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D3.3 – Strategy for EPOS engagement with relevant European thematic initiatives

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2	19-01-2021	Additional contributions included

Executive Summary

EPOS (European Plate Observing System) is the pan-European research infrastructure aimed at ensuring sustainable and universal use and re-use of multidisciplinary solid Earth data and products fostering state-of-the-art research and innovation.

To warrant the sustainability of the EPOS Research Infrastructure, it is necessary to consolidate international collaboration with other initiatives and organisations, which could potentially benefit from the EPOS services or contribute to them. By extending the scope of EPOS, new communities and disciplines will be aware of EPOS and also encouraged to use its services, and potentially expand membership of the EPOS ERIC to a larger number of countries in Europe.

Task 3.2 “Connecting EPOS with other disciplines and initiatives in Europe” forms part of Work Package 3 “Global Dimension, European and International Cooperation”. It aims to establish links with relevant pan-European thematic initiatives that are currently not part of the EPOS infrastructure. For that purpose, eight pan-European thematic initiatives have been identified: ENVRI, ECCSEL-ERIC, EUREF, EGD/GeoERA, EUMETNET, EuroGeographics, Copernicus, and BGI/IGETS.

The strategy to set up a collaboration with each of these initiatives consists of three key steps: 1) raise awareness about EPOS, 2) agree on a collaborative framework between the thematic initiative and EPOS, and 3) formalize the collaboration framework through Memoranda of Understanding (MoU) and other similar forms of agreement. One of the EPOS-SP partners in Task 3.2 has been appointed to lead the engagement with each of the thematic initiative.

The progress achieved so far differs for each of the pan-European thematic initiatives. While some of them are still in step 1 (EUMETNET, EuroGeographics, COPERNICUS, BGI/IGETS), others are at step 2 (ENVRI, ECCSEL-ERIC, EUREF, EGD/GeoERA). The global pandemic situation, with the impossibility to organize face-to-face meetings has not facilitated progress, and explains why some thematic initiatives are presently still in step 1.

1. Introduction

EPOS (European Plate Observing System) is the pan-European research infrastructure aimed at ensuring sustainable and universal use and re-use of multidisciplinary solid Earth science data and products fostering state-of-the-art research and innovation. EPOS has evolved from a simple concept to integrate and distribute digital data into a distributed research infrastructure for European solid Earth science, integrating existing research infrastructures to enable innovative multidisciplinary and cross-disciplinary research.

The EPOS Research Infrastructure (EPOS RI) has completed its Implementation Phase (2015-2019) achieving a cornerstone in its lifecycle and it is currently facing the transition from the Implementation to the operational Phase.

Starting from 2020, a particular stage of the lifecycle of the EPOS RI started: the EPOS Pilot Operational Phase (EPOS POP¹). It will last three years (2020-2022) and the EPOS ERIC will coordinate it. The **EPOS SP project** represents an essential contribution to the EPOS POP because it ensures the continued engagement of those communities committed to the building of the EPOS Delivery Framework.

The overall objective of the EPOS SP project is to ensure the long-term sustainability of the EPOS RI. This will be done by 1) creating effective synergies to secure the governance, financial, and technical sustainability; 2) developing innovation to fully exploit data and service provision; 3) establishing and maintaining excellence by preserving and reinforcing the trust and awareness of users; and 4) exploiting economic and societal benefits to keep stakeholders engaged.

2. Document Objectives

To ensure the sustainability of the EPOS RI, it is necessary to consolidate international collaboration with other initiatives and organisations, which could potentially benefit from the EPOS services or contribute to them. Establishing such concrete and robust cooperative partnerships will promote synergies and alignment that potentially lead to the development and adoption of common approaches and solutions. Creating this common collaborative framework will foster wider engagement throughout the solid Earth domain, promote adoption of the EPOS services across a growing number of stakeholders. By extending the scope of EPOS, new communities and disciplines will be made aware of EPOS and also encouraged to use its services. This will contribute to the long-term sustainability of the EPOS infrastructure and its services.

This document elaborates the progress made in Task 3.2 “Connecting EPOS with other disciplines and initiatives in Europe” part of Work Package (WP) 3 “Global Dimension, European and International Cooperation”. Task 3.2 aims to establish links with selected pan-European thematic initiatives, which represent communities not currently part of the EPOS infrastructure, with whom EPOS wishes to raise awareness with the goal of verifying their interest in using, or in contributing to, EPOS services. A series of recommendations is made for a harmonised solution that forms the basis for the integration of further data, data products, services, or software (DDSS) into EPOS in the future, thus extending the geographical coverage

¹ <https://www.epos-eu.org/about/epos-pilot-operational-phase-pop>

of the EPOS infrastructure, and potentially expanding the membership of the ERIC to include additional European countries.

