



Integrated Capabilities for Global Hazard & Risk Assessment

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June 14, 2023

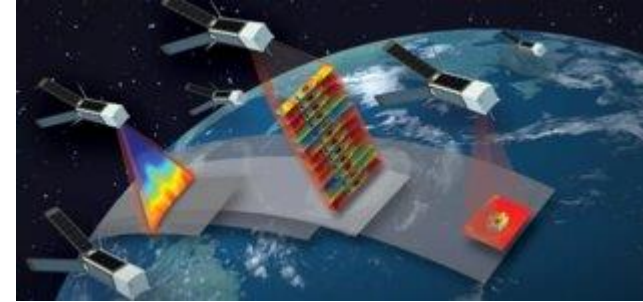


disasters.nasa.gov

NASA'S EARTH APPLIED SCIENCES DISASTERS PROGRAM AREA

Advancing Science to Build Disaster Resilience

- We advance the field of disaster science and build tools to help communities make smarter decisions for disaster planning.
- We work directly with local governments and response teams to support disaster response efforts with Earth observing data and expertise.
- We foster partnerships around the world to build capacity and strengthen global disaster management efforts.



Core Elements



Disaster
Applications



Disaster Response
Coordination System



Disasters
Open Access Portal



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DISASTER APPLICATIONS

- Using Earth observations to **support decisions** throughout the disaster cycle, including risk reduction, preparedness, mitigation, early warning, response, recovery, and resilience.
- Developing **tools and technologies** to enable easier use and broader uptake.
- Improving communities' decision-making by **advancing disaster science and technology**, leveraging Earth observations with data on vulnerability, exposure, and coping capacity.



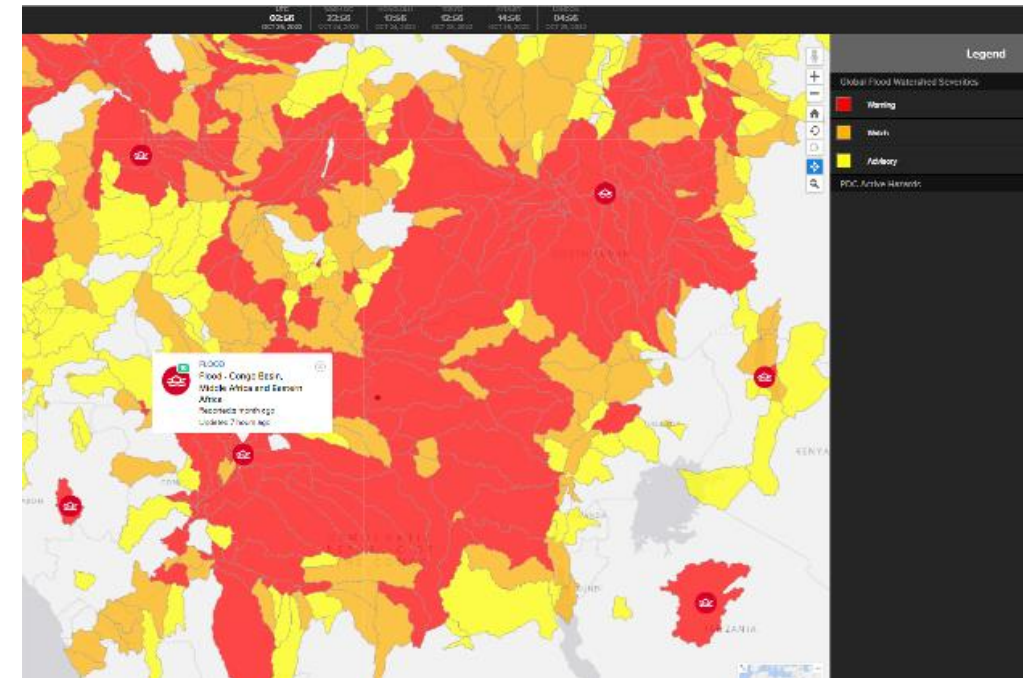
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APPLICATIONS – GLOBAL FLOOD EARLY WARNINGS

“Advancing Access to Global Flood Modeling and Alerting using the PDC DisasterAWARE Platform and Remote Sensing Technologies”

PI: Margaret Glasscoe (University of Alabama in Huntsville)

- Much of the world lacks sufficient flood early warning systems – expanding access will enable early action to save lives and livelihoods.
- **“Model of Models”** (MoM) algorithm combines hydrological models with satellite data to generate **global flood risk severity updates** several times a day.
- Partnered with **the Pacific Disaster Center (PDC)** to deploy MoM in free **DisasterAWARE** platform and generate flood warnings for affected communities.

