EPOS PP

European Plate Observing System | FP7 Preparatory Phase Project

GEO Geohazard Supersites and Natural Laboratories (GSNL): Building data infrastructures for science

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Workshop on Natural Disaster Mitigation and Earth Observations: a GEOSS perspective

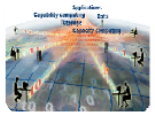
www.epos-eu.org

GROUP ON EARTH OBSERVATIONS

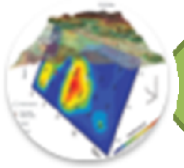
EUROPEANPLATEOBSERVINGSYSTEM

Outline

integration of RIs to foster multidisciplinary research



e-RIs & ICT Services for data access & use



In-situ observatories: the GEO Supersites

Providing Services to different stakeholders

EPOS PP Mission

- The European Plate Observing System (**EPOS**) is a **long-term integrated research infrastructure plan** to promote innovative approaches for a better understanding of the physical processes controlling earthquakes, volcanic eruptions, unrest episodes and tsunamis as well as those driving tectonics and Earth surface dynamics
- EPOS will integrate the **existing advanced European facilities** into **one**, distributed **multidisciplinary Research Infrastructure** (RI) taking full advantage of new e-science opportunities
- The EPOS RI will allow geoscientists to study the causative processes acting from **10^{-3} s to 10^{6} years** and from **μm to 10^{3} km**

EPOS PP Timeline

mid-way through the PP

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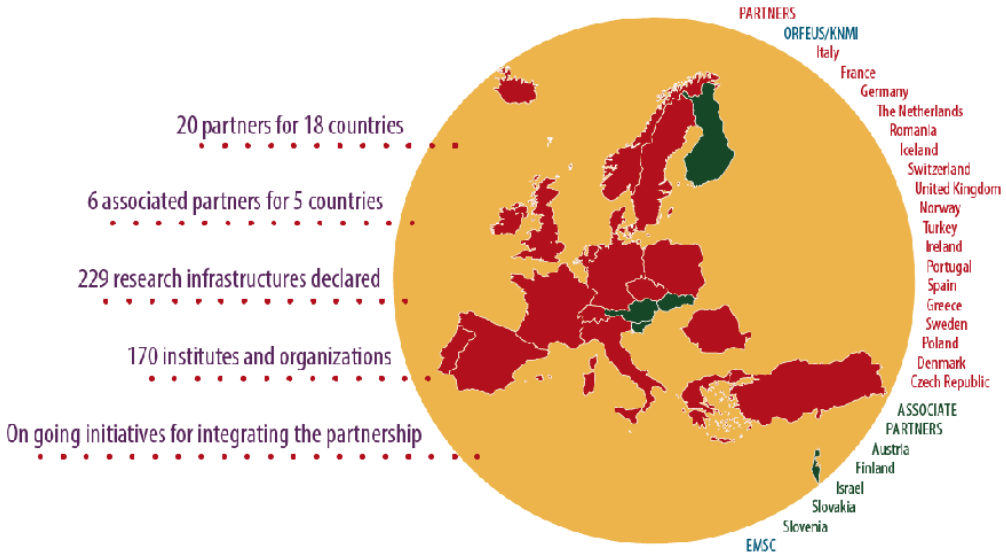
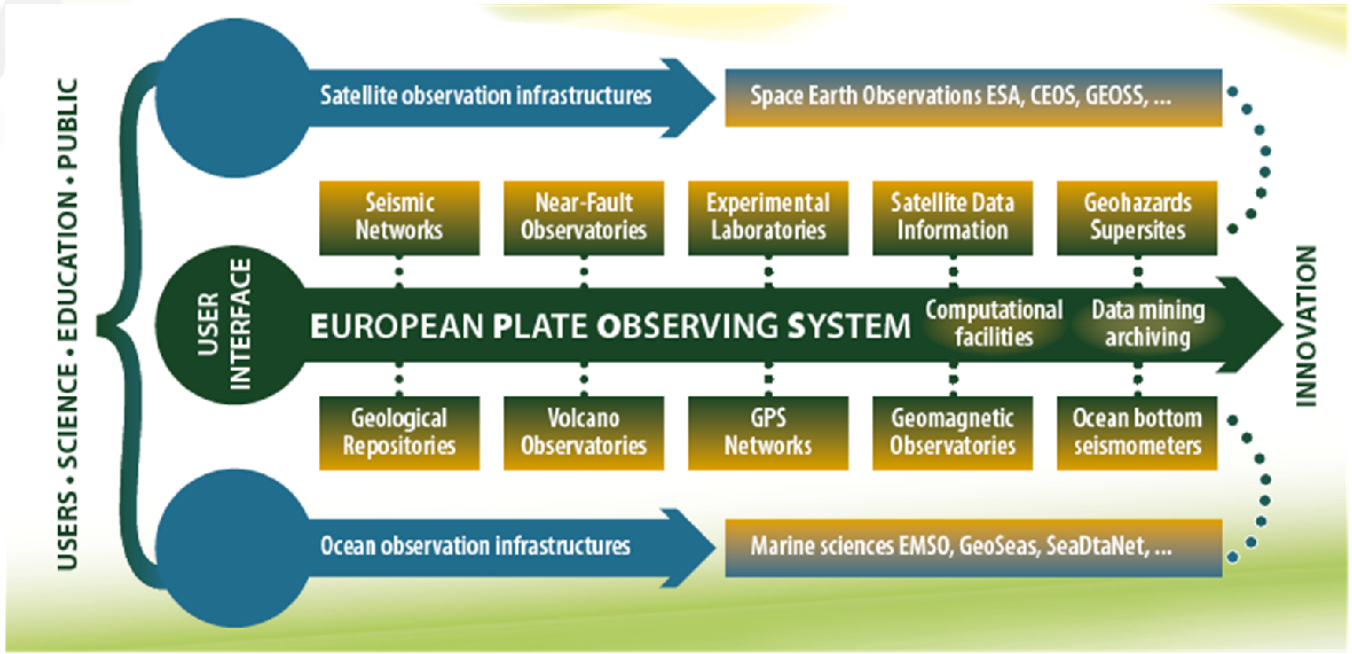


