Implementing data provision and services for solid Earth sciences: the EPOS integrated approach

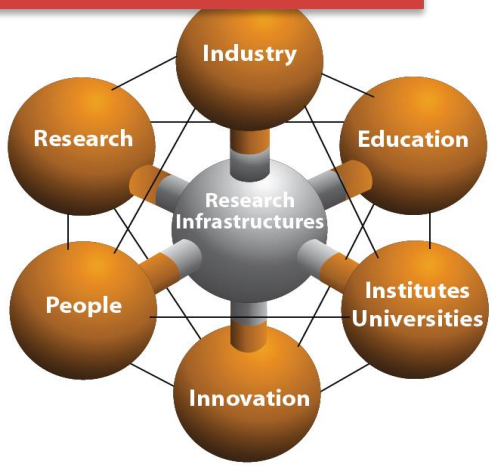
Massimo Cocco[1], Beata Orlecka-Sikora[2]
& EPOS Team[3]

1 Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy
2 Institute of Geophysics, Polish Academy of Sciences, Poland
3 EPOS Consortium, www.epos-eu.org

Access to data: a global challenge

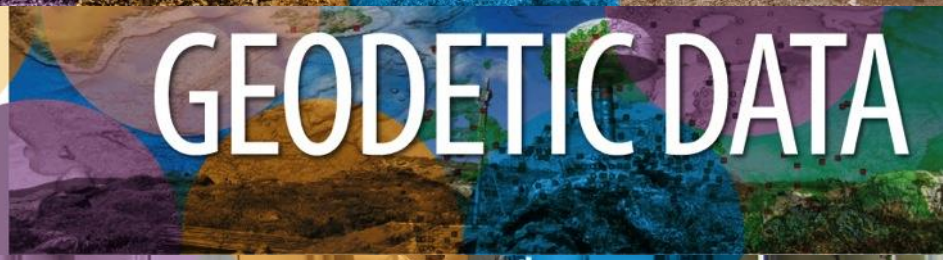
KEY MESSAGE TO BRING HOME:
Induced Seismicity and Anthropogenic Hazard must be included in these integration initiatives both for innovation in science and for a science for society

- More value from reuse of data
- More and more researchers are seeing the value of sharing
- Many countries developing open research **data policies**
- Central Role of **Research Infrastructures**



European Plate Observing System: Solid Earth Science

- Different communities involved (24 countries)
- Multidisciplinary contributions
- Community building
- Services to society
- Geo-Hazards
- Geo-Resources
- Environmental hazards (including anthropogenic hazard)



