# Panel III: Data and Earth Observation for Decision-Making

## Lessons Learned from the Earth from Space Institute's Inaugural Symposium

**Dr. Miguel O. Román**

Universities Space Research Association

The National Academies of SCIENCES ENGINEERING MEDICINE

Advancing Urban Sustainability in China and the United States

#GlobalGoals

More than **17 million** people are at risk of being displaced by floods each year.

SUSTAINABLE DEVELOPMENT GOALS

UNDRR
UN Office for Disaster Risk Reduction

13 CLIMATE ACTION

Source: Global Report on Internal Displacement, 2019

Investing in Disaster Risk Reduction is a Pre-condition for Developing Urban Sustainability

# Making Communities More Resilient to Extreme Flooding

Universities Space Research Association (USRA)

Earth from Space Institute

# By the Numbers

**160** attendees

**95** organizations

**14** sessions

**3** plenary addresses

# Session Breakdown and Linkages to Urban Sustainability

Science & Engineering

Flood Risks & Policy

Visualization & Media

Community Partnerships

- Building Resiliency in the State of Maryland
- Monitoring Flood Dynamics Using Next Generation Satellite Data
- Compound Flooding: Use Cases, Methods, and Challenges
- Geospatial Data Analytics: Flood Insurance, Building Codes and Zoning
- Understanding the Relationship Between Extreme Precipitation and Flood Risk
- Flood Risk Communications: What Information Do Users Need?
- Flood Forecasting from Local to National Scales
- Visualizing Flood Risk and Uncertainty
- Coastal Risk Reduction and Resilience
- What Does Resilience Mean in the Flood Policy Context?
- The Role of Newsrooms and Data Journalism in Improving Perceptions of Flood Risk
- Nature-Based Solutions as a Component of Flood Risk Management
- Flood Resiliency in Practice: How Corporate Responsibility and Charity Can Pivot to Sustainable Disaster Philanthropy
- Flood Risk Management in Rapidly Urbanized Areas



Symposium Program and Summaries: https://www.hou.usra.edu/meetings/efsi2019/agenda/

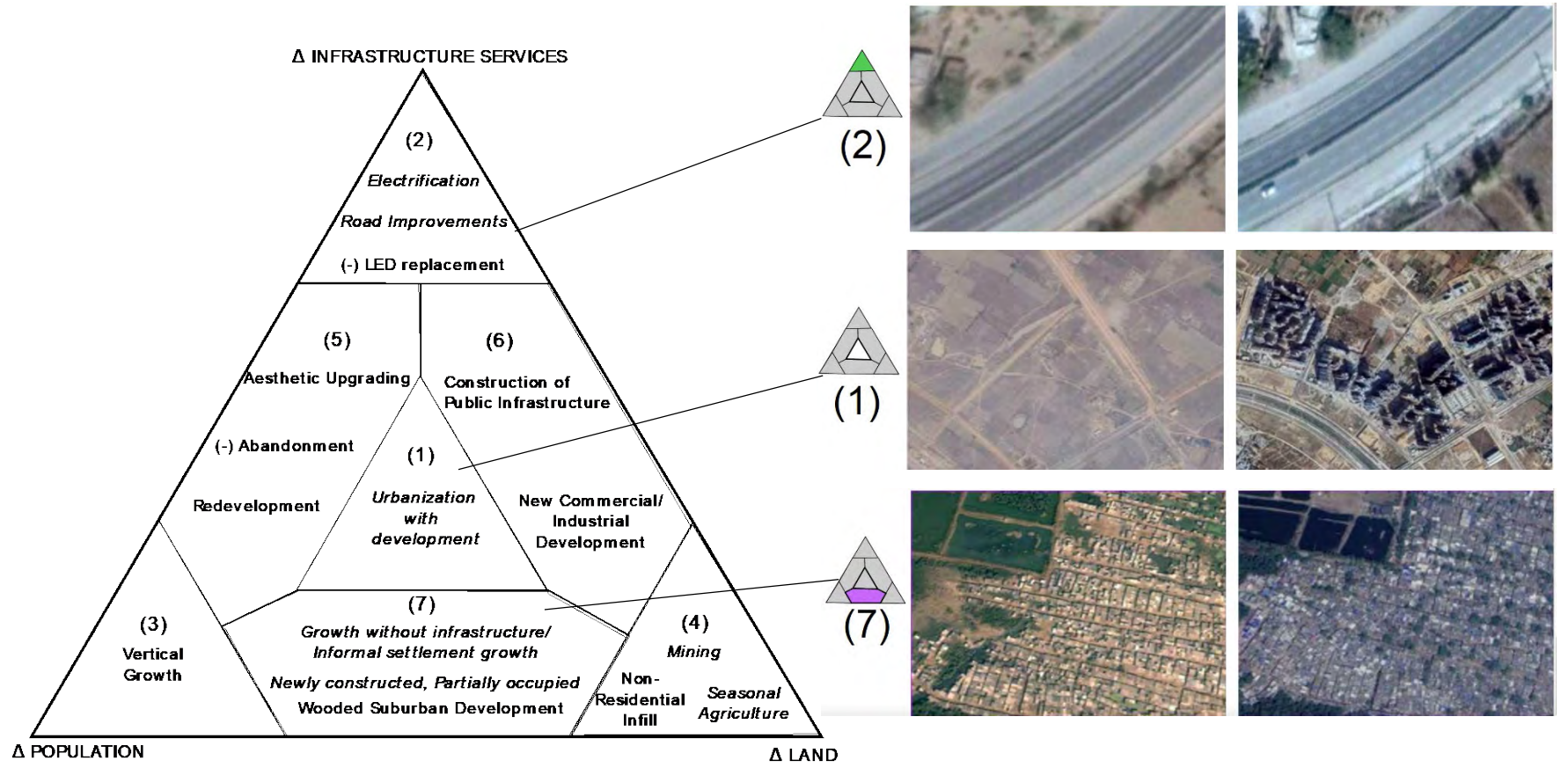
# Optimizing the Urban Dividend

https://www.africancentreforcities.net/

- Urbanization can present both challenges and opportunities for flooding.
- Can be defined and quantified through multiple lenses.
- Risks can propagate downstream due to new impervious surfaces.
- **Investment in "Urban 2.0" data and analytical tools is needed, specifically locally.**

# Characterizing Urban Infrastructural Transitions for the SDG's Using Multi-Temporal Land, Population, and Nighttime Light Data

Eleanor C. Stokes and Karen C. Seto, RSE, DOI:10.1016/j.rse.2019.111430




Though urbanization is often linked to development gains, some regions in Asia, Latin America, and Sub-Saharan Africa have grown in urban population, while remaining bereft of basic services like reliable electricity. Daytime optical remote sensing has tracked urban land cover change for decades, but few studies have monitored whether infrastructure is keeping pace with demographic and land transitions. This study fuses multi-temporal population and land data with nighttime lights data, derived from the Suomi-NPP VIIRS Day Night Band, classifying different types of urban development processes in India and the US.

