Key Challenges in the application of satellite Earth Observations (EO) to Disaster Risk Management

(For presentation at IGARSS 2012, Munich Germany)

Co-authors: Stephane Chalifoux, Andrew Eddy, Stu Frye, Guy Seguin

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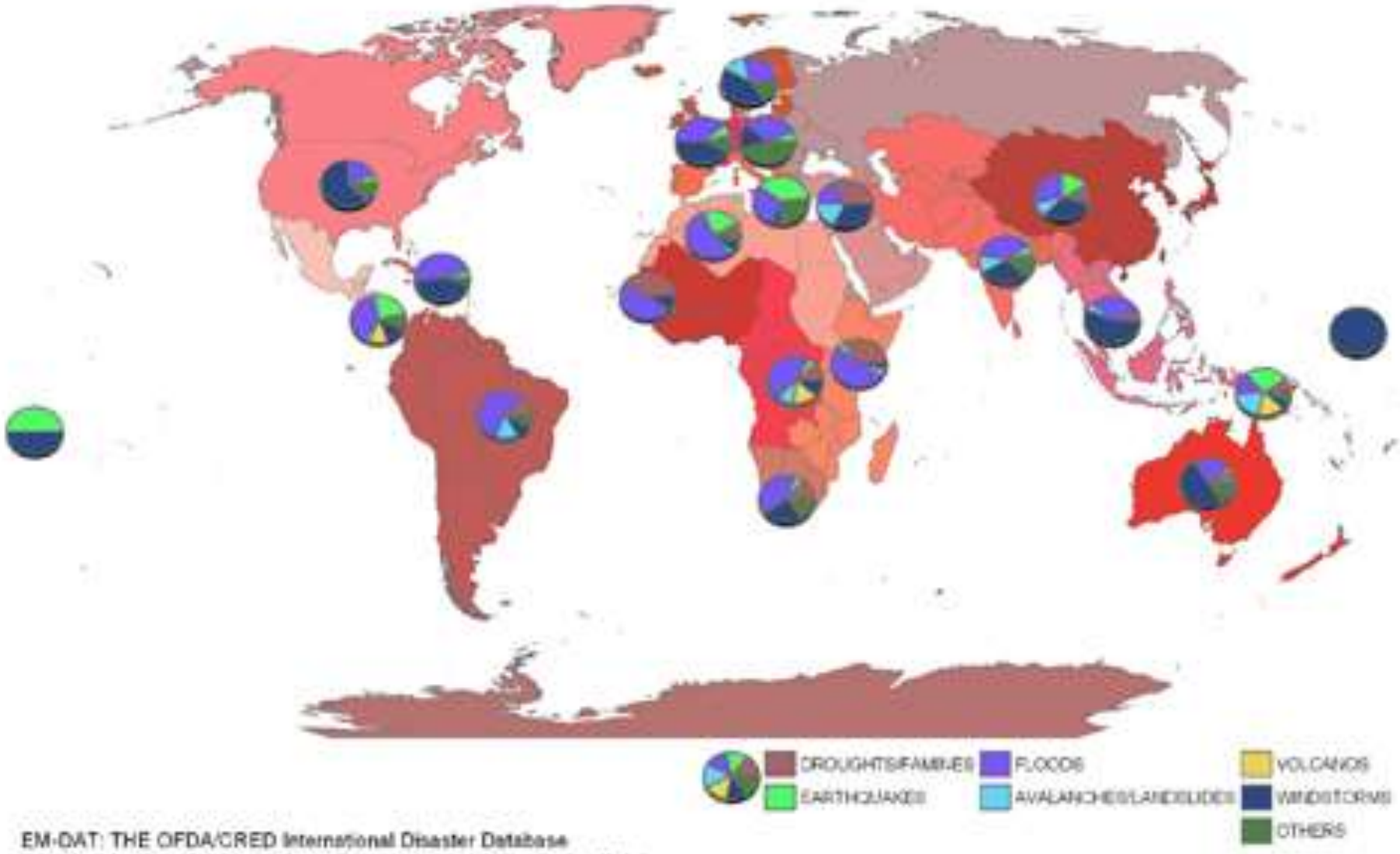
Outline

