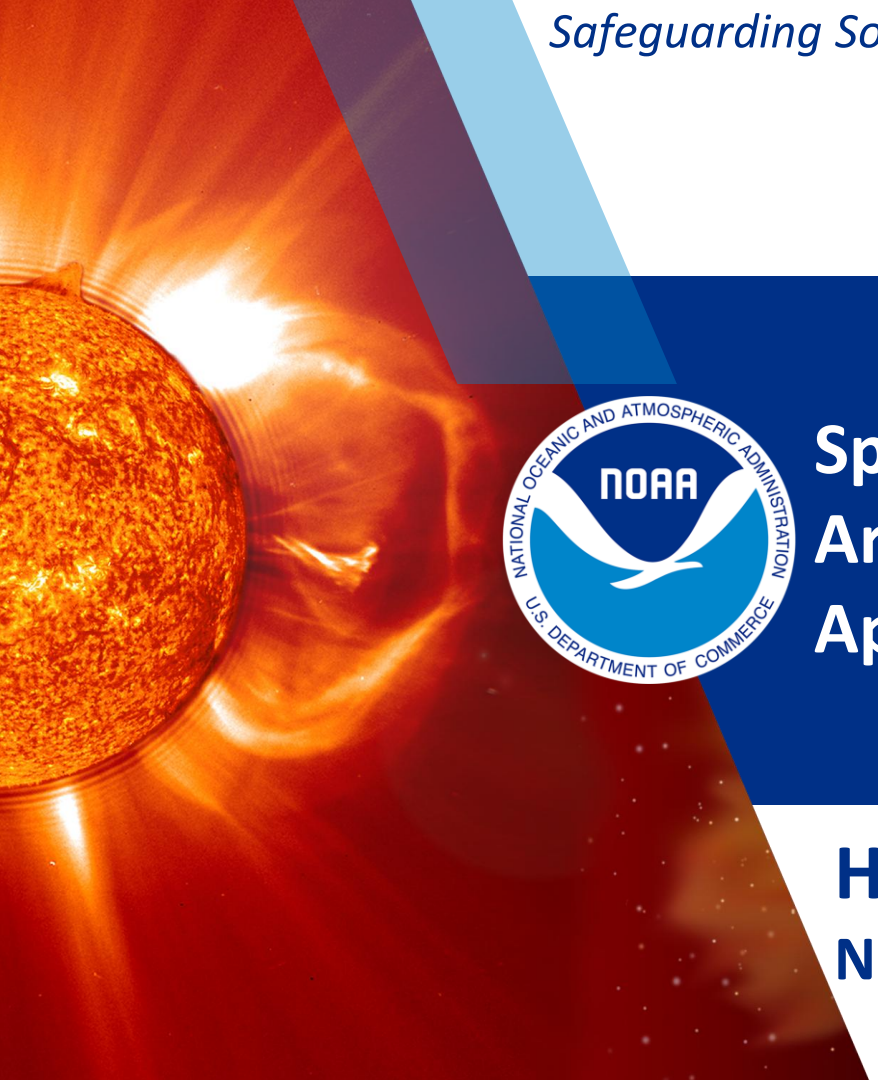
Safeguarding Society with Actionable Space Weather Information



Space Weather Prediction Testbed
Artemis II Exercise
April/May 2025

Hazel Bain

NOAA SWPC

Testbed Exercise Goals

- Enhance preparedness for human space flight endeavors, focusing on Artemis II
- Explore and evaluate new space weather products and applications
- Strengthen collaborations between NOAA SWPC, NASA SRAG, NASA M2M, DoD, academia and industry
- Showcase the ability to perform displaced real-time Testbed exercises to improve the R2O2R process

- 70 participants across NOAA, NASA, U.S. Air Force, commercial space weather companies and academic research institutes.
- In-person, real-time, collaborative environment strengthened relationships and facilitated rapid iteration of products.
- Exercise was repeated in two consecutive weeks to broaden participation reach.

