



# Diversion of Plasma due to High Pressure in the Inner Magnetosphere During Steady Magnetospheric Convection

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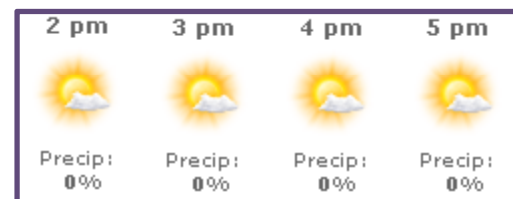
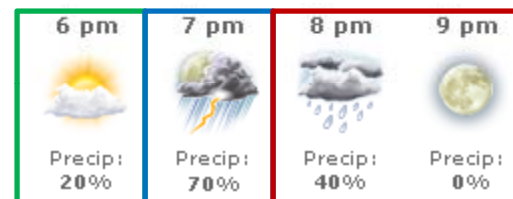
March 23, 2012



# Outline

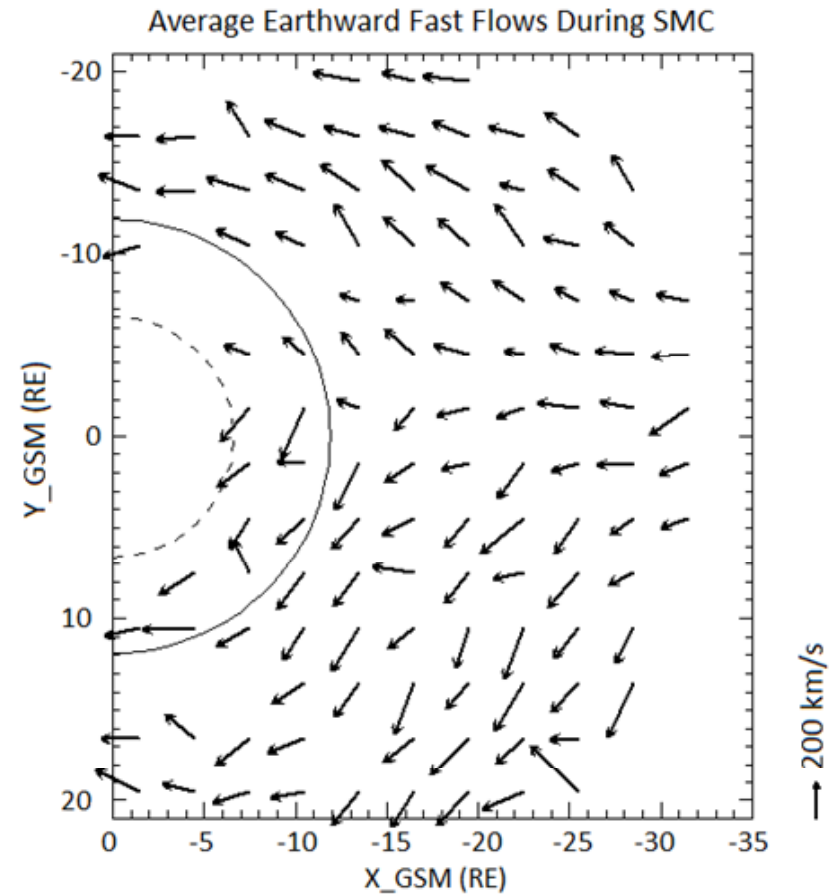
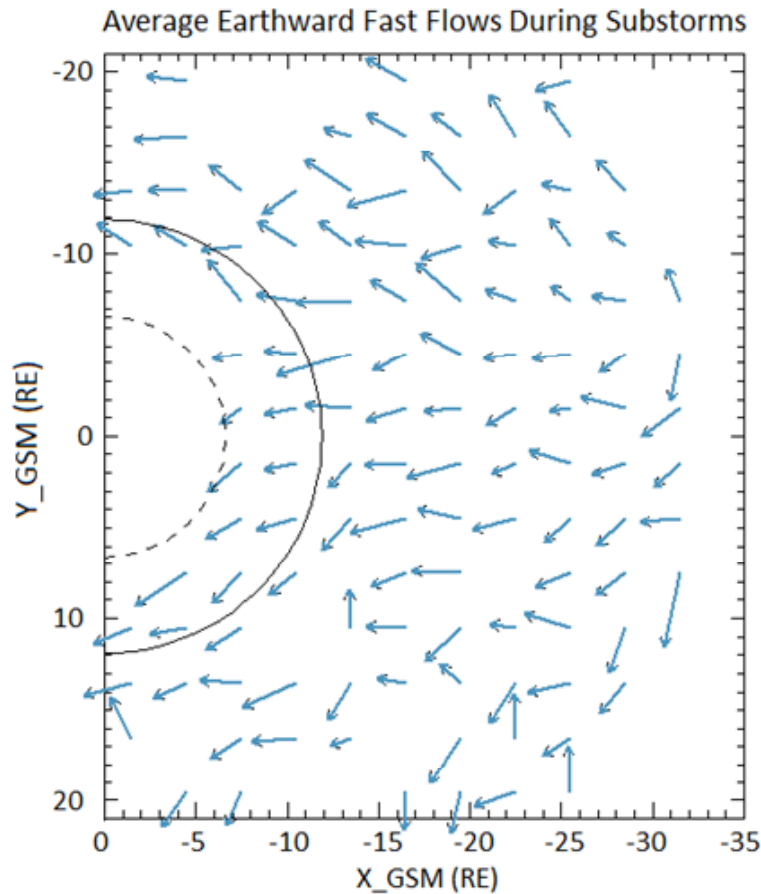