EPOS COMMUNITIES



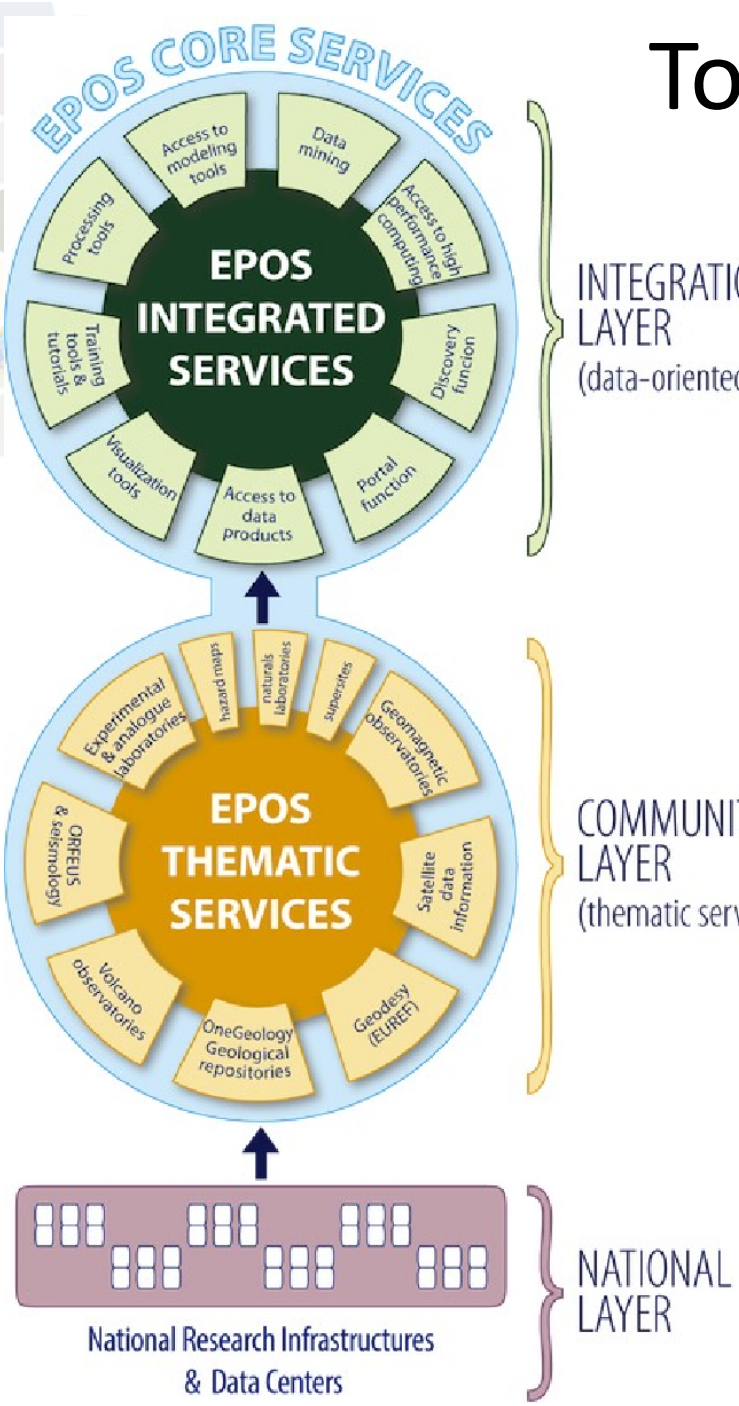
23 countries involved: **20** partners,
6 associated partners,
10 Working Groups (>350 members)

