

Magnetosphere-Ionosphere Coupling

Region of open field lines convecting tailwards

Dusk

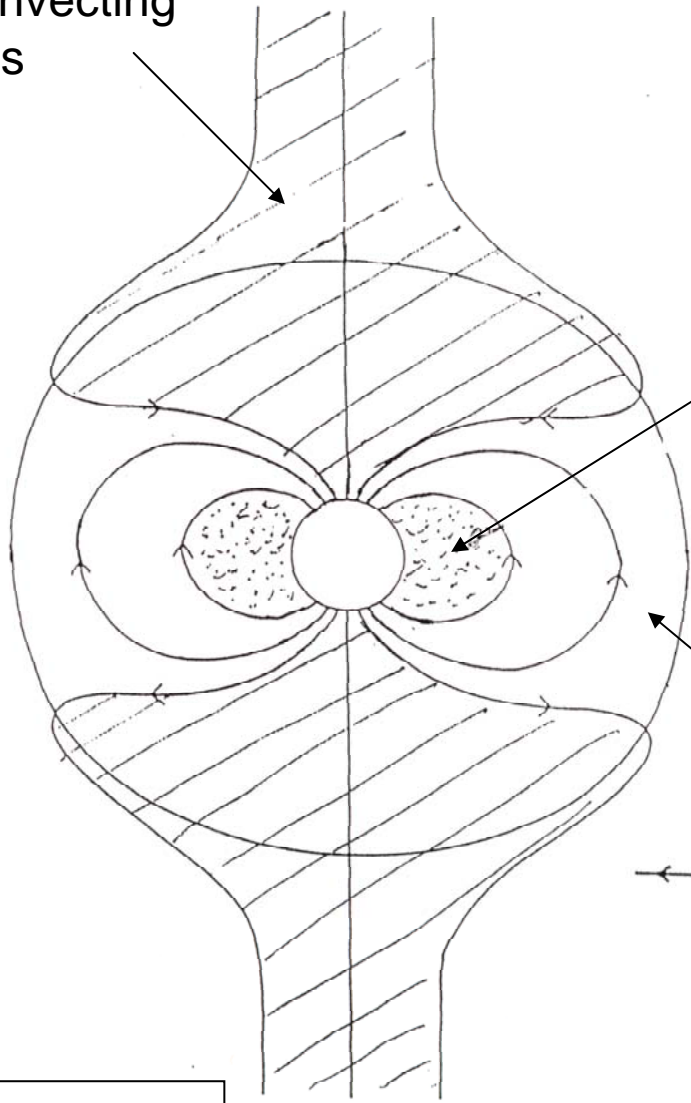
Corotating plasmasphere

Dawn

Region of closed field lines convecting back to dayside

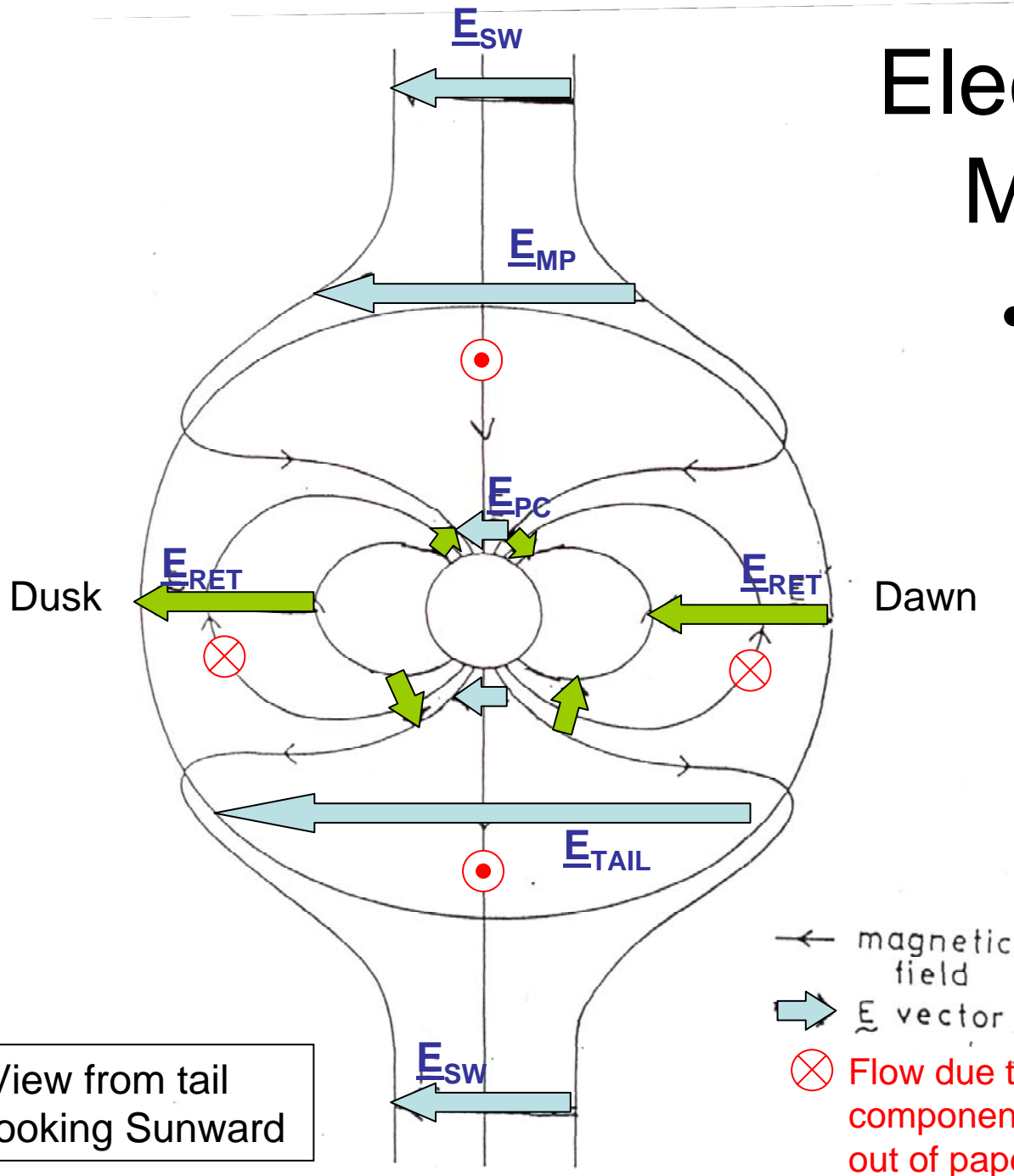
