



Kartverket

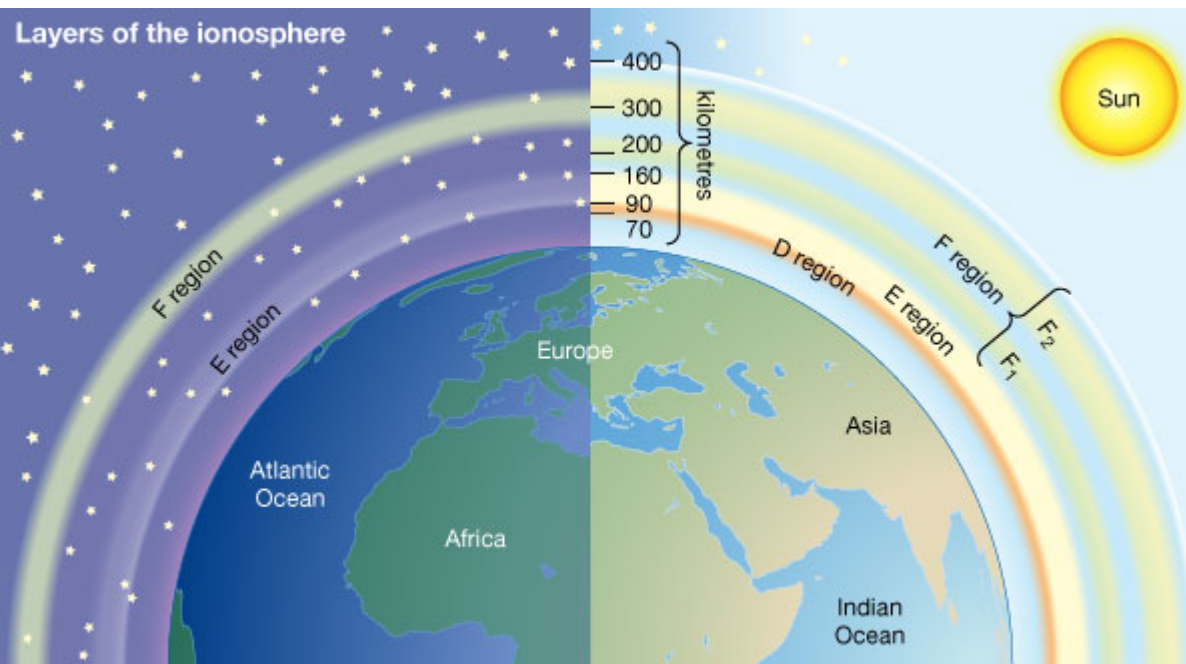
Ionosphere

Part 1 – Basics / The Sun / Space Weather

Knut Stanley Jacobsen

Credit for pictures and illustrations of space phenomena: NASA, NASA/SDO, ESA

The Ionosphere

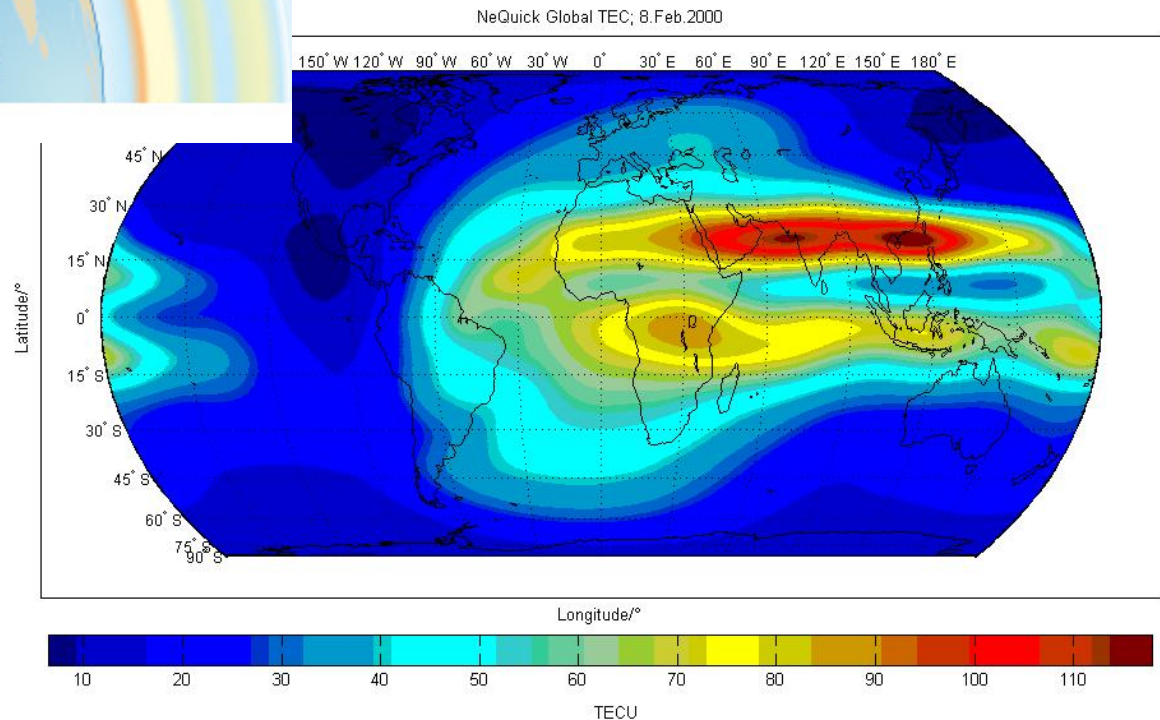


The top region of the atmosphere, where a significant portion of the gas is ionized by radiation from the sun.

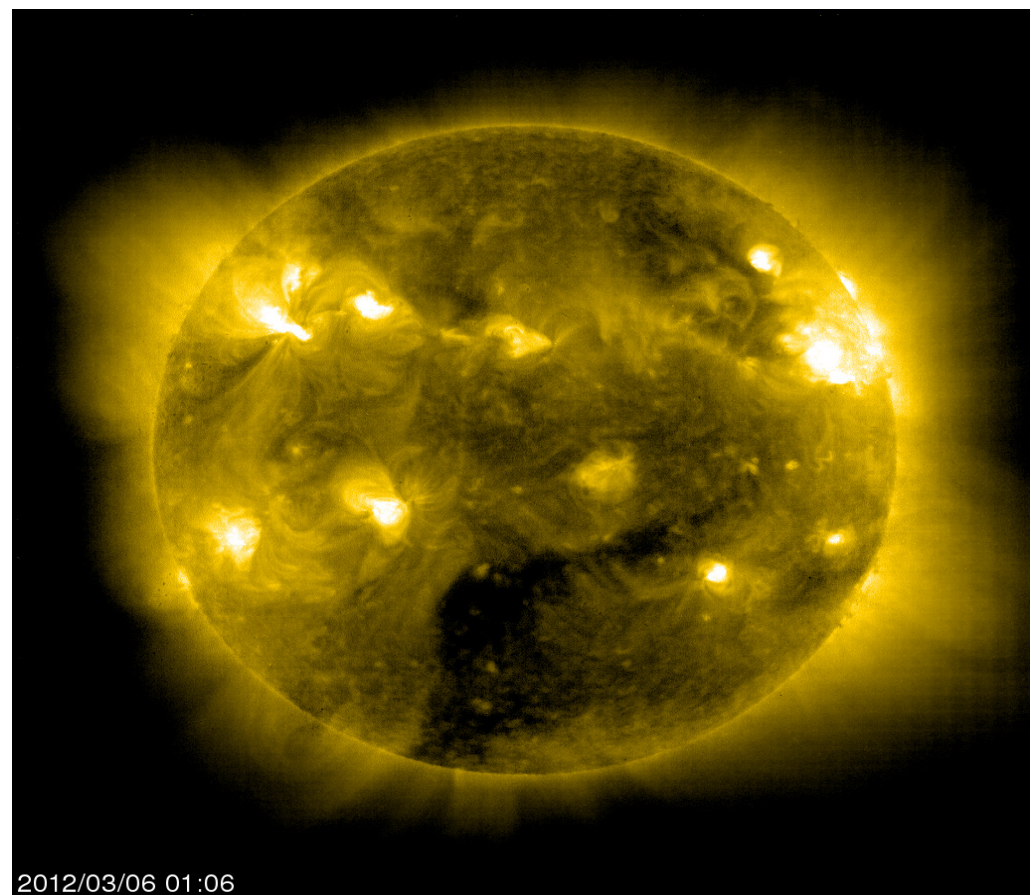
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Dayside and nightside ionosphere are systematically very different.