EPOS
EUROPEANPLATEOBSERVINGSYSTEM

www.epos-eu.org

EPOS Thematic & Integrated Services

WP17
Geo-Energy Test Beds

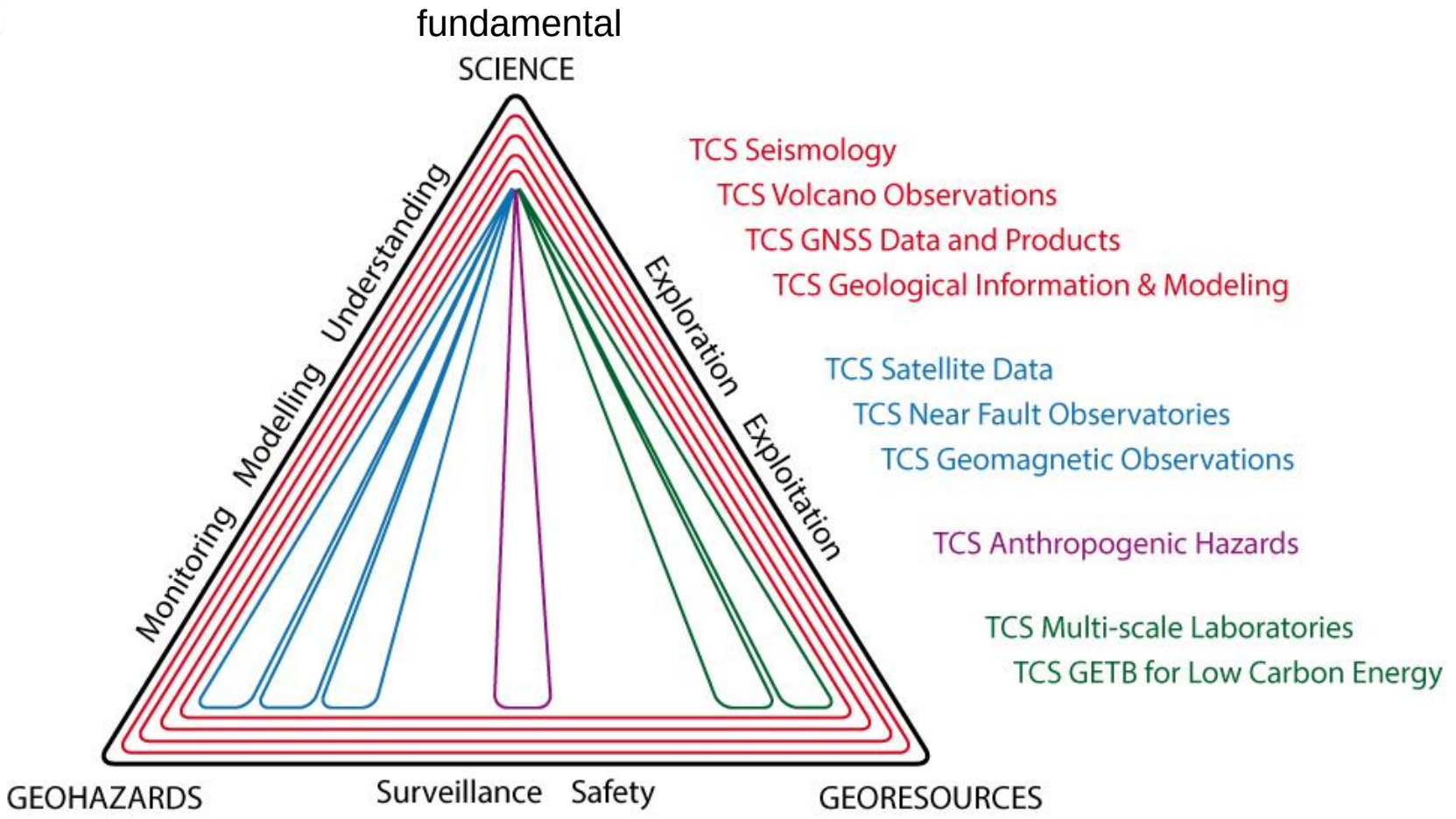
EPOS ARCHITECTURE

THE GOAL OF THIS PRESENTATION:
Further engage this community for participating in the EPOS integration plan by sharing data and products as well as develop services & tools for scientific users and other stakeholders

WP14
Anthropogenic hazard

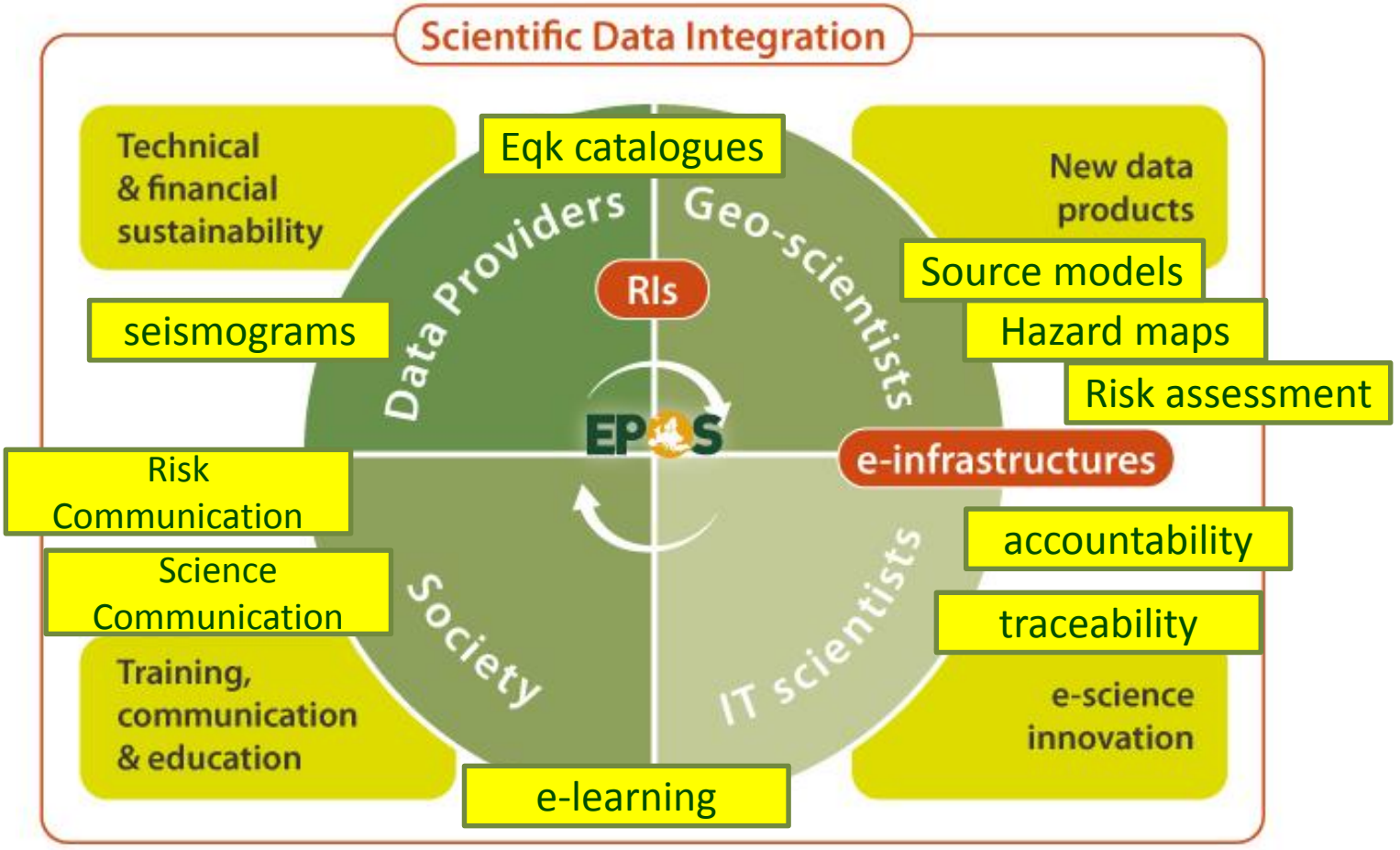
EPOS aims to provide seamless access to pan-European data & services

EPOS Impact & Exploitation of results



EPOS – European Plate Observing System

EPOS will offer to diverse communities data products, tools, and services for intelligible integrated analyses



Accessible data and new e-infrastructures bring novel cross-fertilization of ideas and lead to innovative research, new discoveries & applications for society

