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

Final Progress Report

Reporting Period: 25/09/2021 – 24/09/2023

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

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 previous phase of EMODnet (2019-2021), 39 organisations from 30 countries demonstrated that geological information from all European seas could be compiled and harmonised to map products at 1:100 000 scale or finer where the underlying data permit. The current EMODnet-Geology Project delivers similar information for the entire European seas and beyond, with a multi-scale approach applied when possible. It started in September 2021, has been running for two years, and ended on 24 September 2023, but will continue with 24 months due to the renewal option until 24 September 2025. The project is coordinated by Geologian tutkimuskeskus – Geological Survey of Finland (GTK).

The group consists now 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 (the Barents Sea and the 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 was coordinated by subcontractor VSEGEI (Russia) until 30 August 2022, when the contract was ceased due to geopolitical issues. On 31 January 2023 EMODnet Geology coordinator GTK signed a subcontract with Caspian Locus Limited Liability Company (CLLLC) from Baku, Azerbaijan, who has since then collected and delivered data from the Caspian Sea.

The data that are included in the project are principally those 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:

- Seabed substrate (sediment layer at the seafloor)
- Sediment accumulation rate and sediment erosion
- Seafloor geology - lithology (bedrock geology beneath the surficial sediment and Quaternary deposits)
- Seafloor 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)

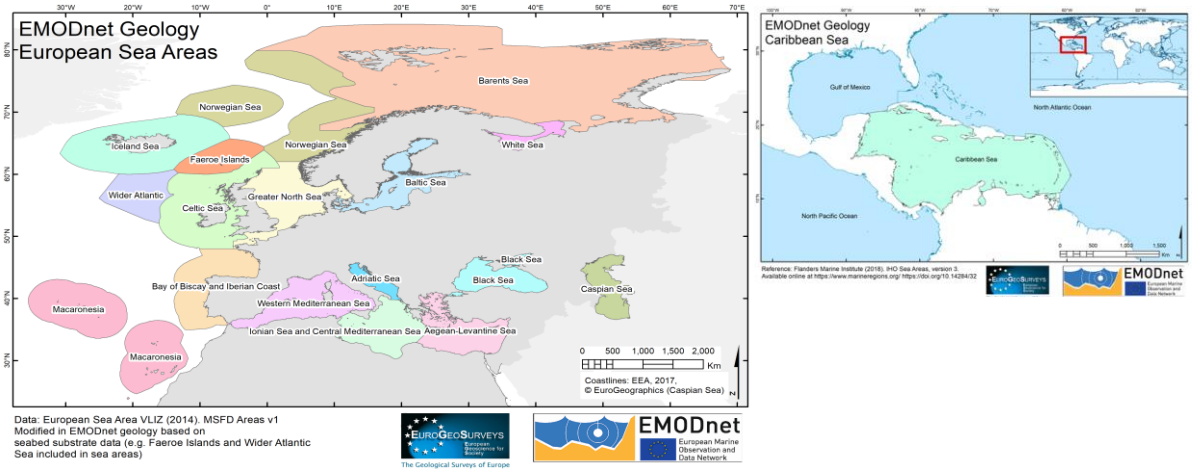

Figure 1. The seas included in the geographical scope of the EMODnet Geology Project.

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, Türkiye); 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, Türkiye), 41. Caspian Locus Limited Liability Company (CLLLC, Azerbaijan).

The partnership consists of the geological survey organisations of the maritime countries of the European Union, added with expertise from six universities, mainly to fulfil 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 are partly archived in external databases. The EMODnet Geology portal (http://www.emodnet-geology.eu/) was from the beginning of the third phase of EMODnet hosted by the Geological Survey of Denmark and Greenland (GEUS) in Copenhagen. Since January 2023 all EMODnet portals have been merged into the EMODnet Central Portal (https://emodnet.ec.europa.eu/en/geology). To ensure the 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

As the principal holders of marine geological information, the EMODnet Geology partnership 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.

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 to the WP's started in Q4/2021 and continued until the end of the project.

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 have been added to the different EMODnet Geology data products and have been updated on Central Portal during the second project year.

Different WPs have also improved the usability of their data products e.g., through quality controls. For example, in WP5 partners conducted a quality control of the coastal-migration map based on satellite data as produced in a previous EMODnet Geology phase. Based on this quality control, WP5 developed filters to remove data points dominated by outliers. The new data product also extends the time series from one to four decades, reducing the influence of outliers on the calculated decadal trends. Finally, the new product includes the southern Mediterranean, the Caribbean Sea and Macaronesia.

Additionally, an initially collated map of georeferenced coastal-vulnerability studies provided by the entire partnership was translated into a single-legend, harmonised polyline shapefile with three classes (higher-medium-lower) and quality-checked by the entire partnership.

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, WMS-C, WFS, and CSW. All project partners can connect directly to the portal PostgreSQL-database and create advanced queries on the data products of the project.

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 biggest task in connection with the migration to the Central Portal was that we had to reduce the number of layers that are shown in the map viewer. If all datasets from all the thematic groups (Lots) were transferred unchanged to the Central Portal, then this would have resulted in more than 1000 layers on the Central Portal. The people at the Central Portal feared that this 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 values had to be updated and harmonised so that the filtering of data can work across data that originate from different layers.

After the launch of the Central Portal, the number of layers from EMODnet Geology has increased gradually. Partly because we had to reintroduce some layers because the reduction had been too extensive - partly because we have added new products like geomorphology lines, seabed erosion, marine aggregates sub deposits and marine hydrocarbon sub deposits.

In the whole period, we have continuously worked with the Central Portal to adjust the configuration of the filter functionality, legends, metadata and download functionality (WFS) in the map viewer.

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

We have been working in close cooperation with the Central Portal to have our data products available to any desired spaces on the Central Portal.

Task 6: Ensure the involvement of regional sea conventions

The RSC issue will be addressed during the next 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:

The Secretariat has regularly monitored and assessed the running systems in terms of performance and quality of service. User feedback has been handled and problems have been resolved within the time limit specified by the help disk at the Central Portal.

The continuous addition of data to the system – both the addition of new features to existing datasets and completely new datasets – has unfortunately resulted in an increasing response time of our services. Most of the external users would probably not have noticed this since the Central Portal uses caching. To mitigate the looming performance problems, we have ordered new hardware from our service provider and in the next two project years we will focus on the reconfiguration of the heaviest layers in our system.

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 until January 2023, when the new Central Portal was launched.

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	24.09.2022	Delivered	23.09.2022	-
D1.1-8: Quarterly reports	WP1/all	15.10.2021 15.01.2022 15.04.2022 15.07.2022	Delivered Delivered Delivered Delivered	15.10.2021 14.01.2022 14.04.2022 14.07.2022 14.10.2022	

		15.10.2022 15.01.2023 15.04.2023 15.07.2023	Delivered Delivered Delivered Delivered	15.02.2023 11.04.2023 14.07.2023	Q4/2022 report postponed by CINEA to 15.02.23
D2.1: Interim report	WP1/all	24.9.2022	Delivered	22.09.2022	-
D2.2: Final report	WP1/all	24.9.2023	This report		
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	Delivered	24.9.2023	-

3. Work Package updates

WP1 – Project management. The Geological Survey of Finland (GTK).

Covering Task(s): 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 11 October and Tuesday 12 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, the Netherlands from 17 to 20 May 2022. Next project meeting was held during the second year as an on-site meeting in Varna, Bulgaria from 7 to 10 November 2022, and the fourth project meeting was held as an on-site meeting from 23 to 25 May 2023 in Torshavn, the Faroe Islands. An average of 60 delegates attended all these meetings.

From 24 February 2022 to 16 January 2023 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 August 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 started immediately the process of subcontracting the former Azerbaijani subcontractor of VSEGEI in order to get new data from Azerbaijan. Caspian Sea data access has on 16 January 2023 been secured by contract with a new subcontractor: Caspian Locus Limited Liability Company (CLLLC), Azerbaijan. Attempts on subcontracting entities from the remaining Caspian Sea countries Kazakhstan and Turkmenistan has been made but it seems that it is very hard to find any possible parties to contract from these countries.

The partners were identifying, collating, and harmonising new national data for this phase of the project during the whole first project year, but new data have been added also during the second half of the project. All data products have been updated and new products were uploaded on the Central Portal by the end of the project (24 September 2023).

EMODnet Geology has had 12 internal Steering Group meetings during the reporting period (see section 7).

The overall progress of the project was 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, but after signing the new subcontract with CLLLC in January 2023 all work packages have received new or updated data from Azerbaijan, the Caspian Sea.

In order to best manage the Caribbean Sea subtask project coordination started negotiations with Asociación de Servicios de Geología y Minería Iberoamericanos (ASGMI), which has many members amongst the geological surveys in the Caribbean Sea area. An EMODnet promotion meeting was arranged in Santo Domingo, the Dominican Republic on 26-27. July 2023. Delegates from the geological surveys of Colombia, Guatemala, Honduras, Cuba, Costa Rica, Mexico, and the Dominican Republic were present at the meeting. The EMODnet Geology project was on site demonstrated by the project coordinator and the deputy coordinator, as well as remotely by all the work package leaders. On the second day of the meeting the Caribbean delegates presented their respective data.

It has been decided that the Spanish geological survey Instituto Geológico y Minero de España (IGME) will act as a Caribbean Sea subtask leader through subcontracting ASGMI. Data from the Caribbean Sea surveys will be added to the EMODnet Geology project during the renewal period of the recent contract.

Caribbean Sea data has during this phase been collected from open sources as well as from some partner surveys that have data from the area. These data have been added to our data products by the end of this contract.

WP2 – Geological data specification and sourcing. The Geological Survey of Finland (GTK)

Covering Task(s): 1, 2

Partners and subcontractors were at the kick-off meeting asked to report new data and metadata, which were collected, harmonised, and combined into our different data products during the second year of the project. Some delays were encountered with the Caspian Sea subtask where the former task leader's contract was ceased due to the geopolitical situation, and it took a while for the coordinator (GTK) to subcontract a new party in Azerbaijan.

Data sourcing has been in good progress in the Caribbean Sea area and first data batches were added to our products by partner organisations by the end of this contract. Third party data deliveries, mainly from local geological survey organisations, are to be expected during the renewal period of the contract (see WP1 description above).

Regarding the amount of data, we calculated based on partner reports that by the end of the first project year we had received about 415.000 square kilometres of new and updated data, as well as almost 11.000 kilometres of line data and a few hundred point data to the different work packages. We also estimated that during the second project year we would get over 1.000.000 additional square kilometres of new and updated data, perhaps as much as 1.200.000 square kilometres. However, based on a new data delivery questionnaire to partners in the spring of 2023 we could re-evaluate data deliveries to our data products by the end of this contract such that we would receive at least 1.350.000 square kilometres of data + 2.800.000 km^2 in one single Caribbean Seabed substrate map, as well as almost 34.400 kilometres of line data and over 3.000 point-data to the different work packages.

WP3 – Seabed substrate. The Geological Survey of Finland (GTK)

Covering Task(s): 1, 2, 4

The delivery of the seabed substrate component of Section 1.6.3. of the tender specifications, including the 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 the WP3.