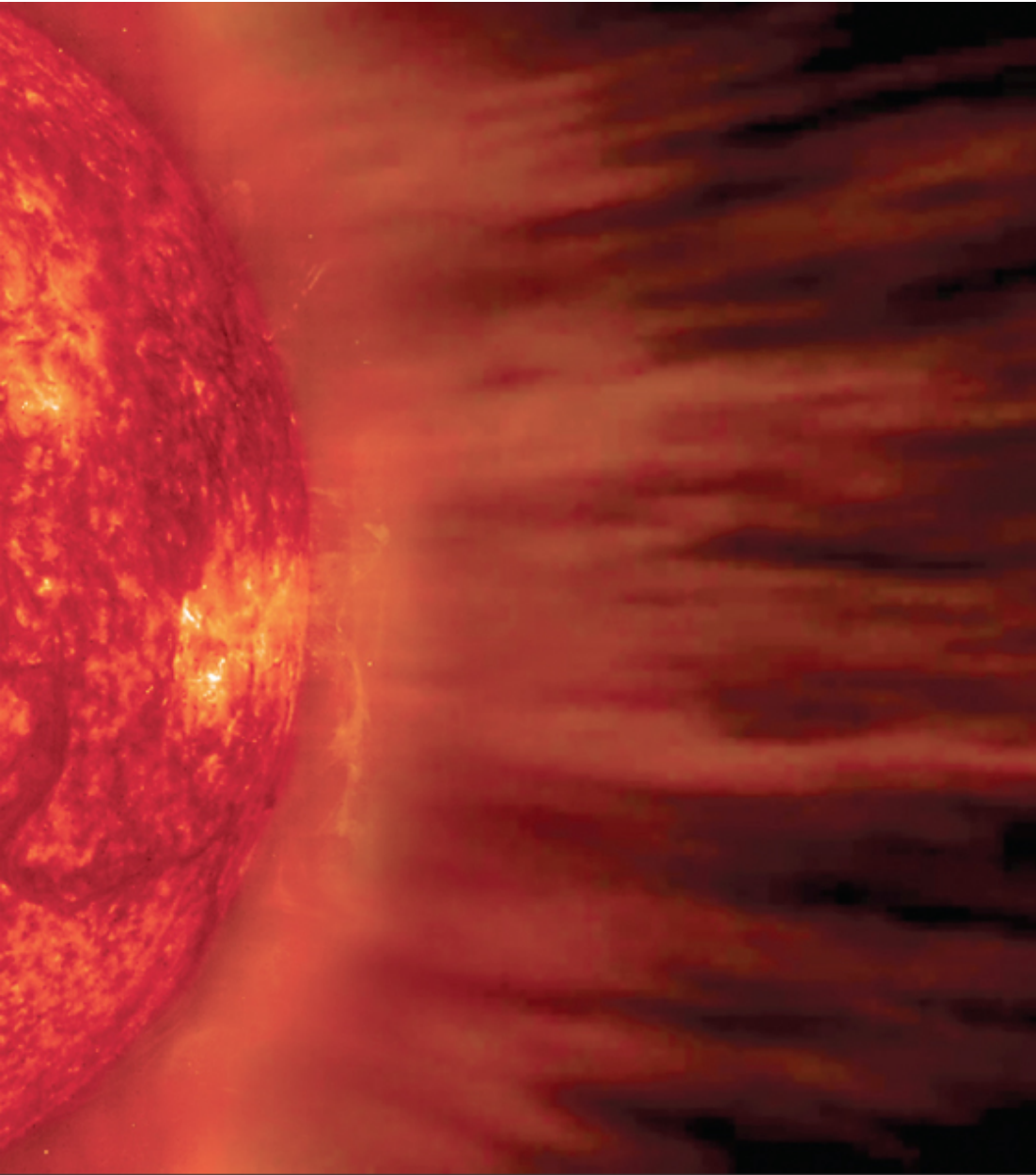
Also, there are big systematical differences with latitude.



The Sun



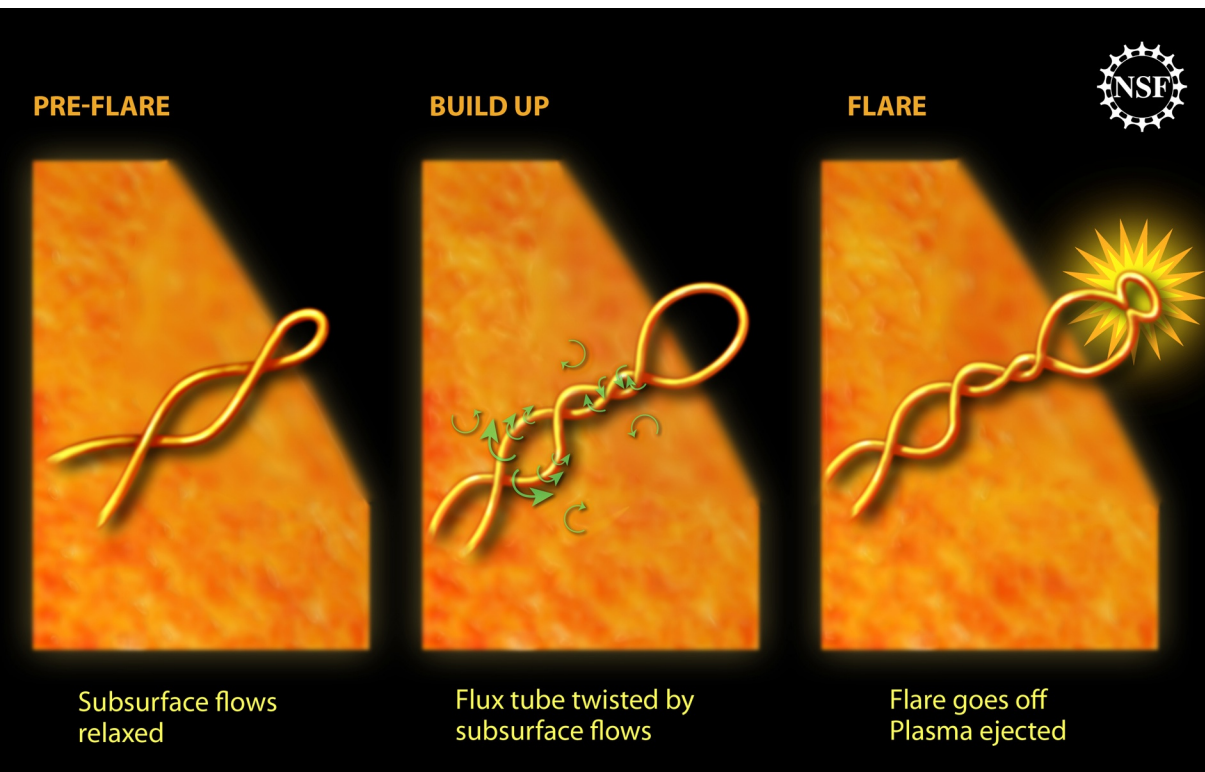
The Solar Wind



- A stream of ionized hydrogen from the Sun
- Carries a magnetic field
- The density, velocity, magnetic field strength and magnetic field direction varies

