EMODnet Thematic Lot n°2 – GEOLOGY

EASME/EMFF/2020/3.1.11/Lot2/SI2.853812

Start date of the project: 25/09/2021 (24 months)

Centralisation Phase

Interim Progress Report

Reporting Period: 25/09/2021 – 24/09/2022

The European Marine Observation and Data Network (EMODnet) is financed by the European Union under Regulation (EU) 2021/1139 of the European Parliament and of the Council of 7 July 2021 establishing the European Maritime, Fisheries and Aquaculture Fund and its predecessor, Regulation (EU) No. 508/2014 of the European Parliament and of the Council of 15 May 2014 on the European Maritime and Fisheries Fund.

Contents

Disclaimer

The information and views set out in this report are those of the author(s) and do not necessarily reflect the official opinion of the CINEA or of the European Commission. Neither the CINEA, nor the European Commission, guarantee the accuracy of the data included in this study. Neither the CINEA, the European Commission nor any person acting on the CINEA's or on the European Commission's behalf may be held responsible for the use which may be made of the information.

1. Introduction

The EMODnet-Geology Project is one of seven that brings together information on the Geology, Chemistry, Biology, Physics, Bathymetry, Seabed Habitats, and Human Activities in the European marine environment. During the fourth phase of EMODnet (2019-2021), 39 organisations from 30 countries demonstrated that geological information from all the European seas could be compiled and harmonised to map products at 1:000 000 scale or finer where the underlying data permit. The current EMODnet-Geology Project delivers similar information for the entire European seas, with a multi-scale approach applied when possible. It started in September 2021, has been running for 1 year, and ends in September 2023.

The group consists of 40 partners or subcontractors who can provide geological information from all European seas, including the North Atlantic Ocean all the way to the margins of the Arctic (Barents Sea and White Sea) as well as the Caspian Sea, and the Caribbean Sea (Figure 1). For the Caspian Sea subtask subcontractors from the Caspian Sea countries were invited to the project. The subtask has been coordinated by subcontractor VSEGEI (Russia). However, due to geopolitical issues the contract with VSEGEI was ceased on 30. August 2022.

The data that are included in the project are principally that held by the project partners, although other organisations contribute to the geological mapping objectives in some of the participating countries. The geology data that were compiled in the earlier phases and in the current project include:

- Sea-bed substrate (sediment layer at the seafloor)
- Sediment accumulation rate and sediment erosion
- Sea-floor geology - lithology (bedrock geology beneath the surficial sediment and Quaternary deposits)
- Sea-floor geology - stratigraphy
- Quaternary geology
- Geomorphology
- Coastal behaviour
- Mineral occurrences (e.g., oil and gas, aggregates, metallic minerals)
- Geological events and probabilities (e.g., earthquakes, submarine landslides, volcanic centres)
- Submerged landscapes (LGM landscape, palaeolandscapes across various postglacial timeframes)

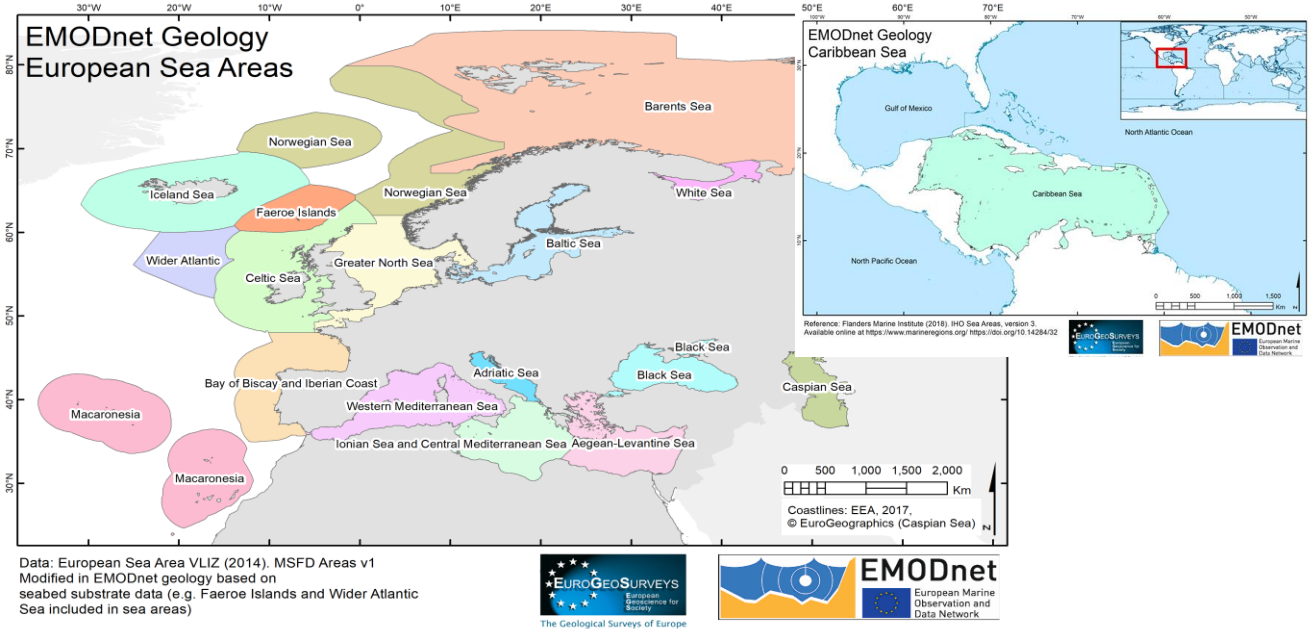


Figure 1. The seas included in the geographical scope of the EMODnet Geology Project.

The consortium included the following organisations 1. Geological Survey of Finland (GTK); 2. Geological Survey of Sweden (SGU); 3. Geological Survey of Norway (NGU); 4. Geological Survey of Denmark and Greenland (GEUS); 5. Iceland GeoSurvey (ISOR); 6 Geological Survey of Estonia (EGT); 7. Latvijas Vidas Geologijas un Meteorologijas Centr – Latvian Environment, Geology and Meteorology Centre (LEGMC; Latvia); 8. Lithuanian Geological Survey (LGT); 9. Polish Geological Institute (PGI-NRI); 10. Geological Survey of the Netherlands (TNO); 11. Royal Belgian Institute of Natural Sciences (RBINS); 12. Bureau de Recherches Géologiques et Minieres (BRGM, France); 13. IFREMER (France); 14. Geological Survey of Ireland (GSI); 15. Geological Survey of Spain (IGME); 16. Instituto Português do Mar e da Atmosfera (IPMA, Portugal); 17. Istituto Superiore per la Protezione e la Ricerca Ambientale. Servizio Geologico d'Italia (ISPRA); 18. Geological Survey of Slovenia (GeoZs); 19. Croatian Geological Survey (HGI); 20. Geological Survey of Montenegro (GEOZAVOD); 21. Geological Survey of Albania (GSA); 22. Hellenic Survey of Geology and Mineral Exploration (HSGME, Greece); 23. Hellenic Center for Marine Research, Greece (HCMR); 24. Institute of Oceanology – Bulgarian Academy of Science (IO-BAS); 25. National Research and Development Institute for Marine Geology and Geoecology (GeoEcoMar, Romania); 26. Geological Survey of Cyprus (GSC); 27. The Malta Geological Survey through the Continental Shelf Department (Malta); 28. Dipartimento Scienze della Terra Università La Sapienza, Roma (UNIROMA, Italy); 29. University of Tartu (Estonia); 30. Foundation for Research and Technology Hellas – Institute of Computer Science (FORTH- ICS); 31. Stichting Deltares, The Netherlands; 32. UK Research and Innovation (UKRI - (BGS), United Kingdom); 33. Jardfeingi (Faroe Islands); 34. Centre for Environment, Fisheries and Aquaculture Science (DEFRA - Cefas, United Kingdom); 35. Edge Hill University (United Kingdom); 36. Institute of Geological Sciences, NAS of Ukraine (IGS-NAS-UKR, Ukraine) 37. Institute of Marine Science and Technology of Dokuz Eylul University (IMST, DEU, Turkey); 38. A.P Karpinsky Russian Geological Research Institute (VSEGEI), contract ceased 30.8.2022; 39. Federal Institute for Geosciences and Natural Resources (BGR, Germany); 40. EMCOL Research Centre, Istanbul Technical University (ITU, EMCOL, Turkey).

The partnership consisted of the geological survey organisations of the maritime countries of the European Union, added with expertise from six universities, mainly to fulfill the requirements of work package 8 Submerged Landscapes. Twenty-five of the project partners are also members of the Geological Surveys of Europe (EuroGeoSurveys), which exists to promote the work of the geological surveys and therefore provides a long-term association under which the project partners collaborate.

As the principal holders of marine geological information, the partnership also ensures that data from all of the European regional seas are provided to the project. The project is built on information primarily held by the project partners, but also connected to other owners of information by offering data delivery to EMODnet either through the EMODnet Data Ingestion portal or straight to the EMODnet Geology portal. By doing so, the project would not recreate information that is held elsewhere. This is especially essential in case of the seismic surveys and borings which were partly archived in external databases. The EMODnet Geology portal (http://www.emodnet-geology.eu/) is from the beginning of the third phase of EMODnet hosted by the Geological Survey of Denmark and Greenland (GEUS) in Copenhagen. To ensure sustainability of the EMODnet Geology project, the EuroGeoSurveys' European Geological Data Infrastructure (EGDI) provides an appropriate platform for developing a long-term infrastructure for delivering the best available and up-to-date marine geological information held by the project partners to EMODnet Geology Central Portal.

2. Update on the Tasks

Task 1: Maintain and improve a common method of access to data held in repositories

Work on collection and harmonisation of new datasets and deliveries to the different work packages were mainly scheduled to begin in Q1 or Q2 of 2022. Data deliveries from partner organisations started in 4/2021, continued during the entire first project year, and will continue until the end of the project.

Example: Map of georeferenced coastal-vulnerability was translated into harmonized polyline shapefile with three classes (high-medium-low) and provided to the entire partnership for quality check before public release. The map and literature database quality checking are complete, and the next step is to make the required amendments before the map deliverable is ready for release.