Partner submissions and Data product updates

Seabed substrate

In the current phase, WP3 introduced a new way to manage the seabed substrate data updates, which helps to improve the data continuity as well as accuracy and lays 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, this guidance document includes instructions for the improvement of coarser 1:250 000 and 1:1 000 000 data and confidence products generated during the earlier EMODnet phases. Altogether 15 partners delivered data updates or new submissions at 9 different scales during the current phase and the seabed substrate data products have been updated accordingly (11 partners to 1: 1 000 000 data product; 12 partners to 1:250 000 data product; 6 partners to 1:100 000 data product; 8 partners to multiscale data product and its individual scales).

Sedimentation rates

A guidance document for sedimentation rates was delivered to the project partners in April 2022. The final product, the sedimentation rates of recent sediments for the European, Caspian and Caribbean Seas as point data was published in July 2023 with 88 new data points.

Seabed erosion

In order to tackle the new task of this phase "seabed sediment … erosion rate", the WP3 leader 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 an inventory of available material on the topic and separate sediment erosion dedicated workshops were arranged during the full partnership project meeting in Utrecht 17 May 2022 and as a remote teams-meeting on 13 June 2022. Seabed substrate Guidance Document III, Seabed erosion and related geodatabase were delivered to the project partners in December 2022. At this phase, the focus was on the compilation of an index map that includes available seabed erosion studies and related metadata/background information. Altogether 11 partners delivered data, varying from index areas of erosional studies to mapped areas with erosional seafloor dynamics. The seabed erosion index map was published on the Central Portal by 24th September 2023.

Case study

WP3 also included a case study "Applying novel machine learning methods to expand sediment composition and sedimentation rate maps to new areas of the European continental shelf" lead by CEFAS. During the current phase, the case study aimed to further the techniques developed in the earlier phase and utilise them within the Baltic Sea. Specifically, it aimed to develop a high-resolution sediment model of the Baltic Sea Basin, study if the accuracy of quantitative sediment models could be improved by extending models to neighbouring regions/basins and analyse how the quantitative methods compare with categorical mapping techniques within the Baltic Sea. A workshop, where the case study leader presented the modelling results to partners, was organised in May 2023. The case study report was finalised by 24 September 2023.

Surface features

Surface features, additional information collected within the seabed substrate data, were discussed, and described in the 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 under review.

Collaboration and outreach

WP3 has participated in vocabulary group and EMODnet Geology Coastal ribbon work with other EMODnet Geology work packages.

WP3 distributed Caspian Sea coastline created in EMODnet Geology to EMODnet Seabed Habitats lot in February 2022 and agreed on the schedule of seabed substrate data delivery in this phase, continuing the well-established cooperation between lots. The draft compilation of the seabed substrate data was delivered to EMODnet Seabed Habitats lot on 30 June 2023.

WP3 products (and the EMODnet Geology project) have been promoted at several events such as IODE Conference 2022, Sopot, Poland; FINMARI Researcher Day 2023, Helsinki, Finland; IODE II Conference, UNESCO, Paris, France; 2022EGU 2023, Vienna, Austria; and Baltic Sea Science Congress 2023, 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 Ingestion 3 and EMOD-PACE, the EMODnet Partnership for China and Europe.

WP4 – Seafloor geology. Bundesanstalt fur Geowissenschaften und Rohstoffe – the Federal Institute for Geosciences and Natural Resources, Germany (BGR).

Covering Task(s): 1, 2, 4

Quality assurance

Confirmed and continued: The good experience with using the BGR Geoviewer for the quality assurance of WP 4 data layers before the final publication on the EMODnet Central Portal. The data are first published at the BGR Geoviewer for review by the participants, review comments are invited and received, and the WP4 team at BGR adds the suggested changes and then transfers the optimised data layers to WP9 for inclusion in the EMODnet Central Portal. Thus, we can provide data quality assured as best at possible.

Partner submissions and Data product updates

Spatial data and Metadata on Geomorphology and Quaternary Geology from France, Poland, Germany, Iceland, Ireland, Italy, Latvia, Malta, Montenegro, Norway, Portugal, Slovenia, Spain, and Ukraine were actualised.

New data for Geomorphology and Quaternary Geology were received from:

Bulgaria (General physiographic features, Geomorphology)
Cyprus (General physiographic features, Geomorphology, Quaternary geology)
Malta (General physiographic features)
France (Geomorphology)
Azerbaijan (Geomorphology, Quaternary Geology)
Denmark (Quaternary)
Greece (Geomorphology)

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

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

Our Albanian partners are working on a study area to demonstrate genetic aspects for defining the coastal ribbon study area.

All WP4 layers (pre-Quaternary, Quaternary, Geomorphology) are updated with the numerous new data and published on the EMODnet Geoportal by end of project (24 September 2023). The coverage of the marine pre-Quaternary data is satisfying for Europe, but for Geomorphology and Quaternary geology gaps need to be filled. Data for the Caribbean Sea are still lacking, and we plan to acquire data from this area during the renewal period of the contract.

Collaboration and outreach

Terms, vocabularies, and portrayal

A cross WP vocabulary working group was established to optimise the vocabularies and include hierarchies.

The focus was especially on the correlation of terms and definitions across the work packages. It was decided to create a new version of the vocabulary during the contract renewal period, if possible, because the actual

one has been in use intensely in this phase, and using two versions would have caused artificial semantic discrepancies.

For the excel sheets to collate the description of units from the partner's hierarchical assignments of stratigraphical terms (e.g., Quaternary, Holocene, Northgrippian) were developed and implemented. This facilitates the assignment of geological times of the submarine units by the project partners.

Coastal Ribbon

A cross-WP Working group led by WP4 drafted an inventory table for collating data on the coastal ribbon off-shore and on-shore ("Coastal ribbon").

Publications

The Geological Society of London Special Issue "From Continenal Shelf to Slope: Mapping the Ocean Realm" is now complete, printed and published with nine contributions from EMODnet Geology partners, of which eight are published prior to this phase and one in 2021 (Sonja Breuer and Kristine Asch: A first Approach to a Quaternary Geomorphological Map 1 of the German Seas). The Special Issue book is available at https://www.geolsoc.org.uk/SP505. Editors: Asch, K. (corresponding editor, WP 4 lead), Kitazatoh, H. & Vallius, H. (EMODnet Geology lead).

WP5 – Coastal behaviour. TNO-Geological Survey of the Netherlands.

Covering Task(s): 1, 2, 4

Partner submissions and Data product updates

During this phase specific attention was 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; to validating and updating the satellite-based coastline-migration maps; and to extending the coverage of these WP5 data products to the southern Mediterranean, Caribbean, and overseas territories.

Coastal vulnerability/resilience

The georeferenced coastal-vulnerability maps have been translated into a harmonised polyline shapefile with three classes (high-medium-low). The coastal vulnerability map, a separate deliverable to the coastal migration map, 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.

Coastline migration

WP5 has validated and updated the satellite-based coastline-migration maps collated and published by the consortium in the previous phases, and extended the coverage to the southern Mediterranean, Caribbean, and overseas territories. By expanding its time series from 10 years (2007-2016) to 38 years (1984-2021), the influence of outliers on trend curves has been reduced. WP5 has implemented a latitude filter to eliminate shorelines that may have ice cover and added a fourth behaviour class 'uncertain' next to landward migration, stable shoreline, seaward migration. For the field-based coastline-migration mapping a new updated file became available in April 2022, with new data for six countries.

WP5 has started up a literature search for field data on riverine sediment supply to the coast, as an explanatory factor for coastline behaviour, and discussed the possibility to link up this database-in-the-making with satellite data to be provided by EuroGeoSurveys Earth Observation Expert Group as part of project GSEU (Geological Service for Europe).

Figure 2. Harmonised map of coastal vulnerability (light blue lower, dark blue higher), showing excellent but not complete coverage in southern Europe and North Africa.

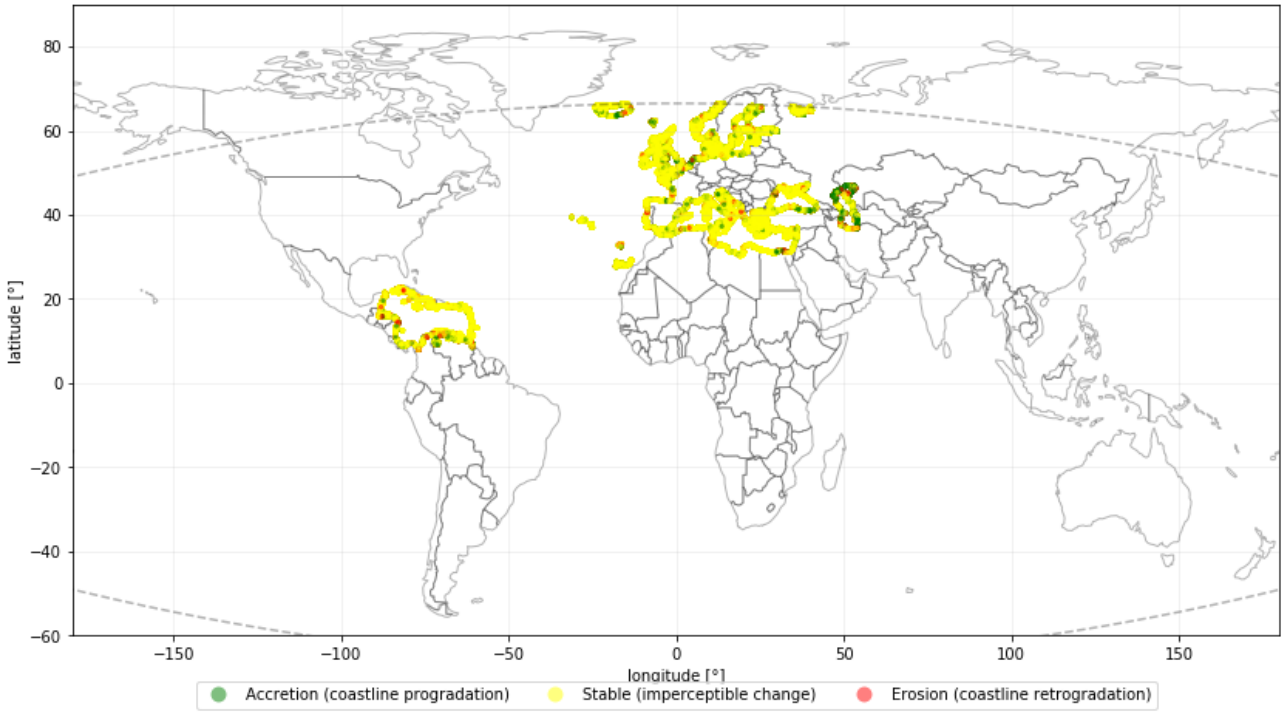

Figure 3. Draft coastline migration (satellite) map, pending final uncertainty assessment and map service (time-series) visualisation.

Collaboration and outreach

Coastal Ribbon (cross-thematic work)

The cross-thematic group has ensured the alignment of work and contributions to the coastal ribbon. The group has developed an inventory questionnaire on data, information and knowledge concerning the coastal ribbon, including a short explanatory document. It will be disseminated to the EMODnet Geology partners during the coming two years.

Publication and outreach

WP5 data products have been presented e.g., at European Geosciences Union conference, May 2022 and at European Geologist Journal (see Chapter 5).