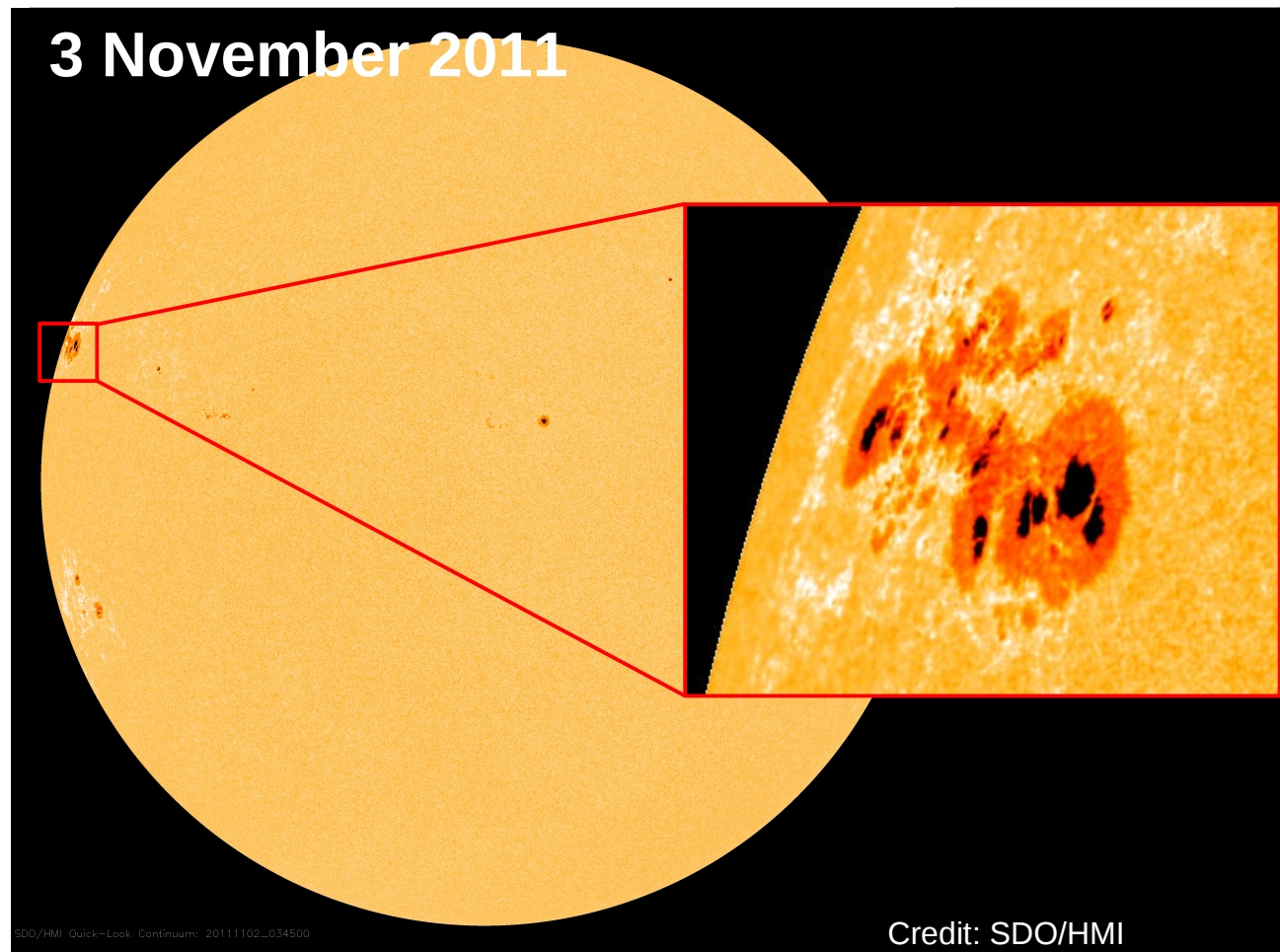
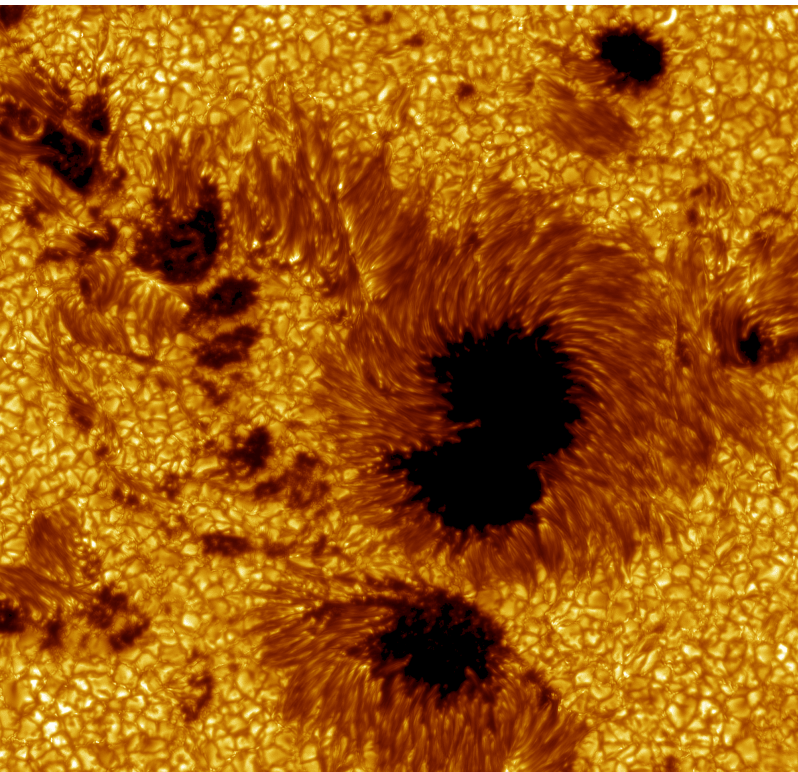
Solar Flares

Extremely powerful explosions on the Sun,
driven by release of magnetic tension



Sunspots

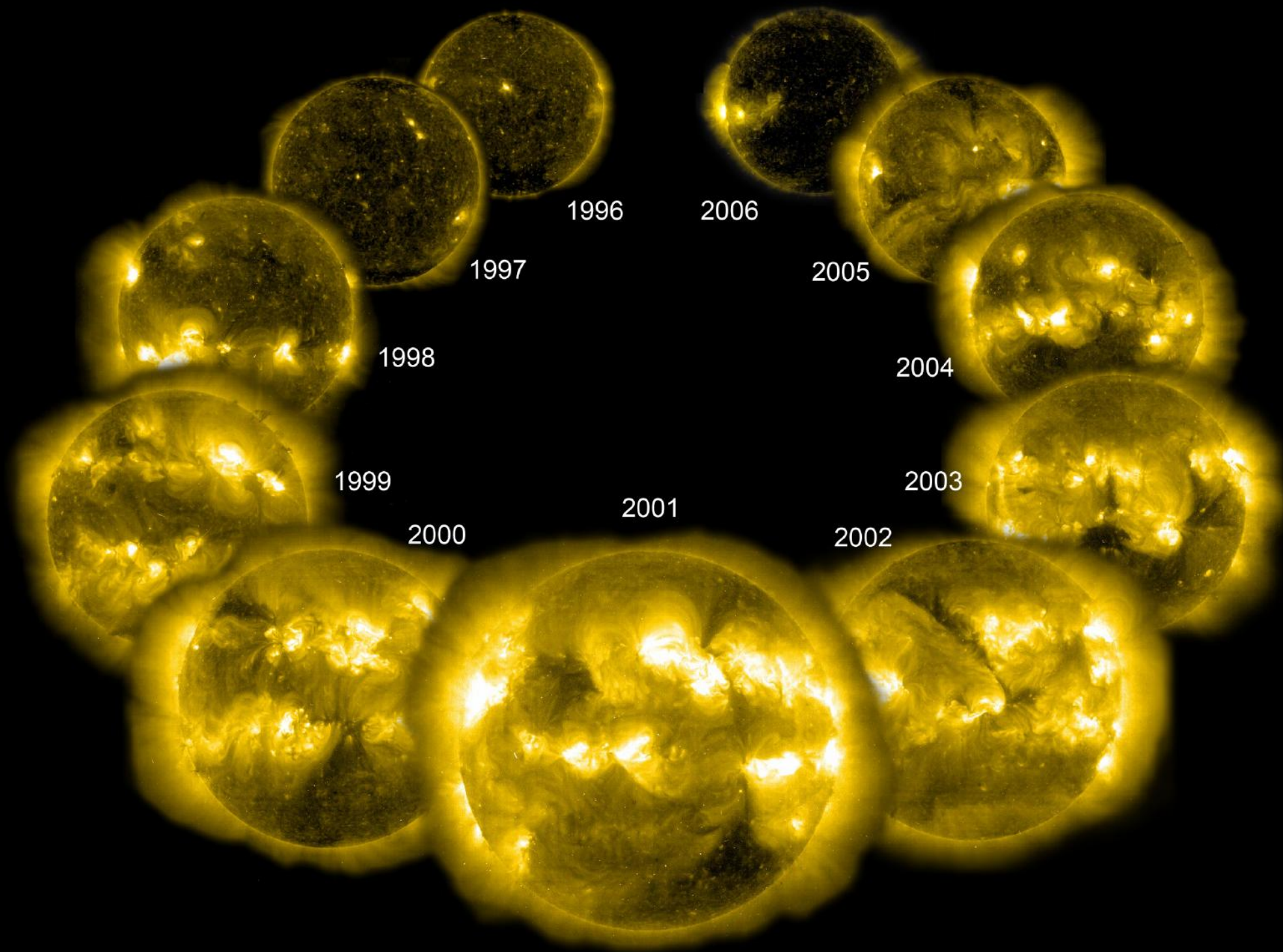
An indicator of active regions on the Sun