← magnetic field

View from tail looking Sunward



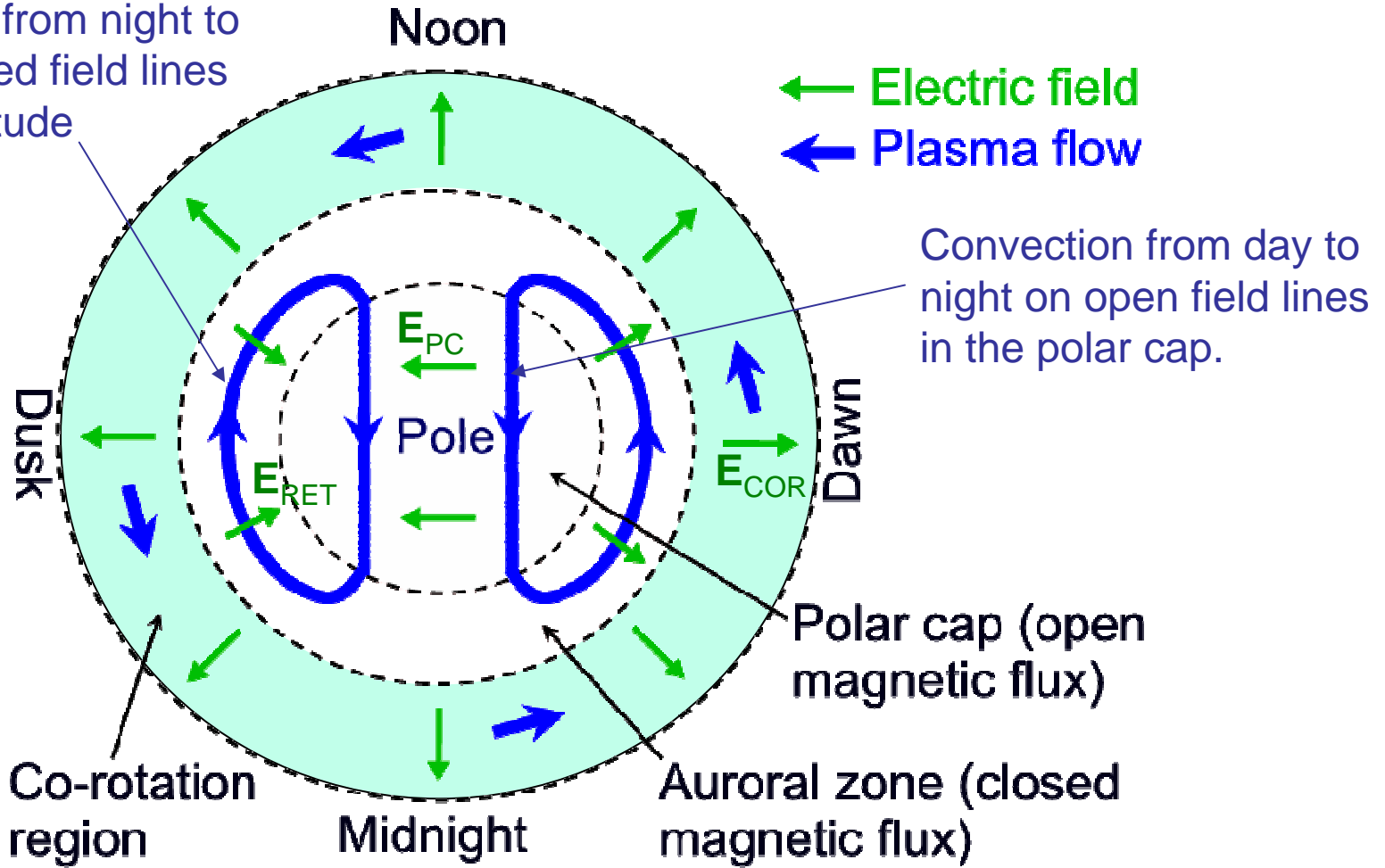
Electric Field Mapping

- Magnetic field lines are equipotentials – hence potential and electric field maps down along field lines



Flows and Electric Fields Mapped to the Ionosphere

Return flow from night to day on closed field lines at lower latitude



Convection from day to night on open field lines in the polar cap.

Polar cap (open magnetic flux)

Auroral zone (closed magnetic flux)