WP6 – Geological events and probabilities. Istituto Superiore per la Protezione e la Ricerca Ambientale: ISPRA.

Covering Task(s): 1, 2, 4

Guidelines and general information

Updated guidelines for the current phase of the Project were elaborated and circulated among partners. In order to help partners to provide correct deliveries, the shapefile format was also shared.

Continued contacts with Azerbaijan partner have been carried on providing information on WP6 procedures and products, which resulted in a new WP6 delivery.

Partner submissions and Data product updates

Data updates and/or new deliveries were received during the current phase from Ireland, Finland, Germany, Spain, Greece, Azerbaijan, Iceland, and Türkiye.

Harmonised layers, including new data and updates, have been displayed on a test website to be validated by partners before submitting the final products to WP9 lead.

WP6 data are provided to the Portal as layers relative to each feature (landslide, volcano, etc.) and to each geometry (polygon, line, point). Whenever updates are provided by partners, they are included in the Europe wide layers which are delivered again to WP9 lead.

Further enquiries were carried out concerning the availability of events probability data, especially regarding coastal areas both at sea and on-land, such as layering state, fracturing state, on-land landslides inventory, landslides susceptibility maps.

Collaboration and outreach

Cross thematic meetings among different WPs have been held with focus on the coastal ribbon and on vocabulary harmonisation.

Cooperation agreements with other Italian Public Research Institutions have been subscribed to promote contributions to refine and implement WP6 data.

WP7 – Minerals. The Geological Survey of Ireland (GSI).

Covering Task(s): 1, 2, 4

Guidelines and general information

Updated guidelines for the current phase were elaborated and circulated among partners. Main change from previous guidelines was the inclusion of a simplified sub-type of category for two mineral types: marine aggregates and hydrocarbons.

Partner submissions and Data product updates

We received data from ten partners under this phase – this includes some new data and reclassified Aggregates and Hydrocarbons for the newly defined sub deposit type classes.

Data updates were received from: Azerbaijan, Denmark, Finland, Iceland, France, Latvia, Malta, Norway, Spain, and Türkiye. Where data was already in the correct format confirmation of this was received from the relevant partners.

New harmonised data layers have been created for Marine Hydrocarbons based on sub deposit types, Oil, Condensate, Gas, Shale Gas, Coal.

New harmonised data layers have been created for Marine Aggregates based on sub deposit types; Sand, Gravel, Pebbles/cobbles, Filling Sand.

Metadata was updated in line with the requirements for the EGDI catalogue for EMODnet Geology

Final WP7 data was delivered to the EMODnet Geology portal.

Collaboration and outreach

WP7 has had collaboration with EU MINDeSEA -Seabed Mineral Deposits in European Seas: Metallogeny and Geological Potential for Strategic and Critical Raw Materials. Collaboration included exchange of information on mineral deposits, check for consistencies in the databases and sharing GIS management protocols.

Cooperation with EMSAGG group in marine aggregates by participating in public forums and in panel discussion.

WP8 – Submerged landscapes. UKRI- British Geological Survey (BGS).

Covering Task(s): 1, 2, 4

Partner submissions and Data product updates

This quarter we have received updates to the Submerged Landscapes work package from partners in Malta, Iceland, Spain, Belgium, Türkiye, and Azerbaijan. This brings our holdings to more than 43,000 features describing 27 different classes of submerged landscape feature. Further we have sourced palaeocoastline data for the Caribbean Sea to be included in the next data delivery. Our partners from Università La Sapienza, Roma presented updates from their work on palaeovegetation on the continental shelf around Italy at the partner meeting in the Faroe Islands. We also had an online meeting to discuss an Arc Story Map describing our work on palaeogeographic reconstruction within the Baltic Sea region.

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 previous contract to 40,953. Subsequently, the final data update increased our holdings further to more than 43,000 features describing 27 different classes of submerged landscape feature. These classes include mapped and modelled palaeocoastlines, evidence for submerged forests and peats, and submerged freshwater springs. During this phase of the project, we have increased the number of features and information by more than two-and-a-half times.

These data describe submerged landscape features preserved on continental shelves across European regional seas, and the Caspian and Caribbean Seas where possible.

WP8 update delivered to portal

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 describing the work package, 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 will be incorporated into the Arc Story Map deliverables for the renewal period of the contract as a commitment to ongoing transparency and dissemination for this work package.

Delivery of palaeogeographic reconstruction case studies on portal

This work package has used suitable geological data and information to reconstruct palaeogeography at two primary case study areas using 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. Partners from Università La Sapienza, Roma and University of Tartu, Estonia have led palaeogeographic reconstruction case studies for this work package. This was a much more involved task than anticipated at the start of the project resulting in delivery delays. These case studies will instead be delivered and disseminated via Arc Story Map describing our work on palaeogeographic reconstruction during the coming two years.

Collaboration and outreach

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

WP9 – Project analysis and sustainability. The Geological Survey of Finland (GTK) and Geological Survey of Denmark and Greenland (GEUS).

Covering Task(s): 1-5, 8,9

Migration to the Central Portal

The main task for WP9 in this phase has been 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 visualisation 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 harmonised so that the filtering of data can work across data that originate from different layers.

Partner submissions and Data products updates

Boreholes, samples, and geophysics

WP9 is responsible for the layers for boreholes/samples and geophysics. The original specifications of boreholes and geophysics contain many attributes. Investigation of the datasets shows that many of these columns are either empty or contain irrelevant data. The sole purpose of the borehole and geophysics datasets is to give the user an overview and information about who to contact to get the wanted data. For this reason, many attributes were removed from the WFS and WMS services. The columns still exist in the database and can be brought to live if needed. A few attributes were also added to be able to differentiate between grab samples and boreholes and between seismic and multibeam data. The new formats are called Borehole index version 2.0 and Geophysics structure 2.0.

In some countries the positions of the seismic lines are confidential but the polygon that shows the approximate position of the survey is not. A new dataset with polygon geometries is added. This dataset has the same structure as the geophysical lines and is included in the same WMS service.

The datasets of boreholes and geophysics are updated continuously. In this phase we got updated geophysics from following partners: GSI (Ireland), NGU (Norway), GTK (Finland), RBINS (Belgium), TNO (Netherlands), GEUS (Denmark) (included a survey from the Caribbean), HGI-CGS (Croatia), LEGMC (Latvia), LGT (Lithuania), CSD-OPM (Malta), EGT (Estonia), IFREMER (France), IPMA (Portugal), IGME (Spain), SGU (Sweden) and GeoZS (Slovenia). Updated borehole and sample data came from these partners: RBINS (Belgium), TNO (Netherlands), NGU (Norway), PGI-NRI (Poland), PSRGE (Ukraine), GEUS (Denmark), EGT (Estonia), HGI-CGS (Croatia), LEGMC (Latvia) and CSD-OPM (Malta)

Maintenance of web services

WP9 also publishes the data from WP3–8 as web map services. After the launch of the Central Portal in January 2023 new services for geomorphological lines and 100K scale layers from WP6 has been added as services and these layers are under the process of being included in the map viewer of the Central Portal. Existing datasets for the different work packages have also been updated.

3D visualisation

According to the tender EMODnet Geology should provide some kind of 3D visualisation of the data. Different possibilities were discussed. We agreed on that the 3D visualisation used in the map viewer at the new Central Portal meets our needs. In the viewer different layers can be draped on the 3D visualisation 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.

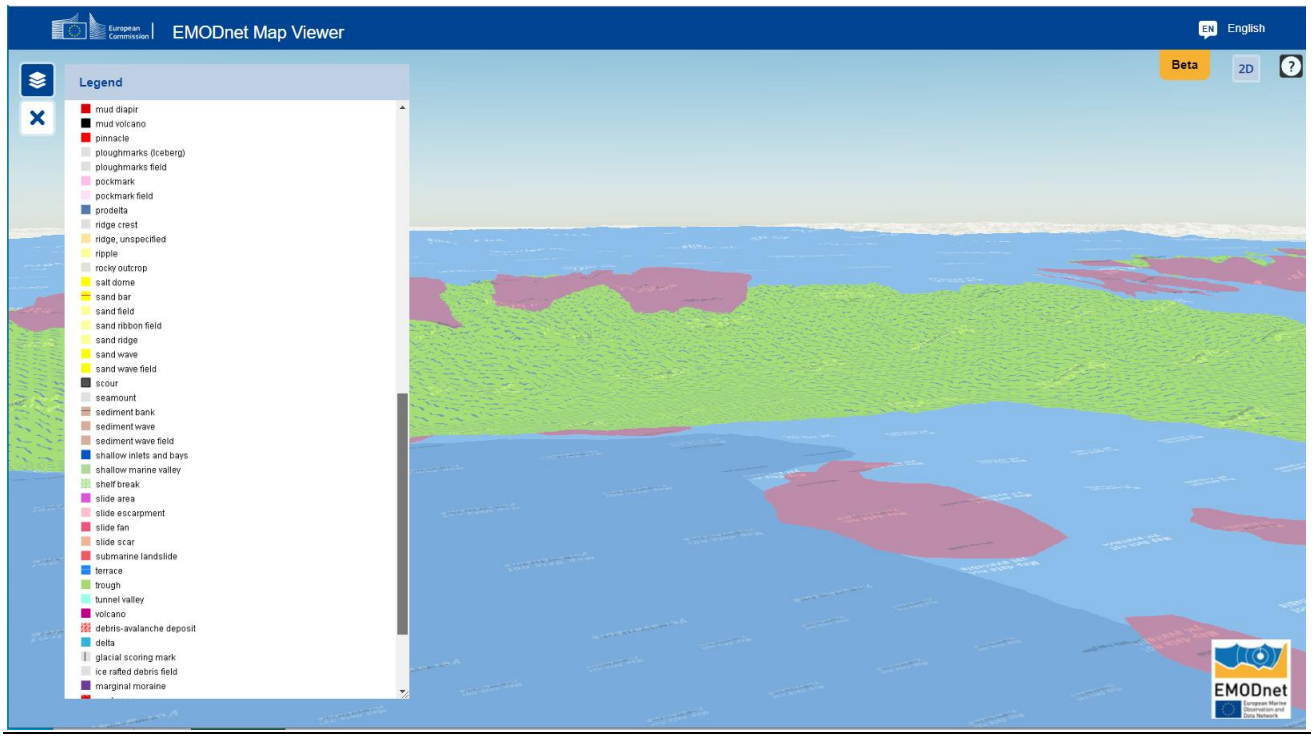

Figure 4. Geomorphology shown in the 3D map viewer at the Central Portal.