NASA M2M SWAO

CCMC SEP Scoreboard

NOAA SWPC

SWPT Replay System

NASA SRAG

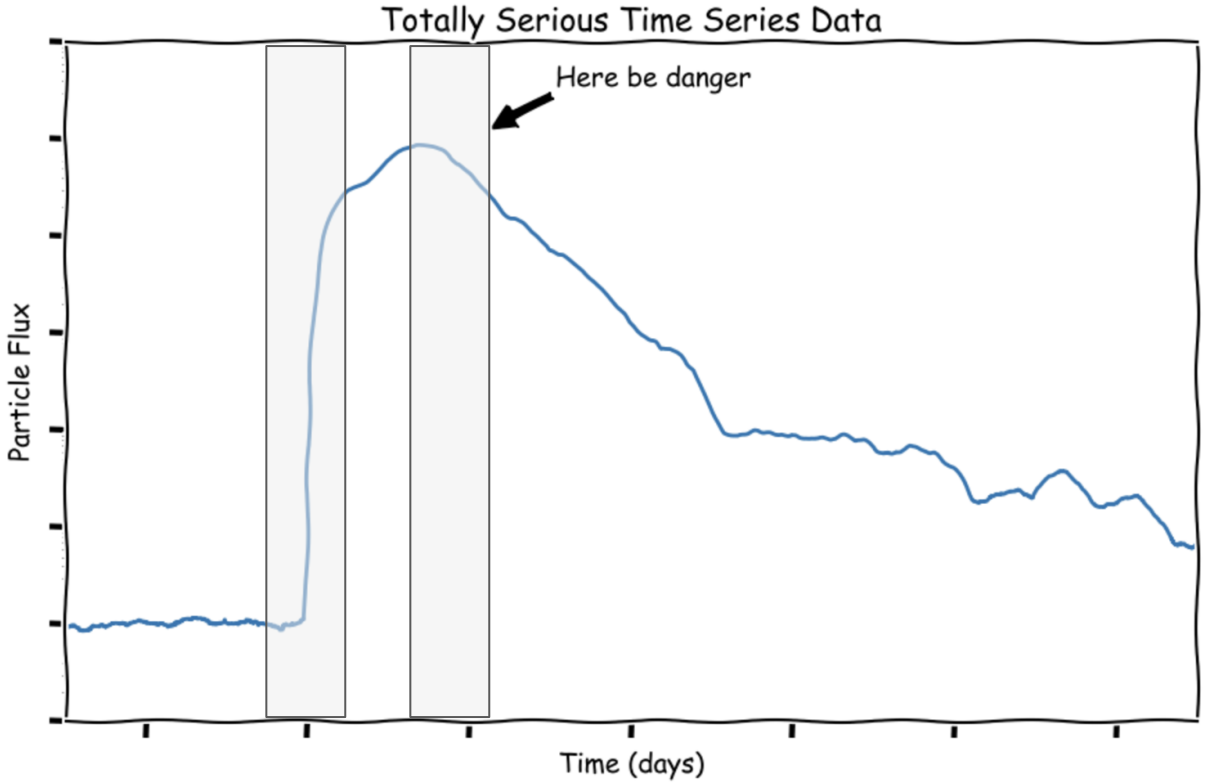
SRAG Dosimeter Sim Tool