Research Infrastructures involved in EPOS
RIDE database: http://www.epos-eu.org/ride/

244 RIs - value (>350M€)
annual running costs (84M€ / per year)

138 Institutions
2272 GPS receivers | **4939** seismic stations
464 TB Seismic data | **1,1** PB Storage capacity
828 instruments in **118** Laboratories

Topological Architecture



The **EPOS Integrated Core Services** will provide access to multidisciplinary data, data products, synthetic data from simulations, processing and visualization tools, ...

The **EPOS Integrated Core Services** will serve scientists and other stakeholders, young researchers (training), professionals and industry

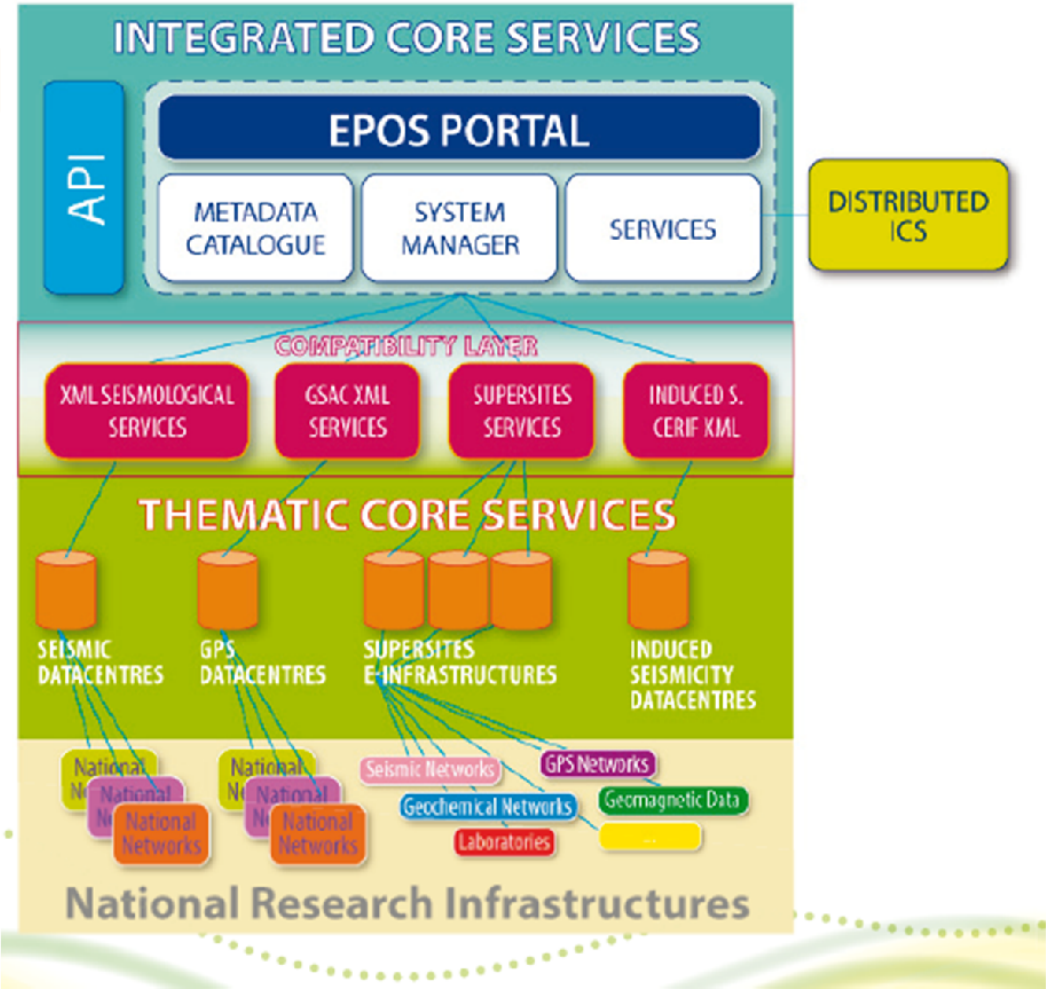
EPOS is more than a mere data portal: it will provide not just data but means to **integrate**, **analyze**, **compare**, **interpret** and **present** data and information about **Solid Earth**