The Solar Cycle

A 22-year solar magnetic field cycle
leads to an 11-year activity cycle



1996

2006

1997

2005

1998

2004

1999

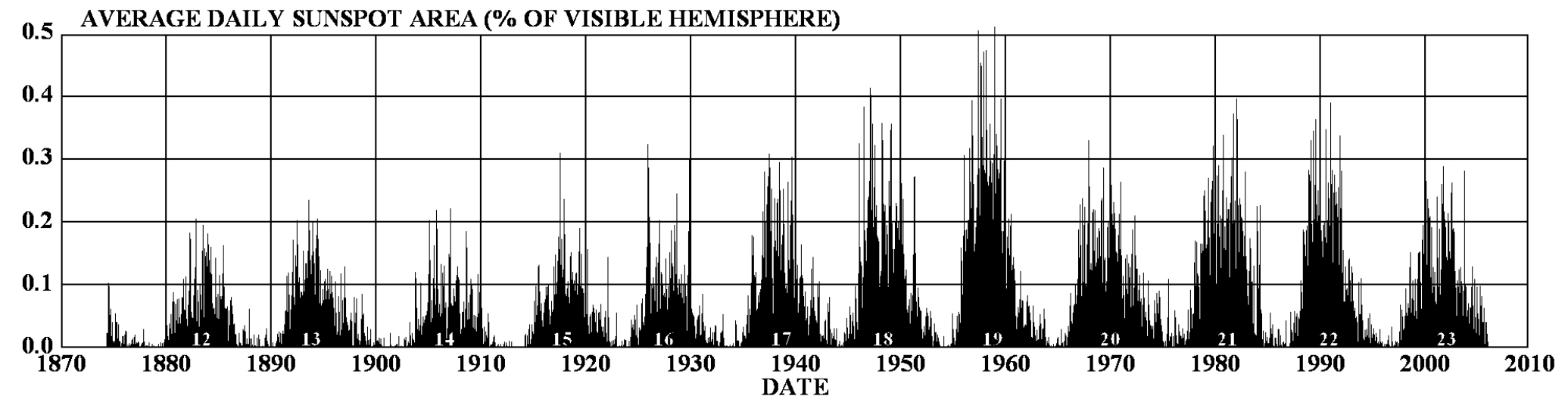
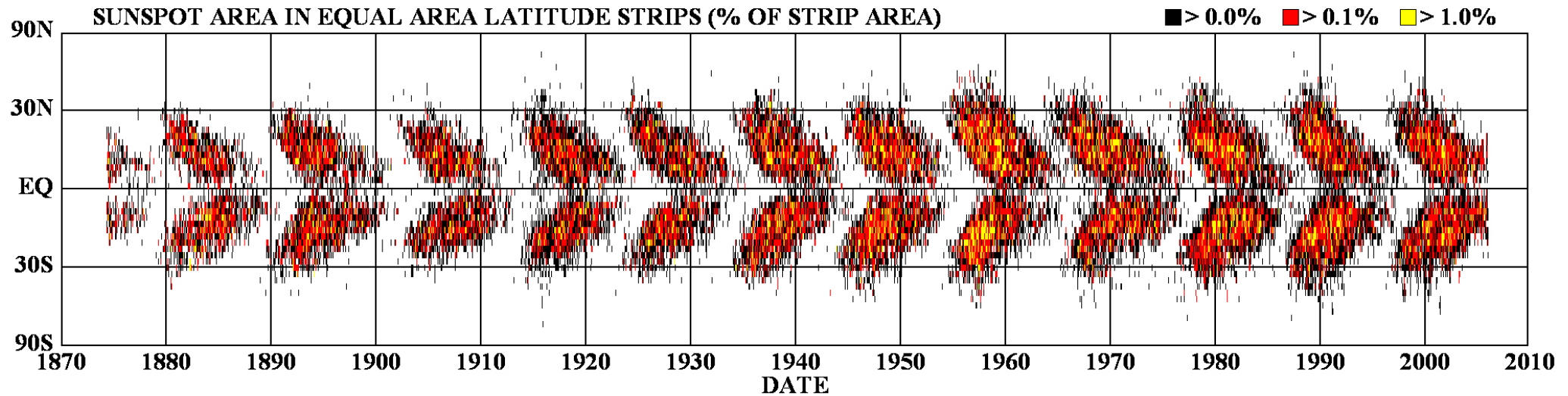
2003

2000

2001

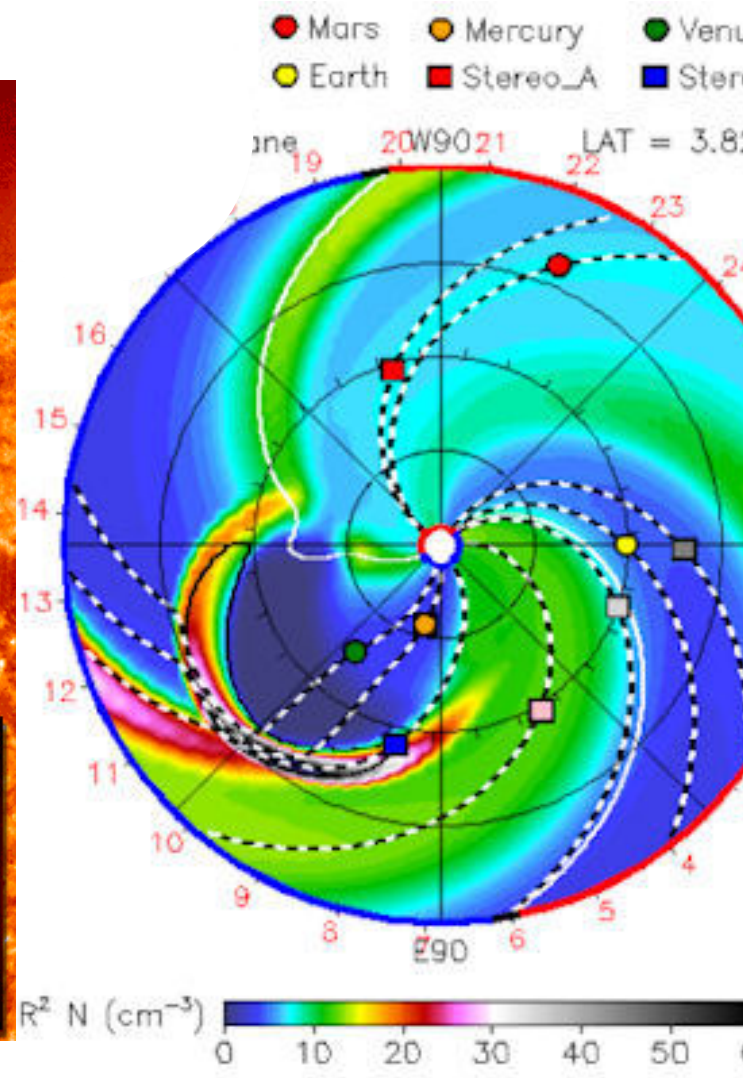
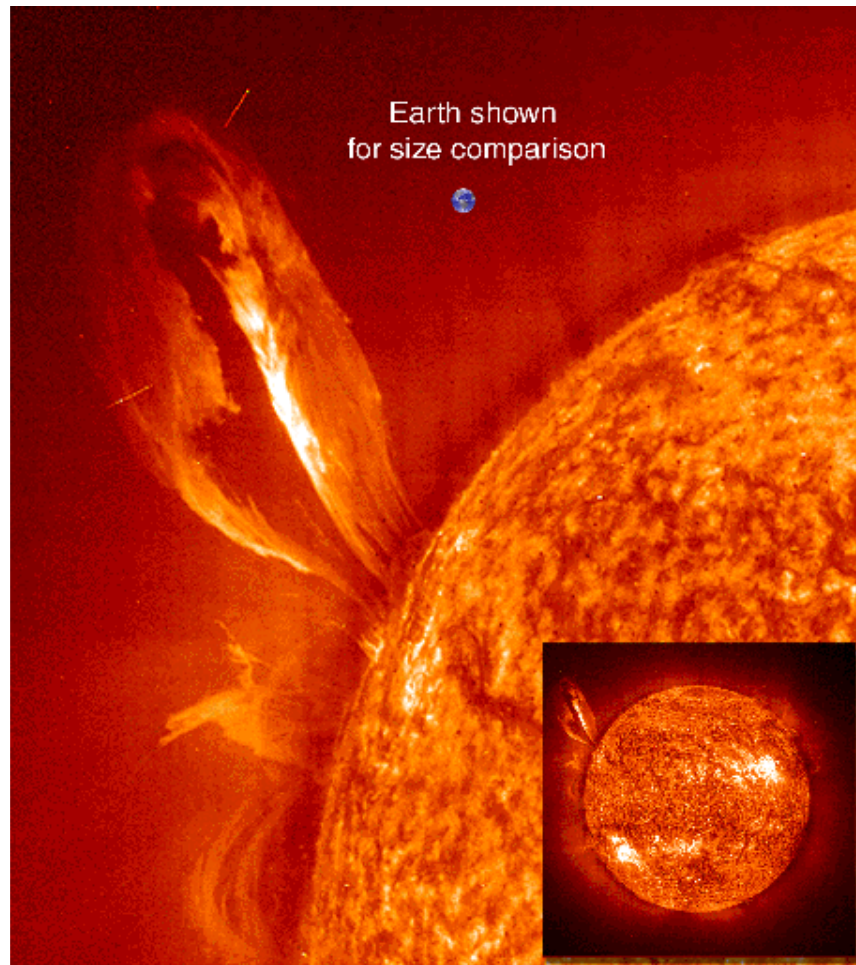
2002

