CEOS Activities for Disaster Risk Management

Chu Ishida on behalf of CEOS ad hoc Disasters Team, 27 November 2013

Committee on Earth Observation Satellites

What is CEOS?

- ✓ Established in 1984 under auspices of G-7 Economic Summit of Industrialized Nations
- ✓ 30 Members (Space Agencies), 23 Associates (UN Agencies, Phase A programs or supporting ground facility programs)

Primary Objectives of CEOS

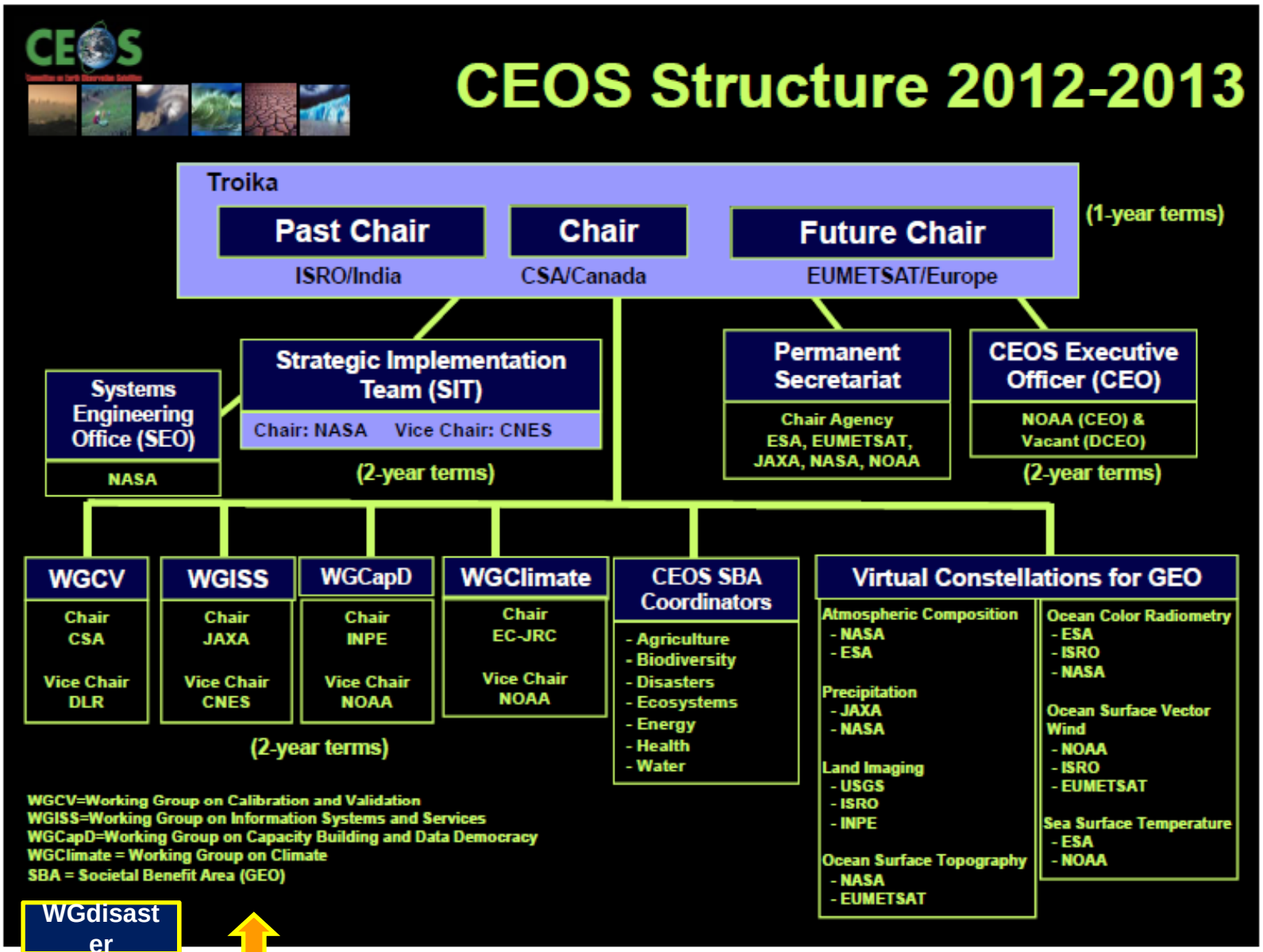
1. To optimize benefits of space-borne Earth observations through:

– Cooperation of its Members in mission planning

– Development of compatible data products, formats, services, applications, and policies;

2. To serve as a focal point for international coordination of space-related Earth observation activities;

3. To exchange policy and technical information to encourage complementarity and compatibility of observation and data exchange systems.