The objective of this document is to elaborate the coherent strategy-led approach for strengthening existing connections and building new partnerships with relevant European thematic initiatives.

3. Strategy for EPOS Engagement

Several Pan-European thematic initiatives representing communities not currently part of the EPOS infrastructure have been selected. For each of them the general strategy is to establish links with these thematic initiatives to

- Raise awareness about EPOS;
- Organize meetings to find a collaboration framework between the thematic initiative and EPOS, such as
 - Usage of existing EPOS DDSS;
 - Interest in DDSS that potentially can be provided by EPOS in the future;
 - Contribution to EPOS as Service Provider to one (or several) Thematic Core Services;
 - Contribution to EPOS as Data Supplier in one (or several) Thematic Core Services;
 - Exchange of best practices related to FAIR data principles, Trans National Access (TNA), ...;
- Formalize a collaboration framework through a Memorandum of Understanding (MoU) between the thematic initiative and EPOS-ERIC.

To optimize the process, Task 3.2 will take advantage of existing relations of Task partners already have with some of the initiatives and assign them as lead partner from EPOS-SP to drive the discussions with each thematic initiative.

3.1 ENVRI

Assigned lead from Task 3.2: UKRI

ENVRI community

ENVRI is the cluster of European environmental research infrastructures within the ESRI roadmap. The wider ENVRI community also includes relevant projects and networks, selected e-infrastructures that provide technical/data solutions for the RIs, as well as a diverse range of other stakeholders.

Despite being relatively diverse, the research infrastructures that make up the ENVRI community share similar challenges, both in their construction and operation. The ENVRI community encourages and facilitates synergies between the component RIs and initiatives for the purposes of knowledge exchange and to work towards a harmonized landscape of environmental RIs. The ultimate goal being a common vision and strategy for the ENVRI community that supports multidisciplinary Earth system science.

The EPOS RI is a key infrastructure within the ENVRI cluster. Working with other RIs within this community provides the opportunity for EPOS to work collaborative across disciplines and domains to identify solutions to common challenges and to coordinate selected research efforts and activities. ENVRI provides the framework necessary for EPOS to work closely with other environmental RIs including sharing of knowledge,

technical solutions and best practices. This activity is facilitated by the Board of European Environmental Research Infrastructures (BEERi), which is advisory body comprising the directors or coordinators of the environmental Research Infrastructures. BEERi both facilitates coordination among the participating RIs and also represents the collective views of the participating environmental Research Infrastructures where necessary.

ENVRI-FAIR

Selected members of the ENVRI community are currently engaged in the EU-funded ENVRI-FAIR² project (EU Project number: 824068). The aim of this project is to deliver FAIR compliant ENVRI cluster services to the European Open Science Cloud (EOSC). As a participating RI, EPOS is providing relevant expertise and aims to deliver FAIR compliant data services to EOSC.

As a mature Landmark Research Infrastructure within the ESFRI Roadmap, EPOS is a lead partner within the ENVRI-FAIR project. As such EPOS will provide:

- Coordination and harmonisation of policies and governance at the solid Earth subdomain level that are needed to ensure adoption and implementation of FAIR concepts that are a pre-cursor to integration of the EPOS services into the European Open Science Cloud
- Expertise and knowledge necessary for other less mature participating RIs to achieve the level of FAIRness of their services necessary for integration into the EOSC and interoperability with other research infrastructures.

This activity within EPOS-SP will provide additional support for the ongoing participation of the EPOS RI in the ENVRI community, and ensure integration of the EPOS services into the EOSC as part of the ENVRI-FAIR project. This approach will form a key element of a longer-term sustainability strategy for the EPOS Delivery Framework, and also maximize availability of the EPOS services to the wider environmental research community.

Engagement strategy and planned outcomes

The engagement with the ENVRI community will focus on alignment of common activities and a shared approach to relevant initiatives such as delivery of FAIR compliant EPOS services to EOSC and promotion of best practices and common standards throughout the solid Earth domain.

To ensure the engagement and coordination with the ENVRI community, the following actions will be undertaken:

- A best effort will be made to ensure participation by EPOS in relevant ENVRI community coordination activities. For example, EPOS will be represented in BEERi meetings through a nominated person. Relevant actions and outcomes from this interaction will be used to inform and align EPOS-SP aims and activities.
- Knowledge exchange between EPOS-SP and ENVRI-FAIR project will ensure alignment of objectives and activities, and avoid duplication of effort.

² <https://envri.eu/about-envri-fair/>

- EPOS will endeavour to contribute to ENVRI community outreach and dissemination activities as resources permit e.g. providing input for ENVRI community booths at relevant events such the annual EGU General Assembly conferences and GEO Plenary meetings

3.2 ECCSEL-ERIC

Assigned lead from Task 3.2: UKRI

The European Carbon Dioxide Capture and Storage Laboratory Infrastructure (ECCSEL) was established in June 2017 as a permanent pan-European distributed research infrastructure, ERIC (European Research Infrastructure Consortium). Within the initial five European founding member countries (France, Italy, the Netherlands, UK and Norway), 21 service providers offer access to around 80 world class CCS research facilities across Europe.

