Strengthening Disaster Management using Earth Observations – GEOSS and CEOS Activities –

George Percivall, Nadine Alameh; OGC
John Evans, GST
Karen Moe, NASA

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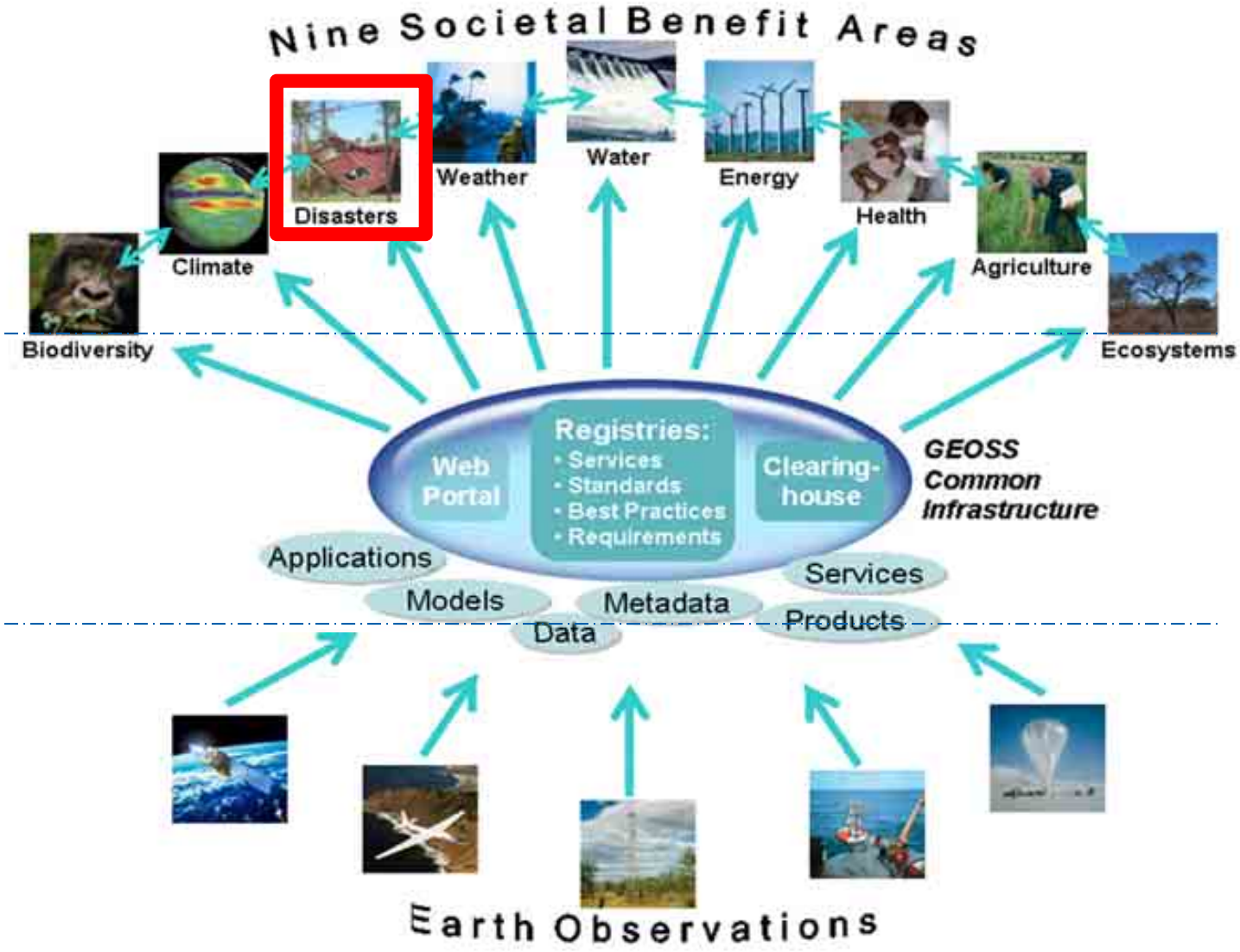
GEOSS and CEOS coordination on DM