ANTHROPOGENIC HAZARDS RESEARCH INFRASTRUCTURE INTEGRATION

WG 10 in EPOS PP & WP14 in EPOS IP [B. Orlecka-Sikora, S . Lasocki]

EPOS EUROPEANPLATEOBSERVINGSYSTEM

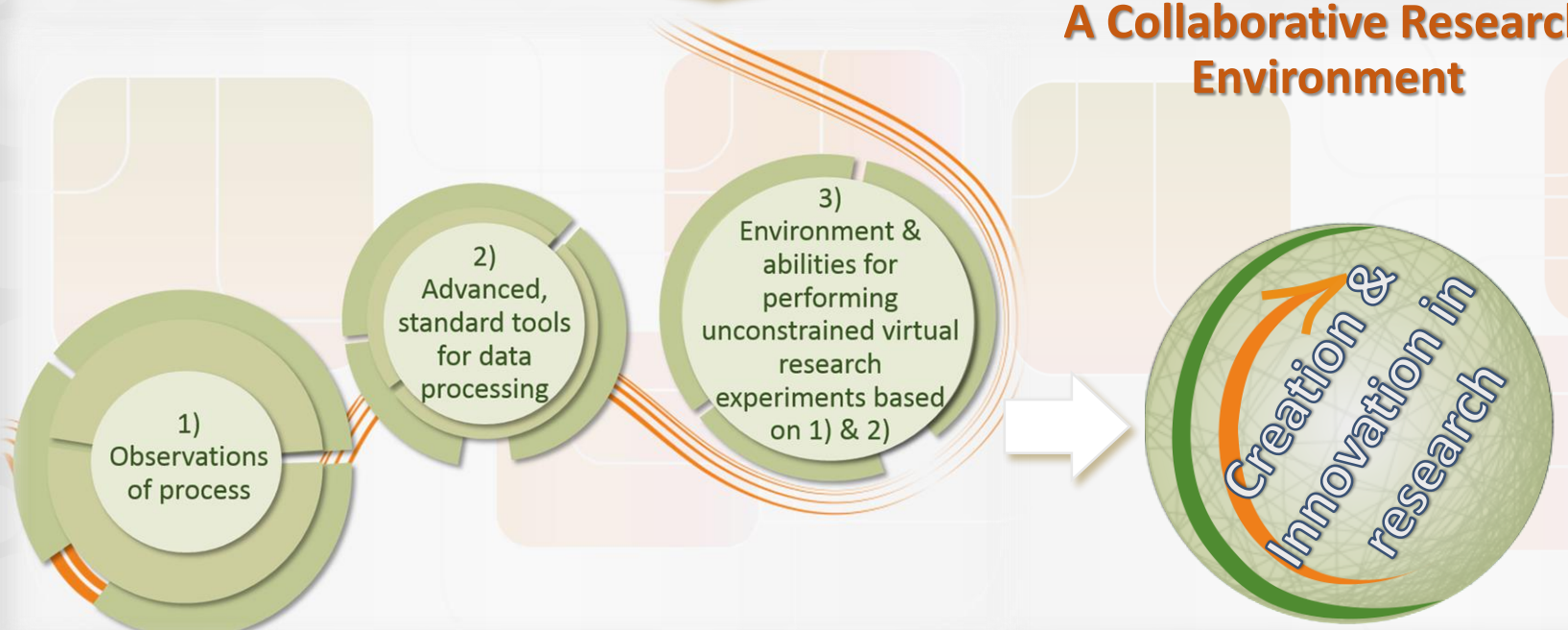
MAIN END-USER → SCIENTIST

Needs catalogue for the end-user

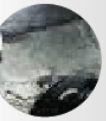
PRIMARY NEED → **To study the response of geosphere to exploitation and exploration of geo-resources**

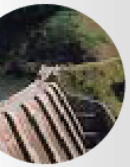
Intermediate Needs

TCS Anthropogenic Hazards
A Collaborative Research Environment







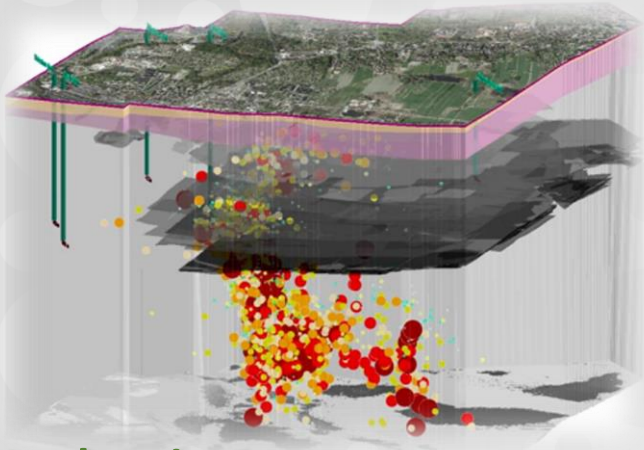


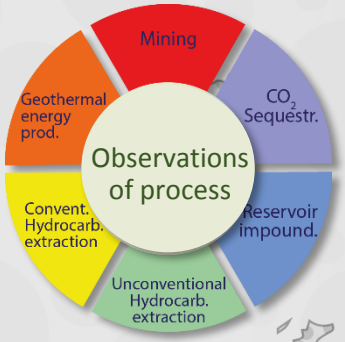




1) Observations of process

***Episode**: a time-correlated collection of **geophysical data** representing the geophysical process, **technological data** representing the technological activity, which is the cause of this process and all **other relevant geodata describing the environment**, in which the technological activity and its result - the geophysical process, takes place*





