CEOS Disaster Risk Management Flood Pilot

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CEOS DRM Flood Pilot Overview

- **Goal:** demonstrate effective application of EO to the full cycle of flood management at all scales by:
  - **Objective A:** Integrating information from existing NRT global flood monitoring / modeling systems into a Global Flood Dashboard;
  - **Objective B:** Delivering EO-based flood mitigation, warning, and response products and services through regional end-to-end pilots
  - **Objective C:** Encouraging at least base-level in-country capacity to access EO and integrate it into their operational systems and flood management practices

Flood Pilot Regions In Purple
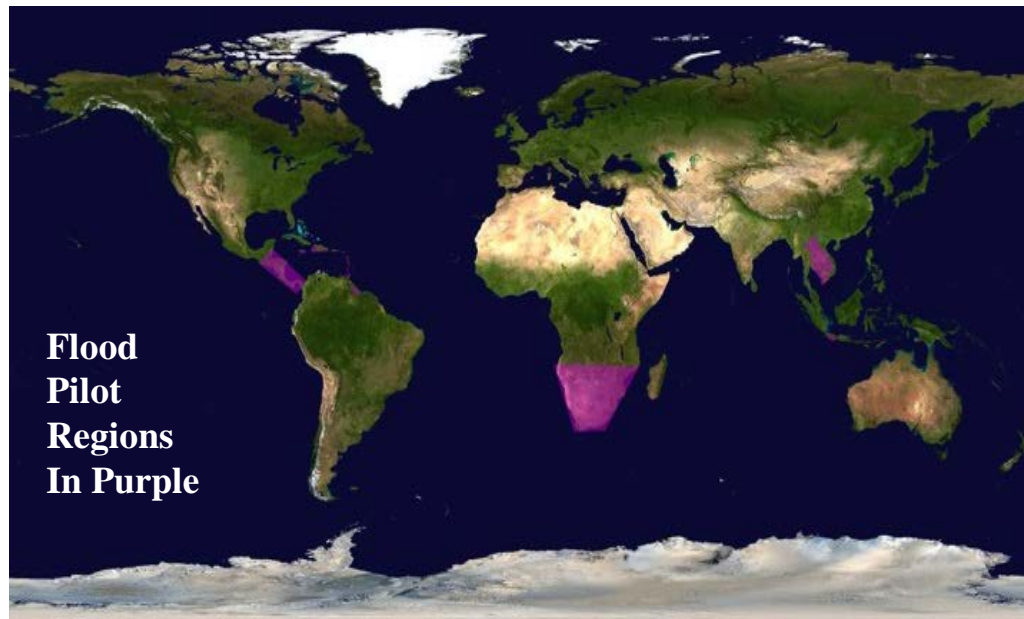
How Data Have Been Exploited

Geographic Area	Product	Value Added Partner
Global	Flood extent maps and flood forecasts	Dartmouth Flood Observatory, University of Maryland
Haiti	Flood extent maps, flood risk maps, landslide maps, flash flood guidance / threat maps, integrated risk assessment platform	SERTIT, CIMA, INGV, Altamira, CIMH, RASOR FP7, NOAA/HRC
Other Caribbean islands, Central America	Flood damage maps, change detection products, co-registered map overlays	CATHALAC, CIMH, NASA/GSFC, RCCP (Costa Rica)
Namibia	Flood extent maps, flood warning products, co-registered map overlays	Namibia Hydrology Dept, Namibian Water Authority, NASA
Zambezi basin	Flood extent maps, flood forecast models, flood hazard maps, flood depth forecasts	Lippmann Institute (HAZARD, WATCHFUL), Deltares, RSS
Mekong	Flood extent maps, flood risk maps, flash flood guidance / threat maps	Mekong River Commission, ADPC, NASA, NOAA, HRC, USGS, Univ. of South Carolina, Texas A&M , IMWI
Java (Bandung, Jakarta, Cilacap)	Flood risk maps, subsidence maps tied to flood risk, tsunami risk maps (Cilacap only), flood extent maps	SERTIT, Deltares, CIMA, Altamira, INGV, RASOR FP7,

Products used by: national end users, civil protection agencies, World Bank, Red Cross, World Food Program, River Commissions (Kavango, Zambezi, Mekong)

Streamlined Real-Time Data Access

Central America

http://centroclima.org/powered-by-nasa/

Southeast Asia

https://pmm.nasa.gov/precip-apps

New Real-Time Flood Products

Figure 1

A — Seasonal MODIS Average (2002-2016)

B — MOD44 Permanent Water

C — NRT MODIS NDVI (1/9/17 - 1/13/17)

Spectral Training and Image Classification

Incorporate Socioeconomic Data

Figure 2 — Southern Thailand Flooding as of 1/13/17

Impacted Landcover (sq km.) in Thailand (as of 1/13)

A

Pie chart values: 0.7212, 1.8316, 0.4047, 0.4047, 0.3681, 0.2604, 0.0262, 0.1102, 0.1433

Legend:
- Wetlands
- Forest
- Crops
- Mixed crop / forest
- Barren
- Shrubs
- Savanna
- Grasslands
- Urban

Population Exposed to Flooding (as of 1/13)

B

Legend: Cambodia, Thailand, Vietnam, Laos

Figure 3

MODIS satellite observations and derived information products (e.g. flooded areas and socioeconomic impacts) are being used by regional NGO's like the Asian Disaster Preparedness center to identify floods and associated impacts to people and infrastructure in near real-time.