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	Resolved	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	25.03.2022
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	16.09.2022
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*	Resolved and closed			

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 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.	-	14.04.2022
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.	-	02.03.2022
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		08.04.2022
EM-415 Provide database dump	Resolved	Provided a database dump		xx.02.2022
EM-518 Request for SSL-certificate upgrade on portal	Resolved			03.05.2022
Above issues identified, communicated and handled before submission of our Interim report (Oct 2022). Below are some issues related to the Interim report itself, as requested by CINEA:				
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.	Resolved	- 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	-	25.10.2022

		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?	Resolved	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 the renewal period of the contract. 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.	-	25.07.2023 This cooperation was further developed when we met ASGMI delegates from seven Caribbean Sea countries (Mexico, Honduras, Guatemala, Costa Rica, Colombia, Cuba, the Dominican Republic) on-site in Santo Domingo
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?	Resolved	- 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.	-	25.10.2022
Concerning WP7 – could you please describe briefly what is the outcome of the initial research on existing	Resolved	On the Caribbean Sea we have investigated extensively International public databases such as the International Seabed Authority	-	25.10.2022

public databases hosted by international organisations and the USA, and what are the next steps expected?		(ISA), NOAA (USA) and USGS (USA) databases. ISA hold relevant seabed mineral information on their online data viewers, also present in the European Atlas of the Seas. The next step will be to contact the authority to request the relevant metadata in order to incorporate the occurrences/deposits into the updated EMODnet viewers for WP7. Additionally, we have directly contacted EMODnet Geology partners who may hold databases for the Caribbean Sea (e.g., France, UK) and will formally request, in the next mid-project meeting, that any existing databases be submitted. Regarding NOAA and USGS, we found out that the mineral deposits information related to the Caribbean Seas is unfortunately limited to the onshore areas.		
Issues identified, communicated, and handled after the Interim report, during the second project year:				
EM-142 -Geology Quality of Service Monitoring	In Progress	The landslide susceptibility map has started giving problems after the update to geoserver 2.22. We are in the process of testing if the use of image pyramids can help		
EM-321 -Content Inventory Geology	Resolved			26-01-2023
EM-336 -Collect names of Portal editors	Resolved			29-11-2021
EM-344 -Collect fields/forms used on Geology Thematic Portal	Resolved			14-03-2022
EM-352 -Geology WMS in EA Atlas broken	Resolved		05-11-2021	10-01-2022
EM-360 -Geology to report on number and volume of downloaded data and data products by 29th of October 2021	Resolved			21-01-2022
EM-394 -Geology review of the new CP map viewer	In Review	The Central Portal is reviewing		
EM-410 -Mapping Geology Portal content to Central Portal	Resolved			25-02-2022
EM-415 -Geology to provide a pd_dump of their POSTGIS database by end January so VLIZ can look into implementing it.	Resolved			21-04-2023
EM-416 -Geology to look if all images are their own or not. Need to be sure a copyright and which rules for diffusion.	Resolved			13-05-2022
EM-417 -Geology to provide version of GeoServer and Postgresql	Resolved			25-01-2022
EM-421 -Log4Jshell Update from Geology	Resolved			21-01-2022
EM-476 -iFrame on Static Content pages allowed: Yes	Resolved			28-01-2022
EM-492 -Geology to report on number and volume of downloaded data and data products	Resolved		09-02-2022	10-02-2022
EM-501 -Create "NEW' Geology page on CP (dev)	Resolved			19-05-2022

EM-518 -Geology SSL certificate has security issues and causes problems with R/Ubuntu clients	Resolved			02-05-2022
EM-525 -Updating of EMODnet Geology - Seafloor Geology layers in the European Atlas of the Seas	In Progress	Waiting for CP to handle our response.		
EM-529 -Geology - EMODnet Catalogue Tags	In Review	Waiting for CP to review		
EM-541 -Partner page - Error with bar dividing coordinators and partners	Resolved			26-01-2023
EM-559 -Geology- Capture all layers in CP portal	Resolved		31-08-2022	04-05-2023
EM-566 -Feedback on CP Main Menu	Resolved		30-06-2022	25-04-2023
EM-608 -Centralisation Checklist for review	Resolved			29-03-2023
EM-634 -Standardise the navigation menu on left hand side of page	Resolved			24-04-2023
EM-641 -Geology to provide input to the Tools & Guidelines section	Resolved			11-10-2022
EM-649 -Geology to review layer legends and add units where they are missing	Resolved			28-02-2023
EM-663 -TWG12-Geology to investigate remaining issues with download	Resolved			28-02-2023
EM-687 -Geology: Geomorphology lines	Resolved			01-03-2023
EM-701 -Broken Links in EMODnet Viewer	Resolved			11-08-2023
EM-712 -The title in the EMODnet product catalogue is repeated several times	Resolved			13-07-2023
EM-720 - EMODnet Geology URL direct to new EMODnet portal	Resolved		23-01-2023	25-01-2023
EM-741 -Legend problem for submerged landscapes	Resolved			24-04-2023
EM-745 -Broken links in Geology Borehole and Grabs Layer GetFeatureInfo	Resolved			12-05-2023
EM-773 -Critical - Geoserver Remote Code Execution - CVE-2022-24816 & CVE-2023-25157	Resolved			16-05-2023
EM-809 -Geology: link + redirect	Resolved			11-08-2023
EM-814 -CP Webservices usage monitoring	In Progress	Discussion on how to monitor webservices		
EM-817 -TWG13 Action 17 Thematics to provide helpdesk email	Resolved			18-07-2023
EM-85 -Geology - Web Services MetadataUrl and DataUrl fields	In Review	Waiting for the next service evaluation		11-08-2023

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 organised 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. 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 organisations 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	04.04.2022
Check WP6 metadata editors	Resolved	Issue concerning retirement of colleagues previously in charge as editors was clarified with Portal manager		14.10.2022
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	-

War and Russian army invasion in Ukraine have affected the progress of the project, especially regarding the Caspian Sea as VSEGEI (Russia) was our former Caspian Sea subtask leader, and we had to discontinue the contract with them. For more than half a year the Caspian Sea part was on idle due to the situation.	Resolved	In order to receive data from the Caspian Sea area a new subcontract was signed between coordinator GTK and Caspian Locus Limited Liability Company (CLLLC) in January 2023. CLLLC collected and harmonised data from Azerbaijan which were delivered to each WP by end of June 2023, problem resolved.	-	16. January 2023 signature by CLLLC and countersignature by GTK on 31. January 2023.
Geopolitical situation has affected sensitivity and thus availability of marine geological data in some marine areas	Resolved (partly)	The sensitive data has been removed or it has been discussed with parties concerned and edited according to the discussion.	-	-
Data availability & harmonisation from third parties in the Caribbean Sea area	Pending	The negotiations are ongoing to establish a contract between EMODnet Geology and ASGMI, which would enable a collaboration with Caribbean geological surveys.	-	-
Transfer of the GIS data from the previous EMODnet Geology portal to new EMODnet Central Portal	Resolved	During the current phase the main GIS layers have been transferred to the new Central Portal.	-	-
EM-595 -the geomorphology layer does not show up on the Central Portal viewer	Resolved			06-07-2022
EM-683 -refreshing of cache of the map viewer	Resolved			16-11-2022
EM-759 -Filter option in some Geology layers are not displayed properly	Resolved			07-07-2023
EM-775 -Revision of attributes and filters for geophysics and borehole indices	In Review			
EM-778 -Legend does not work for Sea Floor Geology | General Physiographic features	Resolved			08-05-2023
EM-780 -Third level menu for Landslide Susceptibility	Resolved			13-07-2023
EM-797 -Problem with filter for layers with more filter criteria	In Progress			
EM-799 -Diagram that shows the position of the shoreline through time	In Progress			
EM-844 -new layers and updates to the sub-theme Geological events and probabilities	Pending		28-08-2023	

EM-846 -New attributes to seabed substrate datasets	Resolved		24-09-2023	20-09-2023
EM-850 -new layer: cp_wp3_seabed_erosion	Resolved		24-09-2023	20-09-2023
EMODNET-1448 -update of Reports Dashboard	Resolved			27-07-2022
EMODNET-1458 -statistics in the interim report	Resolved			07-09-2022
EMODNET-1468 -EMODnet OGC monitor for Geology reports errors	Resolved			26-10-2022
EMODNET-1470 -EMODnet Geology OGC monitor	Resolved			26-10-2022
EMODNET-1518 -new dataset for geology	Resolved			09-02-2023
WP9. Splitting up boreholes into boreholes and grab samples	Resolved		01-01-2022	25-03-2022
WP9. Splitting up geophysical index into seismic and multibeam.	Resolved		01-07-2022	19-09-2022
Creating the associated WP5 web services in line with the new Central Portal, with required functionality, turned out to be more complicated than anticipated originally.	Pending	They will be finalised early during the renewal period, in close cooperation with the EMODnet Secretariat.	-	First project year of the renewed contract

5. Allocation of project resources

Information on the allocation of project resources	
Categories	Resource usage[1] (%)
Making data and metadata interoperable and available	30
Preparing data products	25
Preparing web-pages, viewing or search facilities	5
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
01.10.2021	HCMR.gr	Invitation to conference	Email	1 hr	Resolved	Considered	
08.11.2021	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. – 12.12. 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.
25.01.2022	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		
27.01.2022	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.			
28.02.2022	DDS	Request for website reference	e-mail	3 hrs	Resolved	Information	
04.03.2022	UNIBO	PhD data usage	e-mail	3 hrs	Resolved	Information	
04.03.2022	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	
20.05.2022	University College Cork	Missing confidence information on the 1:250k seedbed substrate map	email	24h/ email	Resolved	Explained	
06.09.2022	ISPRA	Request for information on sediments grainsize underlying Seabed Habitats products	email	One day	Resolved	Reference to EMODnet Geology WP3 data was provided	
10.10.2022	Landesbetrieb für Küstenschutz, Nationalpark und Meeresschutz Schleswig-Holstein	Inquiry about original German North Sea sediment data included in the EMODnet Geology Seabed substrate product	Dr. U. S.	1 day	Resolved	Known references of the original German maps were provided, and contact details of BSH, the original data supplier were given for further questions	
14.10.2022	HafenCity University Hamburg	Question if it is possible to derive coastal type from coastline shape.	email	One day	Ongoing discussion	No easy answer; looking into the possibility of a test.	Pending

19.07.2023	University of Oslo, Norway	Inquiry regarding spatial resolution of seabed substrate data	email	8 days	Resolved	Explained	
12.12.2022	Rijkswaterstaat	Link to EMODnet incorporated into Dutch National Growth Fund proposal for Digitizing the North Sea.	email	One week, several follow-ups	Text edited		Resolved
20.02.2023	Wood Thilsted Partners	EMODNET-1531 -Data request for O-2.2 offshore wind lease area	EMODnet Help Desk	within 1d	Resolved	Guidance how to find data	
08.05.2023	No information	EMODNET-1606 -Inquiry: Data, regarding Underground Water Discharge (UWD) in Europe.	EMODnet Help Desk	within 1d	Resolved	Guidance how to find data	
17.05.2023	niras.se	EMODNET-1607 -EMODNet seabed substrate	EMODnet Help Desk	within 8h	Resolved	Data was added to the downloadable zip file	
08.06.2023	Instituto Investigacións Mariñas	EMODNET-1625 -Seabed substrate EMODnet layers - Download problems	EMODnet Help Desk	within 8h	Resolved	Guidance how to download data	
15.06.2023	University College Cork	EMODNET-1628 -Sediment Samples	EMODnet Help Desk	within 1d	Resolved	Guidance how to get borehole data from Ireland	
21.06.2023	SSE Renewables	EMODNET-1635 - Quaternary geology lithology data - download impossible	EMODnet Help Desk	within 8h	Resolved	WFS was called with wrong parameters	
25.08.2023	Continuum Industries	EMODNET-1666 -Issue with EMODnet Geology WFS service	EMODnet Help Desk	within 8h	Resolved	New layer was named wrongly and has been renamed	

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.)
30.09.2021	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
01.10.2021	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. 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
11.11.2021	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 the current phase. 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	Session on European projects. EMODnet achievements and future portal centralisation presented. More than 80 international delegates.
24.11.2021	on-line	Internal meeting on coastal vulnerability	yes, progress report	O	Status update and discussion of abstracts for EGU and IGU. 5 participants
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
14.01.2022	Remote, Teams-Meeting	Internal EMODnet Geology WP3, GTK Meeting	no	O	Discussions related to the progress of the project
19.01.2022	Remote, Teams Meeting	Internal EMODnet Geology vocabulary group meeting	no	O	Discussion on harmonisation of vocabularies across EMODnet Geology WPs. 6 participants

19.01.2022	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
25.01.2022	Remote, Zoom meeting	EMODnet Central Portal Technical team meeting with Geology	no	A	Discussion on EMODnet Geology migration progress to Central Portal
01.02.2022	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
02.02.2022	Remote, Teams-Meeting	Internal EMODnet Geology Seabed substrate Confidence Group workshop, organised by WP3	yes, Confidence Presentation by SGU	O	Discussion on confidence issues concerning data collated. 20 participants
07.02.2022	Remote, Zoom meeting	EMODnet Central Portal Technical team meeting with Geology	no	A	Discussion on EMODnet Geology migration progress to Central Portal
10.02.2022	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.