DAILY SUNSPOT AREA AVERAGED OVER INDIVIDUAL SOLAR ROTATIONS



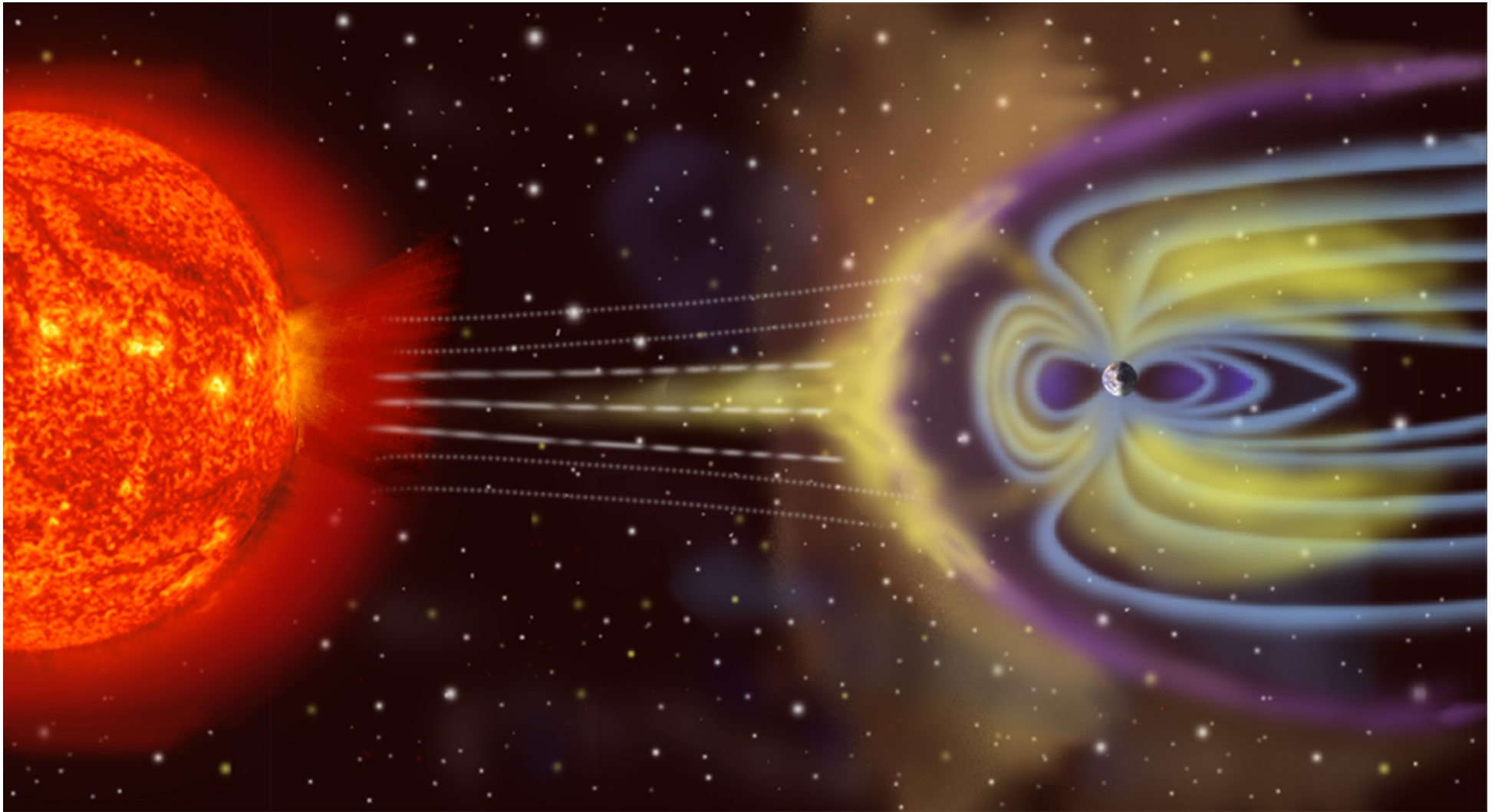
Coronal Mass Ejections (CMEs)

Giant clouds of plasma escaping from the Sun



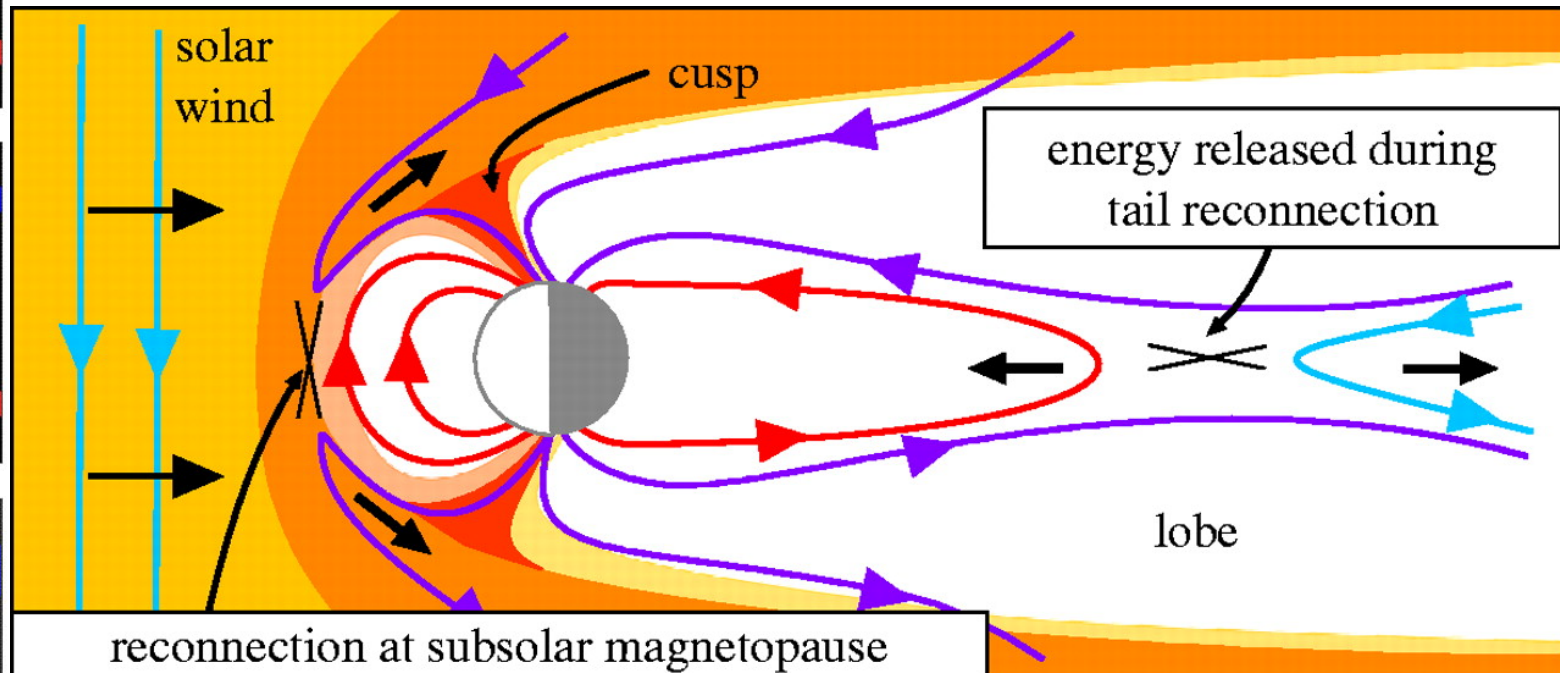
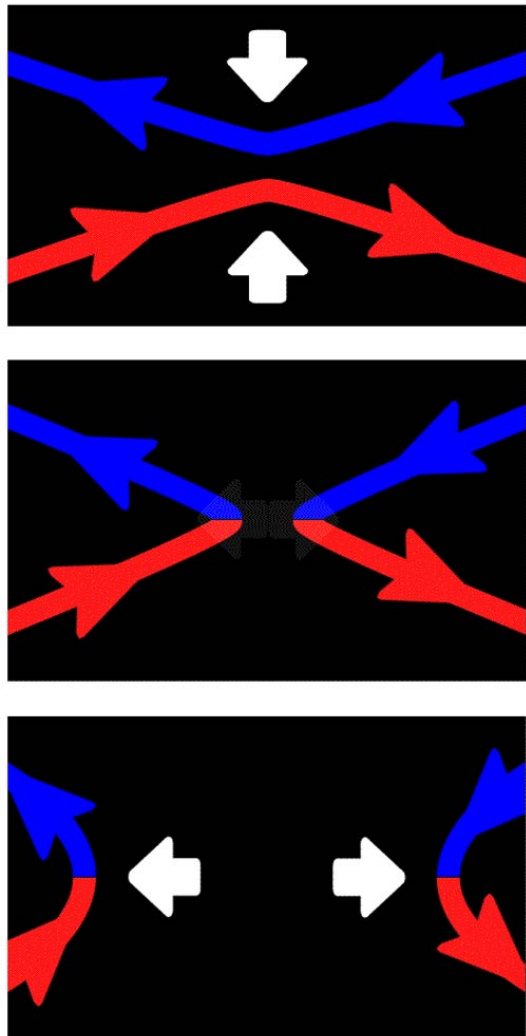
Solar Wind vs Earth

