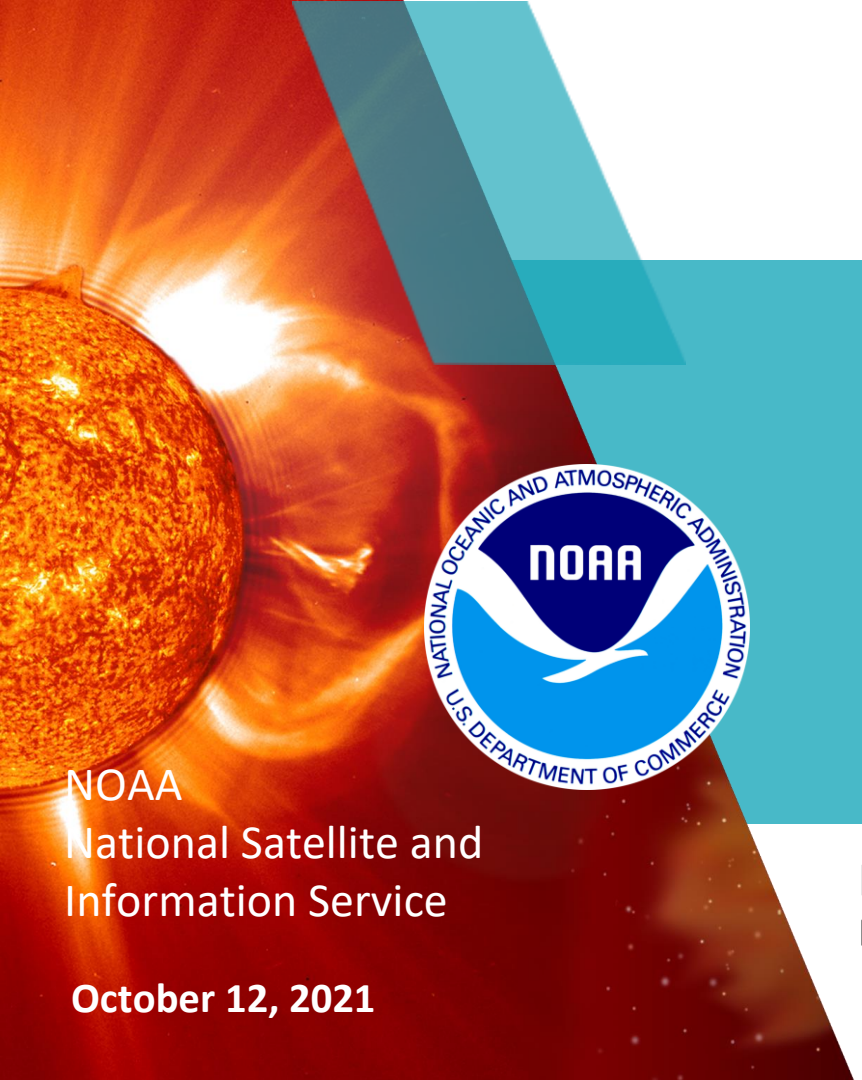

NESDIS Update on Space Weather

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Director, Office of Projects, Planning, and Analysis (OPPA)