15.02.2022	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
16.02.2022	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
18.02.2022	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 participants https://www.infomar.ie/node/529
24.02.2022	Remote, Teams-Meeting	Meeting between EMODnet Geology and EMODnet Secretariat	no	A	Discussion on EMODnet Geology: Sea basin regions to be used in reporting
25.02.2022	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
02.03.2022	Remote, Teams-Meeting	Meeting between EMODnet Geology and EMODnet Secretariat	no	A	Discussion on EMODnet Geology: Sea basin regions to be used in reporting
14.03.2022	On-line	Meeting	no	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.
16.03.2022	Remote, Teams-Meeting	Internal EMODnet Geology, GTK Meeting	no	O	Discussions related to the Central Portal

21.03.2022	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
23.03.2022	Remote, Online Conference	External FINMARI Researcher Day	yes, presentation by Aka/WP3, GTK	A	Dissemination of EMODNET Geology project. 153 participants
24.03.2022	Remote, Teams Meeting	Internal EMODnet Geology vocabulary group meeting	no	O	Discussion on harmonisation 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
31.03.2022	Remote, webinar	External GMME Webinar	yes, presentation by Aka/WP3	A	Dissemination of EMODNET Geology project
05.04.2022	Remote, Teams-Meeting	Internal EMODnet Geology WP3, GTK Meeting	no	O	Discussions related to the product development
07.04.2022	Remote, Webex-Meeting	Internal EMODnet Geology Coastal Ribbon meeting	no	O	Coastal Ribbon review of drafted text for a round mail, work on finalising of Inventory (6 participants).
20.04.2022	Remote, Teams-Meeting	Internal EMODnet Geology WP3, GTK Meeting	no	O	Discussions related to the progress of the project
22.04.2022	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
26.04.2022	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.-28.04. 2022	Remote, Zoom-meeting	16th EMODnet Steering Committee meeting	yes, EMODnet Geology SC report	A	All aspects of project administration, collaboration, and future plans. Including aspects of portal centralisation.
06.05.2022	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
09.05.2022	Remote, Zoom-Meeting	EMODnet CP technical team meeting with Geology	no	A	Discussions on portal centralisation
11.05.2022	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.-14.05. 2022	Reykjavik, Iceland	External, Nordic Geological Winter Meeting 2022	yes	A	Oral presentation by EMODnet Geology coordinator "The EMODNET-Geology project – harmonising geological data of the European seas" on EMODnet Geology and EMODnet in general.
16.-20.05. 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.-19.05. 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
20.05.2022	On-line	Internal EMODnet Geology Steering Group Meeting	no	O	Meeting of the Steering Group to review the EMODnet project meeting
24.05.2022	Remote, Teams-Meeting	Internal EMODnet Geology steering group meeting	no	O	Discussion of EMODnet Geology issues. 10 participants

24.05.2022	remote	Internal EMODnet Geology 2.5 D visualisation meeting between WP4 and WP9	no	O	Small- committee meeting to exchange ideas
06.06.2022	GTK, Otaniemi, Espoo, Finland (+hybrid)	Internal EMODnet Geology WP3, GTK Meeting	no	O	Discussions related to the progress of the project
08.06.2022	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
10.06.2022	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.
13.06.2022	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.)
15.06.2022	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.-17.06. 2022	Glyfada, Athens, Greece (+hybrid)	External EMODnet Ingestion 3 kick-off meeting	yes	A	Discussions on project progress and future steps
20.06.2022	Remote, Teams-Meeting	External, Infosession: "How to make a site compliant"	no	A	Infosession: how make site EU compliant, related to portal centralisation
30.06.2022	Remote, Zoom-Meeting	EMODnet CP technical team meeting with Geology	no	A	Discussions on portal centralisation
04.-06.07. 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	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.

			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.		
06.07.2022	Remote, Teams meeting	External meeting	no	A	Discussion on manuscript "Digital geodata and models of Europe's subsurface support the green transition and UN sustainable development goals" and the link between EMODnet Geology and the European Geological Data Structure. Agreed to add a small section on interoperability.
08.07.2022	Remote Teams meeting	EMODnet Geology Steering group meeting	no	A	Discussion of EMODnet Geology issues. 10 participants
18.07.2022	Remote Webex meeting	DG MARE - EMODnet progress meeting	yes, by coordinators	A	EMODnet progress meeting: Centralisation & state of play
18.07.2022	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
01.08.2022	On-line	Internal	no	O	Coastal Ribbon (5): review of drafted text for a round mail, work on finalising of Inventory. 6 participants
17.08.2022	Remote, Teams-Meeting	Internal EMODnet Geology, WP3 (GTK) Meeting	no	O	Discussions related to the progress of the project
25.08.2022	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
07.09.2022	Remote meeting	External meeting	yes: overview of WP5 output	A	Update on manuscript “Digital geodata and models of Europe’s subsurface support the green transition and UN sustainable development goals” and the link between EMODnet Geology and the European Geological Data Structure. Made arrangements for finalisation of the manuscript.
12.09.2022	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
15.09.2022	Remote, Teams-Meeting	External. First online meeting between EMODnet-Geology partner IGME, the coordinator	no	O/A	Discussions on how to cooperate with geological surveys of the Caribbean Sea area regarding

		(GTK), and Asociación de Servicios de Geología y Minería Iberoamericanos (ASGMI).			ingestion of marine geological data to EMODnet Geology.
20.-21.9. 2022	Remote meeting	EMODnet Business Offshore Renewable Energy workshop	yes	A	Janine Guinan (GSI) presented a showcase of how EMODnet Geology data has been used in context with renewable energy
21.-22.9. 2022	Remote meeting	12th EMODnet Technical Working Group Meeting	yes	A	Internal discussions related to the Central Portal.
22.09.2022	Remote, Webex-Meeting	EMODnet-Copernicus Marine Service coastal workshop	no	O	Periodic informative meeting to discuss cooperation opportunities.
29.09.2022	Hybrid meeting, Teams & Otaniemi, Espoo, Finland	Internal EMODnet Geology WP3/GTK Meeting	no	O	Internal discussions related to the seabed erosion deliverable
04.10.2022	Helsinki, Finland	Lecture, University of Helsinki, Faculty of Biological and Environmental Sciences	yes, Kotilainen Aarno: Evaluating future by history: using the information in seabed sediments	A	EMODnet, EMODnet Geology and EMODnet Ingestion were introduced to students during the lecture, 20 students
07.10.2022	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 the next project meeting. 8 participants.
11.10.2022	Remote, Teams meeting	Kick-off meeting CSA Geological Service for Europe WP5: Coastal Vulnerability and Windfarm Siting.	no	A	Discussion on separation of tasks, and specifically on how EMODnet data are used in GSEU and how GSEU map deliverables will feed into EMODnet Geology.
13.10.2022	Remote, Teams-Meeting	Internal EMODnet Geology coordination meeting (GTK)	no	O	Meeting on issues regarding subcontracting a partner from Azerbaijan.

17.10.2022	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
20.10.2022	Remote, Webex meeting	EMODnet for business - Offshore Renevables workshop	yes	A	Discussions on the offshore renevable energy sector and what EMODnet and the industry can offer each other
26.-27.10. 2022	Brussels, Belgium	External meeting: Eurogeosurveys 50 years conference	yes, poster on EMODnet Geology	A	Marketing of EMODnet and EMODnet Geology at the 50th anniversary Conference of EGS. > 100 participants
27.10.2022	Brussels	External meeting: EuroGeoSurveys 50 Years	yes: Green Sea, Great Deal?	A	Highlighted the interdisciplinary marine playing field of EMODnet for a global audience in the session on interdisciplinary science excellence (livestreamed via the EuroGeoSurveys YouTube channel); discussed cooperation on coastal vulnerability with David Applegate, Director of the United States Geological Survey.
03.11.2022	Remote, Teams-Meeting	Internal EMODnet Geology coordination meeting (GTK)	no	O	Meeting on issues regarding subcontracting a partner from Azerbaijan
03.11.2022	Remote, Teams meeting	WP5 coastal vulnerability progress meeting	no	A	Plan for next few months of student work at Edge Hill University, preparation of presentation for EMODnet Geology Fall Meeting in Varna.
04.11.2022	Remote, Teams-Meeting	Internal EMODnet Geology Steering Group meeting	no	O/A	Meeting on planning of the Varna project meeting
07.11.2022	Varna, Bulgaria	Internal EMODnet Geology Steering Group meeting	no	O/A	Final planning of the Varna project meeting. 5 participants

07.-08.11. 2022	Remote, Zoom-Meeting	17th EMODnet Steering Committee meeting	yes, EMODnet Geology SC report	A	All aspects of project administration, collaboration, and future plans. Including aspects of portal centralisation
07.-11.11. 2022	Varna, Bulgaria	EMODnet Geology project meeting	yes, presentations on future plans and progress by coordinator and all WP leads (11 presentations).	A	Discussions related to the progress and the future work of the project. 60 participants
08.11.2022	Varna, Bulgaria	Cross-WP Workshop on status and results of the coastal ribbon discussions	yes, by chair WP4 lead KA	O	Coastal Ribbon: presentation of case study (Greece) and discussion of data inventory draft, no overall agreement on definition of coastal ribbon achieved –each WP will send out an inventory
08.11.2022	Varna, Bulgaria	Cross-WP Workshop on status and results of the vocabulary group	yes, by chair WP4 lead KA	O	Vocabulary/portrayal: Labels and portrayal discussed: new Quaternary colours accepted, decision made not to create a international common code of abbreviations for geological units
08.11.2022	Varna, Bulgaria	Session on web portal: geometries & boreholes/all geophysics	yes, by chair WP9 lead UL	O	Discussions on web portal and our meta data
08.11.2022	Varna, Bulgaria	Submerged landscapes	yes, by chair WP8 lead HS	O	Discussions on the Submerged landscapes
08.11.2022	Varna, Bulgaria	Caribbean Sea data	yes, by chair TM and EMODnet Geology coordinator	O	Discussions on Caribbean Sea data
08.11.2022	Varna, Bulgaria	WP3 Seabed erosion workshop	Kaskela Anu et al.: WP3, Seabed erosion presentation.	O	Seabed erosion presentation, and discussions on the types of data available and how to report these.
10.11.2022	Varna, Bulgaria	EuroGeoSurveys Marine Geology Expert Group meeting	yes, Kotilainen Aarno, A.T., Highlights 2022, Marine Geology, Geological Survey of Finland	A	EMODnet Geology and EMODnet Ingestion projects were advertised in the presentation. Similar input also from other EGS delegates.

