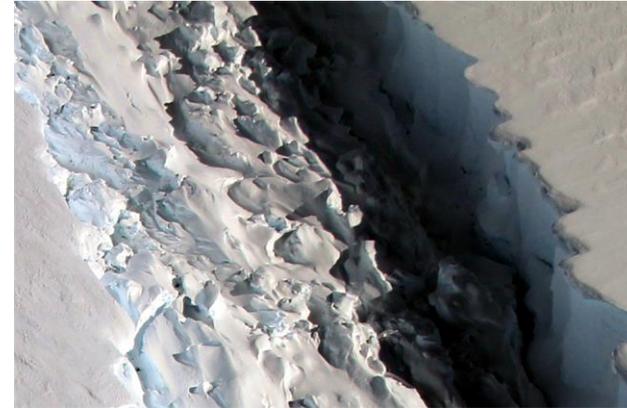




SCIENCE

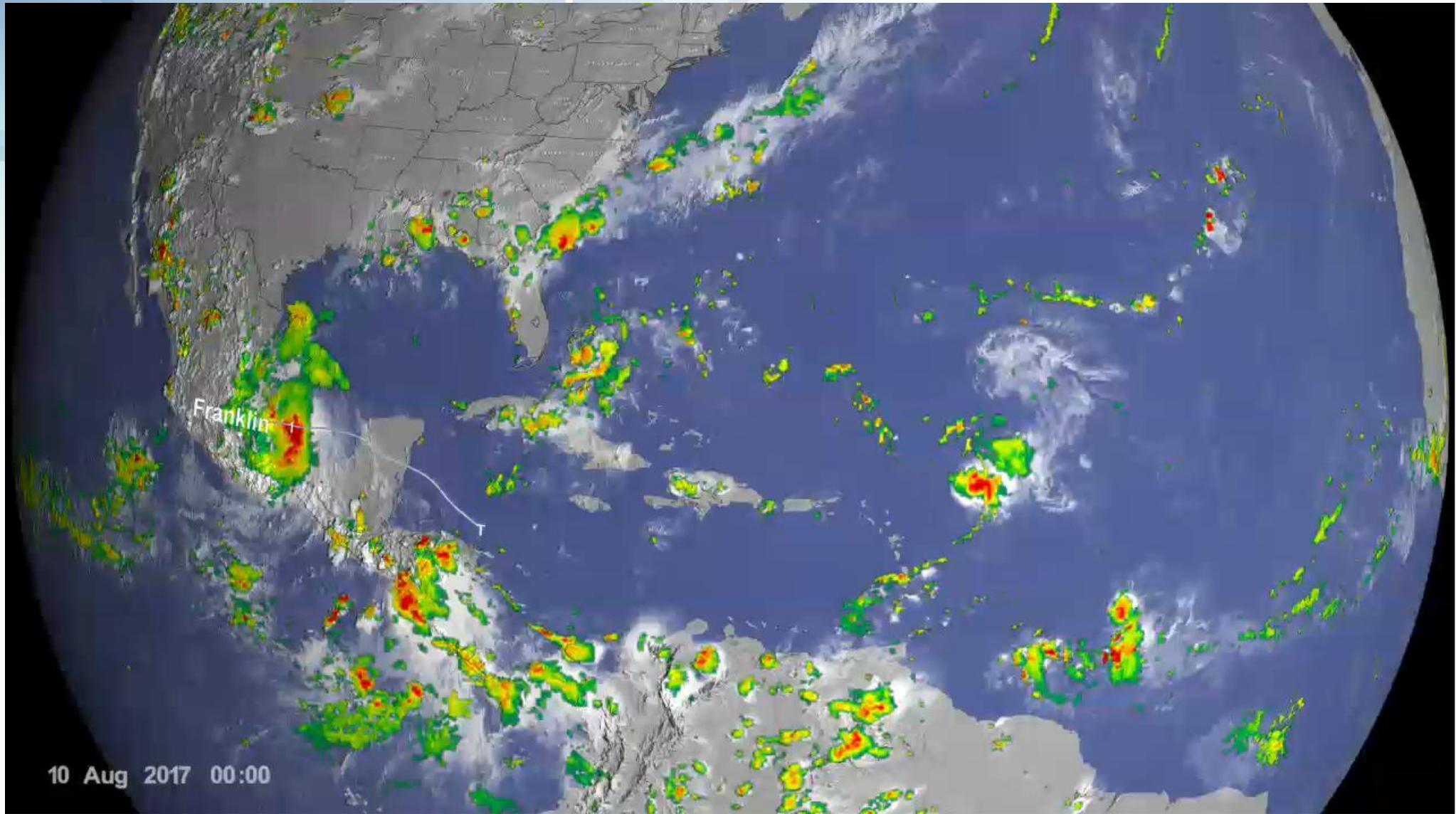


Why Hydrological Services are Important to Business

Dr. David Green

Program Manager, Disasters
Earth Science Division
David.s.green@nasa.gov

May 8, 2018



Communities and Areas of Intensive Risk

- Socio-Economic Disruption
 - Residential
 - Commercial
 - Industrial
- Municipalities, Cities and Towns
 - Communities
- Supply Chains



Flood Research, Response and Resiliency

- Protection
- Control
- Prevention

Answering Questions

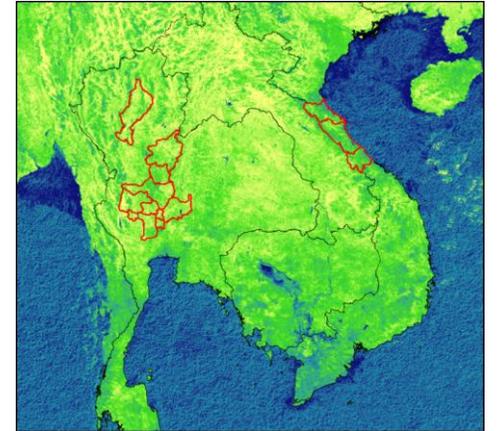
- How much rain dropped?
- Where's the Water?
- What's the impact?
- How do we recover?



