FEMA

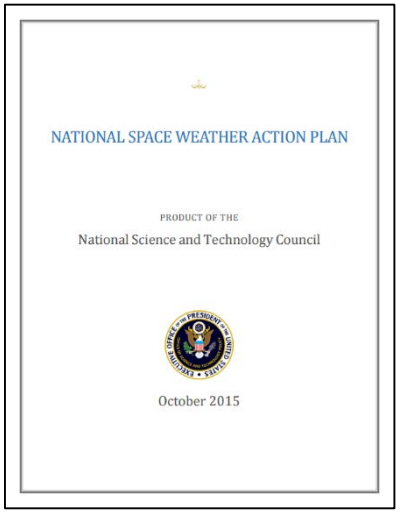
The Space Weather Hazard

Preparing the Nation for the Risks of Extreme Space Weather

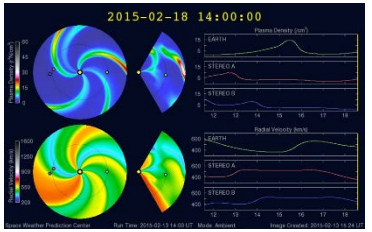
for
The American Meteorological Society
AMS Washington Forum

Past Present Future

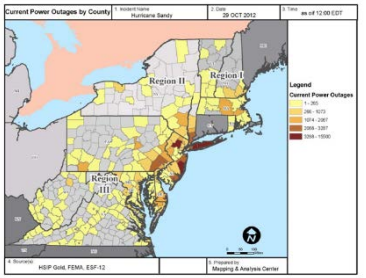
2008



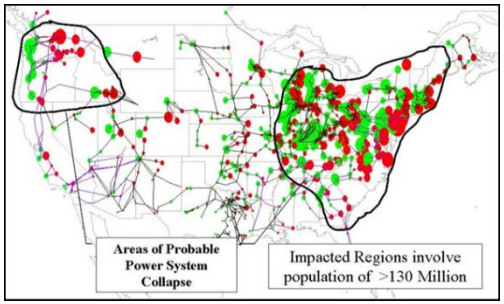
2016



❖Improved Forecast Models



❖Impact Modeling



❖ Recovery 4-10 years

❖ $1-2 Trillion in first year

DRAFT Power Outage Incident Annex to the Response and Recovery Federal Interagency Operational Plans
Date (Month Year)
Homeland Security

Under development

Ready
Prepare. Plan. Stay Informed.

Whole Community

Scientists

Observations and Measurements

Model Runs

Bz, nT/min, V/km, Timing

Utility Engineers

Network Model Runs

Vulnerabilities Identified

Analysis of Impact (Location, Timing, Severity, Duration)