- GEO and CEOS are advancing the use of Earth Observations (EO) in Disaster Management (DM)
- GEOSS informs risk management and disaster reduction with EO-derived information.
  - Architecture Implementation Pilot (AIP)
- CEOS developing GEOSS Architecture for the Use of Satellites for DM and Risk Assessment
  - GA.4.Disasters
- Coordinated GEOSS and CEOS activities

GROUP ON EARTH OBSERVATIONS

CEOS Working Group on Information Systems and Services

GEOSS connects Observations to Decisions



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Architecture Implementation Pilot and DM

AIP-1: GEOSS Common Infrastructure (GCI) prototype
- Applied to DM: oil spill, volcano, hurricane

AIP-2: Disaster Management Scenario
- Scenario and Use Case driven development
- Applied to flooding; Recast to other disasters

AIP-3: Near- real-time dispatching during response
- Component architecture confirmed

AIP-4: DM based on EC BRISEIDE project

AIP-5: Coordination with CEOS on DM – in process

"Fostering interoperability arrangements and common practices for GEOSS"

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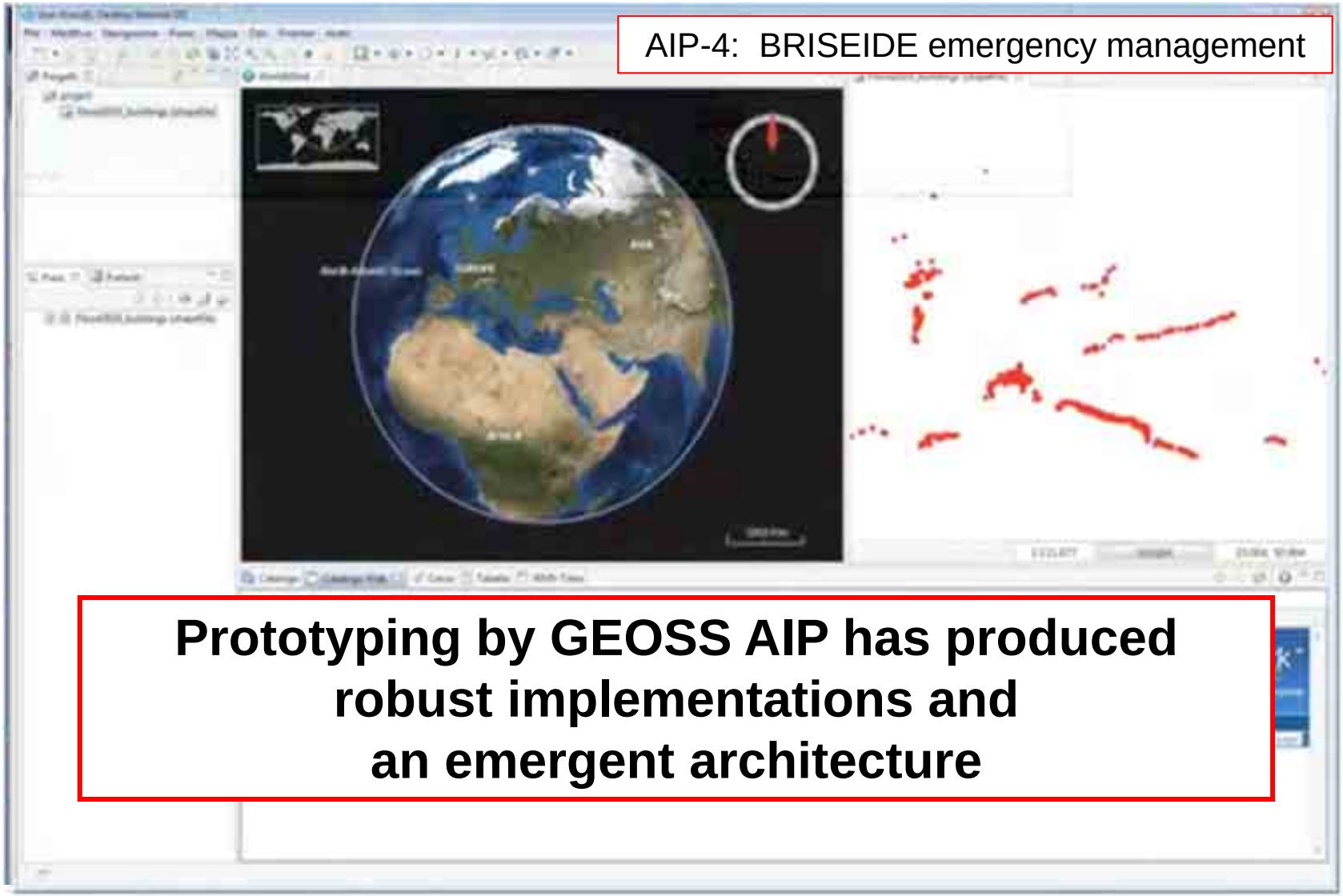
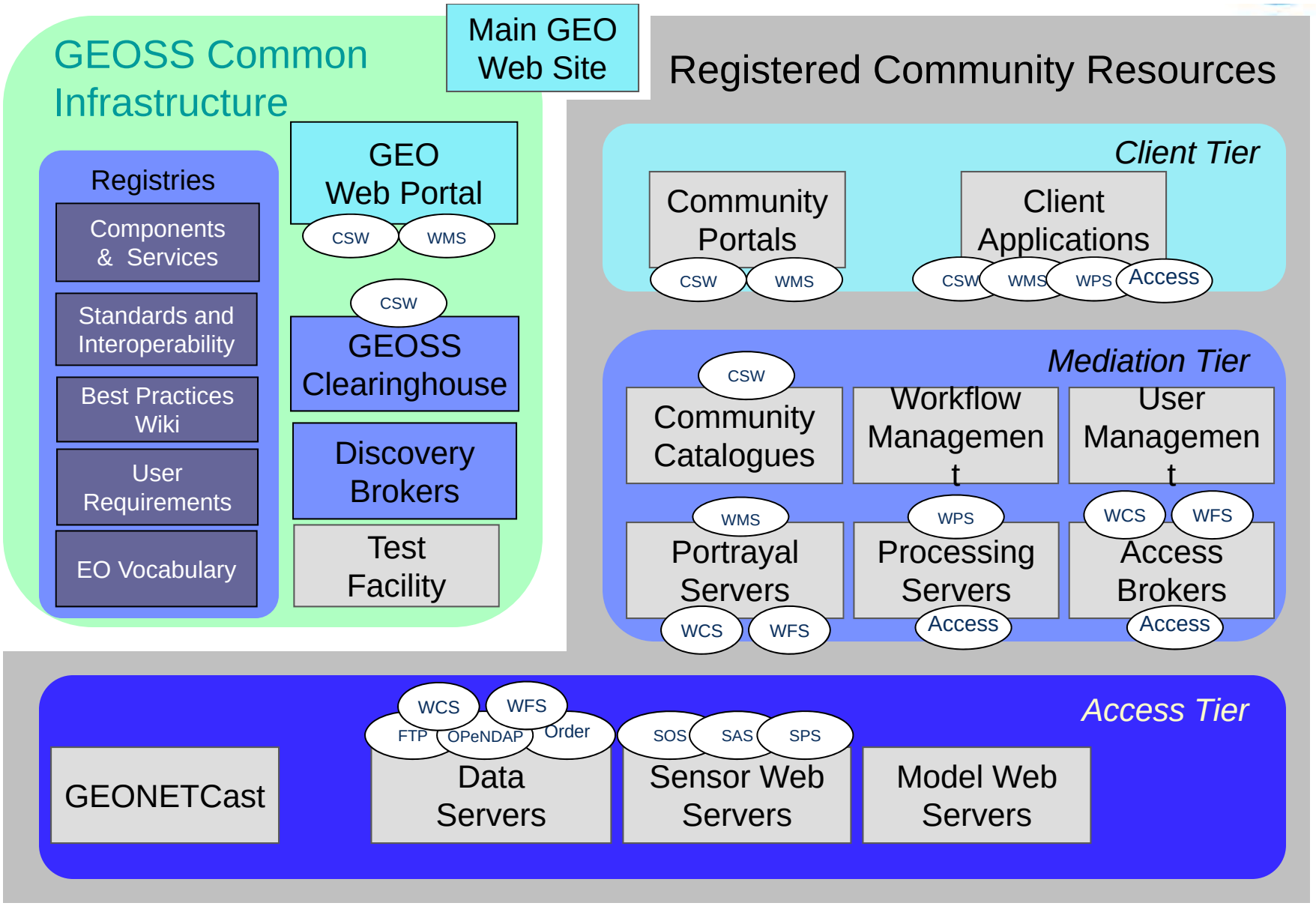
AIP Disaster Management Results

