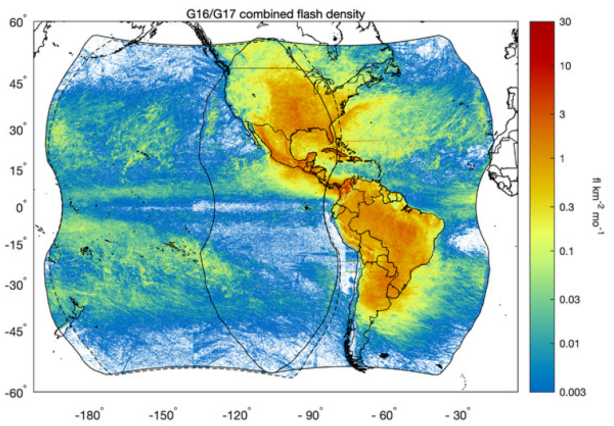
Benefits of Space-Based Lightning Mapping for America

Lightning is one of the oldest observed natural phenomena on Earth, from thunderstorms and hurricanes to heavy snowstorms and intense wildfires. Rapid increases in total lightning activity often precede severe and tornadic thunderstorms, and lightning-initiated wildfires account for more than half of the acreage burned in the continental United States.

The Geostationary Lightning Mapper (GLM) is a first-of-its-kind instrument. It was developed by Lockheed Martin, and operates on NOAA's Geostationary Operational Environmental Satellites—R Series (GOES-R), providing continuous data and imagery of Earth's weather. As the GOES-R Series reaches its end of life in the early 2030s, the Geostationary Extended Observations (GeoXO) constellation will take its place, featuring the next-generation lightning mapper (LMX). LMX will ensure continuity of GLM's critical observations while advancing lightning detection capabilities, ultimately protecting lives and property nationwide.



Combined GOES East and GOES West GLM flash density: Credit NOAA

Lightning mapping from geostationary orbit improves severe storm analyses and precipitation estimates, and increases warning lead times for hazardous weather events. Every U.S. state has had at least one "billion-dollar" weather-related disaster which often result in fatalities in addition to significant economic impacts. From 2021 to 2023 alone, the United States experienced 66 billion-dollar weather disasters, resulting in over $440 billion in economic impacts and nearly 1,700 deaths.

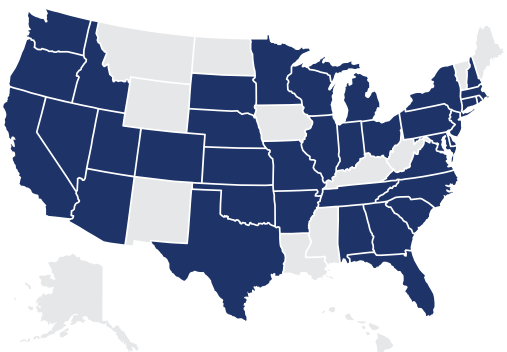
GLM detects lightning with high accuracy across the Western Hemisphere, filling the gaps where other sources are not (i.e., inadequate radar coverage, in rural areas, and over oceans), improving severe weather warning times by up to 30 minutes over ground-based solutions. Persistent lightning observations, updated to forecasters every minute, are a key operational advantage of geostationary orbit and capture the hours-long lifecycle of convective storm systems continuously, unlike sporadic observations from low and medium Earth orbits. This capability, perched from a "stationary" vantage point, offers significant societal benefits, including enhanced public safety, improved disaster response, and safer travel, as well as aiding in wildfire detection, agricultural management, and infrastructure protection.

U.S. Lightning-Impacts	Annual Average
Strikes	40M+
Deaths	20-15
Injuries	100+
Insurance Claims	$1.9B
"Natural" Wildfires	7,000+
– Suppression Costs	$1.25B+
– Acres	3.5M+

GLM plays a crucial role in wildfire detection and prevention by monitoring vast areas from space and identifying sustained lightning flashes that can ignite fires, especially in remote areas. This enables emergency personnel to detect and respond to fires quickly, reducing forest and property loss, firefighting costs, and improving air quality.

The success of GLM has established persistent space-based lightning observations as an essential component of forecast and hazard models. With GOES-R and GLM half-way through their operational lifespans, the development of LMX is necessary to ensure continued availability and advancement of these critical observations.

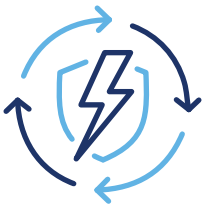
GLM is testament to American innovation and ingenuity, with suppliers from across 37 states contributing to its development. LMX is expected to build upon that success with a broader supply chain, enhanced sensitivity and performance, and significant return on investment.



Geostationary Lightning Mapper Supply Chain, states having 1 or more suppliers.

Societal benefits of lightning mapping from space include:

Improved Weather Forecasting:
Helps predict severe weather events, such as thunderstorms, heavy rainfall, and tornadoes, enabling more accurate and timely warnings that allow for additional time to take precautionary actions.



Enhanced Public Safety:
Provides timely and accurate lightning information to avoid lightning strikes, particularly benefiting outdoor activities, crowds, travel, and events.

Heightened Disaster Response and Recovery:
Aids in disaster response and recovery efforts by providing critical information on lightning activity to prioritize areas of need and allocate resources effectively.

Protection of Infrastructure and Property: Helps identify areas at high risk of lightning strikes and subsequent hazards (e.g., wildfires) to take proactive measures to prepare infrastructure and property.

Agricultural and Water Resource Management:
Provides valuable insights into lightning patterns to optimize crop yields, manage water resources, and reduce agricultural losses.

Aviation and Maritime Safety and Efficiency:
Improves safety for and efficiency of aircraft and ships by providing real-time information on lightning activity along flight routes and shipping lanes.

Fire Prevention and Suppression:
Helps identify areas at high risk of wildfires, enabling Federal, state, and local decision makers to take proactive measures to prevent/suppress fires.

Scientific Research and Environmental Studies: Provides a wealth of data for scientific research to study lightning patterns, understand the underlying physics of lightning, and investigate the relationship between lightning and our changing planet.

Economic Benefits:
Space-based lightning mappers reduce the impact of lightning-related disasters and minimize losses to infrastructure and property. They also enhance weather forecasting and disaster response efficiency. This data can further fuel public-private partnerships, enabling AI-driven innovations and commercial products, such as efforts to isolate and identify lightning strikes that are most apt to spark wildfires, among others.