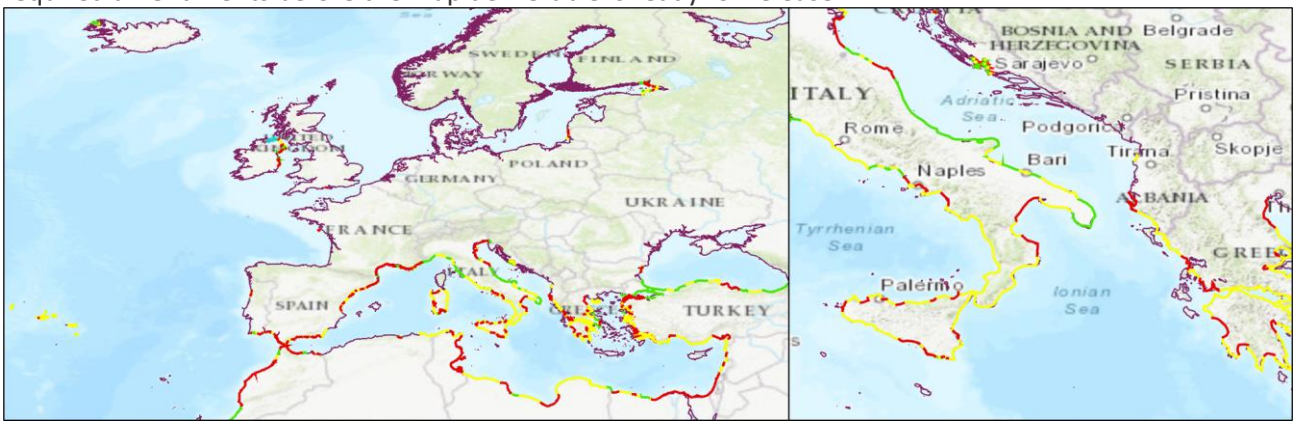


Fig 1. Harmonized map of coastal vulnerability (with detail), showing excellent coverage in southern Europe.

Task 2: Construct products from one or more data sources that provide users with information about the distribution and quality of parameters in time and space

All data submitted by the partners are being added to the different data products and will be updated on Central portal during the second project year.

Task 3: Develop procedures for machine-to-machine connections to data and data products:

We have several connections available to external applications – specifically OGC standards WMS, WFS, and CSW. All project partners can connect directly to the portal PostgreSQL-database and create advanced queries on the project's data products.

Task 4: Contribute data, data products and content to a central portal that allows users to find, view and download data and data products:

The new Central Portal will be taking care of visualisation, downloading and promotion of the data. It does not make sense to use a lot of resource on the development of the old portal anymore and most of the work this year has been about the migration from the old portal to the new Central Portal. A lot of resources have been used on updates of and additions to the existing dataset, that are visible on both the old and new web portal. The central portal administrators feared at a point that the number of separate datasets would make the Central Portal unmanageable for the users. The thematic groups (Lots) were thus instructed to reduce the number of datasets – either by merging the datasets into fewer datasets or by omitting some datasets. We were able to reduce the number of layers from 152 to 33 (mostly by merging). The merging of datasets also meant that some of the values had to be updated and harmonized so that the filtering of data can work across data that originate from different layers.

Task 5: Contributing content to dedicated spaces in Central Portal:

We are working in close cooperation with the Central Portal to have our data as well as our portal ready for all necessary measures regarding migration of EMODnet Geology data and products to any desired spaces on the Central Portal.

Task 6: Ensure the involvement of regional sea conventions:

The RSC issue will be dealt with during this phase, mainly through the planned meetings between all EMODnet thematic lots and the RSC's, a forum which was dismantled some years ago.

Task 7: Contribute to the implementation of EU legislation and broader initiatives for open data

We have been working in close cooperation with DG MARE, CINEA, and the Secretariat to contribute to all joint EMODnet efforts on the implementation of EU legislation and broader initiatives for open data.

Task 8: Monitor quality/performance and deal with user feedback:

We regularly monitor and assess the running systems in terms of performance and quality of service. User feedback is handled, and problems resolved within hours.

Task 9: Maintain the existing thematic web portal for a maximum of six months from the start of the projects: We kept our thematic portal running for a maximum of six months from the start of the project to have it successfully migrated to the Central Portal – and in fact even further as long as necessary, provided that this is further approved by CINEA/DG MARE.

Status of the Milestones and Deliverables listed in the workplan					
Milestone/Deliverable in numerical order	WP	Date due	Status (To do/ Delivered/ Delayed)	Date delivered	If Delayed: reason for delay and expected delivery date
M1: Thematic data products updated T0+6 months	WP9, all WP's	25.03.2022	Delivered	25.03.2022	Our data products have been ready for uploading to CP according to plan.
M2: Data specification and sourcing ready	All WP's	24.09.2022	Delivered	-	-
M3: Interim report and evaluation of progress	WP1&WP9	24.9.2022	Delivered	23.09.2022	-
D1.1-8: Quarterly reports	WP1/all	15.10.2021 15.01.2022 15.04.2022 15.07.2022 15.10.2022 15.01.2023 15.04.2023 15.07.2023	Delivered Delivered Delivered Delivered To do (all the rest)	15.10.2021 14.01.2023 14.04.2023 14.07.2023	-
D2.1: Interim report	WP1/all	24.9.2022	Delivered	-	-
D2.2: Final report	WP1/all	24.9.2023	To do	-	-
D3.1: Thematic data products/maps updated on Central portal	WP9/WP1 /all	24.03.2022	Delivered	-	Our data products have been ready for uploading to CP according to plan.
D3.2: Final data products/maps available	All WP's	24.9.2023	To do	-	-

3. Work Package updates

WP1 – WP1. Project Management

Covering Tasks: All tasks through monitoring the progress as a whole, but mainly tasks **1, 2, 6, 7, and 8.**

This phase of EMODnet Geology started with a remote Kick Off meeting on Monday 11th October and Tuesday 12th October 2021. During the meeting the consortium agreed upon actions for the whole project but especially for the first six months. The second project meeting where progress was monitored and further actions were agreed upon was held as a hybrid meeting in Utrecht, NL on 17th to 20th May 2022.

Since 24.2.2022 all EMODnet Geology activities of the Caspian Sea task were on hold due to the war in Ukraine. This was because those were designated to our subcontractor All-Russia Geological research Institute (VSEGEI), and cooperation with Russian entities was not possible due to the geopolitical situation (moreover financial transactions to Russian entities were completely blocked by all banks). GTK as coordinator of EMODnet Geology started the process of discontinuation of the subcontract between GTK and VSEGEI. The ceasing of our subcontract with VSEGEI was accepted by CINEA on 30.8.2022 after amendment of Annex II of our Service Contract, and VSEGEI was notified on the discontinuation of the subcontract. After that GTK took over the responsibility of all Caspian Sea tasks formerly assigned to VSEGEI. GTK is in the process of subcontracting the former Azerbaijani subcontractor of VSEGEI to get new data from Azerbaijan. Attempts on subcontracting entities from the remaining Caspian Sea countries (except Iran and Russia, which is impossible due to sanctions) will also be made.

The partners were identifying, collating, and harmonising new national data for this phase of the project during the whole first project year. New data will be added also during the second half of the project. All data products will be updated, and new products will be uploaded on the Central portal by the end of the project.

EMODnet Geology has had 6 internal Steering Group meetings during the reporting period (see section 7).

Overall progress of the project is in general on schedule with slight delay regarding the Caspian Sea subtask, where the contract with the original task leader had to be ceased due to the geopolitical situation. During our Utrecht project meeting in May we decided to put more effort on the Caribbean Sea subtask as some resources are running idle due to the Caspian Sea situation. At the time of writing this report project coordination has good connection with Asociación de Servicios de Geología y Minería Iberoamericanos (ASGMI), which has many members amongst the geological surveys in the Caribbean Sea area. There are further plans of cooperation with at least Colombia, Cuba, and Venezuela, who have informed us that they have marine geological data. Further data has been collected from open sources as well as from some partner surveys that have data from the area.

EMODnet Geology was by the coordinator promoted with an oral presentation at the Nordic Geological Winter meeting in Reykjavik, Iceland, on 13 May 2022.

WP2 – Data specification and sourcing

Covering Tasks: 1, 2

Partners and subcontractors were at the kick-off meeting asked to report new data and metadata, which have been collected and are now in the process of harmonisation. Some delays are to be expected for the Caspian Sea subtask where the former task leader's contract was ceased due to the geopolitical situation, and it will take a while for the coordinator (GTK) to subcontract a potential party in Azerbaijan. A subcontract is expected within Q4/2022. The coordinator is also looking for possibilities of subcontracting some actor(s) in the

remaining two possible Caspian Sea countries, Kazakhstan, and Turkmenistan. Iran and Russia are out of the question due to sanctions. As explained for WP1 Caspian Sea data sourcing is in good progress.

WP3 – Seabed substrate

Covering Task: 1, 2, 4

Data products and updates

Delivery of the seabed-substrate component of Section 1.6.3. of the tender specifications, including compilation of all available seabed-substrate information at a scale of 1:100,000 or finer where data permits, as well as information on the sediment accumulation rate and erosion rate of the seabed are the main objectives of WP3.

In the current phase, WP3 introduced a new way to manage the seabed substrate data updates, which helps to improve the data continuity, accuracy and and creates also a solid foundation for the future work by providing a checking point for all the data delivered during previous phases.

Updated guidelines for the new practice were distributed to partners in May 2022, and national geodatabases required for the new procedure were provided in June 2022. Besides the new instructions, the guidance document also includes instructions for the improvement of coarser 1:250k and 1:1M data and confidence products generated during earlier EMODnet phases. Data delivery from partners and data product updates are expected on the second half of the current phase.

Sedimentation rates guidance document was delivered to the project partners in April 2022. Additionally, WP3 has formed a subgroup for partners interested in the confidence of the modelled substrate data. The group had its first remote teams-workshop February 2022.