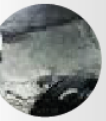
Key barriers to cross (from ERIS v1, 2014):

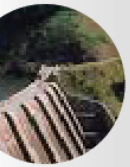
***Discovery** – proper terminology*

***Open & easy access** – standarized formats, proper metadata*

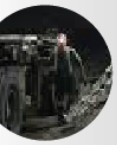
***Understanding** – understandable formats, versioning, language, metadata, uniform documentation of all issues regarding data*

***Trust** – complete documentation & explanations*







2) Advanced, standard tools for data processing

***Services**: already existing and tested, problem-oriented, with the particular attention devoted to methods analyzing correlations between technology, geophysical response and resulting hazard*

Grzegorz Kwiatek, GFZ, Germany

Data Integration & Stewardship Service (DISS) - data tagging, formatting, conversion & homogenization

Data Handling & Mining Service (DHMS) - data access, mining & merging and visualization tools

Services for geo-mechanical model for impact of geo-resource production - stress-deformation patterns generated by type of geo-resource production; THM reservoir models

Services for geophysical data analysis - seismicity-deformation signal processing, sustained and/or emergent signals identification, Moment tensor and point source inversion; elastic properties change over time

Jean Robert Grasso, ISTerre, France

Services to rate the interactions between technology operations and the upper crust seismic deformation - 3D cross correlation between the technology driven stress-strain changes and the local seismic-aseismic deformation through time-space

Services for quantitative probabilistic assessments of anthropogenic seismic hazard - statistical properties of anthropogenic seismic series and their dependence on time-varying anthropogenesis; ground motion prediction equations; stationary and time-dependent PSH estimates, related to time-changeable technological factors inducing the seismic process

Stanisław Lasocki, IGF PAS, Poland

Simulator for Multi-hazard/multi-risk assessment in ExploRation/exploitation of GEoResources (MERGER) - numerical estimate of the occurrence probability of chains of events or processes impacting the environment

Alexander Garcia, AMRA, Italy

Services for outreach, dissemination & comunication - communication strategies and bespoke tools for a comprehensive policy of dissemination inside TCS AH, to the wider scientific and technical community of Researchers and to external stakeholder

Peter Styles, KeU, UK

3) Environment & abilities for performing unconstrained virtual research experiments based on 1) & 2)

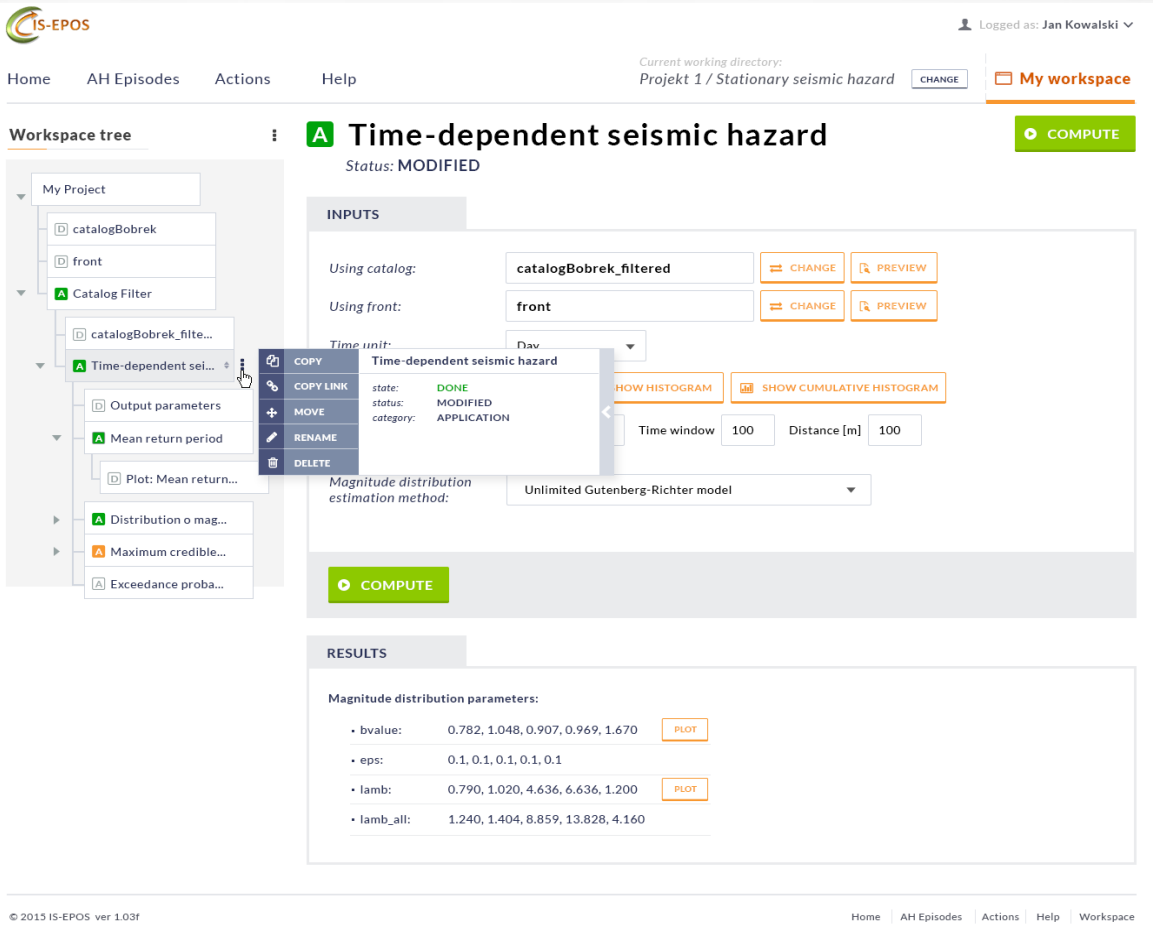
*A functional **e-research environment** with an access to HPC resources, ensuring a researcher unbounded possibility to perform in-silico experiments by providing a virtual laboratory in which he/she will be able to create his/her workspace with own processing streams*