NOAA
National Satellite and Information Service

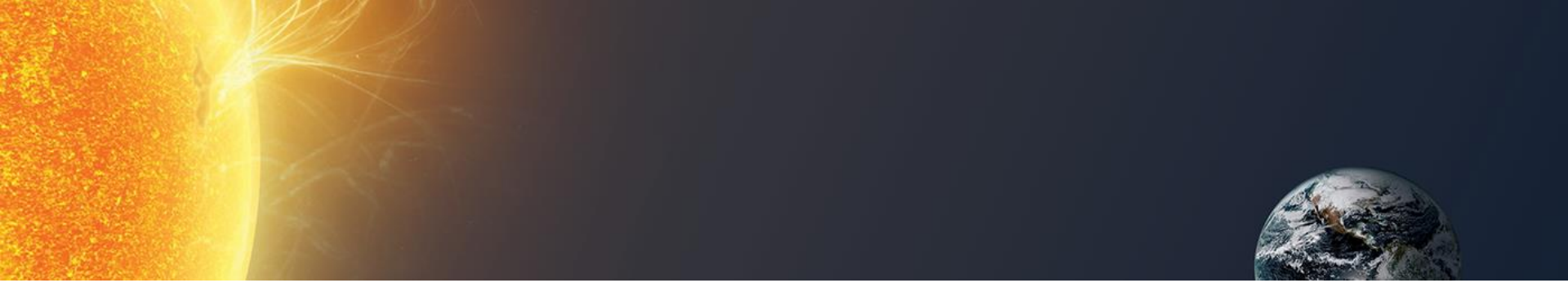
October 12, 2021

Agenda

- Bottom Line Up Front
- Vision and Direction
- Mission Updates
  - COSMIC-2
  - SWFO
  - SWO
- Summary

Bottom Line Up Front

- Space weather is a **new strategic priority** for NESDIS and a growing priority for NOAA.
- The PROSWIFT Act and National Space Weather Strategy are key drivers for NESDIS' space weather work.
- NESDIS plans continuous space weather observations from COSMIC-2, DSCOVR, GOES, POES, SWFO, new SWO Program.
- **NESDIS' Space Weather Observations (SWO) Program** is now in the formulation stage and includes near-term projects for L1, GEO, L5, and LEO observations.



Vision and Direction

- NESDIS Strategic Objective
- Federal Direction

NESDIS' Vision in Space Weather

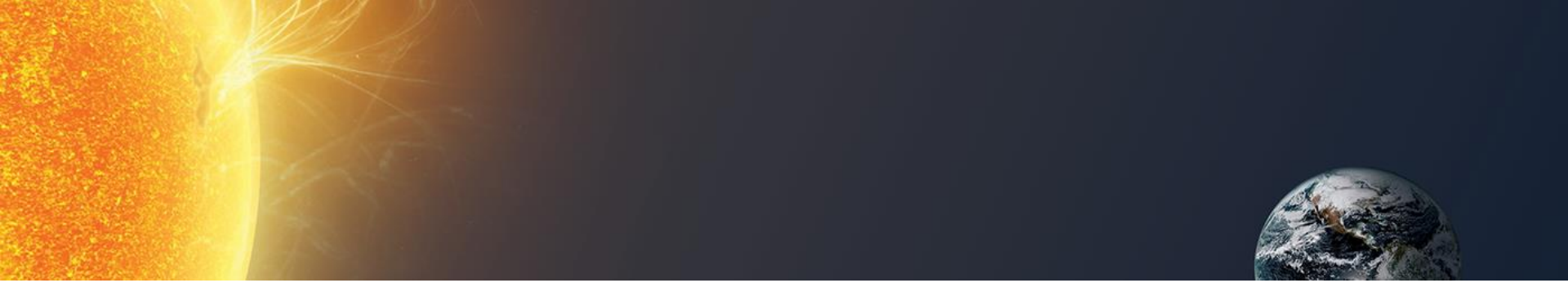
NESDIS Space Weather Strategic Objective:
Advance space weather observational leadership in all applicable orbits to meet mission needs

Space Weather Sub-Objectives:

1. Establish leadership and international collaboration in operational space weather observations
2. Comprehensive understanding and implementation of future space weather observations

Federal Direction

Congressional Direction	• **PROSWIFT Act (2020)** • Weather Research and Forecasting Innovation Act (2017; 2018) • Other (DOC Secretary's Duties)
Administrative Direction	• National Space Policy • **National Space Weather Strategy and Action Plan** • National Plan for Civil Earth Observations
Agency Direction	• DOC Primary Mission Essential Functions • Strategic Plans (DOC, NOAA, NESDIS, NWS)



Updates

- COSMIC-2
- SWFO
- SWO

COSMIC-2 Update

Mission Status:

Spacecraft: 6-Satellite constellation
Launch: June 25, 2019
Mission Life: 5 years
Orbit: 550-km altitude, 24º inclination
Primary Instrument: Tri-GNSS Radio Occultation System (TGRS)
Secondary Instruments: Ion Velocity Meter, RF Beacon

Achieved Mission Full Operational Capability on 9/29/2021

Space Weather Impacts:

TGRS Products

- **Total Electron Content (TEC):** 12000 profiles/day
  - 30-minute median latency
- **Scintillation:** S4 (amplitude) / σ_ϕ (phase)
  - Region Geolocation Maps
  - All-Clear Map
- **Electron Density Profiles**

IVM Products

- **Plasma In-situ:** Density, Composition, Temperature, Drift

Scintillation Geolocation

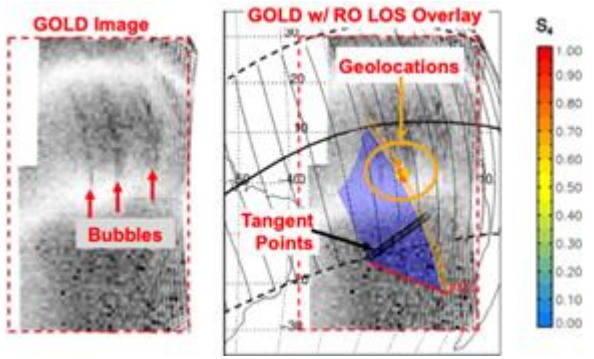
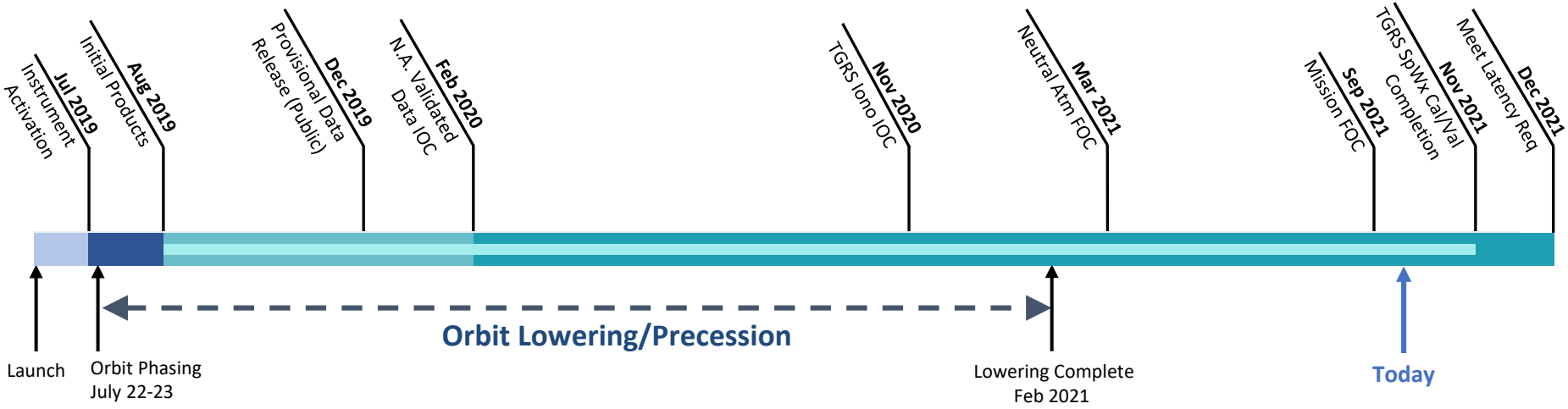


Image Credit: Boston College Institute for Scientific Research

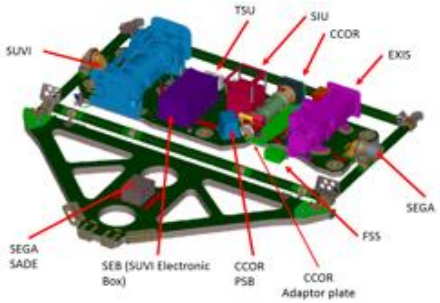
COSMIC-2 Development Schedule



- Launch and early orbit operations
- Checkout and commissioning
- Weather Cal/Val
- Space Weather Cal/Val
- Weather Operations

N.A. = Neutral Atmosphere
Iono = Ionosphere
IOC = Initial Operational Capability
FOC = Full Operational Capability

SWFO Program



CCOR on GOES-U Mission

Establish operational capability and continuity of space weather observational requirements with multiple platforms.

