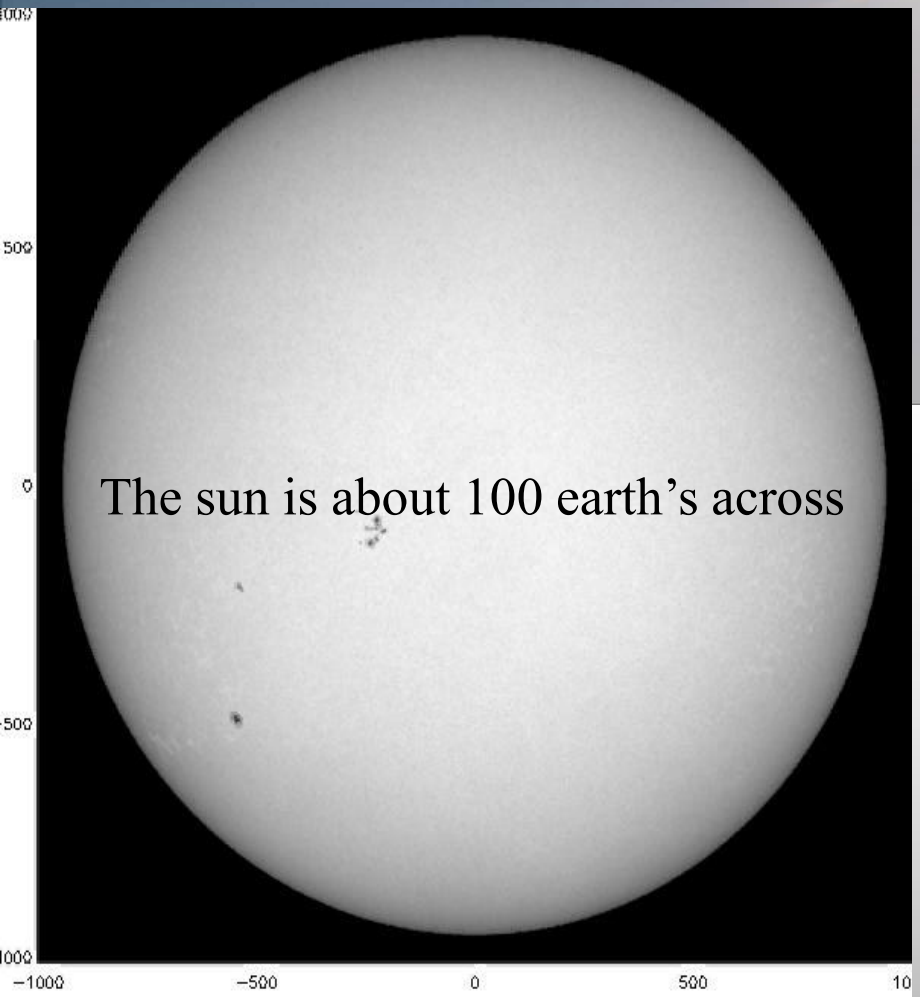
Societal Impacts of Space Weather Workshop