The magnetic field of the Earth deflects most of the solar wind particles



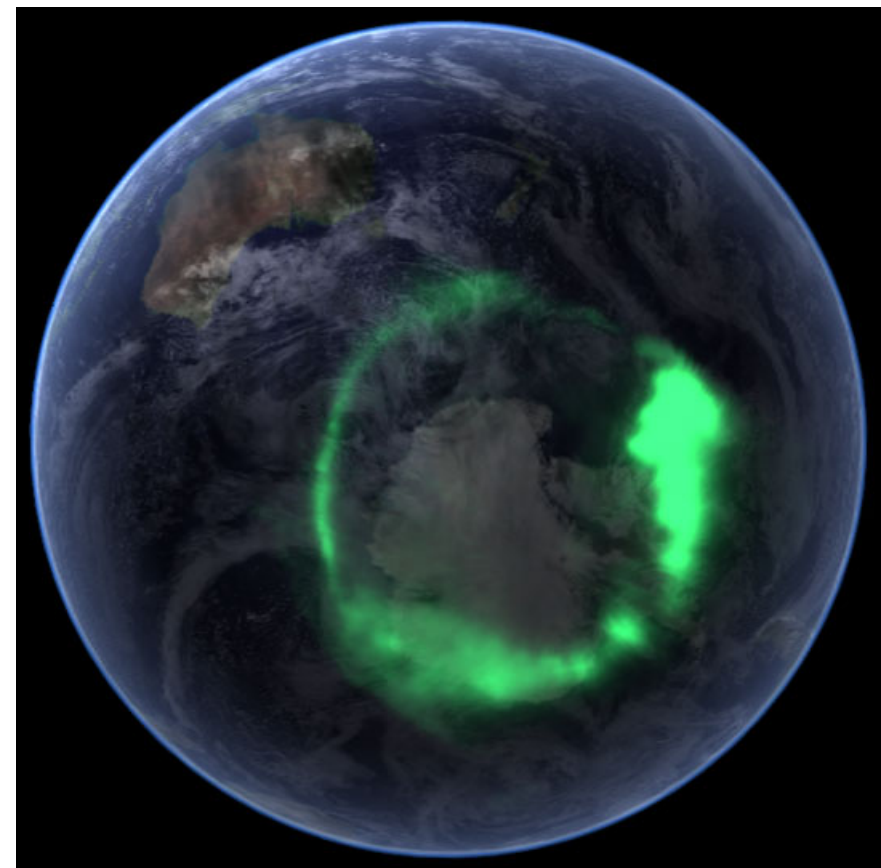
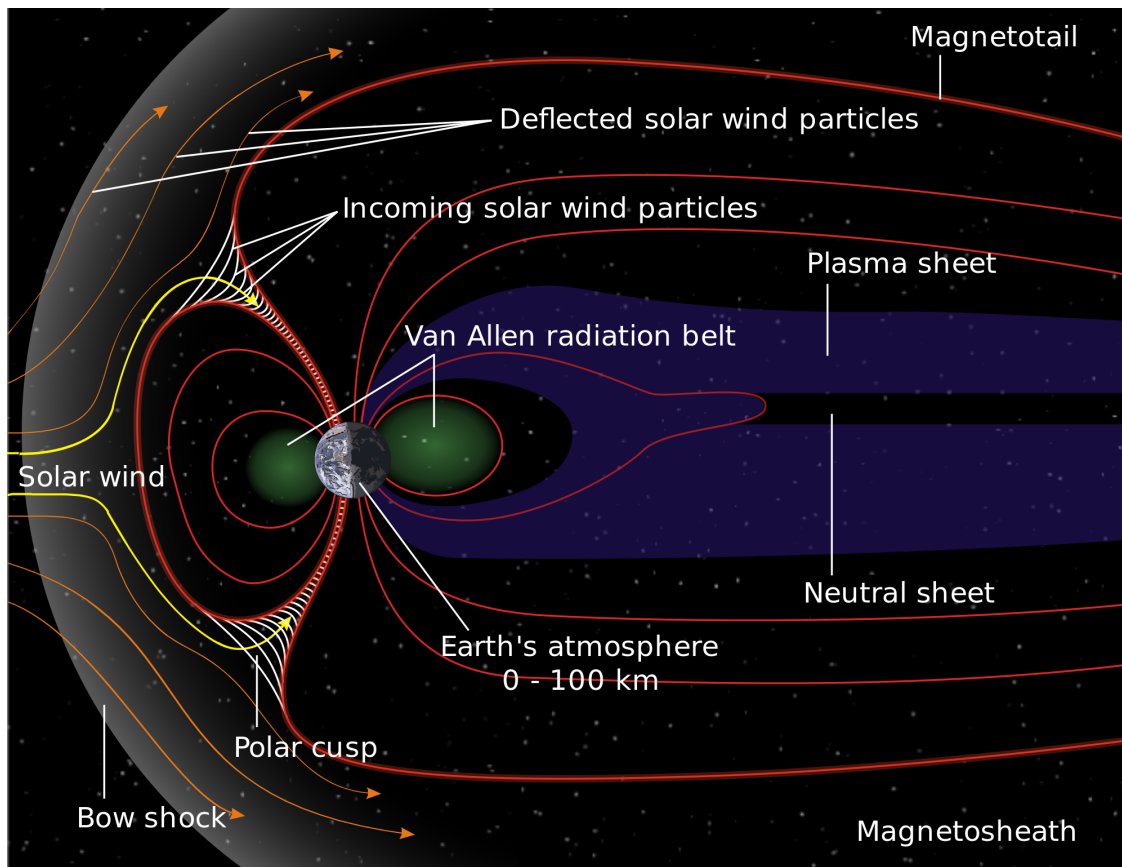
Magnetic Reconnection