In order to tackle the new task of this phase "*seabed sediment … erosion rate*" WP3 leaders sent out a "Seabed erosion" query to partners in October 2021. Summary of the partner query for Seabed Erosion rate was created and distributed to partners February 2022. After the first query results, the new deliverable "Seabed Erosion" has been dealt with through inventory of available material on the topic and a separate sediment erosion dedicated workshops were arranged during the full partnership hybrid project meeting in Utrecht 17.5.2022 and as a remote teams-meeting 13.6.2022. WP3 leader is currently preparing guidelines for the seabed erosion task based on data inventory and workshops.

Surface features, additional information collected within the seabed substrate data were discussed and described in a short article that was submitted to GEUS Bulletin special issue 'Marine and coastal geodiversity and geosystem services in the Scandinavian and Nordic Seas' in May 2022 and is now in review.

Other objectives

WP3 distributed the Caspian Sea coastline which was created in EMODnet Geology to EMODnet Habitats lot in February 2022 and have agreed about the schedule on the seabed substrate data delivery in this phase, continuing the well-established cooperation between lots.

WP3 have participated in vocabulary group and EMODnet Geology Coastal ribbon work with other EMODnet Geology work packages (WP's 3, 4, 5, and 6).

WP3 products and the EMODnet Geology project have been promoted with several events such as IODE Conference 2022, Sopot, Poland and at FINMARI Researcher Day, Helsinki, Finland. A brief literature analysis with Google scholar data, listed over 100 references in different fields such as planning and management, science and research and biodiversity that have used EMODnet Geology Seabed substrate data in their work. This leaves out all usage which has not been peer reviewed, such as two cases 2022, which used WP3

Substrate data in the report on the need for environmental impact assessment, in two planned marine cable route projects in Finland.

WP3 has also been actively involved in EMODnet Data Ingestion 3 and EMOD-PACE, the EMODnet PArtnership for China and Europe project.

WP4 – Sea-floor geology

Covering Task: 1, 2, 4

Data

During this first year of the project spatial data and metadata on Geomorphology and Quaternary Geology from France, Germany, Iceland, Ireland, Italy, Latvia, Malta, Montenegro, Norway, Portugal, and Russia, that were submitted during the previous phase but not yet included in these products, were included now, as were the new data from Slovenia, Spain, and Ukraine.

A new layer "Geomorphology line features" was created, uploaded at BGR Geoviewer (https://geoviewer.bgr.de), and delivered to the EMODnet geology portal.

Geomorphology data from Spain and France were harmonised in communication with the partners from these countries.

Quality assurance

The important task on quality assurance was confirmed and continued. We had good experience with using the BGR Geoviewer for quality assurance of WP 4 data layers before the final publication on the EMODnet Geology and central Portal, and thus this was put into routine operation. Now the data are first published on the BGR geoviewer for review by the participants, then the WP 4 team at BGR add the suggested changes and finally transfers the optimized data layers to WP 9 for uploading on the EMODnet Geology Portal from where it can be transferred to EMODnet Central portal. This way, we can provide data in a quality best possible for the time being.

Terms and vocabularies

We successfully established a cross WP vocabulary working group to optimise the vocabularies and include hierarchies.

Where necessary synchronisation of features was included in the update of the WP 4 guidelines.

In development: Hierarchical assignments for stratigraphical terms in the data acquisition excel sheets to facilitate usage by project partners and short notations for better readability and orientation on the digital maps.

Coastal Ribbon

An inventory for coastal data onshore ("Coastal ribbon") was prepared in a cross-WP Working group led by WP 4. The document and its contents have been discussed and is in review.

Publication and outreach

The Geological Society of London Special Issue "From Continental Shelf to Slope: Mapping the Ocean Realm" with 9 contributions from EMODnet Geology partners is now a complete book, published and available at https://www.geolsoc.org.uk/SP505. Eds: Asch, K. (WP 4 lead), Kitazato, H. & Vallius, H. (WP1, Project lead).

WP5 – Coastal behaviour

Covering Task: 1, 2, 4

Coastal Vulnerability

Specific attention has been paid to mapping the information on coastal resilience (the ability of a coastline to absorb and recover from erosion before a critical state is reached) collated in the previous phase and extending the coverage to the southern Mediterranean, Caribbean and overseas territories. Coastal resilience, a measure of vulnerability, has significant decision-making value because it provides a potential link to the risks faced by the coastal-zone population. It will supplement the previously delivered data products on coastline migration. The literature-based map of coastal-vulnerability indices finalized during the previous quarter was translated into a harmonized polyline shapefile that is presently being QCd in preparation of WMS publication on the portal.

Edge Hill University, UK – A map of georeferenced coastal-vulnerability maps were translated into harmonized polyline shapefile with three classes (high-medium-low) and provided to the entire partnership for quality check before public release. By the end of first project year the quality checking is completed and required amendments need to be made before public release of the coastal vulnerability map deliverable.

The coastal vulnerability map is a separate deliverable to the coastal migration map, that helps coastal-zone managers to focus their attention on key stretches of coastline that are the most vulnerable in terms of safety, socio-economics and environmental value. Coastal resilience, a measure of vulnerability, has significant decision-making value because it provides a potential link to the risks faced by the coastal-zone population. It will supplement the previously delivered data products on coastline migration.

Conference presentation at European Geosciences Union conference, May 2022: Cherith Moses, Cerys Butterill, Tanvi Chopra, Amber Humphries, and Sytze van Heteren (2022) Pan-European coastal vulnerability: translating incomplete data and information for communicating situational awareness. EGU22-2029.

https://doi.org/10.5194/egusphere-egu22-2029 https://meetingorganizer.copernicus.org/EGU22/EGU22-2029.html

Coastal Migration

Specific attention has been paid to validating and updating the coastline-migration maps collated and published by the consortium in the previous phase, and extending the coverage to the southern Mediterranean, Caribbean and overseas territories.

For the Coastal Migration mapping a new updated file has become available in April, where new data has been added from six countries. Data of Russia was delivered before the war but are ready to add, when QC approved.

WP6 – Geological events and probabilities

Covering Task: 1, 2, 4

Since the start of the current phase, discussion has been continued concerning the best way to collate and represent information concerning events occurrences and events probabilities.

New or more detailed data as well as updates are being collected, including new areas such as the Caribbean Sea. Considering the characteristics of data included in WP6, additional layers at different scales will not be created. Data at higher resolution are included into the 100k layers. In order to provide information on the resolution of occurrences reported in the layers, an additional field has been introduced in the attribute table of a few layers to specify the scale at which data have been acquired. Point layers for tsunamis as well as for

earthquakes are each represented in a single layer without scale, since they do not depend on the quality of resolution.

The possibility to create layers including data at all resolutions, by merging the 250k layer with the 100k layer for each feature type, has been considered upon request of the Central Portal for simplified layers. However, products at lower resolution (>250k) could be the result of expert interpretation, whereas more detailed data are mostly the outcome of direct acquisitions; consequently data are not comparable between the different products and their merging is not possible.

Probabilities are generally evaluated concerning single events. However, different methods and parameters may be considered to assess probabilities. An inventory of information concerning probabilities available for any occurrence was proposed. In addition, connections with WP4 and WP5 could be considered for landslides located along the coastal areas. It would be useful to verify whether it is possible to gather information about onland outcrops, such as type of coasts and type of rocks, to complement data on stability. After a few cross-thematic meetings focusing on coastal ribbon issues (see section 7), a questionnaire has been prepared together with other WPs to enquire about data available along coastal areas, both onland and at sea, also concerning information on availability of events probability data within a comprehensive cross-thematic inventory. Moreover, links to other websites providing information on probabilities could be added.

Guidelines for the compilation of WP6 have been circulated to Partners at the beginning of March 2022. Shapefile format was shared with partners through the file manager (23.6.2022).

ISPRA (WP6 lead) has been carrying on cooperation with other Italian Public Research Institutions throughout the different phases of the Project, this is to deliver the best WP6 data available all over the Italian territory. Cooperation agreements with these Institutions have been repeated also for the current phase.

WP7 – Minerals

Covering Task: 1, 2, 4

WP7 seabed minerals presented the plan for this phase of EMODnet Geology at the remote kick-off meeting (12.10.2022). The plan includes the expansion to the Caribbean Sea where important mineral deposits are present. We introduced initial research on the existing public databases hosted by international organizations and by USA.

In this phase we are aiming to advance the sub deposit type classifications for Marine Aggregates and Hydrocarbons. In this first year of the project, we've had updates from Norway and Malta, and we are expecting data from Turkey on hydrocarbons in the Black Sea and in the Marmara Sea. We welcome any updated data for the 12 mineral types included under WP7 or new data not previously submitted. We will contact all Partners in advance of the next meeting in November 2022 to issue a reminder on this and on the updated WP7 Task Guide.

We have been active engaging with national and European activities to publicize the existing mapping services. For this we have presented the national EMODnet activities at our National Seabed Mapping conference (INFOMAR) in Dublin in March 2022, this year with international audience as part of the three-day international Remote Hydrography conference, hosted by the Hydrographic Society UK & Ireland. Also, in November 2021, a more tailored presentation was delivered to the Sand and Gravel forum (EMSAGG) to inform this community of the wealth of data available in European waters via the EMODnet portals, paying particular emphasis on marine aggregates and the sub seafloor potential resources in European coastal waters.