Report on Discussion and Action Items
11 June 2012
Vienna

Space Weather comes from the sun

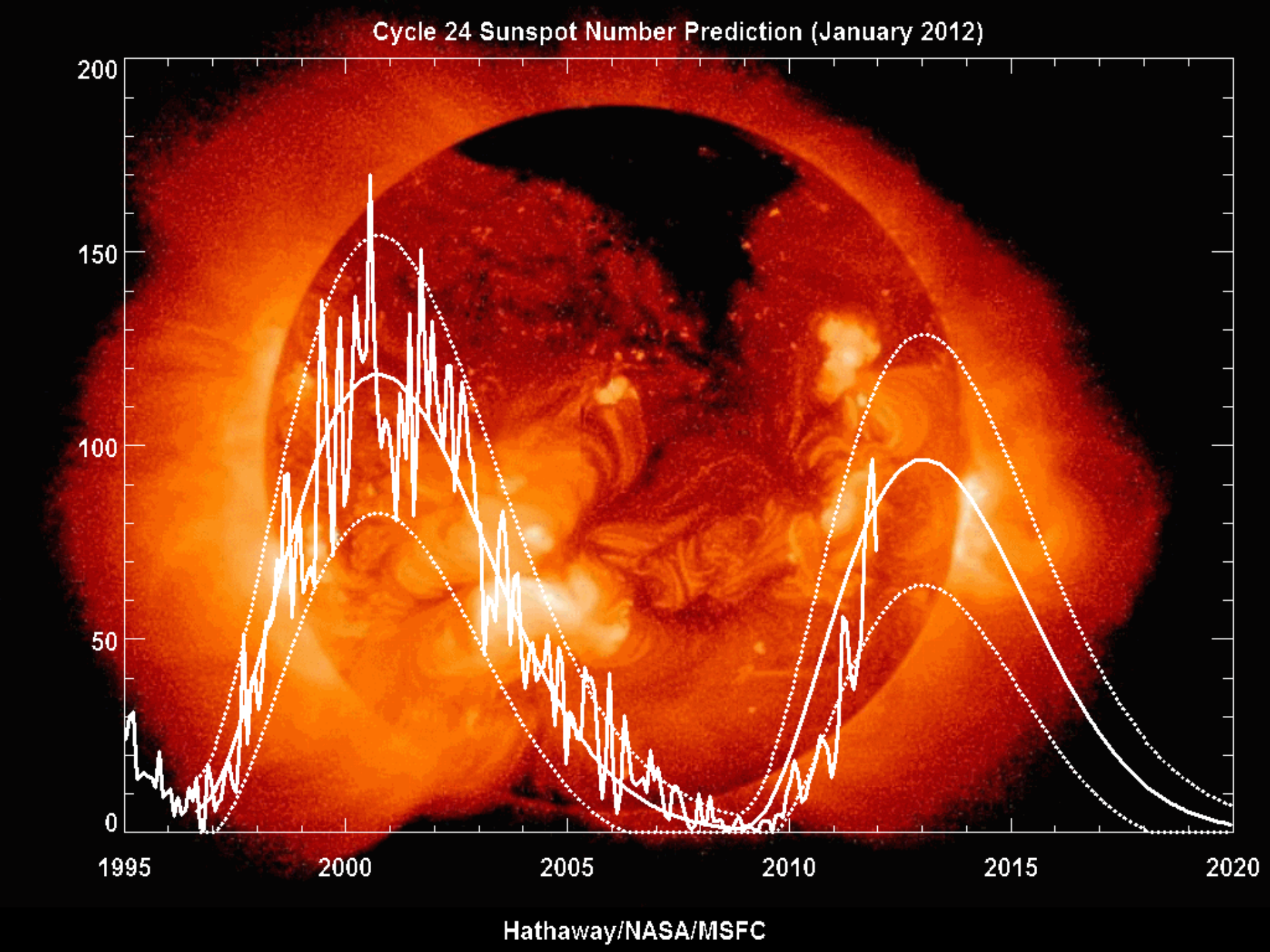


The sun is about 100 earth's across

There are temporal changes in the sun's radio and EUV flux (100 – 1000x)

The sun sheds portions of its atmosphere

These are due to interactions between the sun's magnetic field and its outer convecting layer of plasma.


Cycle 24 Sunspot Number Prediction (January 2012)
200
150
100
50
0
1995
2000
2005
2010
2015
2020
Hathaway/NASA/MSFC

THREE VARIETIES OF SPACE WEATHER

"SPACE TORNADOS"