Interactive Web Map: http://projectmekongnasa.appspot.com

Credit: A. Ahamed, J. Bolten, NASA GSFC

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# Better Flood Observations for Better Forecasts

Pink outline: Simulation based on HydroSHEDS stream network & river widths.

**Blue area**: Simulation based on Landsat-derived stream networks & river widths.
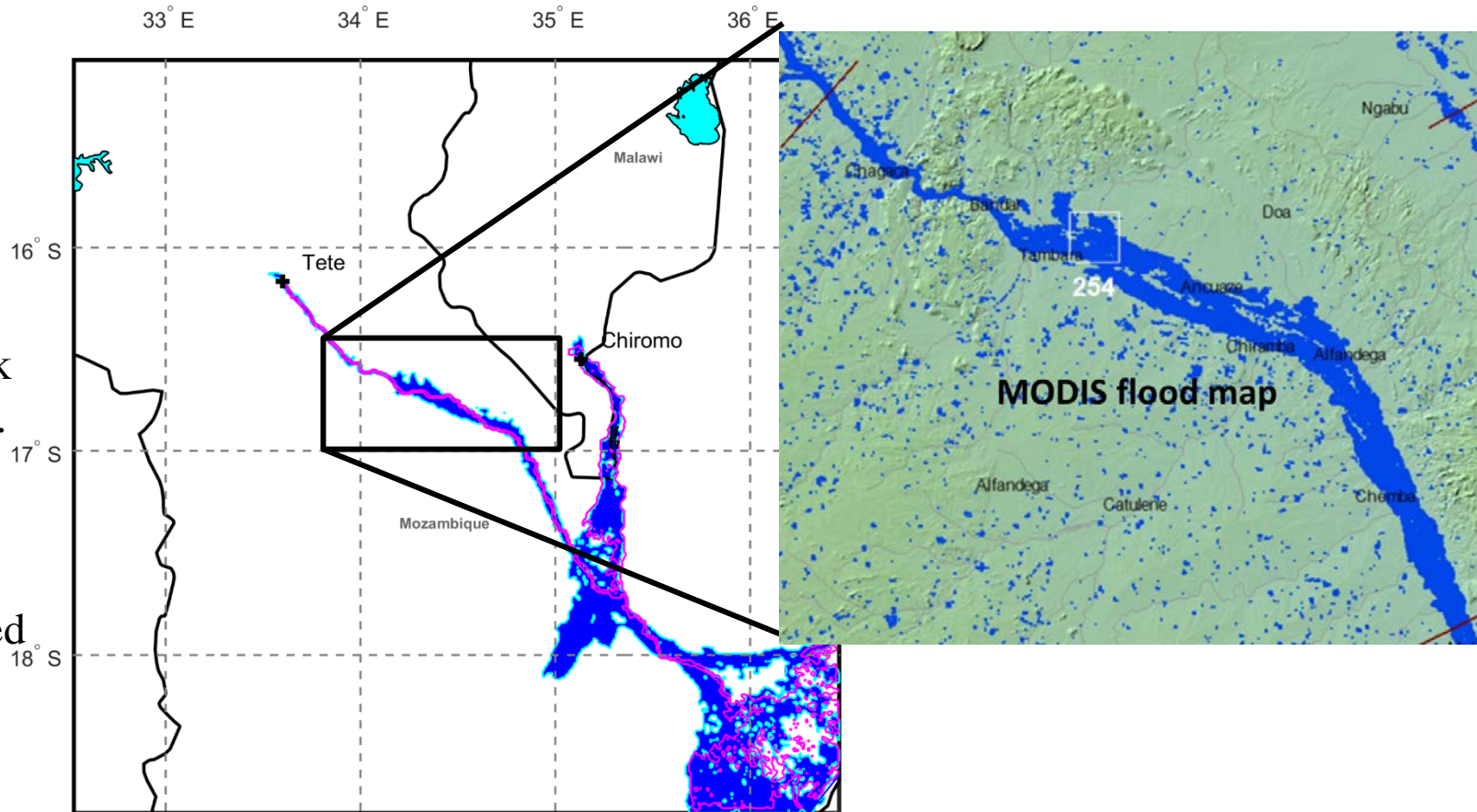
More realistic and complete stream networks from EO data leads to improved flood model simulations in regions with few gauges (Credit: G. Schumann, UCLA)
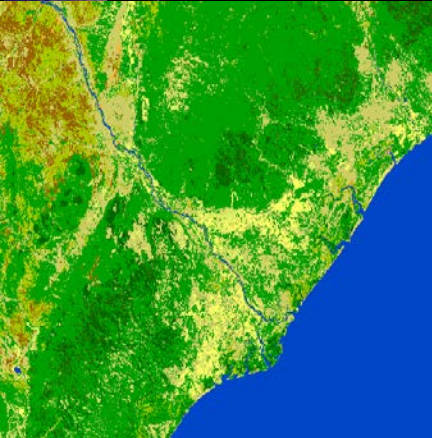
Better Forecasts of Flood Depth
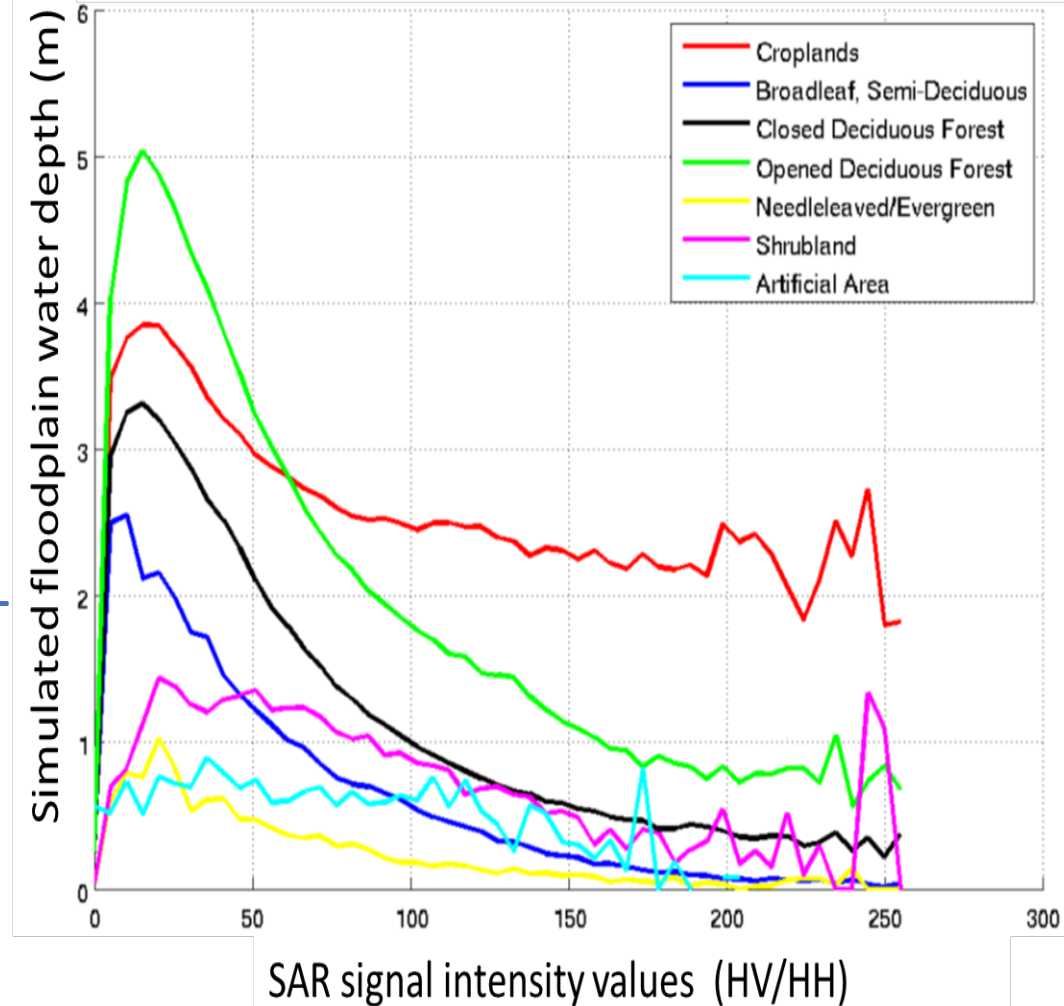