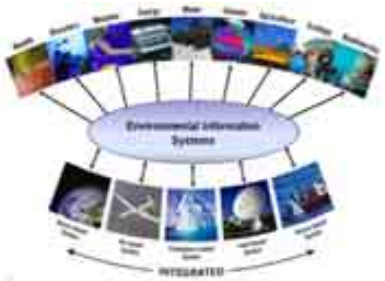


Prototyping by GEOSS AIP has produced robust implementations and an emergent architecture

Engineering Components:
Host data, Interact thru Services



GEOSS AIP Architecture



Community Objectives

Enterprise Viewpoint

GEOSS Vision and Targets
Societal Benefit Areas
System of Systems/ Interoperability

Abstract/Best Practices

Information Framework

Earth Observations
Geographic Features
Spatial Referencing
Metadata and Quality
GEOSS Data-CORE

Information Viewpoint

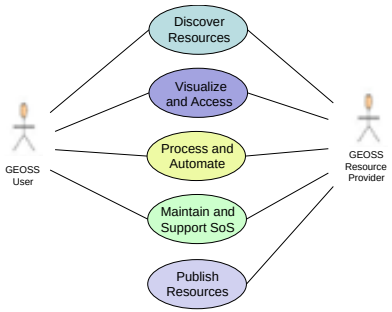
Computational Viewpoint

Services

Catalog/Registry
Access and Order
Processing Services
Sensor Web
User Identity

Optimized Design/Development

Use Cases



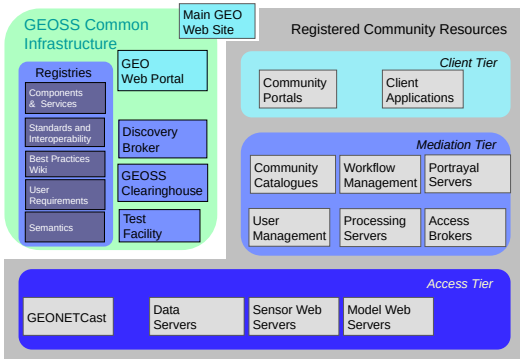
Tutorials

Engineering Viewpoint

Technology Viewpoint

RM-ODP Viewpoints

Component Types



GEOSS AIP DM Findings

- Harm from disasters is minimized by rapid and seamless transfer and use of EO and other geospatial information
- Distribution of alerts, e.g. CAP, GeoRSS, must include geographic location to be useful.
- Replace “order” with “access” to speed delivery and analysis
- Accurate fusion of EO and other geospatial information requires use of open standards
  - OGC Web Processing Service (WPS) for algorithms
- GEOSS approach of interoperable components and services has been shown to improve DM planning and response
  - Aid levels for disaster response can be released prior to on-site damage assessment.

