



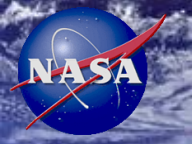
Disaster Risk Reduction and Response from a NASA Perspective

Dr. Miguel Román *for*
Dr. David Green
Disaster Program Manager
Science Mission Directorate
Earth Science Division



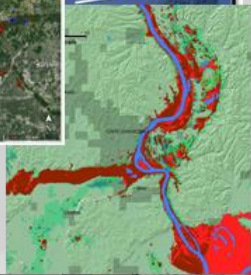
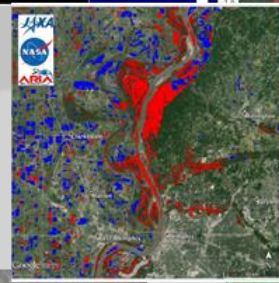
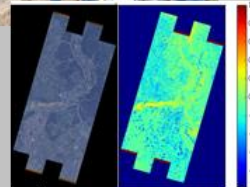
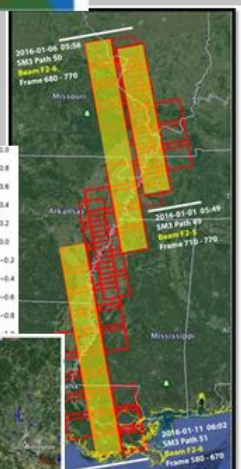
LANCE-UWG

10/3/2017



User-Centric Work Flows: From Data to Information

- Engagement with Stakeholders and Partners
- Monitoring and Observation
- Data Acquisition, Processing and Distribution
- Interpretive and Decision Support



Recent Disasters

- Hurricane Matthew 2016
- Typhoon Megi 2016
- Puerto Rico Blackout 2016
- Amatrice Italy Earthquake 2016
- Louisiana Flooding 2016
- California Wildfires 2016
- Alaska Pavlof Volcano 2016
- Eastern US Blizzard January 2016
- Mississippi Flooding January 2016
- Hurricane Patricia 2015

[View All](#)

Featured Article: October 5, 2016: NASA-Produced Maps Help Gauge Italy Earthquake Damage. NASA/JPL-Caltech-produced maps of damage in and around Amatrice, Italy, from the Aug. 2016, quake, based on ground surface changes detected by Italian and Japanese radar satellites. The color variations from yellow to red indicate increasingly more significant ground surface change. Credits:...

[Read More](#)

About the NASA Disasters Program

The Disasters Applications area promotes the use of Earth observations to improve prediction of, preparation for, response to, and recovery from natural and technological disasters. Disaster applications and applied research on natural hazards support emergency preparedness leaders in developing mitigation approaches, such as early warning systems, and providing information and maps to disaster response and recovery teams.

[Learn More](#)

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



Approach/Principles

■ Global to local reach

- Routine Monitoring to Tiered mobilization

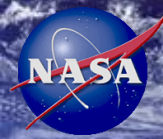
■ Harvesting and exploiting data

- NASA and Non-NASA data and processing systems
- Near real-time and direct readout data/product access
- Impact and risk assessment, static and predictive models
- Exposure, risk extent and damage maps
- Visualization systems, geospatial platform, GIS, and web services

■ Organizational Structure and Playbooks

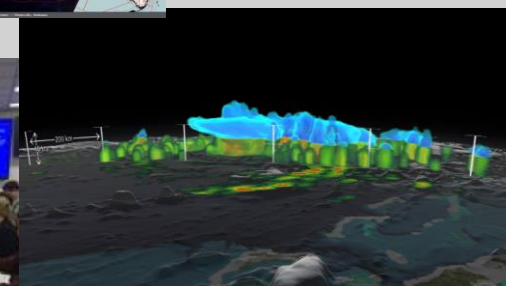
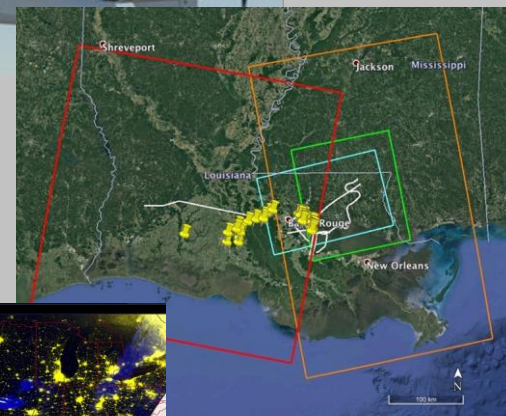
- Center Coordinators, Event Leads and Engagement
- Integrated workforce of scientists, technologists, communication and emergency management specialists
- Principal Investigators, Users, and Volunteer Networks
- Partnerships

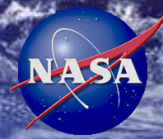
Assessment	Tier 1	Tier 2	Tier 3
Rapid Hazard Assessment Expected - Centers and program experts to contribute within scope of daily activity - Guidance to elevate to Tier response, direct to research or no action - Days <i>E.g.: media report</i>	Response and Recovery Short Term and Best Effort - Centers and programs respond as available with only minor impact to existing/on-going activities - Detailed assessment and products scaled to modest response - Weeks to Month(s) <i>E.g.: Napa Earthquake (2014), Chile Earthquake (2015), Oklahoma tornadoes, yearly floods</i>	Significant Contributions Over Extended Period - Contributions are considerable given continual assessment of size and scale of impact - Personnel relevant to disaster type (s) expected, tasked, and assigned to support - Data and products adapted into recovery - Weeks to Month(s) <i>E.g.: Nepal Earthquake (2015), Deep Horizon (2010), Eyjafjallajökull Eruption (2015)</i>	Disaster is of major national importance - All relevant personnel expected to review activities for level of support to the disaster and/or be on-call - Assets and personnel may specifically assigned and tasked for lengthy time period (Months into recovery). <i>E.g.: Hurricane Katrina (2005), September 11, 2001 attacks</i>



