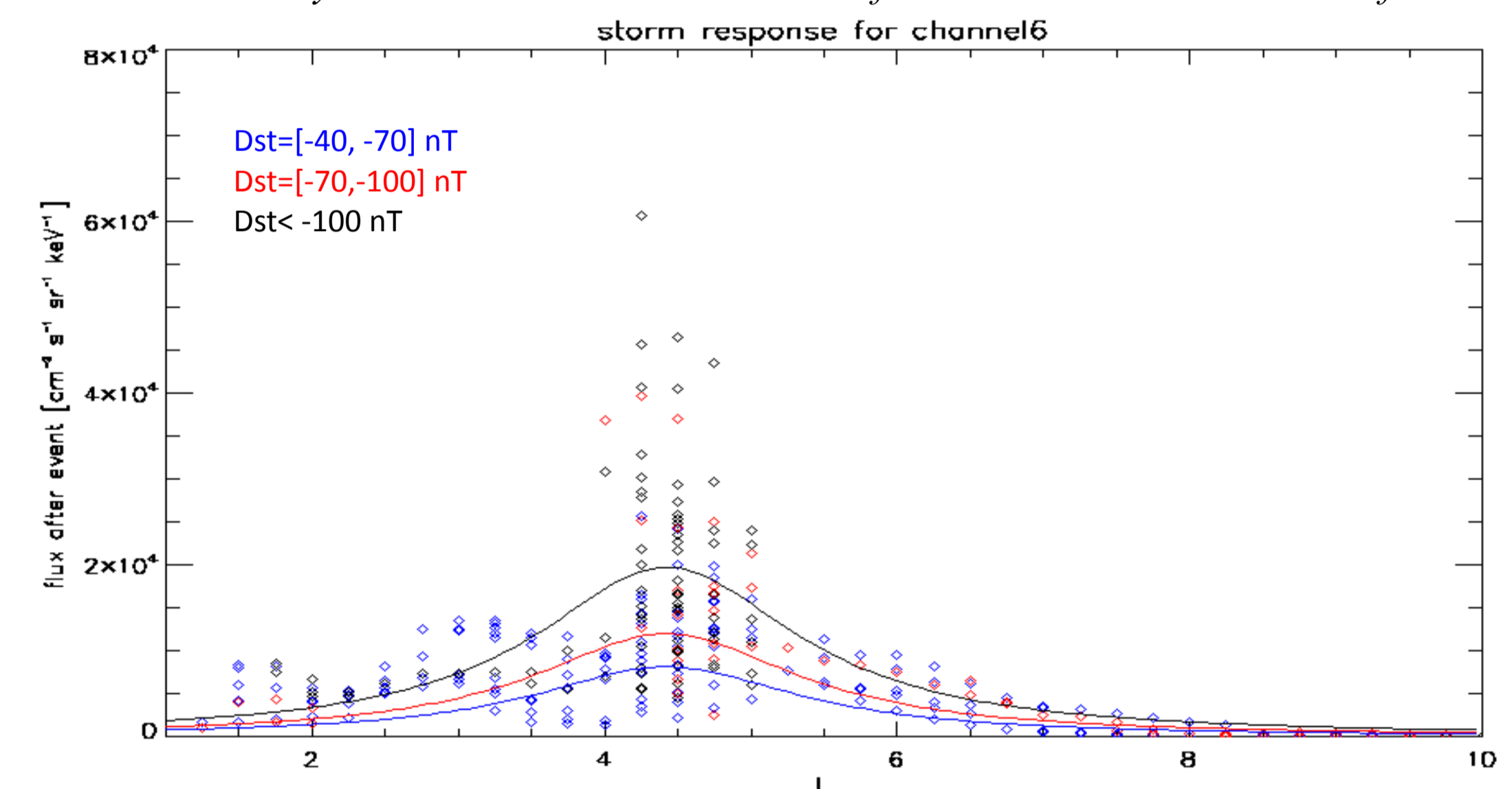
**QUIET MODEL:**  
Based on RAPID observations 2001-2011 only at least 14 days after a storm (Dst<-45 nT)



**DYNAMIC MODEL:**  
Based on RAPID observations during 85 geomagnetic storms



Flux observed by Cluster/RAPID in channel 6 after the 85 storm events as a function of L.



For all the different L and B/B<sub>0</sub> positions, we determine:  
J<sub>q</sub> the differential averaged quiet particle flux  
J<sub>s</sub> the differential flux observed after a geomagnetic storm  
Dt the decay time after the storm (assuming exponential decay)

**Conclusions:** A plasmasphere model is developed and available on the spaceweather portal. Cluster/RAPID data from 2001 until 2012 is analyzed during quiet times and during geomagnetic storms. Based on these observations a dynamic radiation belt model is in development.

### Our recent publications on RADIATION BELTS

- Benck S., L. Mazzino, M. Cyamukungu, J. Cabrera and V. Pierrard, Low altitude energetic electron lifetimes after enhanced magnetic activity as deduced from SAC-C and DEMETER data, *Annal. Geophys.*, 28, 848, 2010.
- Benck S., Cyamukungu M., Cabrera J., Mazzino L., Pierrard V., The Transient Observation-based Particle (TOP) model and its potential application in radiation effects evaluation, *J. Space Weather Space Climate* 3, A03, 2013. Doi: 10.1051/SWSC/2013024.
- Darrouzet F., Pierrard V., Benck S., Lointier G., Cabrera J., Borremans K., Ganushkina N., and De Keyser J., Links between the plasmopause and the radiation belts boundaries as observed by the instruments CIS, RAPID and WHISPER on CLUSTER, *J. Geophys. Res.: Space Phys.*, vol. 118, 1-13, doi: 10.1002/jgra.50239, 2013.
- Pierrard V. and S. Benck, The Dynamics Of The Terrestrial Radiation Belts And Its Links To The Plasmasphere, *AIP Conf. Proc.*, 1500, 216, doi: 10.1063/1.4768769, 2012.
- Pierrard V. and K. Borremans, Fitting the AP8 spectra to determine the proton momentum distribution functions in space radiations, *Rad. Meas.*, doi: 10.1016/j.radmeas.2012.04.002, 2012.
- Lapenta G., V. Pierrard, et al., SWIFF: Space weather Integrated Forecasting Framework, *J. Space Weather Space Phys.*, 3, A05, 1-17, 2013. DOI: <http://dx.doi.org/10.1051/swsc/2013027>.