Science Products and Services

- Data
- Models
- Maps
- Tools
- Available
- Trusted
- Affordable
- Reliable

Project Mekong, NRT MODIS-NDVI Composite

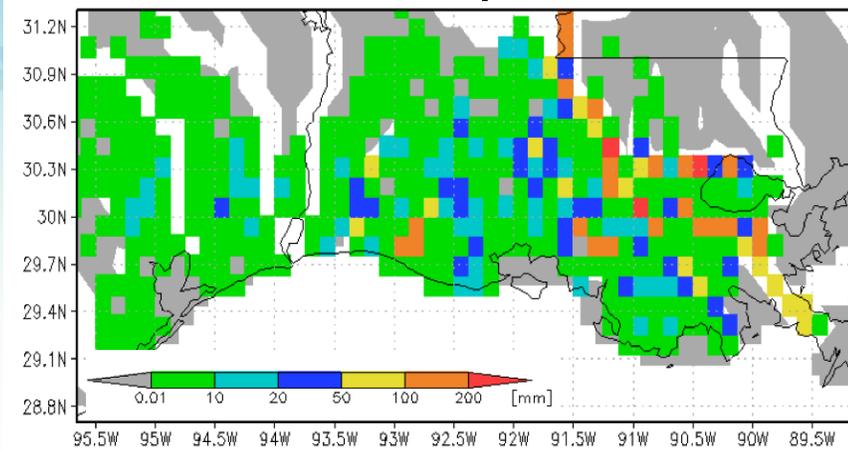


-  Provinces Experiencing Flooding (Red Cross)
-  Real Time Surface Water (MODIS; 250m)

Applications

- Predicting rainfall amounts
- Describing inundation extent
- Predicting crop and infrastructure loss
- Characterizing power outages
- Predicting landslides

Global Flood Mapping

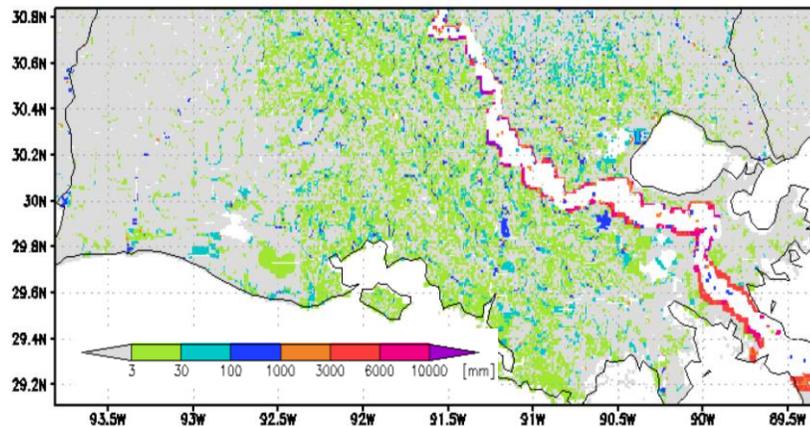


**Flood Detection/Intensity
(Depth above Threshold [mm])
14 August 2016**

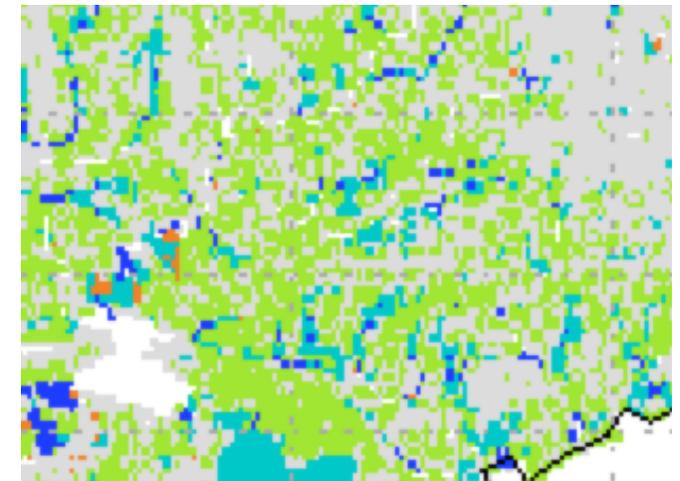
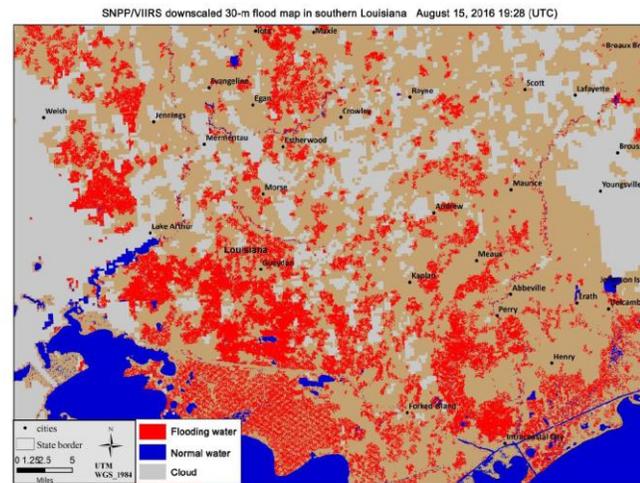
**VIIRS-based Inundation
Estimate**