FLARES: photons, energetic ions

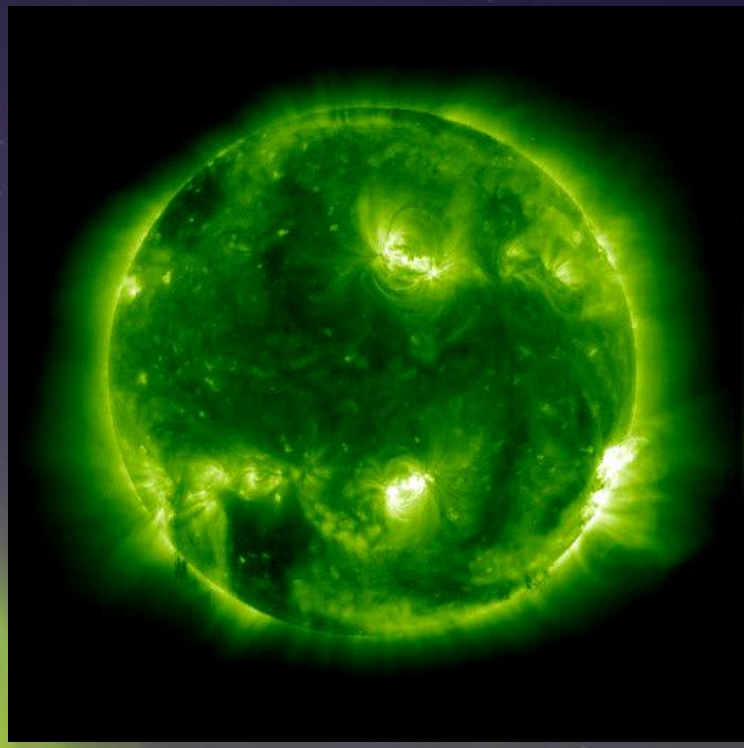
"SPACE HURRICANES" or "SOLAR TSUNAMIS"

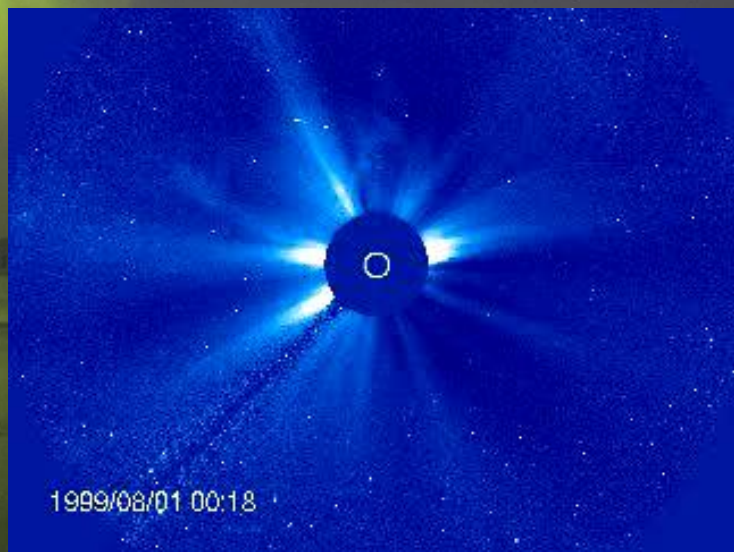
CORONAL MASS EJECTIONS: plasma, magnetic field, energetic ions, energetic electrons

"SPACE WEATHER"

SOLAR WIND: thermal plasma, energetic electrons

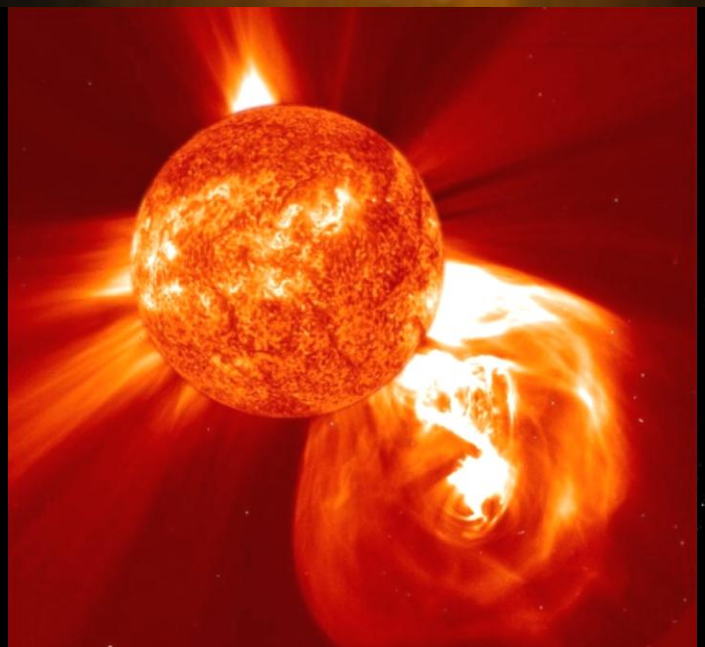
We have limited forecasting ability that is dependent on the nature of the particular event