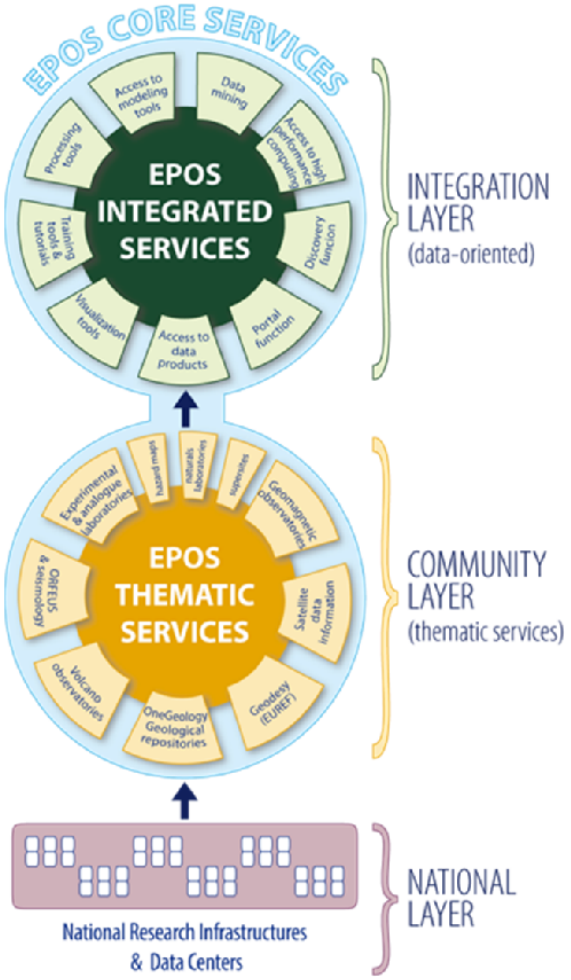
Thematic Core Services are infrastructures to provide data services to specific communities (they can be international organizations, such as ORFEUS for seismology)

National Research Infrastructures and facilities provide services at national level and send data to the European thematic data infrastructures.

EPOS
EUROPEANPLATEOBSERVINGSYSTEM

Functional Architecture





The National RIs

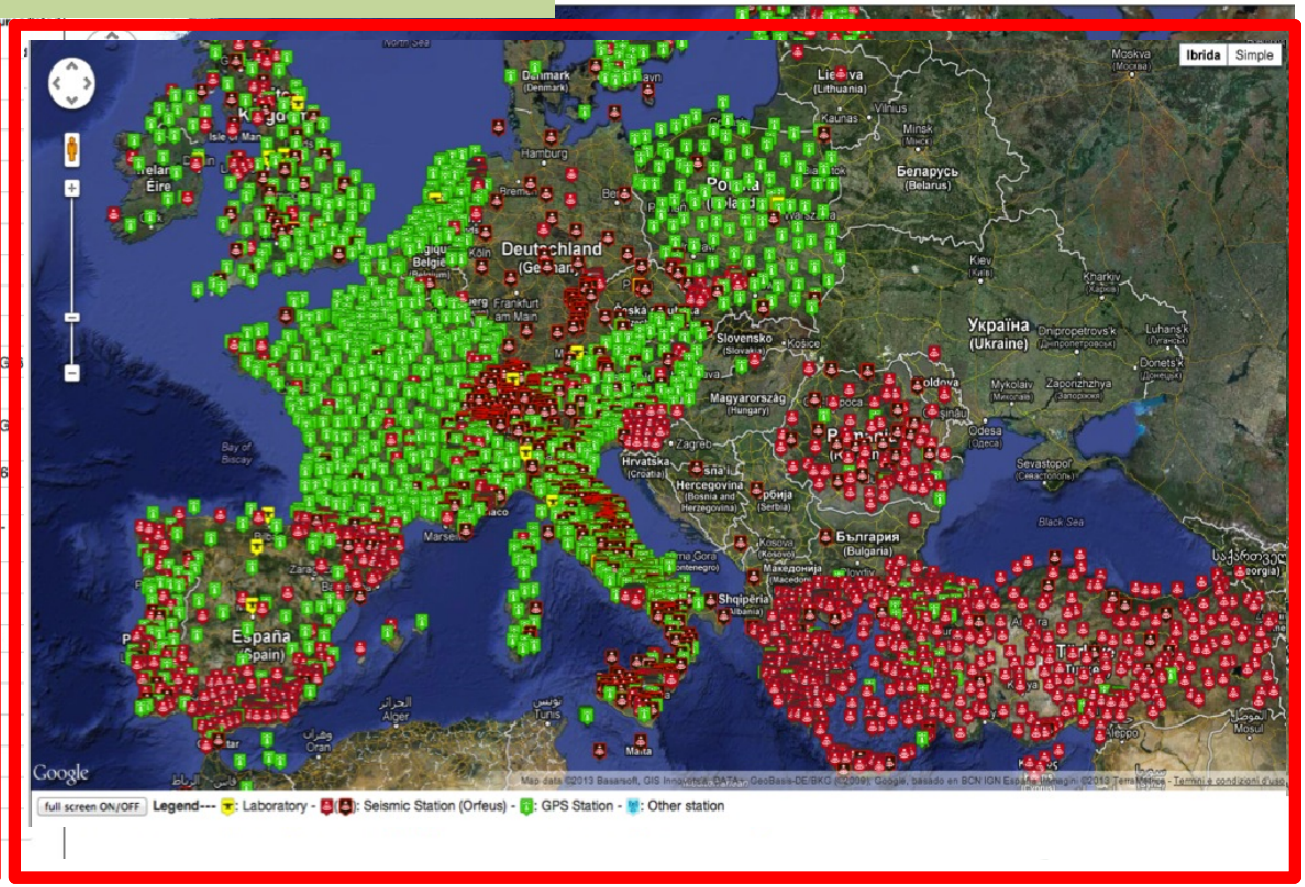
MAP OF:
- Seismic/GPS stations
-Laboratories
-- etc....