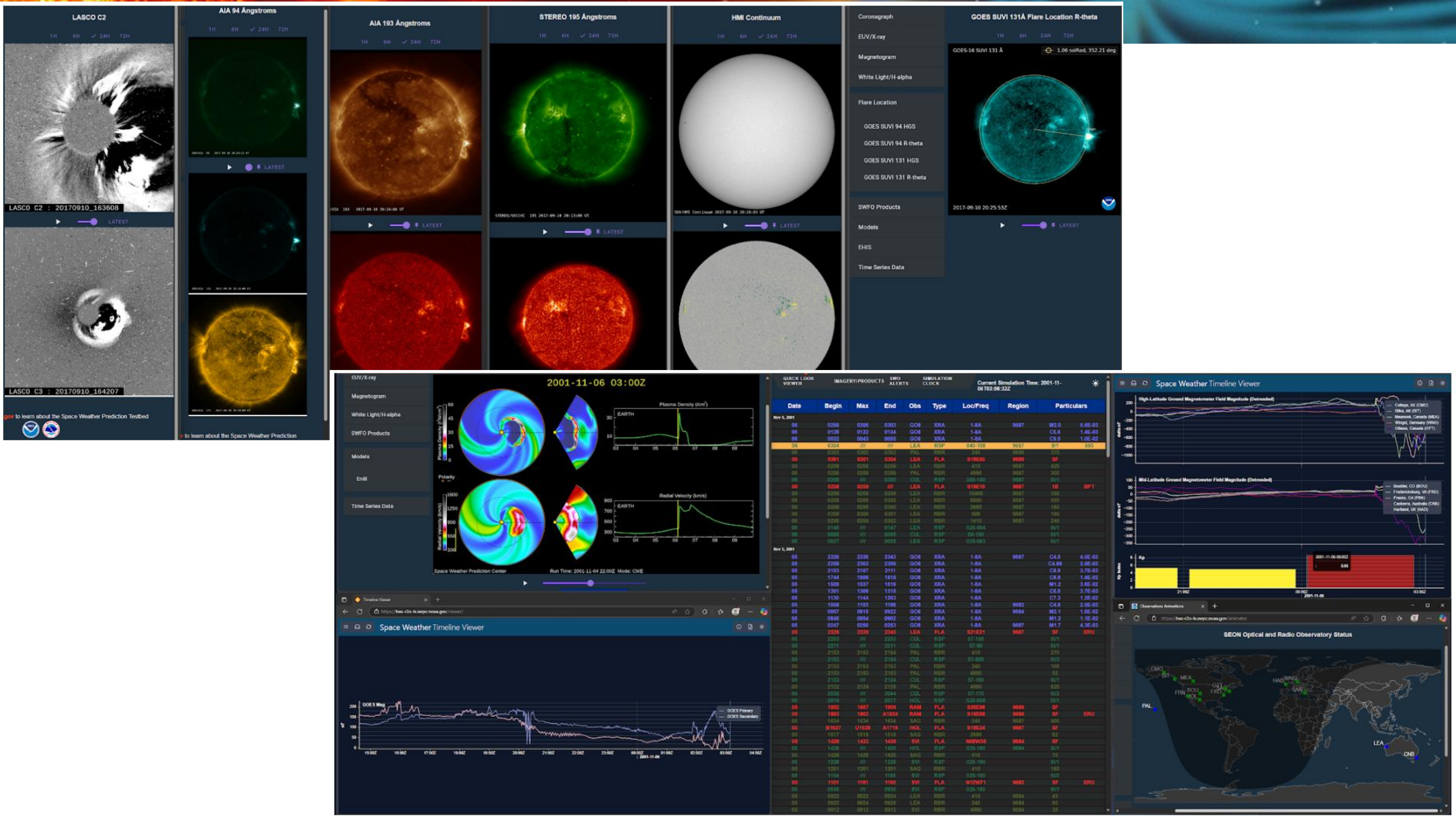
Displace Real-Time Event Replay

Two large historical radiation storms

Focus on periods of interest

Replayed in “real-time”