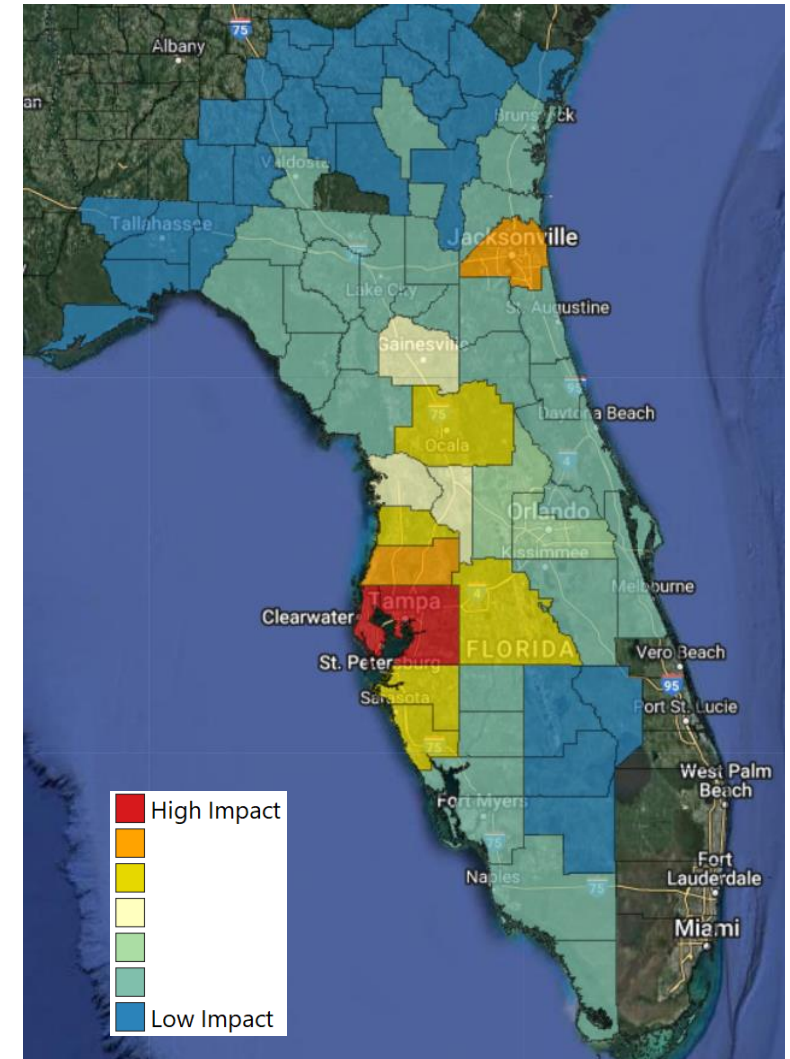


APPLICATIONS – QUANTIFYING ECONOMIC IMPACTS

“Open Critical Infrastructure Exposure for Disaster Forecasting, Mitigation, and Response”

PI: Charles Huyck (ImageCat inc.)

- Quantifying the economic impacts of disasters aids planning by governments, NGOs, and private companies.
- **GEDI – the Global Economic Disruption Index** - assesses economic impacts and helps identify cascading disasters.
- Combines Earth observations, remote sensing, traditional loss estimation, and economic modeling for long-term visualization and **understanding of potential economic disruption**.
- Adapted for use in areas such as Regional Resilience Assessment, parametric-triggered insurance products, and corporate Environmental, Social, and Governance (ESG) reporting.