Floodplain Depth
Shallow
↓
Very deep
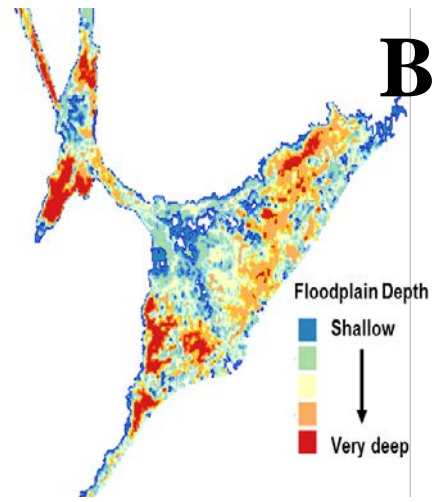
2-D flood model simulation based on Water Balance Model (WBM) long-term simulated hydrologic flows
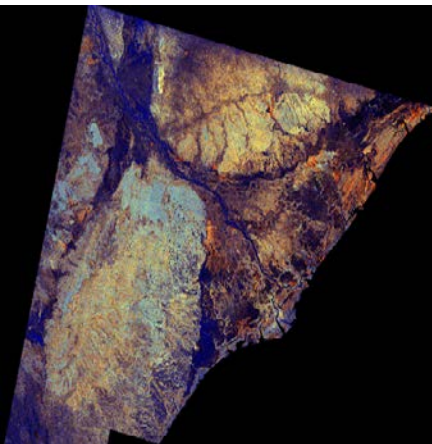
ALOS-PALSAR L-band flood image of the 2015 event. RGB composite of multiple polarizations (HV, HH, HV/HH)

Detailed land cover classification (2009) based on ESA's GLOBCOVER: http://due.esrin.esa.int/page_globcover.php


Coupled WBM-LISFLOOD-FP flood model is capable of simulating floodplain depth magnitudes. Cross-validating those with ALOS L-band polarizations for different flooded vegetation can improve satellite-based flood mapping.

Contributors: G. Schumann, V. Dang, A. Kettner & B. Brakenridge

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Local Capacity for Flood Modeling

- Hong / Flaming (U. of Oklahoma / NOAA) installed the Ensemble Framework for Flash Flood Forecasting (EF5) model at the Regional Centre for Mapping of Resources for Development (RCMRD) in Kenya.

- This model produces real-time products on RCRMD's Amazon cloud that are distributed through the Open GeoSocial API under RCRMD control (web interface is being implemented).

- Training in the RCRMD member states is ongoing.

RCRMD member states

Contracting Member States

Non-Contracting Member States
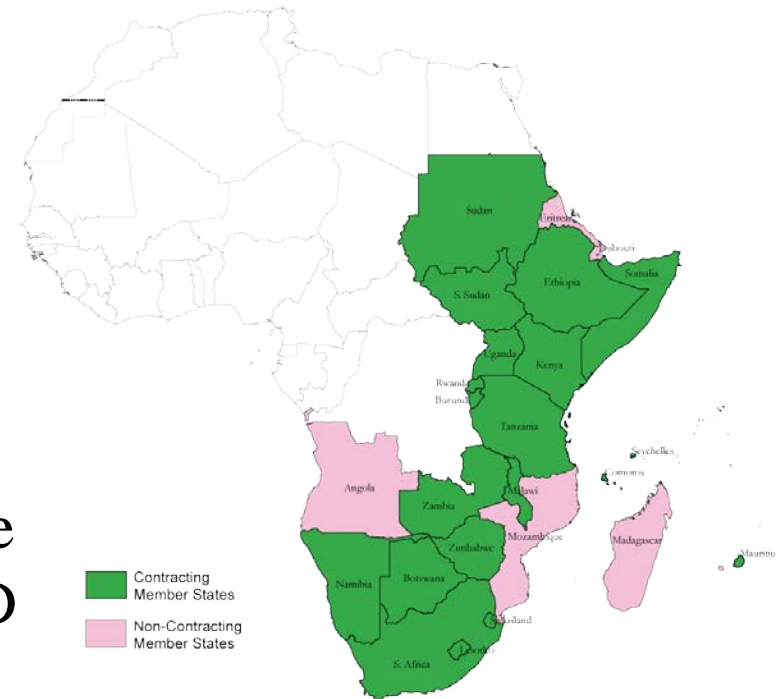
Better Estimates of Flood Severity