# Characterizing Urban Infrastructural Transitions for the SDG's Using Multi-Temporal Land, Population, and Nighttime Light Data

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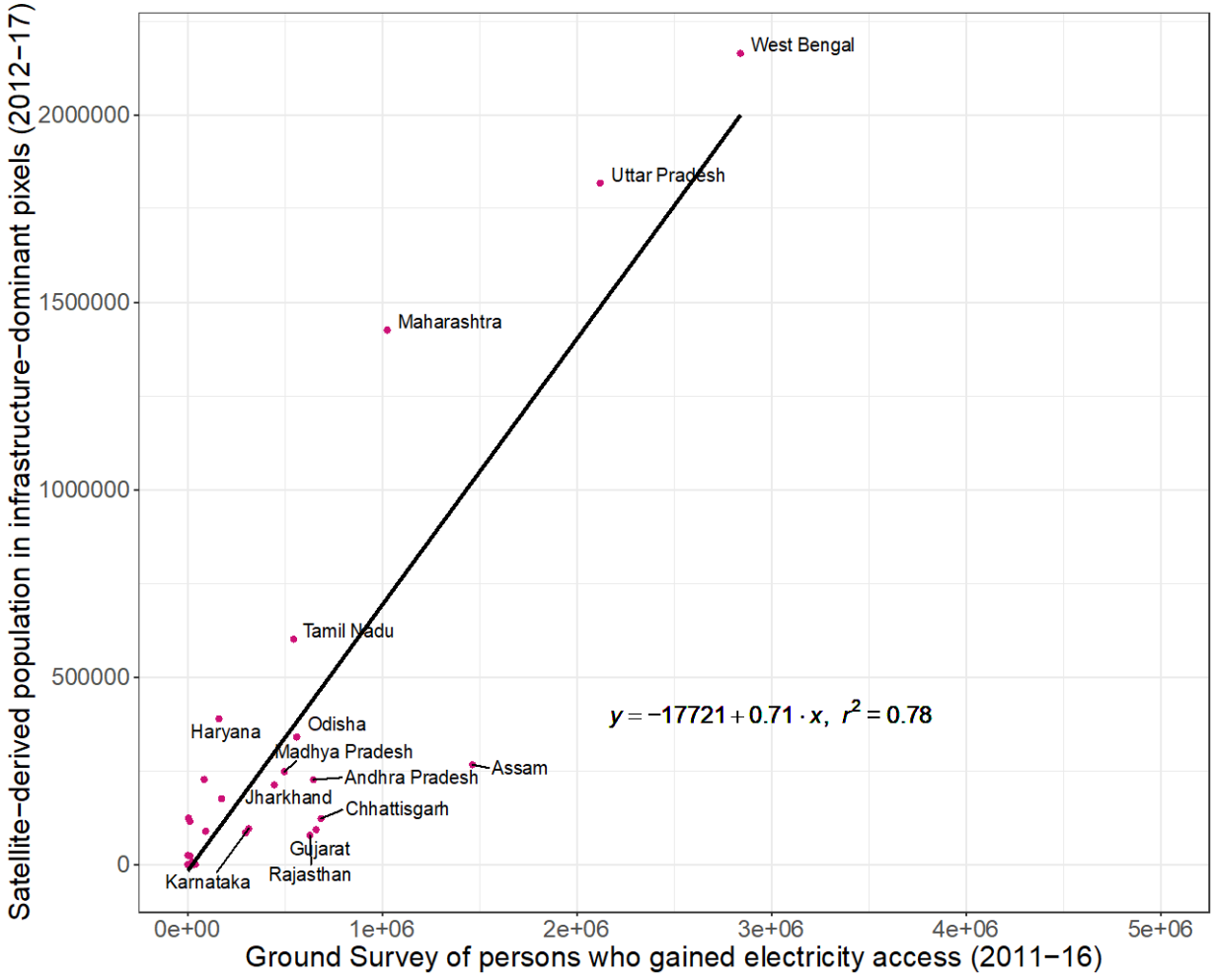
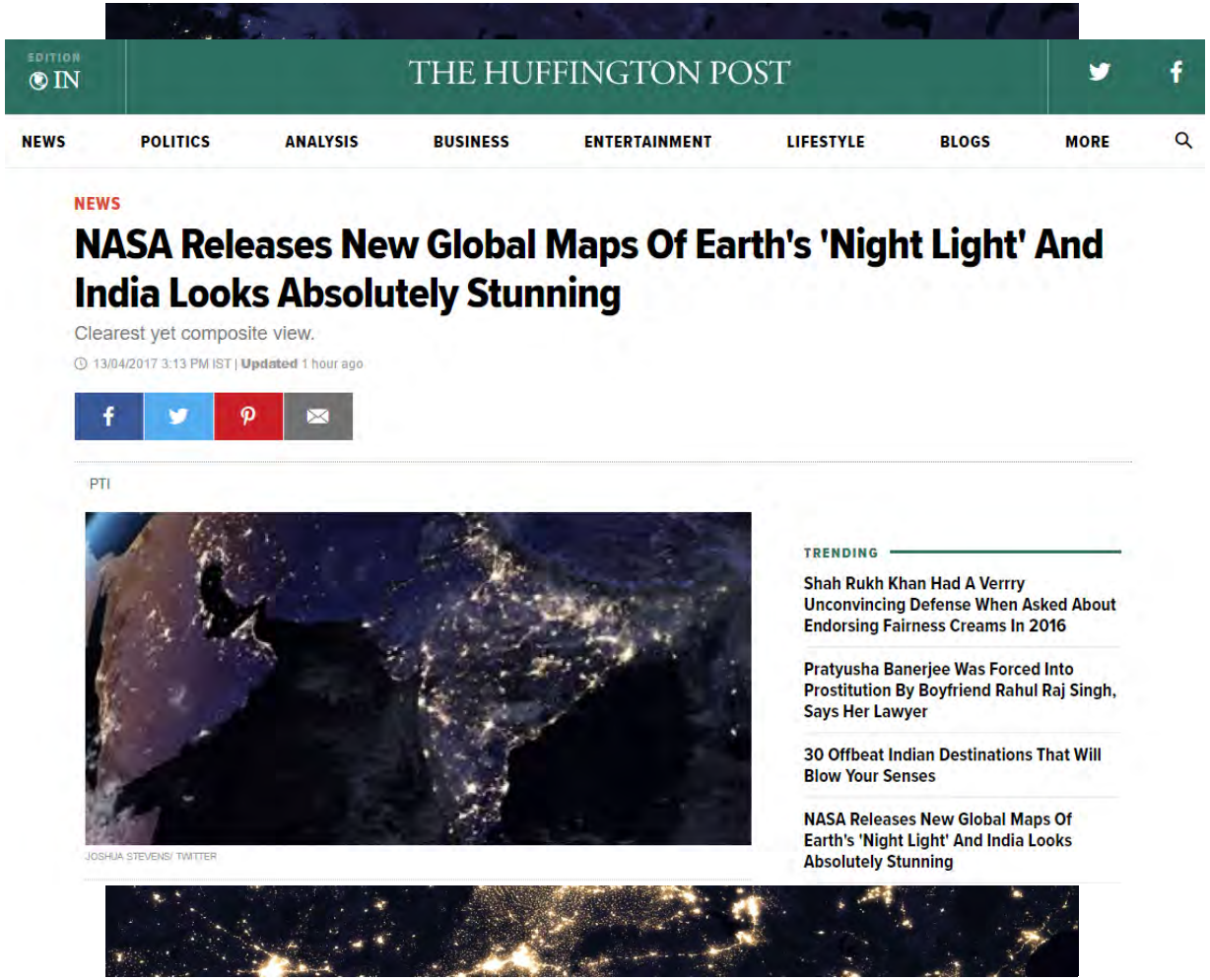
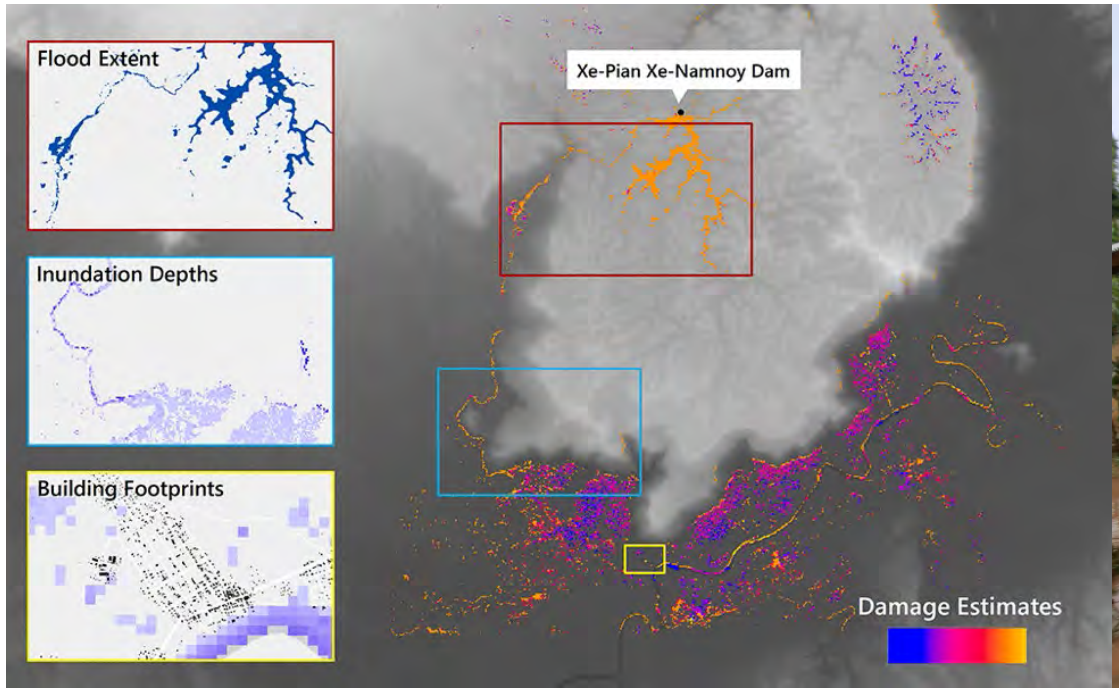