WP8 – Submerged landscapes

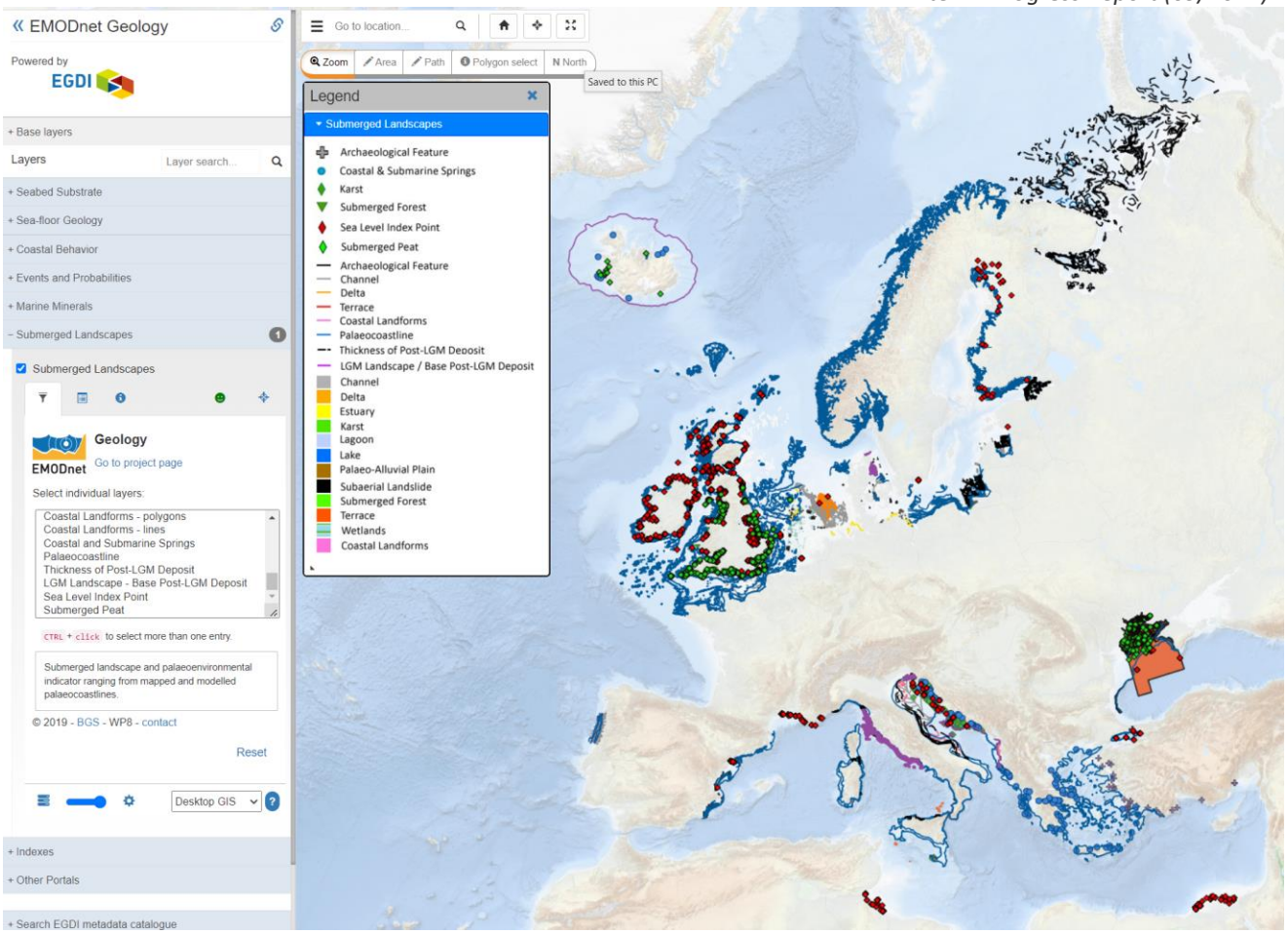
Covering Task: 1, 2, 4

In May 2021 an update to the data product more than doubled the content of the fully attributed GIS layer, increasing the database from 16,126 individual features at the end of last contract phase to 40,953. These data describe submerged landscape features preserved on continental shelves across European regional seas, and the Caspian and Caribbean Seas where possible. By start of this phase the database comprised 27 classes of submerged landscape and palaeoenvironmental indicator including mapped and modelled palaeocoastlines, evidence for submerged forests and peats, and submerged freshwater springs. The next portal update is scheduled for October 2022 with new submissions from 3 partners at the last deadline in Summer 2022.

WP8 continue to deliver information through Web Map Services feeding the EMODnet Central Portal, supporting the preservation of submerged features that are under increasing threat from commercial activities and natural erosion. Additionally, a descriptive webpage (https://www.emodnet-geology.eu/data-products/submerged-landscapes/) describing the workpackage, providing a descriptive vocabulary of features and a description of the metadata supplied in the database attribute table was published in May 2022 as a tool for end users.

This workpackage will use suitable geological data and information to reconstruct palaeogeography at various time frames across European regional seas. We will develop reconstructions of submerged pre-historic landscapes of the European continental shelf at various time periods crucial to Palaeolithic and Mesolithic Man (e.g., Last Glacial Maximum 20,000 years before present). This will be accomplished using the harmonised WP8 database of dated palaeoshoreline limits, polygon data (e.g. palaeo-lagoons, -estuaries, -rivers), combined with supporting point data depicting features such as submarine springs, analytical studies on flora and fauna, and sea-level index points. During Phase 5 regional working groups have been defined which will work on seven geographic regions to frame the available WP8 datasets in a regional context including information on vegetation. Thus far two dedicated meetings (10th February and 18th July 2022) have taken place to further this goal within the project timeframe.

Additional activities: Products and activities from WP8 have been presented at a number of national and international conferences during Phase 4 including the International Conference on Seafloor Landforms, Processes and Evolution (4-6th July 2022) where five WP8 partner presentations were made to an in-person audience of 120-150 people with more joining online.



Submerged Landscapes summary map from the EMODnet Geology portal.

WP9 – Data management, web portal and services

Covering Task: 1-5, 8,9

Most of the work this year has been about the migration to the new Central Portal.

The developers of the new Central Portal have required that the information is merged into fewer services. The reason for this is that future users of the Central Portal otherwise would be overwhelmed by the number of layers to choose from. We were able to squeeze the information from 152 layers into 33 new services that are used for visualization of data on the new map viewer at the Central Portal.

The merging of datasets also meant that some of the values had to be updated and harmonized so that the filtering of data can work across data that originate from different layers.

The new Central Portal has also been reviewed and information of how the layers should be configurated at the central portal has been provided.

Work has also been done on the existing portal.

Indexes for boreholes, samples and geophysics has been updated for Finland, Ireland, The Netherlands, Norway, Ukraine, Belgium, and Poland.

Also, web services for updated geomorphology layers and a new layer: geomorphology lines have been created and added to the test map viewer for review.

https://data.geus.dk/egdi/?mapname=egdi_emodnet_geology_test#baslay=baseMapGEUS&extent=-1676180,-138780,8822020,5000050&layers=emodnet_geomorphology_2022,emodnet_general_physiographic_features_2022,emodnet_geomorphology_lines

WP9 has worked together with WP4 about how geology and geomorphology can be visualized in 3D. Different possibilities were discussed. We agreed on that the 3D visualization used in the Bathymetry portal and the new map viewer at the new Central Portal meets our needs. In the viewer different layers can be draped on the 3D visualization of the bathymetry. This solution is not a true 3D solution but the draping of especially geomorphology and Quaternary geology on the 3D bathymetry is very illustrative. Small adjustment of the style definition on the geoserver was needed to make the draping work.

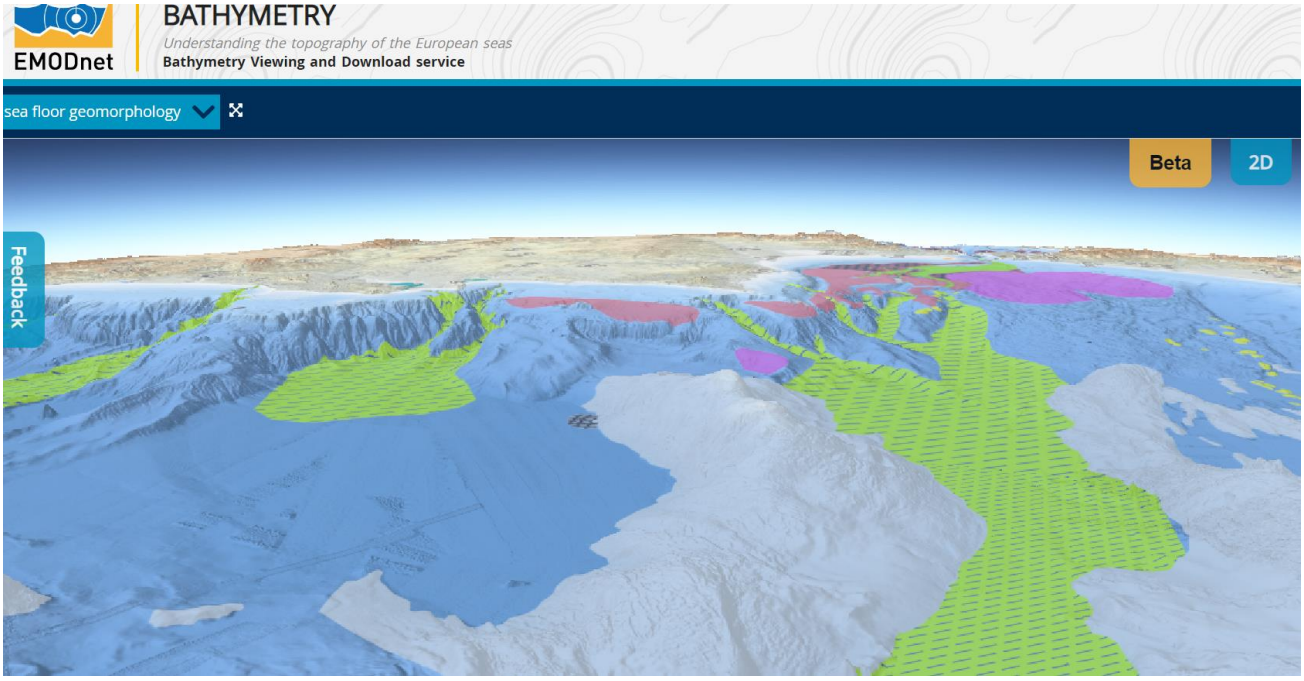


Figure 1. An example from the 3D map viewer on https://portal.emodnet-bathymetry.eu/-, that shows the west coast of Portugal and Spain. The geomorphology is draped on the bathymetry model. Grey: seamountains, bright green: marine cayons, magnenta: slide areas, crimson red: contourite deposits.

In WP9 we have also been involved in the dialogue between the secretariat and the data product owner about use of EMODnet data in the Atlas of the Seas project.