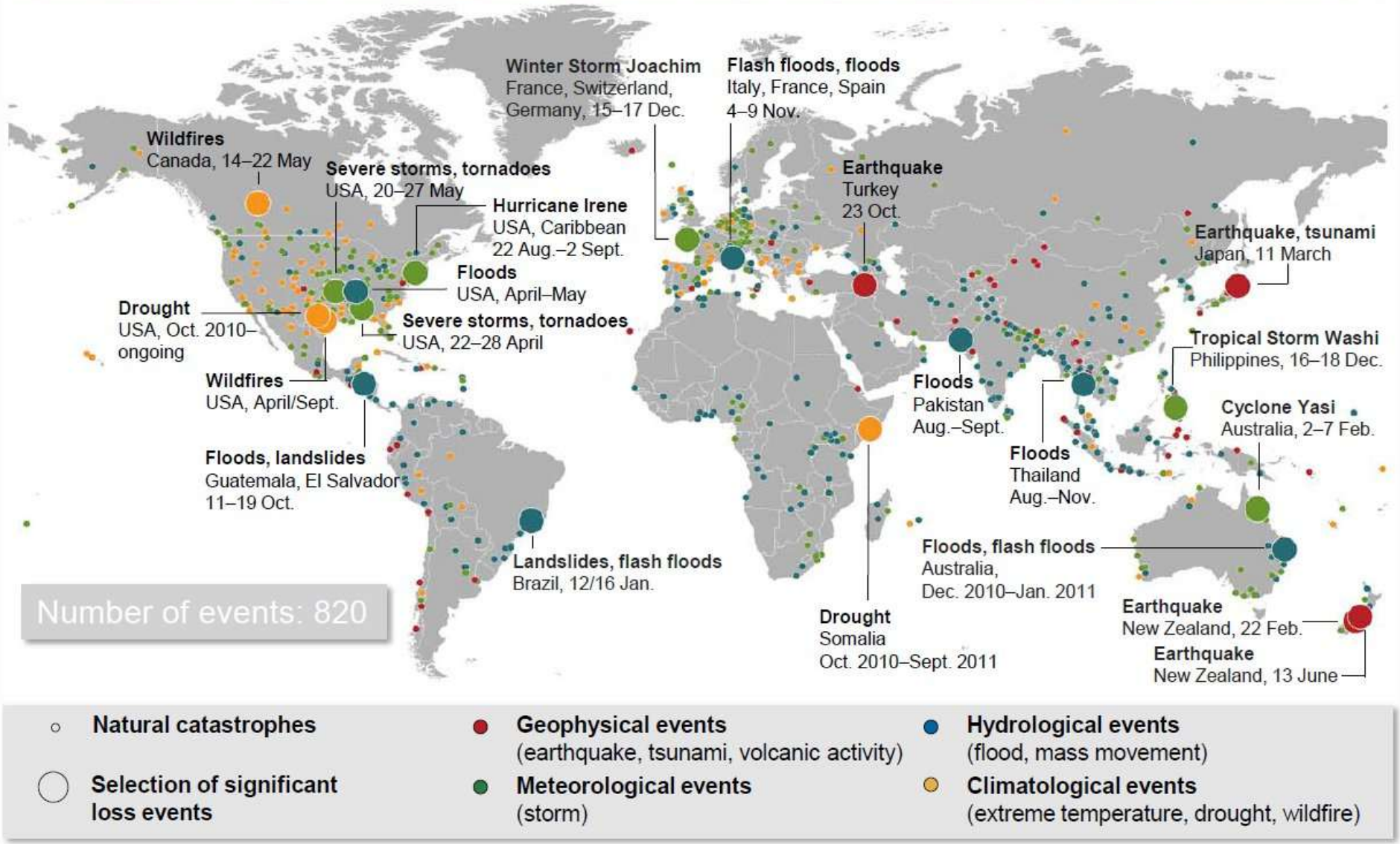
- Who are the users?
- Disasters and the disaster cycle
- EO in Disaster Risk Management (DRM) from user point of view
- EO in DRM from EO provider point of view
- Users & data
- Is data cost an issue?
- What is risk?
- Hazard information from EO
- Exposure information from EO
- Integrated Approach – a way forward
- The benefits

Disaster Type Proportions by United Nations Sub-Regions: 1974-2003



EM-DAT: THE OFDA/CRED International Disaster Database
www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium

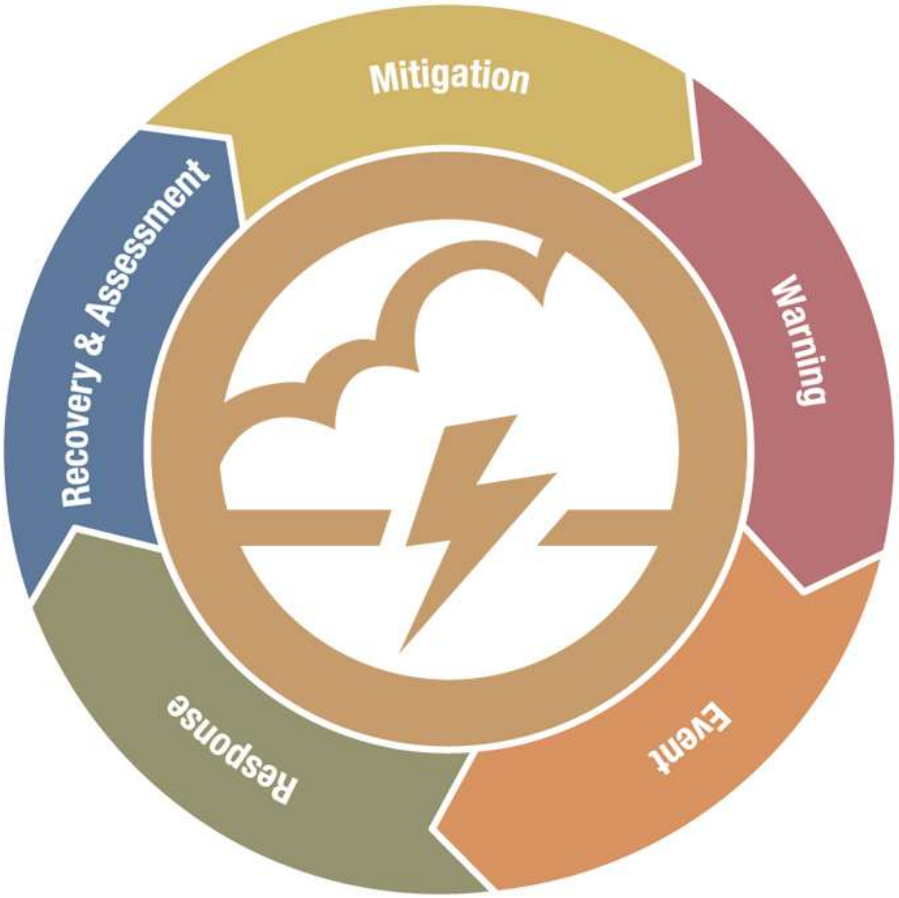
2011 Hazard Summary



Types of Users

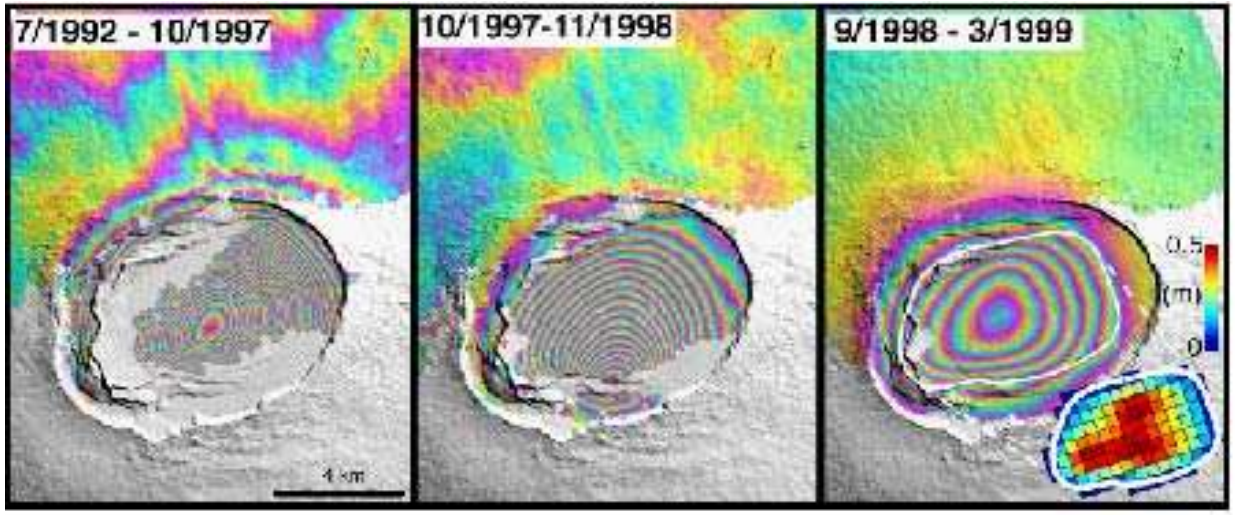
- Responders – time critical, low tech, aversion to new systems, comms issues
- Local decision makers – time critical for response, offers overview useful to integrated approach, cost issues
- Regional decision makers – cost issues, mitigation focus
- National decision makers – briefing up, mandate issues
- International organizations – varies according to mandate
- Differences by phase
- Issues
  - Capacity building
  - Data/information integration

Disaster Cycle



Mitigation

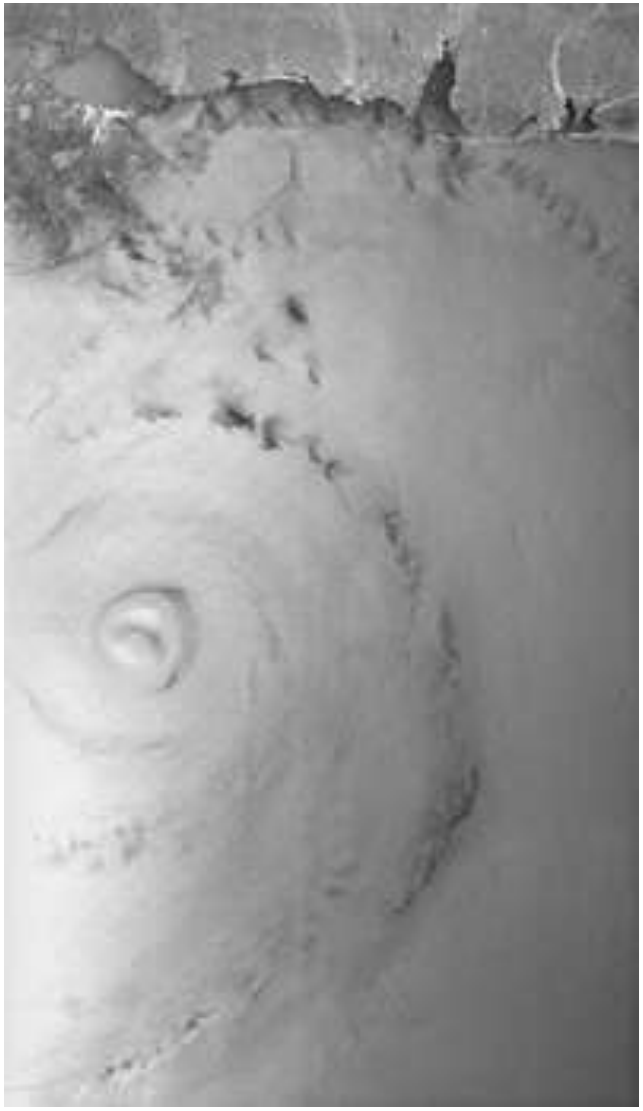
Mitigation activities lessen the impact of disaster events by collecting, analyzing and monitoring factors which influence disasters, and by appropriate follow-up.



