

# GOES-R and GeoXO

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## A note from Pam Sullivan, GEO director:



Happy New Year! It's a very exciting time for the GEO Program! We are gearing up to launch the last of the GOES-R Series

satellites. GOES-U will soon ship to Kennedy Space Center and begin final preparations for its planned launch in April. I commend the GOES-U team for a successful Pre-Shipment Review and all of the work that led to this milestone. GeoXO also had a successful quarter. The final development RFP, for the ACX instrument, was released in October. Evaluation boards are busy reviewing proposals for the spacecraft and the OCX, LMX, and ACX instruments. GOES-16 and GOES-18 continue to provide critical data to keep us informed of and safe from severe weather and environmental hazards. I look forward to more GEO successes in 2024!

## GOES-R HIGHLIGHTS

**The GOES-U Pre-Shipment Review was held Oct. 31 – Nov. 1, 2023.** An independent team of aerospace engineers verified the satellite was built according to specifications and met all government requirements. The review team identified several strengths and no issues or concerns. The spacecraft is proceeding toward shipping to the launch site at NASA's Kennedy Space Center (KSC) in late January 2024.



GOES-U road to launch timeline.

**The second and third GOES-U mission rehearsals were conducted this quarter.** Mission rehearsals use a satellite simulator and the ground system to train operations personnel and test the readiness of operational products and the ground system. They simulate both normal operations and what to do if a procedure doesn't go as planned. Mission rehearsal #2, completed Oct. 23-27, 2023, focused on instrument activation and early calibration activities, while mission rehearsal #3, conducted Dec. 11-15, 2023, covered orbit raising and deployments of the antenna wing assembly and magnetometer boom.

**The Pre-Shipment Review for the Compact Coronagraph-2 (CCOR-2) instrument that will fly on NOAA's Space Weather Follow On (SWFO)-L1 mission was completed on Oct. 19, 2023.** The instrument arrived at Ball Aerospace in mid-November and was mated to the spacecraft in early December.

## DID YOU KNOW:

Atmospheric rivers are the largest transport mechanisms for freshwater on Earth.

## GOES-R HIGHLIGHTS (CONTINUED)

### Several GOES-18 data products are now fully mature, following Peer Stakeholder-Product Validation Reviews.

These include Geostationary Lightning Mapper (GLM), Space Environment In-Situ Suite (SEISS) Magnetic Particle Sensor (MPS) – Hi and MPS–Lo, Extreme Ultraviolet and X-ray Irradiance Sensors (EXIS) Extreme Ultraviolet Sensor (EUVS), and Solar Ultraviolet Imager (SUVI) data. Fully validated data products are fully mature for use in operations.

The [2023 NESDIS Accomplishments Report](#) highlighted several Office of Geostationary Earth Orbit Observations milestones, including GOES-18 transitioning into operational service as GOES West, GOES-U completing environmental testing and preparing for an April 2024 launch, the formal approval of the GeoXO mission, and GeoXO entering the development phase with the award of contracts to build the imager and sounder instruments. GOES-R data applications were also highlighted, including advancements in fire weather detection and monitoring through the NESDIS Wildland Fire Program and Wildland Fire Information System, and LightningCast, a machine

learning model to predict lightning up to 60 minutes in advance.

The GEO ground system team held an appreciation event at L3Harris in Melbourne, Florida, on Nov. 29, 2023, to celebrate the upcoming end of the 14-year development contract for the GOES-R ground system. As part of the event, the team demonstrated level 2+ product generation in the cloud to showcase cloud development efforts.



The GOES-R Program and L3Harris celebrated the GOES-R ground system development contract close-out.

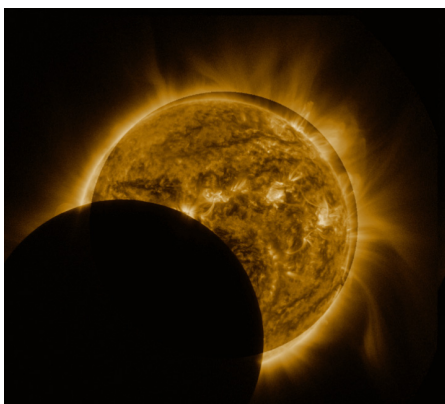
## GeoXO HIGHLIGHTS

The Integrated Baseline Review (IBR) for the GeoXO Imager (GX1) was held Oct. 24-26, 2023. The IBR evaluated L3Harris' project baseline, including scope of work, schedule and resources, to ensure it is realistic for accomplishing all the authorized work within the authorized schedule and budget.