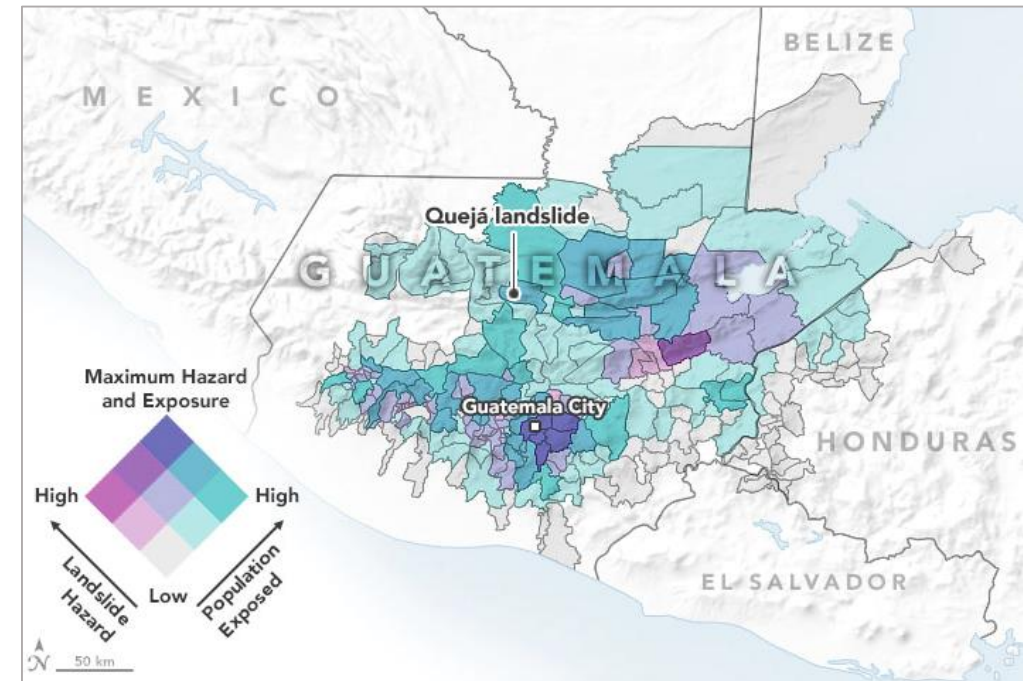


APPLICATIONS – LANDSLIDE RISK AND EXPOSURE MODELING

“Enabling Landslide Disaster Risk Reduction and Response Throughout the Disaster Life Cycle with a Multi-scale Toolbox”

PI: Dalia Kirschbaum (NASA Goddard Space Flight Center)

- Landslides are one of the deadliest hazards but are localized and hard to track – this is the first global model for **rainfall-triggered landslides** and provides early warnings to communities.
- **LHASA - Landslide Hazard Assessment for Situational Awareness** - model combines satellite precipitation data with topography, machine learning, and exposure data to generate global **landslide hazard nowcasts**.
- Partnered with the **Pacific Disaster Center** (PDC) to deploy LHASA in the free **DisasterAWARE** platform and generate landslide hazard warnings for communities across the globe.

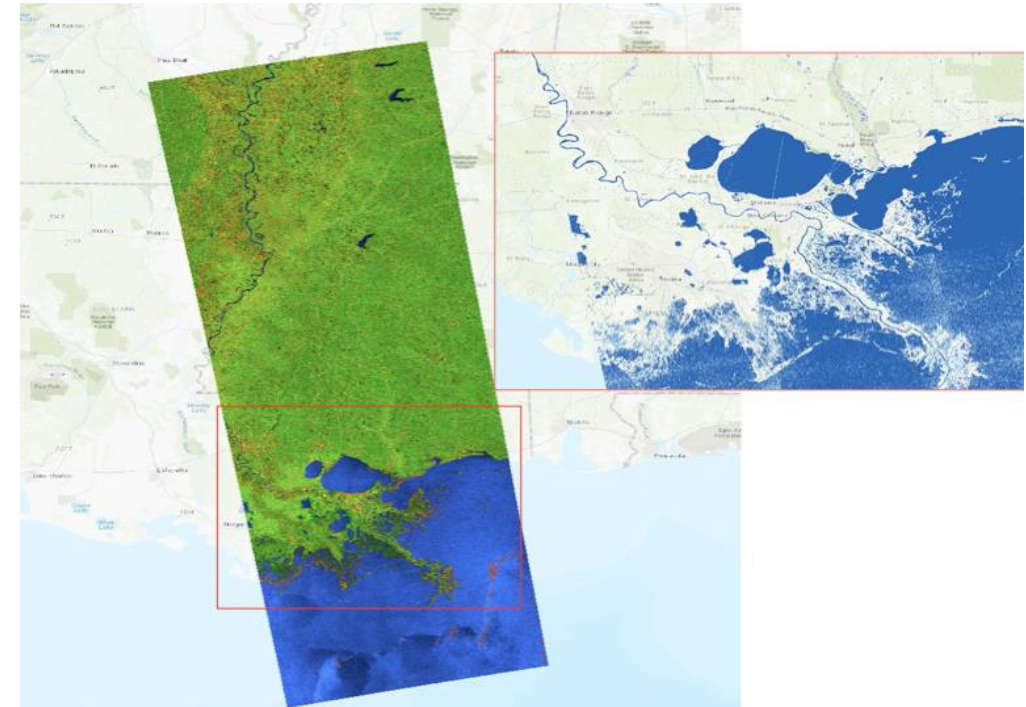


APPLICATIONS – MAPPING FLOODS WITH SYNTHETIC APERTURE RADAR

“Integrating SAR Data for Improved Resilience and Response to Weather-Related Disasters”

PI: Franz Meyer (University of Alaska Fairbanks)

- Automated data pipeline speeds flood map generation and informs stakeholders including FEMA and the USDA Foreign Agriculture Service.
- Synthetic Aperture Radar (SAR) can **view through the clouds**, allowing for flood observations during stormy weather.
- Developing a **SAR-processing toolbox** to isolate flood waters from other surface types, enhancing usability for disaster response teams.