The new classes developed relate directly to human well-being as they describe when infrastructural transitions have kept pace with land and demographic transitions. In India, the class "electrification" tracks the national electrification projects in West Bengal and Uttar Pradesh over the past decade. Regression results above show that estimates of rural population gaining access to electricity between 2011 and 2017 based on the remote-sensing classification closely match estimates based on ground surveys.

## Socioeconomic Impact Evaluation for Near Real-Time Flood Detection in the Lower Mekong River Basin

*Hydrology* **2018**, *5*(2), 23; https://doi.org/10.3390/hydrology5020023



Estimates of flood inundation depths were overlaid onto local land cover, population density, and infrastructure data to produce provisional estimates of persons affected and flood damages (Credit: Perry Oddo and John Bolten, NASA/GSFC)

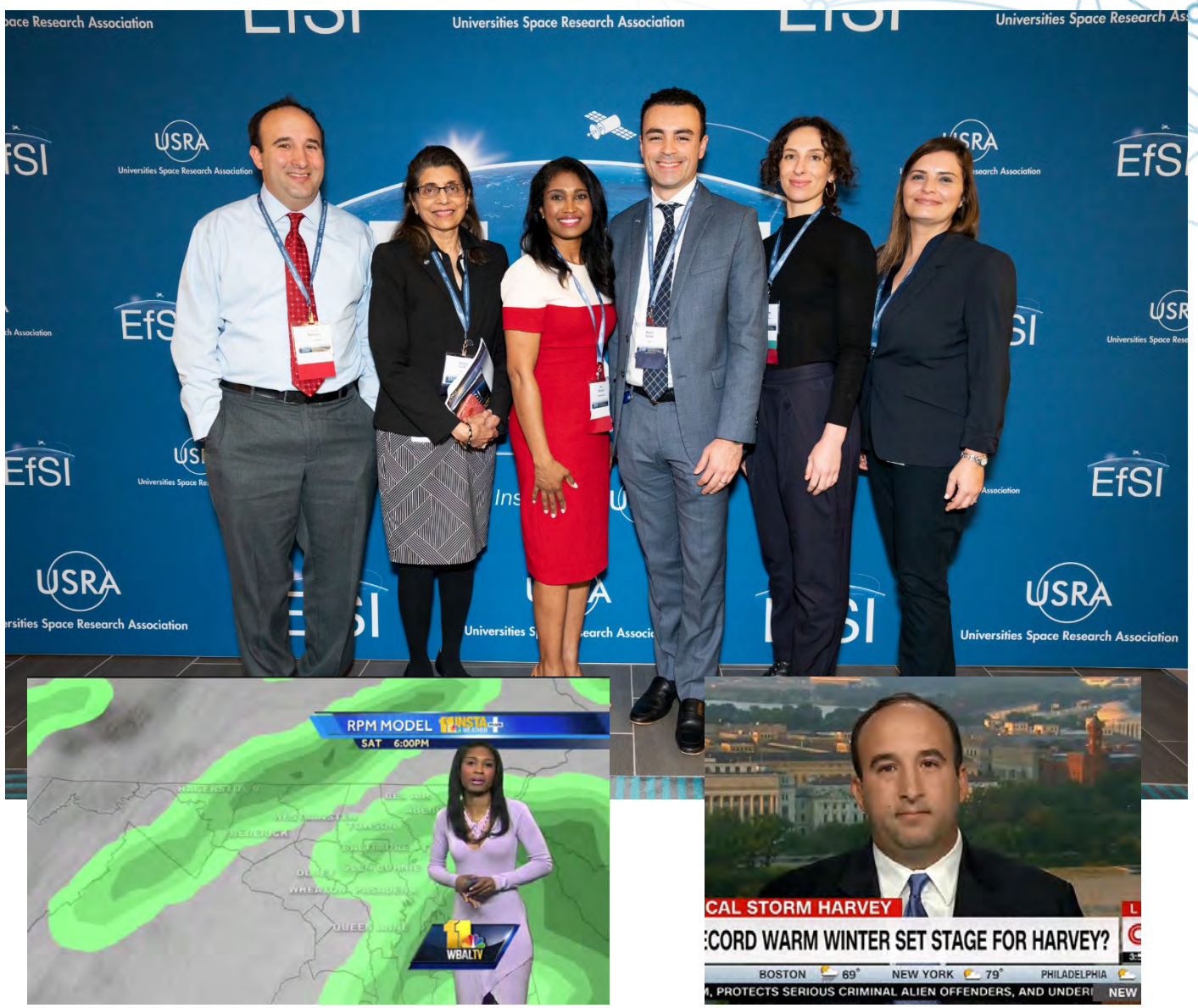
- Populations and vulnerability are dynamic – data has trouble keeping up.
- More information needed on human scale (census) and ground truth.
- Need to contextualize data for each region to understand flood impacts.
- Research on trade networks, resource flows, and interactions needed.

# EfSI-2019 Symposium: Key Takeaways

1. Communication is Key
2. Consider Flooding as a System
3. Visualizations are a Powerful Tool
4. Find the Right Data and Apply It
5. Resilience through Partnerships