**GFMS-based Inundation
Estimate**

Global Flood Monitoring System (GFMS)



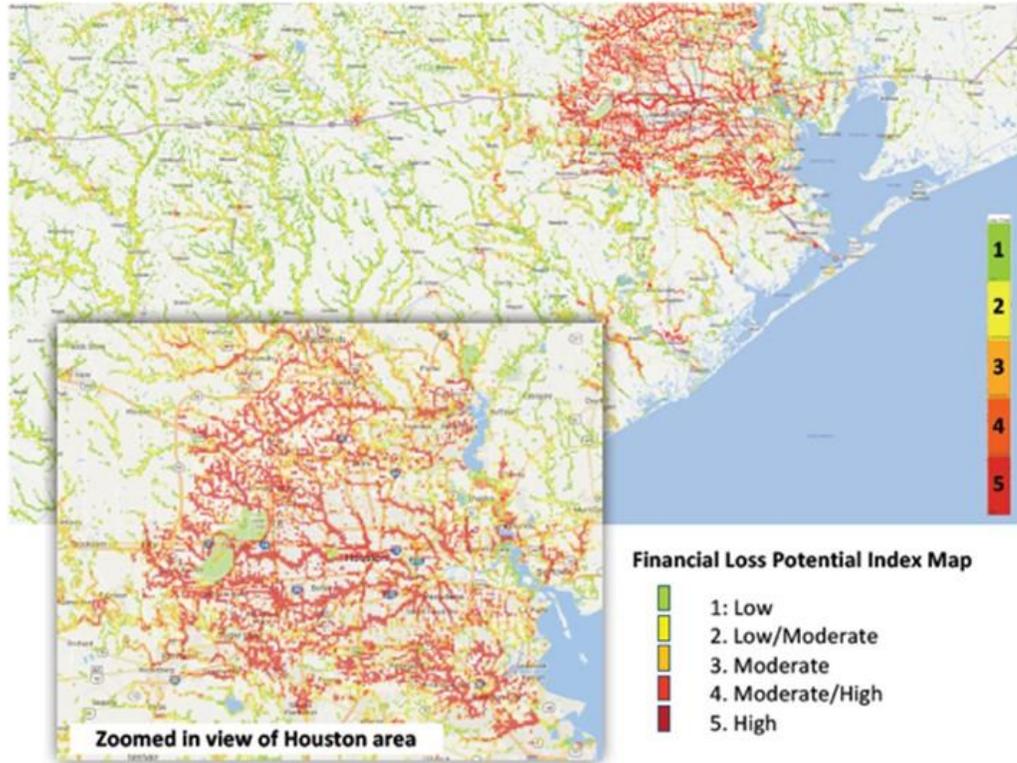
**Inundation Estimation (1 km)
13 August 2016**



Where is the Water? Monitoring 365 Days a Year



Assessing Financial Loss Potential



Combined flood extent maps and depth information to create overlays with exposed property values in the flooded areas.