4. Identified issues: status and actions taken

A. Priority issue(s) identified and communicated by CINEA/ DG MARE/ SECRETARIAT				
Priority issue	Status (Pending/ Resolved)	Action(s) taken/ remaining actions planned	Date due	Date resolved
WP9. Splitting up boreholes into boreholes and grab samples	Done	The secretariat wanted us to reduce the number of layers. So instead of splitting the dataset into two layers, a new attribute, data category, was added. The attribute, data category has the value "borehole" or "grab". This allows the user to filter the dataset	1.1.2022	25.3.2022
WP9. Splitting up geophysical index into seismic and multibeam.	Pending Rescheduled due to lack of content.	We have added a filter so that the user can search for "Multibeam" and "All geophysics". Multibeam data has so far been delivered by one institution only (GTK).	1.1.2022 rescheduled to 1.7.2022.	16.9.2022
Secretariat assessment: **Indicator 6:** *Published use cases:* *One new case study "Exploring the suitability of historic datasets to produce robust quantitative sediment maps." (case-study on quantitative spatial prediction of sediment distribution across selected sea-basins) was published on 24/09/2021. This is not mentioned in the table of indicators (Indicator 7), but it is mentioned in the WP3 update. Please update the table of indicators accordingly.*	Resolved, no actions	The case study is part of WP3 task "seabed substrates" described in our technical tender and it is not a use case with any third party involved. We had a similar case-study in the earlier phase, and we have another in this phase, which will be published in the end of the project. No actions.		
Secretariat assessment: *Task 3: Develop procedures for machine-to-machine connections to data and data products.* ● *The 'Tsunamis Origin Points' and the 'Coast Affected by Tsunamis' layers in the EU Atlas of the Seas are broken because of updates to the origin layers in the EMODnet Geology portal. It is advised that in the future EMODnet Geology should implement a change control process, to inform known users of changes.*	Resolved, closed	These have been repaired and JIRA ticket EM-352 closed. We await the Secretariat to decide on a change control process. Due to the GDPR it is difficult to contact users.		
Secretariat assessment: *Updated evaluation on the INSPIRE metadata and data URL issue for the Geology portal is provided in EM-14 - EASME - Action on Web Services MetadataUrl and DataUrl fields (21/11/2019)* *EM-85: Some of the Service Metadata URL's don't point to a valid Service Metadata XML document; Several layers/feature types in the portal's view and download services have a metadata URL but while it*	resolved and closed			

advertised an XML format (required for machine readability), the link resolves in an HTML page. *JIRA tickets EM-14 and EM-85*				
Secretariat Assessment: *There are more Deliverables listed in the quarterly report than listed in the GANTT chart of the technical workplan*	Resolved	The deliverables listed in the Q report are intended for internal EMODnet Geology use, and unnecessarily included in the Q report, but could be used in Q reporting in a later phase.	-	14.4.2022
Secretariat Assessment: *Sea areas and their boundaries. The Secretariat recommends EMODnet Geology to refer to section 1.4.3 of the Tender Specifications, where it is indicated which boundaries and shapefiles should be taken as reference by all thematic lots (i.e., 'Europe's seas' dataset published by the EEA).*	Resolved	EMODnet Geology reported already during the previous phase in spring 2021 that the EEA dataset of Europe's seas' does not cover all the sea areas that we report. Thus, we have used own Region shapefiles to assess the coverage of the products (maps), this was also reported a year ago. After a meeting with the Secretariat on 2nd March, it was unanimously agreed upon a new division of sea areas in the reporting worksheet, with sea areas covered by EEA and those that are not.	-	2.3.2022
EM-525 Request to update two layers to use different styling on the European Atlas of the Seas.	Pending	Continuous dialogue with the Secretariat. Latest comment was 7.9.2022		
EM-85 Request for better mime-type on a layer	Resolved	Simple Geoserver setting		8.4.2022
EM-415 Provide database dump	Resolved	Provided a database dump		2022-02
EM-518 Request for SSL-certificate upgrade on portal	Done			3.5.2022

B. Issues / challenges identified by the thematic assembly group itself				
Priority issue / challenge	Status (Pending/ Resolved)	Action(s) taken / remaining actions planned	Date due	Date resolved
WP1/all. The ongoing spread of the **Covid-19** virus all over Europe might affect the progress of the project, especially staying on schedule/meeting the deadlines.	Resolved (partly)	We have organized our EMODnet Geology internal meetings as remote events.		
WP1/all. Some partners have encountered challenges in using necessary tools (e.g., software) caused by enforced remote working due to Covid-19.	Resolved (Partly)	There was enough flexibility in the set internal schedules, thus all deliverables and milestones were met according to project deadlines.		
WP1/all. There has been a fire at one partner's office building, which has challenged data handling and storage.		There was enough flexibility in the internal schedule and project deadlines were met.		

WP5. Finding a way to merge the field-based and satellite-based data products in the portal view, using the field-based data, where available and up to date, and the satellite data where reliable to fill the gaps.	resolved	preparation for release	release January 2022	issue resolved September 2021
WP6 lead has limited remote access to GIS resources	pending	Refurbishment of ISPRA office after extended fire	January 2022	4.4.2022
WP6. Not all symbols display correctly on the Portal	Resolved	A specific library of symbols suitable for Portal tools has been created using an external graphic file (SVG) in combination with the SLD file.	End of 2020	September 2021
War and Russian army invasion in Ukraine have already affected the progress of the project. The planned EMODnet Geology WP3 workshop on seabed erosion was originally postponed due to the sudden situation (war).	Resolved	All ongoing cooperation with Russian organizations has been suspended for the time being. The postponed workshop was held during the Utrecht project meeting in May with a follow-up remote meeting in June.	-	-
WP6 lead has limited remote access to GIS resources	Resolved	Refurbishment of ISPRA office after extended fire	January 2022	4.4.2022
Due to the geopolitical situation (the war in Ukraine) GTK has been forced to discontinue the subcontract with subcontractor VSEGEI.	Resolved	A note on discontinuation of the subcontract between GTK and VSEGEI was signed in August (Q3). This was accepted by CINEA after amendment of the Service Contract Annex II	30.8.2022	-

5. Allocation of project resources

Information on the allocation of project resources	
Categories	Resource usage[1] (%)
Making data and metadata interoperable and available	15%
Preparing data products	35%
Preparing web-pages, viewing or search facilities	10%
Managing user feedback	5%
Project management	20%
Outreach and communication activities	10%
Others	5%

[1] Provide the workings of your calculations, *i.e.* percentage allocation of the total amount awarded.

6. User feedback

Overview of user feedback and/or requests received in this project phase							
Date	Organisation	Type of user feedback (e.g. technical, case study, etc.) and short description of the feedback received	Means of contact	Response time	Status of user query (Resolved/ Pending)	Measures taken to resolve the query	Status: if not (yet) resolved/ pending, explain reason why and expected timeline
1.10.2021	HCMR.gr	Invitation to conference	Email	1 hr	Resolved	Considered	
8.11.2021	WSP	Problems with geo-package in accessing WP3 Seabed substrate data	email/portal	1 day	resolved	data distributed in another format (Esri Shapefile)	resolved
09 to 12.2021	TNO Acoustics & Sonar	Case study: Seabed-substrate type, the WP3 deliverable that is presently being used to assess underwater noise, is useful but a far better attribute for sandy seabeds would be grain size.	e-mail	1 day	Pending: grain-size information for Baltic Sea is being provided by partners separately.	As stated in the tender, WP5 will discuss and test median sand size describing the seabed surface, if deemed relevant to a wide range of users of the seabed environment. This message was conveyed to TNO Acoustics & Sonar.	There is no set deadline; EMODnet Geology partners are establishing a line of communication with the Acoustics research community, aiming for a use case.
25.1.2022	University of Oldenburg	The request to provide the data in a format that Matlab can read, e.g., an ESRI shape.	E-mail and SharePoint Microsoft	1 day	resolved		
27.1.2022	University College Cork, Republic of Ireland	Issue with downloading the WP8 products.	Direct Email	WP8 leader contacted user same day (27th	Resolved	Technical coordinator rectified downloading issue on web portal.	N/A

				January), and website developer from GEUS same day.			
28.2.2022	DDS	Request for website reference	e-mail	3 hrs	Resolved	Information	
4.3.2022	UNIBO	PhD data usage	e-mail	3 hrs	Resolved	Information	
4.3.2022	University of Bologna	Requesting further information about substrate	E-mail	1 day	resolved		
22.03.2022	University of Bologna	Request for variation of sediment distribution in the Adriatic Sea through time	email	same day	Resolved	Answer provided; requested data are not available	
20.5.2022	University College Cork	Missing confidence information on the 1:250k seedbed substrate map	email	24h/ email	resolved	explained	

7. Meetings/events held/attended & planned

A. Meetings/events organised and attended in this project phase					
Date	Location	Type event (internal or external meeting; training/ workshop)	Was a presentation given? (yes/no + short description)	Meeting attended (A) / organised (O)	Short description and main results (# participants, agreements made, etc.)
30.9.2021	Remote, Teams-Meeting	Internal EMODnet Geology Steering Group meeting	no	O/A	Information by project coordinator and discussion of EMODnet Geology issues, exchange of information. Planning of Kick-off meeting and phase IV of EMODnet Geology, 8 participants.
1.10.2021	Remote, Teams-Meeting	Internal EMODnet Geology WP3, GTK Meeting	No	O	Planning of the project kick-off meeting, 5 participants.
07.10.2021	videoconference	External meeting of institutions contributing to Italian WP6 deliveries (CNR-ISMAR, OGS, INGV, Universities of Genova, Palermo, RomaTRE and Trieste)	No	O	Discussion on characteristics and quality of features at the scale of the current phase of the Project. 20 participants.
11.-12.10.2021	Remote, Teams-Meeting	EMODnet Geology 4 project kick-off Meeting. Internal.	Yes, several Work Package Presentations by the WP Leaders	O	Kick-off meeting of EMODnet Geology Phase IV: Overview of Project by coordinator Henry Vallius and each WP Leader. Discussions related to the plans and execution of this phase of EMODnet Geology IV, 60 participants.
18.-22.10.2021	Århus, Denmark	Baltic Sea Science Congress 2021. External.	Yes, oral presentation (Kotilainen et al. 2021), poster presentation (Kihlman et al. 2021)	A	dissemination of EMODnet Geology at BSSC 2021 conference, 180 participants.
03.11.2021	on-line	Internal meeting on coastal vulnerability	Yes, progress report	O	5 participants: strategy determined for conversion of georeferenced maps into digitized attributes (levels of vulnerability)
09.11.2021	The Hague, Netherlands	External meeting on seabed substrate and EMODnet	No	O	4 participants from the Royal Netherlands Navy (EMODnet Bathymetry) and TNO

