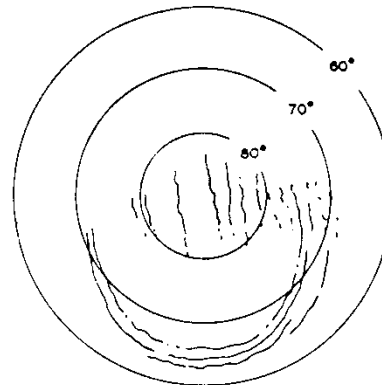
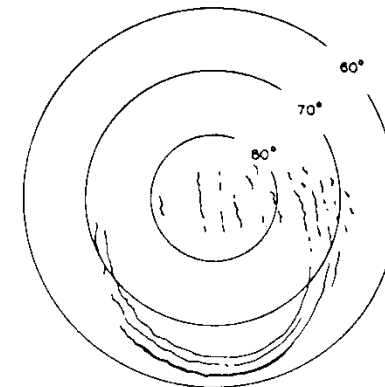


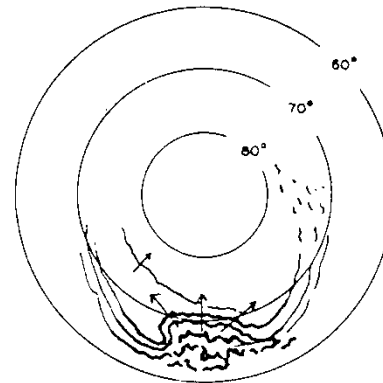
# Substorm phases



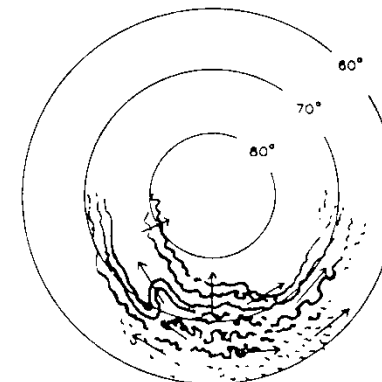
T=0



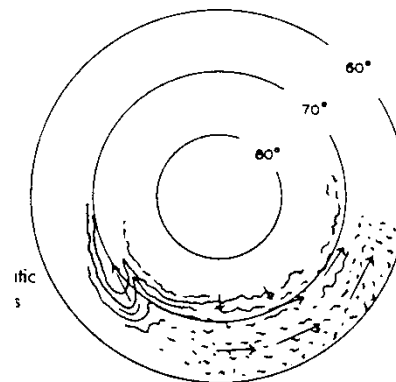