transfers energy and particles from the solar wind to the Earth's magnetosphere



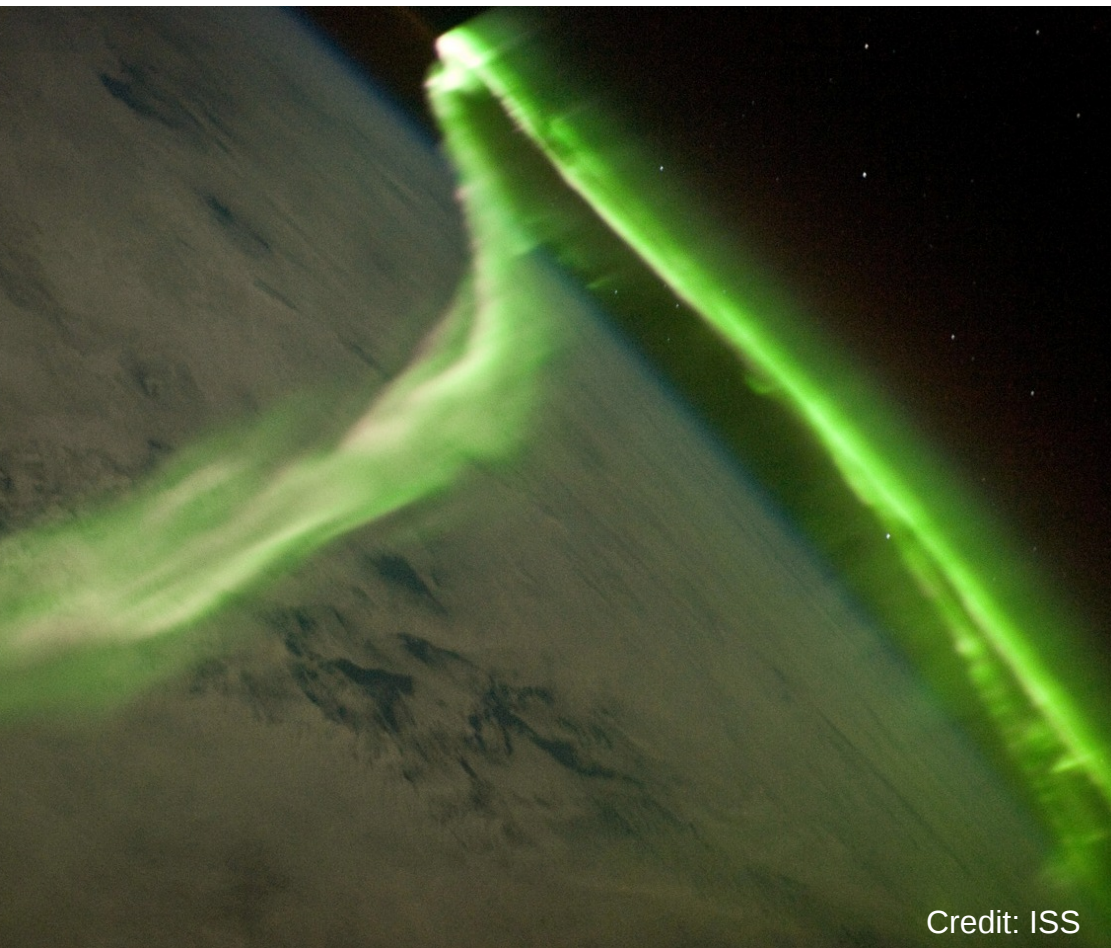
Some high-latitude region are particularly affected by space weather activity