24.11.2022	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
28.11.2022	Remote, Teams-Meeting	Internal EMODnet Geology Steering Group meeting	no	O/A	Discussions related to the progress and the future work of the project
02.12.2022	Remote, Teams-Meeting	Internal EMODnet Geology coordination meeting (GTK)	no	O	Meeting on issues regarding subcontracting a partner from Azerbaijan.
06.12.2022	On-line	Internal WP4 meeting	no	O	Meeting with partners from Iceland (ISOR) to clarify questions the data delivery
09.12.2022	Hybrid meeting, Teams & Otaniemi, Espoo, Finland	Internal EMODnet Geology WP3/GTK Meeting	no	O	Internal discussions related to the progress of the project
19.12.2022	Remote, Teams-Meeting	Internal EMODnet 5 Geology WP3/GTK Meeting	no	O	Internal discussions related to the seabed erosion
11.01.2023	Remote, Teams-Meeting	Internal EMODnet Geology coordination meeting (GTK)	no	O	Meeting on issues regarding subcontracting a partner from Azerbaijan.
12.01.2023	Remote, Teams-Meeting	EMODnet Seabed Habitats ja EMODnet Geology projects cooperation meeting	no	A	Discussions related to collaborations/ interdependencies between EMODnet Seabed Habitats and Geology lots in the during the next contract
17.-19.01. 2023	Porto, Portugal	HE Trident kick-off meeting	yes, presentation on EMODnet Geology	A	EMODnet Geology coordinator attending the kick-off meeting of HE Trident project as invited Advisory Board member representing EMODnet.

23.01.2023	Remote, Teams-Meeting	Internal EMODnet Geology Steering Group meeting	no	O/A	Discussions related to the meeting with CINEA
23.01.2023	Remote, webex-Meeting	Meeting with CINEA - EMODnet: achievements & way forward	no	A	Discussions with CINEA related to achievements & way forward
26.01.2023	Remote, webex-Meeting	Online Stakeholder Workshop: Assessing the benefits of the EMODnet Sea-basin Checkpoints	no	A	Discussion on connectivity of EMODnet Lots in light of Sea-basin checkpoints. Exchange of addresses between parties interested in riverine sediment supply to coasts (Mediterranean Sea-basin Checkpoint) and in geochemistry (EMODnet Chemistry).
30.01.2023	On-line	Internal EMODnet Geology WP4 meeting	yes	O	Kick-off meeting to start working on complete harmonisation of the Western Baltic Sea Quaternary Geology
31.01.2023	Remote, Teams-Meeting	Internal EMODnet Geology coordination meeting (GTK)	no	O	GTK counter signature of the subcontract that was originally signed by Caspian Locus Limited Liability Company, our new Caspian Sea partner
31.01.2023	Brussels	External EuroGeoSurveys 50th National Delegates Meeting	yes: highlighted EMODnet Geology achievements in Annual Report Marine Geology Expert Group	A	Highlighted the interdisciplinary marine playing field of EMODnet for an audience of geoscientists associated with all European geological surveys. Connected the Marine Geology Expert Group with the Earth Observation and Geohazards Expert Group for better use of Copernicus Services.
02.02.2023	Brussels	External EuroGeoSurveys Earth Observation and Geohazards Expert Group meeting	yes: highlighted the need for an EMODnet-MGEG-EOEG connection	A	Plan for joint meeting between MGEGE, EOEG, EMODnet Geology and CMEMS. Plan for joint work within the framework of CSA GSEU on riverine sediment supply and land subsidence, including their geological drivers.

03.02.2023	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. 23 participants
08.02.2023	Brussels	Training & Networking Day for the Coaching & Mentoring Team of OSL 3.0	no	A	Preparation for the EMODnet Hackathon.
09.02.2023	Remote, Teams-Meeting	EMODnet Geology Steering Group meeting	no	O/A	Planning of release of products, promotions. Update on Central Portal, and on meetings with CINEA, the Secretariat etc. 10 participants.
10.02.2023	Remote, Teams-Meeting	Internal EMODnet Geology WP3/GTK Meeting	no	O	Discussion related to WP3 data processing and status
10.02.2023	Remote Teams meeting	Meeting between Earth Observation experts from BGS and EMODnet Geology WP5	no	O	Discussed state-of-the-art coastal characterisation by EO in the UK, and especially the possibility to adopt and roll out high-resolution tools across Europe.
10.02.2023		Meeting with NIOZ on Caribbean data for Dutch territorial waters	no	O	Discussed delivery of geological metadata (first) and data for inclusion in EMODnet Central Portal.
14.-15.02. 2023	Rome, Italy – CNR Headquarters	External meeting: Congress of Italian marine geologists	yes (presentation of EMODnet Geology and of the Italian geological mapping project CARG, from which data was delivered to EMODnet)	A	Dissemination of EMODnet Geology scope and products. ca. 100 participants
16.02.2022	Remote Zoom meeting	"EMODnet Centralisation: One Ocean, One EMODnet"	no	A	“Roundtable on Centralisation Process advantages for EMODnet users” showcase the benefits of the centralised EMODnet services to a diverse audience.

17.02.2023	Hybrid meeting, Teams & Otaniemi, Espoo, Finland	Internal EMODnet Geology WP3/GTK Meeting	no	O	Internal discussions related to the progress of the project
27.02.2023	On-line	Internal EMODnet Geology WP4 meeting	yes	O	WP 4: Western Baltic Sea Prototype area: Demonstration of an additional layer for labels in order to facilitate cross-border harmonisation, example: Denmark and Germany
09.03.2023	Remote, Teams-Meeting	Internal EMODnet Geology GTK Meeting	no	O	Discussions related to the future of the EMODnet Geology project.
10.03.2023	Hybrid: On-site Trieste and Remote, Zoom meeting	EMODnet Chemistry Stakeholder Conference	no	A	EMODnet Chemistry Stakeholder consultation. Dsicussions on EMODnet Chemsitry and data.
14.03.2023	On-line	Internal EMODnet Geology WP4 meeting	yes	O	WP 4 Meeting with partner from Albania to clarify questions on the influence of rock genesis to the coastal ribbon geology. Agreed that at next project meeting in Faroe Islands an Albanian study area will be presented by Sokol Marku to demonstrate the intricacies of land-sea connection
14.-16.03. 2023	Helsinki, Finland	1st GeoDays Conference	yes, oral presentation (Kotilainen et al. 2023), poster presentation (Vallius et al. 2023)	A	Dissemination of EMODnet Geology at 1st GeoDays Conference, > 100 participants
14.-15.03. 2023	Helsinki, Finland	VELMU Conference	yes, poster presentation (Vallius et al. 2023)	O	Dissemination of EMODnet Geology at 1st GeoDays Conference, > 100 participants
21.03.2023	Helsinki, Finland	Lecture, University of Helsinki, Department of Geosciences and Geography	yes Kotilainen Aarno: Aquatic Sedimentary Environments	A	EMODnet, EMODnet Geology and EMODnet Ingestion were introduced to students during the lecture, 10 students

20.-21.03. 2023	UNESCO Headquarters, Paris, France	IODC-II Conference	yes. On-line poster presentation Kaskela et al. 2023 Harmonising seabed substrate data of European Seas – EMODnet Geology	A	Dissemination of EMODnet Geology and WP3 at conference, ca 400 participants
22.-24.03. 2023	UNESCO Headquarters, Paris, France	27th Session of the IOC Committee on International Oceanographic Data and Information Exchange (IODE)	no	A	Participation by EMODnet Geology coordinator and deputy coordinator in 27th Session of the IOC Committee on International Oceanographic Data and Information Exchange (IODE)
24.03.2023	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. 20 participants
27.-28.03. 2023	Remote Zoom meeting	Open Sea Lab 3.0 EMODnet Hackathon	no	A	Two EMODnet Geology representatives guided four teams participating in the Hackathon.
03.04.2023	Remote, Teams-Meeting	EMODnet Geology Steering Group meeting	no	O	Discussions related to the progress of the project. 10 participants
04.-05.04. 2023	Hybrid meeting: Physical meeting in Brussels & online connection	13th EMODnet Technical Working Group Meeting	yes, Uffe Larsen gives an overview of the EMODnet Geology architecture	A	Discussions related to the progress of the project
18.04.2023	Remote Teams meeting	HE S34I project 1st. Progress Meeting	no	A	EMODnet Geology coordinator attending the kick-off meeting of HE S34I project as invited Advisory Board member representing EMODnet.
21.04.2023	Remote, Teams-Meeting	Internal EMODnet Geology/ GTK Meeting	no	O	Discussions related to Nord Stream 2 data delivery to EMODnet

24.-28.04. 2023	Wien, Austria	EGU 2023 Conference	yes, poster presentations. Session co-convener from EMODnet Geology WP4: "Geological Mapping of Extreme Environments" with several EMODnet Geology contributions.	A	Dissemination of EMODnet Geology at EGU 2023 Conference, > 10000 participants Asch et.al. https://doi.org/10.5194/egusphere-egu23-16050 Kihlman, et.al., https://doi.org/10.5194/egusphere-egu23-13602 (poster) Vallius, et.al. https://doi.org/10.5194/egusphere-egu23-10770 (poster) Erlendsson et.al. https://doi.org/10.5194/egusphere-egu23-15536
02.05.2023	Remote, Teams-Meeting	Internal EMODnet Geology WP3 /GTK Meeting	no	O	Discussions related to the progress of the project.
04.05.2023	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. 16 participants
05.06.2023	Remote, Teams-meeting	National/ Finnish seminar on Marine Wind Energy	yes, presentation "Offshore wind energy from a geological perspective" was given (Kihlman, S.)	A	Discussions related to the marine wind energy and Finnish marine areas & nature, ~230 participants
09.05.2023	Remote, Teams-meeting	Internal EMODnet Geology WP3 workshop	EMODnet Geology WP3 workshop on Seabed substrate Case study. yes. Simeon Archer-Rand (Cefas) had a presentation about the seabed substrate model of the Baltic Sea.	O	After the presentation, there was a free discussion on the topic, ~20 participants.