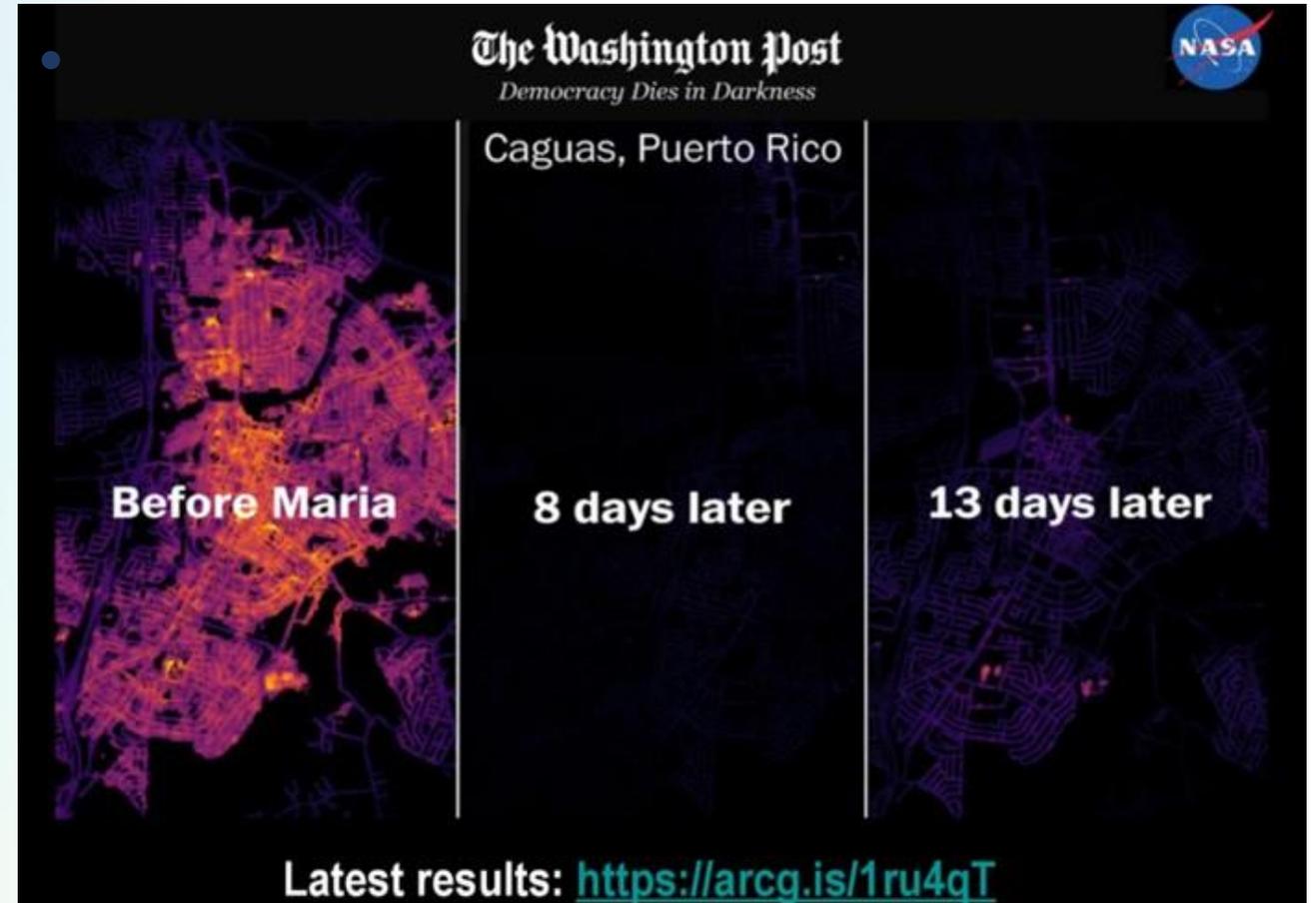
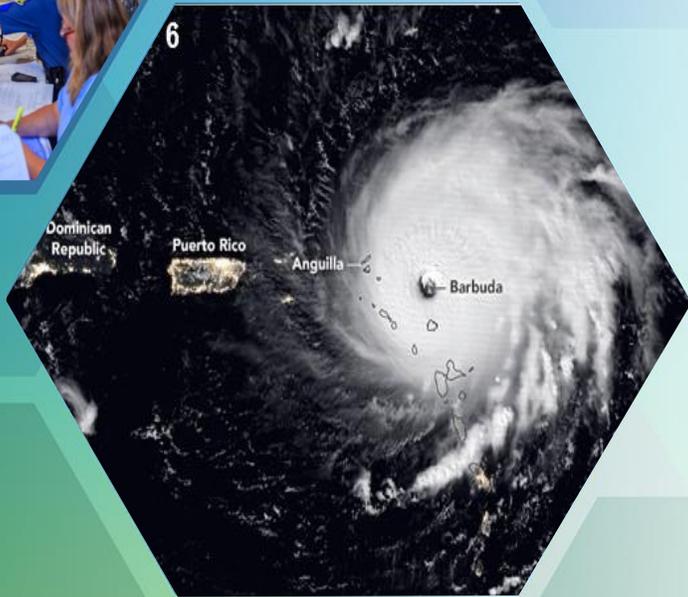
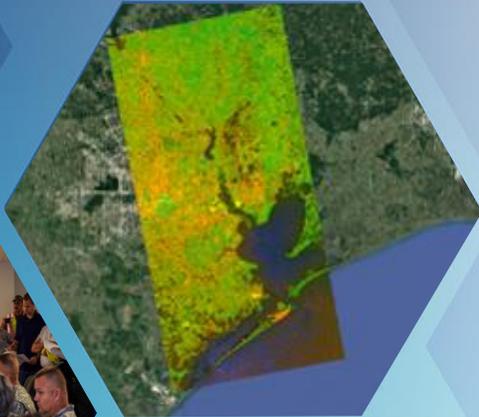
- *Where are financial losses concentrated?*
- *How severe are they? Where should recovery and mitigation efforts be focused?*