Confidence Level

Emergency Managers

Plans, Training, and Exercises

Messaging to the Public

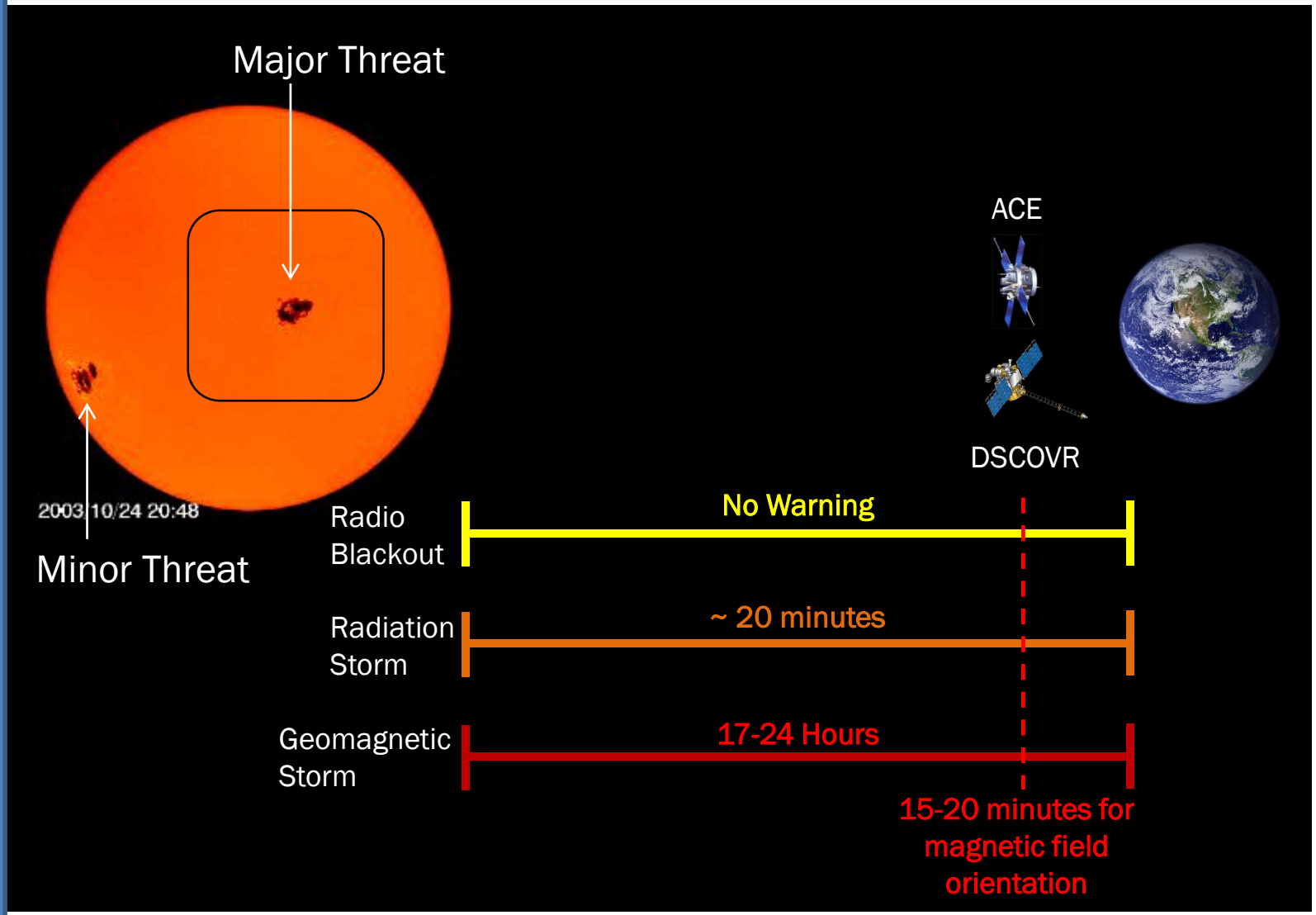
Crisis Planning

Emergency Response

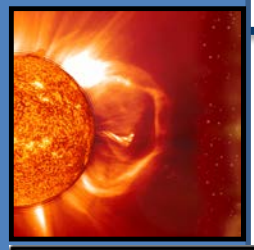
Information Need

- Emergency Managers and the Public Need:
  - Plain Language!!!
  - Improved Forecast Models
  - Analysis
    - Probable location(s) of impact
    - Estimated time of impact at those locations
    - Severity of impact at those locations
    - Duration of impact at those locations
    - Confidence level of the model(s)
  - Information must be sharable with key decision makers at all levels: Federal, State, Territory, Tribe, local, private sector (as appropriate)!!!
- They DO NOT want:
  - Scientific jargon
  - Almost anything with a unit of measure