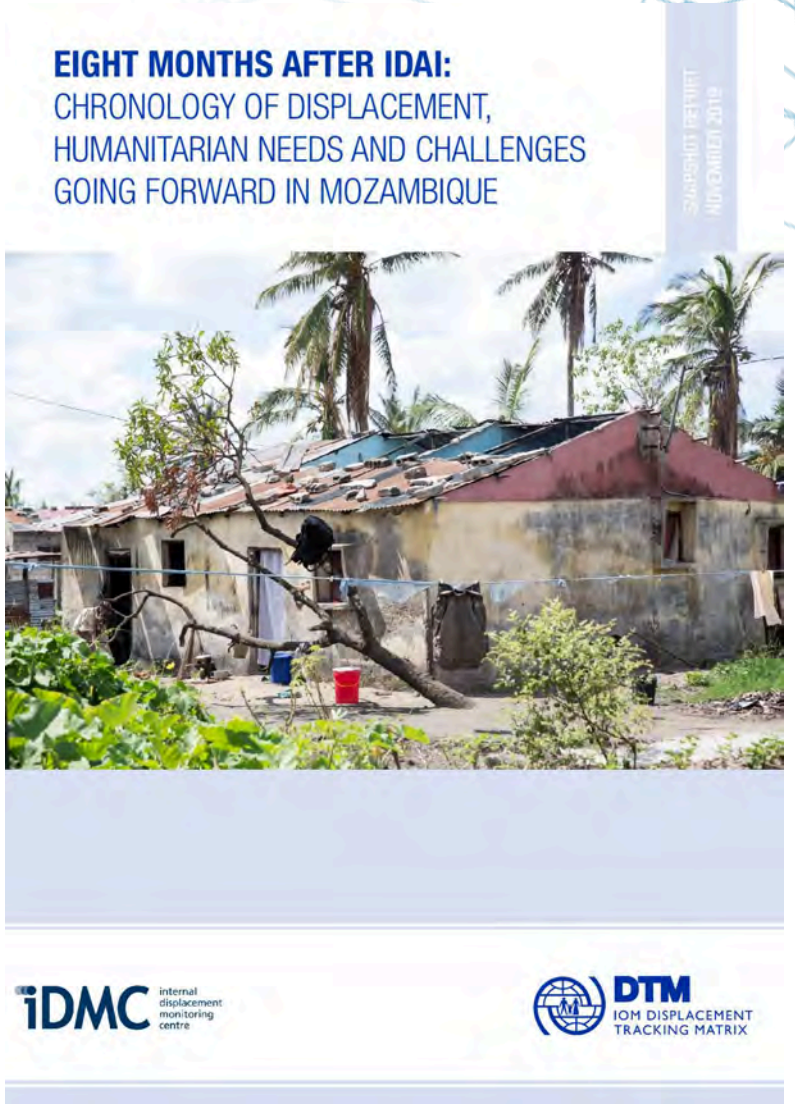
# Communication is Key

- The media plays a central role in influencing how people obtain, understand, and apply information about flooding.
- In a session on Newsrooms and Data Journalism, panelists expounded on ways to adapt messaging according to the timescale and needs of an audience.
- A local weather forecast with updates on current road conditions may be meant for immediate consumption, whereas an article about climate change may be effective long after it's published.




https://www.wusa9.com/weather
https://www.washingtonpost.com/news/capital-weather-gang/

# Visualizations are a Powerful Tool

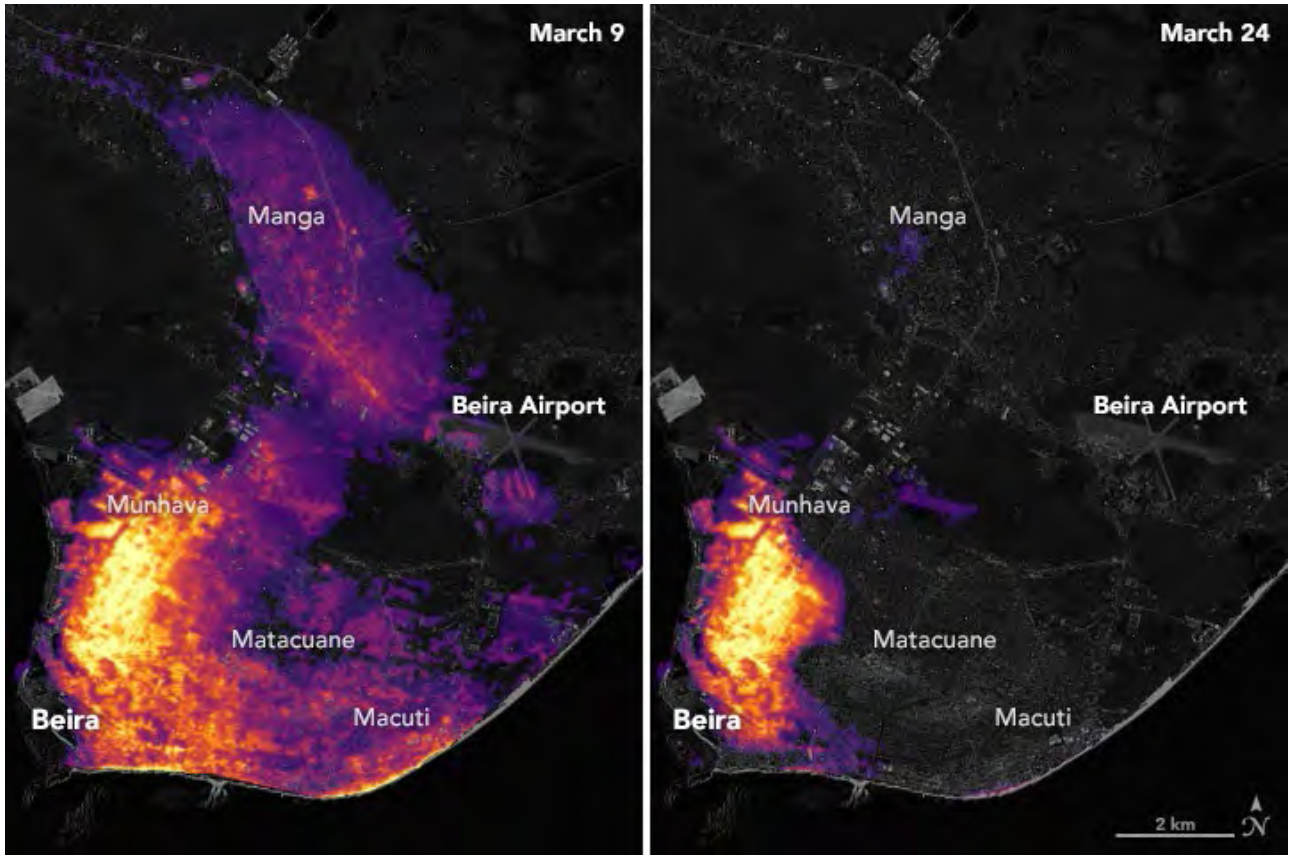


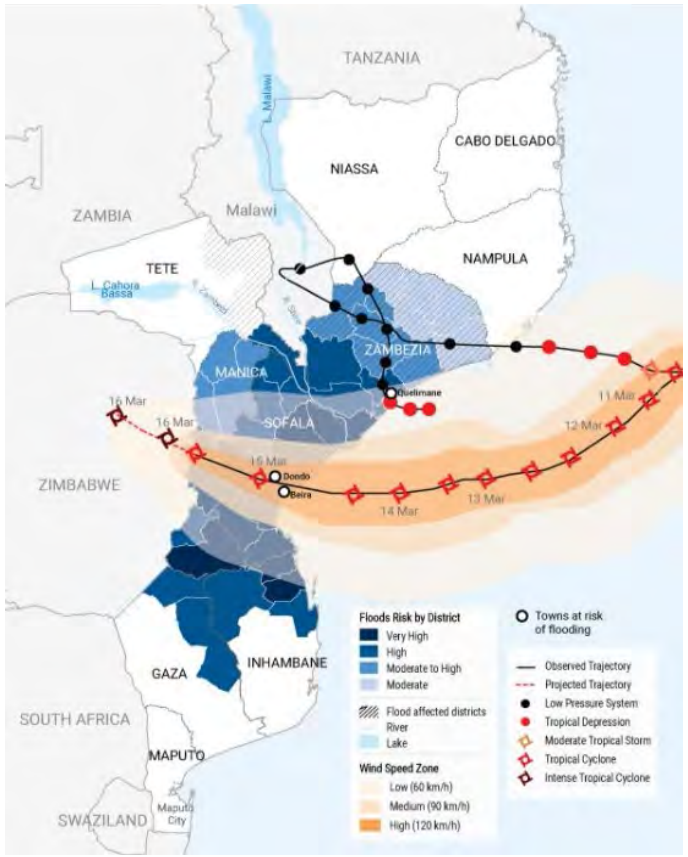

http://www.internal-displacement.org/publications/eight-months-after-idai-chronology-of-displacement-humanitarian-needs-and-challenges

