Satellite Data for Disaster Risk Finance

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SEPTEMBER 2019
$30K

49994
Why care about satellite data for DRF?

Good Planning

Good Decisions

The Right

Tradeoffs in

Tough Situations

ABRAHAM LINCOLN

WAS A

WOMAN!

Shocking pix
found in White
House basement

Was John Wilkes Booth her jilted lover?
Examples in the DRF Context

How to increase the speed, predictability, and transparency of disaster response?

How to ensure that money reaches the people who need it the most, when they need it the most?
Introduction to Satellite Data - Types

- **OPTICAL**
- **RADAR**

**Legend**:
- Forest 2 bare
- Immature pltn 2 bare
- Mid-age pltn
- Mature pltn
- Mature pltn w haze
- Bare 2 bare
- Forest 2 forest
- Cloud 2 forest
- Shadow 2 forest
- Water
- Mangrove

*Images and diagrams illustrating different types of satellite data.*
Limiting Factors and Trade-offs

SPATIAL RESOLUTION
The size of one pixel on the ground

25cm US Legal Limit

For 1000 POINTS!
1cm is possible in principle!
https://www.blog.google/products/search/helping-keep-people-safe-ai-enabled-flood-forecasting/
Limiting Factors and Trade-offs

**Spatial Resolution**
The size of one pixel on the ground

**Temporal Resolution**
How often data of the same area is collected

**Spectral Resolution**
Dimension and number of specific wavelength intervals

**Radiometric Resolution**
How many grey levels are measured between pure black and pure white

These usually fight against each other

Why? 10 Points
Example - The Copernicus Sentinel-2

SENTINEL-2
Europe's flagship for Optical Earth Observation
What Types of Disasters Would Benefit From Satellite Data For DRF?

5 POINTS PER EXAMPLE!
Value of Satellite Data in DRM

https://disasterscharter.org
Value of Satellite Data in DRM

- Often available globally
- Provides objective information
- Often captures what is going on better than models
- Short time lags (some data available in less than 2 hrs after the satellite overpass)
- Ability to combine multiple data sources
How about night time satellite data?

What can we do with night time satellite photos?

10 POINTS
Value of Satellite Data in DRF – Example

- Link night time light observations (= impacts on power grids) after major cyclones or floods to displacement or to show economic growth areas
Sources of Satellite Data/Imagery

**EXAMPLES**

European Space Agency (ESA) will provide free and open access to a range of data types.

NASA – Specifically the Advanced Rapid Imaging and Analysis (ARIA) team at NASA's Jet Propulsion Laboratory.

JAXA - Japan Aerospace Exploration Agency - Advanced Land Observing Satellite DAICHI (ALOS)

Private companies such as: Fusion Space Technologies, ICEYE, GaoJing, ImageSat International, Deimos Imaging Inc, and BlackSky Global, CubeSpace, etc.

**DETAIL**

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New Technology
Algorithms for Enriching

Raw data doesn’t always answer the important questions.

Often one needs models, or algorithms, to add value to the raw data. Increasing role for Artificial Intelligence (AI)
Advantages, disadvantages and consequences of satellite data for DRF
EVENT – Cyclone Idai – 14 March 2019

- Idai originated from a tropical depression on 4 March
- Copernicus Sentinel-3 mission shows Cyclone Idai west of Madagascar and heading for Mozambique, Zimbabwe and Malawi
- Width of the storm is around 800–1000 km
- Winds of up to 105mph (170km/h)
- Expected to make landfall 16 March as a Category 4 Tropical Storm
International Disaster Management Cycle

Using satellite data to better analyse and understand the DRF implications in each step of the DRM Cycle.
Potential Response

1. Declare State of Emergency
2. Apply via International Charter on Space and Disasters
3. Receive updated satellite data and analysis
4. Provide data and analysis to authorities on the ground to see:
   - How Much Funding is needed
   - What is the affected area (Hazard Mapping)
   - How can you reach the affected area
   - Who are affected
   - How do we evacuate
   - How is the situation changing over time
Image Details
- Mission: Advanced Rapid Imaging and Analysis (ARIA)
- Target: Earth
- Spacecraft: ICEYE-X2, Sentinel-1, ALOS-2
Potential Recovery Strategy

1. Review satellite data to find areas for temporary housing, fresh water, safe areas, etc

2. Overview activities aimed at restoring the lives of affected people and the infrastructure that supports them
Drone and Arial Imagery
Example: Satellite-derived night-time light observations

- Monitor displacement via satellite-derived observations of night-time lights
- Spatial extent of power outages can serve as a proxy for disaster impacts
- Estimations of people affected or the coordination of rapid response teams.
Potential Mitigation Strategy

1. Post event review of disaster
   - Eliminate or reduce the probability of disaster occurrence
   - SET UP TRIGGERS FOR FUNDS
   - Review and update building codes; vulnerability analyses updates; zoning and land use management; building use regulations and safety codes; preventive health care; and public education

2. Ease access to quality updated satellite data

3. Update national and regional development planning

4. Potentially set up programs to better collect, exploit, analyse and integrating satellite and drone data
Potential Preparedness Strategy

1. Ensure satisfactory level of readiness to respond to any emergency situation through programs that strengthen the technical and managerial capacity of governments, organizations, and communities
2. Early warning alerts – ALSO FOR FINANCING
3. Ongoing satellite trend analysis
4. Machine learning predictive and classification models
Devastating Impact

• Idai caused severe flooding in Madagascar, Mozambique, Malawi, and Zimbabwe
• Idai ranks as the second-deadliest tropical cyclone on record (1300+ fatalities)
• Hundreds of thousands of people in urgent need of assistance
• A cholera outbreak ensued in the storm's wake, with more than 4,000 confirmed cases and seven fatalities by 10 April.
• Over 1,9 million people still affected by related drought and damage to agricultural land
Costliest tropical cyclone in the South-West Indian Ocean basin

Total damages at least $2.2+ billion
Group Discussion – 15 Minutes

EVENT

Choose Hypothetical Disaster in Your Region

Design a DRF Strategy using the DRM Cycle and Satellite Data

Bonus points for best strategies!
Design a DRF Strategy using the DRM Cycle and Satellite Data

1. What Disaster are you preparing for and why?

How Will you use Satellite Data to:

2. RESPOND (Financing, Planning, Timing, etc.)
3. RECOVER (Analysis, Unlocking Funds, etc.)
4. MITIGATE (Planning, Strategies, etc.)
5. PREPARE (Alerts, Financing etc.)
THANK YOU!