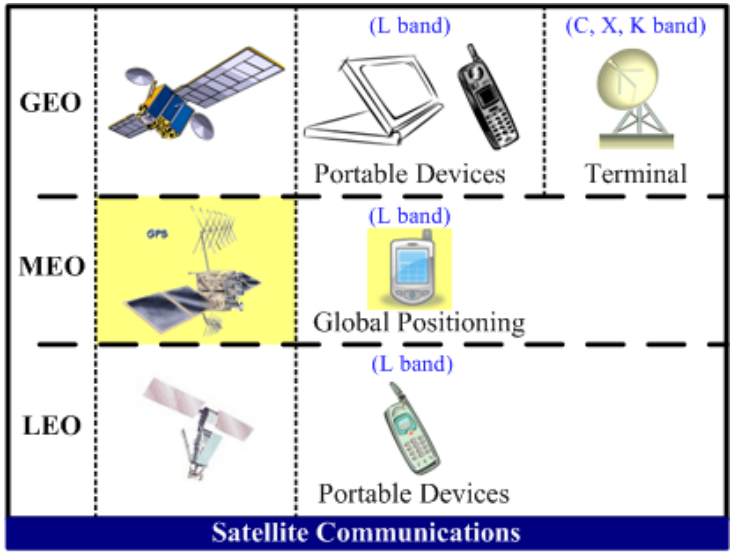
Extreme Event Warning Times

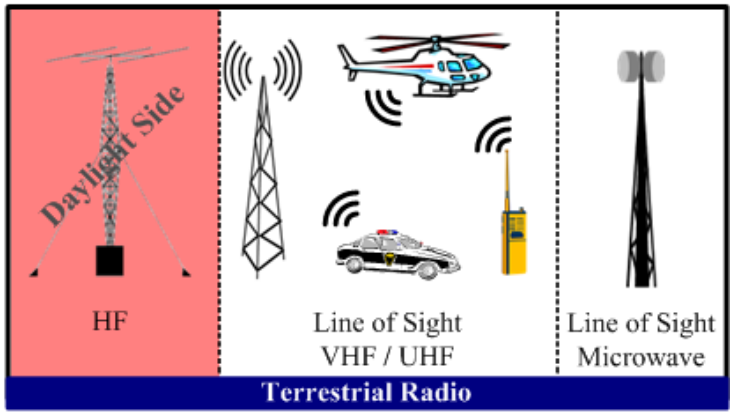


R5 Radio Blackout Event



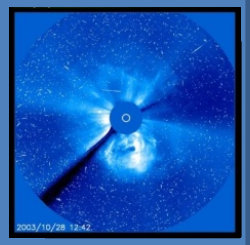
- HF: Several hours (daylight side)
- GPS: Seconds to 15 Minutes
- Little or no impact to line-of-sight public safety radio