T=0-5 min



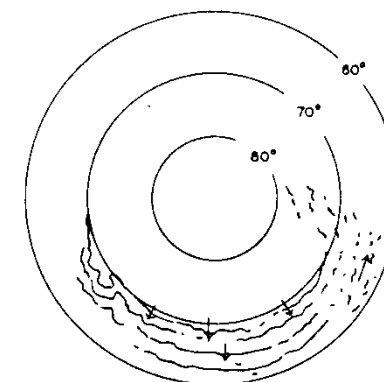
T=5-10 min



T=10-30 min



T=30-60 min

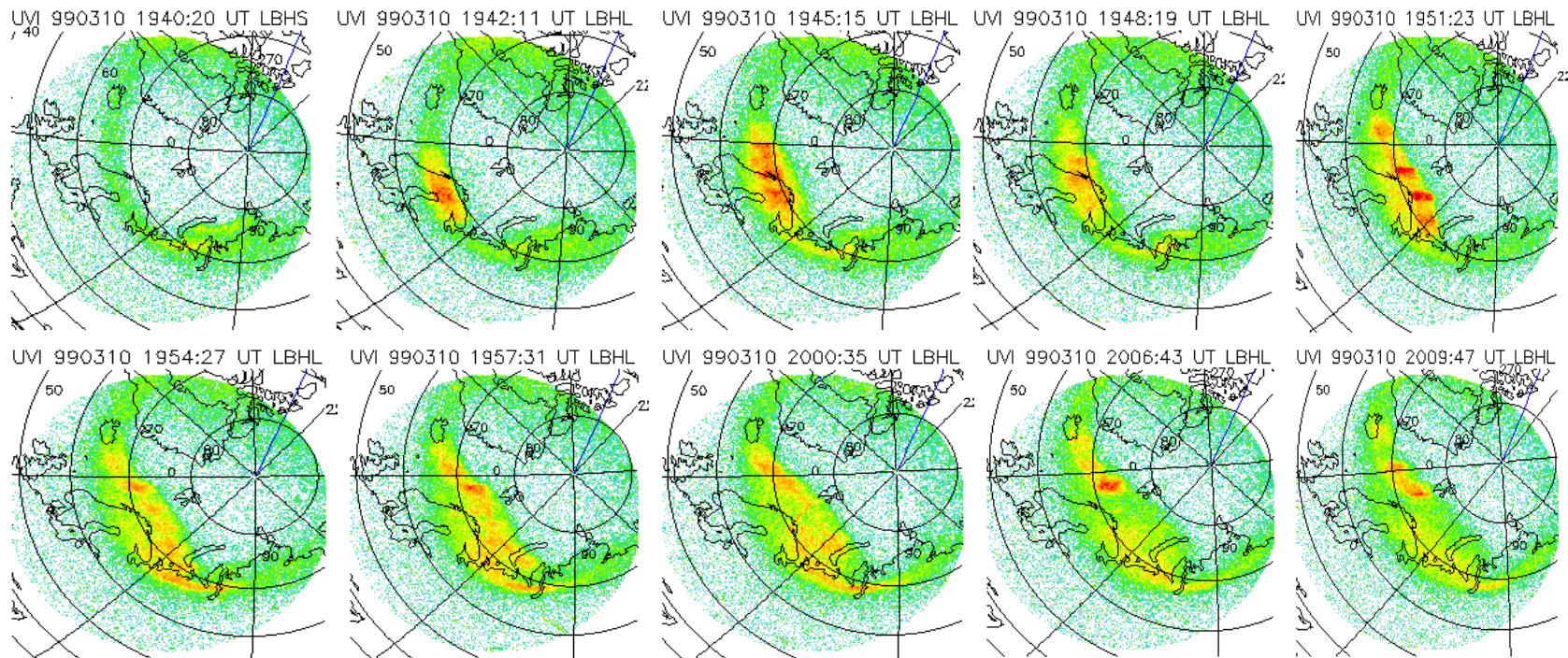


T=1-2 hours



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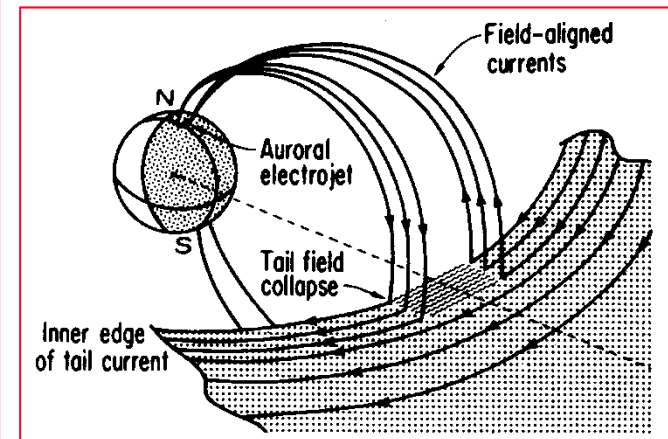