					(EMODnet Geology): agreement updated on online accessibility of Dutch side-scan-sonar archive, first national (Dutch) interdisciplinary meeting on EMODnet discussed
11.11.201	on-line	WP 4, 5, 6 Internal meeting on Coastal Ribbon (1)		O	Discussion on how the coastal ribbon can be defined and how results can be achieved in the scope of phase V. Strategy determined for steps needed to ensure on-time delivery. 4 participants from WP 4, 5, 6.
18.11.2021	on-line	External webinar	Yes	A	EMSAGG webinar – 'Marine resource mapping in the UK and Europe'. Overview EMODnet Geology presentation in front of EMSAGG stakeholders.
24.11.2021	on-line	Internal meeting on coastal vulnerability	Yes, progress report	O	5 participants: status update and discussion of abstracts for EGU and IGU
09.12.2021	videoconference	External meeting of institutions contributing to Italian WP6 deliveries (CNR-ISMAR, OGS, INGV, ENEA, Universities of Genova, Palermo, RomaTRE and Trieste).	No	O	discussion on characteristics and quality of features at the scale of the current phase of the Project. 22 participants.
13.12.2021	on-line	WP 4, 5, 6 Internal meeting on Coastal Ribbon (2)		O	Presentation and discussion of first results of data analysis in large scale in Liguria and discussion of steps needed to ensure on-time delivery. 4 participants from WP 4, 5, 6.
14-18.12.2021	online	30th International Cartographic Conference. External.	Yes	A	Congress on all aspects of mapping and representation. 630 participants.
14.1.2022	Remote, Teams-Meeting	Internal EMODnet Geology WP3, GTK Meeting	no	O	discussions related to the progress of the project
19.1.2022	Remote, Teams Meeting	Internal EMODnet Geology vocabulary group meeting	no	O	discussion on harmonization of vocabularies across EMODnet Geology WPs (6 participants)

19.1.2022	Remote, Teams Meeting	Internal EMODnet Geology Coastal Ribbon group meeting	no	O	Coastal Ribbon start drafting inventory for coatal ribbon data. With WP leaders of WP's 3,4,5,6, and 8 and supporter. Discussions on coastal ribbon (6 participants).
25.1.2022	Remote, Zoom meeting	EMODnet Central Portal Technical team meeting with Geology	No	A	Discussion on EMODnet Geology migration progress to central portal
01.2.2022	videoconference	meeting of institutions contributing to Italian WP6 deliveries (CNR-ISMAR, OGS, INGV, ENEA, University Genova, Palermo, RomaTRE and Trieste)	No	O	discussion on the most appropriate terminology and symbols to be adopted to represent features within WP6 (18 participants)
2.2.2022	Remote, Teams-Meeting	Internal EMODnet Geology Seabed substrate Confidence Group workshop, organized by WP3	yes, Confidence Presentation by SGU	O	Discussion on confidence issues concerning data collated (20 participants)
7.2.2022	Remote, Zoom meeting	EMODnet Central Portal Technical team meeting with Geology	No	A	Discussion on EMODnet Geology migration progress to central portal
10.2.2022	Remote	Internal EMODnet-Geology WP8 Palaeogeographic Framework Workshop Workshop Presentations included recent research on submerged landscapes by project partners, summary of working groups across 7 case study regional sea areas, methodology and other partners we need to approach.	Yes. 8 presentations	O	The online workshop was held to discuss and identify the regional study areas to progress the palaeogeographic reconstruction element of the WP8 aims and deliverables. This was attended by 32 participants. A realistic timeline towards delivery in 2023 as per D3.2 was the main outcome.

15.2.2022	Sopot, Poland, Hybrid event, (Remote presentation)	External International Ocean Data Conference 2022, Sopot, Poland	yes, presentation by SK/WP3, GTK	A	dissemination of EMODNET Geology project, over 590 online and 60 on-site participants
16.2.2022	Remote, webinar	External Webinar on Baltic Sea, The Finnish association of nature conservation, Helsinki branch	Yes, presentation by AKa/WP3	A	dissemination of EMODNET Geology project
18.2.2022	Remote, Teams-Meeting	Internal EMODnet Geology WP3, GTK Meeting	no	O	discussions related to the progress of the project
21.02.2022	Dublin (Ireland)	INFOMAR seminar 2022	Yes. Present the EMODnet achievements and future portal centralisation: EMODnet geology and Bathymetry	O	Sessions was on European projects. Audience was international. More than 80 delegates https://www.infomar.ie/node/529
24.2.2022	Remote, Teams-Meeting	Meeting between EMODnet Geology and EMODnet Secretariat	no	A	Discussion on EMODnet Geology: Sea basin regions to be used in reporting
25.2.2022	Remote, Teams Meeting	Internal EMODnet Geology Coastal Ribbon group meeting	no	O	Coastal Ribbon discuss inventory draft, and next actions. With leaders of WP 3,4,5,6, and 8 and supporter. Discussions on coastal ribbon and exploring potential synergies (6 participants).
2.3.2022	Remote, Teams-Meeting	Meeting between EMODnet Geology and EMODnet Secretariat	no	A	Discussion on EMODnet Geology: Sea basin regions to be used in reporting
14.03.21	On-line	meeting	o	O	Second meeting of the WP 4 vocabulary group: first draft of comparison tables cross-WPs. With WP leaders of WP 3,4,5,6, and 8 and supporter.

16.3.2022	Remote, Teams-Meeting	Internal EMODnet Geology, GTK Meeting	no	O	discussions related to the Central Portal
21.3.2022	Remote, Teams-Meeting	Internal EMODnet Geology Steering Group meeting	no	O	Discussion of EMODnet Geology issues related to the progress of the project (10 participants)
23.3.2022	Remote, Online Conference	External FINMARI Researcher Day	yes, presentation by Aka/WP3, GTK	A	dissemination of EMODNET Geology project, 153 participants
24.3.2022	Remote, Teams Meeting	Internal EMODnet Geology vocabulary group meeting	no	O	discussion on harmonization of vocabularies across EMODnet Geology WPs (6 participants)
25.03.2022	videoconference	meeting of institutions contributing to Italian WP6 deliveries (CNR-ISMAR, OGS, INGV, ENEA, University Genova, Palermo, RomaTRE and Trieste)	No	O	discussion on the most appropriate terminology and symbols to be adopted to represent features within WP6 (15 participants)
31.3.2022	Remote, webinar	External GMME Webinar	Yes, presentation by Aka/WP3	A	dissemination of EMODNET Geology project
5.4.2022	Remote, Teams-Meeting	Internal EMODnet Geology WP3, GTK Meeting	no	O	Discussions related to the product development
7.4.2022	Remote, Webex-Meeting	Internal EMODnet Geology Coastal Ribbon meeting	no	O	Coastal Ribbon review of drafted text for a round mail, work on finalizing of Inventory (6 participants).
20.4.2022	Remote, Teams-Meeting	Internal EMODnet Geology WP3, GTK Meeting	no	O	Discussions related to the progress of the project
22.4.2022	Remote, Webex-Meeting	Internal EMODnet Vocabulary Group meeting	no	O	3rd meeting of the Vocabulary Group to complete the tables comparing related terms and definitions across WPs. Harmonisation of the vocabulary used in the project (6 participants).

26.4.2022	Remote, Webex-Meeting	Internal EMODnet Coastal Ribbon meeting	no	O	Coastal Ribbon meeting - to discuss the last version of the inventory and prepare the EMODnet Geology project meeting (6 participants).
26.-27.4.2022	Remote, Zoom-meeting	11th EMODnet Technical Working Group Meeting	yes	A	Discussion on EMODnet central portal
27.-28.4.2022	Remote, Zoom-meeting	16th EMODnet Steering Committee meeting	yes	A	All aspects of project administration, collaboration, and future plans. Including aspects of portal centralisation.
6.5.2022	videoconference	External meeting of institutions contributing to Italian WP6 deliveries (CNR-ISMAR, OGS, INGV, ENEA, University Genova, Palermo, RomaTRE and Trieste).	No	O	discussion on the implementation of Italian contribution to WP6 products (18 participants)
9.5.2022	Remote, Zoom-Meeting	EMODnet CP technical team meeting with Geology	no	A	Discussions on portal centralisation
11.5.2022	Remote, webinar	External, "Expanding Ocean data interoperability between Europe and Asia"	no	A	The webinar will present examples and achievements of ongoing collaborations between EU, Chinese and Asian marine data, and information services.
11.-14.5.2022	Reykjavik, Iceland	External, Nordic Geological Winter Meeting 2022	yes	A	Oral presentation by EMODnet Geology coordinator "The EMODNET-Geology project – harmonizing geological data of the European seas" on EMODnet Geology and EMODnet in general.
16.-20.5.2022	Venice, Italy	External, The GeoHab 2022 Conference: marine geological and biological habitat mapping	yes (oral presentation by Kotilainen et al.)	A	International conference on marine geological and biological habitat mapping, 120 participants.
17.05.2022	Utrecht, Netherlands, and online	Internal Workshop	yes	O	Meeting to discuss actual status and possible actions and benefit on Quaternary and Geomorphology Prototype Areas