On Oct. 25, 2023, NASA posted the request for proposals for the GeoXO Atmospheric Composition (ACX) instrument implementation contract. [Industry was](#)

[invited to submit a proposal for developing the GeoXO ACX instrument.](#) The contract scope includes the tasks necessary to design, analyze, develop, fabricate, integrate, test, evaluate and support the launch of the GeoXO spacecraft; provide engineering development units; supply and maintain the ground support equipment and simulators; and support mission operations at the NOAA Satellite Operations Facility. Proposals were received and are under review.

## SCIENCE



GOES-16 SUVI imagery of the annular solar eclipse on Oct. 14, 2023, as the moon partially passes across the sun's disk. Image credit: NOAA/CIMSS

On Oct. 14, 2023, an annular solar eclipse crossed North, Central and South America. An annular solar eclipse occurs when the moon passes directly between the sun and Earth but, due to its distance from the Earth as they pass each other, does not completely cover the sun's disk. As a result, the moon does not completely block out the sun and causes a ring of fire to appear. The GOES-16 (GOES East) SUVI captured a partial eclipse, and [the GOES-16 and GOES-18 \(GOES West\) ABIs viewed the moon's shadow as it moved across the Earth in near real-time.](#)

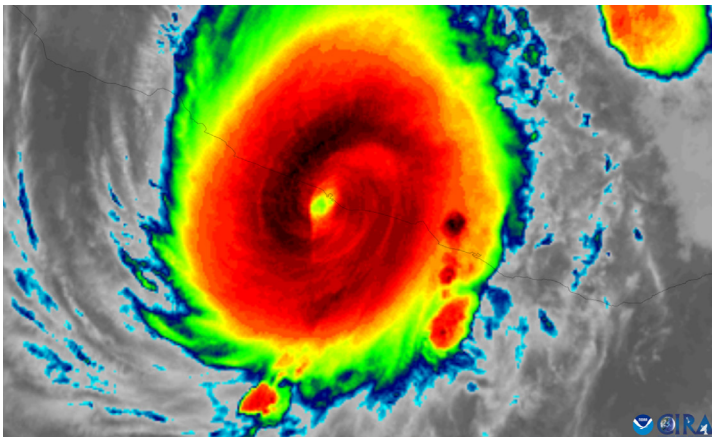
A new data product is helping NOAA provide better air quality forecasts. [The Regional Hourly Advanced Baseline Imager \(ABI\) and Visible Infrared Imaging Radiometer Suite \(VIIRS\) Emissions \(RAVE\) product](#) uses observations from NOAA's geostationary and polar-orbiting environmental satellites to estimate wildfire emissions based on heat signatures. Unlike previous methods that used only the VIIRS



## SCIENCE (CONTINUED)

instrument on NOAA's Joint Polar Satellite System and the MODIS instrument on NASA's Aqua and Terra satellites, RAVE incorporates data from the ABI instrument onboard NOAA's GOES East and GOES West satellites, which provides more frequent updates for predicting how a wildfire is impacting air quality. RAVE is now an integral part of the NOAA Office of Oceanic and Atmospheric Research's High-Resolution Rapid Refresh (HRRR) smoke model and helps the HRRR derive smoke emissions and perform smoke plume rise calculations. In January 2024, RAVE will also be incorporated into NOAA's Community Multiscale Forecasting Air Quality (CMAQ) model, which supports the National Air Quality Forecasting Capability by providing multi-day ozone and fine particulate pollution forecast guidance.