Capacities

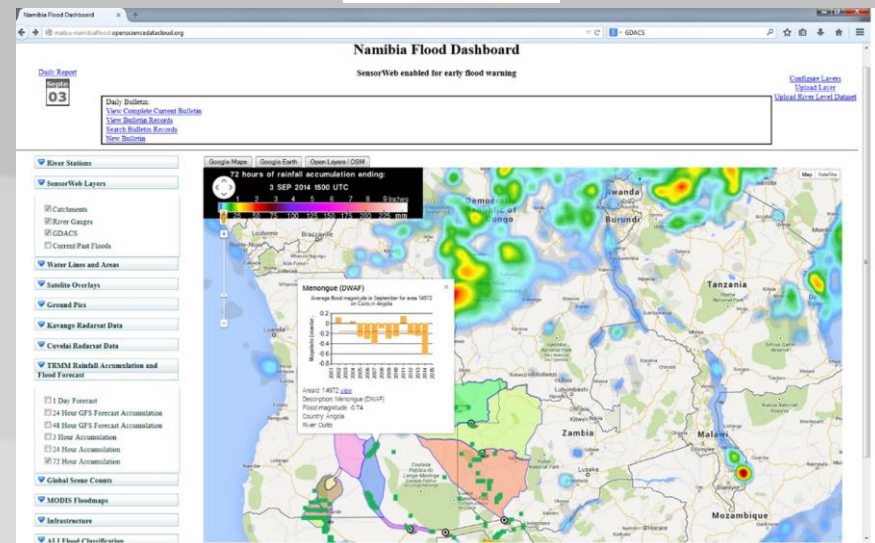
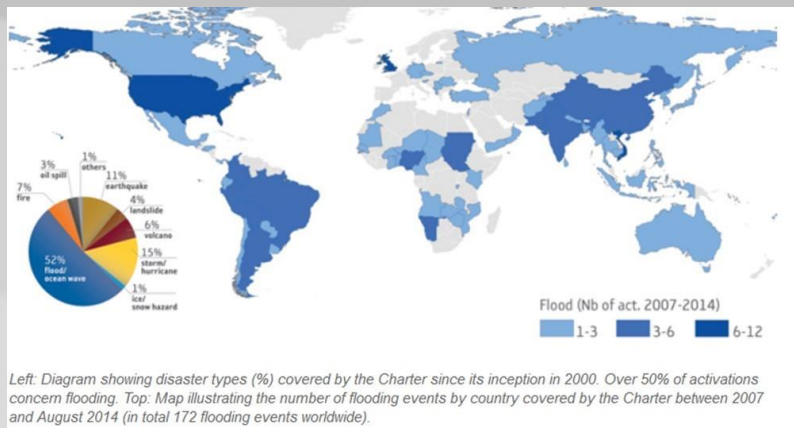
- ***Airborne Instruments***
 - UAVSAR – Radar
 - LVIS – Lidar
 - AMS, MASTER – Thermal Infrared
 - HIWRAP, APR2, HAMSR, HIRAD, PALS
 - MAPIR – Active and passive microwave
- ***Data processing, analysis systems, Data Centers***
 - EOSDIS-ESDIS
 - LANCE/NRT/DB/SPoRT
- ***Modeling and Analysis***
 - *Flood and Earthquake Models, Damage and infrastructure Maps, Day/Night and plum extent maps*
 - *Capacity Building*
 - *Response Exercises & Simulations*





International Coordination and Data Sharing

Group on Earth Observations
Committee of Earth Observing Satellites
International Charter



GEO Flood Task: Supporting access to a unified system of space data acquisition and delivery, models and mapping to support those affected by natural or man-made disasters

CEOS Flood Dashboard

<https://kubeworks.wixsite.com/argentina-summit>

En español



Strengthening Disaster Risk Reduction across the Americas

September 3-8, 2017 Buenos Aires, Argentina

A Regional Summit on the Contribution of Earth Observations



INTERCONTINENTAL HOTEL
BUENOS AIRES
Moreno 809, C1091AAQ
CABA Argentina
Phone: +54-11-43407170

TAKING PLACE

The Strengthening Disaster Risk Reduction across the Americas (DRRA) Summit affords a unique opportunity to strengthen our collective ability to meet the multiple challenges of disaster risk reduction (DRR) in the Americas and with an overarching approach to promote the use of earth observation (EO).

The Americas is particularly exposed and vulnerable to multiple hazards and intensive disaster risk. Recognizing the value of global collaboration, the Summit builds on the momentum and targets of the UNISDR Sendai Framework for Disaster risk Reduction 2015-2030, advances the outcomes of the Sustainable Development Goals (SDGs), and optimizes the societal benefits from the Group on Earth Observations (GEO). The Summit convenes stakeholders with specific attention to the social and cultural context of nations in the Americas.

Summit Goals and Getting Started



- **Establish and strengthen the Regional Community of Practice for Disaster Risk Reduction and Earth Observations by:**
 - Identifying key stakeholders role and interests
 - Building a comprehensive database of providers, partners, practitioners and users, including:
 - Federal, state, municipal and local authorities,
 - Academic institutions,
 - International and intergovernmental bodies (AmeriGEOSS, CEOS, OGC and GFP)
 - Sector and non-governmental organizations including Mercy Corp, Conservation International and Red Cross
 - Geospatial communities including OpenStreet map
 - In situ networks for hydro, met and geodynamicsP
 - Private sector and innovation communities
 - Global virtual networks including Water and UN Youth
 - Conservation and community groups
 - Decision and policy makers.
 - **Capture regional priorities, capacities and capabilities**
 - Recognize existing capacities and capabilities
 - Raise awareness of new and emerging earth observation and resilience capabilities
 - Share best and effective practices and promote learning
 - Identify effective partnerships, nascent capacity and earth observation opportunities
 - **Advance integrated regional and global work plans, demonstrations and pilot activities**