Sierra Negra, Galapagos, InSAR, each color-cycle is 5 cm range change between the ground and the satellite (Amelung et al., 2000)

Warning

Warning consists of early detection, resource stockpiling, contingency planning and evacuation of potentially affected areas

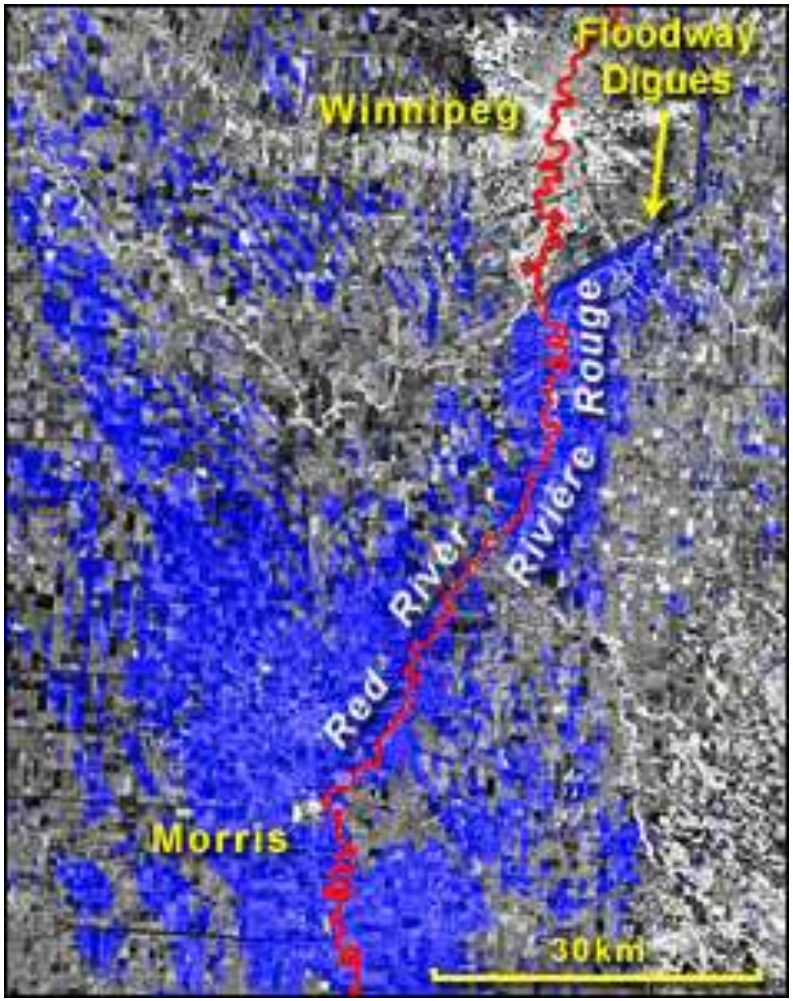


RADARSAT image of Hurricane Katrina just as it strikes New Orleans.

The image clearly shows the eye of the hurricane as a depression in the ocean surface.