WGdisaster is just established in Nov 2013!

Overview

Growing interest in Disaster Risk Management (DRM)

- Large international organisations (UN, WB, EC,..), nations, dedicating growing resources to disaster risk reduction

Role for CEOS

- Satellites have a unique role to play to support DRM
- Lack of awareness of potential satellite contributions
- Users need to see benefit of EO through dedicated pilots
- Coordinated action greater than sum of individual agency's contribution.
- Build on existing initiatives e.g. Charter, Supersites, Sentinel-Asia,..

Mandate of ad hoc Disasters Team (from 26th Plenary, 2012)

- Define a CEOS DRM Observation Strategy to support enlarged actions for disaster risk management
- Position satellite EO in the post-Hyogo Framework for Action activities

4 Demonstrators: 3 Pilots + Recovery Observatory

Observation Strategy

- Coordinate CEOS acquisitions to reduce overlap and eliminate gaps
- Support pilots with focussed objectives scalable to global action
- 2014-2016 - address pilot needs; longer-term vision for post 2016 to be assessed through pilots

Flood, seismic and volcano R&D demonstrator Pilots defined by experts

- 35 experts from 10 CEOS Agencies; 26 from non-CEOS organisations (user and practitioner community at local/national or regional levels).
- EO observation requirements based on real and prioritised user needs.
- Maximum reuse of existing projects, initiatives & assets from CEOS agencies targeted new activities to bridge gaps. Aligned with GEO.
- Demonstration period 2014-2016 with significant outcomes for the 2015 World Conference on Disaster Risk Reduction – WCDRR (UN, Japan).

"Recovery Observatory" (builds on Charter and CNES' Haiti work)

- Sharing EO data to support recovery from catastrophic disaster.

Pilots Overview

Pilot	Team Co-Leads	Deliverables
Floods	**NASA**, S. Frye **NOAA,** B. Kuligowski	• **Global Flood Dashboard (single access for multiple existing systems)** • **Three regional pilots showcasing end user benefit of frequent high spatial resolution observations (Caribbean, Southern Africa, Mekong/Java)**
Seismic Risks	**ESA,** P. Bally **DLR,** J. Hoffmann	• **Demonstrator for EO-based global strain map** (main focus on Turkey, Himalayas and Andes) • **Exploitation platform for large data set analysis (strain map, supersites)** • **Rapid scientific products for 4 to 6 earthquakes per year (>M5.8)**
Volcanoes	**USGS,** M. Poland **ASI,** S. Zoffoli	• **Demonstrate feasibility of systematic global monitoring in regional arc (Latin America)** • **Develop new EO-based monitoring products at supersites** • **Real-time in-depth monitoring of one '100-year' category major eruption**
Recovery Observatory	**CNES**, A. Giros	• **Provide multi-year EO-based database to support recovery from one catastrophic disaster**

Floods – the need

Photo Telecom sans frontière

WHY? **Most prevalent global disaster – largest number of events and largest number of people affected (**500 million people every year)**, greatest economic impact (**1-2 billion $ /yr in the 1970s ; 15 billion $/yr today**); EO can track flood waters, predict affected areas and support prevention.**

WHAT'S MISSING? **Lots of rapid mapping for response today, but little flood cycle management using EO. Full-cycle real-time flood monitoring using high resolution optical and radar data brings greatly improved accuracy. Application of EO globally is either at low resolution on large geographical zones or high resolution over limited areas on ad hoc basis; few linkages between global and regional efforts.**

Flood Pilot Objectives

Application of satellite EO to the full cycle of flood management at global and regional/local scales by:

<u>Objective A</u> – Integrating information from existing near-real time global flood monitoring and modeling systems in a Global Flood Dashboard for hydro-met modelling by science users;

