Using Satellite Data for Disasters & Risk Management

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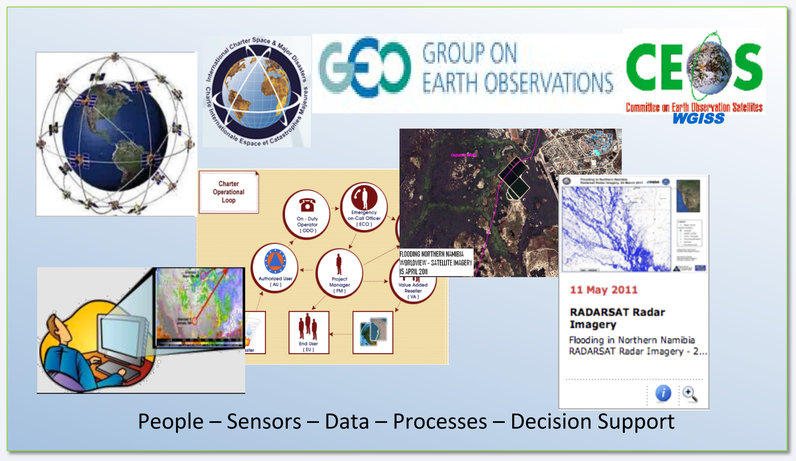
Problem to be Solved



People – Sensors – Data – Processes – Decision Support

International disaster management involves many activities by many players and many ad hoc arrangements, thus limiting effectiveness, efficiency

It is unclear

- How new suppliers can plug in their data / services
- How new users can tap into these data / services
- What resources are shared … missing … interdependent … isolated

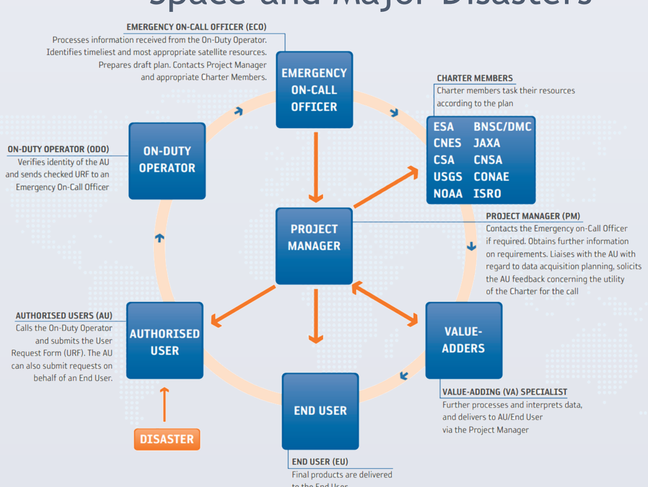
What is needed

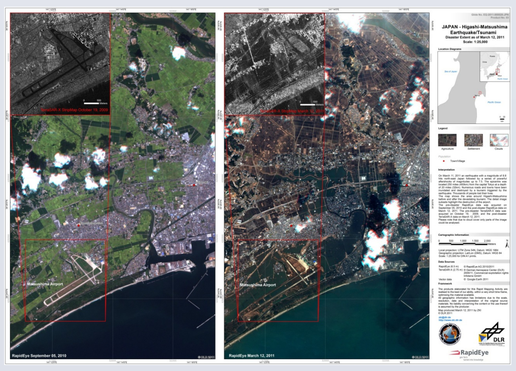
- A precise, common understanding of processes, information, resources, and needs
- Establish partnerships, standards, shared understanding, etc., in advance of disaster events

CEOS Project Purpose: Streamline and harmonize how space agencies support disaster management and response with satellite data

Approach – Case Study Analysis

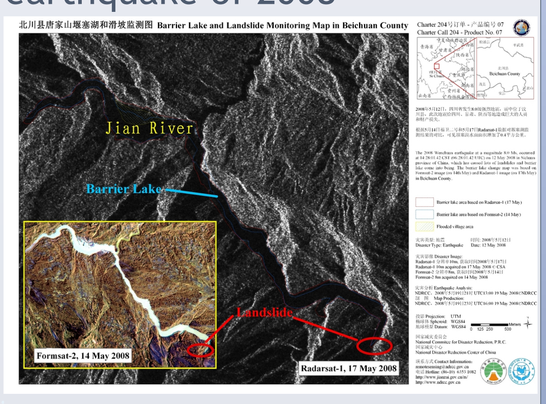
International Charter: Space and Major Disasters

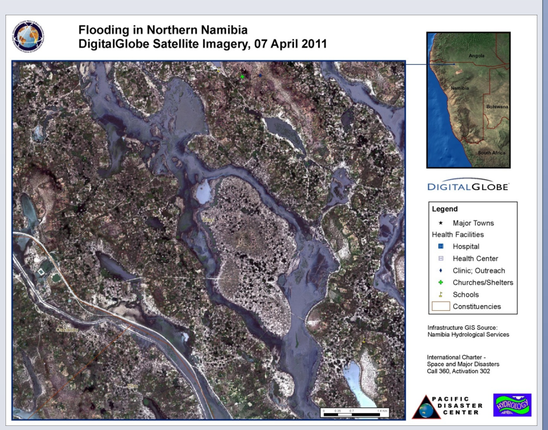




Great East Japan earthquake of 2011

China: Wenchuan / Sichuan earthquake of 2008





Flooding in Northern Namibia in 2011

CEOS Project Steps

- Characterize and evaluate disaster response processes
- Draw on case studies and WGISS contributions to GEOSS
- Use a well-defined architecture framework to describe the GEOSS disaster management enterprise as a whole
  - Key classes of people, system components, processes/services, products
  - Shared understanding of relationships and interdependencies
  - Common terminology and high level interfaces
  - Apply and extend GEOSS Architecture Implementation Pilot (AIP)
- Infer requirements for disaster/risk management users portal, e.g., search indexing; access interfaces; data priorities
- Capture lessons learned; recommended standards and products; building blocks for sustainable capability