Where is the Impact - And By Night

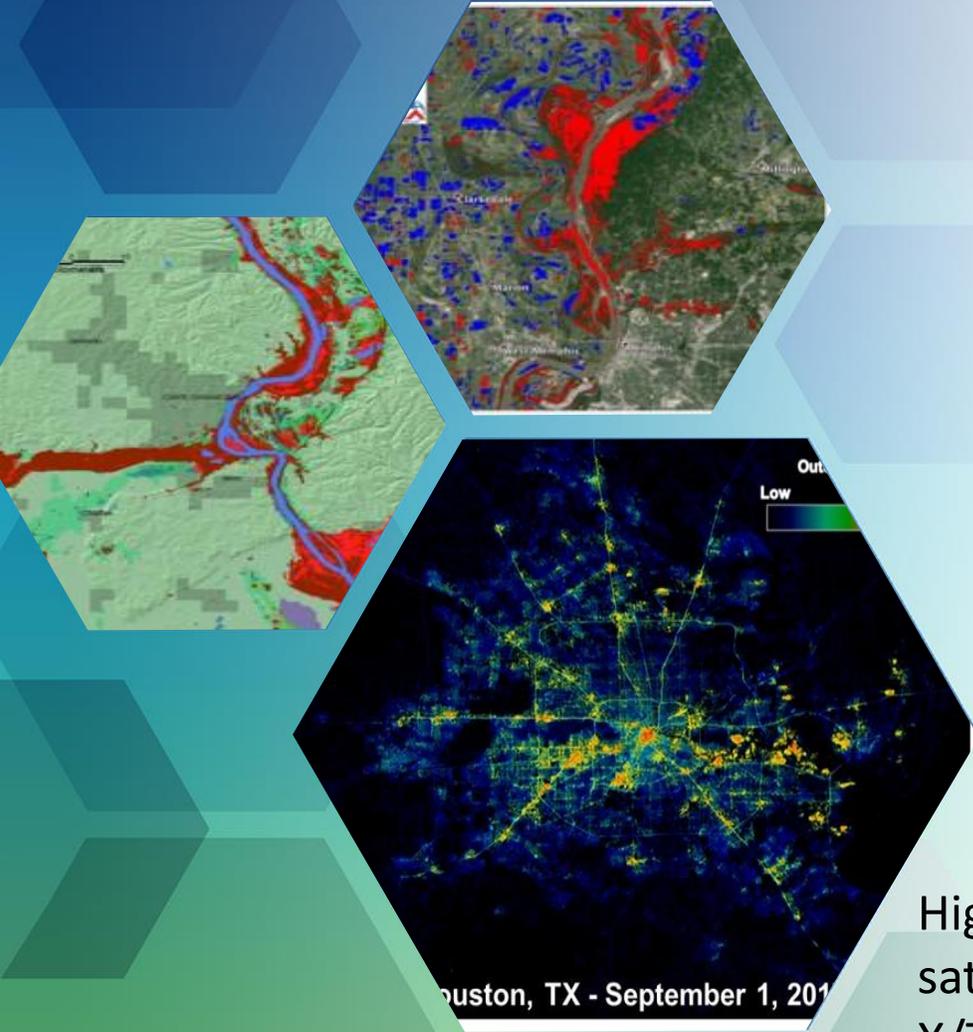


Communicating Perils



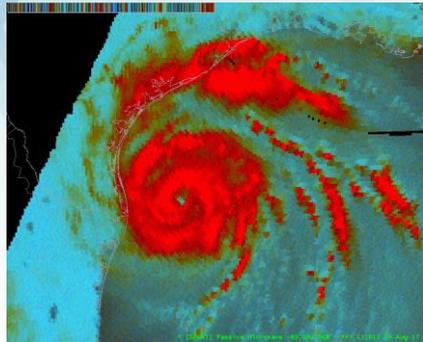
Monitoring Critical Infrastructure

- Radar
- Optical
- Thermal
- Lifelines
- Transport
- Power
- Water Resources
- Supply Chains

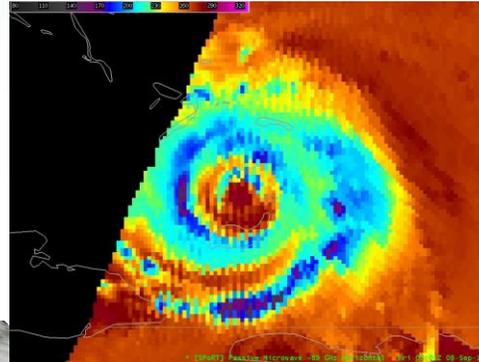


High resolution nighttime maps combined data from six satellites (Suomi-NPP, Landsat-8, Sentinel 2A & 2B, TerraSAR-X/TanDEM-X) to enable first-ever daily monitoring of affected areas at neighborhood scales (< 30 meters)