Days 1 and 2: Preparedness and Mitigation



- Plenary sessions, NASA Earth Science and Disaster Response; National to Regional capabilities and emerging satellites and other data sources
- Argentine and national experiences;
- Data providers from CEOS, AmeriGEOSS,
- Planners and framers from UNISDR, SDGs,
- Science and technical status from hydromet, global flood, geohazards tracks
- Data systems, standards and management
- Data quality and information systems
- Emergency management needs and a capabilities
- Resilience and community context
- Communications and dissemination capabilities
- Rapid mapping and information tools
- Community roles and youth networks



Day 3: Mitigation and Readiness



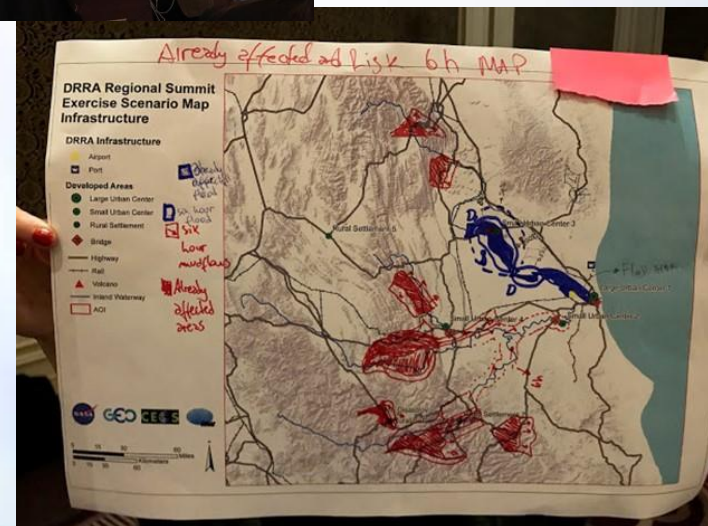
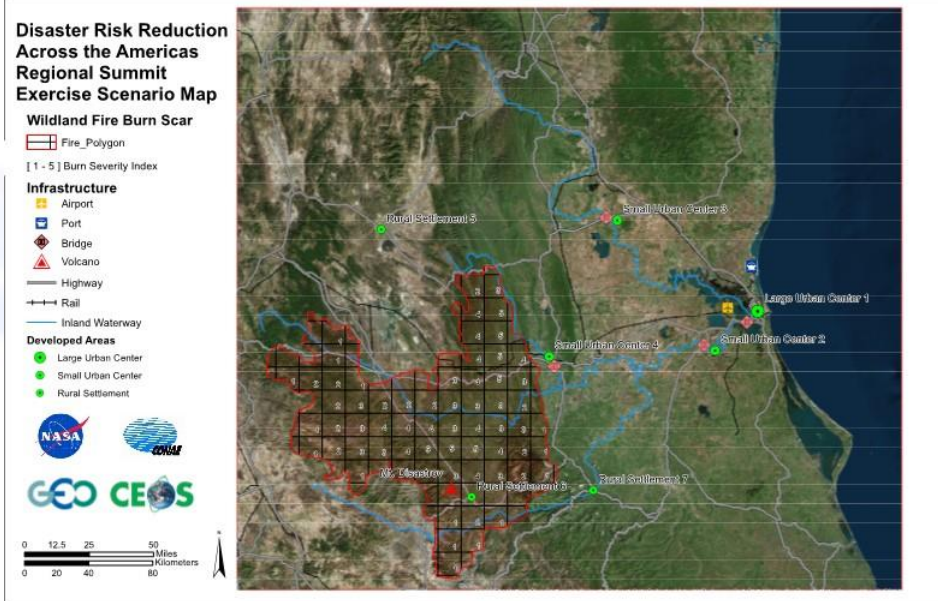
- Plenary on building capacity, humanitarian role and understanding maps and tools
- Raising awareness and specialized training
- Role of the International Charter and Copernicus Services
- Flight, drones and other observing systems
- Decision tools and virtual networks for mapping and sourcing
- Delivery of Disaster management and resilience services
- Interpretive Support and Shared knowledge
- Strengthening understanding of mutual roles and dependencies



Day 4: Disaster Strikes! A Scenario Driven Exercise

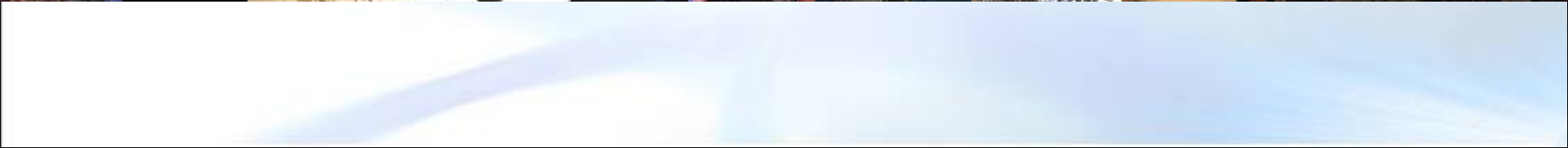


Disastrov has been wracked by a year long drought that culminated in wildfires just before monsoon season...





Summit Participants Pull Together to Save Disastrov



Day 5: Wrapping Up and Looking Forward



- Regional Work Plans

Participants crafted draft input to integrated Americas Regional Work plans incorporate earth observations, risk reduction and resilience building