Co-rotation region

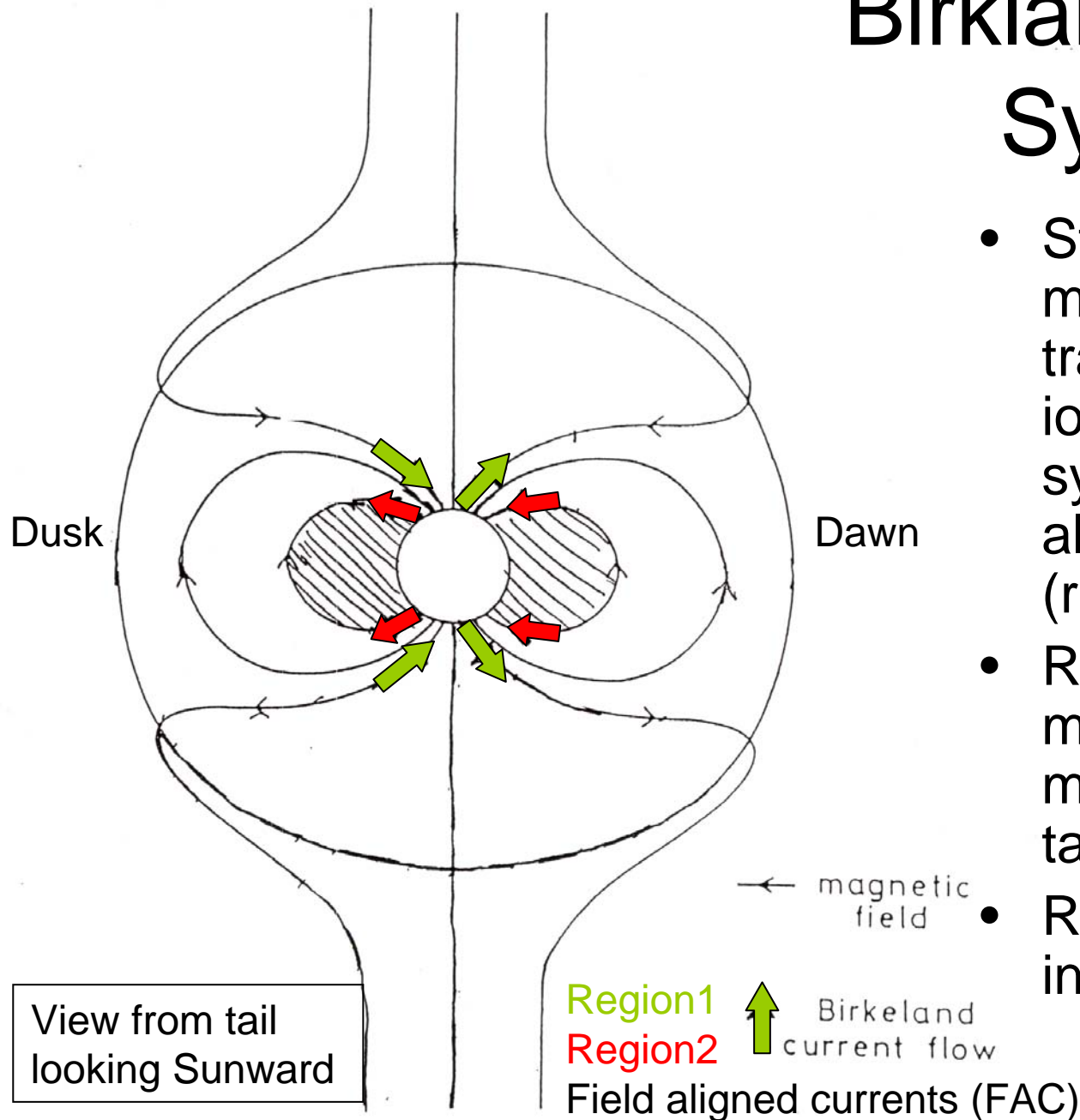
Midnight

Magnetic field everywhere into paper

Auroral zone extends from $\sim 76^\circ$ magnetic latitude to $50-60^\circ$

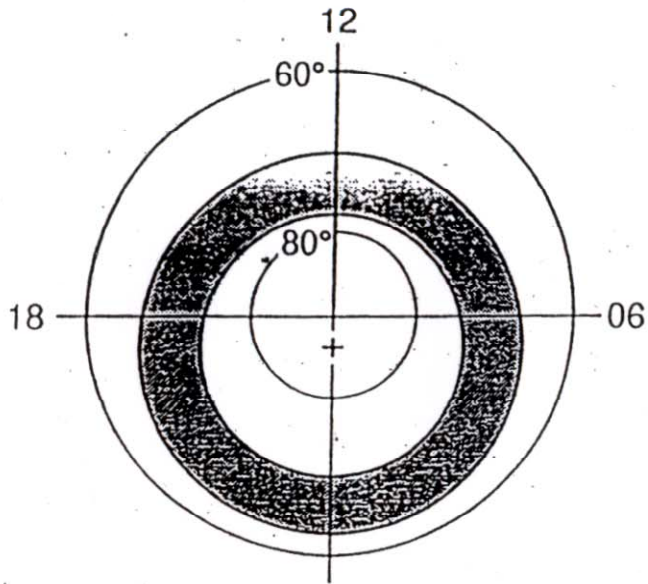
View from above north pole

Birkland Current Systems

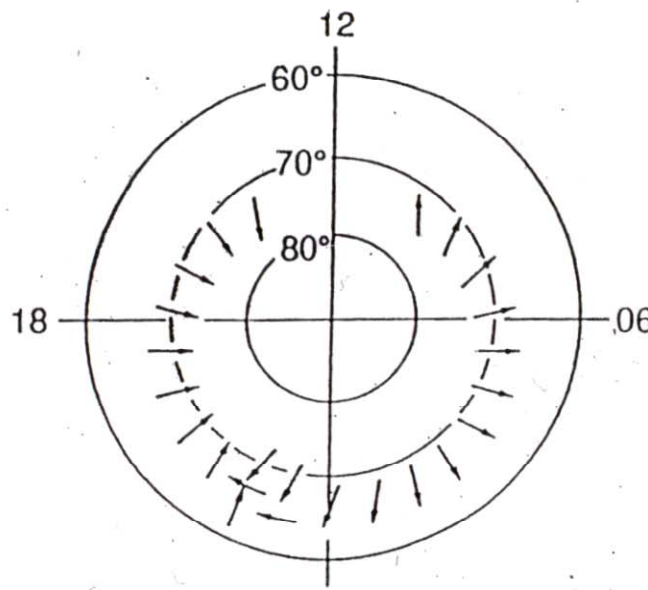


- Stresses from the magnetosphere are transmitted to the ionosphere through a system of field aligned currents (recall that $\mathbf{F}_M = \mathbf{j} \times \mathbf{B}$)