Monitoring Impact

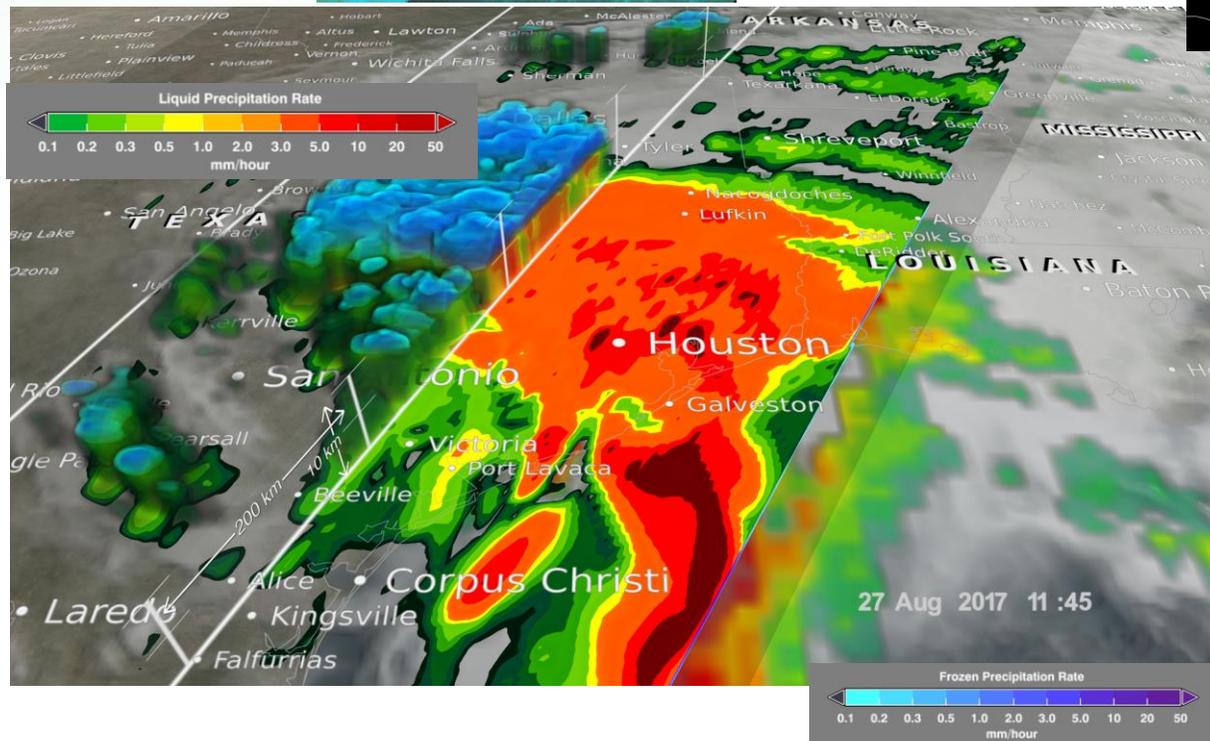


Harvey

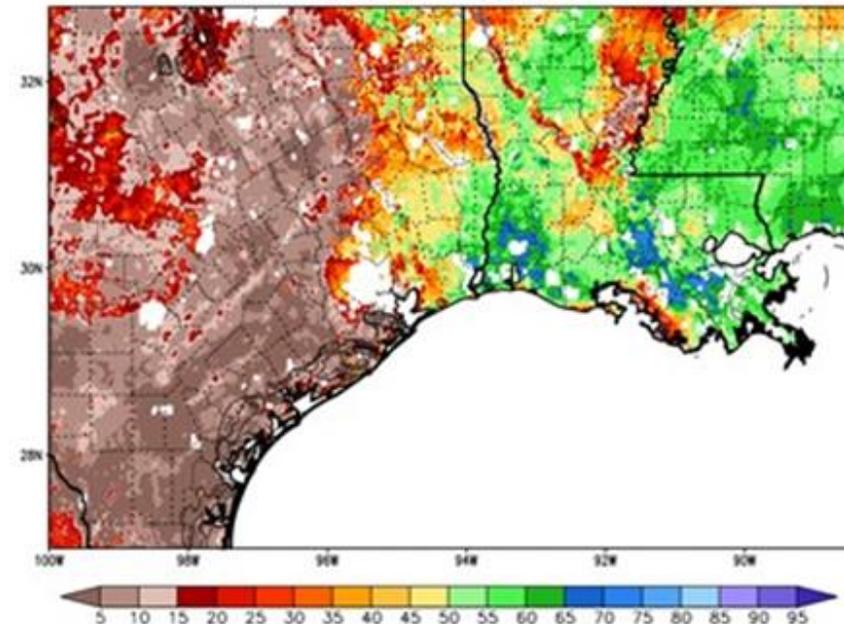


Irma

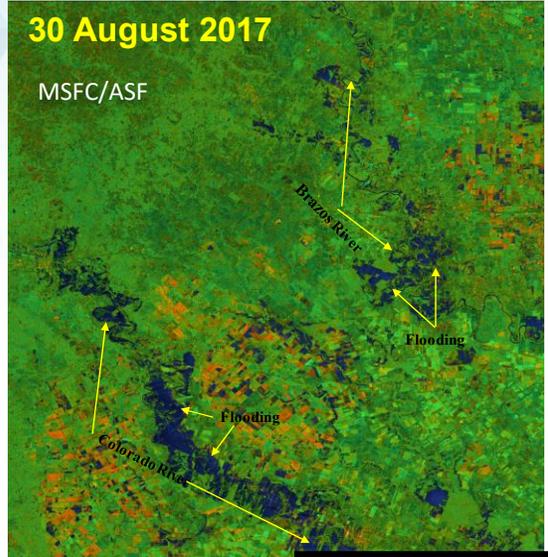
GPM and the IMERG product provide rainfall estimates for islands lacking radar, or to help gap fill radar coverage lost in the storm (NWS San Juan, PR)



0-100 cm Relative Soil Moisture (available water; %) valid 10z 25 Aug 2017
Precipitation in previous hour (1,2,5,10,15,20,25 mm contours)



Mapping Exposure, Flood Extent and Damage



Satellite Radar Mapping



“We found your (flood maps) extremely useful during Harvey for model validation and identifying locations of flooding that we could not predict with modeled riverine depth grids.” -FEMA

Radar Mapping Flood Impact

What this provided:

- *Helped provide a more complete picture than with satellite imagery alone*
- *Information on flood cresting across four major river basins as waters drained to the Gulf*

“I think we may have seen the future of flood response” - Gordon Wells, Texas Center for Space Research and Special Advisor to the TX Natural Disasters Working Group.



NASA deployed UAVSAR to fill information gaps and generated single channel quick-look products during flight and post-flight for officials.

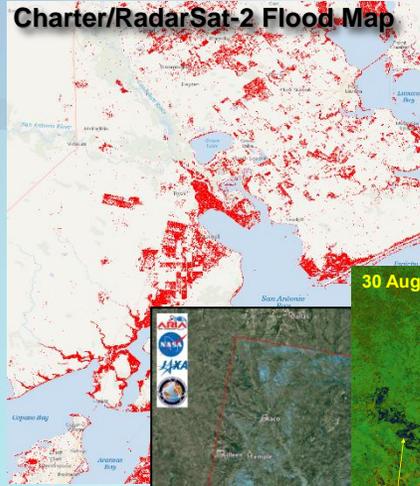
UAVSAR HH-polarized quick-look images acquired 3 days apart showing areas around Wharton, a small town along the Colorado River, no longer flooded.