IT Platform Challenges:

Data: all re
collecte
availabl
platform;
results
pr

User spac
how Data
are organ
research
group of

atform that:
s of data of large
tions on data
y of doing
tage on novel
progress beyond
ways';
bility for hundreds
g data' at the

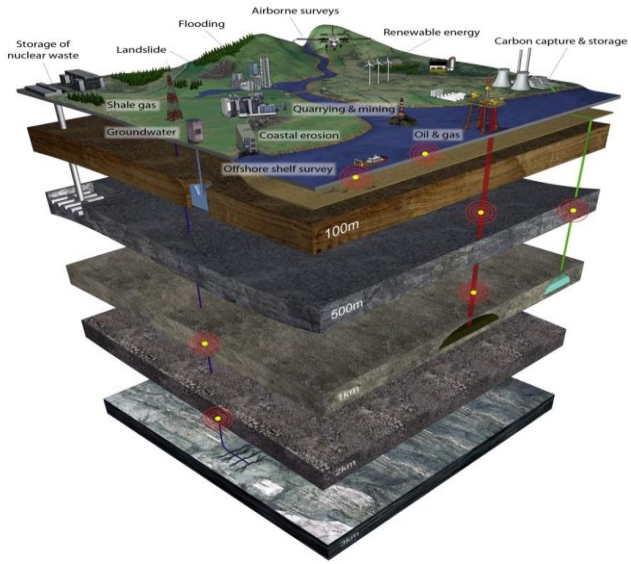


WP17 GEOENERGY TEST BEDS

Components

- Underground Laboratories and associated surface monitoring systems
- Geothermal, Hydrothermal, Unconventional gas,
- Underground Geological Energy Storage
- Gas, compressed air/water potential energy storage
- Radioactive Waste Storage
- Test laboratories such as tunnels and deep mine
- 4-D Subsurface Monitoring and reservoir imaging
- Sensor and data management (physical, chemica and biological)
- High end computer Modelling (fluids, faults, PT, Geochem bio-geochem)

UK ESIOS

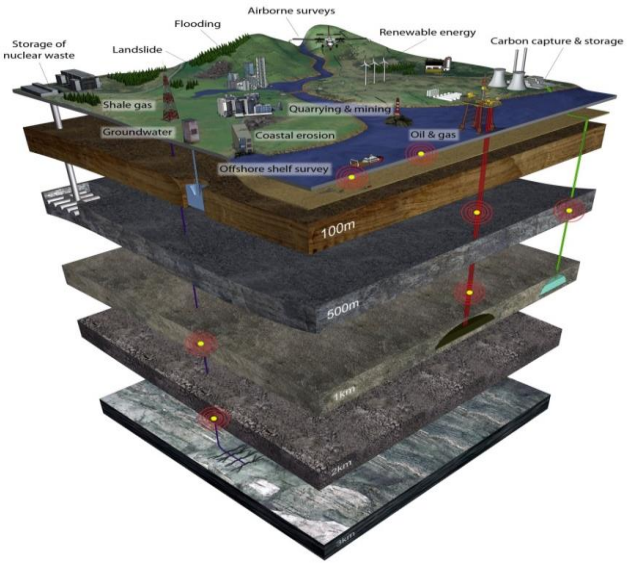


WP 17 GEOENERGY TEST BEDS

Services

- Brokering service for access to industrial applications
- Models for de-Risking Underground Operations
- Data and Software products for monitoring systems
- New sensor systems (including commercial products)
- Transnational Access to underground laboratories
- Technical Support, Standards and Protocols