Activity	Who	When/Where	Desired Outcome

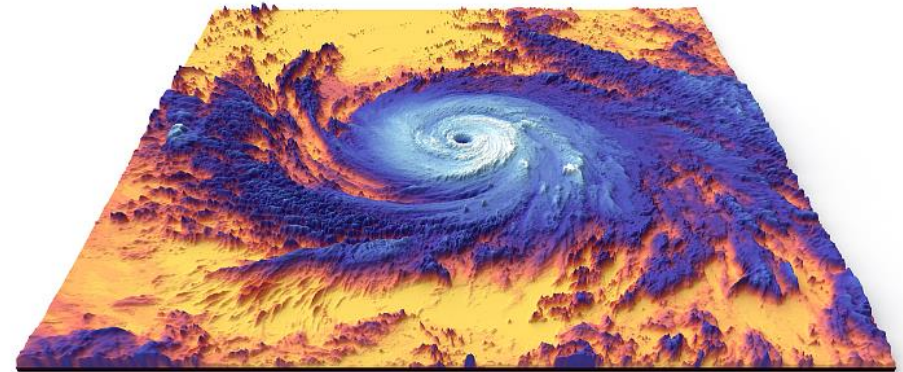
Activity	Who	When/where	Desired outcome
1. To include satellite information and tools in the Universities' curricula in Latin America and the Caribbean	AmeriGEOSS, NASA, NOAA, CIIFEN CEPREDENAC, ESPOL, REDULAC	ECUADOR, SECOND SEMESTER 2018	<ul style="list-style-type: none"> Satellite tools and information are used in the curricula of at least 4 different countries' universities More BSc graduates go for MSc in Satellites
2. To foster the interaction in the Climate Outlook Fora between information and forecast providers	AmeriGEOSS, NASA, NOAA, CIIFEN CEPREDENAC, ESPOL, REDULAC	COSTA RICA, FIRST SEMESTER 2019 (Quarterly meetings)	Better informed decision-makers Support for capacity building in Satellite management

ACTIVIDAD	QUIEN	CUANDO/DONDE	PRODUCTO
Teleconferencia de socialización y formulación de la propuesta.	<ul style="list-style-type: none"> AmeriGEOSS (Angelica Gutierrez) UNGRD (Lina Dorado, Paula Contreras) NASA (David Green) NOAA (Angelica Gutierrez) IGAC (TBD) 	Primera semana de octubre (Virtual).	Modelos digitales de elevación de la zona (1:2.000) Mapas de susceptibilidad y amenaza.
Evaluación de las herramientas existentes.	<ul style="list-style-type: none"> Academia Nacional de Ciencias USA (Laurent Augustine) SGC (Marta Calvache, Gloria Ruiz) IDEAM (Diana Quimbay) CMGRD Mocoa (TBD) Universidad Nacional de Colombia (Fernando Muñoz Carmona) USAID 	Primera semana de noviembre (Virtual)	Mapas de vulnerabilidad. Proceso de fortalecimiento institucional y Comunitario (comunicación, educación). Insumos para el Plan de Ordenamiento Territorial-POT. Aumento de la resiliencia (comunidad específica).

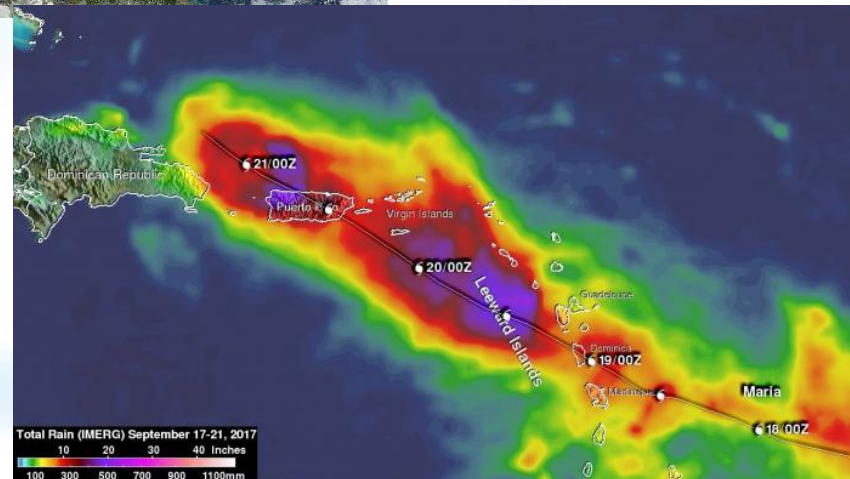
Things LANCE can do to better serve NASA's Disaster Response Efforts...