- LIST flood hazard maps determine flood severity by comparing flood extent in a SAR image with computed extent / return period from simulated historic floods
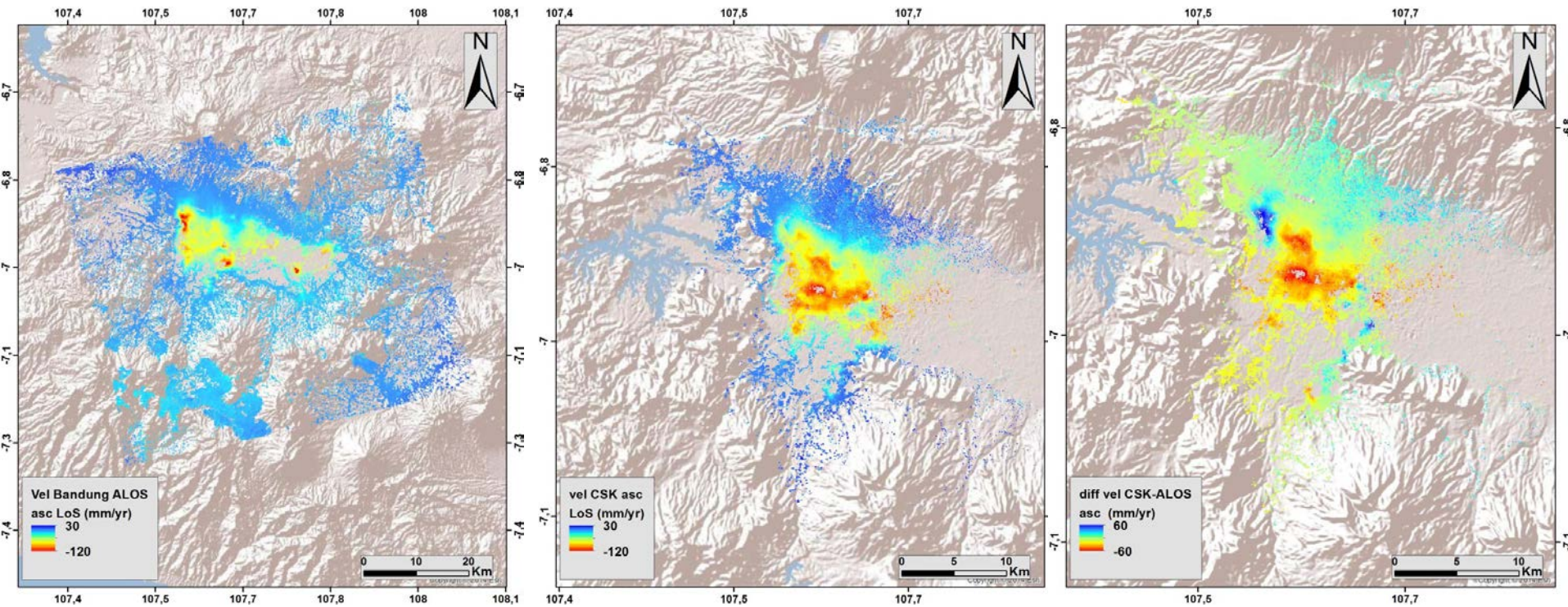- The UN World Food Programme has shown interest
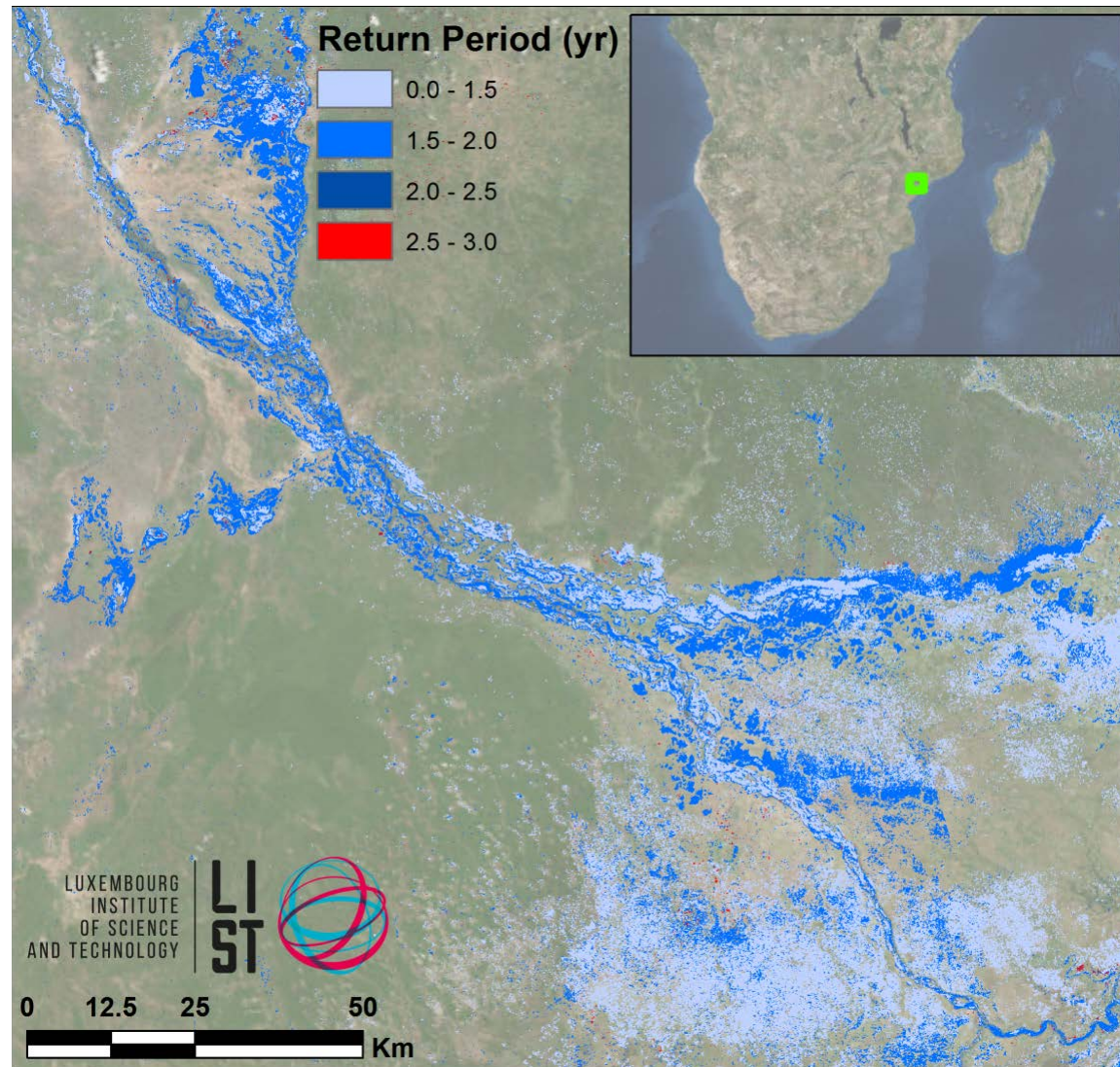
Evaluating Subsidence…