UK ESIOS



Big Data **Open Data**

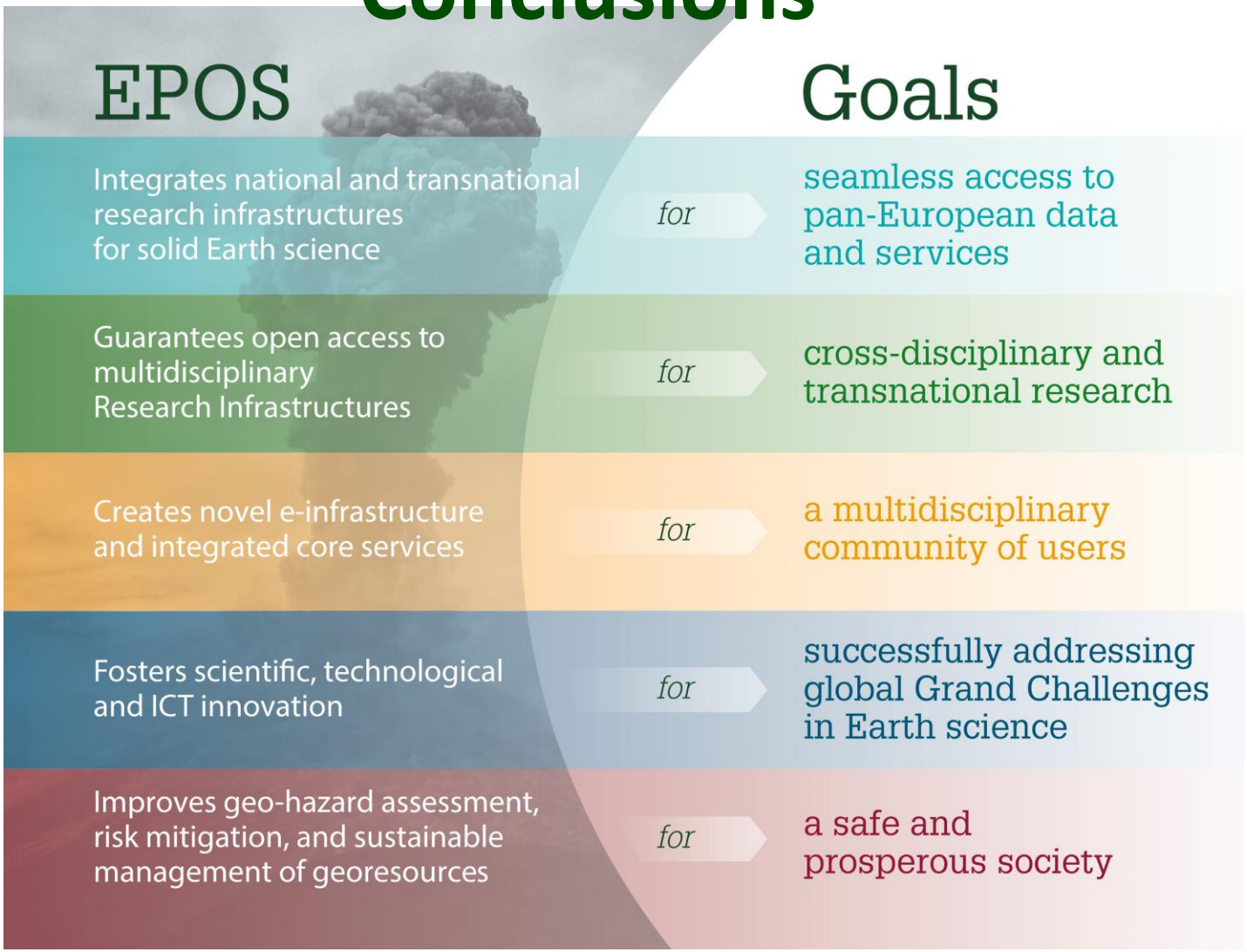
Open Data & Services

- Accessibility (scientific use)
- Commercial use
- Dissemination to Society
- Service to society

Implications

- Metrics (use & re-use)
- Public funding
- Education & traning
- Ethic Issues

Conclusions



EPOS Data, Access, and IPR policy

Guiding principles: – open access
– licensing
– no charges

Protect EPOS legally | Unrestricted use & access | Trace EPOS use & users

Balance: Legal risk : Openness : Traceability

Licensing
IPR
Terms & Conditions
Restrictions

Data & Service **Providers** → Open Access deposit terms → EPOS → Open Access license → Data & Service **Users**