Primary operational objectives:

- Observe CME parameters, shape, density, velocity
- Produce CME characteristics for input into operational heliospheric propagation code
- Enable space weather watches, warnings, forecasting and predictions

SWFO-L1 Mission

Establish operational capability and continuity of space weather observational requirements.

Primary operational objectives:

- Coronal White Light Images for detection Coronal Mass Ejections (CMEs)
- Observe CME parameters, shape, density, velocity
- Produce CME characteristics for input into operational heliospheric propagation code
- In situ solar wind measurements
- Measure solar wind magnetic field, thermal plasma, and energetic particles

Image Credits: NOAA & NASA (left), Ball Aerospace (right)

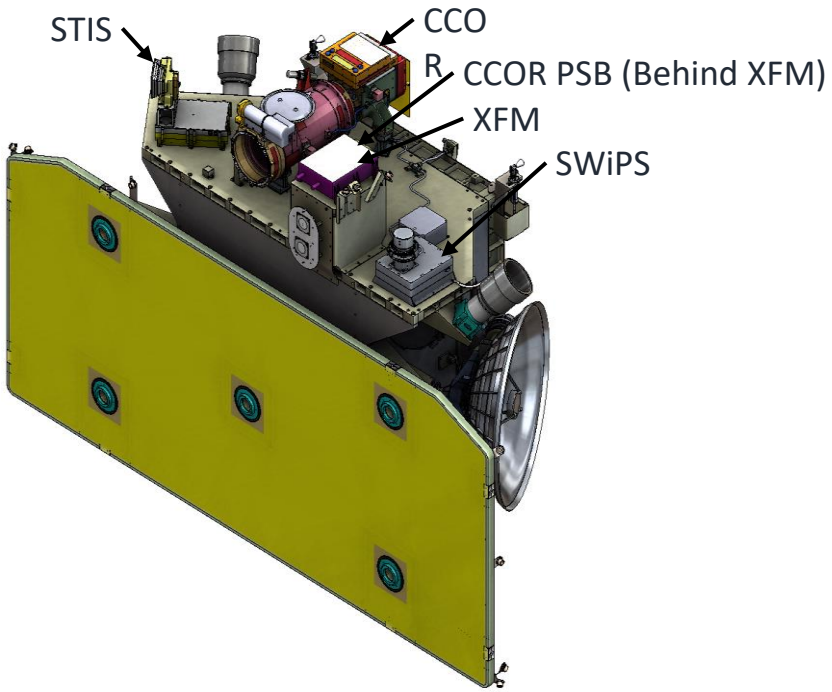
SWFO Program Instruments

Compact Coronagraph (CCOR): Observes the solar corona and will fly on GOES-U (CCOR-1) & SWFO-L1 (CCOR-2).

Solar Wind Plasma Sensor (SWiPS): Measures properties of the solar wind plasma flowing past SWFO-L1, such as density, velocity, and temperature.

Suprathermal Ion Sensor (STIS): Collects fast ions in the solar wind.

Magnetometer (MAG): Measures the magnetic field carried by the solar wind.



