Informing Disaster Response: An Introduction to the NASA Disaster Response Coordination System

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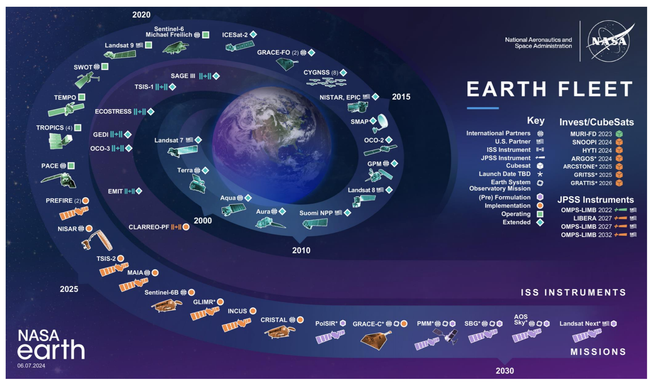
ABSTRACT

Satellite observations provide information about the Earth that can be critical to building situational awareness and filling in data gaps during disaster response. The Earth Science Division at the National Aeronautics and Space Administration (NASA) has a Disasters Program which aims to advance Earth science data and information to support management decisions that prevent or mitigate the impacts of disasters. In support of this goal, NASA's Disaster Response Coordination System (DRCS) manages a whole-of-NASA approach to coordinate and mobilize the Agency's assets and expertise to provide geospatial information during disasters. The purpose of the DRCS is to advance the utility of Earth observation information for supporting disaster response decision support, build skilled and effective response communities through improved coordination, engagement, and learning, and reduce impacts on lives and livelihoods by empowering communities to respond to disasters more effectively. The DRCS employs a user-centered, activation framework that begins with direct requests from responders and ends with after-action assessments that feed lessons learned and process improvements. This poster will introduce the DRCS model and approach to expanding the use of Earth observations and geospatial information to support disaster response, share use cases for recent event activations, and highlight initial lessons learned.

NASA EARTH SCIENCE

Advancing Understanding of the Earth as a system and developing technologies to improve the quality of life on our home planet.



Using the global vantage point of space, NASA's Earth Science Division (ESD) builds fundamental, scientific knowledge about Earth and how it is changing, advances understanding of Earth as an integrated system, and develops and tests applications that deliver direct societal benefit.

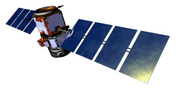
NASA's DISASTERS PROGRAM

Programmatic Elements

Disaster Applications

Disaster Response Coordination System

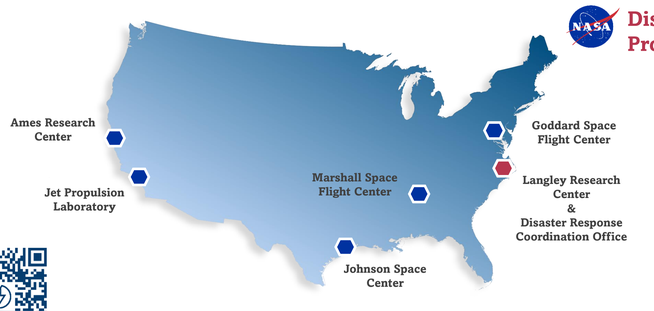
Disasters Mapping Portal



The DRCS is a core element of the NASA Disasters Program, which advances science and builds tools to help communities make informed decisions for disaster planning. Before, during and after disasters strike, the Disasters Program provides partners with actionable data to recover from disaster impacts and build resilient communities.

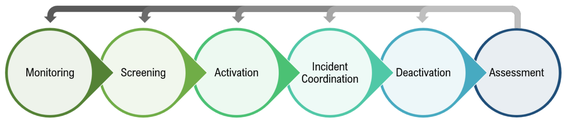
DISASTER RESPONSE COORDINATION SYSTEM

The NASA DRCS is a whole-of-NASA approach that leverages Earth science, technology, and expertise to provide trusted and actionable information to organizations actively responding to disasters. The DRCS works with government agencies, NGOs and private sector partners to provide insights that inform decision making and reduce impacts on lives and livelihoods.



disasters.nasa.gov

DRCS RESPONSE CYCLE



Monitoring

The DRCS network maintains situational awareness of impending and actual disasters with potentially significant humanitarian, infrastructural, social, or economic impacts. Some natural hazards occur in remote or uninhabited areas and are unlikely to cause such impacts, but DRCS also maintains awareness of these events if information gleaned from observations may benefit research at NASA and partner agencies.