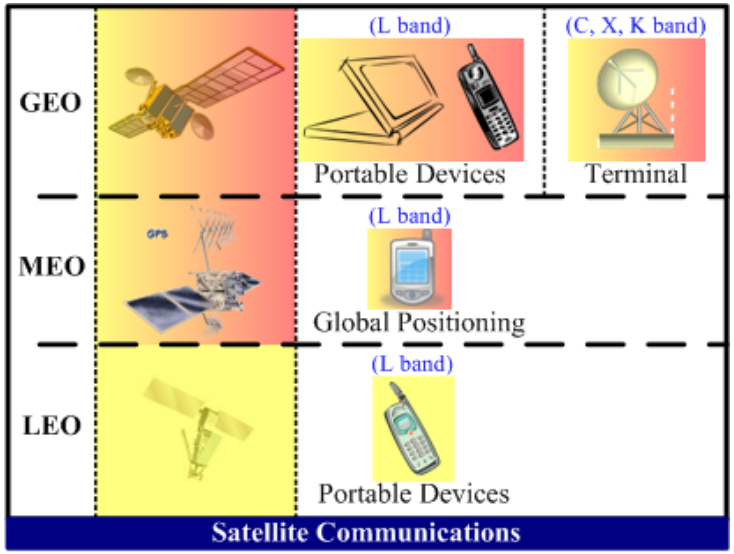


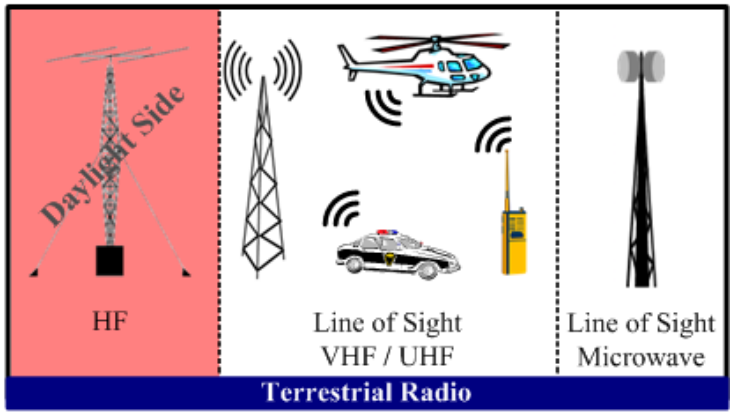
Impact | Possible | Probable | Significant | Severe

S5 Solar Radiation Storm



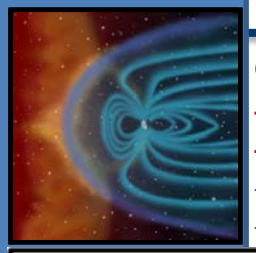
Solar radiation storm arrives ≈ 20 minutes after solar flare. Radio blackout event continues.
- 3-24 hours (various effects)
Possible ≈ 15% of satellite fleet lost due to solar panel damage
Possible ≈ 50 times normal satellite anomalies





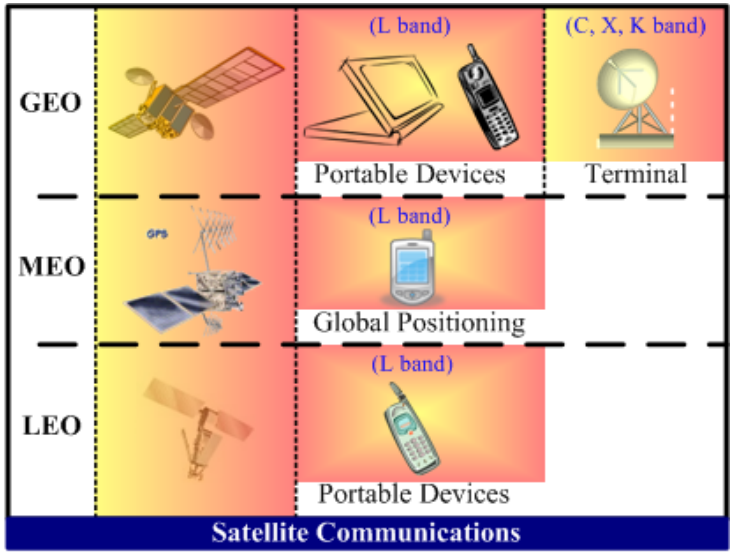
Impact | Possible | Probable | Significant | Severe

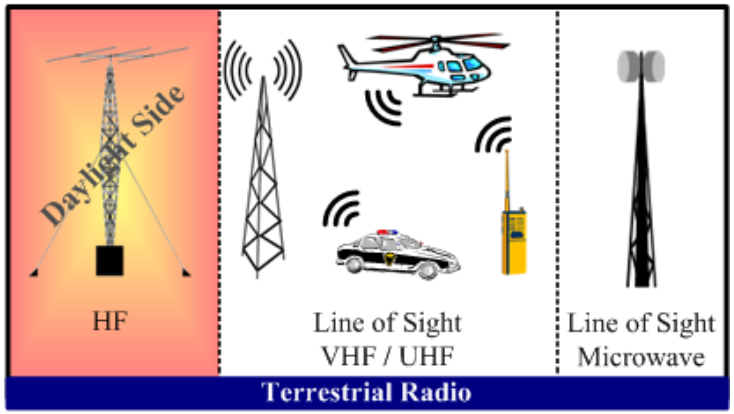
G5 Geomagnetic Storm



CME with southward magnetic orientation arrives at Earth causing extreme geomagnetic storm.