APPLICATIONS – ASSESSING HAILSTORM RISK WITH REMOTE SENSING

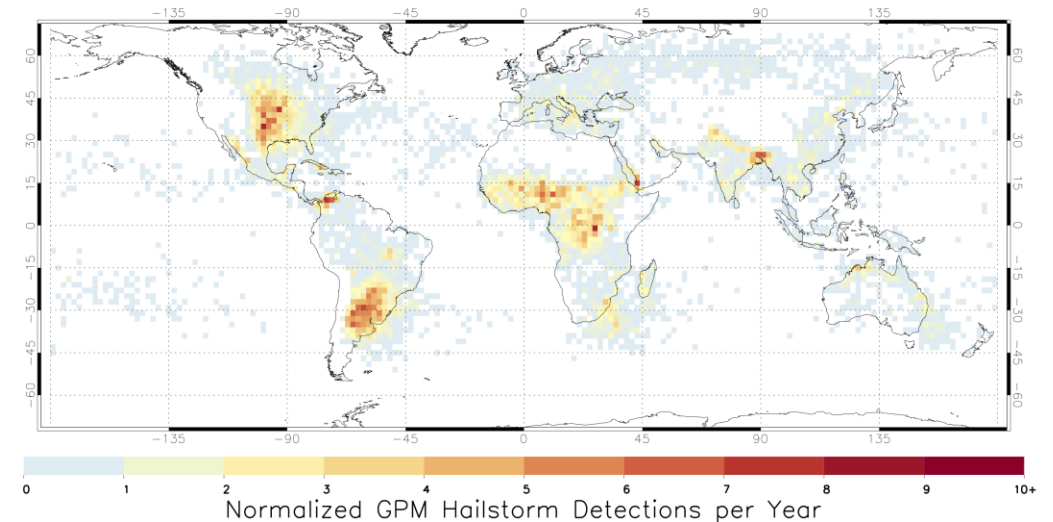
“Hail Storm Risk Assessment Using Space-Borne Remote Sensing Observations and Reanalysis Data”

PI: Kristopher Bedka (NASA Langley Research Center)

- Hailstorms are one of the most expensive natural hazards in the world – causing around \$10 billion in damages yearly in the U.S. alone.
- Developing a hailstorm climatology datasets to help the reinsurance industry understand hazard frequency and impact around the world.
- The team recently worked with partners in South America to integrate hailstorm climatologies into their reinsurance workflows and to develop satellite-based nowcasting tools that can provide early warning of severe storms to reduce hailstorm risk.