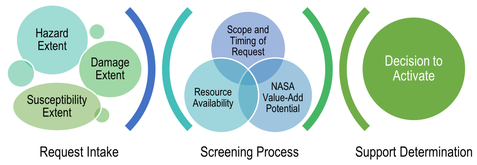
The DRCS is request driven. Requests can come from disaster response organizations in:

- State, local, Tribal, or federal government entities
- Non-profit organizations working at the national scale
- International governments
- Organizations focused on emergency management and/or disaster response.

Requests should be sent by email to DRCS@nasa.gov.

Screening

The DRCS requires a request from an organization involved in disaster response and/or emergency management to elevate from the Monitoring to the Screening step.



Activation

Once a request is made and an event meets established criteria, the DRCS assigns a team to lead collaboration and response and incident coordination begins.

Incident Coordination

Incident Coordination includes timely and organized information and data sharing, streamlined communications across DRCS and within NASA, communications with requestors and partners, data acquisition, product development (as appropriate), and handoff of data/products to requestors. Incident Coordination involves a cyclical process of receiving requests, developing products, and supporting partners.

Deactivation

Upon verification from the requestor that their request is fulfilled or if after 72 hours elapse since the last communication received following DRCS communication outreach, the DRCO will make the decision to proceed to the deactivation of the response.

Assessment

The DRCS pursues a systematized approach to monitoring, evaluation, and learning (MEL) to drive adaptation and efficacy. MEL activities will include a robust after-action assessment process centered around collection of lessons learned with a review cycle to take these inputs and feed them back into the DRCS processes.

ACTIVATION EXAMPLES

2023 Maui Wildfires



Operational Land Imager (OLI) on Landsat 8 satellite. 10:25pm local time on August 8, 2023. Image was composed from OLI observations of shortwave infrared light (band 6).



High Resolution Imagery from the International Space Station from August 8, 2023, and August 18, 2023.

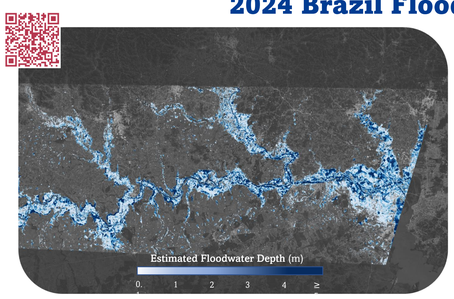
In August 2023, a fast-moving wildfire devastated the historic town of Lahaina on Maui, Hawaii's second largest island.

The fires occurred during a period of strong winds and dry conditions in Maui. Between August 7-9, 2023, the island experienced peak gusts that ranged from 45 to 67 miles (72 to 107 kilometers) per hour, according to the National Weather Service. The presence of a strong high-pressure area to north of the island and Hurricane Dora to the south may have helped fuel the winds.

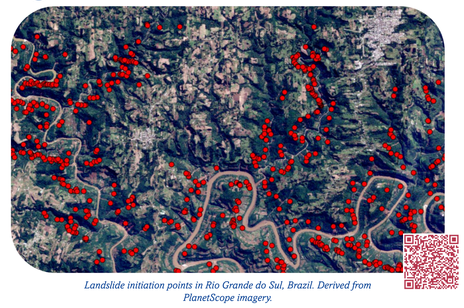
The image on the left shows the signature of the fire at 10:25pm local time on August 8, 2023 as observed by the Operational Land Imager (OLI) on the Landsat 8 satellite. The image was composed from OLI observations of shortwave infrared light (band 6). Infrared observations are useful for distinguishing the locations of active fires, shown here in yellow. The shortwave infrared data were overlaid on a natural-color mosaic image based on Landsat 8 observations for added geographic detail.

The image on the right shows high-resolution imagery of the burn scar taken by astronauts on August 8 and August 18, 2023, from the International Space Station.

2024 Brazil Flooding & Landslides



OPERA ARIA DSWx HLS scene for May 6, 2024.