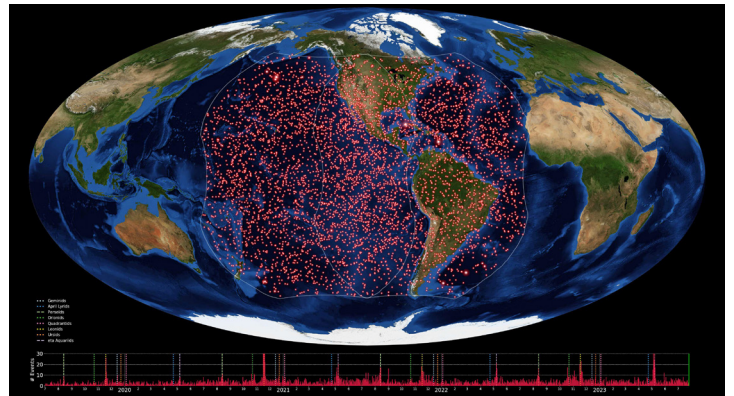
**GOES-16 and GOES-18 monitored Hurricane Otis as it rapidly intensified from a tropical storm into a Category 5 hurricane and made landfall near Acapulco on Mexico's southern Pacific coast on Oct. 25, 2023.** Otis was the strongest hurricane in the Eastern Pacific to make landfall in the satellite era. [The hurricane brought storm surge, flooding, mudslides, and strong winds to the coast and caused widespread damage and fatalities in the region.](#) The GLM measured lightning within the eyewall while it was rapidly intensifying. Infrared imagery showed the structure of the storm as it developed and intensified before making landfall.



GOES-18 infrared imagery of Hurricane Otis making landfall near Acapulco, Mexico, on Oct. 25.

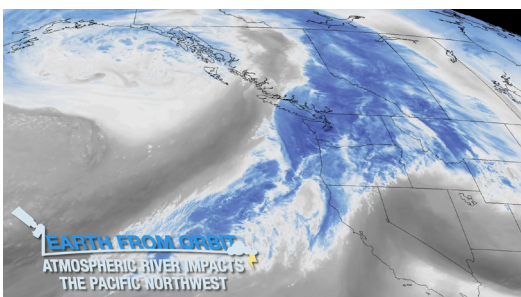
**The ProbSevere LightningCast model data is now available at the National Weather Service (NWS) Storm Prediction Center (SPC),** allowing forecasters to demonstrate how probabilistic lightning guidance can improve short-term thunderstorm forecasts. [LightningCast was developed at the University of Wisconsin and is transitioning to operations at NESDIS.](#) The machine learning-based model uses only GOES-16 and GOES-18 ABI data to provide the probability that lightning will occur at some point within the next 60 minutes. It was trained using GLM data as the truth.

**The SETI Institute, in partnership with NASA, Sandia National Labs, and the University of California, is using GLM data to unlock insights into asteroid impact risks.** [Scientists have developed a machine-learning algorithm to analyze the GLM lightning data.](#) The GLM detects millions of lightning strikes per day using a near-infrared optical sensor to see momentary changes in light. However, a handful of these events aren't lightning but bolides—large exploding meteors in Earth's atmosphere. Scientists are using the GLM data to create a dataset of bolide light curves to inform the planetary defense community of the risks associated with meteoroids and significant asteroid impacts.



All bolide events detected by the GOES East and GOES West GLM instruments over the four years from 2020 to 2023. Image credit: NASA

## EDUCATION AND OUTREACH



Earth from Orbit: Atmospheric river impacts the Pacific Northwest

**The GEO Program, in partnership with JPSS, NOAA Satellite and Information Service (NESDIS), NASA Goddard Space Flight Center, and the Cooperative Institute for Research in the Atmosphere (CIRA) produced six “Earth from Orbit” videos during the fourth quarter of 2023.** [Earth from Orbit](#) is a series of short videos that showcases a compelling weather event, environmental hazard, or interesting meteorological phenomenon, as seen by NOAA satellites. A web article with additional information accompanies each video.



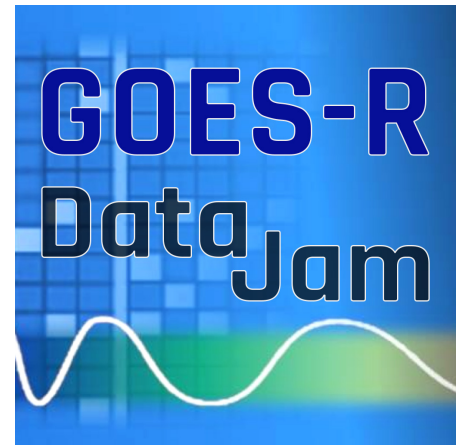
## EDUCATION AND OUTREACH (CONTINUED)

The GEO Program partnered with NASA Space Place and NOAA SciJinks to conduct an art challenge for the Oct. 14, 2023 annular eclipse. The art challenge invited children to imagine they were scientists in charge of creating a space weather report for people viewing the upcoming solar eclipse. [Selections from the art challenge were published on Nov. 2.](#)



Art challenge submission from Alder, age 9.