Hurricane Maria Case Study

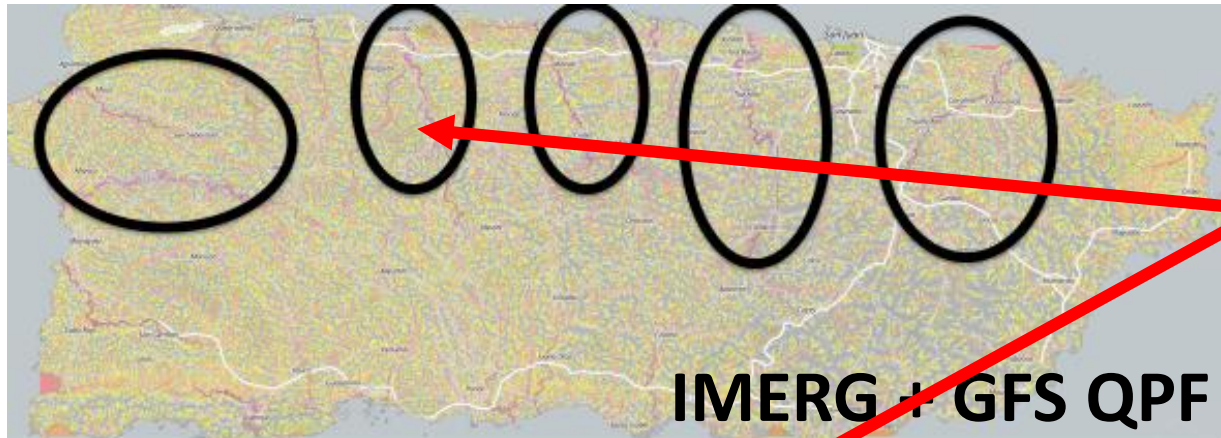


Thermal Signature
Colder Warmer

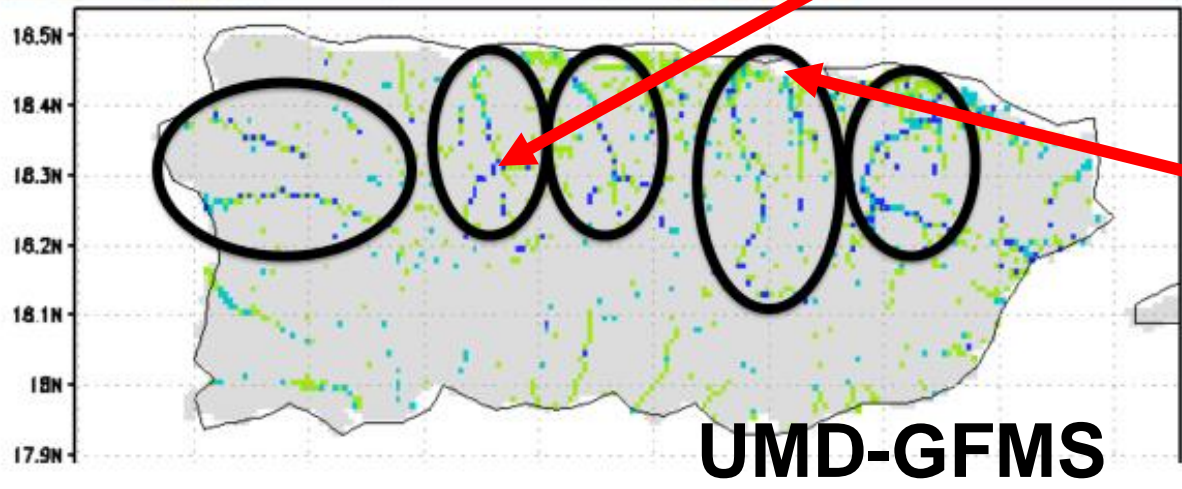


NASA's Integrated Multi-satellitE Retrievals for GPM (IMERG) data were used to estimate the total amount of rain that Hurricane Maria dropped from September 17 to early September 21, 2017.

Hurricane Maria Flood Impacts (24 hours before landfall)



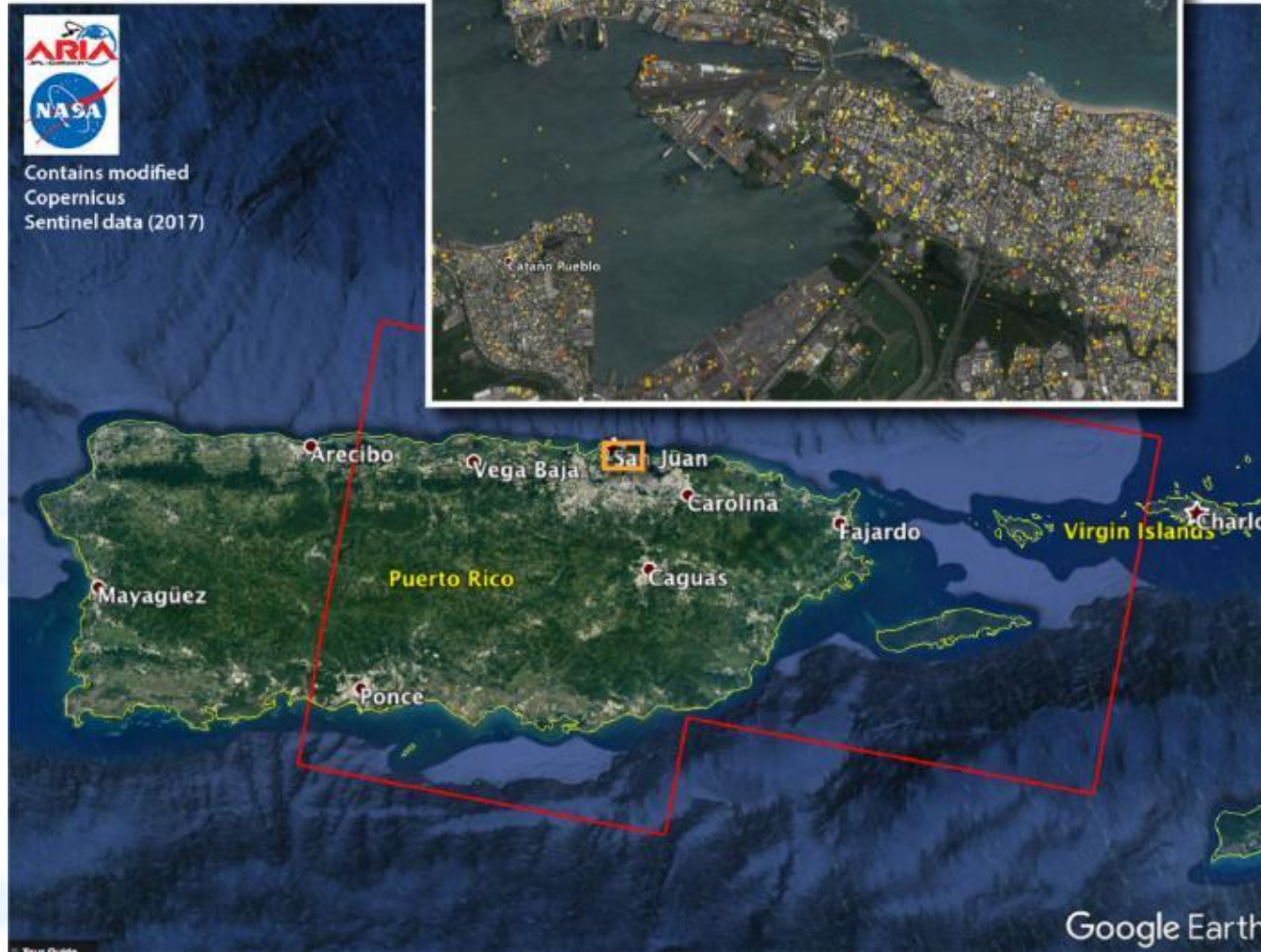
Lago Guajataca
Dam Breach



Cataño

*Usually we are emailed 2-5 flood products and we rarely know which one is best, or which one to 'trust'.
(Andrew Kruczkiewicz -- International Red Cross)*

Hurricane Maria: Infrastructure Damage Proxy Maps (DPM)



I'm trying to understand how to map the Aria DPM for PR into specific categories of damage (Chris Vaughn – FEMA).