The specific strategy for EPOS engagement with ECCSEL consists of reinstating the existing (now expired) Memorandum of Understanding with the EPOS TCS Geo-Energy Test beds for Low Carbon Energy (GETB) and extend it to EPOS-ERIC to demonstrate the intention of the two ERICs to collaborate on multiple levels as ECCSEL's relevance to EPOS goes beyond the GETB TCS towards Anthropogenic Hazards, Seismicity (induced seismicity), and Geological Information and Modelling. EPOS and ECCSEL are now discussing the collaborative framework in which they want to interact; ECCSEL remain enthusiastic and proactive. A starting point for this discussion is the identification of specific topics that are relevant for the communities, for example, share access rules for Trans National Access or share data. However, this is taking place alongside the reorganization of leadership of the GETB TCS, which drove the original MOU. In addition, in order to move this forward, it is still necessary to decide where a new MOU should be positioned i.e. at TCS level, or at EPOS ERIC level.

3.3 EUREF

Assigned lead from Task 3.2: ORB

EUREF is the Reference Frame Sub-Commission for Europe of the International Association of Geodesy. EUREF deals with the definition, realization and maintenance of the European Reference Frame, which is the geodetic infrastructure for multinational projects requiring precise geo-referencing (e.g. three-dimensional and time dependent positioning, geodynamics, precise navigation, geo-information). For this purpose, EUREF coordinates a network of GNSS stations owned by agencies all over Europe and generates GNSS data products. Both the data from EUREF's GNSS stations as well as some of its data products are valuable for EPOS (especially for the TCS GNSS Data and Products). Several of the agencies operating EUREF stations have already integrated their GNSS stations in EPOS, but this has been done on an agency-by-agency basis. Only the GNSS data assets of EUREF stations that signed the EPOS Data Supplier Letter were integrated in EPOS so far. However, much more of EUREF's GNSS stations could be integrated in EPOS and have the potential to extend the geographic coverage of EPOS. In addition, DDSS provided by the TCS GNSS Data and Products could be valuable to EUREF.

The specific strategy for EUREF will be to elaborate a more formal collaboration agreement between EUREF and EPOS-ERIC. The most important challenge are 1) the harmonization of EUREF's and EPOS' data policy and metadata (data licenses and usage of Digital Object Identifiers) and 2) agree on the mechanisms to facilitate the mutual exchange of data and data products.

The EUREF Governing Board recently formalize agreed to elaborate an MoU with EPOS-ERIC and is presently discussing the concrete collaboration topics to be included in this MoU.

3.4 EGDI/GeoERA

Assigned lead from Task 3.2: GEUS

GeoERA is a 3-year research ERANET program (14 scientific projects related to geology). One of these projects gathers info and makes them available through services via the EGDI (European Geological Data Infrastructure) platform. EGDI was originally set up by EuroGeosurveys and therefore includes already other data. GeoERA will however extend EGDI to accommodate new data.

EGDI will be an EPOS Service Provider (SP) in the TCS Geological Information and Modelling. Although a large number of EGDI services are not relevant for EPOS, EGDI will be an EPOS SP for a selected number of data sets. The focus from the side of EGDI has been to prepare for the EPOS POP testing. Some of the services that are currently known to EPOS from the geological community are not the ones that will be served in the longer term. These services should have to be in place and operational before discussing if additional services from EGDI/GeoERA will be relevant for EPOS.

The specific strategy for EGDI/GeoERA will be to reflect together with EPOS which of the new services introduced by GeoERA in EGDI, are also relevant for EPOS. A new MoU between EPOS-ERIC and EuroGeoSurveys, replacing the MoU signed some five years ago, is under preparation. However, due to COVID, this has been delayed.

3.5 EUMETNET

Assigned lead from Task 3.2: ORB

EUMETNET groups 31 European National Meteorological Services and provides a framework to organise co-operative programmes between its Members in the various fields of basic meteorological activities. These activities include observing systems, data processing, basic forecasting products, research and development and training. One of these programmes is E-GVAP whose goal is to provide EUMETNET members ground-based GNSS Zenith Total Delay (ZTD) estimates in near real-time for use in operational meteorology. As ZTD is sensitive to water vapour, E-GVAP provides additional water vapour information to weather models and meteorologists in Europe and beyond.

Participants to E-GVAP operate many GNSS stations and could potentially provide that to the GNSS data and products TCS. In addition, it needs to be investigated if the tropospheric data products provided by E-GVAP could be of interest for any of the EPOS TCS. On the other hand, the data from the EPOS' GNSS stations could be valuable for E-GVAP.