[Diversity in data type and formats]

http://www.epos-eu.org/ride/

Research Infrastructure List

- 226 Research Infrastructures
- 1658 GPS receivers (out of 2500)
- 2517 seismic stations
- 385 TB Seismic data
- 913 TB Storage capacity
- 109 storage data centers
- 512 instruments in laboratories



Thematic Services: an example from seismology

EPOS Board of Service Providers

EPOS Seismology Products and Services (ESPS)

Governance and coordination by Board of Service representatives, 4-6 members

WAVEFORM DATA

Ground motion recordings from seismic sensors *(possible extension to infrasound)*

Structure: Distributed (ORFEUS umbrella)
~8 nodes, including ORFEUS & EIDA nodes, SISMOS, SMdB

Products (indicative list)
Continuous and event waveforms from permanent and temporary stations (broadband, short period, strong motion); historical waveform archive; synthetic waveform data; strong motion data (products)

Services (…)
Station information (metadata, site characterization…); data quality (control) information

European Infrastructures
Mobile pools, OBS pools…

EARTHQUAKE PRODUCTS

Parametric earthquake information and event-related additional information

Structure: Distributed
~ 5 nodes, including EMSC & its key nodes, AHEAD

Products (indicative list)
Earthquake parameters & bulletins; earthquake catalogues (instrumental, macroseismic, historic, synthetic); moment tensors; source models

Services (…)
Rapid earthquake information dissemination (felt maps, ShakeMaps)

HAZARD AND RISK

Seismic hazard & risk products and services

Structure: Distributed
~3 nodes, including EFEHR (EUCENTER & ETH nodes)

Products (indicative list)
Hazard: Fault maps & models; source zones; hazard maps & curves & disaggregation; GMPEs
Risk: Inventories & inventory models; vulnerability functions; risk maps & scenarios

Services (…)
Tools for model building and visualization; product viewer; hazard & risk calculation software & infrastructure

COMPUTATIONAL SEISMOLOGY

High performance and high end computing, data intensive computing

Structure: Distributed
~3 nodes (build upon VERCE)

Products (indicative list)
Tools for massive scale data applications (processing, mining, visualization,…)

Services (…)
Access to HPC resources; data staging; data massive applications; data simulation; model repository and model handling tools (large 3D velocity models, rupture models,…)

EPOS Volcanology

EPOS Geology

… Other EPOS Communities

e-Seismology & common services

Seismological services for visualisation, discovery and access to portal (based on seismicportal.eu)
expert groups, standards

EPOS Integrated Services

Visualisation tool / discovery & access portal
high performance and high end computing (may absorb E-Seismology)
expert groups, standards

EPOS Board of Service Providers

Thematic Services: Satellite Data Information

EPOS Remote Sensing Products & Services (EGPS)

Governance and coordination by Board of Service representatives, 4-6 members

Satellite Acquisition Strategy

Priorities are the areas identified in the Santorini white paper

Structure: Distributed
~ 3 nodes (ESA, DLR, CNES)

Products (indicative list)
Definition of an acquisition plan over geohazard areas in Europe:
-sensor type/Satellite mission
-potential coverage (acquisition geometry, resolution and mode)
-type of product (interferogram, velocity map, land use map,...)