(higher temporal and lower spatial resolution)

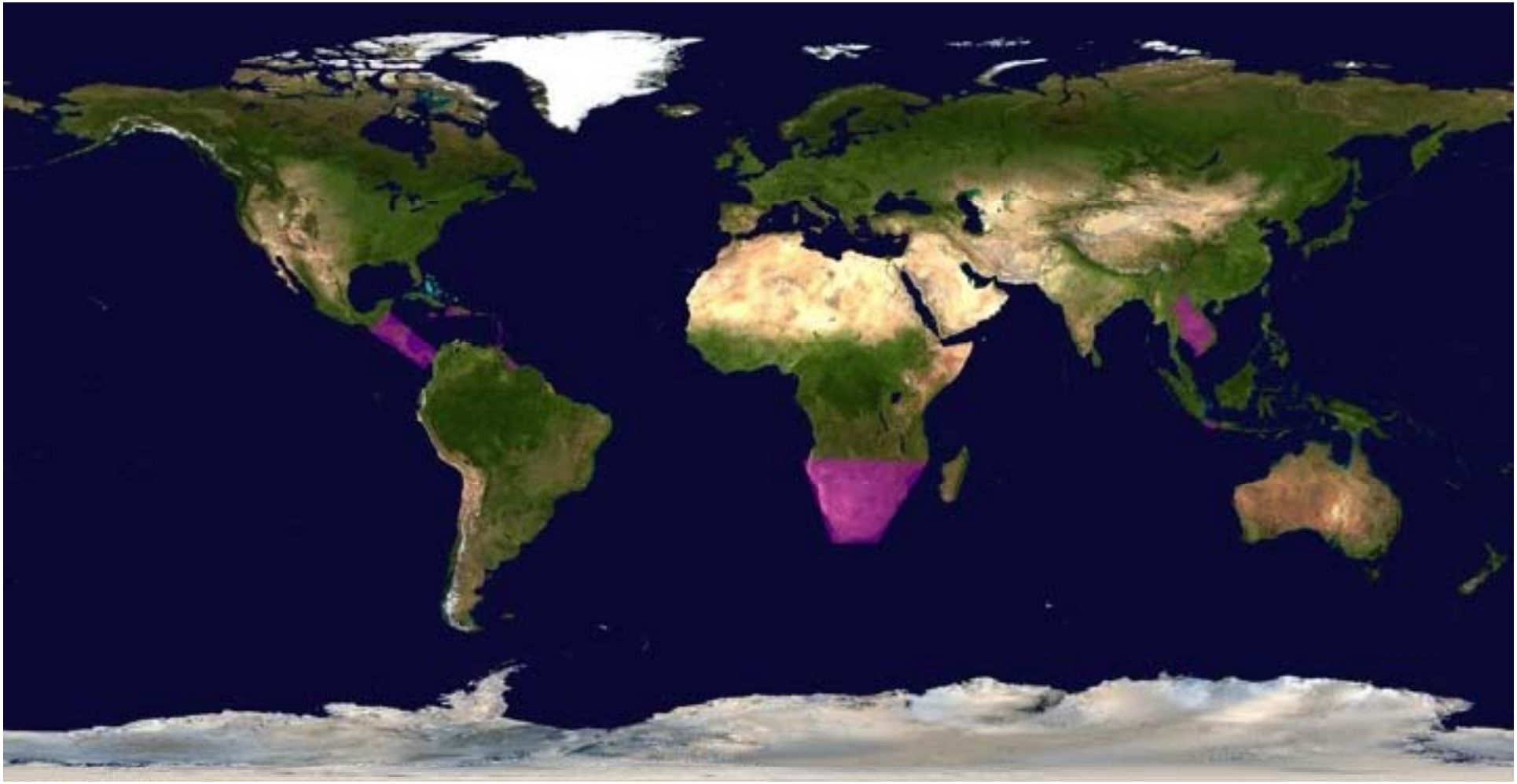
<u>Objective B</u> – Delivering EO-based flood mitigation, warning and response products and services through regional end-to-end pilots for local authorities in:

- **The Caribbean (with particular focus on Haiti);**
- **Southern Africa, including Namibia, South Africa, Zambia, Zimbabwe, Mozambique and Malawi;**
- **Southeast Asia (with particular focus on the lower Mekong Basin and Java, Indonesia).**

(higher spatial and lower temporal resolution)

<u>Objective C</u> – Encouraging regional in-country capacity to access EO data and integrate into operational systems and flood management practices.