The winning projects from the [GOES-R DataJam](#), a two-week virtual competition for undergraduate and graduate students to showcase their best use of GOES-R Series data, were announced on Nov. 8, 2023. Teams selected one of two proposed challenges and scoped out their projects in early October. Over the course of two weeks the teams designed their solutions, and then presented their project to a panel of judges on Oct. 27, 2023. The winning project for “Visualize the View” communicated GOES-R ABI smoke/ fire detection to a general audience. The winning project for “Clouds Computing Clouds” leveraged GOES-R observations for near real-time monitoring of weather hazards over the continental United States.



## CONFERENCES AND EVENTS

The GLM science meeting was held virtually on Nov. 13-15, 2023. Presentations included program updates from GOES-R and GeoXO, preparations for GOES-U GLM data, and a wide variety of science applications using GLM data. One noteworthy presentation from Amanda Back, NOAA OAR, highlighted that GLM data is planned to be assimilated into the operational Rapid Refresh Forecast System (RRFS), the follow-on to the High-Resolution Rapid Refresh (HRRR) model, scheduled to go live via the NWS in 2025. Lightning activity from GLM informs the model where active convection is occurring and allows it to improve its initial state to better capture the timing and placement of ongoing storms.

The American Geophysical Union (AGU) Fall Meeting was held Dec. 11-15, 2023, in San Francisco. The GeoXO science team convened a session titled “Weather, Water, and Climate Applications from Geostationary Satellites of the Present and Future,” which included both oral presentations and posters. GeoXO was also a primary theme in several other sessions and talks, including one focusing on air quality. In addition to the main science agenda, team members gave multiple presentations at the NOAA booth in the exhibition hall.



GOES-R program scientist Dan Lindsey at the NOAA exhibit at the 2023 AGU Fall Meeting. Photo credit: NOAA



## AWARDS

**Tiffany Ferrell received a NASA Office of Procurement Enterprise Award for Contract Specialist of the Year.** Tiffany was honored for her work on the GeoXO Imager procurement.

**Kevin McMahon received a NOAA Silver Sherman Award in December 2023 for outstanding service to the GEO ground project and GOES-R and GeoXO programs.** The Silver Sherman Award recognizes NOAA employees who perform work above their normal requirements to help fulfill NOAA's mission, achieve a milestone that contributes significantly or critically toward a particular program goal or demonstrate leadership toward process improvement of a significant magnitude.



Kevin McMahon accepts his NOAA Silver Sherman Award from GEO program director Pam Sullivan. Photo credit: NOAA

## MEET THE TEAM



**In this issue, meet Brian Hall, deputy director of the Office of Geostationary Earth Orbit Observations.**

In this role, Brian supports the program director with leadership oversight for the ground and flight projects. He joined the team in September 2023 from the NASA Wallops Flight Facility.

“One of the reasons I was so excited to join the GEO program was the tremendous importance of the data the program provides. Our data products impact the daily lives of the public, ranging from use in weather forecasting to predicting and responding to weather-related natural disasters,” Brian said.

Brian has been with NASA for more than 27 years – eight years as a contractor and 19 as a civil servant. He has a civil engineering degree from North Carolina State University and began his career as a civil engineer. He started as a support contractor at NASA Wallops Flight Facility and soon transferred to the mechanical systems division supporting the NASA Sounding Rockets Program. Brian has served in various engineering, project management, program management, and organizational management roles along the way.

Throughout his career, Brian has had numerous opportunities to support outreach, ranging from engaging students at all academic levels to public information sessions to collaboration with commercial and government partners. “I truly enjoy speaking about the great work that we do and how it benefits the public. I also enjoy engaging with partners to collaborate on lessons learned or new concepts to help solve challenging problems or develop plans to improve and enhance the work that we do,” he said.

Outside of work, Brian's pride and joy are his two children. He has a son in elementary school and a daughter in college. When he's not spending time with his children, Brian enjoys being outdoors — bicycling, riding his motorcycle, and boating.

## UPCOMING EVENTS

**GOES-U ship to KSC**

Jan. 22, 2024

**GOES-U Operational Readiness Review**

Jan. 23-24, 2024

**American Meteorological Society Annual Meeting**

Jan. 28 – Feb. 1, 2024

**GOES-U mission rehearsal #4**

Feb. 26 – Mar. 1, 2024

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