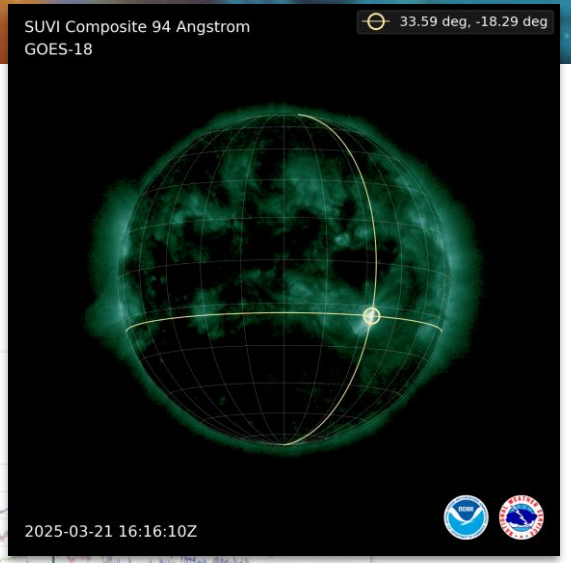


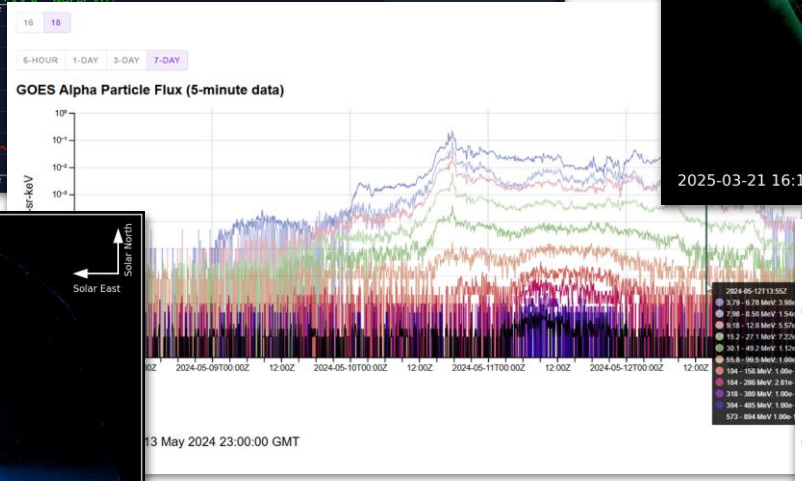


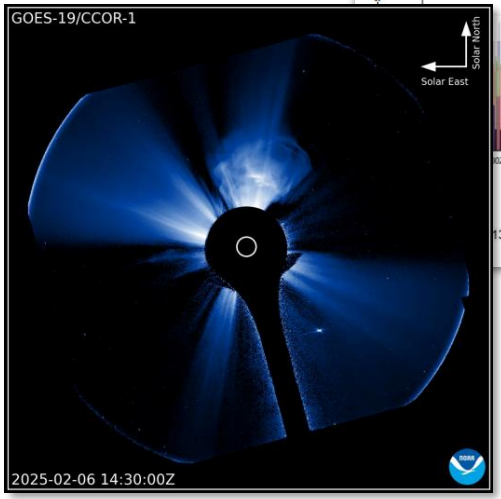
LASCO C2
LASCO C2 : 20170910_163608
LASCO C3 : 20170910_164207
AIA 94 Ångstroms
AIA 193 Ångstroms
STEREO 195 Ångstroms
HMI Continuum
Coronagraph
EUV/X-ray
Magnetogram
White Light/H-alpha
Flare Location
GOES SUVI 94 HGS
GOES SUVI 94 R-theta
GOES SUVI 131 HGS
GOES SUVI 131 R-theta
SWFO Products
Models
EHIS
Time Series Data
GOES SUVI 131Å Flare Location R-theta
GOES-16 SUVI 131 Å
2017-09-10 20:25:53Z
LATEST
to learn about the Space Weather Prediction Testbed
2001-11-06 03:00Z
Plasma Density (/cm³)
Radial Velocity (km/s)
EARTH
Space Weather Prediction Center
Run Time: 2001-11-04 22:00Z Mode: CME
Enlil
Space Weather Timeline Viewer
GOES Mag
Date
Begin
Max
End
Obs
Type
Loc/Freq
Region
Particulars
High-Latitude Ground Magnetometer Field Magnitude (Detrended)
Mid-Latitude Ground Magnetometer Field Magnitude (Detrended)
Kp
SEON Optical and Radio Observatory Status

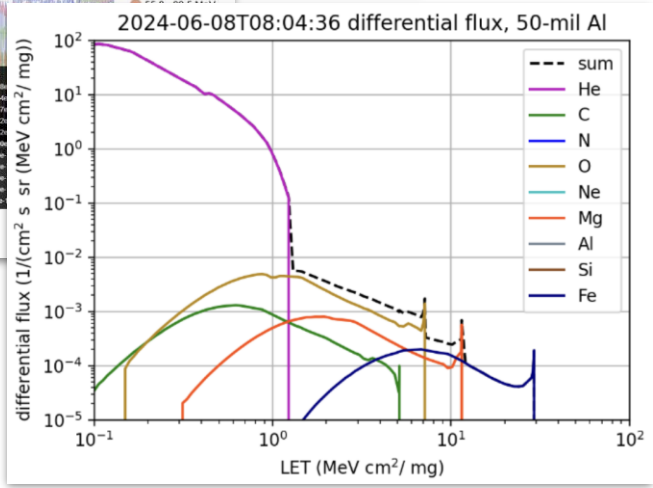

Space Weather Timeline Viewer
EPAM Electron
EPAM Protons
SIS
Space Weather Timeline Viewer
GOES X-Ray Flux
GOES Proton Flux
UMASEP Threshold Crossing
GOES Electron Flux
Latest GOES Fluxes
Latest UMASEP Prediction
Space Weather Timeline Viewer
IMF GSM
Phi GSM
Density
Speed
Temperature
Kp
Latest IMF GSM/RTSW (ACE)