Courtesy of Ball Aerospace

*A sixth Instrument, the X-ray Flux Monitor (FXM), is planned to be contributed by the European Space Agency

SWFO SAN Antenna Locations

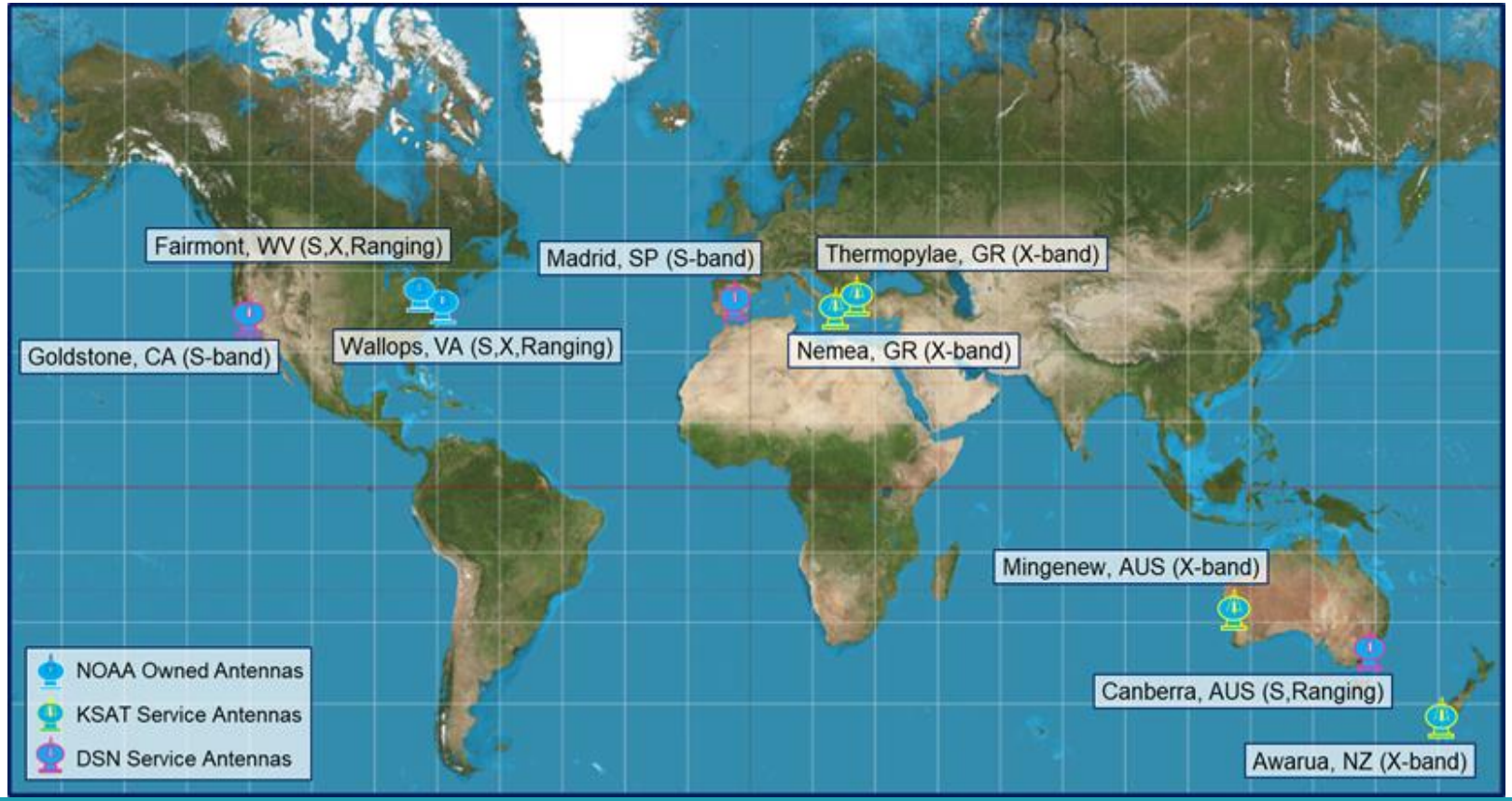


Image Credits: NOAA & NASA (left), Ball Aerospace (right)

NESDIS is Planning for a Space Weather Observations (SWO) Program

Image credit: NOAA

Oversees all of NESDIS' space weather work.

