Mapping the World’s Floods with Satellites & Assessing Flood Vulnerability for Decision-making

Cloud to Street

CloudtoStreet.info
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An estimated 6,000 people died in a flood in 2013.

In 2014 the government still had insufficient information on the new shape of the rivers and their flood vulnerability.
THE PLATFORM & OPPORTUNITY

Landsat 4, 5, 7, 8 and Sentinel 1, 2
Raw, TOA, SR, .. 10-30m, 14 day

MODIS
Daily, NBAR, LST, ...
250m daily

Terrain
SRTM, GTOPO, NED, ...

Land Cover
GlobCover, NLCD, ...
RapidEye 5m, Planetscope 3-5m

Atmospheric
NOAA NCEP, OMI, ...

> 200 public datasets
> 5 million images
> 4,000 new images every day
> 5 petabytes of data

Plus Planet and Digital Globe

Google Earth Engine
The Platform & Opportunity

- **Landsat 4, 5, 7, 8 and Sentinel 1, 2**
  - Raw, TOA, SR, .. 10-30m, 14 day

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Current Global Flood Inventory

5,000 flood in the global inventory. 5% have been mapped.
OUR SOLUTION

STREAMING DATA
- Satellite imagery
- Crowdsourcing
- Social media

MACHINE LEARNING
HYDROLOGY
Mapping the floodplain

SOCIAL
VULNERABILITY
Identifying the most vulnerable communities

Cloud to Street
Automating Flood Detection

Global Flood Mapping Tool

Cloud to Street
Largest Global Database of Flood Map Database (released publically in Fall 2017)
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Flood in Argentina
Seasonal vs Extreme Flooding

Flood in Sudan
Duration of Flood by Area
8/1/2016 – 9/1/2016

Flood Extent  Permanent Water  Seasonal Water

Days Flooded

1  13

Permanent Water
Flood in Argentina
Seasonal v Extreme Flooding

Flood in Sudan
Duration of Flood by Area
8/1/2016 – 9/1/2016

Days Flooded
1
13
Observations used to train Machine Learning algorithms, optimized and cross validated to predict floodplains in critical regions in Senegal – overall accuracy 91.5%.
Socio-physical Vulnerability Index, Senegal

1. Lack of basic healthcare and access to information (17%)
2. Elderly (15.5%)
3. Disabilities (15%)
4. Rurality (15%)
5. Internal Migrants (6%)
1. Lack of basic healthcare and access to information (17%)

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The floodplain of Senegal - 5,596 km² - 30% of which are predicted to have high risk populations (97,000 people) today.
Using New Data Food Maps in Decision Making

**Governments & Development Agencies**
- A never out of date inventory of floods for any area of interest and a local social vulnerability index
- Prepare communities most exposed to hazards and those least likely to absorb this future shock

**Development Agencies**
- Map of communities that were hit hardest by a flood
- Precisely target recovery programs and rebuilding in the locations where the hazard was the most intense

**Emergency Managers**
- Predict the size and damage of a flood as the storm approaches (in development)
- Alert local residents in time
- Target evacuation and position search and rescue where its most needed

**Humanitarians**
- A near-real time map of floods as they unfold (coming soon)
- Effectively mobilize aid and other support when it is most critical, the 24 hours after the disaster

**The Disaster Cycle**
- Prepare
- Forecast
- Respond
- Recover
- Flood
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Expanding Flood Observations

- Crowdsourcing
- Community engagement
Where we are:

- pilots in India, Senegal, Argentina

Future research:
- High resolution imagery
- Near real-time flood mapping
- Expanding flood observations
- Capacity building
- Local community engagement
- Cell phone data
- More locations

Where we want to be:

- Flood-prone & socially vulnerable places with little or inaccessible risk data
CLOUD TO STREET
DYNAMIC FLOOD VULNERABILITY MAPPING

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