# Advanced analysis of displacement based on NASA's Black Marble

Markus Enenkel, Ranjay Shrestha, Eleanor Stokes, Miguel Román, Zhuosen Wang, et al. 2019

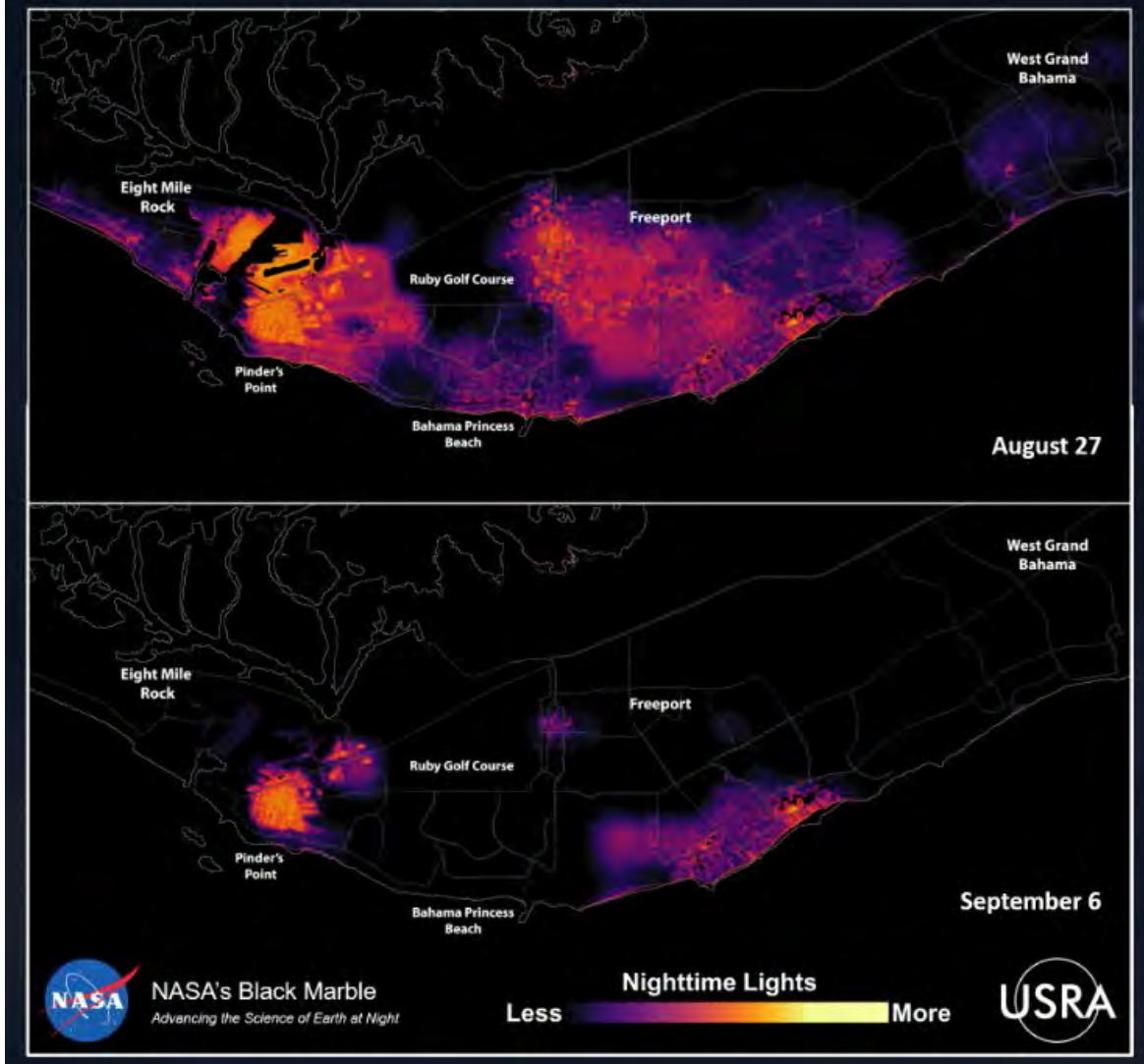
IBM Journal of Research and Development , DOI: 10.1147/JRD.2019.2954404




This study aimed to support the monitoring of displacement via satellite-derived observations of night time lights (NTL) from NASA's Black Marble product suite along with an SMS-based emergency survey after cyclone Idai had made landfall in Beira (Mozambique) in March 2019. Information about anomalies in NTL has the potential to support humanitarian decision-making via estimations of people affected or the coordination of rapid response teams. We found that around 90 percent of Beira's power grid had been affected. In collaboration the Internal Displacement Monitoring Center (IDMC) we used these findings to establish a framework that links NTL observations with existing humanitarian decision-making workflows to complement ground-based survey data and other satellite-derived information, such as flood or damage maps.

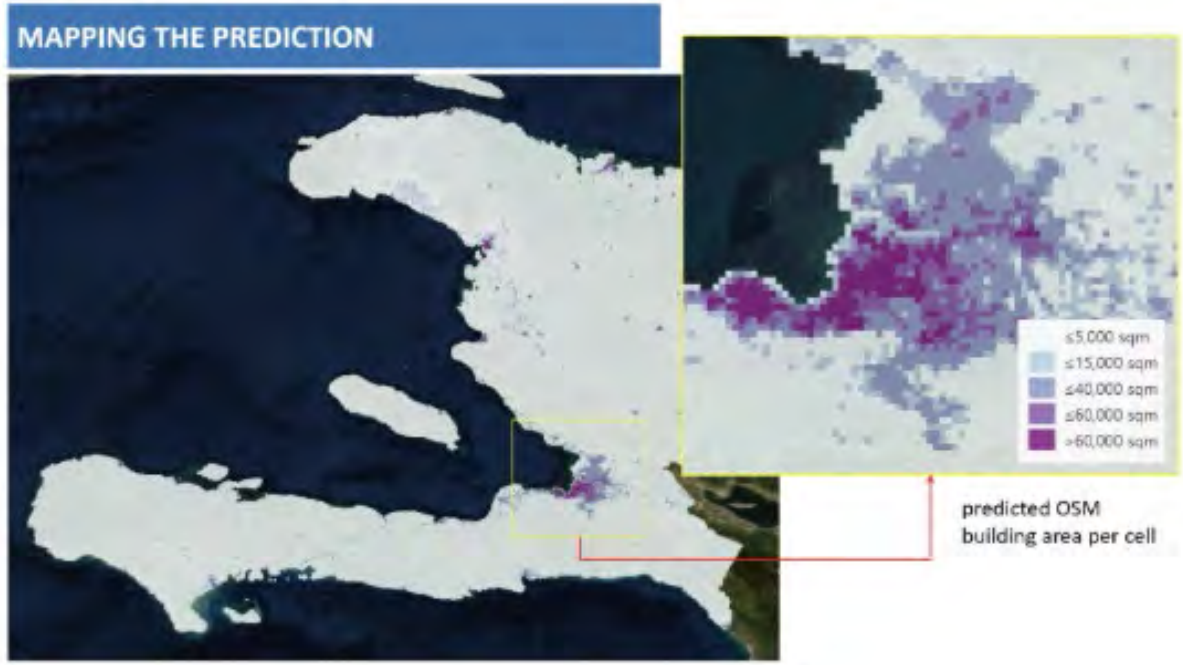
# Tracking Displaced Refugees to Help Deliver Aid and Services