- 12-24 hours (various effects)
- SATCOM/GPS severely disrupted due to scintillation
- HF may be possible early
- Line-of-sight public safety radio not impacted
- Satellite frequency scintillation more severe at lower frequencies (L band)
- If power lost, phones and computers not connected to backup power lose service



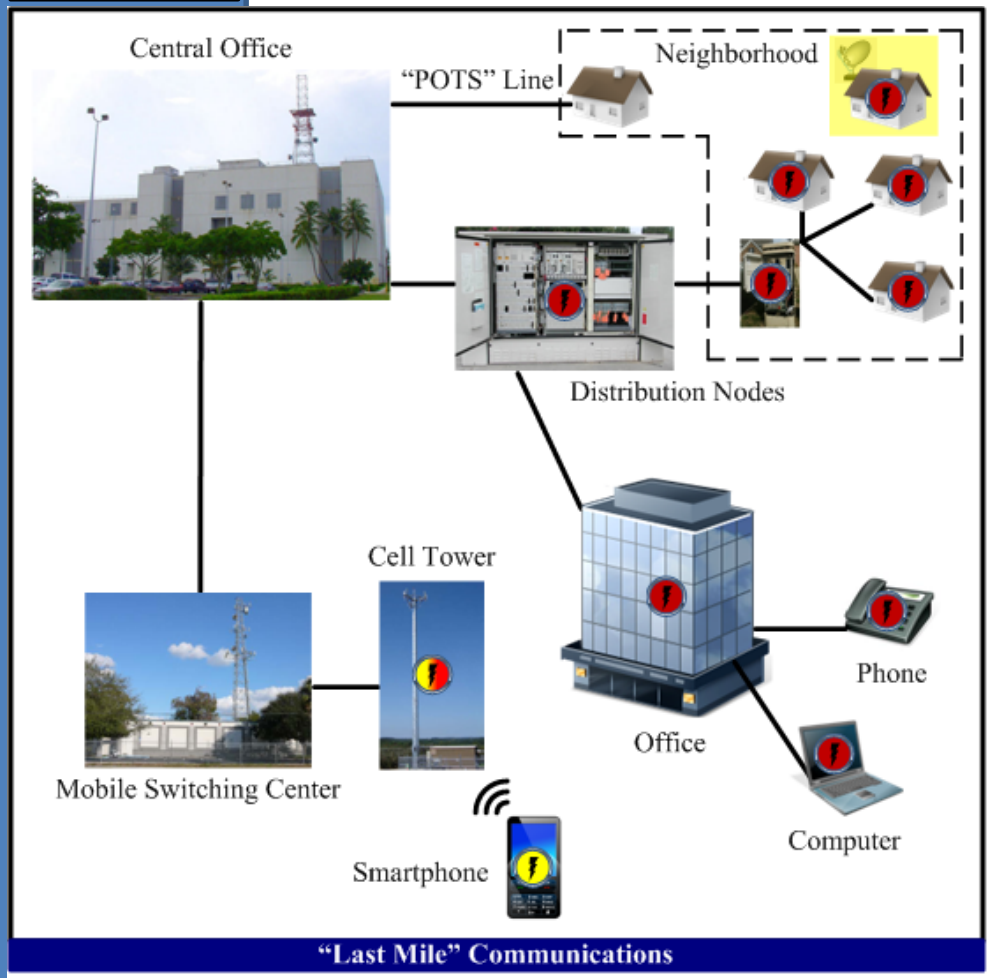


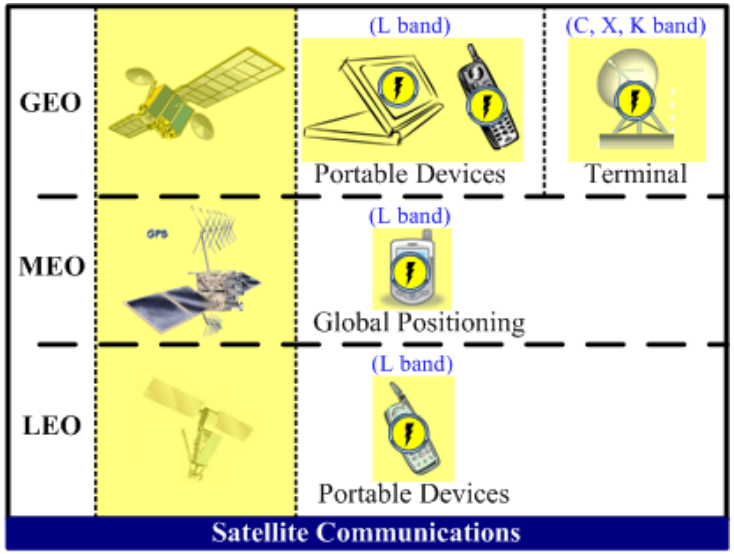
Impact | Possible | Probable | Significant | Severe