Hurricane Maria: Electric Infrastructure Maps

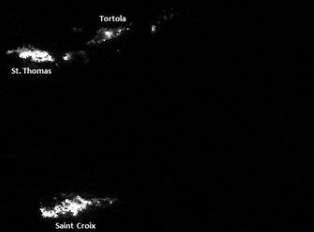
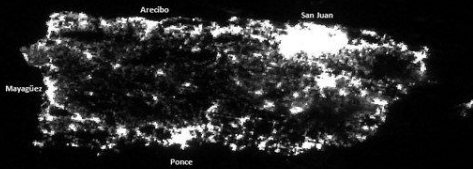


SPACE.com
NEWS TECH SPACEFLIGHT SCIENCE & ASTRONOMY

Space.com > Science & Astronomy

Puerto Rico's Dramatic Power Loss Shown in Satellite Photos

Before After



VIIRS – Day Night Band
24 July 2017, 2:00 am AST



VIIRS – Day Night Band
25 September 2017, 2:19 am AST



Space.com -- On Sept. 25, NOAA tweeted an additional before-and-after satellite image of Puerto Rico at night. The images provide a glimpse at the extensive loss of power throughout the island. NOAA representatives did not say whether the images had been processed, and whether all of the light shown in the images is human-produced.

<https://www.space.com/38339-puerto-rico-power-loss-satellite-images.html>

Hurricane Maria: Electric Infrastructure Maps

Heavy Clouds were present across Quebradillas (shown below), Arecibo, and Isabela sectors; areas that are currently undergoing evacuation due to the rupture of the Guajataca Dam.

NOAA/CIMMS maps are being misinterpreted as if these areas have been evacuated (because no lights are present); when the observed change is the result of cloud obscuration.



