

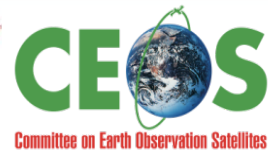
# Proposed CEOS Disaster Risk Management Flood Demonstrator

Presented at the CEOS Disasters Working Group  
Meeting #9 in Brussels, Belgium

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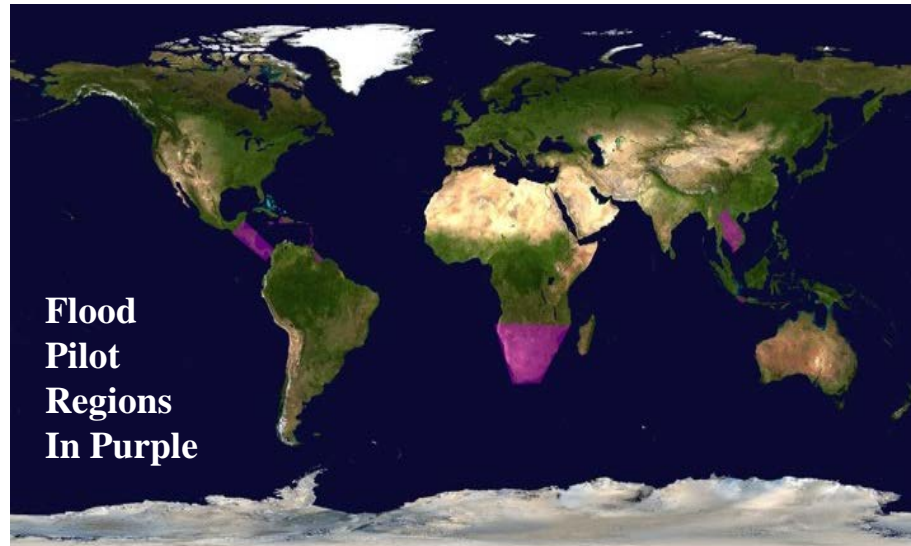


# Outline

- **Flood Pilot Accomplishments (5 pages)**
- **Flood Demonstrator Overview (5 pages)**
  - **Transition from Hazard Identification to Risk Assessment**
  - **Spatial Scaling between Regional and Global**
  - **Mapping Flooded Areas Where it Matters Most**
- **Leveraging GEO-DARMA Regional Risk Assessments and Connections With End Users**
- **Flood Demonstrator Team**
- **CEOS Data Request**
- **Questions/Discussion**

# CEOS DRM Flood Pilot Goals

- **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 Accomplishment: Streamlined Near-Real-Time Data Access

## Central America

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

The screenshot shows the Centroclima website dashboard, which is powered by NASA. The page features a navigation bar with links for 'ACERCA DE NOSOTROS', 'EXPLORAR', 'MANTENGASE INFORMADO', and 'INVOLUCRESE'. The main content area is divided into several sections, each with a map and a 'Ver Producto' button:

- Lluvia acumulada de un día (TRMM):** El TRMM (Tropical Rainfall Measuring Mission) es un trabajo en conjunto de NASA, junto con JAXA (Japan Aerospace Exploration Agency) para coleccionar datos de lluvia y realizar estudios sobre el tiempo atmosférico e investigación climática. El satélite fue lanzado en noviembre de 1997 con el objetivo de coleccionar datos de lluvia, sin embargo dejó de recolectar datos el 15 de abril de 2015, lo que lo convierte en un set de datos único con 17 años de información de lluvia y relámpagos. El TRMM contaba con tres sensores para lluvia (PR, TMI, VIRS), y dos instrumentos relacionados (1 IS y CFRFS).
- Lluvia acumulada de un día (GPM):** El GPM (Global Precipitation Measurement) es un satélite creado bajo una misión internacional de NASA y JAXA (Japanese Aerospace Exploration Agency) que genera observaciones de lluvia y nieve a nivel mundial cada tres horas. El satélite fue lanzado el 27 de febrero del 2014, con instrumentos avanzados que permiten crear un nuevo estándar de mediciones de precipitación desde el espacio. Los datos obtenidos son utilizados para unificar las mediciones de precipitación creadas por redes internacionales de satélites para cuantificar cuándo, dónde, y cuánto llueve al exterior del mundo.
- Áreas Quemadas en la Región:** En esta herramienta se muestran áreas que fueron afectadas por el fuego, utilizando el sensor MODIS (Moderate Resolution Imaging Spectroradiometer).
- Derrumbes regionales a corto plazo (GSFC):** El Sistema de Monitoreo de Inundaciones Globales (GIMS) creado por NASA, utiliza el sistema de Análisis de Precipitación Multi Satélite TRMM (TMPA) casi a nivel mundial (50°N - 50°S) para ejecutar modelos hidrológicos de escorrentía con una precisión de 1/8 grados de latitud y longitud. El GIMS genera estimaciones de derrumbes de tierra, los cuales son uno de los desastres naturales más generalizados en el mundo, resultando ser los que generan más pérdidas económicas y humanas causan.
- Fuegos Activos:** MODIS Moderate Resolution Imaging Spectroradiometer.