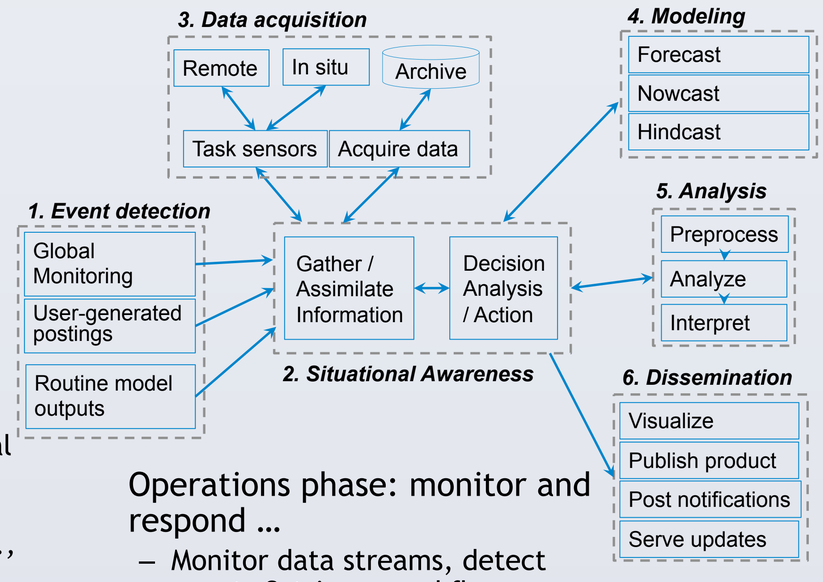
Preliminary Findings

Cross-Case Comparisons

	Namibia	China	Japan
Information used	Rainfall estimates (from sat. data & 3 hydro models validated w/ TRMM); MODIS; Landsat; EO-1 and RADARSAT (via tasking)	Airborne imagery provided necessary high resolution	Daichi ALOS; many others
Information processing	Preprocessing (geolocation, calibration); Atmospheric correction; Interpretation ("water mask" and other flood features)	Georectification, contrast stretch, joining image scenes, image interpretation, and extracting graphics and digital elevation models. Also 3D simulation & visualization	inSAR; false-color composites; damage analysis; rendering as digital or hardcopy images
Recommendations	More localized interpretation algorithms; obtaining quantitative data from Int'l Charter; tasking arrangements with JAXA, SPOT, et al.	Higher-resolution, higher-frequency satellite observations. Alternatives to ground control for geolocation. Int'l cooperation	Capacity building in regional offices; sharing workloads; communications infrastructure; wider awareness

- Different users need very different data: PDFs and JPEGs vs. Quantitative data grids
- Metadata describing fitness for use is crucial
  - Operational decisions require knowing data quality
  - Can't just filter out all imperfect data
- Collaboration, not just dissemination, is key, involving providers, analysts, & end users
- Need frequent, high-resolution satellite observations
- Traditional IT challenges apply:
  - Discovery, semantics, provenance
  - Uncertainty in processing, modeling, and forecasts
  - Security

Architecture Implications for System Initiation vs Operations



Initiation: identify and develop …

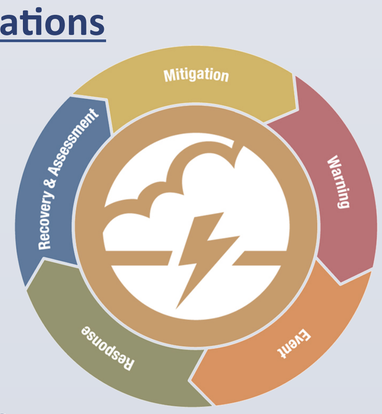
- Inputs for event detection, triggers
- Indicators for situational awareness (*e.g.*, flood extent)
- Modeling elements (*e.g.*, regional flood model)
- Workflows and data flows (for processing and delivery)
- Automation opportunities (*e.g.*, subscriptions, custom products)

Operations phase: monitor and respond …

- Monitor data streams, detect events & trigger workflows
- Track key indicators
- Task sensors; acquire data
- Run models (hindcast, nowcast, forecast)
- Analyze and disseminate products

Preliminary Recommendations

- Need to expand coordination / brokering mechanisms, like the Charter, to all phases of the disaster lifecycle
- Must allow broader data access / data sharing
- Need a services infrastructure to streamline access
  - Near-real-time services
  - On-demand, user-customizable products
- Need open, well-defined, interoperable interfaces



Further Information

Committee on Earth Observation Satellites (CEOS) Working Group on Information Systems and Services project GEOSS Architecture for Disasters http://tinyurl.com/GA4Disasters

CEOS Disasters SBA http://tinyurl.com/CEOS-DisastersSBA

GEO/GEOSS http://www.earthobservations.org/geoss.shtml

International Charter http://www.disasterscharter.org

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