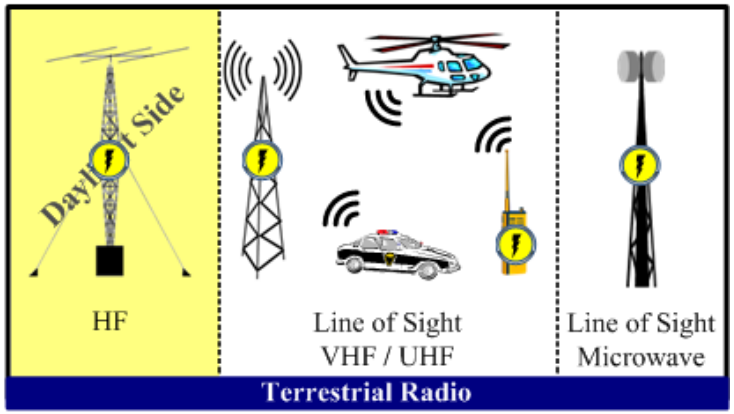
G5 + 24 Hours

G5 storm ends. ***If*** **loss of power, begins to impact critical systems.**

- Damage to satellites may impact SATCOM
- PSTN distribution nodes may fail
- Land Mobile Radio and Cellular towers begin to fail
- Some generators require refueling
- Loss of internet access possible







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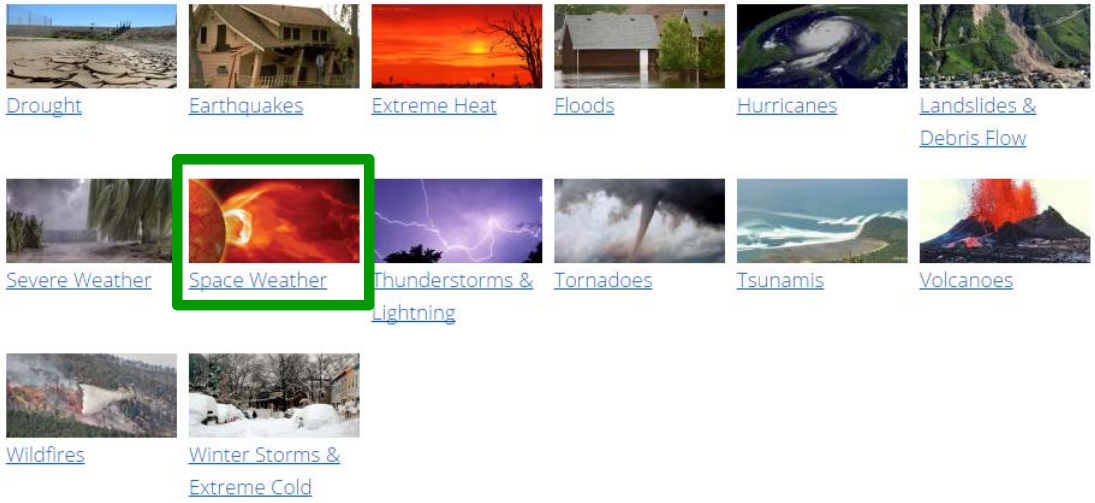
Prepare. Plan. Stay Informed.

Ready.gov

Ready.gov/kids

Natural Disasters



- Build an emergency kit
- Make a family communications plan