Flood Pilot – regional areas of focus



High spatial resolution full-cycle flood monitoring in Caribbean/Central America, Southern Africa and Southeast Asia (Mekong and Java); will be used to validate high temporal resolution low spatial resolution global work

Volcanoes – the need

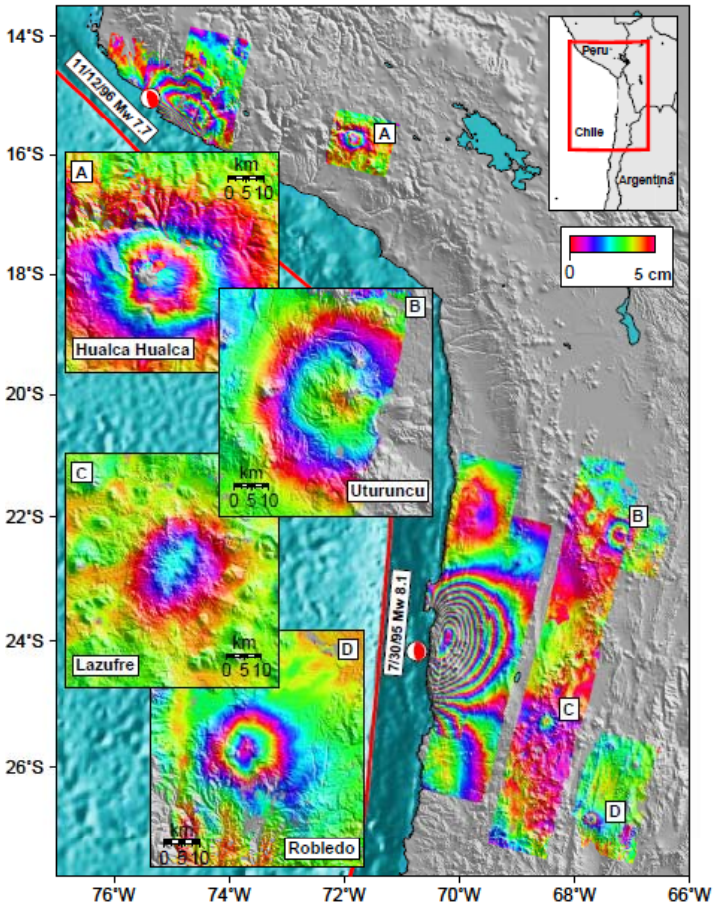
WHY?

Over 300,000 people have been killed by volcanoes since the 1600s, and hundreds of millions live within 20 km of an active volcano today.

WHAT'S MISSING?

- **Only ~10% of the ~1500 active volcanoes in the world are being monitored in some way**
- **Current EO data collection is not coordinated for volcano monitoring**
- **Need partners to exploit data that are currently collected**
- **Need systematic observations before, during, and after volcanic events**

Volcano Pilot Objectives



Stepping-stone towards the long-term objectives of the Santorini Report:

1) global background observations at all Holocene volcanoes;
2) weekly observations at restless volcanoes;
3) daily observations at erupting volcanoes;
4) development of novel measurements;
5) 20-year sustainability; and
6) capacity-building.

Three main outcomes for volcano observatories and VAACs:

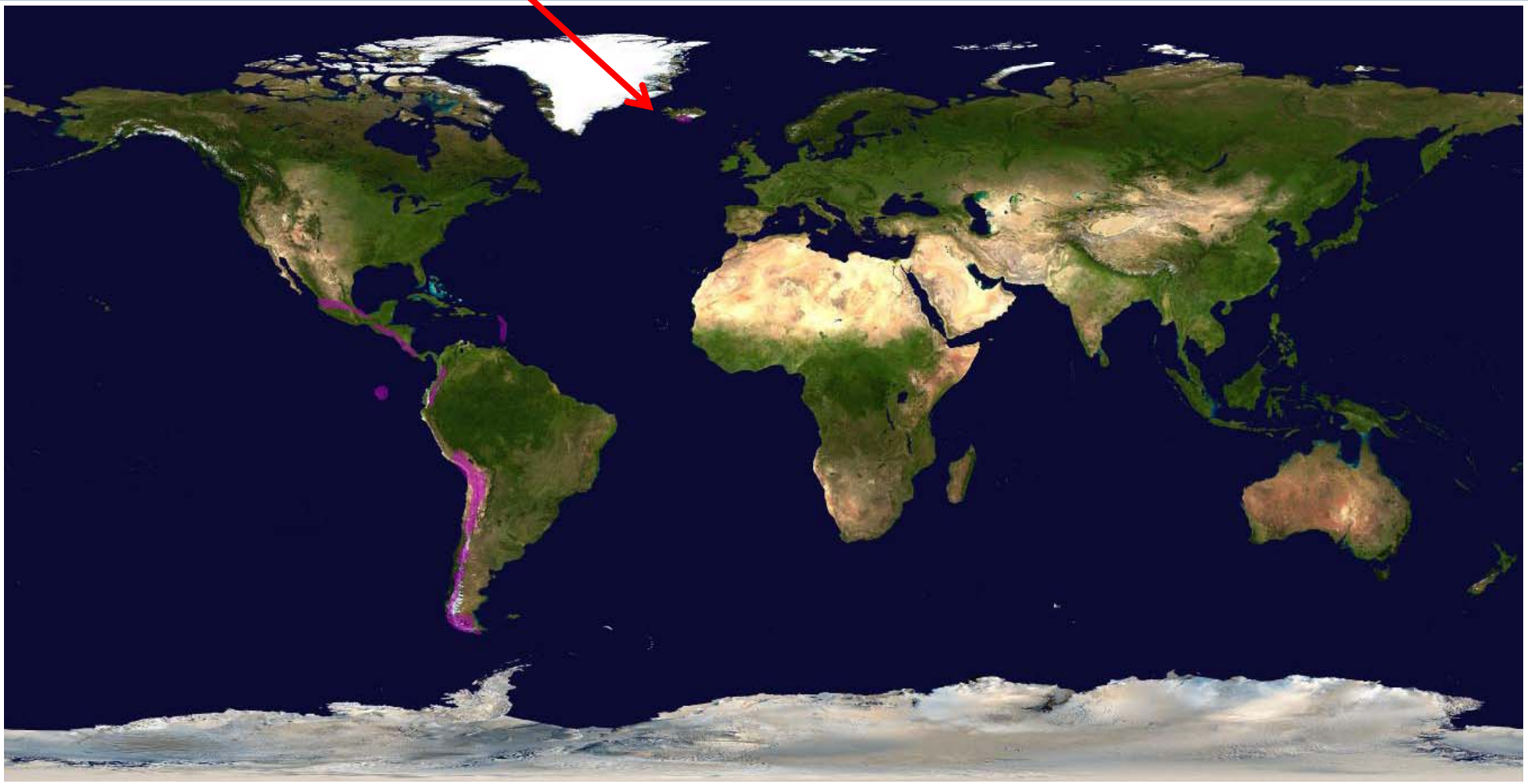
A. Demonstration of systematic monitoring in Latin America