- The Auroral Oval
- The Polar Cusp

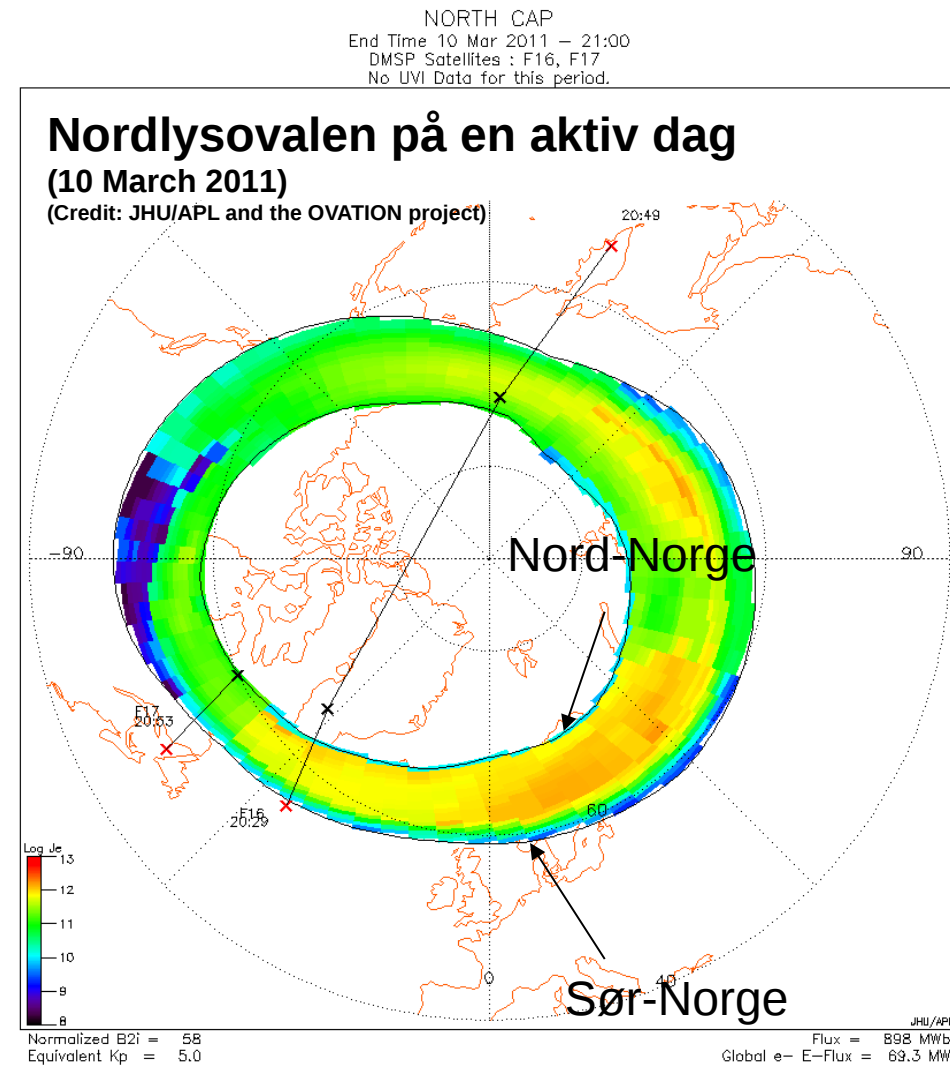


The Auroral Oval

A visible space weather phenomenon

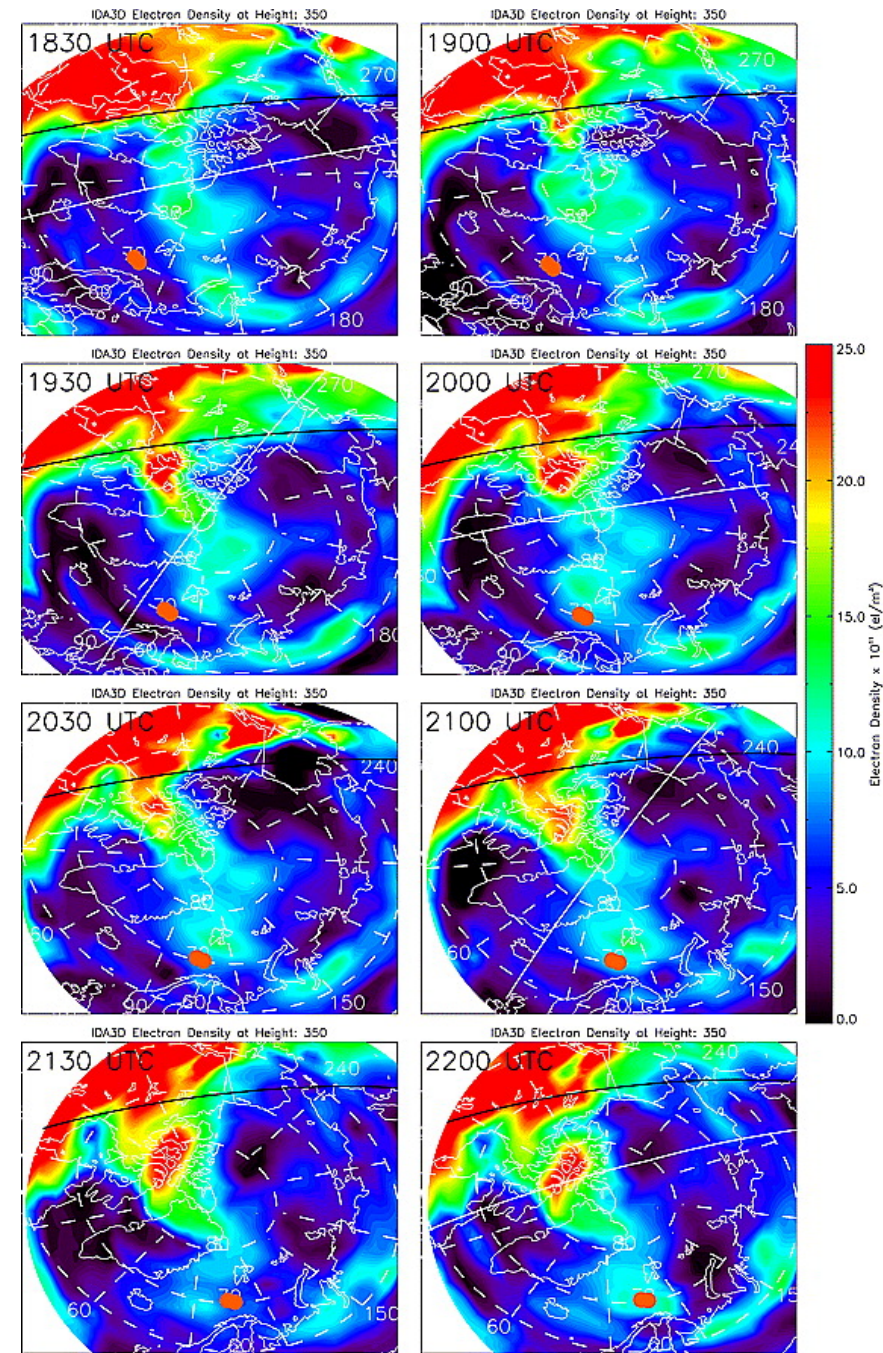
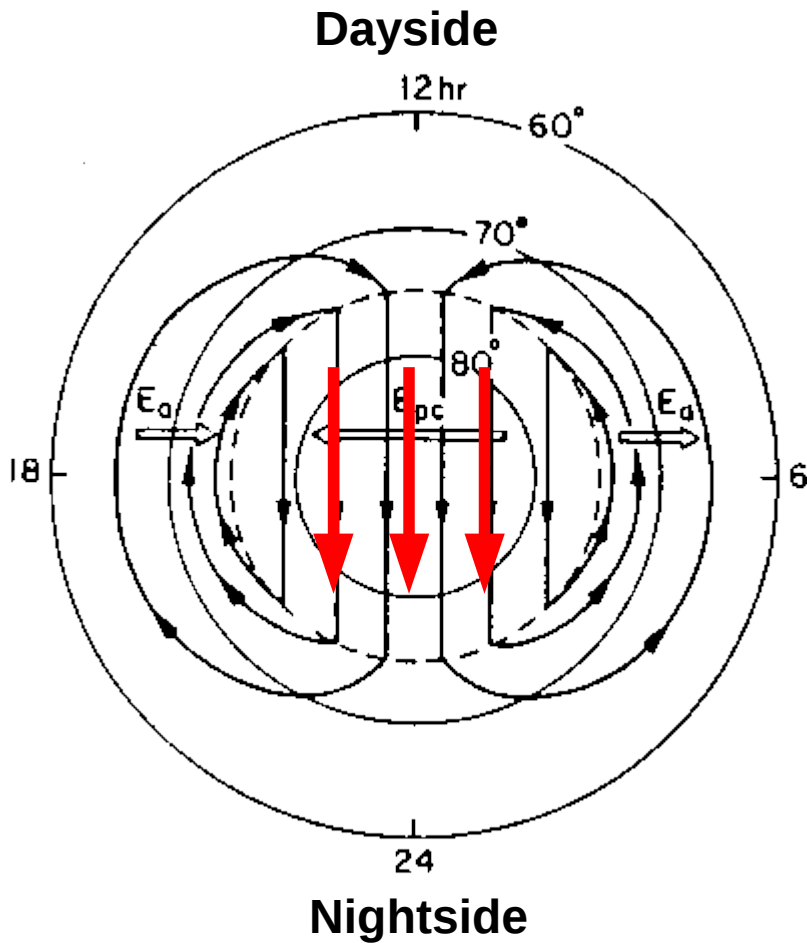


Credit: ISS



Polar cap Ionospheric convection

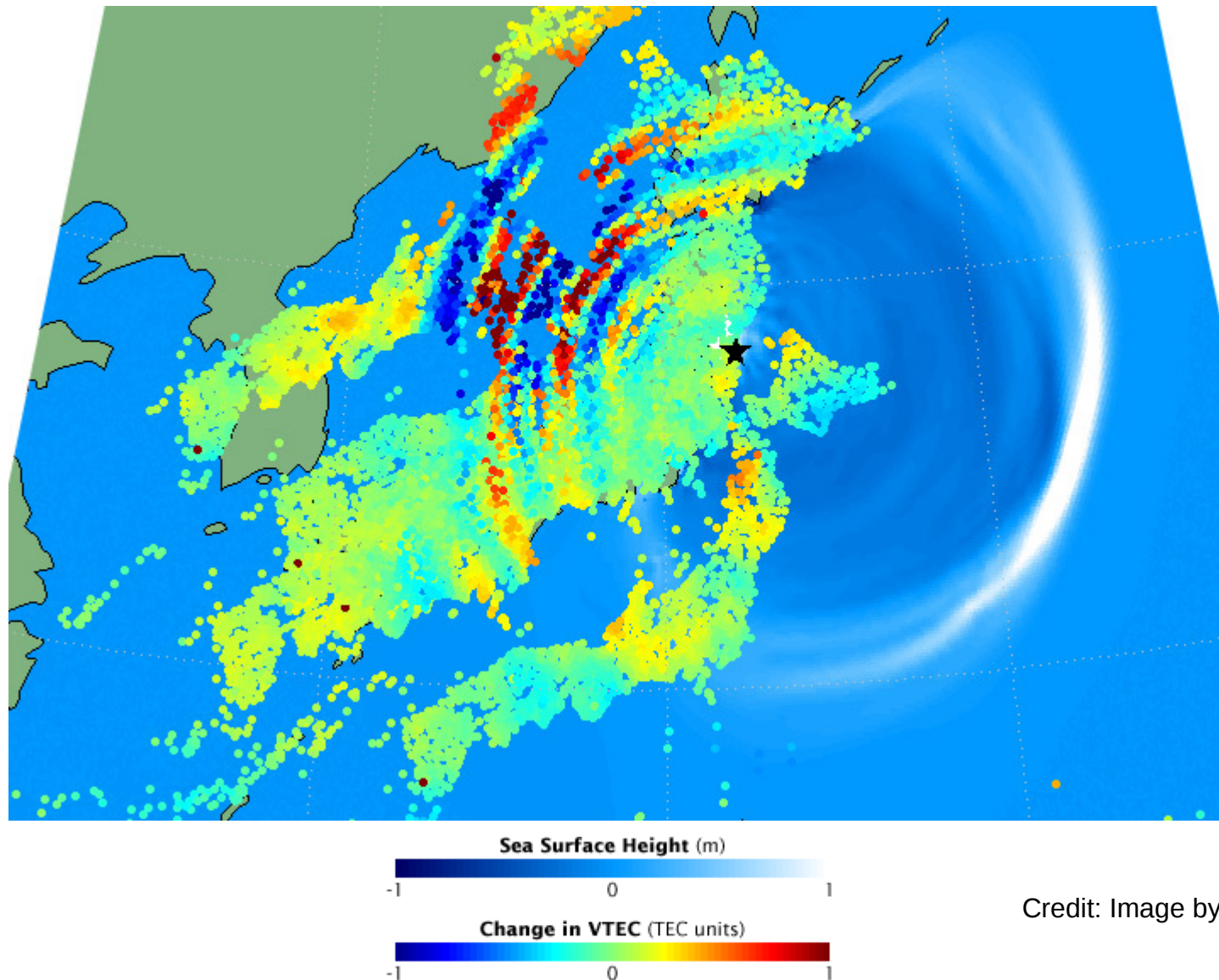
Plasma structures drift across the polar cap, from the dayside to the nightside.



Credit: G. S. Bust and G. Crowley ==>

Waves from the lower atmosphere can modulate ionospheric plasma density

Japan quake in 2011



Credit: Image by NASA/JPL-Caltech

Question time!