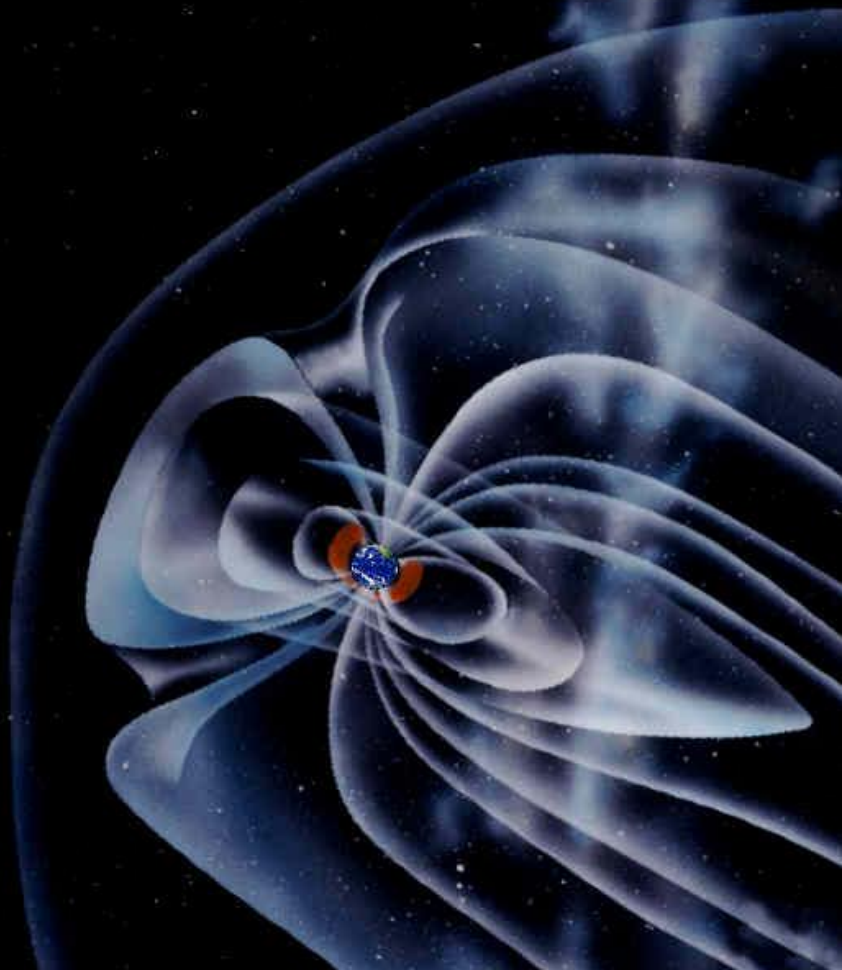




When the sun sheds atmosphere, the magnetic field goes with it

This can modify earth's magnetic field





Space Weather Effects Summary

- Flares (warning time is zero; 10 min to 2 days)
- EUV swells the atmosphere – increased drag, space situational awareness
- Ionospheric effects can hamper or deny communications and navigation signals
- Radiation can damage or destroy satellite electronics and solar cells
- CMEs (warning time is 1.5 to 4 days)
- Induced currents can cause blackouts, enhance pipeline corrosion
- Radiation can damage or destroy satellite electronics, solar cells
- Solar Wind (warning time is an hour to a month)
- Radiation can damage or destroy satellite electronics, solar cells

Solar events have not increased in strength or ferocity;
We've increased our reliance upon vulnerable systems