B. Development of new products for geohazard supersites initiative GSNL (Hawaii & Iceland)

C. Showcase 1 major eruption 2014-2016

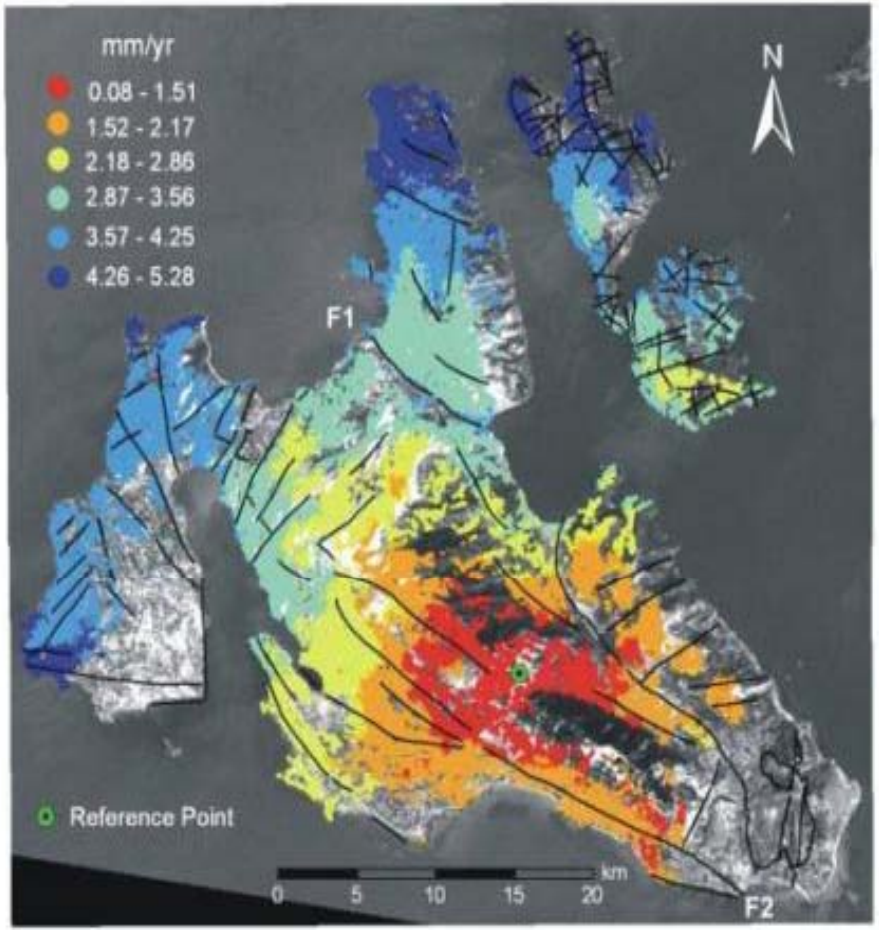
27th CEOS Plenary
Montréal, Canada
5-6 November, 2013

Volcano Pilot – regional areas of focus



Regional monitoring demonstration in Latin America; new product development over existing volcanic GSNL (Hawaii and Iceland); single volcano response demonstration if major event in 2014-2016

Seismic Hazards – the need



Precise terrain motion product to support Crustal Block Boundaries analysis over the Cephalonia Island, Greece, Standard Deviation of Velocity Field using ENVISAT Descending (2003 – 2008), Credits: NKUA.

WHY? **Most devastating global disaster – large number of events and largest number of total deaths (large events); EO can support increased understanding of nature and extent of risk – cannot predict earthquakes. EO also supports response and other phases.**

WHAT'S MISSING? **Large data collects over seismic strain belt (15% earth surface) to improve scientific knowledge of seismic hazard; partners to analyse data to generate surface strain model based on interferometric SAR analysis. GSNL provide EO data for improved scientific understanding but only over limited areas. Science products for EQ response (M>5.8 not covered by GSNL, data types for science not covered by Charter).**

Seismic Hazards Pilot Objectives

Objectives based on priorities elaborated through an open review process in the framework of the Santorini Conference.

The three objectives are:

A) Support the generation of globally self-consistent strain rate estimates and the mapping of active faults at the global scale by providing EO InSAR and optical data and processing capacities to existing initiatives, such as the iGSRM for science users

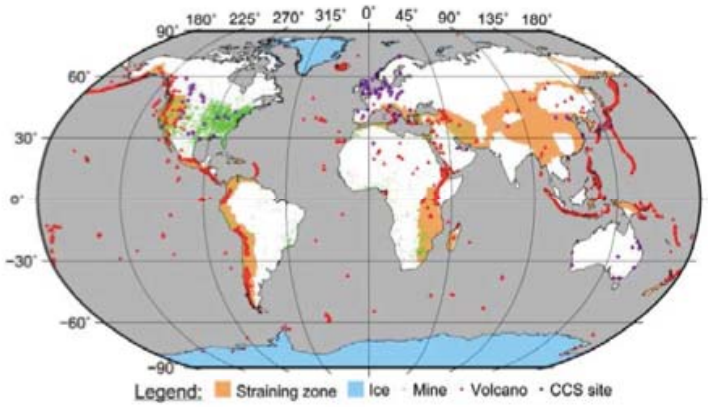
[Wide extent satellite observations]