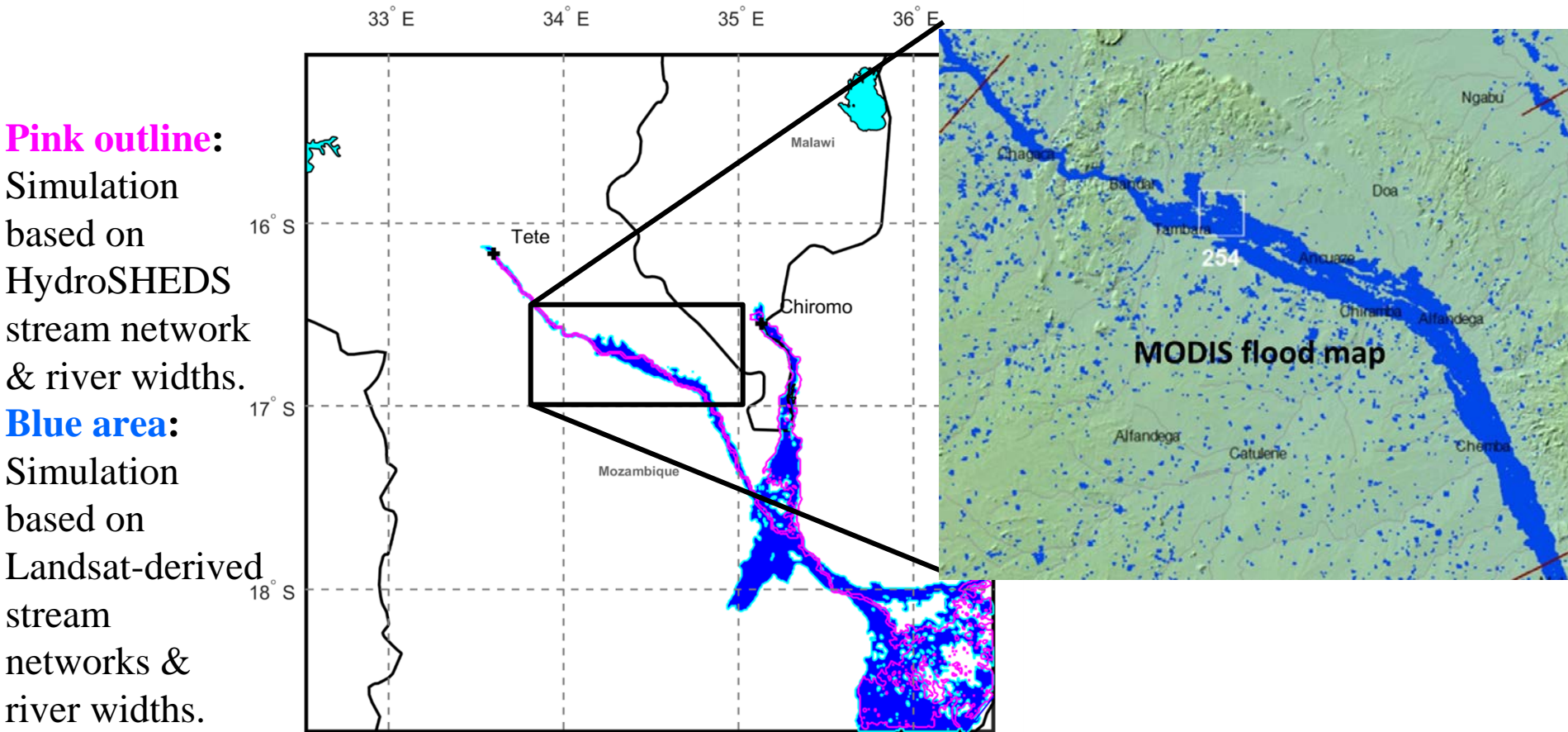
## Southeast Asia

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

The screenshot shows the 'Precipitation and Applications Viewer' interface. It features a map of Southeast Asia with a legend for '1-d Rainfall Accum. (GPM)'. The legend includes a color scale from 1mm (dark blue) to 60mm (red). The interface also includes a search bar, a 'Select Region' dropdown menu set to 'Asia', a 