Response

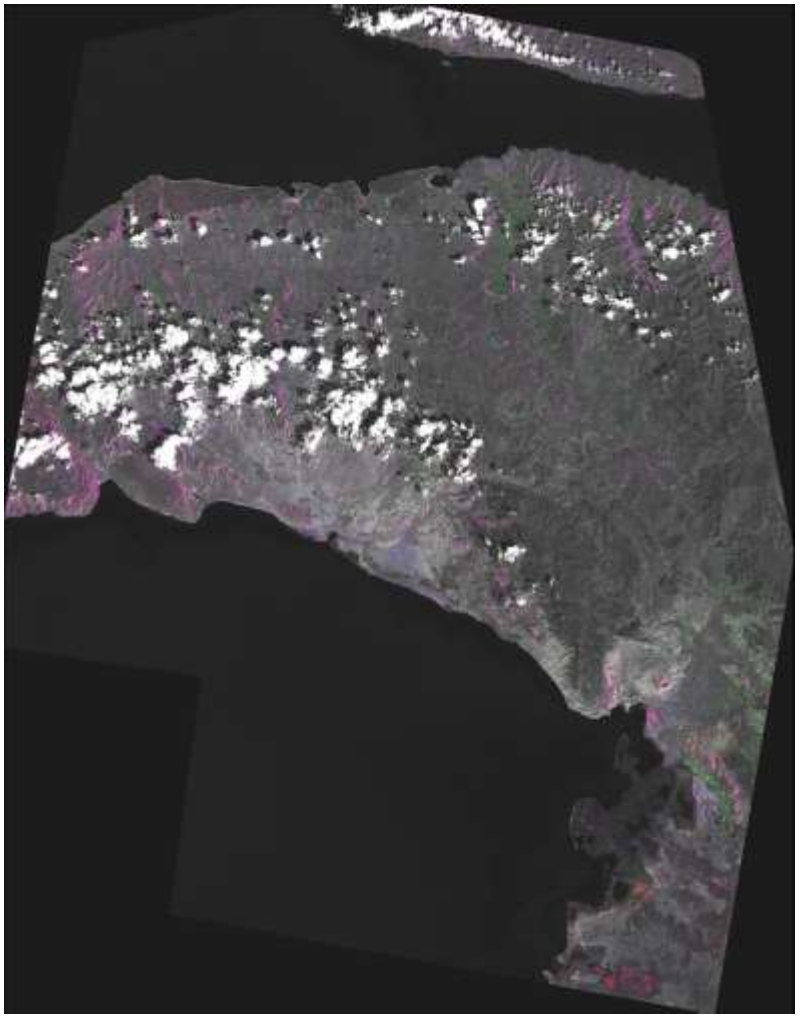
Response involves dealing with human and environmental concerns during and immediately following a disaster



RADARSAT image of the Red River flooding around Winnipeg.

Recovery & Assessment

The recovery and assessment phase includes restoration of infrastructure and rehabilitation of services, as well as stock-taking to determine insurance claims or how the environment is recovering

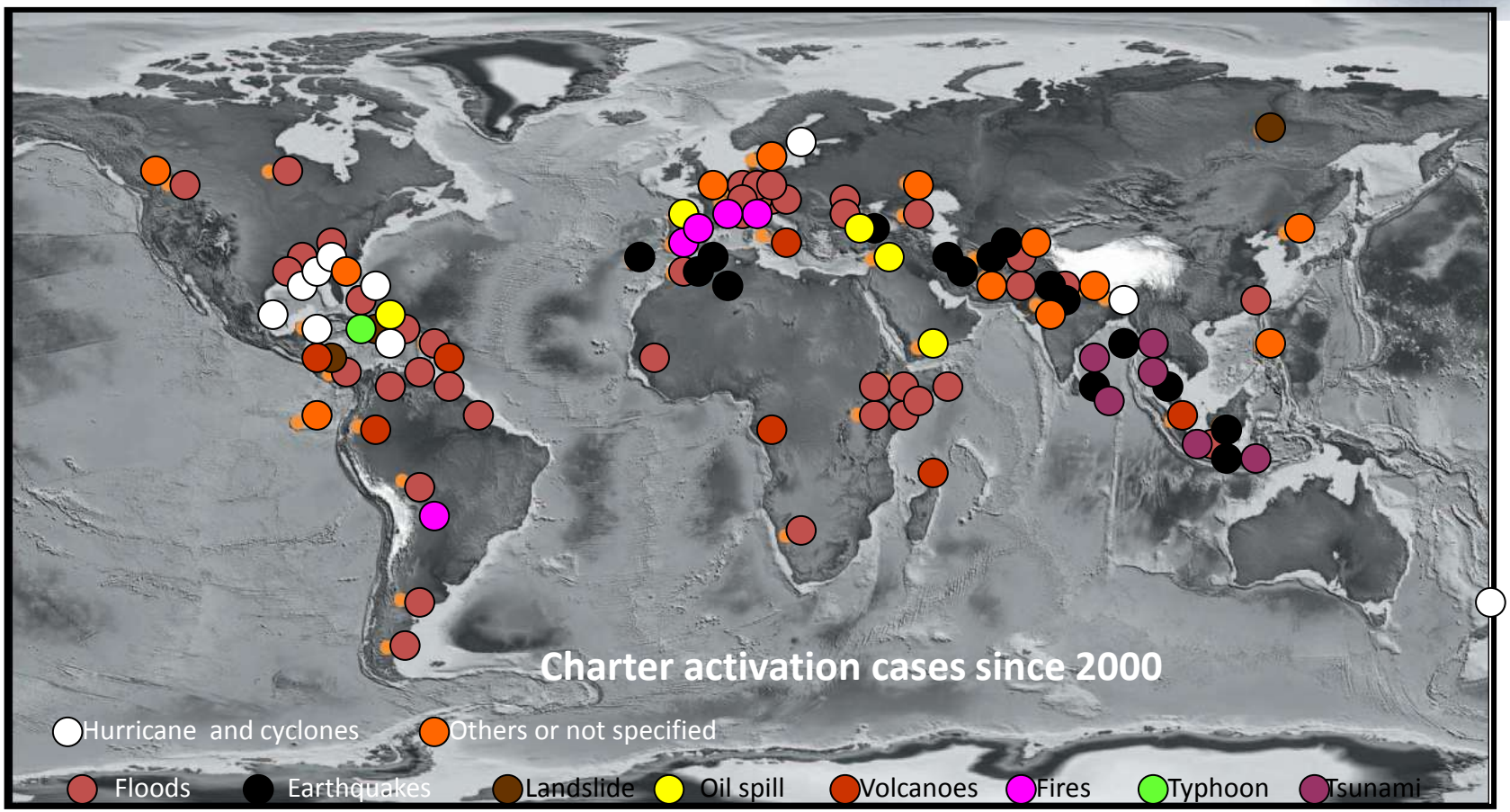


Floods, Haiti, Sept. 2004, RADARSAT-1 data, color-coded and superimposed on Landsat-7 scene (© CSA and RSI)