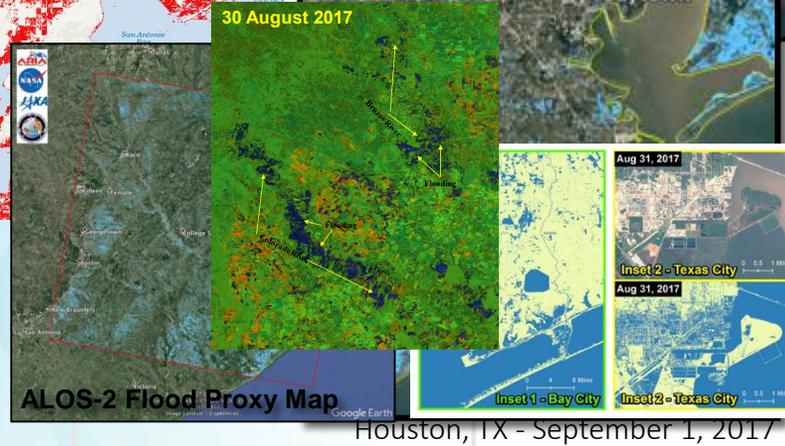
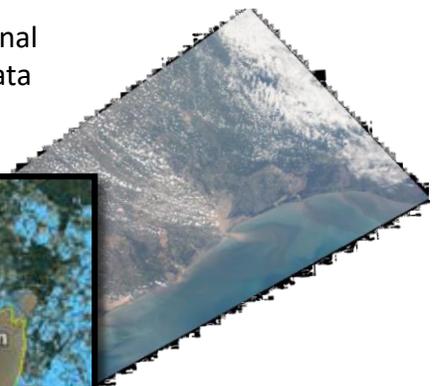
Wharton Historical Museum

Hydro-Meteorology Timeline Hurricane Harvey (Aug-Sept 2017)

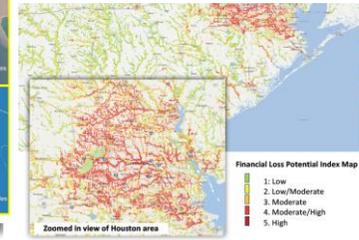
Forecasts for Harvey identify impacts to U.S. mainland, NASA team activates for coordination calls, product generation, and end-user engagement



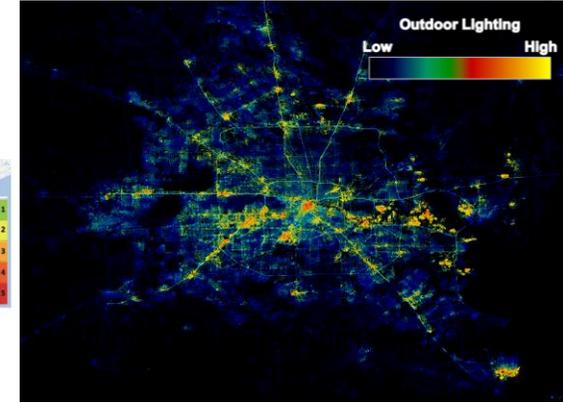
NASA, NOAA, ESA, International Space Station, and Charter data used collaboratively to map flooding from SAR/optical



Modeling disaster impacts, insured losses, in Houston metro



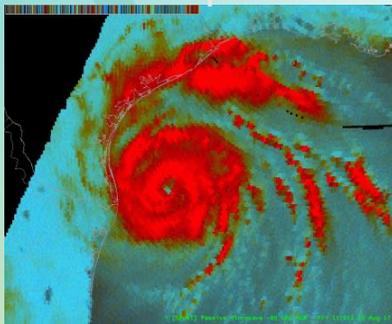
Use of NASA Black Marble HD product to explore power outages during post-Harvey flooding



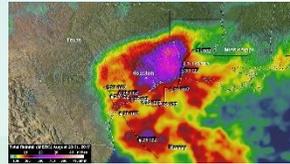
Houston, TX - September 1, 2017



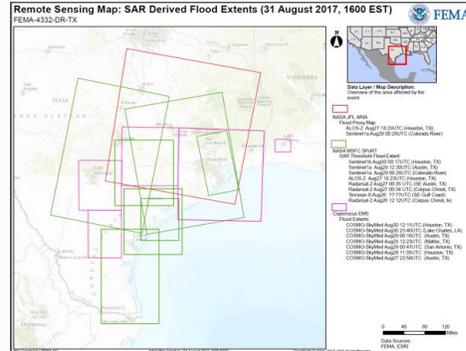
Daily calls begin to coordinate NASA team in generation of products, engagement of funded PIs, and coordination with federal end user partners including FEMA, USGS, National Guard, and others.