Categorization

as needed for legal aspects

Data & Data Products
Level 0,1, 2, 3

Tools & Software

Open : Restricted : Embargoed

mix and match as required

Anonymous : Registered : Authorized

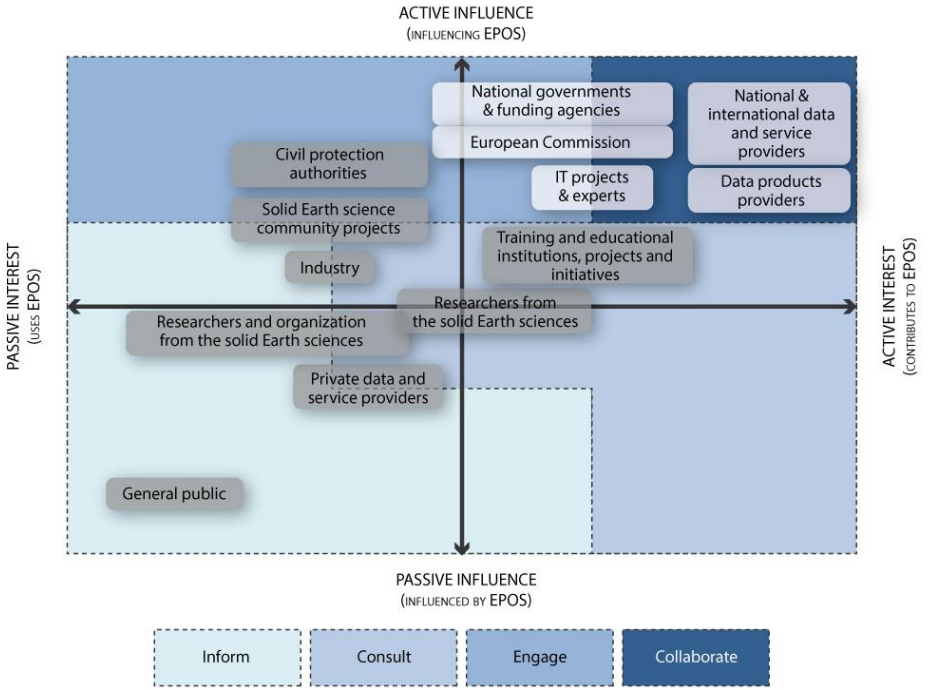
Users

Users & Stakeholders

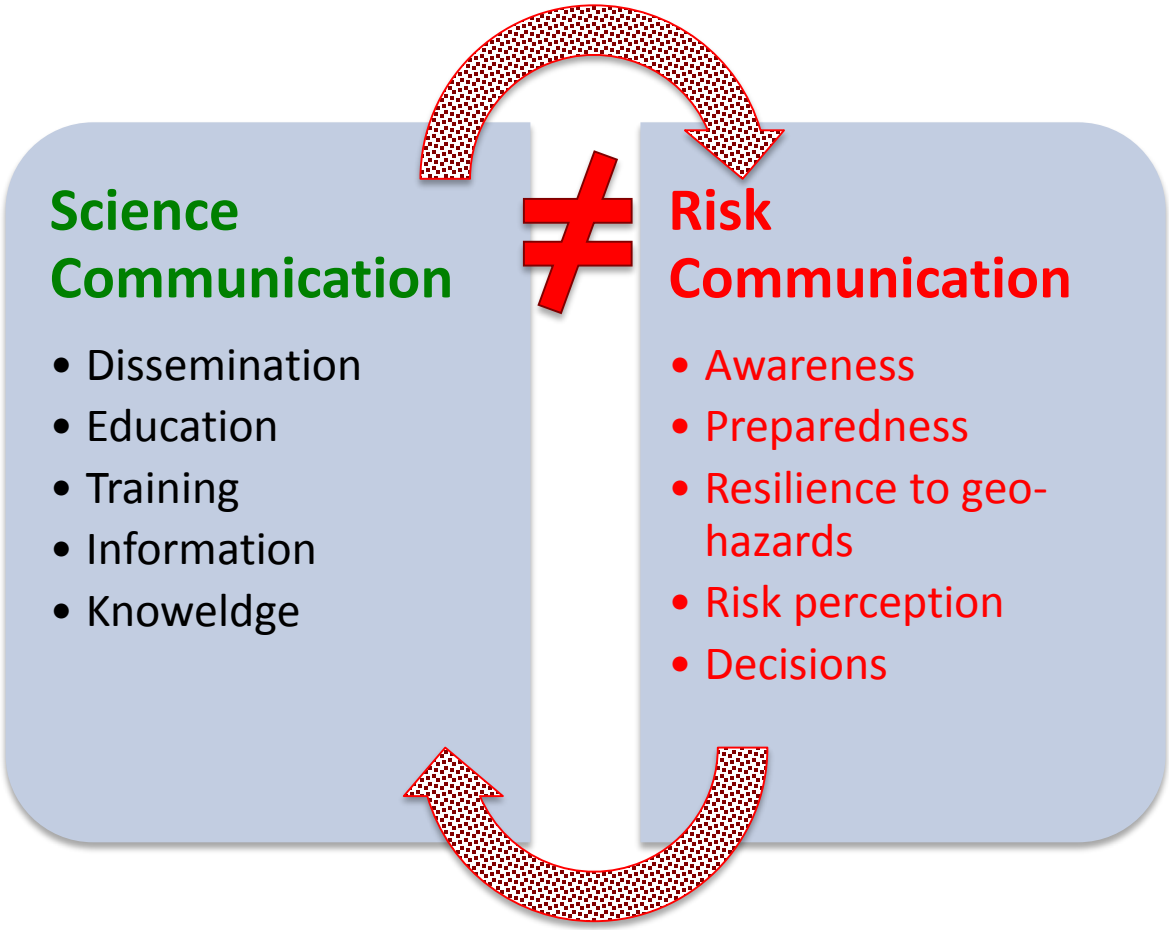
Stakeholders categories

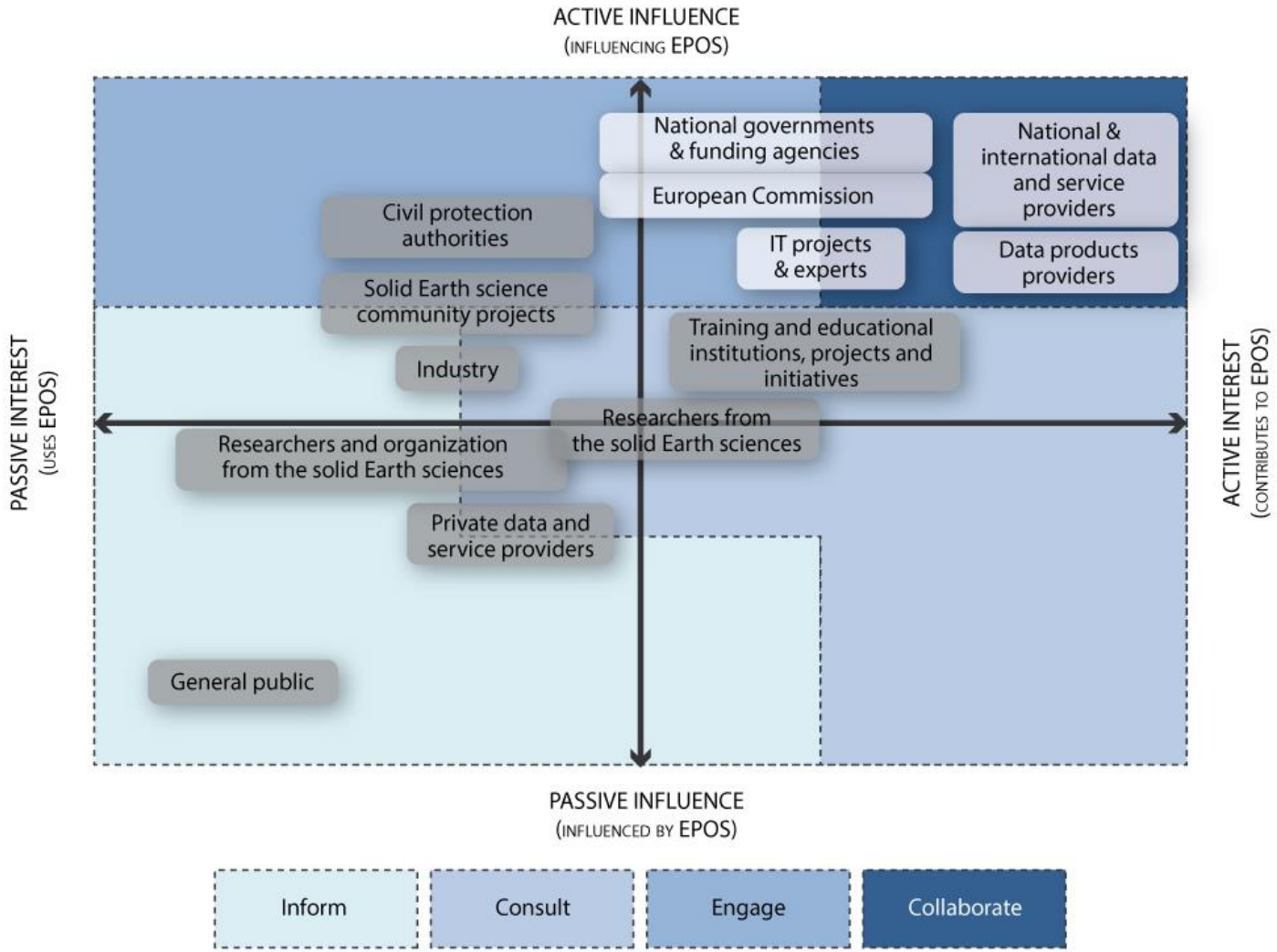
- Data and service providers from the solid Earth science (SES) community
- Scientific user community (including researchers from outside SES)
- Governmental organizations
- Industry
- Other data & service providers
- General Public