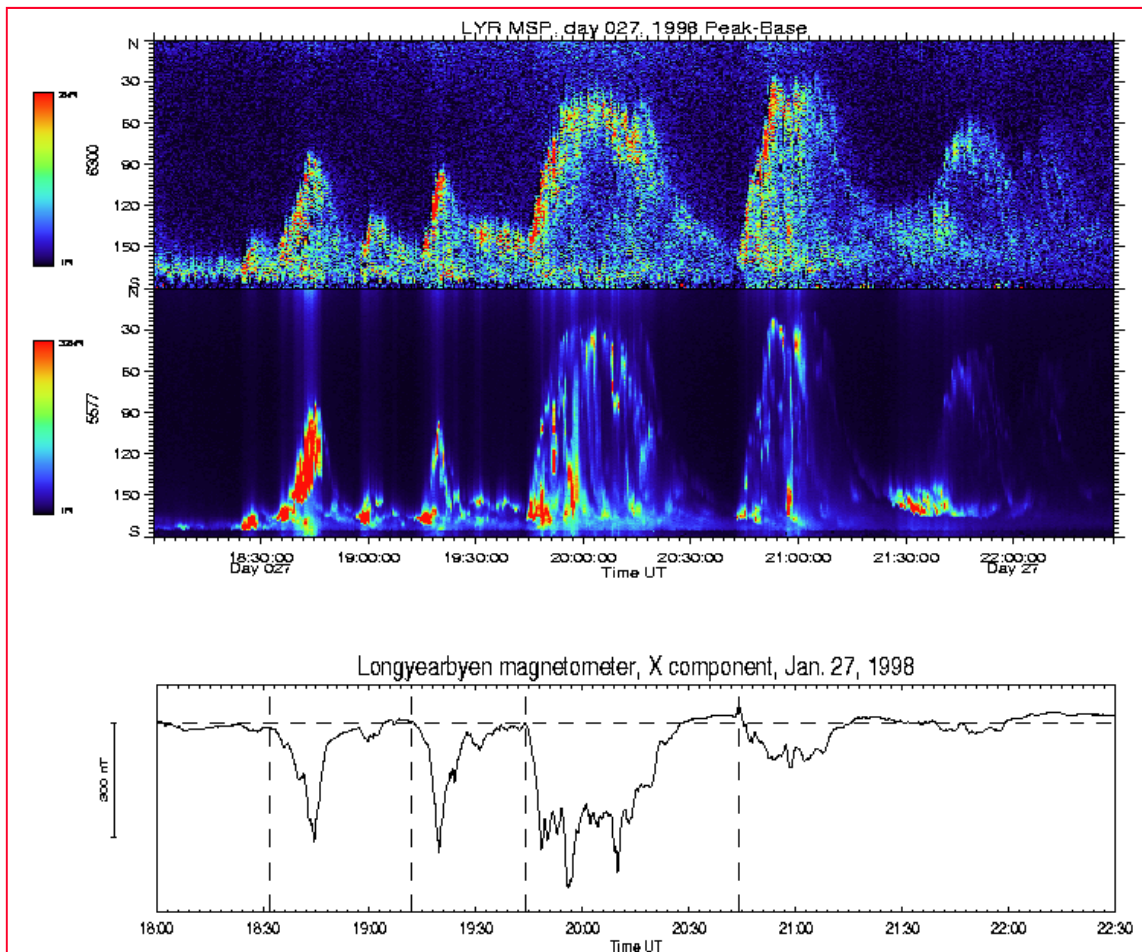
# Dynamics of the substorm expansion phase





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# Auroral and Magnetic Signatures associated with substorm onset