NASA's GPM helps track Harvey with data provided to NOAA/NWS and NHC



GPM maps the record-setting rainfall in SE Texas from Harvey



Team collaborations provide over a dozen detailed maps from SAR used by FEMA's geospatial team



NASA provides daily flights of UAVSAR from September 1-4 to rapidly map evolving flood impacts

Geospatial Enablement

<https://maps.disasters.nasa.gov/arcgis/home/>

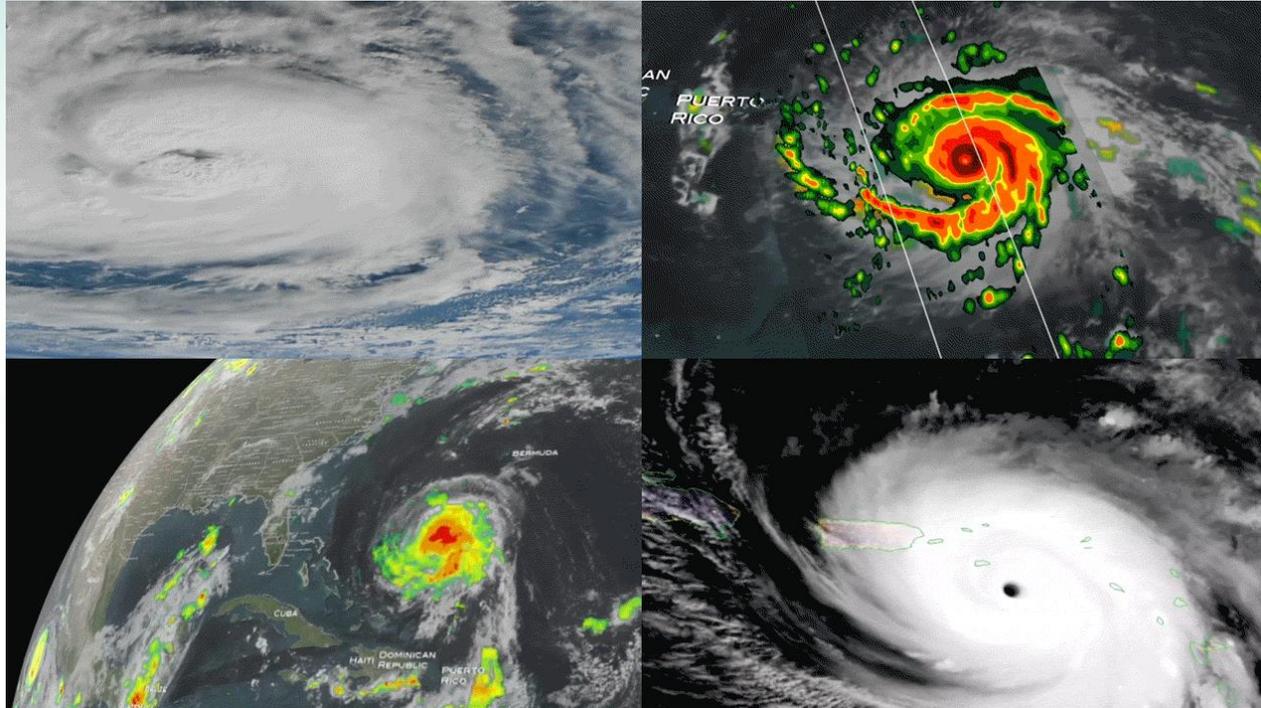
The screenshot shows the NASA Disasters Mapping Portal (BETA) interface. At the top, there is a header with the NASA logo and the text "NASA Disasters Mapping Portal BETA". Below the header is a "Featured Maps and Apps" section with four featured items: "Near Real Time (NRT) Products Map", "Aoba (Ambae) Volcano Eruption, Vanuatu", "Mount Kilauea Volcano Eruption, Hawaii", and "Kauai, Hawaii Flooding; April 2018". Below this is a grid of disaster categories with representative images: Tropical Cyclones, Earthquakes, Floods, Wildfires, Volcanoes, Industrial Accidents, Landslides, Oil Spills, Severe Weather, Winter Weather, Droughts, and NRT Products. On the right side, there is a "Recent Responses" section listing various disaster events from 2017 and 2018, such as "Kilauea, Hawaii Eruption 2018", "Vanuatu Eruption 2018", "Hawaii Flooding 2018", "Mid-West Flooding 2018", "Oaxaca Earthquake 2018", "Tropical Storm Gita 2018", "Mount Fuego Eruption 2018", "California Winter Storm and Mudslides 2018", "Severe Winter 'Bomb Cyclone' Storm 2018", and "Southern California Wildfires, December 2017".

<https://disasters.nasa.gov/home>

The screenshot shows the NASA Disasters Program website. At the top, there is a header with the NASA logo, the text "NASA Earth Science DISASTERS PROGRAM", and "NASA Applied Sciences Program | www.nasa.gov". Below the header is a navigation menu with "ORGANIZATION", "DISASTERS", "RESILIENCE", and "RESOURCES". A search bar is located in the top right. The main content area features a large map of Hawaii with a text overlay titled "GPM IMERG Data Used to Evaluate Kauai Hawaii's Flooding Rainfall". The text describes a low pressure trough moving through the Hawaiian Islands, causing heavy rainfall and mudslides on April 12, 2018. To the right of the map is a "Recent Responses" section with a "Register now" button. Below the map is a section titled "About the NASA Disasters Program" with a "Learn More" button. The background of the page features a dramatic image of a volcano erupting.

NASA's *DISASTERS* Program

Perspectives on Earth as a Dynamic System



- Accessible
 - Scalable
 - Flexible
-
- Reducing Risk
 - Building Resilience

Poster: NASA Applied Sciences Disasters Program – Flood Research, Response and Resiliency Efforts