'Date' field set to '2017-02-25', and a 'Dataset' dropdown menu set to 'GPM IMERG L300 R...'. There are buttons for 'Show Legend', 'Show Controls', 'Load Data', 'Download', and 'Preview Image'.

Also see the Southern Africa regional flood dashboard at <http://matsu-namibiaflood.opensciencedatacloud.org/>

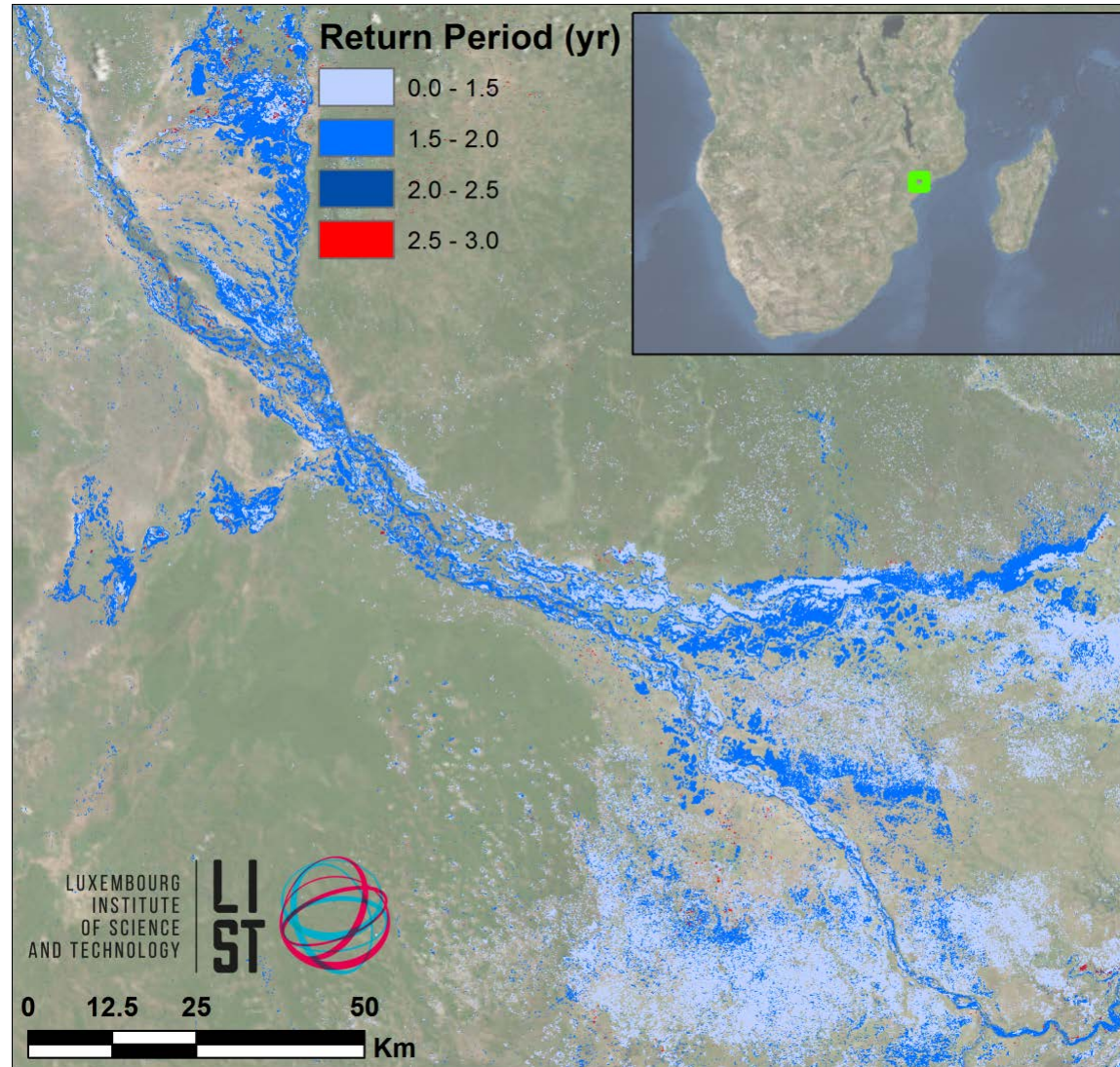
# Flood Pilot Accomplishment: Better Flood Parameter Observations for Better Forecasts