The specific strategy for EUMETNET/E-GVAP consists in first raising their awareness of EPOS within EUMETNET, as EPOS is not yet well known within this community. After that, it will be necessary to investigate if common interest can be found. Initial contacts with the manager of the EUMETNET E-GVAP (GNSS) program have been taken in order to identify usage of common GNSS data with EPOS as a first step. In this process, the EPOS TCS GNSS data and products was identified as the EPOS component with whom the most common ground could be found. However, it is still necessary to raise awareness of the general EUMETNET/E-GVAP community of EPOS. Due to the global pandemic, progress has been slow.

3.6 EuroGeographics

Assigned lead from Task 3.2: ORB

EuroGeographics is an independent international not-for-profit organisation representing Europe's National Mapping, Cadastral and Land Registration Authorities. EuroGeographics could potentially link with several of EPOS TCS.

The specific strategy for EuroGeographics consists in first raising their awareness of EPOS as EPOS is not yet well known in this community. As EuroGeographics can potentially link with several of the EPOS TCSs, a first informal meeting was set up between delegates of several TCSs (Geological Information and Modelling, Seismology, GNSS Data and Products, Geomagnetic Observations, and Multi-scale Laboratories) and a EuroGeographics representative. A follow-up meeting will soon be planned, but due to a recent change in the management of EuroGeographics this meeting was temporarily postponed.

3.7 Copernicus

Assigned lead from Task 3.2: CNRS

Copernicus is the Global Monitoring for Environment and Security programme, previously known as GMES. It will provide accurate, timely and easily accessible information to improve the management of the environment, understand and mitigate the effects of climate change and ensure civil security. Copernicus is headed by the European Commission (EC) in partnership with the European Space Agency (ESA).

ESA is developing a new family of satellites, called Sentinels, specifically for the operational needs of the Copernicus programme. At present, three complete two-satellite constellations are in orbit plus an additional single satellite, Sentinel-5P.

The specific strategy for Copernicus is that the various teams involved in the TCS Satellite data currently follow the Copernicus initiative for creating a new service devoted the ground deformation called "European Ground Motion service" (EU-GMS), based on ESA Sentinel-1 data. EU-GMS aims to provide consistent, regular, standardised, harmonised and reliable information regarding natural and anthropogenic ground motion phenomena over Europe and across national borders, with millimetre accuracy.

A common data standard, including metadata, is required to ensure the harmonization of products across geographical borders. EU-GMS metadata specifications can be build upon previous experiences in defining common metadata standards for Earth Observation and Remote Sensing applications, such as what was done in EPOS.

3.8 Gravity (BGI/IGETS)

Assigned lead from Task 3.2: CNRS

Gravity data and models can be interpreted as stand-alone, but are also very useful to complement other geophysical data (e.g. seismology) for assessing the inner structure of the earth and its evolution. Time varying gravity as now monitored thanks to very accurate ground or satellites measurements and provide unique information about mass transfer within the solid Earth and its envelopes. Such mass transfer can be due to various phenomena and can occur at various time and spatial scales. It ranges from gravity changes due to mass evolution inside an volcanic edifice linked to pre and eruptive processes to the large scale gravity

effects linked with post-glacial rebound process through pre-, co- and post- seismic gravity effects for large earthquakes or the ice sheets mass balance. Gravity data are also very useful and largely used for modelling geological structures (basins, mountain ranges, rifts...).

EPOS aims at giving a comprehensive and thorough access to data and products about the Solid Earth. Gravimetric data and models are nowadays sorely lacking in the panoply of data provided by EPOS.

The specific strategy for the gravity community is to focus on the existing services within the International Association of Geodesy (IAG), which are dealing with gravity.

Two services of the International Association of Geodesy (<https://www.iag-aig.org/iag-services>), namely the International Gravimetric Bureau (BGI) and the International Geodynamics and Earth Tide Service (IGETS), have already been contacted to increase their understanding of EPOS. Following this, they expressed their potential interest for engaging within EPOS inside a new TCS Gravity. Other services of the IAG dealing with gravity will also be contacted. The next step will then consist in discussing with them how exactly their community and related services can be engaged within EPOS.

4. Conclusion

Eight European thematic initiatives have been selected with the goal of establishing links between them and EPOS, and consequently extend the scope of EPOS.

The pandemic that hit the project in the first couple of months, and the (at that time incorrect) assumption that face-to-face meetings might be resumed after a couple of months, delayed the progress mostly for the initiatives which were not yet familiar with EPOS. For these initiatives, which already had previous interactions with EPOS, the progress made so far was significantly better with ongoing discussion on the common framework that will be the basis of several MoUs between the initiatives and EPOS-ERIC.