GPM Hailstorm Frequency, April 2014 to March 2019

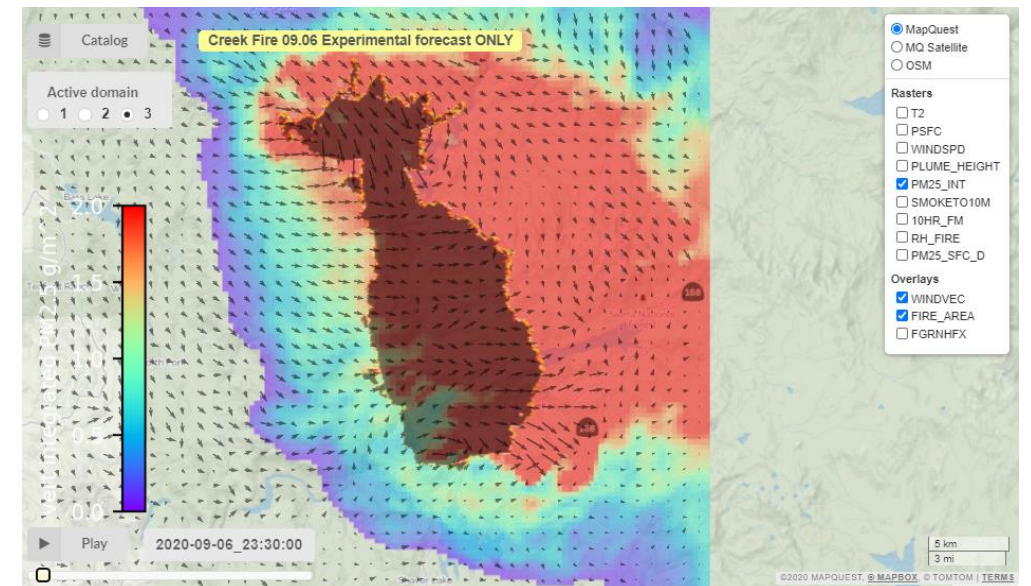


APPLICATIONS – FORECASTING WILDFIRES AND SMOKE

“Coupled Interactive Forecasting of Weather, Fire Behavior, and Smoke Impact for Improved Wildland Fire Decision Making”

PI: Kyle Hilburn (Colorado State University)

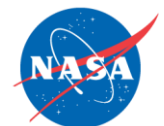
- Climate change is causing hotter and drier conditions, leading to **increased frequency and intensity of wildfires globally**. Improved tracking and forecasting tools are critical to **reducing wildfire risk** in affected communities.
- Weather Research Forecasting SFIRE (WRF-SFIRE) uses weather models, fuel moisture data and satellite fire detection to **forecast fire and smoke up to 7 days out**.
- In a **partnership with the U.S. Forest Service**, WRF-SFIRE is now operationally integrated into the FS Rocky Mountain Center for Fire-Weather Intelligence (RMC) for fire forecasts across the U.S.





DISASTER RESPONSE COORDINATION SYSTEM

- Providing **Earth observing data and expertise** to aid government agencies, NGOs and private sector stakeholders' disaster response needs.
- Building effective response communities through **improved coordination**, engagement, and learning.
- Reducing impacts to lives and livelihoods by **empowering communities** with data.



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RESPONSE – TÜRKIYE & SYRIA EARTHQUAKES 2023

- **M7.3 earthquake** and hundreds of aftershocks, caused over 50,000 casualties and widespread devastation.
- NASA supported stakeholders including USAID, US State Dept., USGS, NIST, Esri Disaster Program, California Seismic Safety Commission, the World Central Kitchen, and Miyamoto Global Disaster Relief, and others
- Shared **damage proxy maps** to assess extent of damage.
- Shared **surface displacement maps** with USGS to assess geological conditions and risk of further aftershocks
- **Mapped landslides** and overlaid with roads to support humanitarian relief efforts.



RESPONSE – HURRICANE IAN 2022

- Third most costly weather disaster in Florida history, with **12 foot storm surge** and heavy rainfall causing **widespread flooding**.
- NASA **supported FEMA response** by filling gaps in satellite imagery and developing flood extent maps.
- Used a novel **flood mapping** technique combining RADARSAT data, USDA crop masks, and other datasets to distinguish between water bodies, marshes, and flood areas.
- NGOs, such as **World Central Kitchen** and **Team Rubicon**, used NASA's products to target relief efforts and determine accessibility of affected areas.



RESPONSE – TONGA VOLCANIC ERUPTION & TSUNAMI 2022

- Jan. 2022 explosive eruption of **underwater volcano Hunga Tonga Hunga Ha'apai** with the power of 10-15 megatons and a ~36-mile-high plume. Most powerful eruption of the satellite area.
- Local impacts - destructive **tsunami waves** and **heavy ashfall** hit the Tonga islands damaging coastal infrastructure, destroying crops, contaminating water supplies and disabling communications and airports.
- Global impacts - **lofted volcanic ash and gas** high into the stratosphere, triggered extreme lighting, and sent **tsunamis, meteotsunamis, and atmospheric gravity waves** across the planet.
- NASA shared **damage proxy maps**, Planet Labs **optical imagery**, and **SO2 emissions** data with stakeholders including NOAA and the World Central Kitchen (WCK).
- Advanced applications science in tracking storm cloud-heights and developing tsunami early-warning systems with GNSS data.