Space Weather Timeline Viewer
GOES X-Ray Flux (1-minute data)
GOES Proton Flux (5-minute data)
GOES Electron Flux (5-minute data)
Latest X-Ray Flux
Latest UMASEP Predictions


SUVI Composite 94 Angstrom
GOES-18
33.59 deg, -18.29 deg
2025-03-21 16:16:10Z


6-HOUR
1-DAY
3-DAY
7-DAY
GOES Alpha Particle Flux (5-minute data)
13 May 2024 23:00:00 GMT


GOES-19/CCOR-1
Solar North
Solar East
2025-02-06 14:30:00Z


2024-06-08T08:04:36 differential flux, 50-mil Al
sum
He
C
N
O
Ne
Mg
Al
Si
Fe
differential flux (1/(cm² s sr (MeV cm²/ mg))
LET (MeV cm²/ mg)

GOES-8 0.1-0.8nm X-rays	GOES-8 >=2 MeV Electrons	GOES-8 >=10 MeV Protons	GOES-8 >=100 MeV Protons
2001-11-06 03:05	2001-11-06 03:05	2001-11-06 03:05	2001-11-06 03:05
8.09e-6	0.13	21900.00	210.00

Actions issued in last 72 hours — Last update: 2001-11-06 03:05Z

Issued Date	Type	Start	End
16:14 2001-11-04	X-Ray Flux exceeded M5	2001-11-04 16:13	
16:19 2001-11-04	Type II Radio Emission	2001-11-04 16:19	
16:21 2001-11-04	Type IV Radio Emission	2001-11-04 16:21	
01:58 2001-11-06	Geomagnetic Sudden Impulse		
16:53 2001-11-04	Proton Event 100MeV Integral Flux exceeded 1pfu	2001-11-04 16:53	
16:53 2001-11-04	WARNING: Proton 100MeV Integral Flux above 1pfu expected	2001-11-04 16:45	2001-11-04 23:59
16:57 2001-11-04	WARNING: Proton 10MeV Integral Flux above 10pfu expected	2001-11-04 16:50	2001-11-05 12:00
17:06 2001-11-04	Proton Event 10meV Integral Flux exceeded 10pfu	2001-11-04 17:06	
17:07 2001-11-04	10cm Radio Burst	2001-11-04 17:07	
17:50 2001-11-04	Proton Event 10meV Integral Flux exceeded 100pfu	2001-11-04 17:50	
18:37 2001-11-04	X-ray Event exceeded X1	2001-11-04 18:37	2001-11-04 16:37
12:00 2001-11-05	WATCH: Geomagnetic Storm Category G3 Predicted	2001-11-06 12:00	2001-11-09 00:00
15:16 2001-11-05	Proton Event 10meV Integral Flux exceeded 1000pfu	2001-11-05 15:16	
16:47 2001-11-05	WARNING: Geomagnetic K-index of 4 expected	2001-11-05 16:46	2001-11-06 18:00
20:50 2001-11-05	Proton Event 10meV Integral Flux exceeded 10000pfu	2001-11-05 20:50	
01:29 2001-11-06	WARNING: Geomagnetic Sudden Impulse expected	2001-11-06 01:26	2001-11-06 02:26
01:31 2001-11-06	WARNING: Geomagnetic K-index of 7 or greater expected	2001-11-06 01:30	2001-11-07 09:00
01:32 2001-11-06	WARNING: Geomagnetic K-index of 6 expected	2001-11-06 01:31	2001-11-06 15:00
01:33 2001-11-06	WARNING: Geomagnetic K-index of 5 expected	2001-11-06 01:32	2001-11-06 23:59
01:33 2001-11-06	WARNING: Geomagnetic K-index of 4 expected	2001-11-06 01:33	2001-11-06 23:59
02:04 2001-11-06	Geomagnetic K-index of 5	2001-11-06 02:04	

Successes

Relationship Building – In-person interaction got researchers, developers and operators onto the same page.

Accelerated R2O2R – Rapid, real time feedback and iteration of new models and applications.

Event Simulation – Demonstrated the ability to simulate events in a displaced real time capacity – vital for the R2O process.

Social Science – Participants were challenged to think beyond the science/forecast.

Future Opportunities

Broaden research participation and better source interested parties.

Build out the rest of the replay capabilities.

Engage other sectors and accelerate the number of testbed activities.

Engage with the SWxR2O program participants.

Questions?