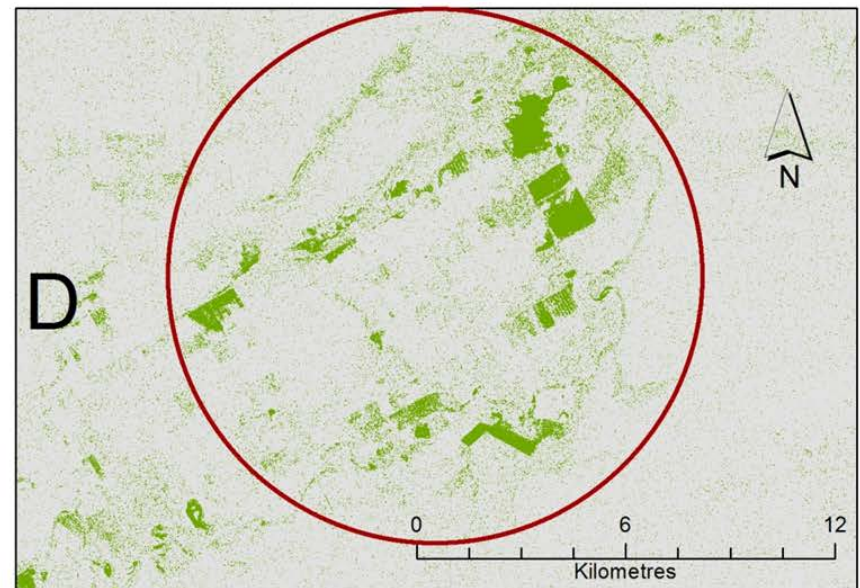
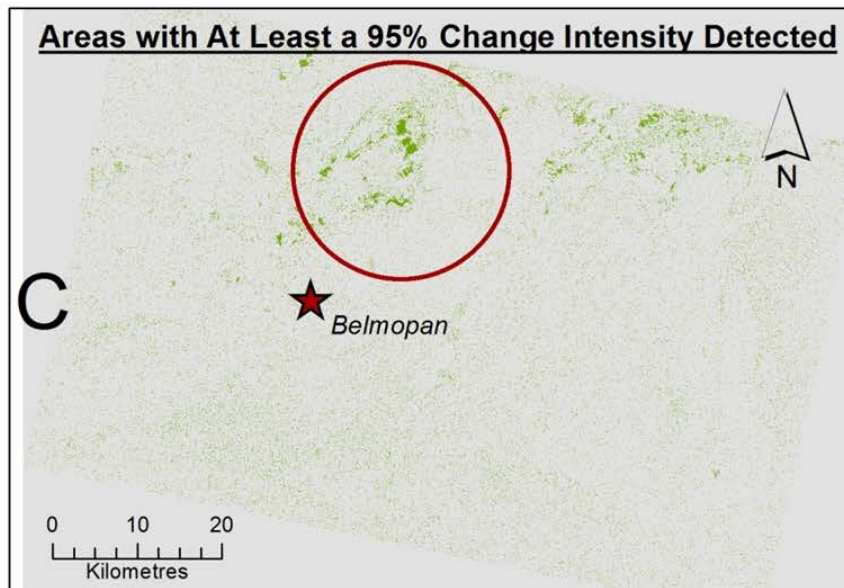
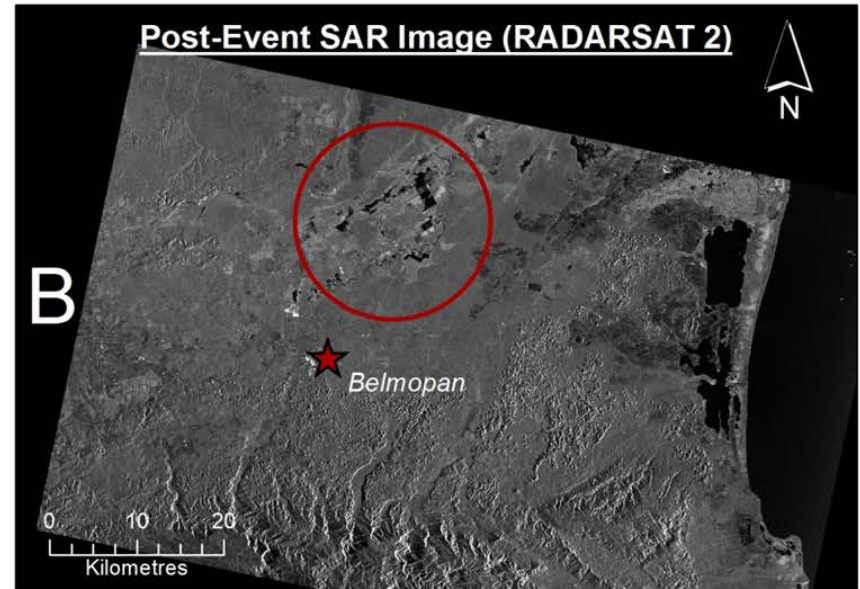
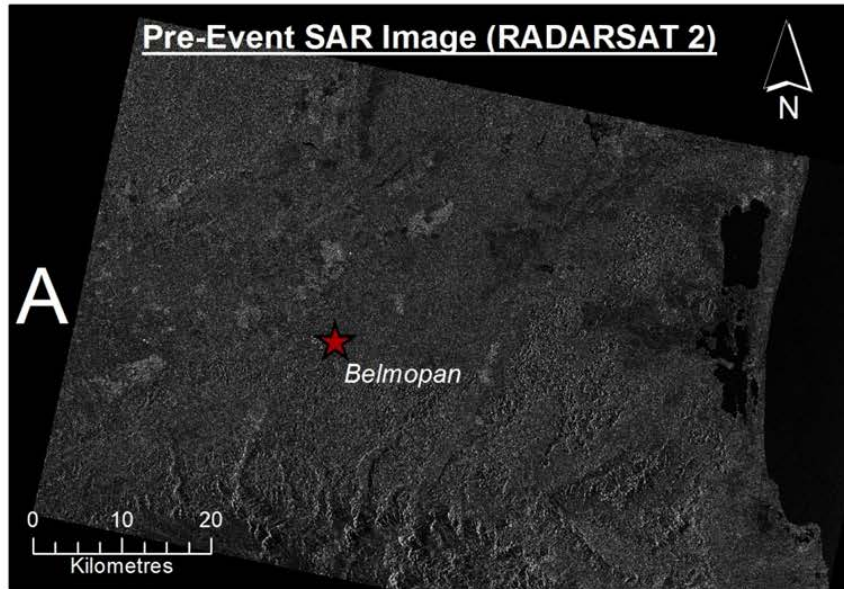
More realistic and complete stream networks from EO data leads to improved flood model simulations in regions with few gauges (Credit: G. Schumann, UCLA)