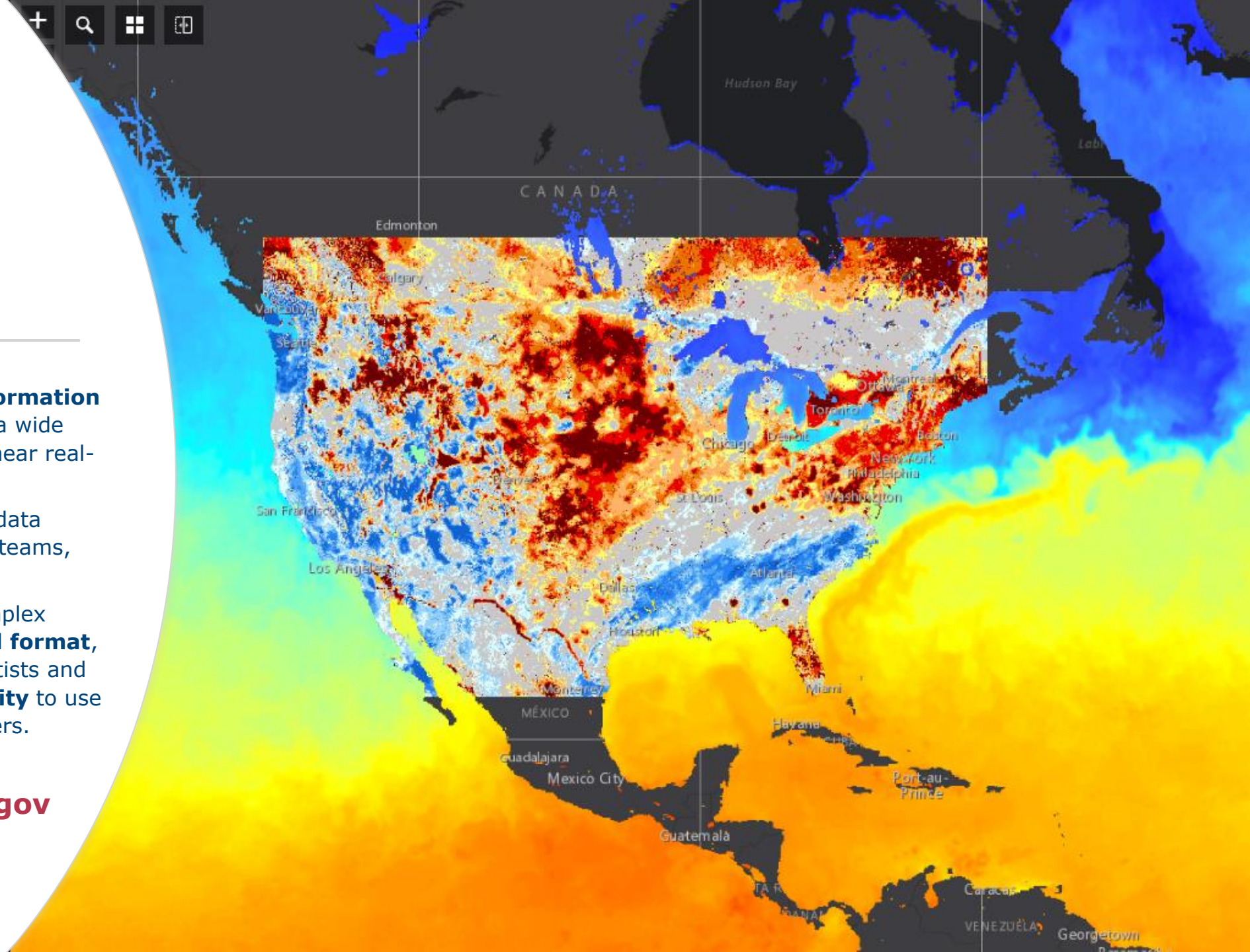
DISASTERS MAPPING PORTAL

- Free and open **geographic information systems (GIS)** portal hosting a wide array of disaster products and near real-time dashboards.
- Enables **collaboration** among data producers, scientists, response teams, and communities.
- View, analyze and combine complex datasets in an **intuitive, visual format**, bridging the gap between scientists and end users, and **building capacity** to use Earth observing data for disasters.