Manages projects to deploy and sustain NESDIS' flight and ground-based equipment for space weather measurements.

Includes a new **joint NOAA-NASA Program Office**.

SWO Program Plans & Partnerships

SWO will implement:

- Continuity of **current L1** & **geostationary** SpWx measurements
- Additional measurements as recommended by NSOSA

SWO will leverage partnerships including:

- NASA, DoD, EUMETSAT partnerships (**LEO**)
- European Space Agency (ESA) agreement (**L5**)
- Canadian Space Agency (CSA) (**HEO**)
- Space Weather (Follow-On) Antenna Network

Image credit: NOAA/NESDIS

Major Formulation Objectives

- Define preliminary program requirements and priorities
- Establish partnerships (interagency, international, commercial)
- Establish program reference architecture using an Analysis of Alternatives (AOA)
- Identify program risks (technical, cost, schedule)
- Develop risk mitigation plans
- Identify sufficient program resources
- Develop the program plan and establish program baseline

Summary

- Space weather is a **new strategic priority** for NESDIS and a growing priority for NOAA.
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- NESDIS plans continuous space weather observations from COSMIC-2, DSCOVR, GOES, POES, SWFO, new SWO Program.
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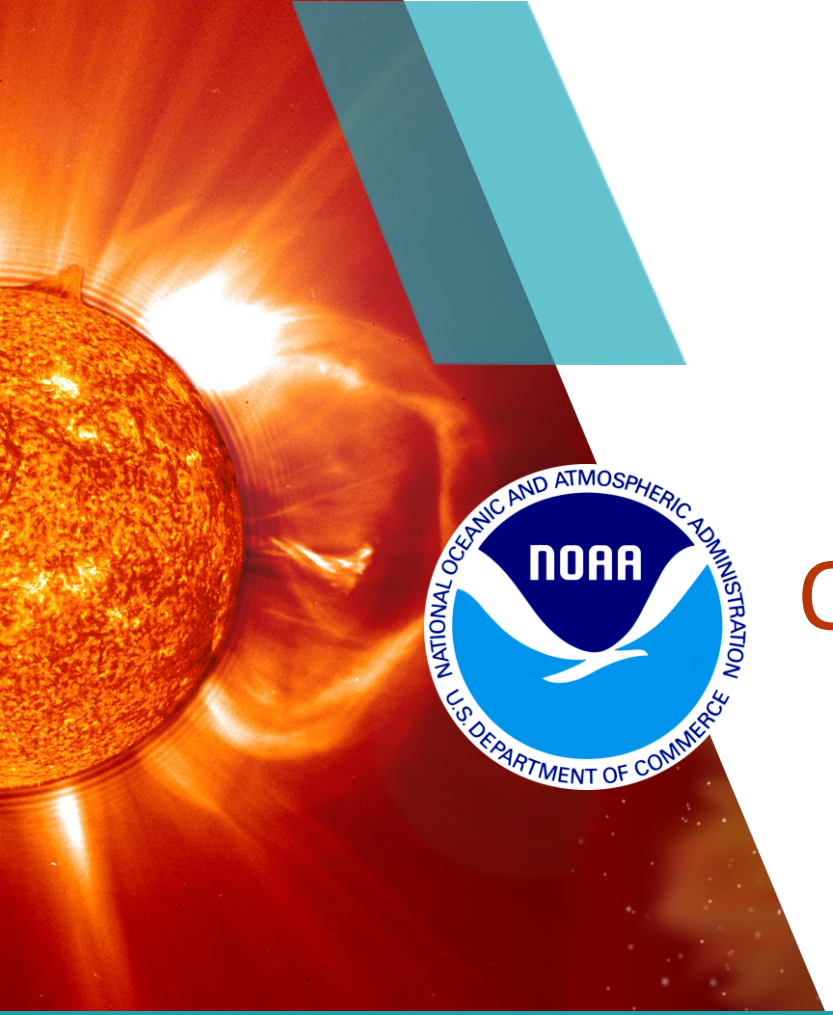

Questions?