09.-11.05. 2023	Reunion Island and online	GeoHab 2023 conference	no	A	Meeting of marine scientists where discussions on hot topics and technical and methodological innovations take place. ca. 100 participants
10.05.2023	Remote, Teams-meeting	Internal GTK Environment Unit meeting	yes	A	Presentation of EMODnet Geology to GTK colleagues
23.-25.05. 2023	Tórshavn, the Faroe Islands	EMODnet Geology project meeting	yes, presentations by coordinator and all WP leads (11 presentations)	O	Discussions related to the progress and the future of the EMODnet Geology project. 60 participants
01.06.2023	On-line	Internal EMODnet Geology WP4 meeting	no	A	Discussion on data and updates of the Baltic Sea area
08.06.2023	Lammi, Finland	Geoscience Olympiad Coaching Camp	yes, lecture about Marine Geology (Kotilainen A.)	A	Dissemination of EMODnet Geology and EMODnet Ingestion at camp, 14 high school student participants
09.06.2023	Hybrid University of Limerick and Teams meeting	HE Trident project workshop "Assessing the environmental impacts from potential resources extraction"	no	A	EMODnet Geology coordinator attending the kick-off meeting of HE Trident project as invited Advisory Board member representing EMODnet.
16.06.2023	Remote Teams meeting	Meeting between EMODnet Geology and DG MARE	no	O/A	Discussions on EMODnet Geology past achievements and the future
26.06.2023	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. 15 participants
27.06.2023	Remote, Teams-meeting	Internal EMODnet 5 Geology WP3/ GTK Meeting	no	O	Discussion about the new way to process EMODnet WP3 erosion metadata at EGDI portal, 3 participants

14.-20.07. 2023	Rome University	XXI INQUA congress	yes (case study derived from WP6 data: updated structural map of Italian seas)	A	International Union for Quaternary Research congress. Dissemination of EMODnet Geology WP6 activity. 3000 participants
24.07.2023	On-line	EMODnet-GSEU meeting	yes	O/A	EMODnet-GSEU meeting on assessment of coastline change using satellite-based earth observation – comparing different approaches. 7 participants.
25.-27.7. 2023	Santo Domingo, the Dominican Republic and remote Zoom	Discussions between EMODnet Geology and the marine geology experts of the ASGMI (Asociación de Servicios de Geología y Minería Iberoamericanos)	yes, several. All EMODnet Geology WP leads presented their WP's and the Caribbean delegates their respective country information	O/A	Meeting between EMODnet Geology and Caribbean Sea marine geology experts from Mexico, Honduras, Guatemala, Costa Rica, Colombia, Cuba, and the Dominican Republic. 20 participants
01.08.2023	On-line	Online interview, EMODnet - GSEU	yes	A	EMODnet Feedback on GSEU's Work and Strategy – online interview with Kate Larkin on aligning these two initiatives. 5 participants
21.-25.08. 2023	Helsinki, Finland	Baltic Sea Science Congress 2023	yes, oral presentation and two poster presentations. In: Baltic Sea Science Congress 2023, 21-25, August 2023, Helsinki, Finland. The science we need for the Baltic Sea we want. Book of abstracts.	A	Scientific discussions on the state of the Baltic Sea and dissemination on how EMODnet can support the scientific community and society. Kotilainen, A. et al. EMODnet Ingestion – Wake Up Your Data. #181. (Oral). Kihlman, S et al. Review of the seabed surface feature information – EMODnet Geology. #136. (Poster). Vallius, H. et al. EMODnet Geology – towards new standards on harmonising marine geological data. #31. (Poster).
29.08.2023	Remote, Teams-Meeting	Internal EMODnet Geology GTK Meeting	no	O	Discussions related to the future of the EMODnet Geology project.
29.08.2023	Remote, Webex meeting	EMODnet Conference and Jamboree: Coordinators planning meeting	no	A	Discussions on EMODnet Jamboree and the EMODnet Open Conference to be held in November 2023.

04.09.2023	Remote, Teams-Meeting	EMODnet Geology Steering Group meeting	no	O	Discussions related to the future of the EMODnet Geology project. 8 participants
04.09.2023	Berlin	GeoBerlin2023 conference	yes, EMODnet Seabed minerals results and GSEU CRM	A	Over 300 participants. EU Constanze Veeh, DG GROW, European Commission was present with a talk on SRM and CRM
05.09.2023	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. 25 participants
07.09.2023	Remote, Google meeting	EMODnet Caribe – ASGMI meeting	no	O/A	Planning the cooperation between EMODnet Geology and the Caribbean Sea ASGMI members. 14 participants
13.09.2023	On-line	Internal WP 4 – WP 9	no	O/A	Discussion on how to solve technical issues to transfer the last updates of WP 4 on-line
13.09.2023	Remote, Webex meeting	EMODnet – DG MARE meeting "EMODnet: achievements & way forward"	no	A	Discussions on the future of EMODnet between all EMODnet thematic Coordinators and DG MARE
SUM				**O**	**Total # of meetings organised = 99**
SUM				**A**	**Total # of meetings attended = 83**

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
18.10.2023	Remote	14th EMODnet Technical Working Group meeting	A	Updates and progress since previous TWG and discussions related to the progress of the project
27.11.-01.12. 2023	Brussels, Belgium	EMODnet Jamboree & Open Conference	A	Project partner meeting, inter-thematic meetings and attendance in Open Conference
14.-19.4.2024	Vienna, Austria & Online	EGU 2024	A	The EGU General Assembly 2024 brings together geoscientists from all over the world to one meeting covering all disciplines of the Earth, planetary, and space sciences.
May 2024	Finland	Project meeting	O	Project partner meeting
25.-31.08.2024	Busan, South Korea	IGC 37 Congress	A (O)	An EMODnet Geology related session has been approved for the 37th International Geological Congress, 2024

8. Communication assets

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
15.02.2022	Oral presentation and abstract	Susanna Kihlman, Henry Vallius and EMODnet Geology partners, 2022. EMODNET Geology – harmonising geological data of the European seas and beyond.	Public dissemination	Oral (Remote) presentation at International Ocean Data Conference 2022, 15. February 2022. Sopot, Poland
23.03.2022	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
31.03.2022	On-line 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.
31.03.2022	On-line presentation	Kristine Asch (BGR): "EMODnet Geology Seafloor Geology and Geomorphology" Presentation about EMODnet Geology and WP Seafloor Geology, its methods and results	Presentation given and discussed	Oral presentation at EuroGeoSurveys Geological Mapping & Modelling Expert Group seminar on EMODnet Geology 31.3.2022, online event.
31.03.2022	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.
13.05.2022	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.
05.05.2022	Tweet by @EMODnet	#EMODnet Geology's pledge on #MakeEUBlue	3 retweets and 7 likes	Twitter
09.05.2022 16.05.2022	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
25.05.2022	Tweet by @EHU_Geo	Presenting results from WP5 coastal vulnerability at European Geophysical Union 2022 EGU2022.	3 retweets, 7 likes.	Twitter
08.06.2022	Tweet by @EuroGeoSurveys	World Oceans Day 2022 tweet featuring EMODnet-Geology.	4 retweets, 11 likes.	Twitter
31.01.2023	Web article	Aarno Kotilainen, Anna Laine-Petäjäkangas, Jukka Turunen, Tuija Vähäkuopus, Jaana Jarva. Geology for helping in mitigation and adaptation to climate change in land and marine areas (in Finnish).	Public dissemination	

		https://www.gtk.fi/ajankohtaista/geologiasta-apua-ilmastonmuutoksen-hillintaan-ja-ilmastonmuutokseen-varautumiseen-maa-ja-merialueilla/		
01.02.2023	Blog	Ulla Alanen, Aarno Kotilainen. Seabed Survey Lines – One Hundred Thousand Kilometres of Geology in the Baltic Sea. https://www.gtk.fi/en/current/seabed-survey-lines-one-hundred-thousand-kilometres-of-geology-in-the-baltic-sea/	Public dissemination	
15.03.2023	Oral presentation and abstract	Kotilainen, A.T., Kaskela, A.M., Kihlman, S., Leinikki, J., Kotilainen, M.M., 2023. Shaking the Earth beneath the sea – a case study from the Baltic Sea. In: Heinonen, J.S. (ed.) (2023) Abstracts of the 1st GeoDays, 14th-17th March, Helsinki, Finland. Proceedings of the Geological Society of Finland, vol. 3, p. 20. (Oral).	Public dissemination	Oral presentation at 1st GeoDays Conference, 14th 17th March 2023, Helsinki, Finland
15.03.2023	Poster and abstract	Vallius, H., Kihlman, S., Kaskela, A.M., Alanen, U., Kotilainen, A.T., and EMODnet Geology partners, 2023. EMODnet Geology – seabed geological data for the sustainable use of world ocean. In: Heinonen, J.S. (ed.) (2023) Abstracts of the 1st GeoDays, 14th-17th March, Helsinki, Finland. Proceedings of the Geological Society of Finland, vol. 3, p. 49. (Poster).	Public dissemination	Poster presentation at 1st GeoDays Conference, 14th 17th March 2023, Helsinki, Finland
14.-15. 2023	Poster	EMODnet Geology poster	Public dissemination	VELMU Conference – Bringing Marine Nature Back to our lives – The role of science. Helsinki, Finland
20.-21.03. 2023	Poster and abstract	Kaskela, A.M., Kihlman, S.,Kotilainen, A.T., Alanen, U., Vallius, H. & EMODnet Geology partners Harmonising seabed substrate data of European Seas – EMODnet Geology	Public dissemination	IODC-II, The Second International Ocean Data Conference at Unesco Headquarters in Paris, France, Paris
23.03.2023	Post by @EMODnet Geology coordinator	Post on EMODnet Geology attending the 27th session of IOC/IODE at UNESCO HQ in Paris 22-24.3.2023.	22 likes. 911 impressions by September 20th 2023	Post on LinkedIn
26.04.2023	Poster presentation and abstract	Kihlman, S., Kaskela, A., Kotilainen, A., Alanen, U., Vallius, H., and Partners, E. G.: Analysing the added value of surface features information in the Seabed substrate data from the European sea areas – EMODnet Geology, EGU General Assembly 2023, Vienna, Austria, 24–28 Apr 2023, EGU23-13602, https://doi.org/10.5194/egusphere-egu23-13602, 2023.	Public dissemination	EGU 2023
26.04.2023	Poster presentation and abstract	Vallius, H., Kihlman, S., Kaskela, A., Kotilainen, A., Alanen, U., and Geology Partners, E.: EMODnet Geology – towards new standards on harmonizing marine geological data of the European seas – and beyond, EGU General Assembly 2023, Vienna, Austria, 24–28 Apr 2023, EGU23-10770,	Public dissemination	EGU 2023

		https://doi.org/10.5194/egusphere-egu23-10770, 2023.		
22.08.2023	Poster presentation and abstract	Vallius, H., Kihlman, S., Kaskela, A., Kotilainen, A., Alanen, U., 2023. EMODnet Geology – towards new standards on harmonizing marine geological data. In: Baltic Sea Science Congress 2023, 21-25, August 2023, Helsinki, Finland. The science we need for the Baltic Sea we want. Book of abstracts. 31. (Poster).	Public dissemination	Poster presentation at the BSSC 2023 Congress in Helsinki, Finland
23.08.2023	Poster presentation and abstract	Kihlman, S., Kaskela, A., Kotilainen, A., Alanen, U., Vallius, H., 2023. Review of the seabed surface feature information – EMODnet Geology. In: Baltic Sea Science Congress 2023, 21-25, August 2023, Helsinki, Finland. The science we need for the Baltic Sea we want. Book of abstracts. 136. (Poster).	Public dissemination	Poster presentation at the BSSC 2023 Congress in Helsinki, Finland
25.08.2023	Oral presentation and abstract	Kotilainen, A., Alanen, U., Tikka, K., 2023. EMODnet Ingestion – Wake Up Your Data. In: Baltic Sea Science Congress 2023, 21-25, August 2023, Helsinki, Finland. The science we need for the Baltic Sea we want. Book of abstracts. 181. (Oral).	Public dissemination	Oral presentation at the BSSC 2023 Congress in Helsinki, Finland
2023	BGR Annual Report 2022	Gemeinsame Karten zur Geologie von Europas Meeresböden (Joint maps of Europe's seafloor) Contains information on EMODnet Geology, the work package Seafloor geology (WP 4), it's results and the role of BGR	Dissemination of information on EMODnet, EMODnet Geology and the role of BGR	
04.09.2023	Poster	EMODnet Geology WP7 poster produced.	Outreach (poster) material of all partners at disposal	GeoBerlin2023
28.07.2023	Post by EMODnet @Geology coordinator	Post on EMODnet Geology meeting with Caribbean Sea marine geology experts at Servicio Geologico Nacional in Santo Domingo.	27 likes. 1120 impressions by September 20th 2023	Post on LinkedIn