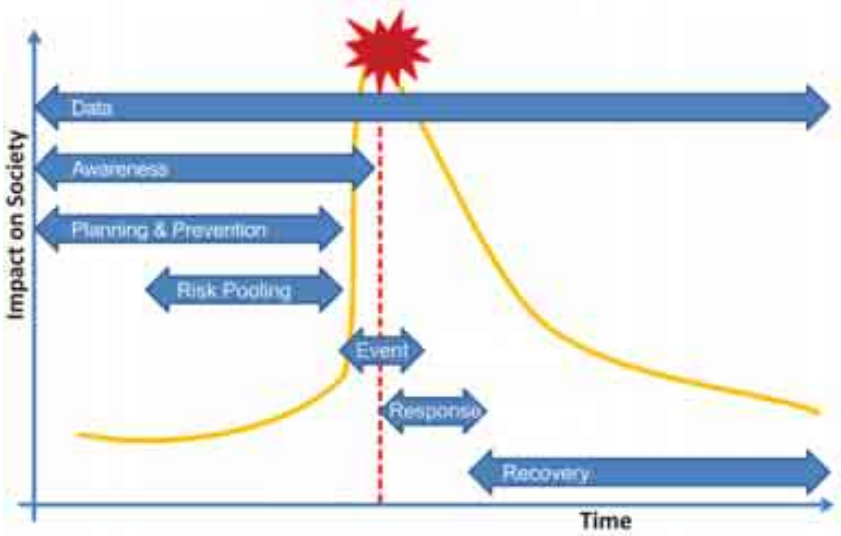
GEOSS Architecture for the Use of Satellites for Disaster Management and Risk Assessment (GA.4.Disasters)

People – Sensors – Data – Processes – Decision Support

Project of the **Committee on Earth Observation Satellites (CEOS) Working Group on Information Systems and Services (WGISS)**

GA.4.Disasters: Problem Statement

- Need a holistic treatment of all phases of the disaster management lifecycle
  - response, recovery, mitigation, preparation
- Many activities by many players
  - Many ad hoc arrangements
  - Limited effectiveness, efficiency



- Unclear how new suppliers can plug in their data / services
- Unclear how new users can tap into these data / services
- Unclear what resources are shared … missing … interdependent … isolated
- Need to establish partnerships, standards, vocabulary, etc., in advance of disaster events
- Need a precise, common understanding of processes, resources, and needs

Graphic bBased on World Economic Forum, 2011, "A vision for managing natural disaster risk: proposals for public/private stakeholder solutions," p. 21.

GA.4.Disasters Approach: Practitioner Case Studies

- Collect insights, practices, vocabulary, mechanisms, lessons from practitioners in the field
  - To ground and supplement architecture use cases
  - Focus on *Enterprise*, *Information*, *Computation* viewpoints
- Disaster response experiences
  - *e.g.,* 2008 China / Sichuan earthquake;
    2011 Japan / Tohoku earthquake / tsunami; 2011 Thailand floods
- Technology Pilots
  - *e.g.,* Namibia Sensor Web Flood Pilot; Ukraine / ESA Wide Area Grid;
    Virtual Mission Operation Center (VMOC)
- Satellite Data Brokers
  - *e.g.,* International Charter - Space and Major Disasters
  - Disaster Monitoring Constellation (DMCii); Sentinel Asia
- Value-added service providers
  - *e.g.,* NASA SERVIR; GEOSS Geohazards Supersites

GA.4.Disasters Case Studies: starting points for data collection

1. Summarize the disaster event in a few sentences
2. Who participated in disaster response, recovery, or preparations?
3. How did these organizations or individuals interact or collaborate?
4. Who was involved in supplying satellite information?
5. What satellite information was used to support these activities?
   What other observations might've been useful?
6. What processing was performed on the data? (e.g., reformatting; georectification; interpretation, classification)
7. How could information support to these activities been streamlined?
   Or, how could these activities have taken better advantage of available information?