# Flood Pilot Accomplishment: 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



# Flood Pilot Accomplishment: Developing Local Capacity to Evaluate Flood Damage



# CEOS Flood Demonstrator Formulation

- Created a formulation sub-group with flood pilot team members to examine results of previously listed consultations as well as new areas to demonstrate satellite data integration, in particular:
  - Scalability of user interface, to move from global views to local views seamlessly;
  - Moving from hazard to risk, identifying ways in which EO data can improve other aspects of the risk equation (exposure, vulnerability) and improving display of risk information;
  - Increasing user uptake of demonstrated methodologies in three specific geographic areas, working directly with end users.
- Sub-group to report to WG Disasters meeting March 2018 in Brussels on Status of Flood Demonstrator implementation plan



# Proposed CEOS DRM Flood Demonstrator

**Goal:** Build on and extend the successes of the Flood Pilot in three focus areas:

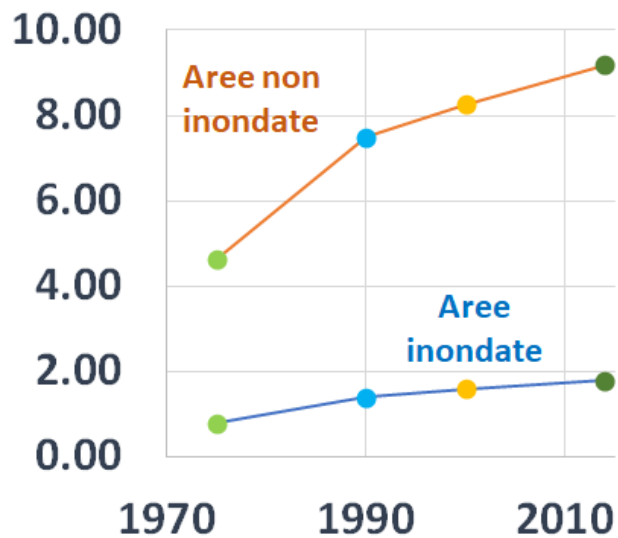
1. Transition from Hazard Identification to Risk Quantification
  - Proactive identification of areas of flood risk is the critical next step for improving Disaster Risk Reduction
  - Archival EO data will be used along with flood models to quantify risk based on historic flooding
2. Spatial Scaling for Users between Regional and Global
  - Build upon the existing flood portals to create an integrated flood data portal that serves both global and regional users
  - Provide access to both archive and near-real-time EO data products
3. Mapping Flooded Areas where it Matters the Most
  - Urban areas carry significant populations and significant flood risks
  - Improvements in spatial resolution are now making it possible to accurately map flood risk in urban areas

# From Hazard Identification to Risk Assessment

- Specific question is how to best quantify flood risks in ways that are actionable by end users
- End users will only trust risk maps if they can be validated against model forecasts and monitoring data on multiple scales

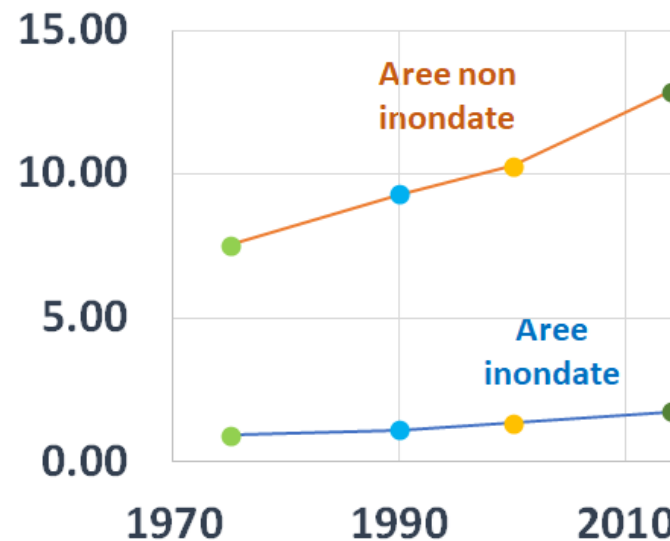
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Sviluppo demografico 