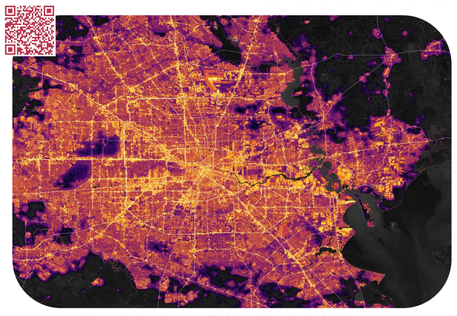
Landslide initiation points in Rio Grande do Sul, Brazil. Derived from PlanetScope imagery.

Storms and torrential rain battered southern Brazil beginning in late April 2024, causing deadly, destructive flooding that persisted through much of May. Toward the end of the month, parts of Rio Grande do Sul state remained underwater, and the scope of the damage became increasingly evident. Maps of floodwater extent are one way to assess a flooding event. But information about the depth of that water is also useful, potentially aiding rescue and relief operations, informing decisions about road closures and accessibility, and contributing to analyses of damage and flood risk.

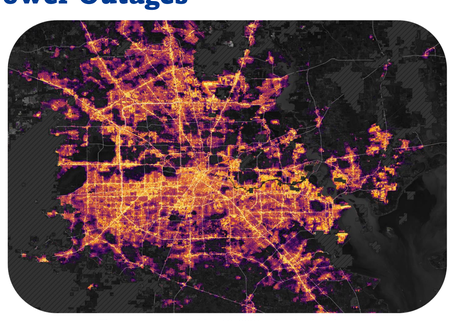
The map on the left shows estimates of flood depth in areas west of Porto Alegre, the state's capital city, on May 6, 2024. The darkest blue areas are where floodwater that day was at least 5 meters deep. But much of the inundated floodplain is light blue, which equates to depths of between 0.1 and 1 meter (4 and 40 inches). The flood extent data for this map are from the OPERA Dynamic Surface Water Extent from Harmonized Landsat Sentinel-2 (OPERA DSWx-HLS) product, and ground topography data are from the Shuttle Radar Topography Mission (SRTM).

The image on the right landslide initiation points manually mapped by the NASA GSFC landslides team. The points were derived from PlanetScope imagery

2024 Houston Power Outages



Composite showing normal light conditions in April 2024.



The same area early May 18, 2024, after the derecho.

On May 16, 2024, an especially strong and long-lasting band of storms—a derecho—charged across Central Texas and struck Houston. The storm unleashed tornadoes and destructive winds that reached 100 miles (160 kilometers) per hour. It shattered windows, tore roofs off homes, and toppled trees and power lines. Nearly one million homes and businesses in the Greater Houston area lost power, according to news reports.

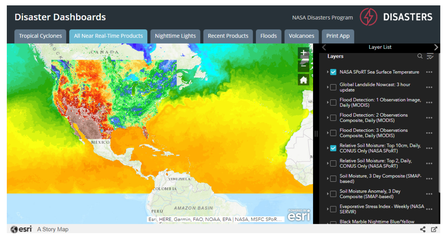
Power outages were widespread enough to be noticeable in nighttime satellite images. The maps are based on data from the Visible Infrared Imaging Radiometer Suite (VIIRS) sensor on the NASA-NOAA Suomi NPP satellite. The maps come from the Black Marble HD product, provided by the NASA Black Marble science team.

For the full suite of products of Houston response products, visit:

DISASTERS MAPPING PORTAL

The Disasters Mapping Portal is a free and open **geographic information systems (GIS)** portal hosting a wide array of disaster products and near real-time dashboards. It serves as the primary interface for sharing maps, data, and analysis with response stakeholders.

- **Standardized GIS format allows easy integration into decision-support tools.**
- **No login requirements**
- **Every product has REST and WMS endpoints**
- **Most services discoverable on ArcGIS Online**
- **Most imagery files can be downloaded**
- **Two types of products:**
  - Event-based Products
  - Near Real-Time Products



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GET INVOLVED

Join the Disasters Program newsletter to keep up to date with the DRCS. We welcome opportunities to connect and engage.

Contact DRCS at **DRCS@nasa.gov**

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