- Goal: Compare modes of response
  1. Steady magnetospheric convection (SMC)
  2. Pre-SMC (two hours prior)
  3. Substorm phases
    - Growth, expansion, recovery
  4. Quiet
- Main question: *How does the magnetotail balance the dayside merging rate and nightside reconnection rate during SMC?*
- Datasets: Geotail (1997-2006) and THEMIS (2007-2010)





# Fast Flows During SMC and Substorms



- $V_{\perp x-y} \geq 200 \text{ km/s}$ 
  - Earthward:  $V_{\perp x} > 0 \text{ km/s}$
- Duration from  $>200 \text{ km/s}$  to  $<200 \text{ km/s}$



# Fast Flow Selection



## Earthward Fast Flows by Mode of Response

Response	# Events	Data Hours	Earthward flows (#)	Occurrence rate (%)	Earthward Transport (%)
Quiet	1422	2972	1045	0.3	4.2
Pre-SMC	2853	1034	2692	2.5	15.4
SMC	2853	1505	5653	3.8	20.1
Sub. Growth	8600	1147	1337	1.1	9.0
Sub. Expansion	8600	1113	1859	1.5	12.2
Sub. Recovery	8600	2986	5349	1.8	13.4



# Inner Magnetosphere Fast Flows



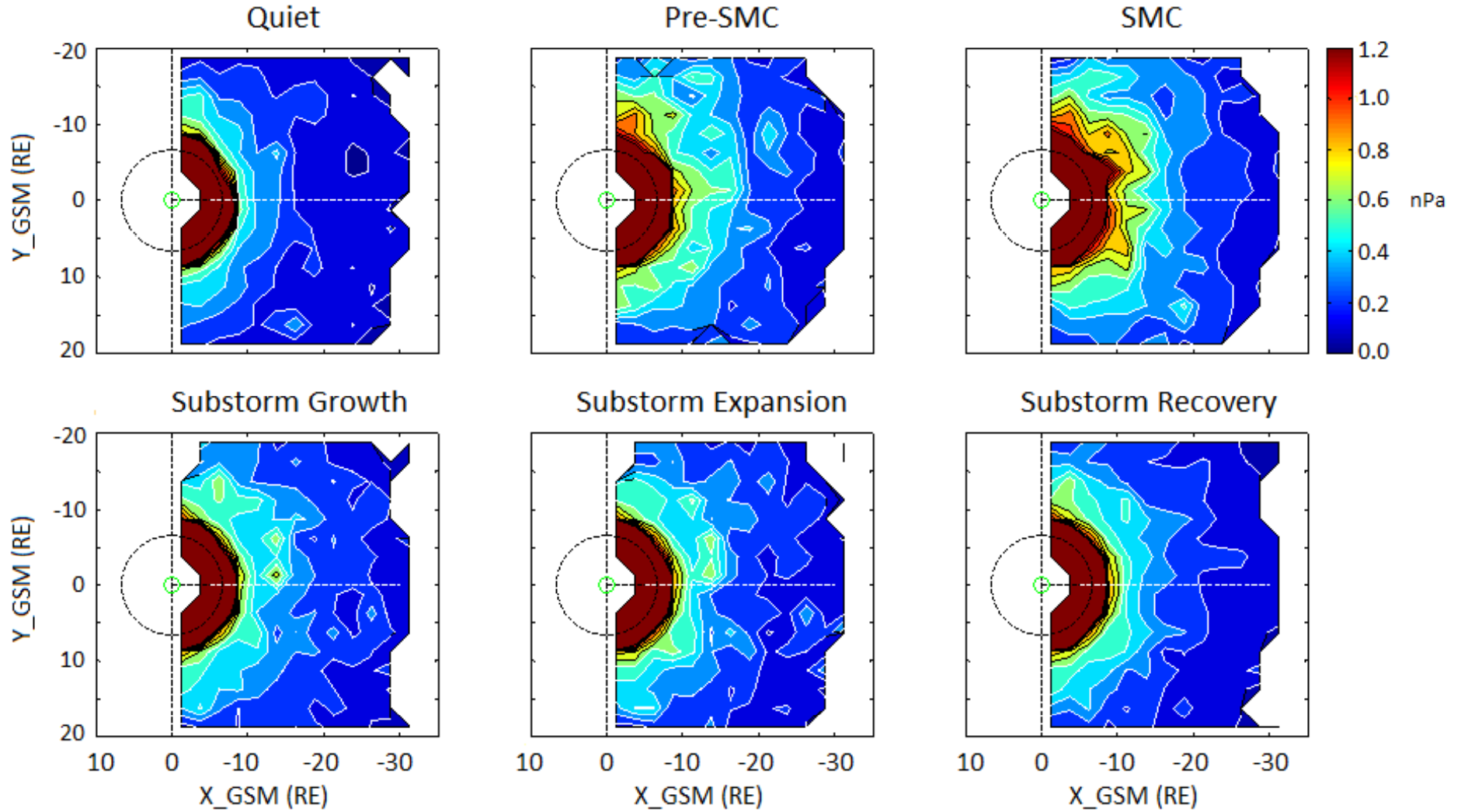
Earthward Fast Flows within 15 R <sub>E</sub>			
Response	Earthward flows (#)	Occurrence rate (%)	Earthward Transport (%)
Quiet	151	0.06	1.6
Pre-SMC	230	0.41	4.5
SMC	156	0.18	1.6
Sub. Growth	242	0.22	6.8
Sub. Expansion	521	0.50	3.8
Sub. Recovery	415	0.20	2.8