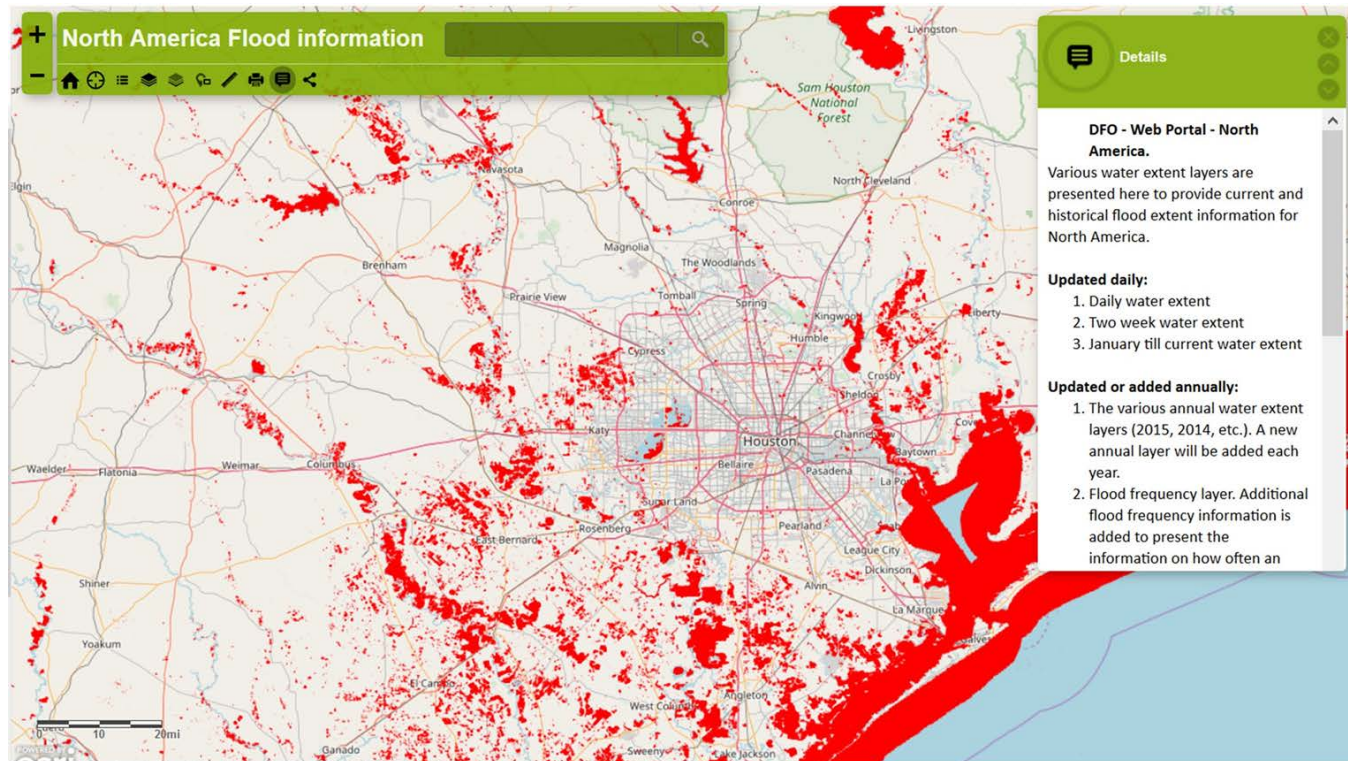
Densità media [ab./km<sup>2</sup>]



Evolution of flood risk change in the Murray-Darling basin: % of total built area and population density (both from satellite imagery: GHS Built & GHS Pop) within inundated and non-inundated area over time (credit: University of Bologna & Guy Schumann)