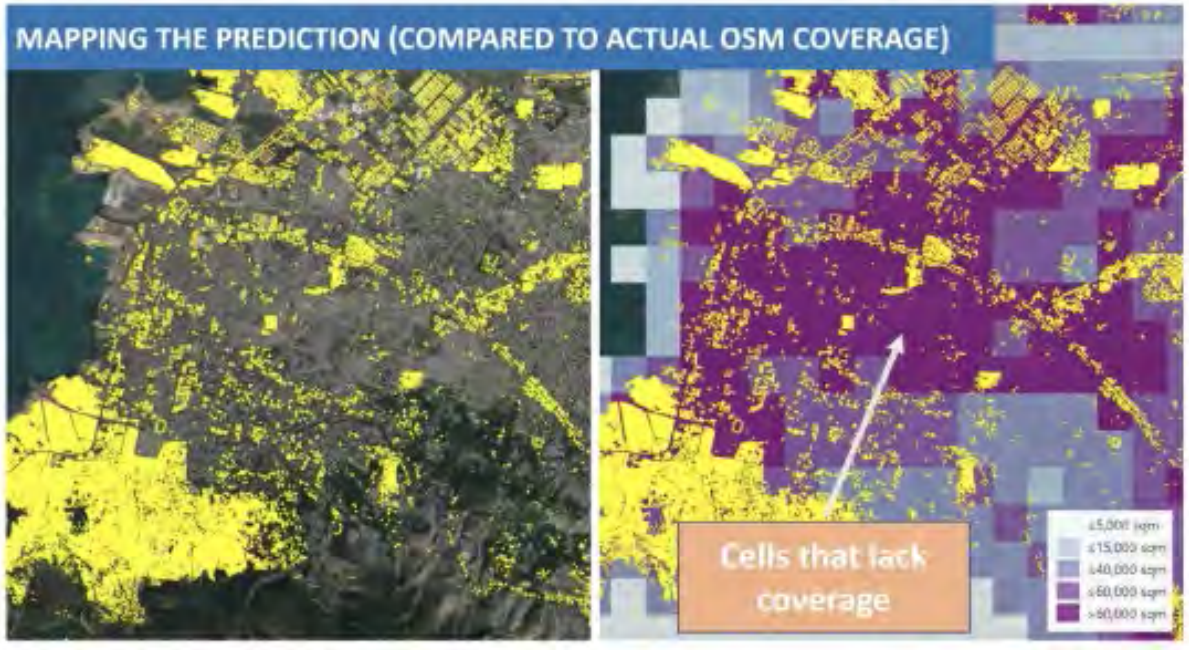


https://www.padf.org/news/padf-launches-hurricane-dorian-bahamas-recovery-campaign-accepting-donations

# Find the Right Data and Apply It

## Identifying gaps in OpenStreetMap coverage through machine learning

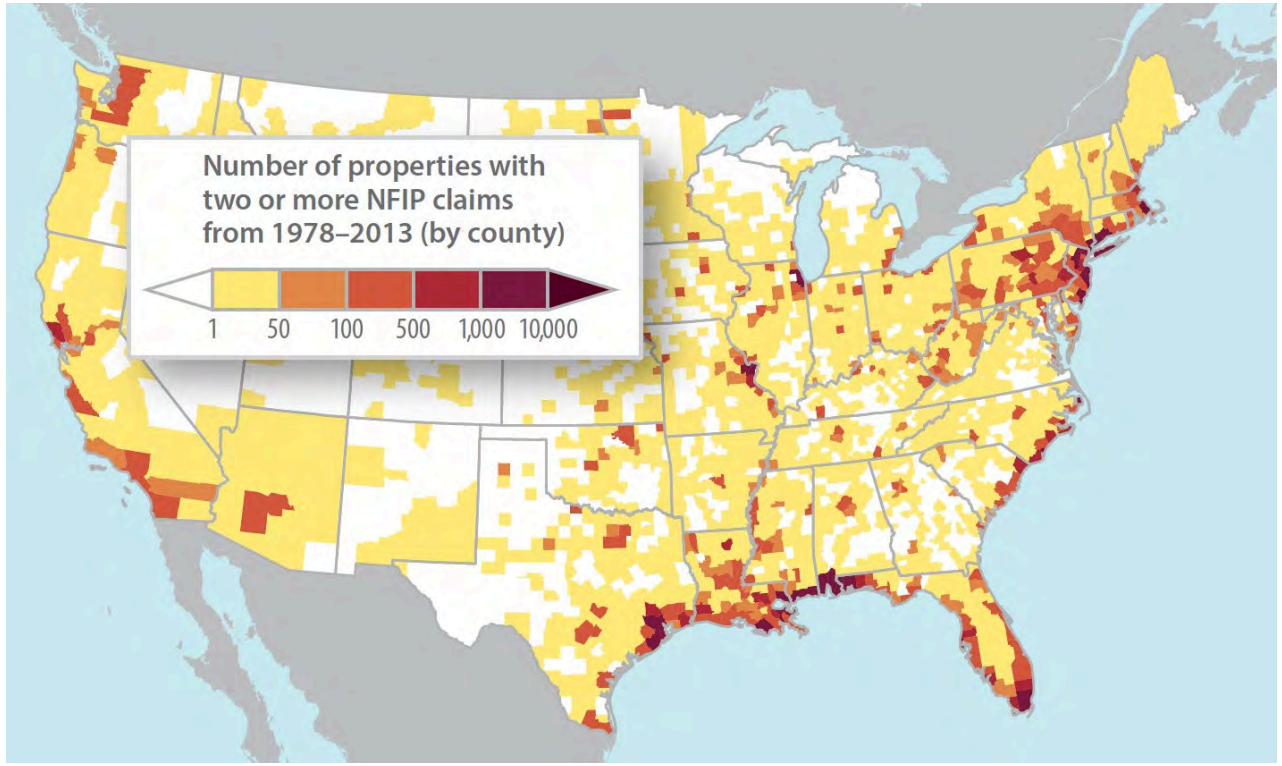



**Goal:** Use VIIRS Nighttime lights to better distinguish fully mapped areas from those where additional mapping (for example through crowd-sourcing campaigns) would pay greatest dividends.

Credit: Nick Jones, Global Facility for Disaster Reduction and Recovery (GFDRR) / World Bank.
Ran Goldblatt, New Light Technologies

# Address the Causes of Flood Risk, instead of the Symptoms



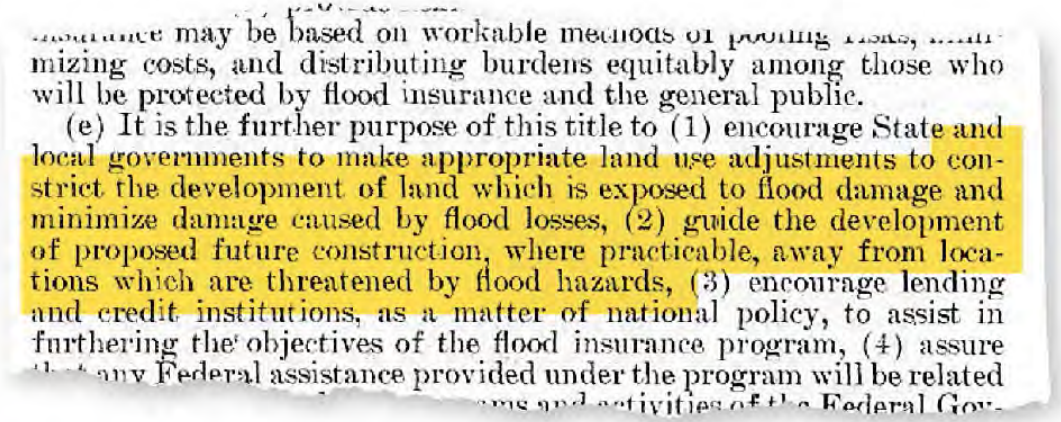

WEATHER UNDERGROUND

## Why Is It So Hard to Fix the National Flood Insurance Program?

### 'Gross public irresponsibility'

An unknown thousands of homes have been built and rebuilt in the floodplain across the U.S. since the creation of the National Flood Insurance Program. That is not what lawmakers originally intended.