EO in Disaster Risk Management (DRM) Today (the provider perspective)

- Large EO data capacity is under-utilised
- EO applications could offer operational solution in many areas
- Cost/price of EO not an issue if application is important

International Charter Space and Major Disasters



EO in DRM Today
(the user perspective)

- EO not used operationally
- EO solutions not yet mature/don't address user information needs
- EO world is confusing and data required does not exist
- EO is costly

Barriers to Satellite EO Access (1)

Barriers to EO Access	Improving Access	Outcomes
Disorganised Supply (confusing)	**One-stop shop for EO data (with integrated needs-driven data selection tool)**	**CEOS or commercial supplier could provide single meta-data source linking to key providers Users have single interface to determine whether data they need exists and where to find it**
Fragmented Supply (only partial answers)	**Provide links to value added industry through exploitation platform (through value-added industry?)**	**EO data integrated with other services in user driven context**
EO utility still unproven	**Promotional demonstrations along key priority themes (targeted service development)**	**Value demonstrated in limited area (user champions created)**

Barriers to Satellite EO Access (2)

Barriers to EO Access	Improving Access	Outcomes
Cost of data ; cost-benefit not well-known	Need for Disaster Risk Reduction (DRR) Baseline Data Set (prime the pump), just as Charter provides response data Better document user benefits (space agencies)	High-profile contributions that enables new EO users to explore possibilities of EO use Sustained partnership with key users to demonstrate benefits
Lack of user capacity	Project driven capacity development activities on regional basis (World Bank? Donors? Space agencies?) Decentralisation of data archives in cooperation with partners (e.g. WB GeoNodes) to stimulate interest in capacity development	New capacity fostered with focus on DRR Easier access to EO data and sense of ownership in user community

Users & EO Data (1)

- Is the right data available?
- Is it up to date?
- Can it be delivered in a timely fashion?
- How much does it cost?

Users & EO Data (2)

- How do they find it?
- How do they know what they need?
- Does it fit with their existing systems?
- How do they use it?

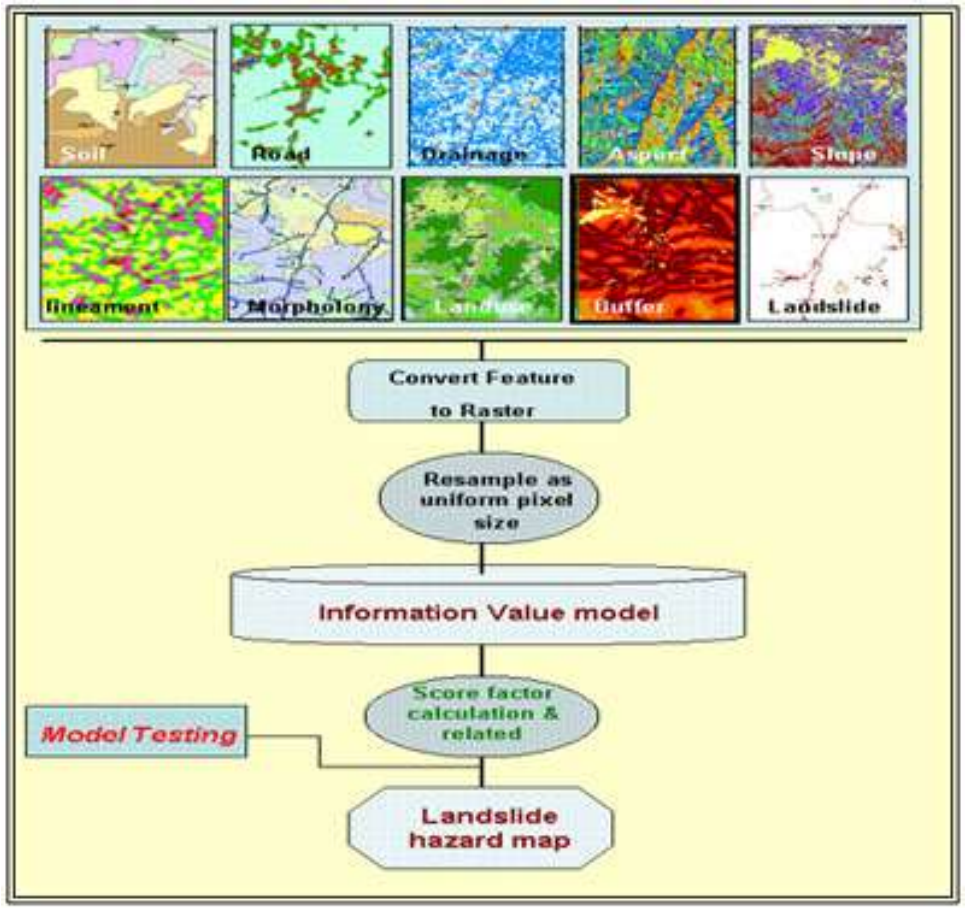
Is data cost an issue?