Subsidence Mapping by INGV (RASOR)

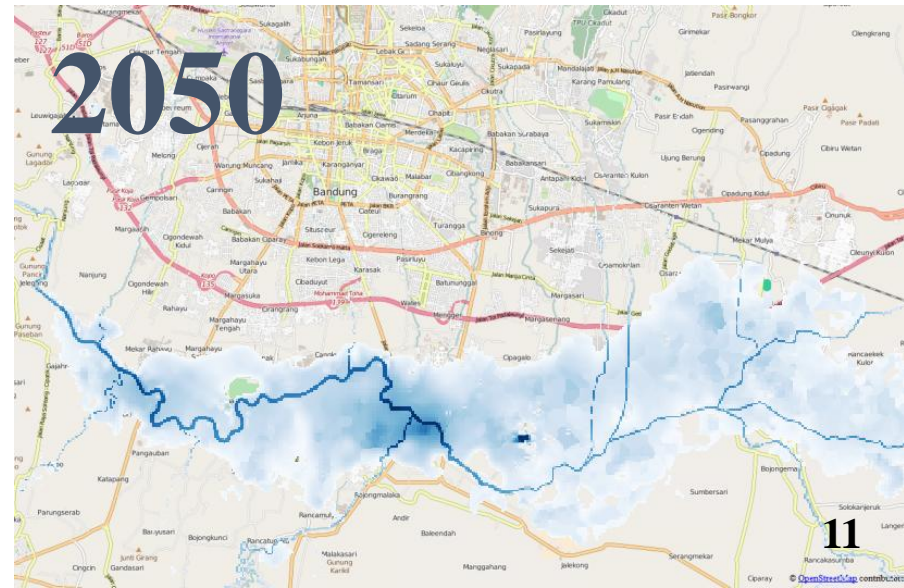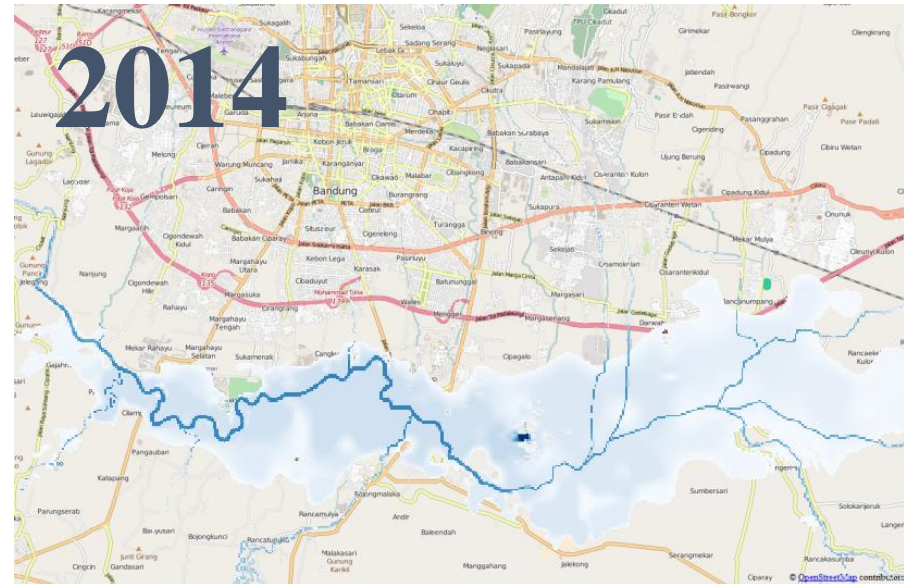ALOS ascending (2007-2011)   CSK ascending (2013-2015)   Difference (CSK-ALOS)