# Average Total Pressure (nPa)



## Average Total Pressure

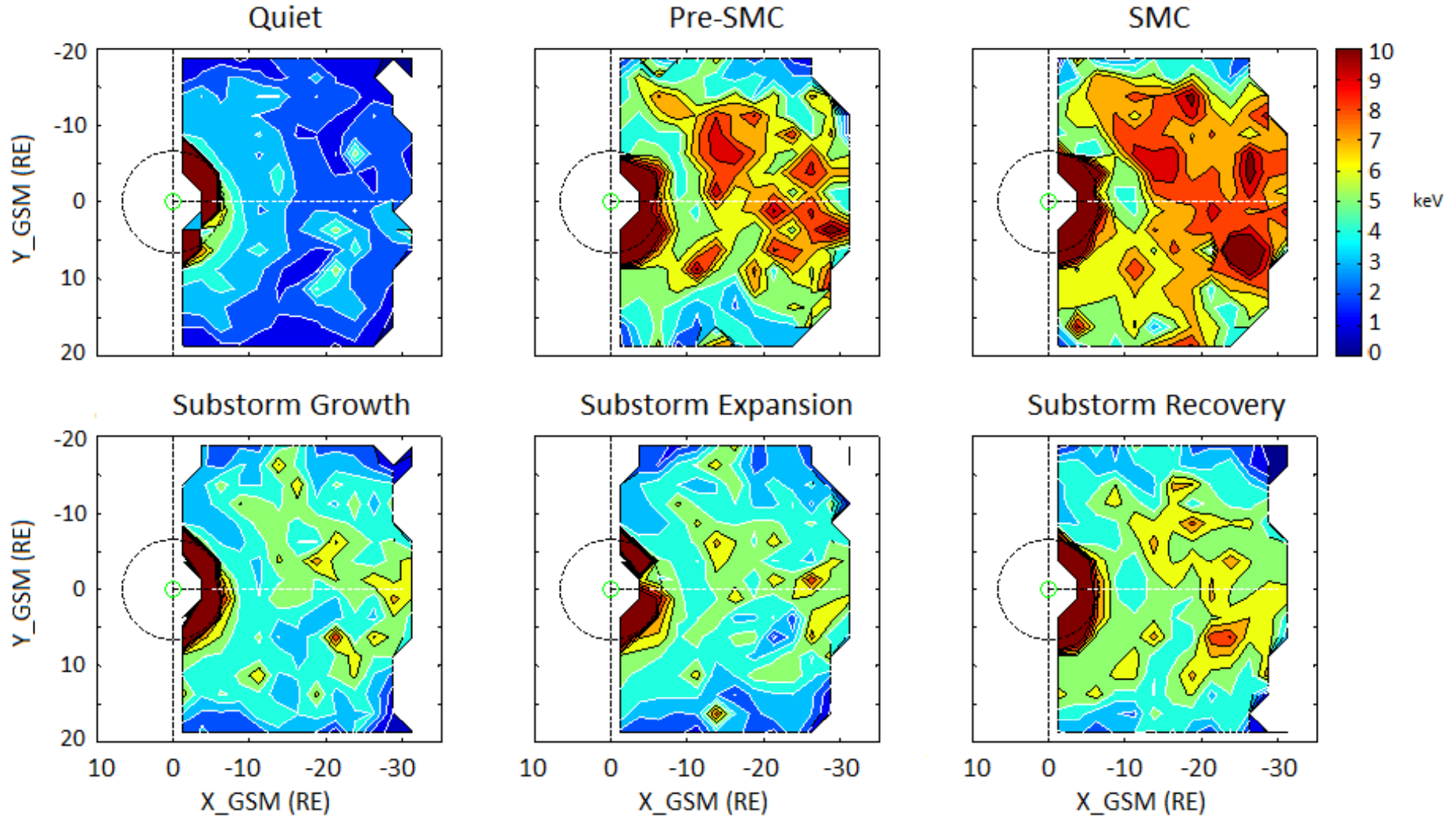




# Average Temperature (keV)



## Average Plasma Temperature

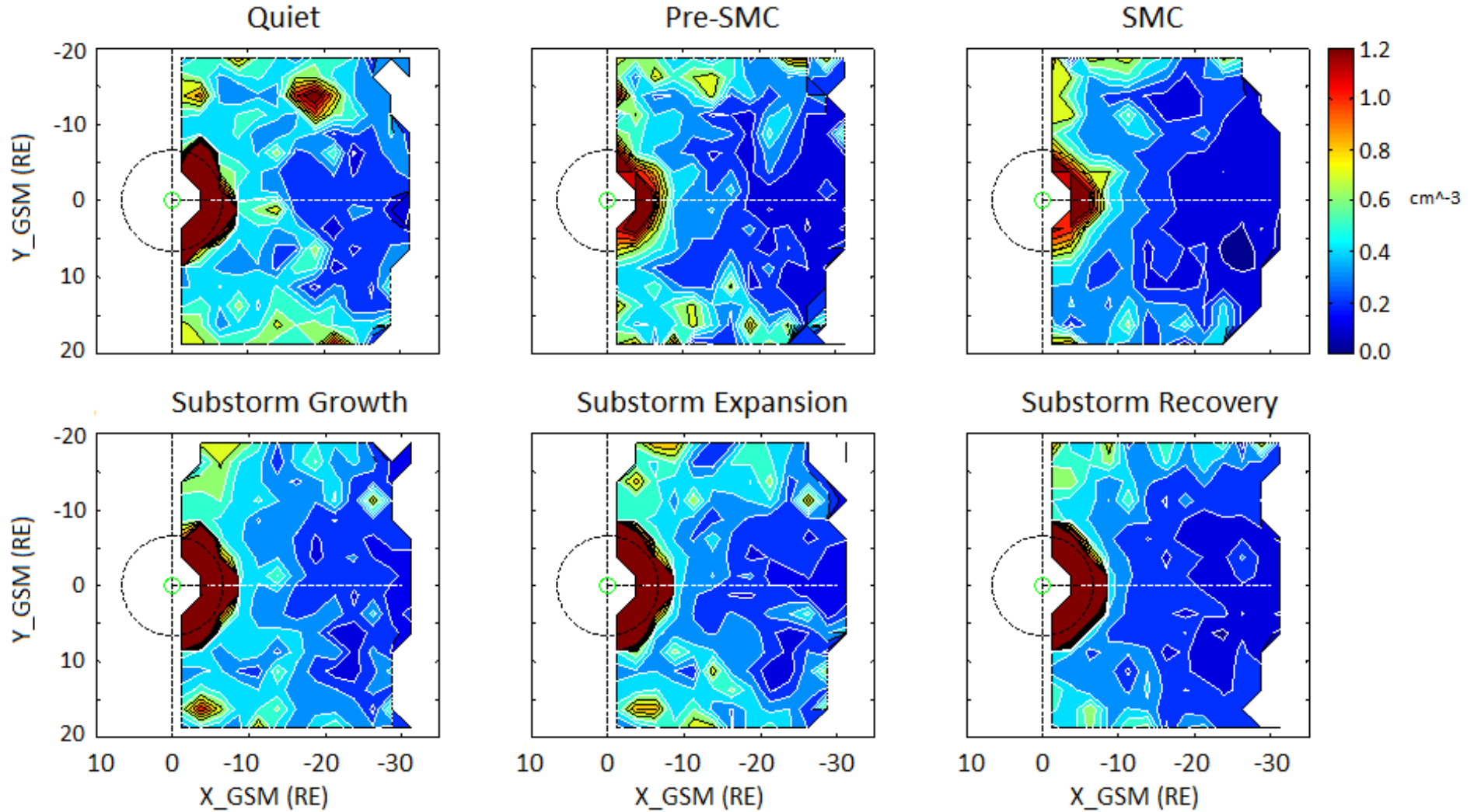