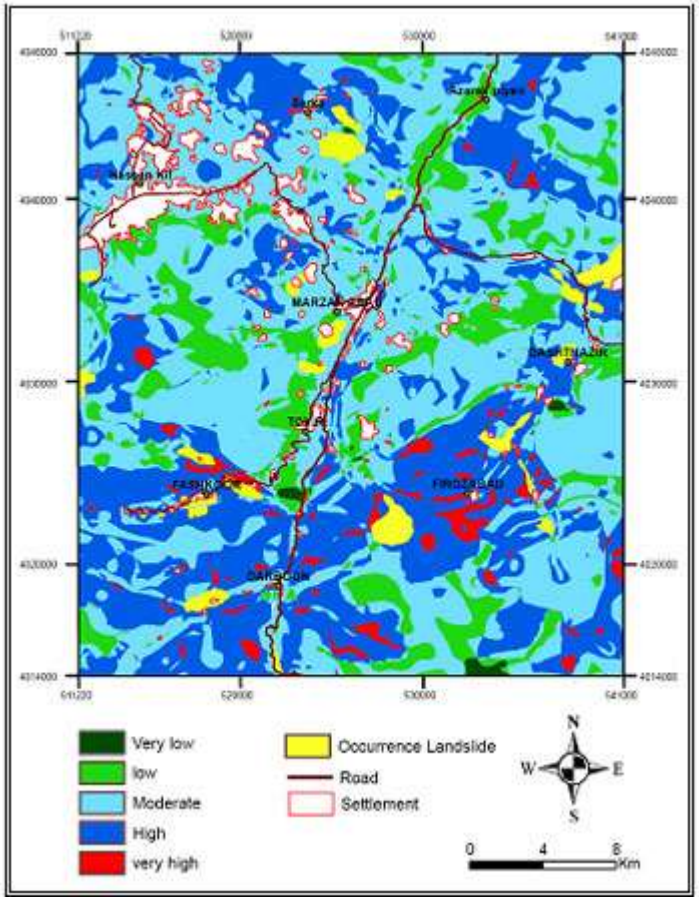
- Is gas expensive?
- Short-term: of course it is...
- Long-term: real issue is cost-benefit. EO sector must demonstrate its value through targeted partnerships with end users

Risk

- “Risk” is the probability of a loss, and depends on three elements, hazard, vulnerability and exposure.” (Crichton, 1999)
- EO can inform both hazards and exposure, Vulnerability is harder...