17.-19.5.2022	Utrecht, Netherlands (+hybrid remote)	Internal, EMODnet Geology Project Meeting	yes, presentations by the partners	O	Discussions on project progress and future steps, 60 participants
20.5.2022	On-line	Internal EMODnet Geology Steering Group Meeting	no	O	Meeting of the Steering Group to review the EMODnet project meeting
24.5.2022	Remote, Teams-Meeting	Internal EMODnet Geology steering group meeting	No	O	discussion of EMODnet Geology issues (10 participants)
24.5.2022	remote	Internal EMODnet Geology 2.5 D visualization meeting between WP4 and WP9	no	O	Small- committee meeting to exchange ideas
6.6.2022	GTK, Otaniemi, Espoo, Finland (+hybrid)	Internal EMODnet Geology WP3, GTK Meeting	no	O	Discussions related to the progress of the project
8.6.2022	Remote, Teams-Meeting	Internal EMODnet Geology WP 9, WP3 and WP 4: 2,5 D visualisation, online-meeting	yes	O	Discussions related to the portal and 2.5D visualisation (5 participants).
10.6.2022	Remote, Teams-Meeting	External, Kick-Off EMODnet for Ocean Decade Coordination Group	no	A	Discussion on EMODnet participation in UN Ocean Decade. Several members from EMODnet Geology attended.
13.6.2022	Remote, Teams-Meeting	Internal Seabed Erosion Workshop, EMODnet Geology WP3	Yes, presentations by partners	O	Discussions on available data and how to proceed with the erosion task (D3.4.)
15.6.2022	Remote, Webex-Meeting	Internal EMODnet Geology WP 9, WP3 and WP 4: 2,5 D visualisation, online-meeting	yes	O	Discussions related to the portal and 2.5D visualisation
16.-17.6.2022	Glyfada, Athens, Greece (+hybrid)	External EMODnet Ingestion 3 kick-off meeting	yes	A	Discussions on project progress and future steps
20.6.2022	Remote, Teams-Meeting	External, Infosession: "How to make a site compliant"	no	A	Infosession: how make site EU compliant, related to portal centralisation

30.6.2022	Remote, Zoom-Meeting	EMODnet CP technical team meeting with Geology	no	A	Discussions on portal centralisation
4-6.7.2022	Hybrid online and in-person at University of Malta campus	International Conference for Seafloor Landforms, Processes and Evolution.	Yes. Five WP8 presentations: Miko, S. et al. | *Late Pleistocene and Holocene paleoenvironments of a submerged karst landform (Pirovac Bay, Croatia).* Senolt, N. et al. | *Holocene Paleoenvironmental Reconstruction of a Karst Krka River Estuary (Eastern Adriatic Coast).* Hasan, O. et al. | *Submerged marine terraces and paleo shorelines along the eastern rim of the Mid Adriatic Deep.* Prampolini, M. et al. | *Submarine geomorphology north-east of the Maltese Islands.* Stewart, H A. and EMODnet Partners | *Submerged Landscapes Across European Seas.*	A	Opportunity to engage with wider community, gain feedback on products and source new data contributions. In-person attendance 120-150 people with more joining virtually. Representation from geological surveys, marine institutes, industry, and universities from around Europe and globally.
8.7.2022	Remote Teams meeting	EMODnet Geology Steering group meeting	No	A	discussion of EMODnet Geology issues (10 participants)
18.7.2022	Remote Webex meeting	DG MARE - EMODnet progress meeting	Yes, by coordinators	A	EMODnet progress meeting: Centralisation & state of play
18.7.2022	On-line	Internal Working Group Meeting	Yes. Informal overview slides given by WP8 Leader Heather Stewart and modelling example slides by Dr. Federico Di Rita.	O	Meeting with palaeobotanists Dr Francesco Chiocci, Dr Donatella Magri and Dr Federico Di Rita ased at the Università La Sapienza, Roma to discuss broad scale palaeovegetation on the continental shelves as part of working group activities for palaeographic reconstruction. Primary outcome was to definition of a case study area in the Western Mediterranean Sea / Italian continental Shelf to test the

					feasibility of extrapolating palaeovegetation across a previously exposed continental shelf base on sparse dataset.
27.07.2022	Videoconference	Meeting of institutions contributing to Italian WP6 deliveries (CNR-ISMAR, OGS, INGV, ENEA, University Genova, Palermo, RomaTRE and Trieste)	No	O	Discussion on the implementation of Italian contribution to WP6 products (18 participants)
1.8.2022	On-line	internal	no	O	Coastal Ribbon (5): review of drafted text for a round mail, work on finalizing of Inventory
17.8.2022	Remote, Teams-Meeting	Internal EMODnet Geology, WP3 (GTK) Meeting	no	O	Discussions related to the progress of the project
25.8.2022	Remote, Teams-Meeting	External meeting between Coordinating party (GTK) and Center for Caspian Sea Problems, Institute of Geography of Azerbaijan NAS.	no	O	discussions on possibilities of cooperation within EMODnet Geology project for the Azerbaijan part of the Caspian Sea.
06.09.2022	Remote, Teams-Meeting	EMODnet Geology Steering group meeting	no	O/A	EMODnet Geology Steering group meeting
12.9.2022	Remote, Teams-Meeting	Meeting between EMODnet Geology Coordinator and WP's 3 and 4.	no	O/A	Discussions on EMODnet Geology geomorphology as VME elements for ICES
15.9.2022	Remote, Teams-Meeting	External. First online meeting between EMODnet-Geology partner IGME, the coordinator (GTK), and Asociación de Servicios de Geología y Minería Iberoamericanos (ASGMI).	no	O/A	Discussions on how to cooperate with geological surveys of the Caribbean Sea area regarding ingestion of marine geological data to EMODnet Geology.
SUM				**O**	**Total # of meetings organised = 47**
SUM				**A**	**Total # of meetings attended = 27**

B. Meetings/events planned in the future				
Date	Location	Type event (meeting, training (workshop), etc.)	Meeting to be attended (A) / organised (O)	Short description and main expected outcomes
September 2022		EMODnet Technical Working Group Meeting	A	Discussion on the EMODnet Central portal and centralisation
November 2022	Varna, Bulgaria	EMODnet Geology Project Meeting	O	Discussions on project progress and future steps
November 2022	In person	Meeting	O	Palaeogeographic reconstruction working group dedicated workshop back-to-back with the project meeting in November 2022 in Varna, Bulgaria.
April 2023	Vienna	Own EMODnet Geology Session together with Eurogeosurveys MGEG at EGU Conference 2023	O	The EGU General Assembly 2023 brings together geoscientists from all over the world to one meeting covering all disciplines of the Earth, marine, planetary, and space sciences. >20.000 delegates.
TBD	Online	Meeting	O	Schedule a meeting with Prof. F. Gamberi to discuss the METIQ project (reconstruction and Quaternary Evolution of the Italian territory) to see if any overlap / data that can be delivered via the EMODnet Geology portal.
TBD	Online	Meeting	O	Schedule a meeting with Prof. Aaron Micallef to discuss the MARCAN project (groundwater specific) to see if any overlap / data that can be delivered via the EMODnet Geology portal.
TBD	Online	Meeting	O	Schedule a meeting with Dr Simon Fitch regards integrating Open Access submerged Landscape Data from the Doggerland and Lost Frontiers projects.

8. Communication asset

A. Communication products developed				
Date	Communication material	Short description (of the material, title, …) of the asset	Main results	Name of event at which material was disseminated (if applicable)
October 2021	Oral presentation and abstract	Kotilainen, A.T., Kotilainen, M.M., Vartti, V.-P., Hutri, K.-L., Virtasalo, J.J., 2021. 137Caesium contents in the northern Baltic Sea sediments. In: 13th Baltic Sea Science Congress, 18-22, October 2021, Århus, Denmark: Abstract Book. 18. Oral.	Public dissemination	Oral presentation at Baltic Sea Science Congress, 18-22, October 2021, Århus, Denmark
15.10.2021	Press release	EMODnet Geology Phase completion and WP summary results	Public dissemination	
October 2021	Poster presentation and abstract	Kihlman, S., Kaskela, A.M., Kotilainen, A.T., Alanen, U., Vallius, H., EMODnet Geology partners, 2021. Seabed substrate data of European Seas – EMODnet Geology. In: 13th Baltic Sea Science Congress, 18-22, October 2021, Århus, Denmark: Abstract Book. 118. (Poster).	Public dissemination	Oral presentation at Baltic Sea Science Congress, 18-22, October 2021, Århus, Denmark
18.11.2021	Oral presentation	EMSAGG webinar – 'Marine resource mapping in the UK and Europe',	Public dissemination	Introduce results to the marine aggregate community represented in the EMSAGG group
November 2021	Blog	Blog about 137Cs activity contents and sedimentation rates in the Baltic Sea sediments (in Finnish). "Vuoden 1986 Tšernobylin ydinvoimalaonnettomuuden jäljet näkyvät yhä Itämeren sedimenteissä" (Kotilainen, A.T.; Kotilainen, M.M.; Vartti, V.-P.; Hutri, K.-L.; Virtasalo, J.J.)" at GTK's webpage. https://www.gtk.fi/ajankohtaista/vuoden-1986-tsernobylin-ydinvoimalaonnettomuuden-jaljet-nakyvat-yha-itameren-sedimenteissa/	Public dissemination	Scientific publication in Marine Pollution Bulletin
23.11.2021	TV documentary	"Under the volcano", information on volcanoes in Italy, with a focus on submerged structures which have been inventoried for EMODnet Geology	dissemination	"Mompracem" TV documentary series
15.2. 2022	Oral presentation and abstract	Susanna Kihlman, Henry Vallius and EMODnet Geology partners, 2022. EMODNET Geology – harmonizing geological data of the European seas and beyond.	Public dissemination	Oral (Remote) presentation at International Ocean Data Conference 2022, 15. February 2022. Sopot, Poland
23.3. 2022	Oral presentation	Anu Kaskela, Susanna Kihlman, Aarno Kotilainen, Ulla Alanen, and Henry Vallius: EMODnet Geology provides access for marine geological data.	Public dissemination	Oral presentation at FINMARI Researcher Day Conference, 23 March 2022, Helsinki, Finland, online event