# Average Density ( $\text{cm}^{-3}$ )



## Average Plasma Density

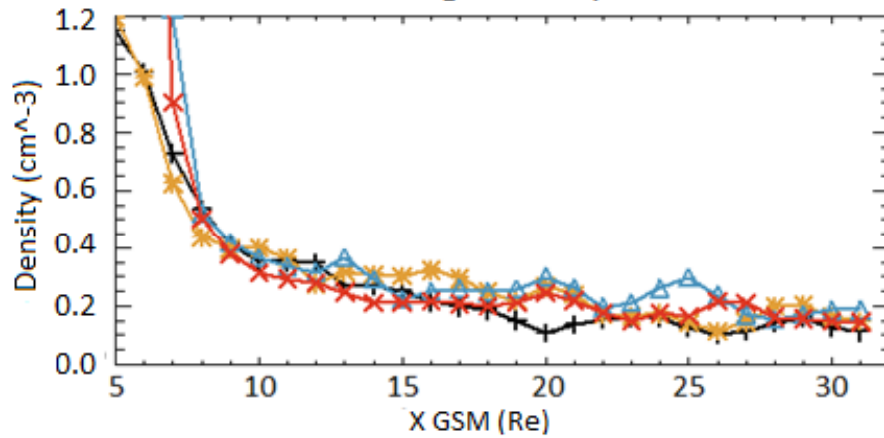




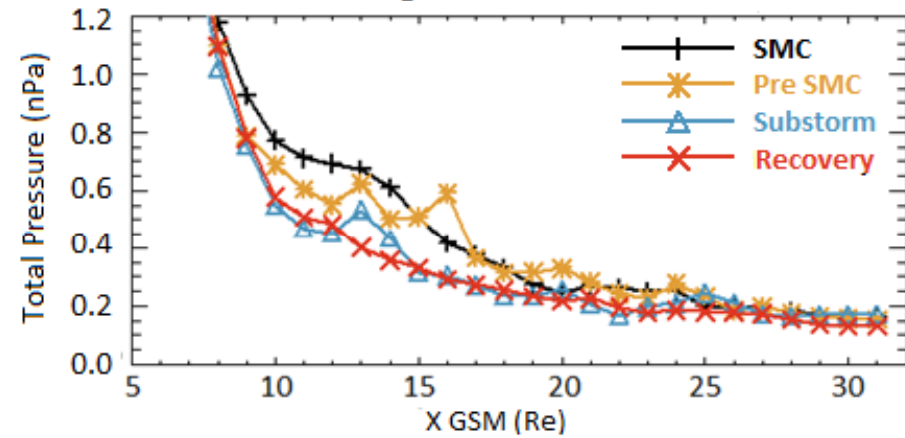