Impacts on Communication on the Dayside Hemisphere and Polar Regions

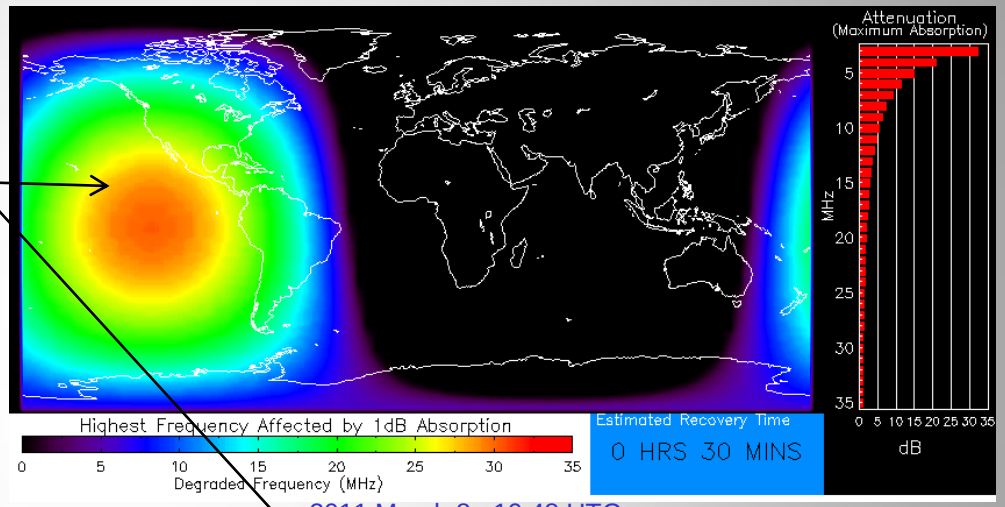
X-Ray Flares create HF radio communication outages over the daylight region

Energetic Particles create HF Radio communication outages and increased radiation at high latitudes

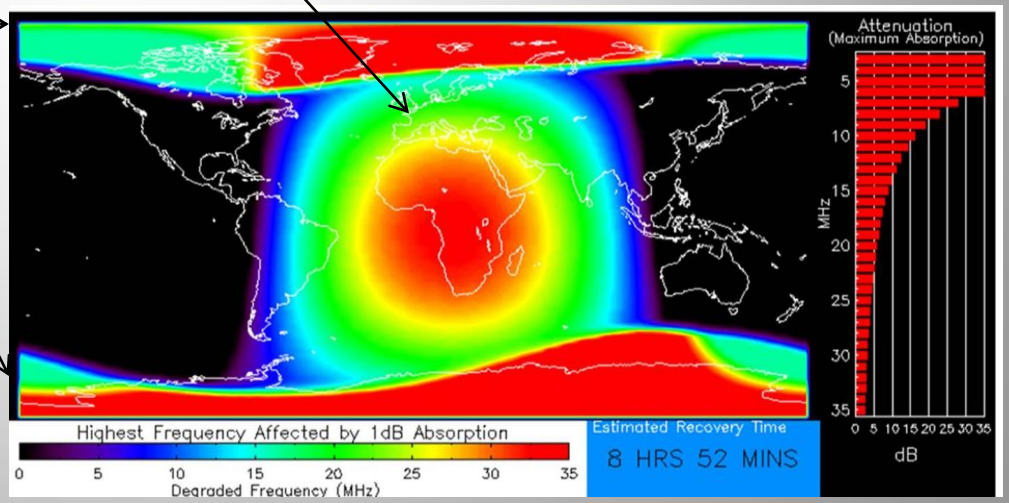
HF Communication is critical for:

- Commercial Airlines
- Humanitarian Operations
- Numerous other applications

2011 March 7 20 UTC



2011 March 8 10:48 UTC



Prediction and mitigation requires both space-based and global terrestrial instrumentation

This job is too big for any one nation: International Cooperation is Required

Action Items from the Workshop

1. Consideration and Discussion of International Cooperation
2. Articulation of Societal Impacts in Cooperation with EG-A

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