Services
-Defining Satellite Data provider
-Site information (metadata, site characterization…)
-data quality information

Geohazard Supersites

SAR displacement maps

Structure: Distributed
multiple nodes, potentially one for each Supersite

Products (indicative list)
For volcanic Supersites:
-sineruptive displacement map
-volcanic source model

For seismic Supersites:
-coseismic displacement map
-cross comparison with GPS
-seismic source model

Services
Preservation of historical data (also from commercial networks).
Data quality information.

Data Archiving

Data repository from other projects

Structure: Distributed
~3-5 nodes, including EPOS Data Gateway.

Products (indicative list)
-PSI data from TERRAFIRMA ESA project all over Europe
-Wide Area Product data over Greece and Turkey

Services
Repository of existing:
- PSI velocity maps
- time series,
- added value products

IT Tools

Support to Satellite data processing

Structure: Distributed
~ 3 nodes (ESA, DLR, CNES)

Products (indicative list)
- Fast generation and delivery
- Diffusion of best practices.

Services
Web-services for online
- processing of satellite data (SAR in particular) and estimation of velocities (interseismic and post-seismic signals).
- provide guaranteed, reliable, easy, effective access to a variety of data, facilities, and applications to an ever increasing number of users.
- enable multidisciplinary collaboration among communities and the creation of user-configured virtual research facilities

EPOS Volcanology

EPOS Geology

… Other EPOS Communities

e-Remote Sensing & common services

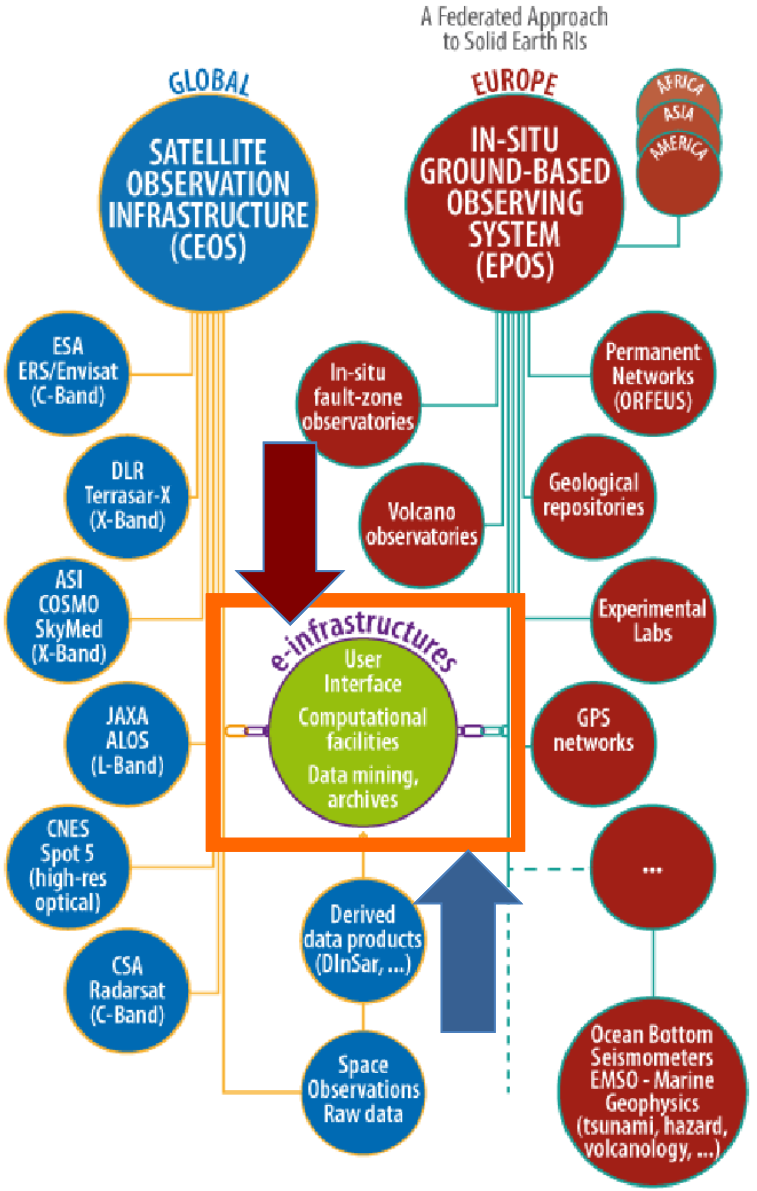
Services for visualisation, discovery and access to portal
expert groups, standards