## Plasma Parameters Along Midnight Meridian

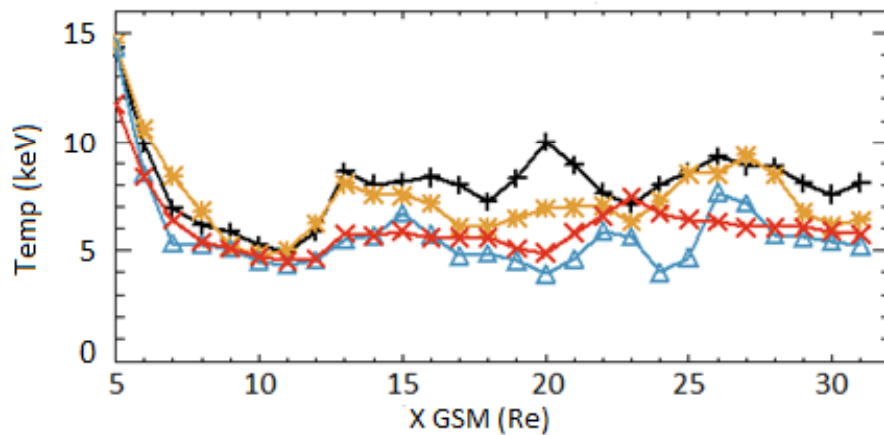
### Average Density



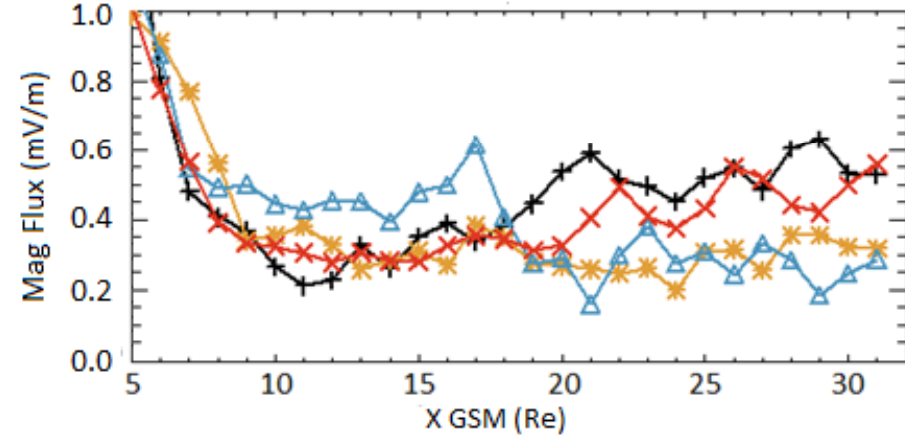
### Average Total Pressure