### From the original National Flood Insurance Program law

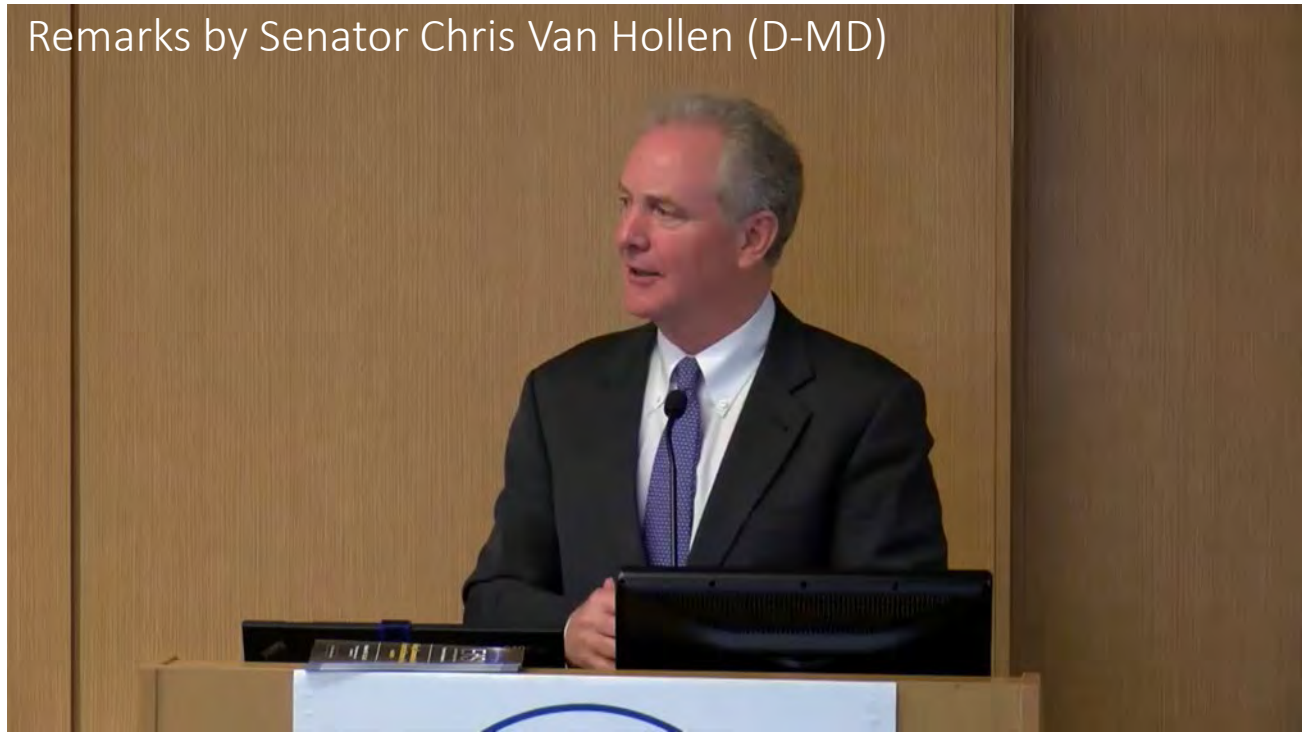


...surance may be based on workable methods of pooling risks, ...mizing costs, and distributing burdens equitably among those who will be protected by flood insurance and the general public.

(e) It is the further purpose of this title to (1) encourage State and local governments to make appropriate land use adjustments to constrict the development of land which is exposed to flood damage and minimize damage caused by flood losses, (2) guide the development of proposed future construction, where practicable, away from locations which are threatened by flood hazards, (3) encourage lending and credit institutions, as a matter of national policy, to assist in furthering the objectives of the flood insurance program, (4) assure ... any Federal assistance provided under the program will be related ... and activities of the Federal Gov-

Houston Chronicle

# Address the Causes of Flood Risk, instead of the Symptoms

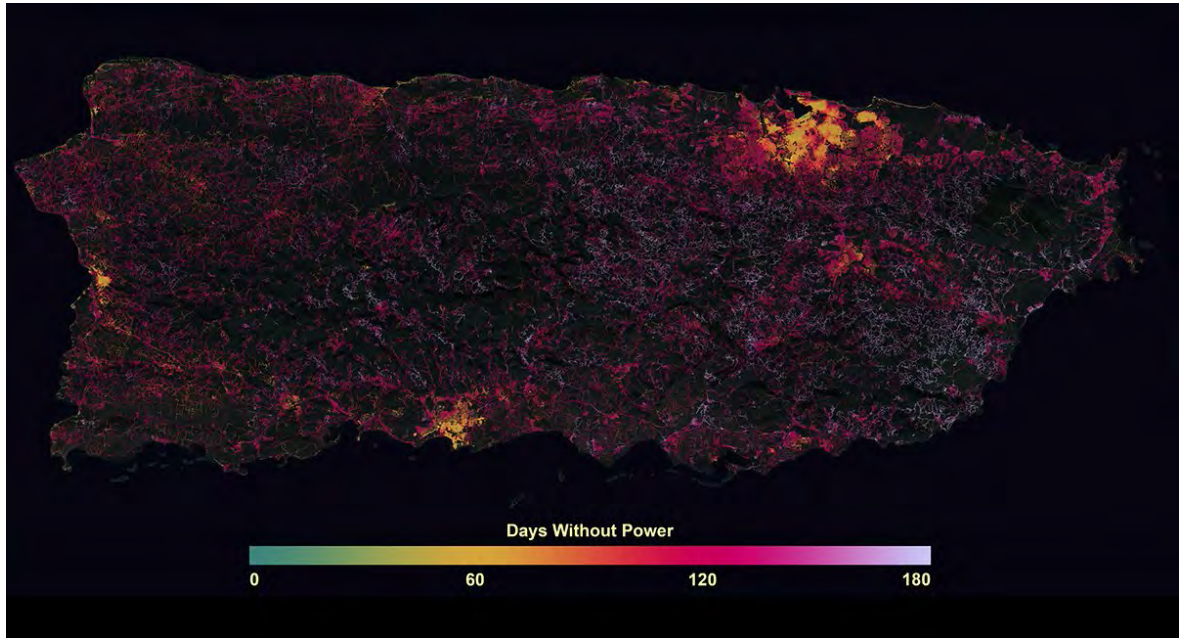



PLOS ONE

## Satellite-based assessment of electricity restoration efforts in Puerto Rico after Hurricane Maria

Miguel O. Román, Eleanor C. Stokes, Ranjay Shrestha, Zhuosen Wang, Lori Schultz, Edil A. Sepúlveda Carlo, Qingsong Sun, Jordan Bell, Andrew Molthan, Virginia Kalb, Chuanyi Ji, Karen C. Seto, Shanna N. McClain, Markus Enenkel

Published: June 28, 2019 • https://doi.org/10.1371/journal.pone.0218883



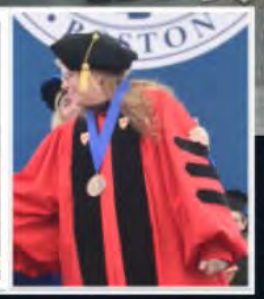

# $1.4 Billion:

- 200,000 households with small rooftop PV systems.
- Reduces Puerto Rico's blackout by 173 days.
- Reduces fuel costs by $157 million / year.