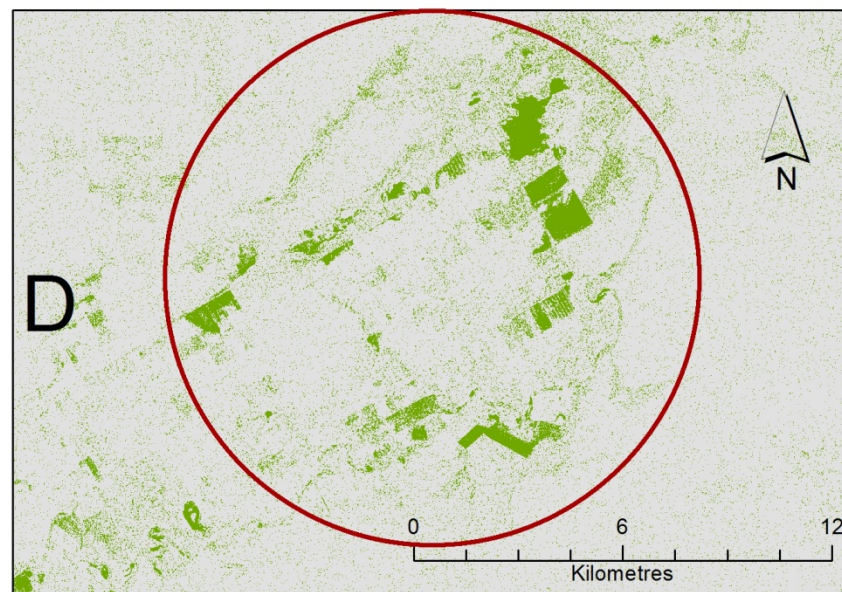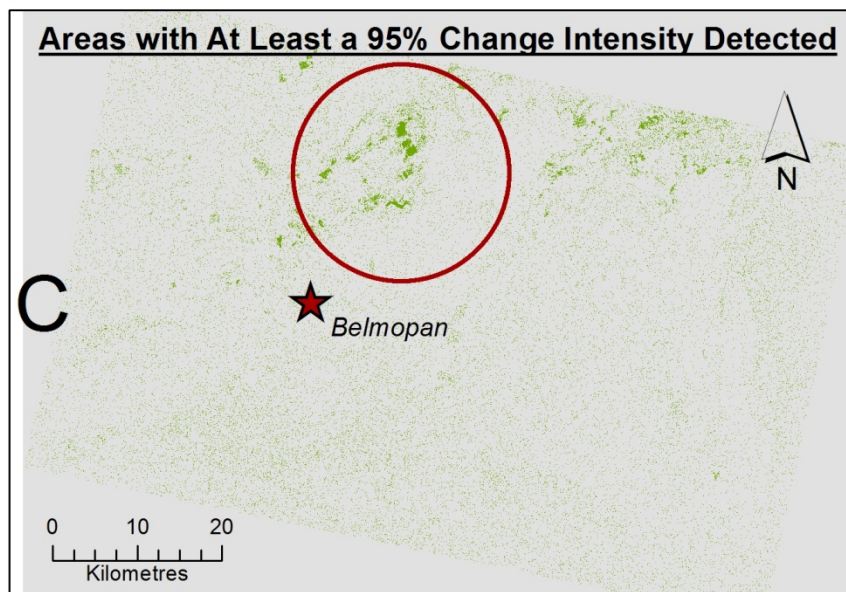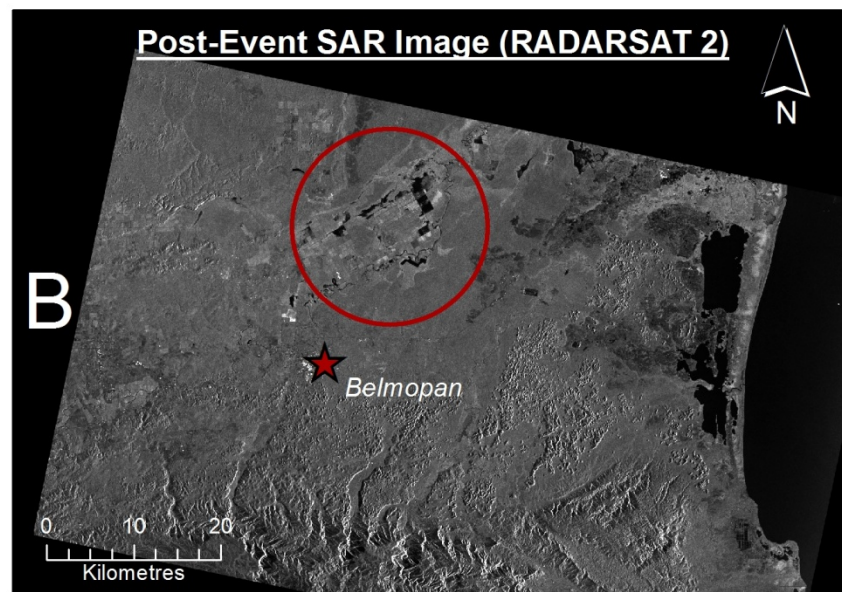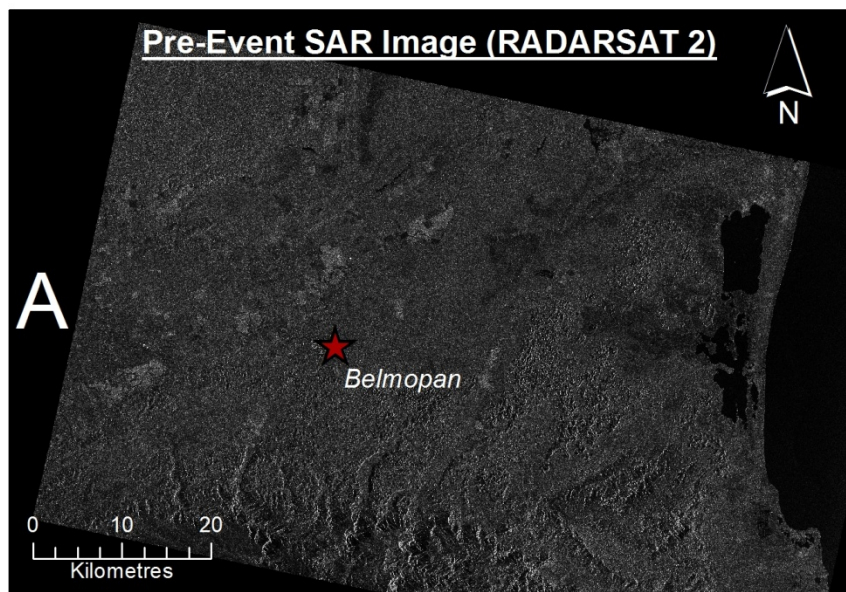(red = increased rate of subsidence)