### Average Temperature

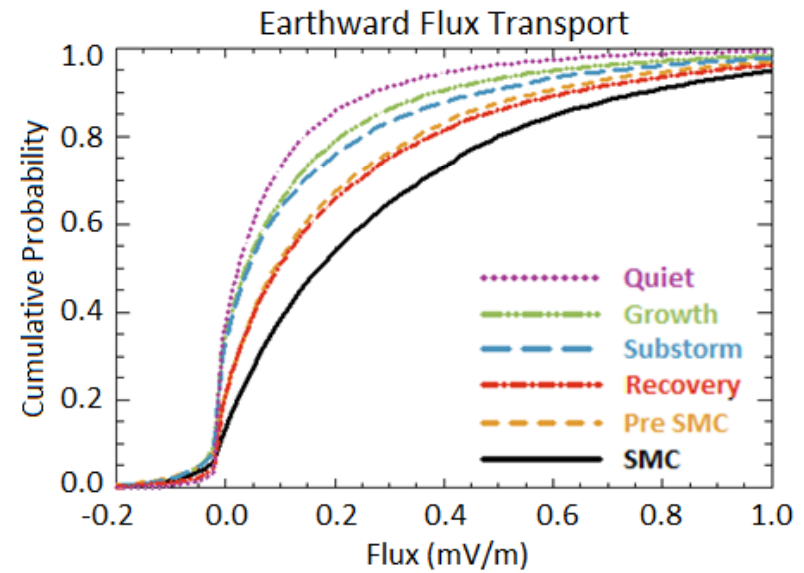
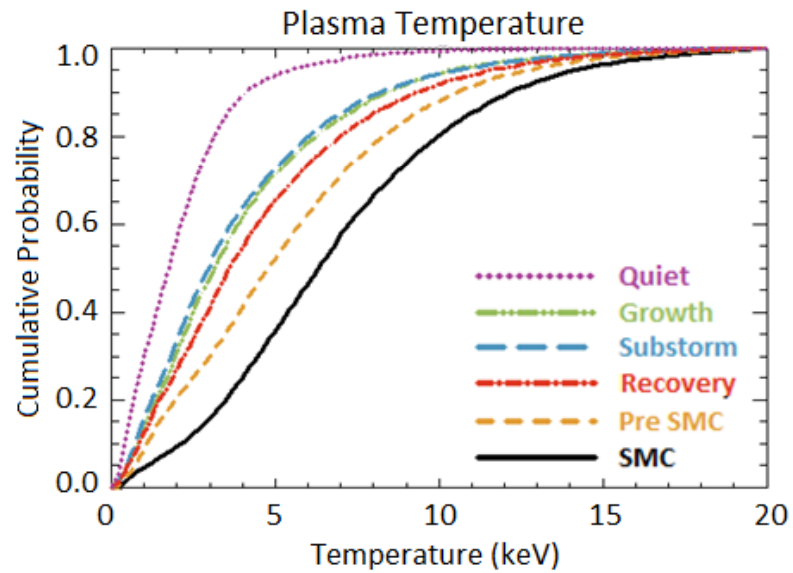
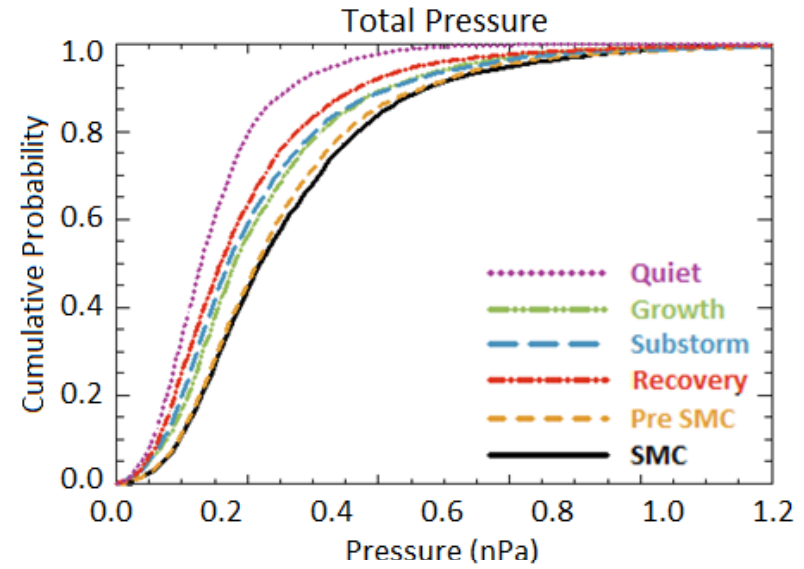
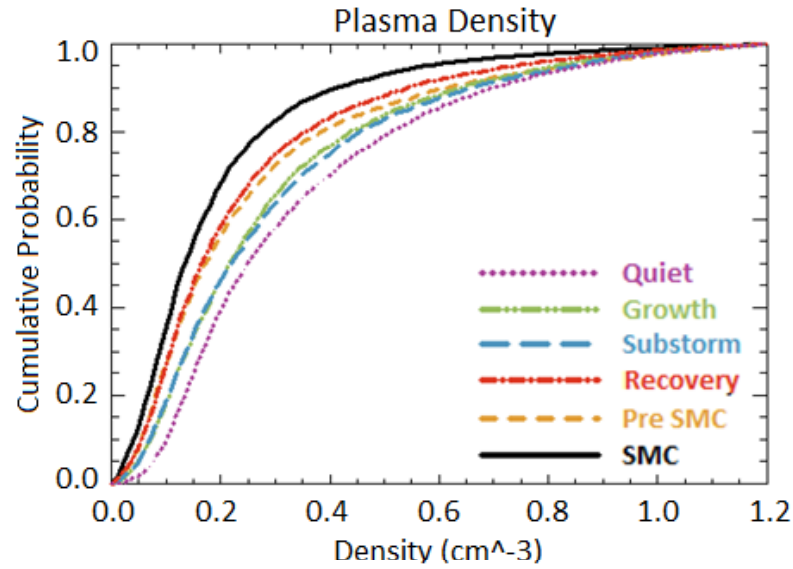