B. Planned communication products			
Date	Communication material	Short description (of the material, title, …) and/or link to the asset	Main results expected

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
November 2021	Marine Pollution Bulletin	Chernobyl still with us: 137Caesium activity contents in seabed sediments from the Gulf of Bothnia, northern Baltic Sea. Marine Pollution Bulletin. 172. https://doi.org/10.1016/j.marpolbul.2021.112924		https://doi.org/10.1016/j.marpolbul.2021.112924	Yes
27.11.2021	paper	Breuer, S. & Asch, K. (2021) A first approach to a Geomorphological Map of the German Seas. In Asch, K., Kitazato, H & Vallius, H. From Continental Shelf to Slope - Mapping the Oceanic Realm. Geological Society of London Special Issue: GSLSpecPub2021-24		https://doi.org/10.1144/SP505-2021-2	no
July 2022	Journal article	Hollis, J., Bricker, S., Čápová, D., Hinsby, K., Krenmayr, H.G., Negrel, P., Oliveira, D., Pouiadji, E., van Gessel, S., van Heteren, S., Venvik, G. "Pan-European geological data, information, and knowledge for a resilient, sustainable, and collaborative future." European Geologist 53 (2022): 6-19.	-	10.5281/zenodo.6883282	Yes: Pan-European geological data, information, and knowledge for a resilient, sustainable, and collaborative future (researchgate.net)
09.2022	Book	Geological Society of London Special Issue: From Continental Shelf to Slope: Mapping the Ocean Realm	9781786204950		partly
08.2022	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		No
2022	paper	Asch.K., Kitazato, H. and Vallius, H. (2022): Introduction to the Geological Society of London		https://doi.org/10.1144/SP505-2022-	yes

		Special Issue: From Continental Shelf to Slope: Mapping the Ocean Realm			
April 2023	conference abstract	Asch, K., Müller, A.M. & Blischke, A. (2023): Marine mapping: Finding and compiling spatial data on extreme environments – key information even for a general mapping project such as EMODnet Geology		https://doi.org/10.5194/egusphere-egu23-1605	y
April 2023	conference abstract	Vallius, H. et. Al. (2023): EMODnet Geology – towards new standards on harmonizing marine geological data of the European Seas and beyond		https://doi.org/10.5194/egusphere-egu23-1077	y
April 2023	conference abstract	Erlenddsson, O. et al (2023: The Geological Mapping of Icealand's Insular Shelf and Adjacent Deep Ocean		https://doi.org/10.5194/egusphere-egu23-15536	y
Sept.2023	Conference abstract for 175th anniversary Meeting of the German Geological Society (Geoberlin)	Seafloor geology and the European EMODnet data infrastructure: The challenge of integrating off-shore data across EEZ boundaries (Asch, K.)			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
13.12.2021	Conference Publications of the International Cartographic Association	Fiorentino, A., Battaglini, L., Conti, M., D'Angelo, S. and Innocenti, C.: EMODnet Geology: digital geological maps of European seas, Abstr. Int. Cartogr. Assoc., 3, 80		https://doi.org/10.5194/ica-abs-3-80-2021, 2021	Yes
13.12.2021	Conference Publications of the International Cartographic Association	Battaglini, L. and Carta, R.: CARG Geological Database: new layers, new data, Abstr. Int. Cartogr. Assoc., 3, 24,		https://doi.org/10.5194/ica-abs-3-24-2021, 2021	Yes
2022	GSL Special Issues (Book)	Asch.K., Kitazato, H. and Vallius, H. (2022): Introduction to the Geological Society of London Special Issue: From Continental Shelf to Slope: Mapping the Ocean Realm		https://doi.org/10.1144/SP505-2022-	Yes
08.06.2022	The Prime Minister's Office's publication (Finland)	Prime Minister's Office, 2022. National Implementation Plan for the UN Decade of Ocean Science (in Finnish). 25 pages. https://urn.fi/URN:ISBN:978-952-383-122-3 The Actions include developing uniformity and usability of marine data flows, where key areas include e.g., cooperation between EMODnet	978-952-383-122-3		Yes
12.-17.06. 2022	Poster presentation and abstract	Pensa A., Giordano G., Pinton A., Fiorentino, A., D'Angelo, S., Vita L., Bonamico A. and De Benedetti A.A.: Atlas of Italian Submarine Volcanic Structures			N/A
March 27	Invited keynote presentation	Moses, C., 2023, Weathering the storm: rock coast resilience and vulnerability, Annual Conference of the Engineering Group of the Geological Society at Cambridge University			N/A

April 2023	Conference abstract	Asch, K., Müller, A.M. & Blischke, A. (2023): Marine mapping: Finding and compiling spatial data on extreme environments – key information even for a general mapping project such as EMODnet Geology		https://doi.org/10.5194/egusphere-egu23-1605	y
April 2023	Conference abstract	Vallius, H. et. Al (2023): EMODnet Geology – towards new standards on harmonizing marine geological data of the European Seas and beyond		https://doi.org/10.5194/egusphere-egu23-1077	y
April 2023	Conference abstract	Erlenddsson, O. et al (2023: The Geological Mapping of Icealand's Insular Shelf and Adjacent Deep Ocean		https://doi.org/10.5194/egusphere-egu23-15536	y
14.-20.07. 2023	Poster presentation and abstract	Fiorentino A., Agate M., Battaglini L., Del Ben A., Busetti M., Civile D., Conti M., Crispini L., Dal Cin M., D'Angelo S., Ferrante V., Frisicchio V., Frugoni F., Giordano G., Locatelli M., Loreto M.F., Morelli D., Orefice S., Palmiotto C., Pantaloni M., Papasodaro F., Pensa A., Sgroi T., Sulli A., Vita L., Volpi V.: The process of update of the structural map of Italian seas			N/A
14.-20.07. 2023	Poster presentation and abstract	Fiorentino A., Agate M., Battaglini L., Del Ben A., Busetti M., Civile D., Conti M., Crispini L., Dal Cin M., D'Angelo S., Ferrante V., Frisicchio V., Frugoni F., Giordano G., Locatelli M., Loreto M.F., Morelli D., Orefice S., Palmiotto C., Pantaloni M., Papasodaro F., Pensa A., Sgroi T., Sulli A., Vita L., Volpi V.: The process of update of the structural map of Italian seas			N/A
Sept. 2023	Conference abstract for 175th anniversary Meeting of the German Geological Society (Geoberlin)	Seafloor geology and the European EMODnet data infrastructure: The challenge of integrating off-shore data across EEZ boundaries (Asch, K.)			

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

9. Monitoring indicators

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	**ArcGIS**	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). Please note that our data products are updated regularly due to data improvements, these qualitative updates do not necessarily show as an increased data coverage. The latest seabed substrate data update (24.9.23) includes four 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 50 % of the Geology Regions (incl. the Caribbean), data at scale 250 k covers about 10 % and more detailed scales cover less than 5 %. Due to the inclusion of the Caribbean, the total coverage of the region has expanded. Therefore, the total coverage% in the 1: 1 000 000 scale data, where we have full-coverage data for the Caribbean, has increased and the total coverage% at other scales have decreased. The coverages by sea-basin are indicated in the excel file (Indicator 2). Please notice that in the excel file we have only included seabed substrate data that has extended to new areas. The latest Sea-floor Geology update (24.9.23) includes four data products. The Pre-Quaternary Geology data covers about 90 % of the project sea areas. Quaternary Geology data covers from about 27 % of the project area. Geomorphology data covers altogether about 9 % of the Geology regions. General physiographic features cover about 43 % of the sea areas. Please notice that the

		Caribbean Sea has been considered when calculating these figures. Consequently, the total project area has expanded, and, in some cases, the data coverage percentages have decreased.
B) Usage of data products since the start of the project phase		With the exception of the sedimentation rates usage of the services has doubled or more in this phase
3. Internal and external organisations supplying/approached to supply data and data products since start of the project phase		One new data provider in the Consortium, Caspian Locus Limited Liability Company.
4. Online 'Web' interfaces to access or view data		We have created layer groups to comply to the requirement about reduction of layers. This means that we cannot provide interfaces for each sub-theme
6. Statistics on information volunteered through download forms		After the launch of the Central Portal the collection of organisation types and use stopped. Due to GDPR we have never registered place of origin and we do not have information about the country from which the download initiated
7. Published use cases		There are no data from the previous period - so we cannot comment on trends
9. Technical monitoring		Satisfactory both response time and up-time. Note that this statistic stops at the time the Central Portal was launched (January 2023)
10. Visibility & Analytics for web pages		The usage has been fairly constant through the years. There generally is a small dip in usage in the third quarter due to summer vacation
11. Visibility & Analytics for web sections		The usage has been fairly constant through the years. There generally is a small dip in usage in the third quarter due to summer vacation
12. Average visit duration for web pages		There is a lot of fluctuation but no general trend
5.1 NEW. Daily number of page views of EMODnet Thematic entry page since the start of the contract		The peak in May corresponds to the meeting for all EMODnet Geology partners the 23-25 May. The numbers are lower in the summer period due to holidays.
5.2 NEW. Total number of visitors, page views, unique page views and percentage of returning visitors, since the start of the contract		We have received statistics that covers the hole period 1. January 2023 to 11. September 2023. We are not able to compare the last month of the contract with the first month after the centralisation.

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

EMODnet Geology has been actively considering how the project should develop (~10 years horizon). These ideas for the future are presented in a document that was distributed to DG MARE and CINEA on 6th April 2023. Also, there was an online discussion with DG MARE on 16th June 2023.

In addition, there are few things that we recommend taking under consideration in future:

- The dedicated website of the EEA on sediment discharges from European rivers has been discontinued in March 2023 and this argues for a sustainable FAIR place to find them similar to other geological databases. (River discharge data are very important in sediment balance calculations).
- Collecting data on sand provenance, tectonic provinces linked to faults, magnetometry and gravimetry could be essential, especially for data-poor regions like Caribbean Sea area.

11. Annex: Other documentation attached