- Region 1 currents map out to the magnetopause and tail current systems
- Region 2 map out into the ring current

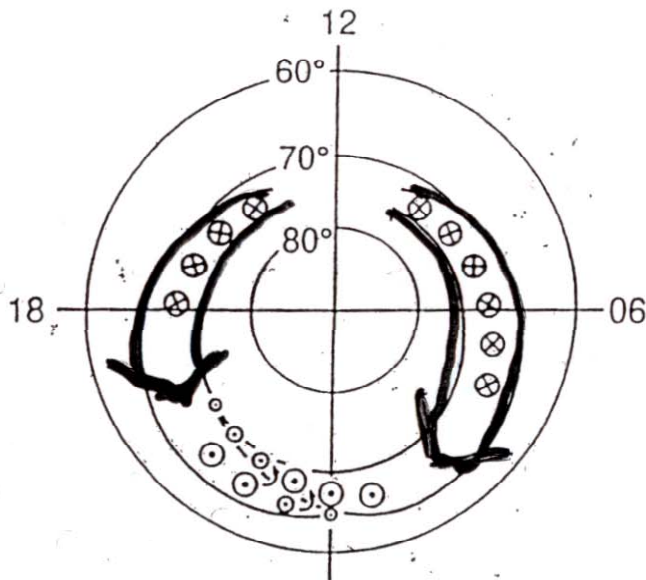
Ionospheric Current Closure



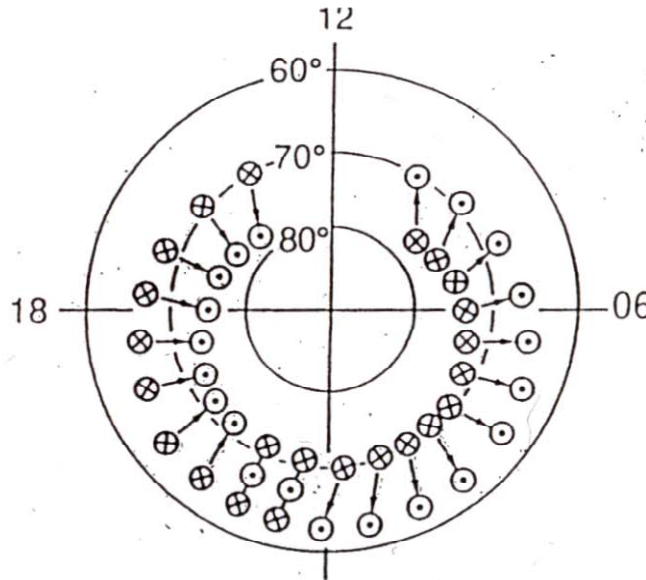
Conductivity Structure
(Auroral Oval)



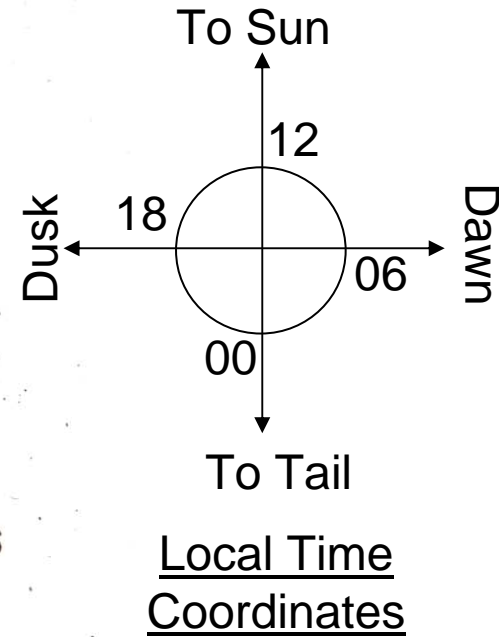
Electric Field Pattern
(due to return flows on flank)