EPOS Integrated Services

Visualisation tool / discovery & access portal
high performance and high end computing
expert groups, standards

The European Supersites

- EPOS is a **GEO** participating institution. **TASK-DI-01 C2**: Geohazard Supersites and Natural Laboratories (**GSNL**)
- EPOS as a **regional federation** to provide multidisciplinary services in solid Earth
- **EPOS** is coordinating efforts with the three EC **supersites**:
  - MARSITE (Istanbul)
  - FUTUREVOLC (Icelandic Volcan.)
  - MED-SUV (Italian Volcanoes)



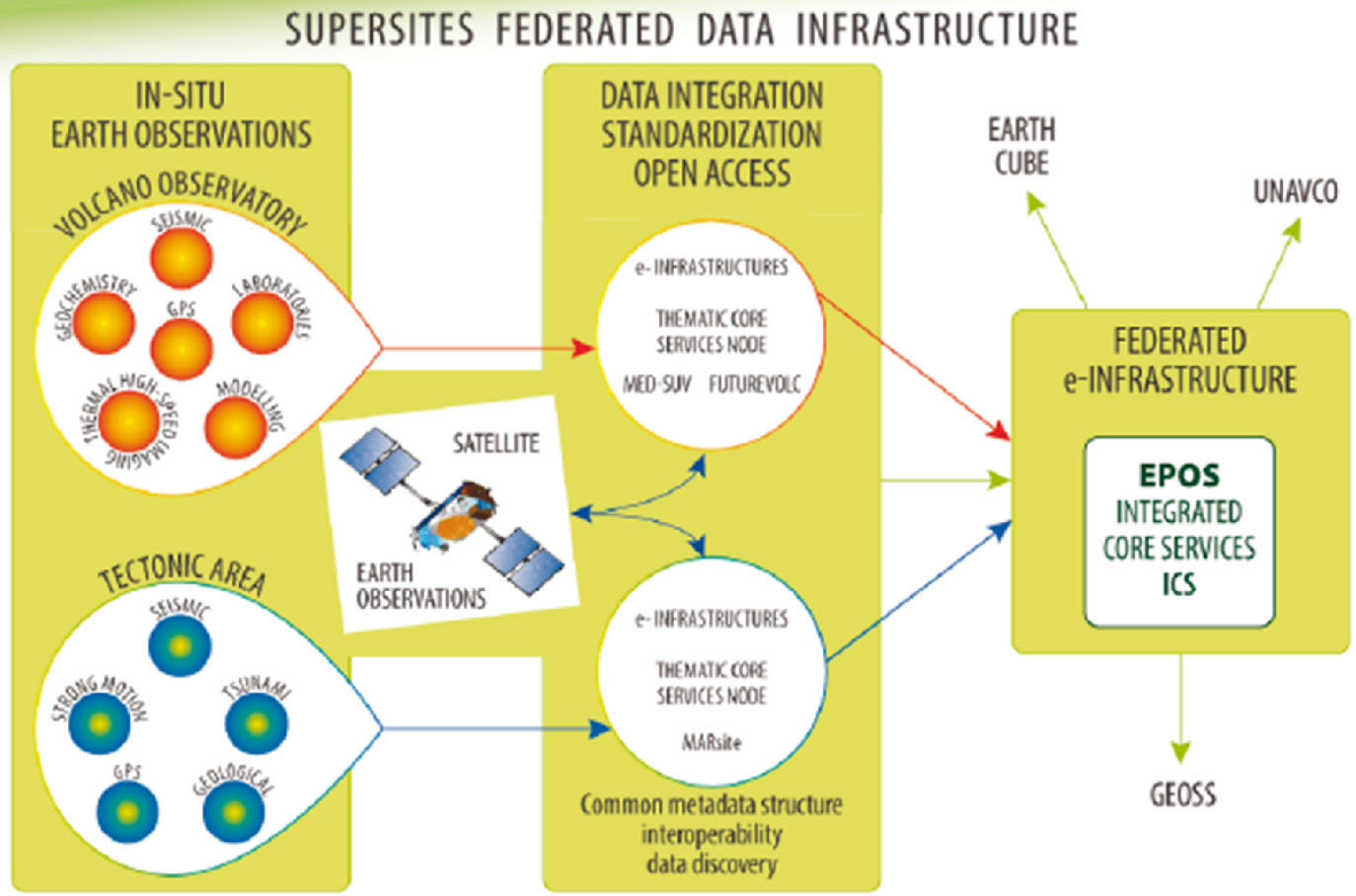
MED-SUV
Italian Volcanoes
Mt. Etna, Campi Flegrei, Vesuvius, volcanoes: data sharing, volcanic hazard and risk, preparedness, awareness