Román et al., (2019), PLOS One

# Resilience through Partnerships

Román-Duval Wedding at Boston University's Marsh Chapel, 2007



NASA Goddard Space Flight Center

NOAA National Environmental Satellite, Data, and Information Service

Sun Yat-sen University

The Climate Corporation

UMass Boston/Landsat-8 Science Team

UMD Earth System Science Interdisciplinary Center

US Department of Agriculture

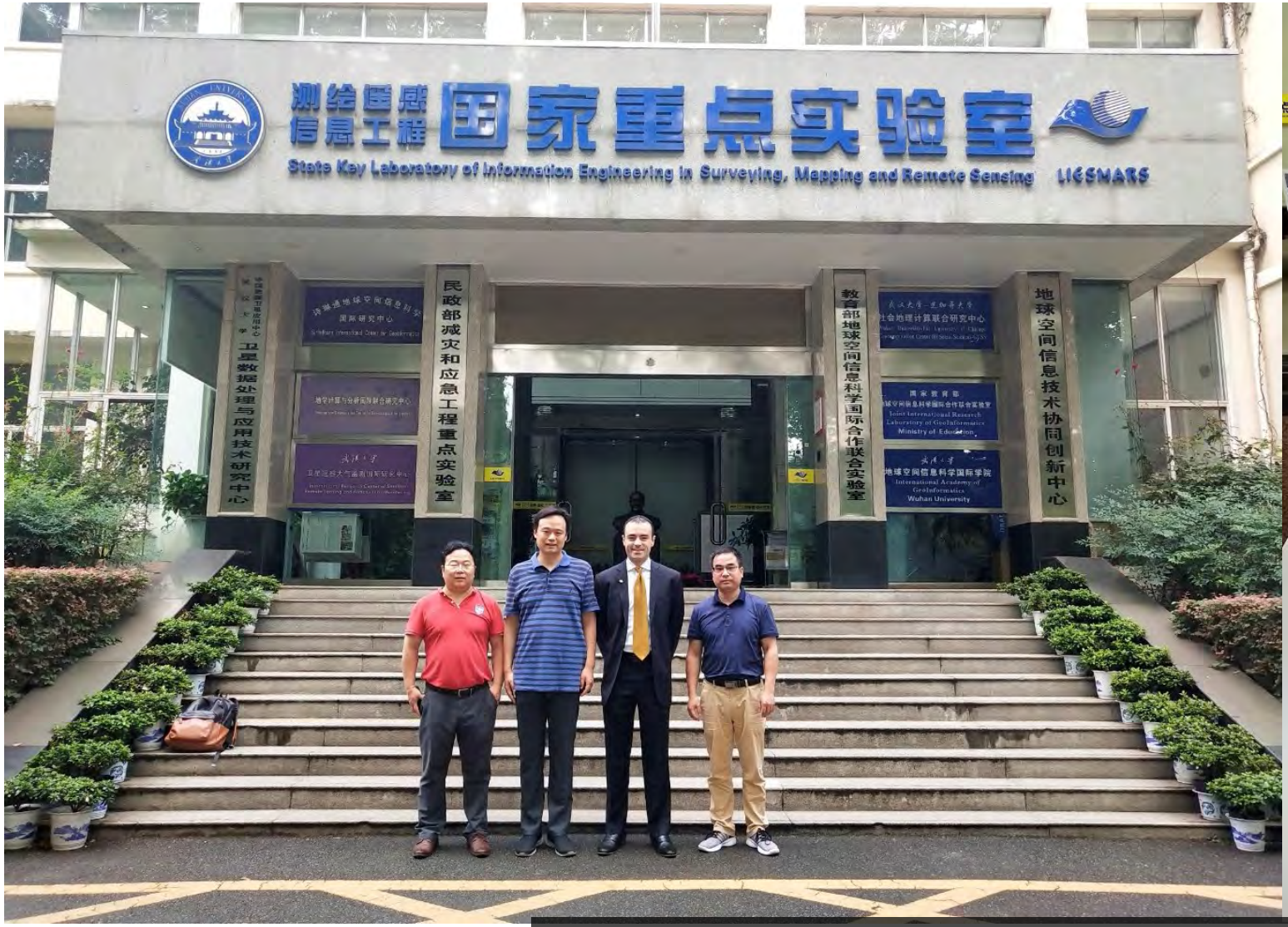
Institute of Remote Sensing and Digital Earth, CAS

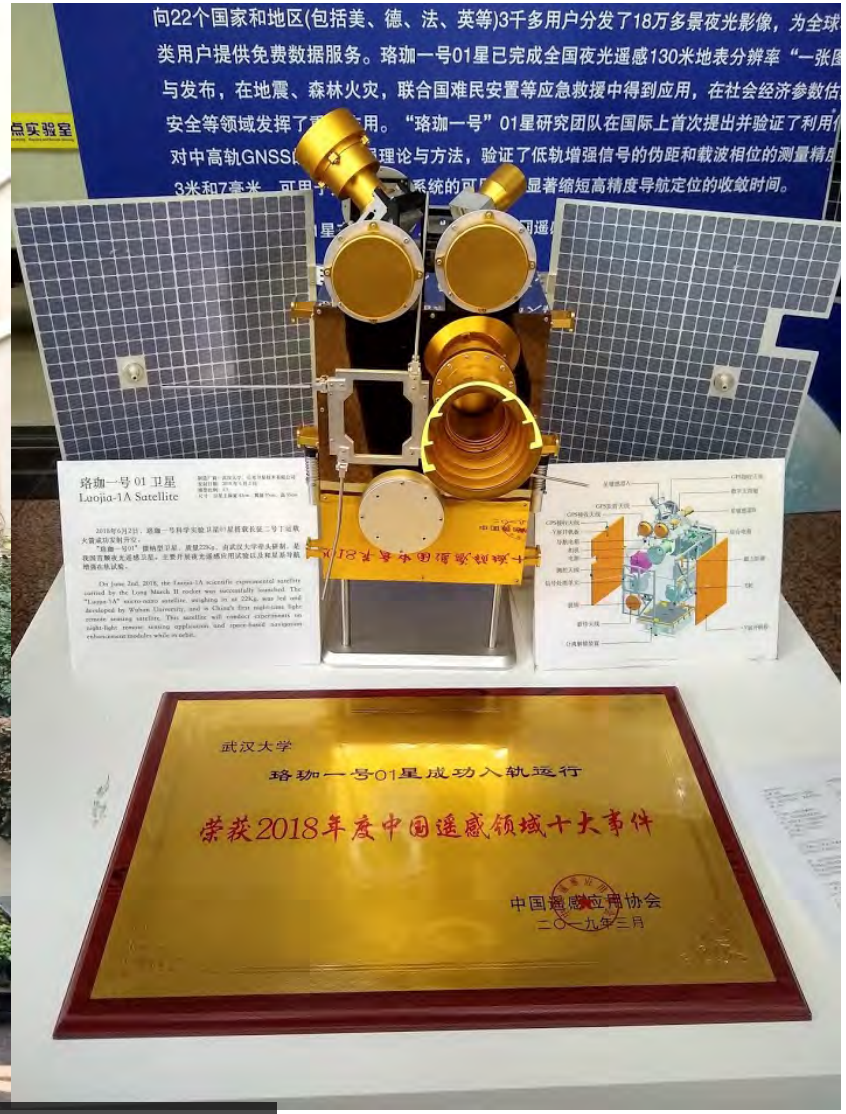
**Li-Strahler-Schaaf Group**

Zhuosen Wang, Jicheng Liu, Miguel Román, Yanmin Shuai, Tian Yao, Xiaoyuan Yang, Qingling Zhang

[Not Pictured] Yun Yang, Feng Gao, Xiaoyang Zhang, Ziti Jiao, Feng Zhao, Yan Liu, Qingsong Sun

# Resilience through Partnerships




2019 Luojia-1A Workshop, Wuhan University

# For More Information

The Earth from Space Institute
www.usra.edu/efsi

Universities Space Research Association
www.usra.edu

EfSI-2019 Symposium Recordings
www.tiny.cc/efsi_stream

## Questions?

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