### Average Earthward Flux Transport



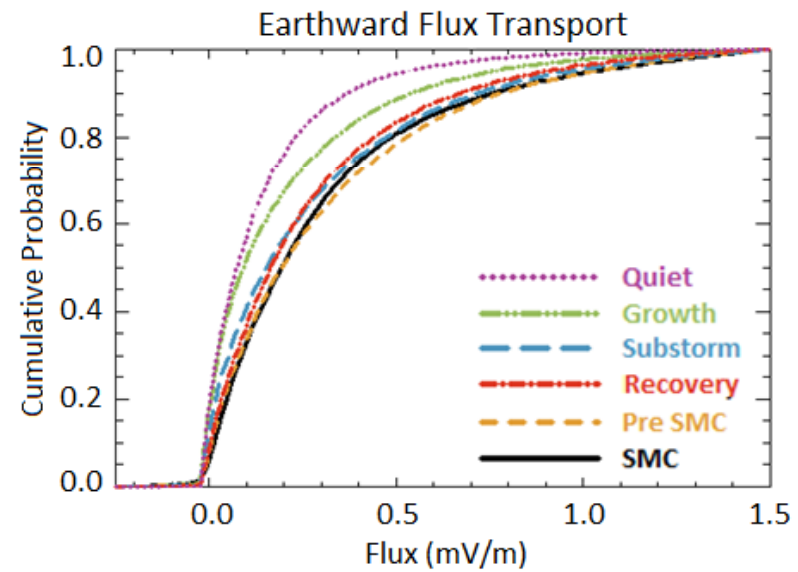
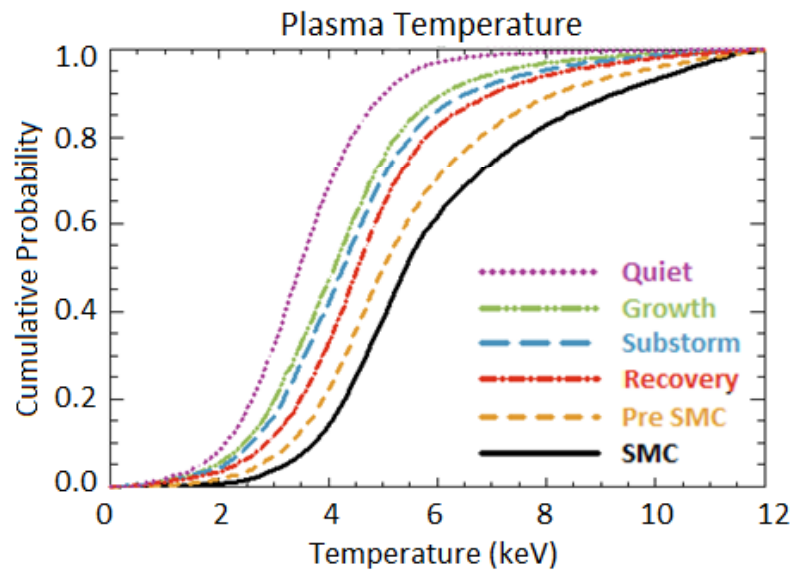
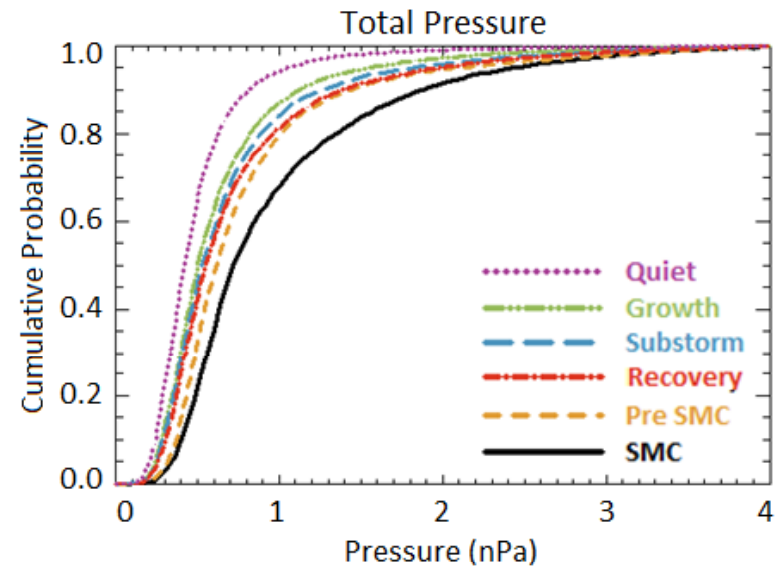
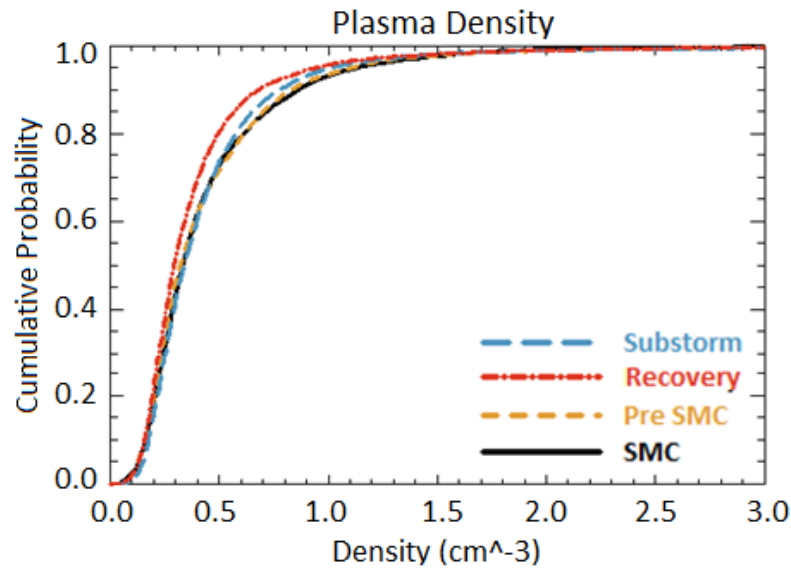


### Average Tail ( $\rho > 15$ RE) Conditions





### Average Inner ( $\rho < 15$ RE) Conditions





## Conclusions



- The state of the magnetotail depends on *mode of response*.
- Fast flows carrying flux are *deflected* either duskward or dawnward and toward the dayside during SMC.
- This is due to the *high pressure region* in the *inner magnetosphere*.
  - Pressure (and other parameters) are very well organized by activity
  - Quiet < Substorm Growth < Substorm Expansion < Substorm Recovery < Pre-SMC (initiating substorms/activity) < SMC
- This situation allows flux to return to the dayside and assist *balance of reconnection rates*.
- *Preconditioning* of the magnetosphere plays a key role.