B) Support and continue the geohazard supersites initiative (GSNL) for seismic hazards & volcanoesf or science users

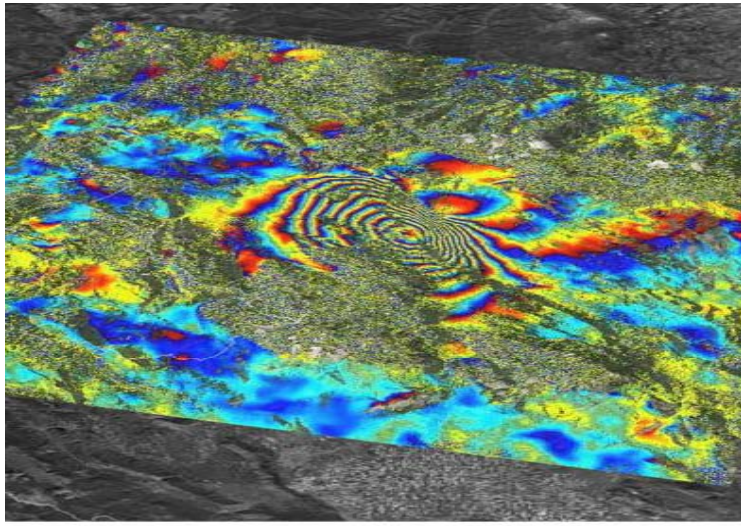
[Satellite observations focused on supersites]

C) Develop and demonstrate advanced science products for rapid earthquake response for civil protection authorities

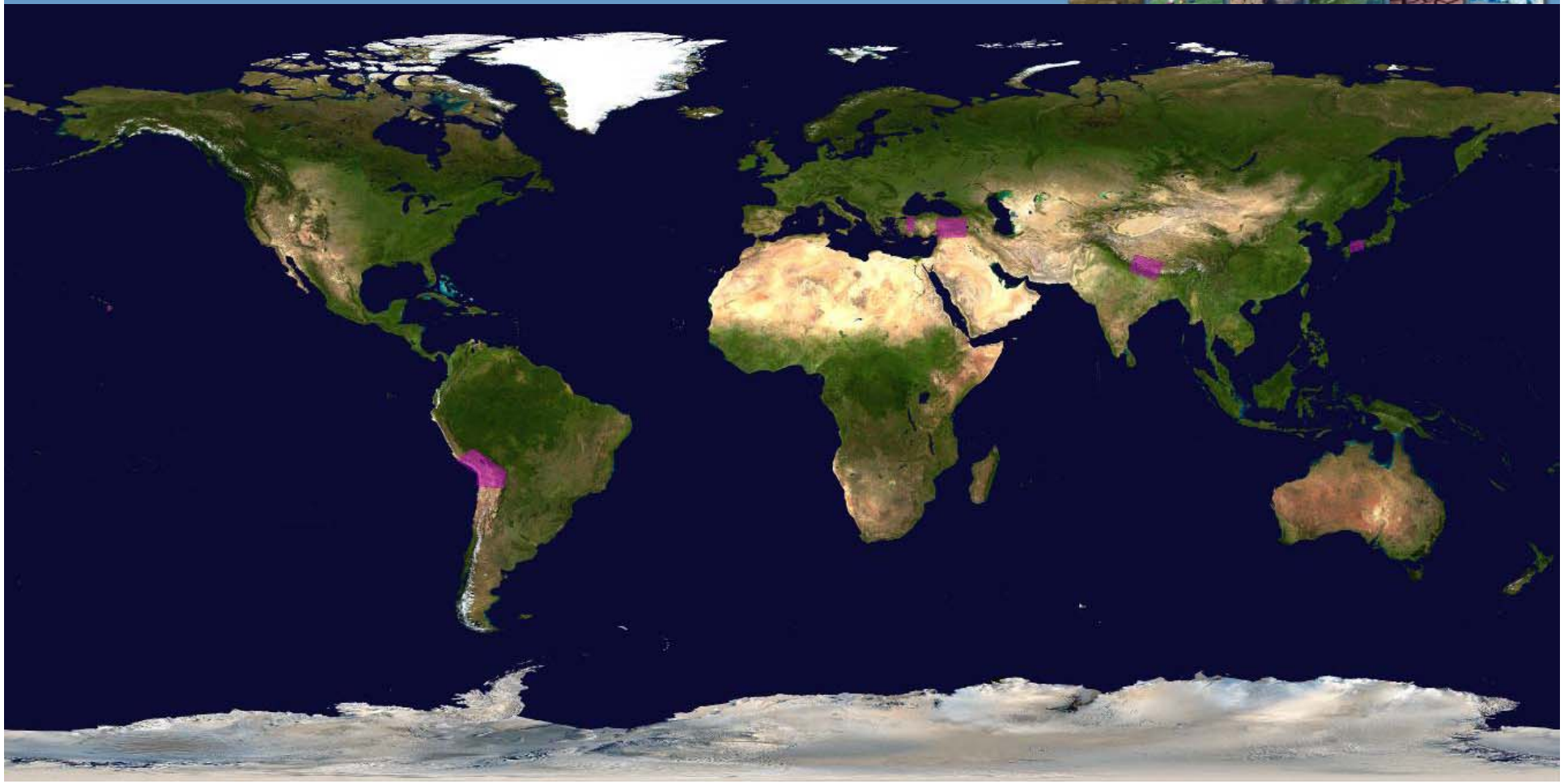
[Observation of earthquakes with M>5.8]