sport_dnbir_20170925.png

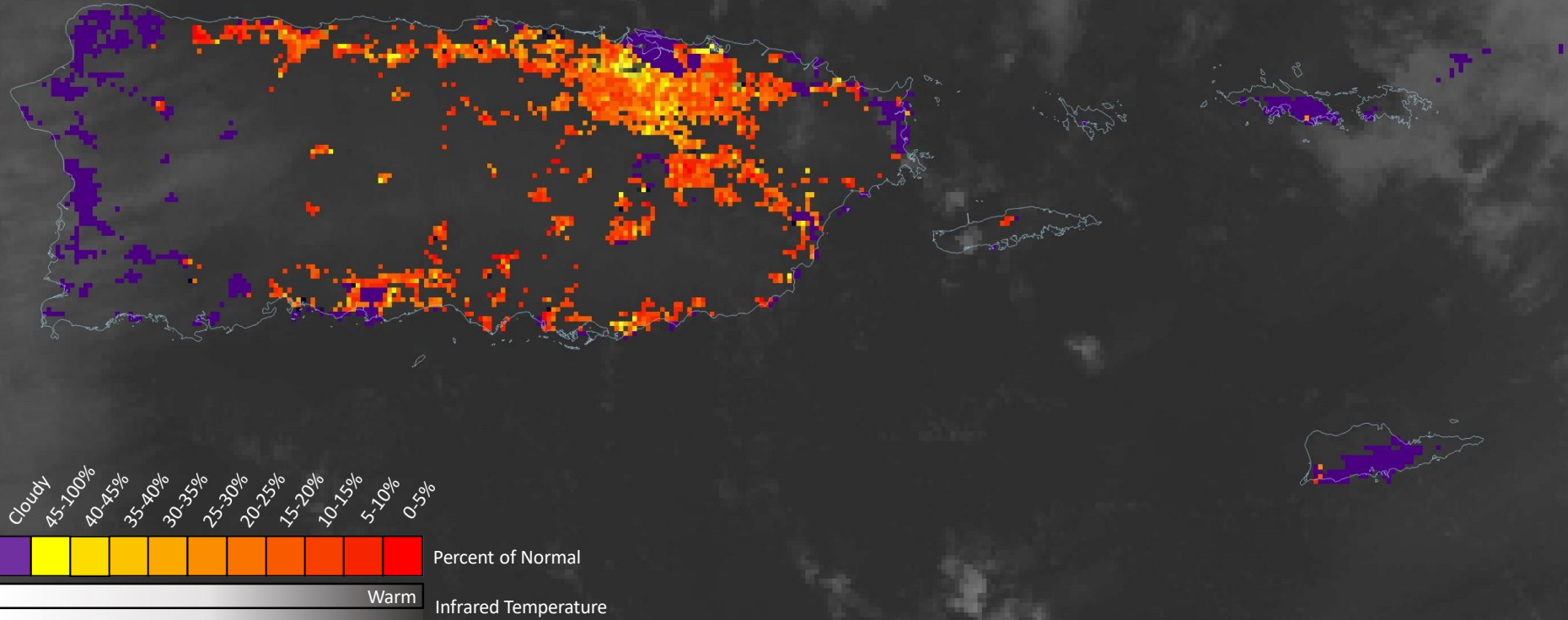


Hurricane Maria: Electric Infrastructure Maps



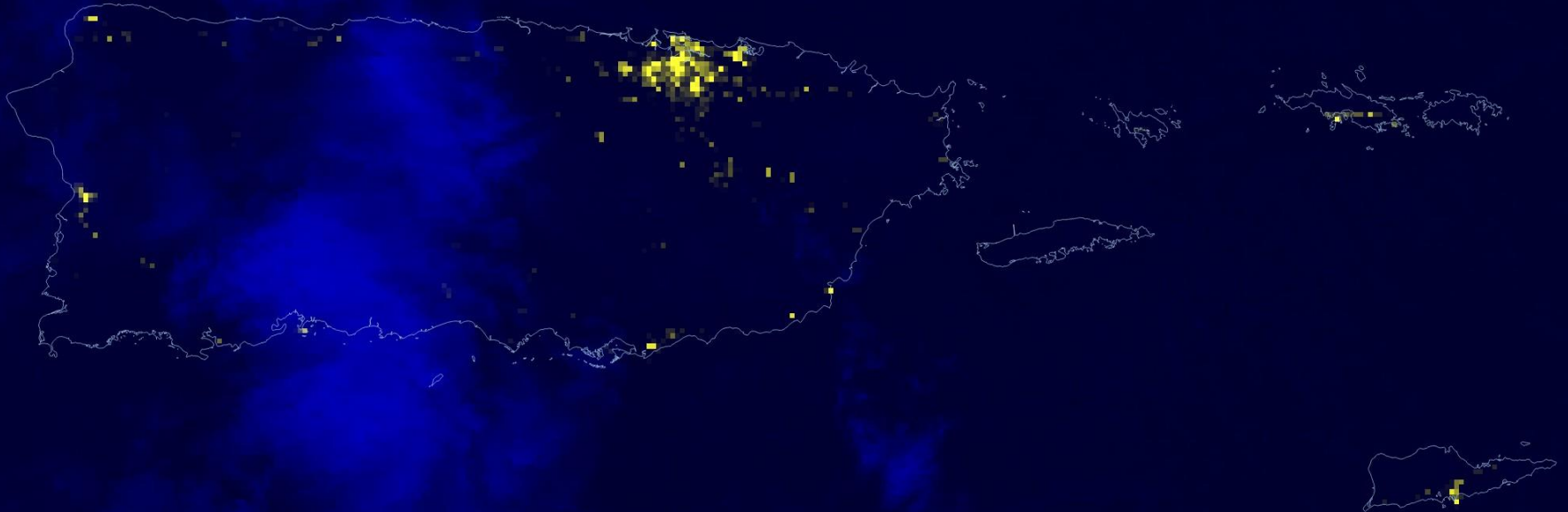
SPoRT DNB/DNB/IR False Color Composite on September 27, 2017

Hurricane Maria: Electric Infrastructure Maps



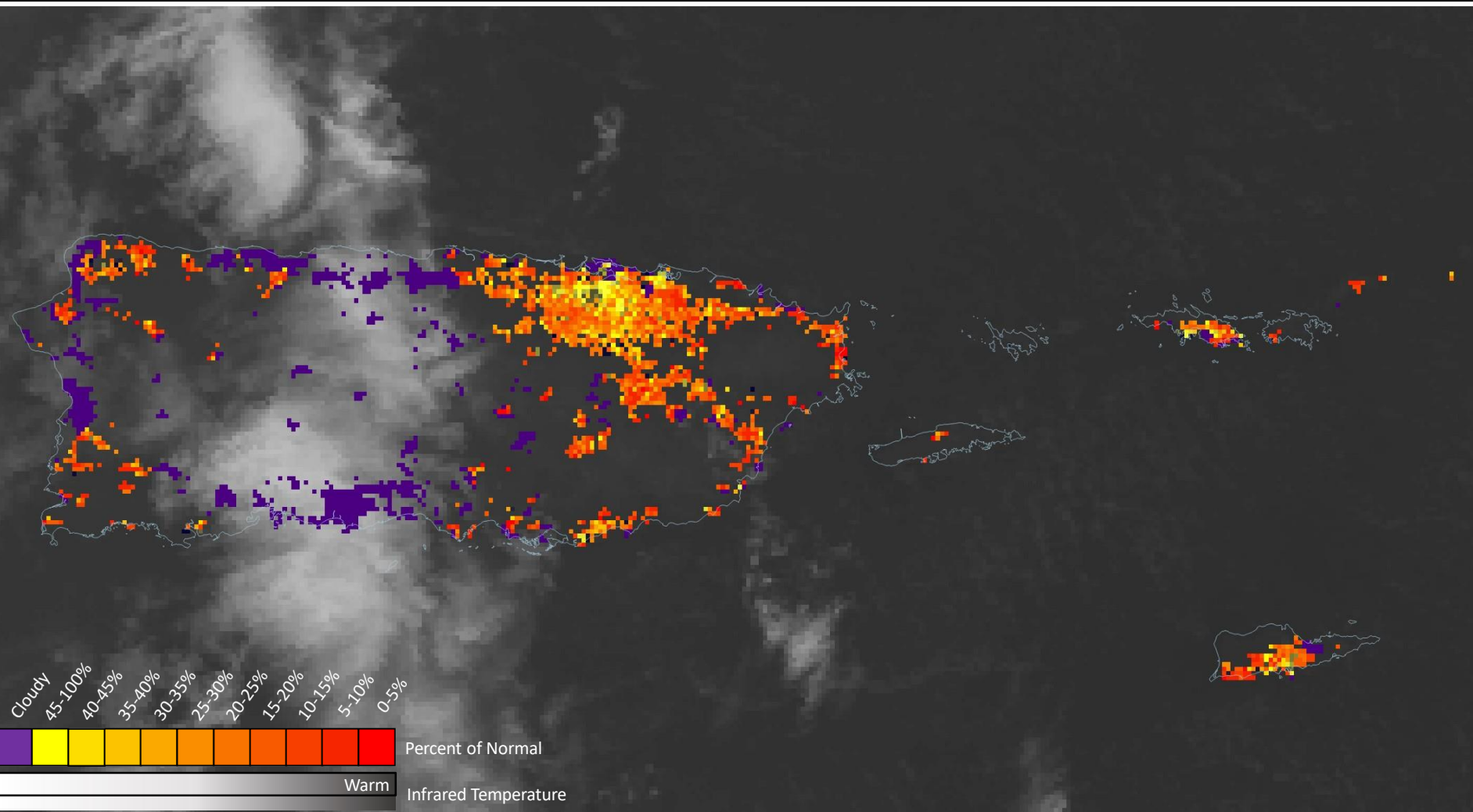
Percent of Normal Product using Moon Free Mean and M15 Brightness Temperatures on September 27, 2017 Thresh: 3 nW