23.–27.3.2022	Abstract and oral presentation	Cherith Moses, Cerys Butterill, Tanvi Chopra, Amber Humphries, and Sytze van Heteren, Pan-European coastal vulnerability: translating incomplete data and information for communicating situational awareness	Presentation given and discussed	EGU General Assembly 2022
31.3. 2022	Oral presentation	Anu Kaskela (GTK): EMODnet Geology WP 3– Aspects of Compiling seabed Substrate Map Data.	Presentation given and discussed	Oral presentation at EuroGeoSurveys Geological Mapping & Modelling Expert Group seminar on EMODnet Geology 31.3.2022, online event.
31.3. 2022	On-line presentation	Kristine Asch (BGR): EMODnet Geology WP 4 – Aspects of compiling seafloor geology and geomorphology map data	Presentation given and discussed	Oral presentation at EuroGeoSurveys Geological Mapping & Modelling Expert Group seminar on EMODnet Geology 31.3.2022, online event.
13.5.2022	Oral presentation and abstract	Henry Vallius on behalf of EMODnet Geology partners "The EMODNET-Geology project – harmonizing geological data of the European seas". Nordic Geological Winter Meeting, 11-13 May, Reykjavik, Iceland: Abstracts.	Public dissemination	Oral presentation at the Nordic Geological Winter Meeting, May 2022, Reykjavik, Iceland. https://jfi.is/wp-content/uploads/2022/05/NGWM-2022.pdf
May 2022	Vocabulary and product description	A product of the workshop held on 10th February 2022 has been a vocabulary describing all the features compiled for WP8. Additionally, more information on the format of the data available on the portal has been summarised.	Updated WP8 explanatory webpage.	Online via the EMODnet Geology portal. https://www.emodnet-geology.eu/data-products/submerged-landscapes/
May 2022	Oral presentation and abstract	Kotilainen, A.T., Kotilainen, M.M., Jokinen, S., Virtasalo, J.J., Kaskela, A.M, 2022. Coastal estuaries – Baltic Sea habitat types under threat. In: The GeoHab 2022 Conference: marine geological and biological habitat mapping, 16-20 May 2022, Venice, Italy: Abstracts	Public dissemination	Oral presentation at the GeoHab 2022 Conference, May 2022, Venice, Italy.
5.5.2022	Tweet by @EMODnet	#EMODnet Geology's pledge on #MakeEUBlue	3 retweets and 7 likes	Twitter
9..5.2022 16.5.2022	Two tweets by @MEDIN_marine on same subject	Advertising the latest MEDIN newsletter that featured EMODnet-Geology seafloor substrate data being used to inform habitat distribution.	6 retweet, 13 likes	Twitter
25.5.2022	Tweet by @EHU_Geo	Presenting results from WP5 coastal vulnerability at European Geophysical Union 2022 EGU2022.	3 retweets, 7 likes.	Twitter
8.6.2022	Tweet by @EuroGeoSurveys	World Oceans Day 2022 tweet featuring EMODnet-Geology.	4 retweets, 11 likes.	Twitter

B. Planned communication products

Date	Communication material	Short description (of the material, title, …) and/or link to the asset	Main results expected
soon	BGR report	EMODnet Geology: the project, WP 4 and BGR role	Dissemination of information on EMODnet, EMODnet geology and the role of BGR

A. (Co-)Authored peer-reviewed publications in this project phase					
Date of publication	Type of publication	Full reference	ISBN	DOI	Is it open access? Yes/No
09.2022	Book	Geological Society of London Special Issue: From Continental Shelf to Slope: Mapping the Ocean Realm	9781786204950		partly
8.2022	Book chapter	Asch, K., Klump, J., Mathers, S., Kessler, H. (2022): Geology. In: Kresse, W. & Danko, D: Springer Handbook of Geographic Information, 2nd ed Chapter Geology, in Springer Handbook of Geographic Information 2022	978-3-030-53124-9		N

B. Other/non-peer reviewed types of publications (co-)authored in this project phase					
Date of publication	Type of publication	Full reference	ISBN	DOI	Is it open access? Yes/No
	e.g. paper; conference proceedings; book chapter; …				

For a compressive overview of publications referring to/making use of EMODnet data and/or data products, please consult Google Scholar.

9. Monitoring indicators

[Refer to the standardised monitoring tool, i.e. Matomo/ Europa Analytics, to complete the indicators excel template, and provide a short explanation in the table below on the numbers and trends for each indicator when possible/applicable. ***Indicate clearly if monitoring was carried out using tools other than Matomo/Europa Analytics.****]*

Comments on the progress indicators in the indicators spreadsheet		
Progress indicator	Means of collecting figures	Comment
1. Current status and coverage of total available thematic data A) Volume and coverage of available data	Matomo/ Europe Analytics/ other Please specify	**We do not acquire data in this project.**
What is your opinion on the data coverage within EMODnet for your thematic?		
B) Usage of data since the start of the project phase		
2. Current status and coverage of total number of data products A) Volume and coverage of available data products	See the "comments" column	**Updates on data products with coverage (WP's 3 and 4) are planned for the second year of the project.** There is no uniform digital definition (in GIS format) of the European sea areas and their boundaries used in the EMODnet Lots. Therefore, EMODnet Geology has used its own Regions shapefile to assess the coverage of the products (maps) (WP3, WP4). WP3. No updates on the portal yet in this phase. The latest seabed substrate map update (21.9.21) includes 4 data products at different scales: 1:1 000 000, 1: 250 000, 1: 100 000 and multiscale. The multiscale data includes 11 layers at varying scales (1:70 000 – 1: 1500). The seabed substrate data at 1 M scale covers about 43 % of the Geology Regions, data at scale 250 k covers about 12 % and more detailed scales cover less than 5 %. The coverages by sea-basin are indicated in the excel file (Indicator 2). Updated seabed substrate data was published in September 2021. WP4: No changes during this Phase yet. No report on new numbers of area coverage, as the latest project contributions consists of a line feature layer (marine geology -

		geomorphological line features) on the BGR Portal. Due to the characteristics of the line geometry, we cannot asses its areal coverage. Coverage: Pre-Quaternary geology: complete; Quaternary Geology: rather good coverage, partly with excellent detail data, several data gaps remain; Geomorphology: Excellent detail data from mapping campaigns of numerous regions. General physiographic features: rather good coverage with several data gaps
B) Usage of data products since the start of the project phase	Analysis of logs at the gateway server	The numbers are fluctuating a lot. Generally, the usage goes up around new releases and now when there has not been updates for a longer period usage has dropped. Especially the downloads have gone down because no new data or updates have been added to the portal this year. Our updates are planned for the second year of the project
3. Internal and external organisations supplying/approached to supply data and data products since start of the project phase		No change since last report, except that our Russian partner All-Russia Geological Research Institute (VSEGEI) was excluded from the consortium on 30.8.2022, and is thus not a data provider anymore. No Russian data expected in the future.
4. Online 'Web' interfaces to access or view data		The Central Portal requested to limit he number of layers to enhance the usability of the map viewer. To do this, new services for aggregated layers were implemented
6. Statistics on information volunteered through download forms		Due to GDPR we do not register place of origin.
7. Published use cases		The geological data have been used by a wide range of disciplines and both public and private organisations. Examples of use are planning of offshore installations such as windfarms, habitat mapping and landslide susceptibility. New use Case: The GARAH project The GARAH project has made estimates of conventional and unconventional hydrocarbon resources in the North Sea and estimates of gas hydrate resources around Europe. The results of this project can be used in the planning of secure sources of affordable energy and storage of CO2.
9. Technical monitoring		GEUS, who hosts the EMODnet platform for Geology, has been in the process of getting a new IT service supplier. In this process GEUS' systems occasionally have been unstable and this can explain, why the average response time is slightly too high. (It only exceeds the accepted limit with 51 msec)

10. Visibility & Analytics for web pages		The use of the website has been fairly stable over time.
11. Visibility & Analytics for web sections		The use has been fairly stable over the last year
12. Average visit duration for web pages		It seems that the time spent on the website has increased a little during the period. We cannot explain the fluctuations of the contribute curve.

The monitoring numbers reported as part of the progress monitoring of EMODnet performance are collected through Matomo and/or Europa Analytics, unless reported otherwise.

10. Recommendations for follow-up actions by the EU

[Give a list of recommendations and suggestions for the EU to consider and take action. Max 1 page.]

11. Annex: Other documentation attached

Response to CINEA regarding the request for clarifications to the Interim report

- Please develop briefly the sentence in page 7 "*The partners were identifying, collating, and harmonising new national data for this phase of the project during the whole first project year"* by providing an estimate of the amount of new data and, if possible, also of what percentage of increase does this represent in the context of the EMODnet Geology project.

  - Our process proceeds such that data are identified during the first year, submission to WP's start in second half of the first project year, but majority of data is submitted early during the second year. We estimate that we have received about 415.000 square kilometres of new and updated data during the first project year, as well as almost 11.000 kilometres of line data and a few hundred point data to the different work packages. The majority of data is, however, to be submitted during the second project year, estimated by partners to over 1.000.000 additional square kilometres, perhaps as much as 1.200.000 square kilometres. This corresponds to about 7 per cent of all EMODnet sea areas. But as we have several data products with areal coverage in different scales and they obviously overlap it is very difficult to give any exact percentage of areal increase. Still, we can expect a few per cent of increase. Also the amount of line kilometres and data points will most probably increase from the first year.

  Regarding metadata we have until now during this phase altogether 41997 data points, from which 29225 are completely new data. Regarding metadata on geophysical survey lines we have altogether 55029 lines, from which 40320 are completely new data.

  We are still working on Caribbean Sea and Caspian Sea data, which are being included in the data products during the second year of the project.

- Also in page 7, could you please provide with further info on when do you expect data delivery from the countries around the Caribbean Sea to start taking place?
  - We aim to have Caribbean Sea data from EMODnet geology partners delivered to WP leads by end of Q1 2023 and third party data, especially Caribbean Sea geological surveys (including Cuba, Venezuela, Colombia and possibly the Dominican republic), by end of Q2 2023. But, as two years is a very short time to start a completely new collaboration, we believe that many data will be delivered during next phase of the project. Data which are believed to be accessed from the Caribbean Sea Coastal partners include coastal geology, minerals and possibly geomorphology, but this has to be evaluated more thoroughly during the second year of the project. A training course/conference on EMODnet Geology for possible Caribbean Sea actors has been discussed.

- For Task 7 (page 6), could you please elaborate (e.g. by providing examples) on how EMODnet Geology is contributing to the implementation of EU legislation and broader initiatives for open data?

  - EMODnet Geology provides an open access distribution of scattered marine geological data from national repositories that could be otherwise unreachable. Furthermore, harmonisation enables distribution of data that is restricted or inaccessible in its original form. For example, Finnish seabed substrate data in its original scale, 1:20 000, is restricted due to national defence issues, and thanks to EMODnet, we were able to publish it for open use after the harmonisation process and rescaling into 1: 100 000 and coarser.