Influence & interest



Ethic Issues




ACTIVE INFLUENCE
(INFLUENCING EPOS)
PASSIVE INTEREST
(USES EPOS)
ACTIVE INTEREST
(CONTRIBUTES TO EPOS)
PASSIVE INFLUENCE
(INFLUENCED BY EPOS)
National governments & funding agencies
European Commission
IT projects & experts
National & international data and service providers
Data products providers
Civil protection authorities
Solid Earth science community projects
Industry
Training and educational institutions, projects and initiatives
Researchers from the solid Earth sciences
Researchers and organization from the solid Earth sciences
Private data and service providers
General public
Inform
Consult
Engage
Collaborate

OECD Principles and Guidelines for Access to Research Data from Public Funding

13 principles

A – Openness

- **Openness means access on equal terms for the international research community at the lowest possible cost, ...**

B – Flexibility, C – Transparency, D – Legal conformity, E – Protection of intellectual property, F – Formal responsibility, G – Professionalism

H – Interoperability

- **Technological and semantic interoperability is a key consideration in enabling and promoting international and interdisciplinary access to and use of research data. ...**

I – Quality, J – Security, K – Efficiency, L – Accountability

M – Sustainability

- **... taking administrative responsibility for the measures to guarantee permanent access to data that have been determined to require long-term retention.**

[http://www.oecd.org/dataoecd/9/61/38500813.pdf]

EPOS KEYWORDS

- **Integration** of the existing national and trans-national RIs
- **Interoperability** of thematic (community) services across several multidisciplinary communities
- **Open access** to a multidisciplinary research infrastructure for promoting cross-disciplinary research
- **Acknowledgment** of the data source
- **Progress in Science** through prompt and continuous 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)*
- Data infrastructures and novel core services will contribute to **information**, **dissemination**, **education** and **training**.
- **Implementation** plans, which require strategic investment in research infrastructures at national and international levels.
- **Societal** contributions, e.g., hazard assessment and risk mitigation

"Geo - energy test beds ….. continued "

Sustainability

National energy programmes research foundation and government agencies
Products would attract support and possible co-funding from oil and gas companies, utilities and energy and environment consultancies (current lead BGS, CCS, INGV, GFZ, Almeria, Utrecht …)

Impact

- ✓ De-Risking Underground Operations
- ✓ A catalyst for industry both onshore and offshore to stimulate investment and speed new technology options to commercialization, for example Geothermal, shale gas and UCG, energy storage
- ✓ It will thus act as a bridge from ideas to application
- ✓ Spin outs in a renewed European energy industry

Geo energy test beds

Earth scientists with the energy companies are developing infrastructures to allow the subsurface to be monitored at time scales that are consistent with our use of the subsurface, these will …

- ✓ Increase efficiency and environmental sustainability
- ✓ Act as a catalyst to stimulate investment and speed new technology energy options to commercialisation. F
- ✓ Ensure confidence amongst policy makers and industrial investors, and most of all public confidence.
- ✓ Link with the upstream energy producers and other ESFRI projects such as ECCSEL, EU radioactive waste directive, EU renewable energy storage schemes.

Comments on data sharing in EPOS

- EPOS communities feature very **different levels** of **data organization development & maturity**
- Most communities have developed **in-house their own data services**
- Many communities are already **striving for their own data archive** and services and they are afraid and in some cases **difficult to share their data** *(e.g., why should I put resources in changing what I am doing if I can barely keep track of the services I am compelled to provide ?)*
- Many communities **think they have already the best services** *(i.e., they can carry out their own research!)* and they do not see why the data should be shared (or better qualified).
- Overall, it is a **slow process to introduce new concepts**, to adopt the **same jargon** and users/scientists often **not yet ready**
- **BUT it is a positive maturation process**

The EPOS chain: high gain/high-*but manageable* risk