Hurricane Maria: Electric Infrastructure Maps



SPoRT DNB/DNB/IR False Color Composite on September 28, 2017

Hurricane Maria: Electric Infrastructure Maps

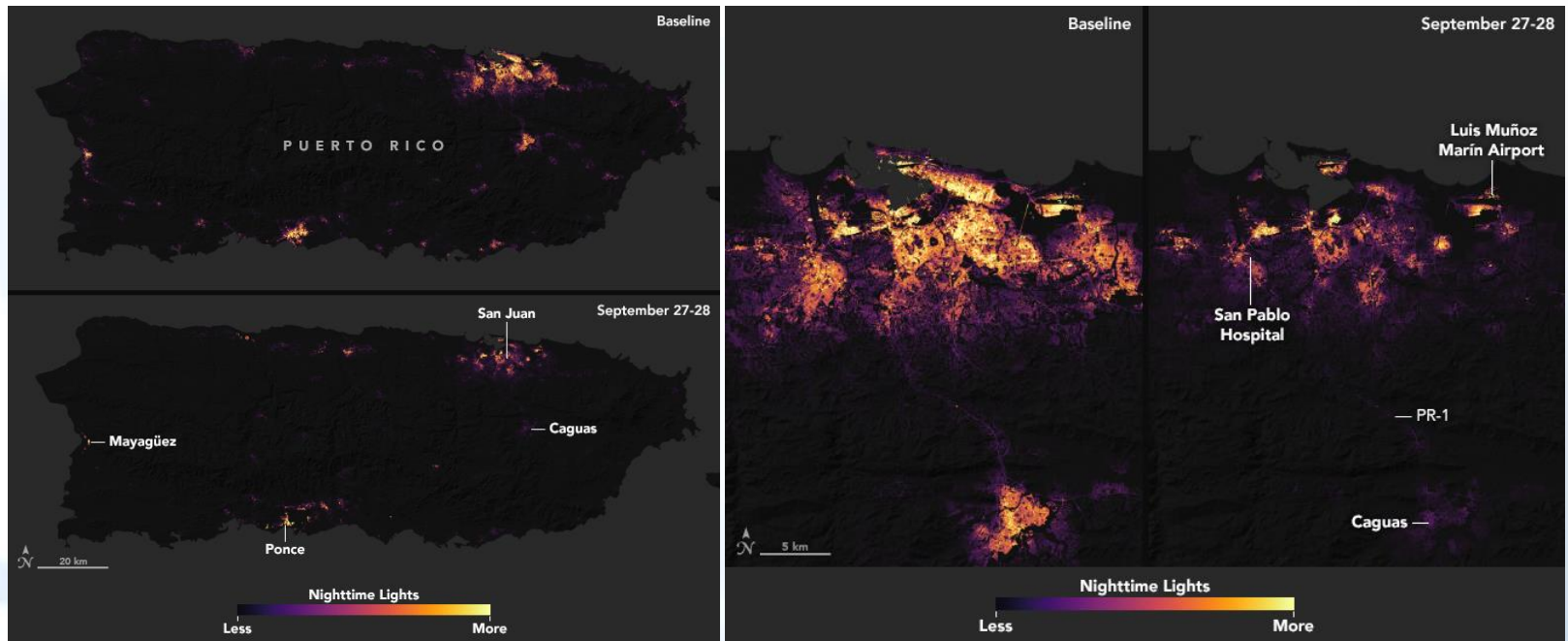


Percent of Normal Product using Moon Free Mean and M15 Brightness Temperatures on September 28, 2017 Thresh: 3 nW

TECNOLOGÍA

La importancia de la NASA en la recuperación de Puerto Rico

Mediante imágenes de satélite tomadas antes y después del huracán María, la organización colabora con los grupos de rescate



A team of NASA scientists processed and corrected the raw data to filter out stray light from the Moon, fires, airglow, and any other sources that are not electric lights. Their processing techniques also remove as much other atmospheric interference—such as dust, haze, and thin clouds—as possible. (El Nuevo Día, Puerto Rico)



- **Focus on Impacts: Flood Extent, Infrastructure Damage (Urban built-up and other critical services, e.g., energy, transportation, telecommunications).**
- **Have a capacity to generate custom or experimental NRT products using multiple sources of data (VIIRS + Landsat/Sentinel + SAR + GIS Layers).**
- **Recognition of, and responsiveness to, the diversity of users and their needs.**
- **New motto for LANCE-NRT:**

We'd rather be right than first.



ORGANIZATION DISASTERS PRODUCTS RESOURCES

January 11, 2017

ARIA Flood Proxy Map for Floods in Northern California and Nevada

ARIA Flood Proxy Map for the floods in Northern California and Nevada on January 8th, 2017.

Flood Proxy Map (FPM) covering an area of 155-by-224 miles (250-by-360 km), derived from Sentinel-1's pre- (2016-12-15 6 PM PST) and during-the-event (2017-01-08 6 PM PST)...

[Read More](#)

Recent Disasters

- California Flooding 2017
- Alaska's Bogoslof Volcano Eruption
- Thailand Flooding 2017
- Argentina Wildfires 2016/17
- Hurricane Matthew 2016
- Typhoon Megi 2016
- Puerto Rico Blackout 2016
- Amatrice Italy Earthquake 2016
- Louisiana Flooding 2016
- California Wildfires 2016

[View All](#)

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[Learn More](#)

Community

- FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)
- PACIFIC DISASTER CENTER
- USAID FROM THE AMERICAN PEOPLE

[More...](#)

Organization

The Team

- Org Chart
- Disaster Response Coordination Team
- Monthly Status Reports (MSR)
- Contact Us

NASA Organizations:

- NASA HQ
- NASA Applied Sciences
- NASA Earth Science

[More...](#)

Resources

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Program: <http://appliedsciences.nasa.gov/programs/disasters-program>