…and Its Impact on Potential Future Floods

Inundation depths calculated for subsidence scenarios in 2014, 2020 and 2050 based on rainfall from the Dec 2014 flood
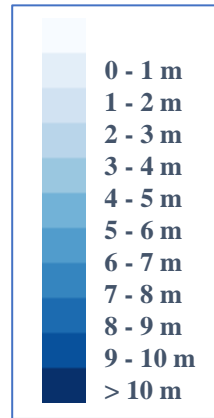
Developing Local Capacity to Evaluate Flood Damage

User Comments

- "These files [of flooding in Sri Lanka in May 2016] are perfect for me and our needs…Your outreach and forward thinking about open data really does save lives." – Blake Giradot, Humanitarian Open Street Map Team

- "This [flood products for Louisiana in May 2016 converted to GIS layers] is absolutely the direction we want to head."—C. Vaughan, Federal Emergency Management Agency (FEMA)

- "We see our success as the openings we made with all the assistance offered and given by our CEOS partners. Some components [include] the tremendous access to satellite images and the actual use of these images by our staff…and last but not least the capacity building and access to new techniques for our young professionals."—Namibia Department of Water Affairs, Hydrology Division Director Pauline Mufeti

Looking Forward

- Although the official Flood Pilot will end in December, a number of participating efforts will continue, including:
    - Lower Mekong River Basin Project (NASA GSFC/SERVIR) which includes locally-produced flood maps and products showing flood impacts
    - Dartmouth Flood Observatory (Univ. Of Colorado), which has received support to collaborate with Remote Sensing Solutions to develop a more comprehensive "one-stop shop" for global flood disaster response assistance
    - Global Flood Monitoring System (U. of Maryland) will continue to provide automated flood forecasts to users worldwide
    - Global Flash Flood Guidance (HRC), which provides real-time flash flood forecasts to roughly 10% of the entire global population
- GEO-DARMA will leverage and extend other Pilot efforts though the details are still being worked out
- In the Americas, the AmeriGEOSS Disasters Group will extend flood DRM accomplishments from the Caribbean and Central America region to all participating GEO countries in Latin America

Questions / Discussion