maps.disasters.nasa.gov

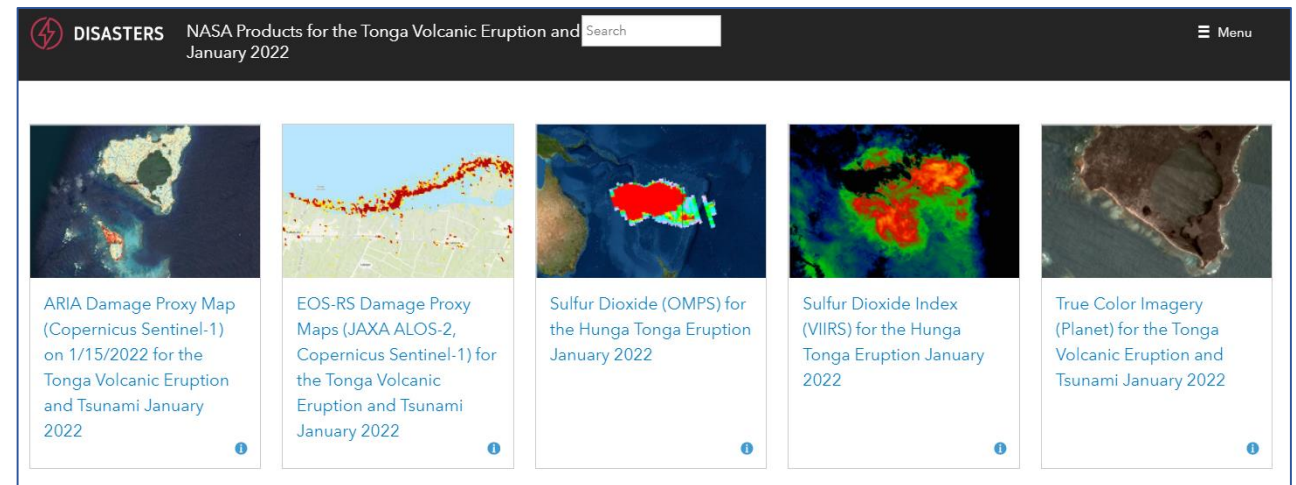
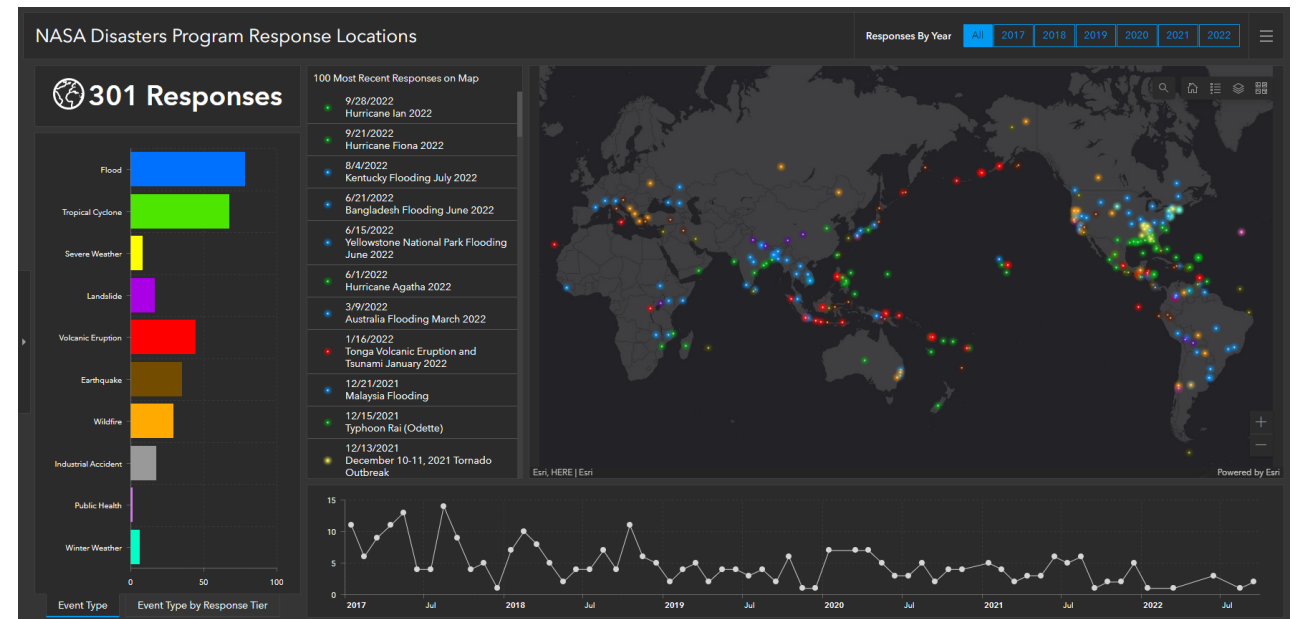


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MAPPING PORTAL – EMPOWERING DISASTER RESPONSE & APPLICATIONS

- Serves as a primary interface for **sharing maps, data and analysis** with response stakeholders.
- Standardized GIS format allows **easy integration** into decision-support tools.
- **Testbed for new products** developed by NASA Disasters applications scientists, garnering valuable **real-world feedback**.
- Portal-to-portal connections with partners such as the World Food Programme to streamline data delivery.