# Spatial Scaling for Users - Regional and Global

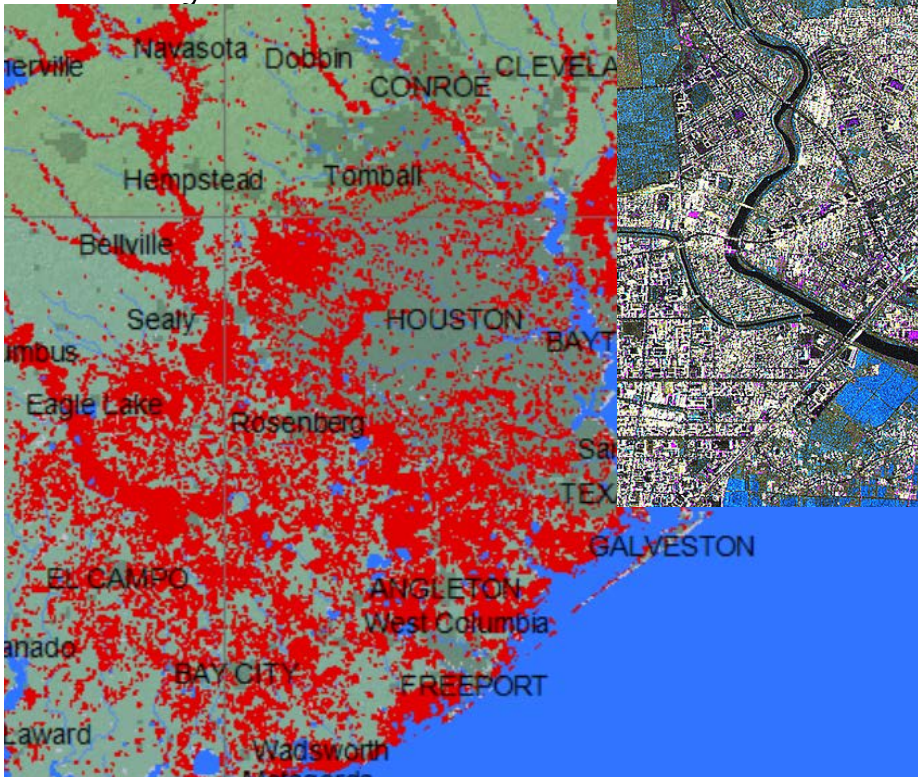
- Utilize regional flood dashboard concept developed in pilot to seamlessly integrate across national, regional, and global data sets to validate global systems on a local scale
- Include risk maps in addition to flood hazard and forecast maps that can be visualized on a map as well as downloaded by users



DFO's Web Map Service (WMS) allows users to display layers from local to global scale

# Mapping Flooded Areas where it Matters the Most

- Leverage archive data and new images to improve urban flood mapping records
- Develop flood risk maps to include latest DEM, land use/land change, and population data layers



DFO's map showing flooded areas within and around the urban area of Houston during Harvey



TerraSAR-X image showing flood damages after the 2011 tsunami in the port of Sendai

- Integrate historical tsunami records in addition to precipitation induced flooding

# Leveraging GEO-DARMA Risk Assessments and Interacting with End Users Across Efforts

- Explore Urban Flood Risks in Asia with GEO partners
  - In communication with UNESCAP and ADPC as end users in this region – will engage national and city-level agencies
  - Will leverage GEO-DARMA Asia Risk Assessments
- River Basin Risks in Africa
  - Working with RCMRD and CIMA Foundation end users to develop risk assessments for flooding along Africa river basins
  - Will leverage GEO-DARMA Africa Risk Assessments
- Latin America / Caribbean Flood Risk Development
  - Bring in AmeriGEOSS partners in this region through collaborating CEOS agencies (e.g., CONAE, INPE, etc.) to complete GEO-DARMA regional risk assessments and work with end users such as CDEMA, CIMH, and others

# Flood Demonstrator Team

- Lead to be identified from a CEOS agency
- Contacted CNES and EU partners to gauge interest...still need to contact other WG Disasters members
- Volunteers willing to be members of the demonstrator team:
  - Shawn Boyce (CIMH)
  - Albert Kettner (U. of Colorado / Dartmouth Flood Observatory)
  - Patrick Matgen (LIST)
  - Roberto Rudari and Giorgio Boni (CIMA)
  - Guy Schumann (RSS / U.of Colorado)
  - Sandro Martinis (DLR)

# Requested Data from CEOS Agencies

## (In addition to Other Freely Available Data from NASA and ESA)

- Continued Access to Charter Data (optical and SAR)
- SAR (250 archive images/50 new acquisitions per year per agency)
  - Cosmo Sky-Med
  - Radarsat-2
  - SAOCOM
  - NISAR
- Optical Imagery:
  - Pleiades
  - Other Digital Globe/MDA and Planet partners
  - Drone data where available

# Questions / Discussion

1. CEOS support for the Flood Demonstrator proposal?
2. Go forward to SIT-33?