FUTUREVOLC
Icelandic Volcanoes
European volcanological supersite in Iceland: a monitoring system and network for the future

MARsite
MARmara Supersite
New Directions in Seismic Hazard Assessment through Focused Earth Observation in the Marmara area

e-INFRASTRUCTURES & IT INNOVATION

BIG DATA, SCIENCE, CHALLENGES: **APPROPRIATE SOLUTIONS**



KEYWORDS

- **Integration** of the existing in-situ Ris through data infrastructures and web services in each supersite. **Integration** of terrestrial and satellite observations
- **Interoperability** of in-situ data infrastructures & web services
- **Access** to past and present data through shared data policies
- **Acknowledgment** of the data source and **Metrics** to check the use of data
- **Progress in Science** through availability of high quality data and the means to process and interpret them *(e.g., explore and mine large data volumes, results easily reproducible/replicable)*
- **information**, **dissemination**, **education** and **training**
- **Implementation** plans, which require strategic investment in research infrastructures at national and international levels (**sustainability issue**)
- **Societal** contributions, e.g., hazard assessment and risk mitigation

GEOSS - System of Systems

The Global Earth Observation System of Systems addresses nine areas of critical importance to people and society.

EPOS Stakeholders

I. Data and service providers from the solid Earth sciences

- ✧ RIs declared in RIDE (www.epos-eu.org/ride/) & EPOS WGs

II. Scientific User Community

- ✧ Researchers from solid Earth Science
- ✧ Solid Earth science community projects (NERA, SHARE, REAKT, ...)
- ✧ Training and educational institutions, projects and initiatives
- ✧ Researchers and organizations from outside the solid Earth sciences

III. Governmental Organizations

- ✧ National governments
- ✧ Funding agencies
- ✧ Civil protections authorities
- ✧ European Commission

IV. Other data and service providers and users

- ✧ IT projects and experts, Industry, Private data and service providers

V. General Public

INVOLVEMENT

Science for Society: from understanding to increasing resilience to natural hazards

Fundamental Science

- Monitoring (implementing data infrastructures)
- Understanding physical processes
- Forecasting occurrence of events

Applied Science

- Hazard Assessment
- Vulnerability assessment
- Risk assessment and mitigation

Decision Makers

- Prevention actions
- Emergency management & planning
- Disaster management

local communities

- Education & Training
- Outreach and dissemination
- Increasing Resilience to natural hazards

INGV

Conclusive Remarks

- Access to **multidisciplinary data** and promoting **cross-disciplinary** research is a key contribution to foster **progress in science**
- Joining community efforts for the **long-term sustainability** of RIs & supersites (involving governments and funding agencies)
- Dissemination and Education require effective **Communication Policies**
- **Risk Communication** is nowadays a complex endeavor

Risk Communication: Lessons from recent earthquakes

- Sumatra M 9.3 (Indonesia) 2004
- L'Aquila M 6.1 (Italy) 2009
- Haiti M 7.0 2010
- Maule M 8.8 (Chile) 2010
- Christchurch M 7.2 (New Zealand) 2010
- Tohoku M 9.0 (Japan) 2011
- Virginia M 5.8 (USA) 2011

Risk Communication
…. as well as from other events

- Eyjafjallajökull volcano (Iceland)
- Kathrina Hurricane
- Irene Hurricane

Caveat: all these events are characterized by hazard assessment and event forecast

Progress in solid Earth sciences

- Data availability and monitoring infrastructures
- Early warning systems
- Long-term hazard assessment
- Short term probability and operational forecasting
- Proper approach to face prediction (i.e. CSEP), but risks in focusing on prediction (misinterpreting forecasting)

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Research Infrastructure and e-science for Data and Observatories on
Earthquakes, Volcanoes, Surface Dynamics and Tectonics

Thank you for attention

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