Hall Current Circuit
(Auroral Electrojet)



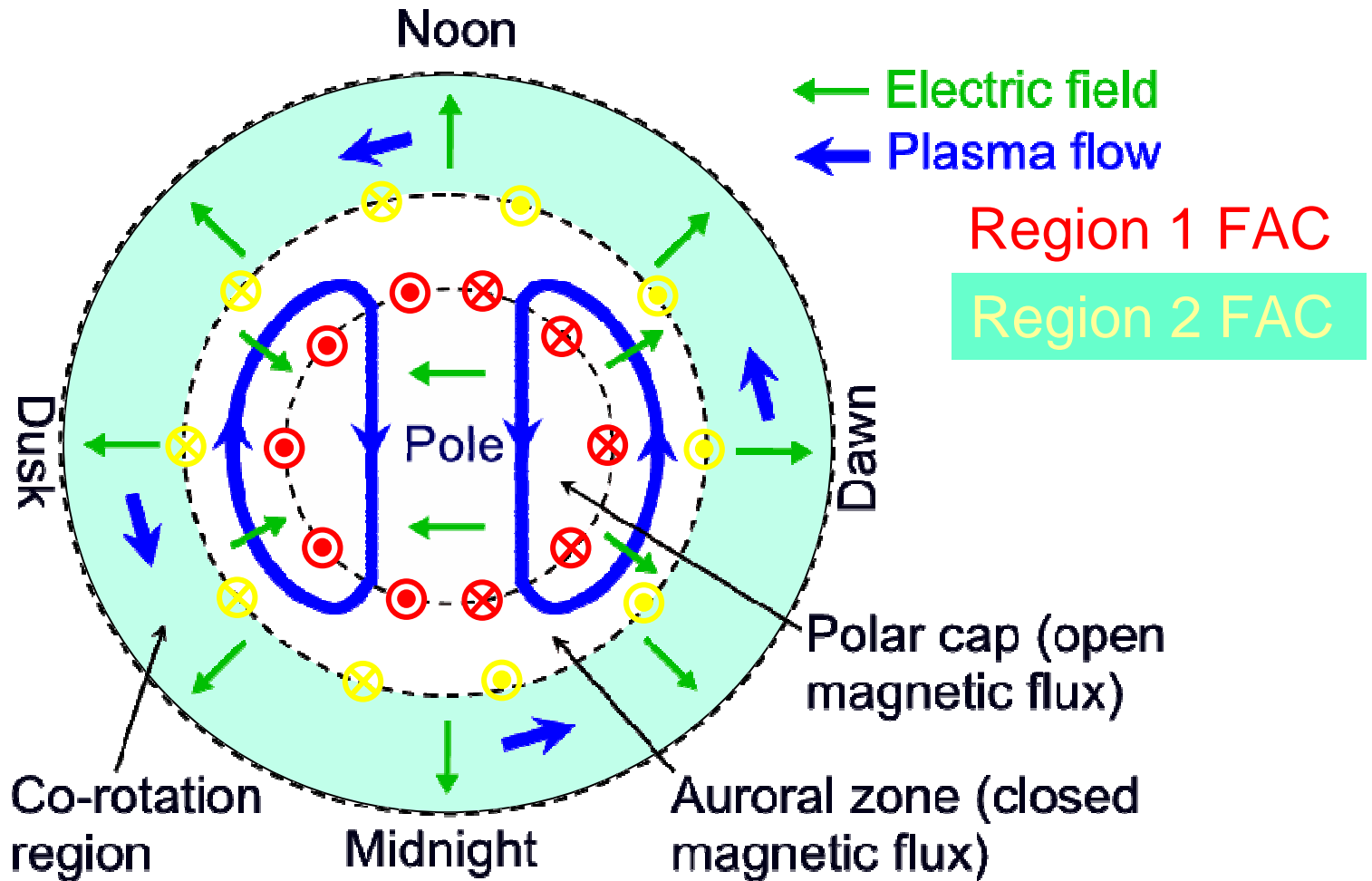
Pedersen Current Circuit
(connects Region 1
and Region 2 FACs)



Local Time
Coordinates

View from above
north pole

Flows and Electric Fields Mapped to the Ionosphere



Magnetic field everywhere into paper

View from above north pole