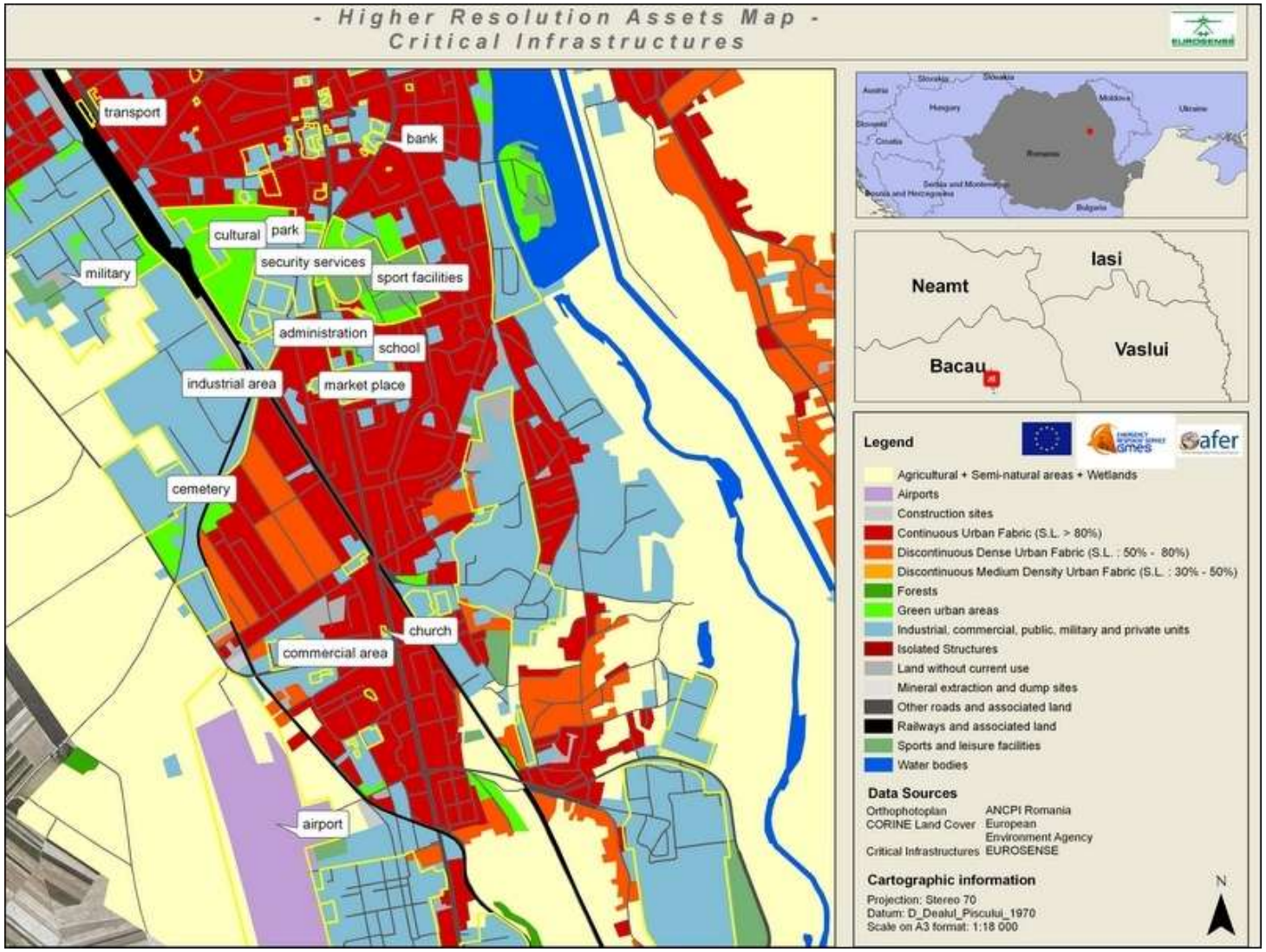
Hazard information from EO





Source: www.geospatialworld.net

Exposure information from EO



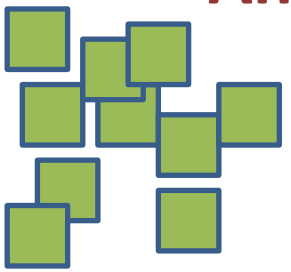
EO-based asset map for Bacau, Romania

Courtesy www.eurosense.com

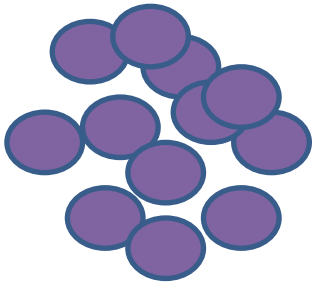
EO in DRM Tomorrow (the way forward)

- EO requires demonstration in user-defined pilots at little or no cost to user (raise awareness, 'prime the pump')
- EO is in many cases the most cost-effective means of achieving risk reduction goals, but this has not been demonstrated to stakeholders (cost benefit analysis required)
- Meeting EO information needs requires better understanding by supply community to ensure proper data sets collected
- EO will only be widely adopted if part of an integrated solution that is not satellite-centric

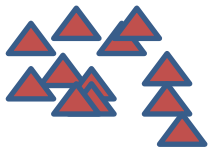
An Integrated Approach



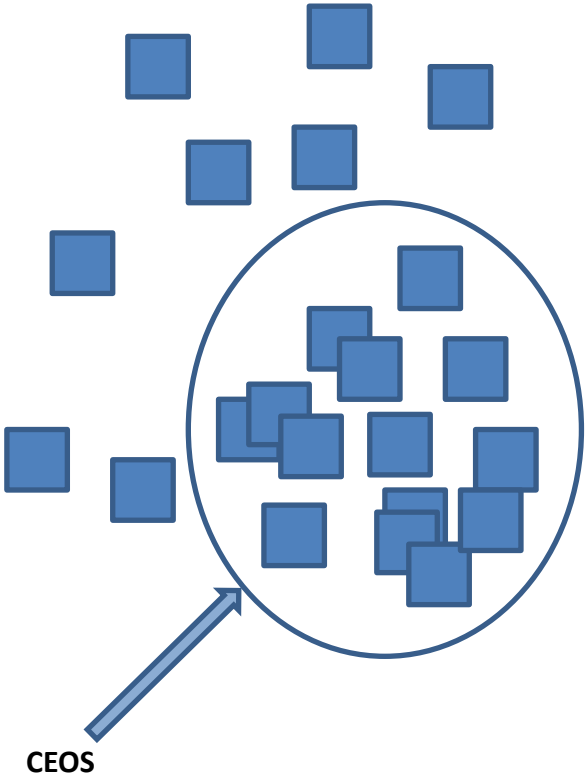
In-situ data



Models, algorithms



GPS, statistics



CEOS

Satellite EO for DRM

Not satellite EO + other data for DRM

Products Services

INTERMEDIATE USERS

END USERS

Capacity:
- Integration
- Exploitation
- Interpretation

Reliable, Sustainable Information

EO in DRM Tomorrow (the benefit)

- Uptake of EO by DRM community offers large new use area for EO data, with spill-over benefits to related areas such as development and ecosystem management
- Operational EO use in DRR will prevent loss of life and reduce exposure of property to damage
- Operational EO use in DRR will augment the effectiveness of existing response initiatives such as the Charter
- High-profile application of EO in DRM generates political support for increased EO capacity over long-term