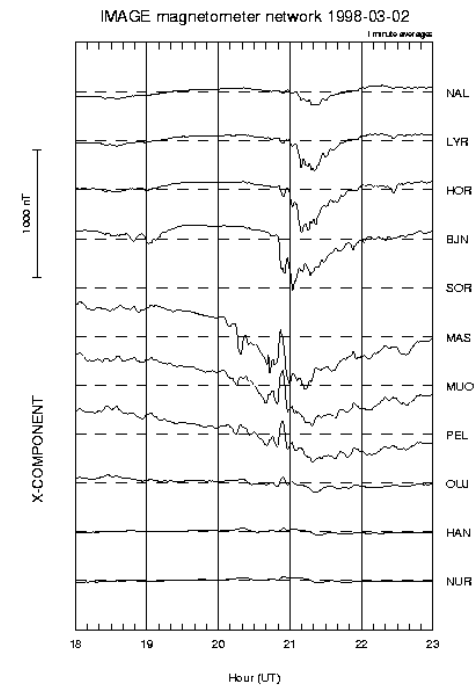
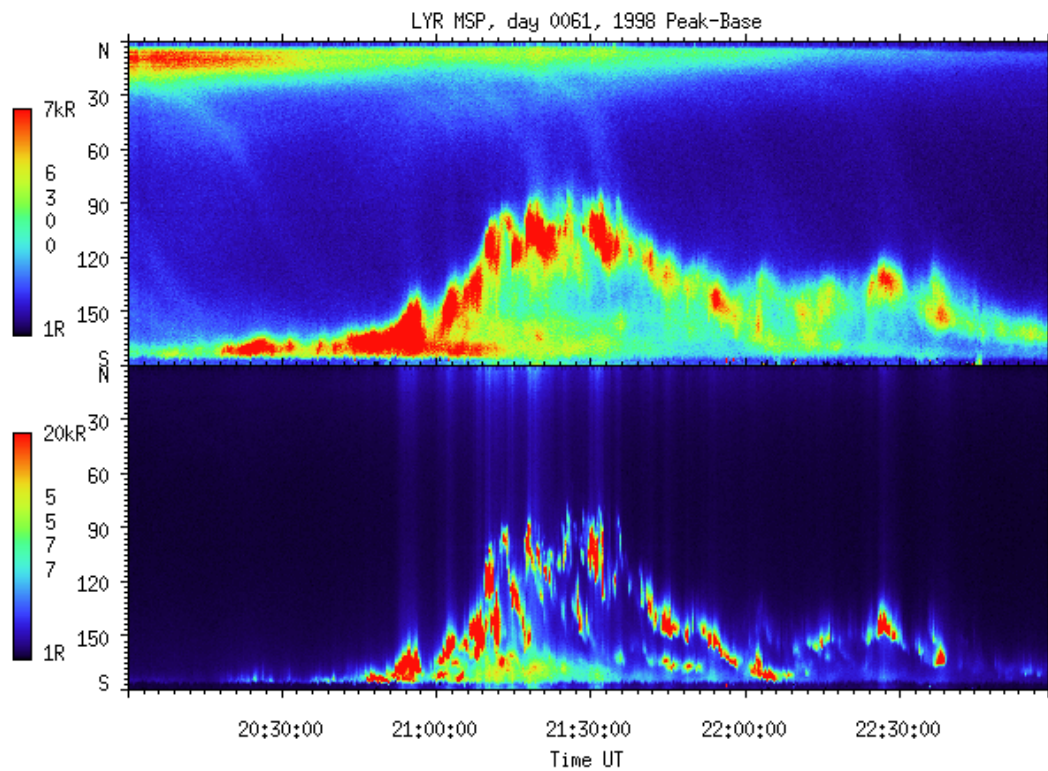
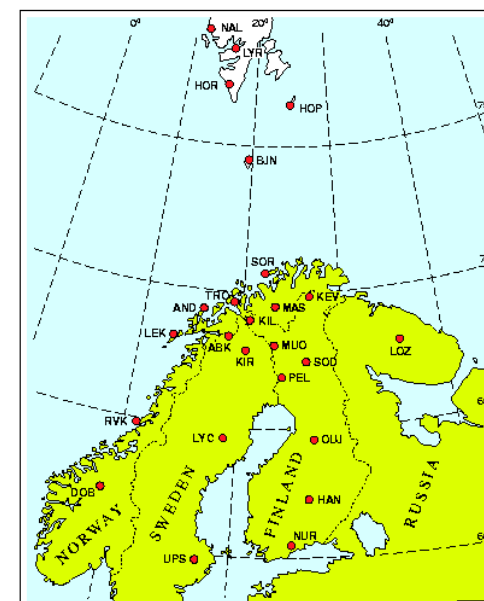
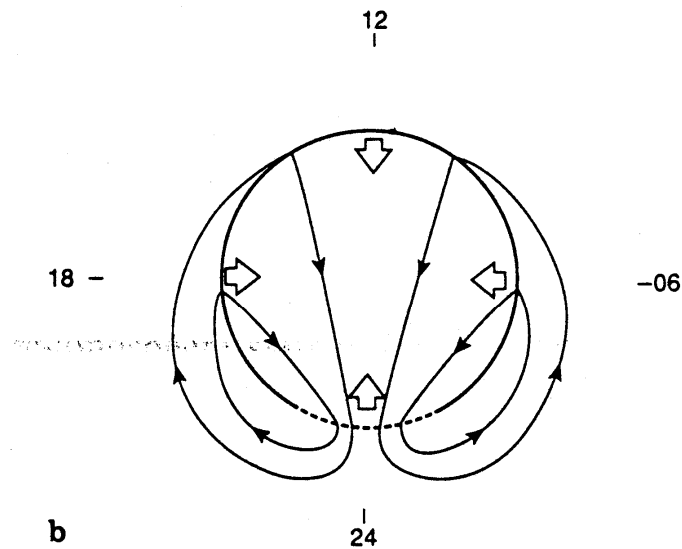