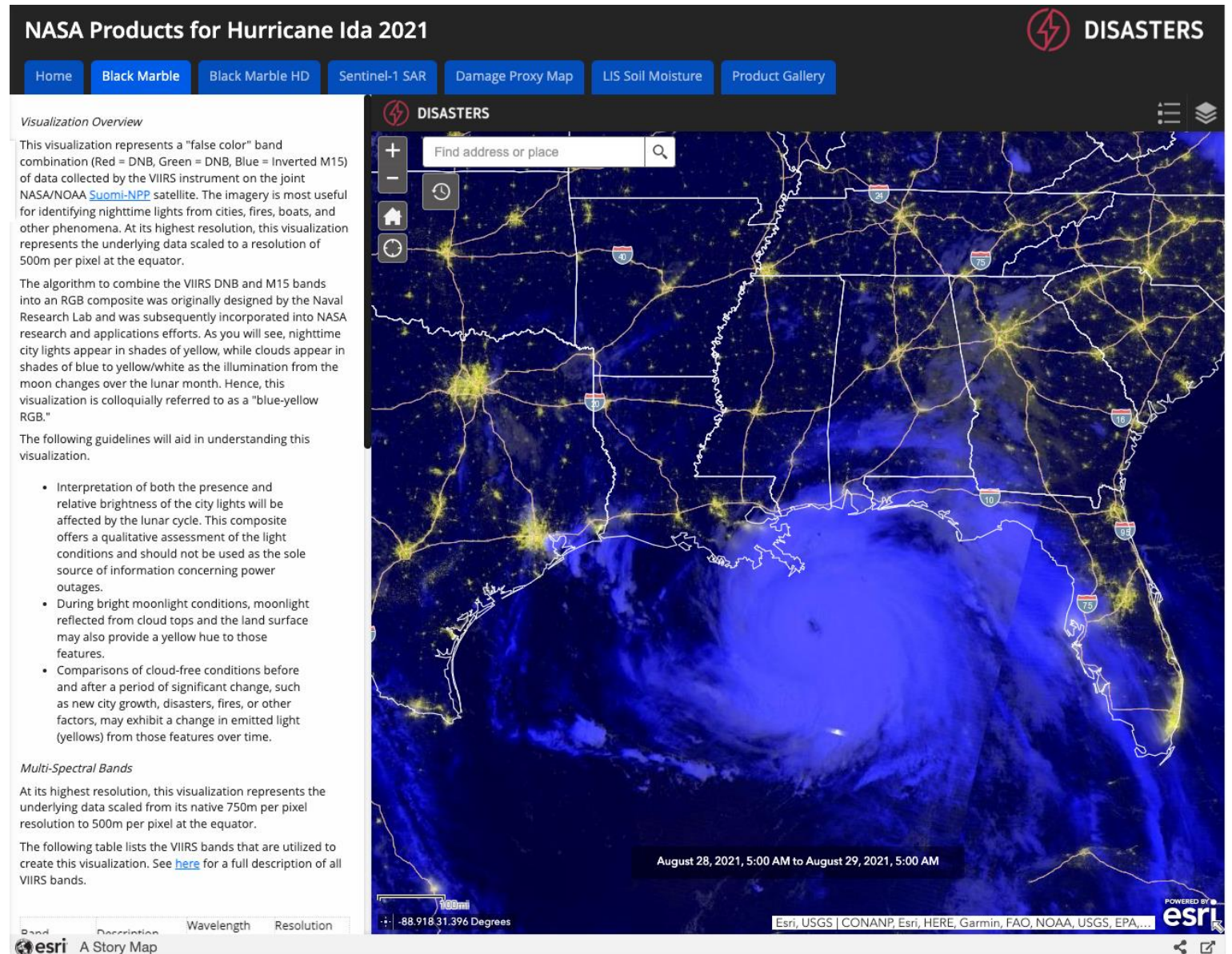
MAPPING PORTAL – BUILDING GIS COMMUNITIES

- Disasters team attends GIS user conferences and other outreach events to **share resources and collaborate** with the GIS community.
- Training and technology exchange essential to building **effective relationships** with stakeholders.
- Gathering **end-user feedback** to improve the portal's usability, enhance its capabilities, and engineer a cloud-based future.
- NASA Disasters strives to set an example for **open science** and effective use of GIS across NASA, sharing knowledge throughout NASA's Earth Science Division.



MAPPING PORTAL – STORYMAPS

- Interactive online stories containing text, maps and multimedia.
- Provides a deeper look into how we view a given disaster by **combining multiple datasets** with interactive elements and a narrative component.
- **Builds capacity** for users to understand applications of Earth observing data for disaster risk reduction and response





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