Straining areas (seismic belts) and volcanoes of the world (Kreemer et al., 2003). Figure : GSNL Strategic Plan 2012.



Seismic Pilot – regional areas of focus



Strain estimation in Himalayan lift area, Turkey and the Andes; Validation zones in Turkey, California and Japan. GSNL exploitation platform in Hawaii and Iceland.

Recovery Observatory – the need

Indian Ocean Tsunami 2004

Hurricane Katrina 2005

Deepwater Horizon 2009

Haiti Earthquake 2010

Tohoku Tsunami 2011

Photo credits: www.nationalgeographic.com; www.mediamythalert.com; www.tampabay.com; www.manongeo.wordpress.com; www.japansociety.org.uk.

Recovery Observatory – the idea

Response (weeks)

Recovery (years)

- International Charter
- Sentinel-Asia
- Copernicus/GMES

EO data from National Agencies and commercial providers

Recovery Observatory (3-5 yrs)

Organise EO data from response phase and pre-disaster in repository

Plan coordinated acquisitions to support:

- Built area damage assessment (initial and later detailed);
- Natural resource and environment assessment;
- Reconstruction planning;
- Reconstruction monitoring; and
- Change monitoring.

Coordination
Effective Resource Allocation
Clear Institutional Links

Ad Hoc Approach
Lack of Coordination and Cooperation
Lack of Institutional Links
Lack of Awareness of Role of EO

Recovery Observatory – the proposal

Recovery Observatory Implementation:

- Oversight Team (CNES, ESA, JAXA, NASA, ASI) created summer 2013
- Proposes **ONE** Observatory as part of Observation Strategy 2014-2016
- Builds on success of Charter, Sentinel-Asia and KAL-Haïti project
- Next steps:
  - Completed detailed analysis
  - Preparation (conditions for triggering, infrastructure establishment, generic planning)
  - Cold storage
  - Triggering
  - Operations (3-5 years)
  - Closing

Detailed analysis to be presented by Oversight Team at SIT April 2014.

CEOS participation in 2015 WCDRR

WCDRR Preparation meeting with JAXA – Japan Cabinet Office and Japan Foreign Ministry (September 26, 2013):

- Good contacts established with WCDRR local host (Thanks to GEO SEC)
- Active participation of CEOS welcome by Japanese officials
- Still perception gap as to positioning of space assets in HFA.

Meeting between B.Ryan (GEO) and M.Walhstrom (UN ISDR) (Sep. 2013):

- CEOS DRM presented to UN ISDR
- M.Walhstrom's advice:
  - Local users are still missing the capabilities to access and exploit the information derived from EO satellite data
  - EO satellite data needs to be integrated in traditional disaster management processes.

A Task Force led by JAXA (Chu) will define and implement a strategic approach for the CEOS' participation in the WCDRR (e.g. side event, exhibition, conference declaration, ..) **and CEOS' contribution to the HFA2 (2015-2025).**