IMAGE Magnetometer Network



# Tail reconnection



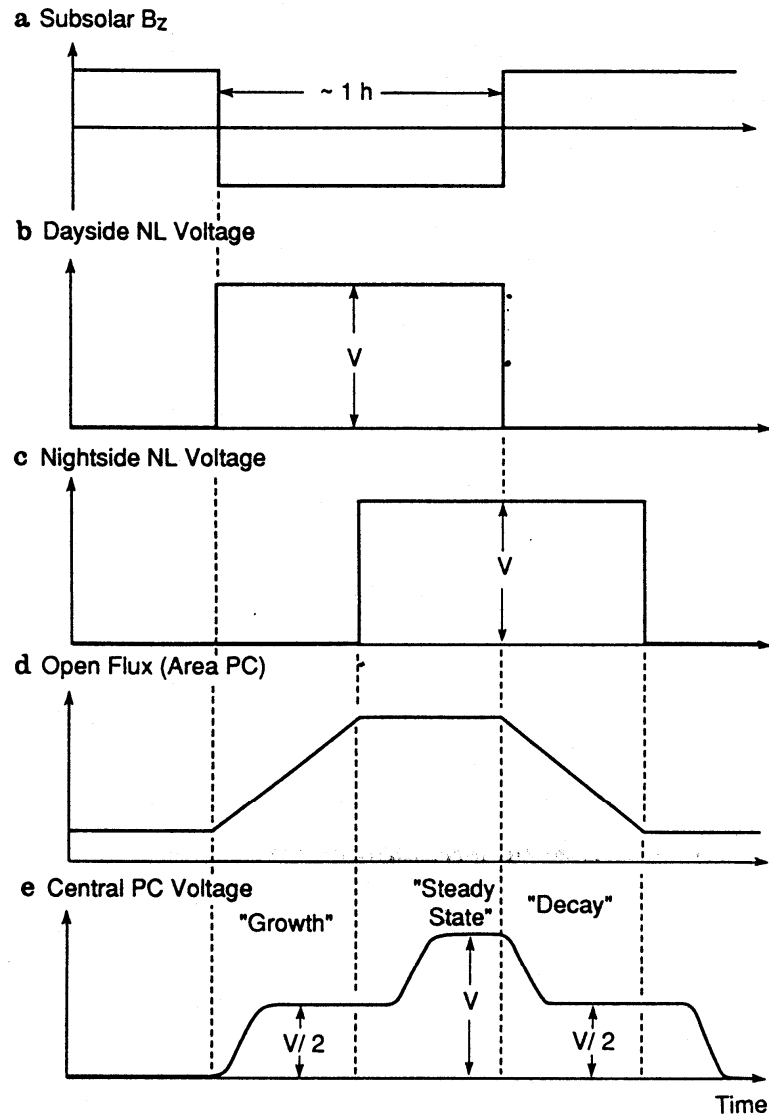
**Polar Cap Boundary or (PCB)**

**Open-Closed-Boundary (OCB):**

**Dashed line = reconnection boundary – plasma flow across this boundary during episodes of reconnection**

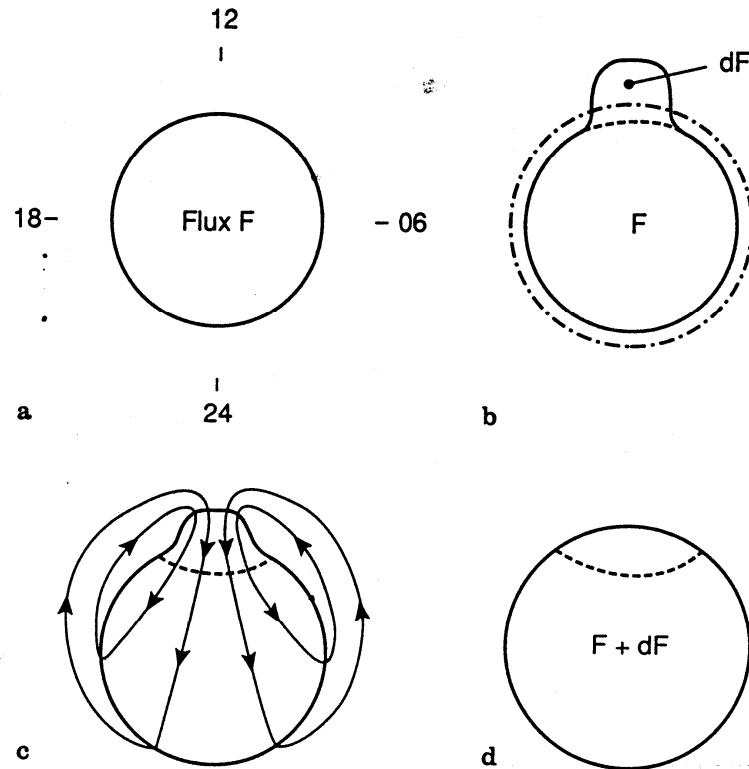
**Full line = adiaroic boundary – this boundary is frozen into the plasma movement**

# Magnetosphere response to a 1 hour interval of southward IMF

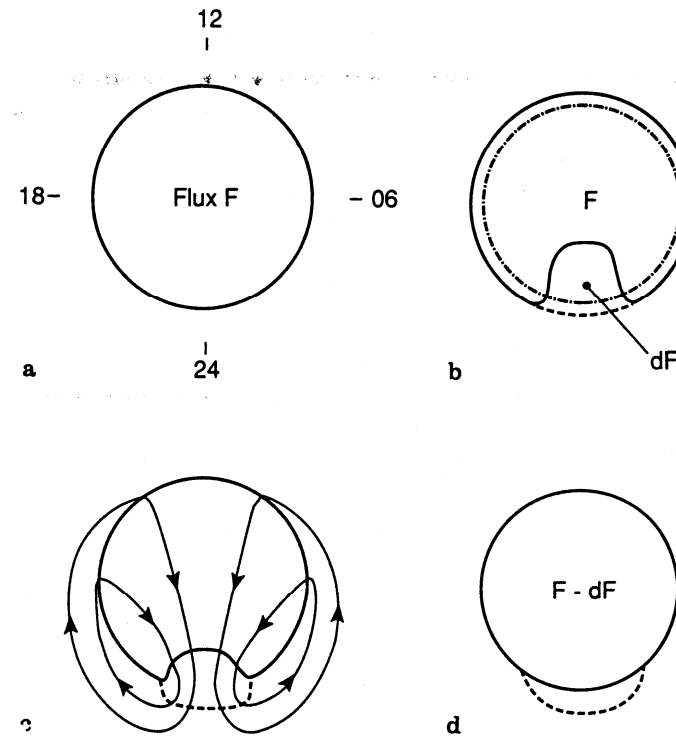


- A simple case when the nightside reconnection voltage follows the dayside reconnection voltage but with a 30-min time delay.
- Note that the open flux area is constant during balanced magnetopause and tail reconnection.
- e) shows the central polar cap voltage assuming a circular expanding or contracting polar cap.

# The principle of flow-free equilibrium



**The ionospheric  
response to an impulse  
of magnetopause  
reconnection**



**The ionospheric  
response to an impulse  
of tail reconnection**