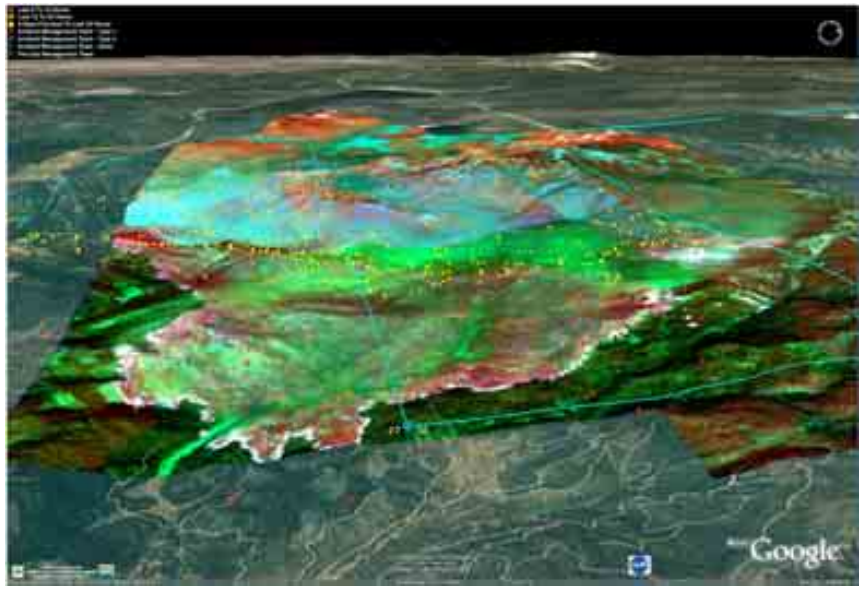
GA.4.Disasters: Enterprise Viewpoint elements

- Purpose, scope, structure
  - More effective, efficient use of satellite data in disaster management
  - Disaster lifecycle phases
  - Disaster types – e.g.,
    - Natural: Geophysical, Hydrological, Climatological, Meteorological, Biological
    - Manmade: Conflict, Famine, Displaced populations, Industrial / Transport Accidents
  - Stakeholders
    - Civil defense agencies; Regional / Global data brokers;
    - CEOS / WGISS member agencies; GEO/GEOSS; UN-SPIDER
- Policies / Principles
  - (Interoperating) System of (autonomous) Systems
  - GEOSS data sharing principles; Interoperability arrangements
- Basis
  - GEOSS Strategic Targets, GEO 2012-2015 Work Plan, CEOS Disasters SBA requirements, AIP, others

Graphic: "Is 'Flood Risk Management' Identical to 'Flood Disaster Management'?" Vanneuville et al., posted on March 21st, 2011, Earthzine on-line magazine published by IEEE and ICEO, http://www.earthzine.org/2011/03/21/is-flood-risk-management-identical-to-flood-disaster-management/

GA.4.Disasters: Information Viewpoint elements

- Observation requirements *vs.* disaster types and lifecycle phases
- Observations by orbital sensor types
- Satellite data processing in disaster management – *e.g.,*
  - Decoding raw satellite feeds
  - Georeferencing / georectification
  - Atmospheric correction
  - Image interpretation, feature extraction
  - Image resampling / tiling for interactive visualization
  - Image enhancement *(e.g., pan sharpening)*
- Semantics / ontologies / translation
- Metadata for discovery and assessing fitness-for-use



GA.4.Disasters: Computation Viewpoint elements

- Priority service types for satellite data in disaster management
  - Data Access
  - Data Processing
    - esp. Image Interpretation
  - Portrayal
  - Sensor Tasking
  - User Management
    - esp. for sensor tasking

- Constraints and requirements for satellite data services in disaster management
  - Near-real-time performance
  - Cross-community interoperability
  - Easy access by a variety of users
  - Streamlined system maintenance
  - Service-oriented approach vs. push / broadcast

CEOS and GEOSS coordination on DM

- Coordinated development of GEOSS Architecture for Disaster Management Reference Model led by CEOS
  - Use of RM-ODP increases coordination
- Refine Disaster Management Scenario further via implementation in GEOSS AIP-5
- Refine use cases and interoperability for GEOSS components in Disaster Management
  - Discovery, access, processing, workflow
  - Authentication and authorization
- Continuously engage the international DM community to fully utilize EO resources for societal benefit

References

- GEO
  - earthobservations.org
- GEO Architecture Implementation Pilot
  - www.ogcnetwork.net/AIpilot
- GEOSS Registries and SIF
  - geossregistries.info
- CEOS/WGISS GA.4.Disasters project:
  - tinyurl.com/GA4Disasters