



NOOS

EuroGOOS North West European Shelf
Operational Oceanographic System

NOOS

— Strategy 2030





Chair's FOREWORD

The unveiling of the **NOOS 2030 Strategy** marks a decisive moment in the history of operational oceanography in North-Western continental Shelf seas (NWS). For the first time since 2002, the NOOS community has carried out a global reflection and dared to redefine its role and ambition in a continuously more centralised European Ocean Observing landscape, where a select few exert considerable influence.

We recognize the merits of pan-European initiatives such as **EMODnet**, **CMEMS**, **EDITO**, and **JERICO-RI**, and applaud the dedication of numerous NOOS members who contribute individually. Nevertheless, we acknowledge the gradual shift that has diminished the prominence of **EuroGOOS Regional Operational Oceanographic Systems** -including NOOS- within these initiatives, even as we continue our unwavering commitment to their success. We call upon the EuroGOOS Board to heed this shift as they shape the future.

Looking ahead, we are resolute in our commitment to an inclusive approach, a cornerstone that has defined NOOS since its inception. Amidst a proliferation of networks, working groups and task teams, NOOS remains the singular network that unites government agencies, research centres, and universities from the nine countries bordering the NWS. Together, we form a cohesive unit, uniting key national agencies and institutes to gather observations, run models, generate forecasts, services, and information that drive industries, inform the public, and empower end users.

While each component serves distinct purposes, together they converge to address vital NWS management themes—ranging from sustainable fish stock exploitation to public safety, from navigational efficiency to the preservation of thriving marine ecosystems, even extending to essential marine climate services.

The **NOOS 2030 Strategy** encapsulates our collective response to region-specific challenges, including the impacts on hydrodynamics brought by the widespread deployment of renewable energy platforms in the North Sea. Our collaborative spirit fuels a continuous exchange of ideas, the birth of innovations, and the discovery of solutions. Capitalising on our respective national strengths, we co-develop and co-operate pioneering community products and services, exemplified by the NOOS marine data portal, the operational storm surge Bayesian Model Averaging (BMA) product, and a suite of multi-model ensemble analysis tools.

As the pages of the NOOS 2030 Strategy unfold, it's imperative to reflect on the journey that has propelled us here—a voyage marked by dedication, unity, and resilience. With NOOS 2030 Strategy as our guide, we'll embrace limitless possibilities.

Warm regards,



Dr. Sébastien Legrand
NOOS Chair

30 August 2023

Working groups are established and closed down as appropriate, following a work plan laid out primarily by the group leader but always up for debate. A working group may be permanent, with the aim of establishing a sustained service or aimed at knowledge development, it may be temporary, with fixed goals to be obtained and closing down when those are achieved, or in sleeping mode, waiting for resources to be allocated.

NOOS is organised to have an annual meeting, including a workshop, a progress report presentation by each working group (usually presented by the group leader), and a formal business meeting. In connection with the meeting, each partnering institute is encouraged to work out a small report of

the accomplishments during the year that was. The material is published through the NOOS website, noos.eurogoos.eu. The annual meeting is open to any number of delegates from member institutes, within manageable bounds. Institutes take turns hosting meetings. In recent years (2020-) online or hybrid meetings have become more feasible and are widely used by the working groups.

NOOS appoints a **Steering Group** to **deliver and stimulate the implementation of a NOOS strategy**, to **support its members in taking actions**, and to **represent NOOS in a number of networks**. NOOS has established ambassadors, who form a link between NOOS and EuroGOOS working groups.

20+
members
from
9
countries



Executive SUMMARY

NOOS is a regional collaboration forum concerned with the European North West Shelf Seas marine physics and health. NOOS consists of partner institutes who:

Facilitate seamless on-line sharing of marine data

Combine model data into a common forecast product

Promote sharing of methods and technical advances

01 NOOS focuses on **building operational services**, without expiry date

NOOS partners have signed a **Memorandum of Understanding**, laying out guidelines for collaboration. Other than that, no formal obligations exist

02

03 NOOS is one of five regional operational oceanographic systems **supported by EuroGOOS**

The principal NOOS information channel is through the website <https://noos.eurogoos.eu>

04

05 This NOOS strategy aims to state **NOOS vision and mission** and give direction for the coming years to the cooperation

North West European Shelf Operational Oceanographic System – NOOS

Fit-for-purpose, integrated operational oceanography enables us to predict, monitor and manage our ocean, underpinning relevant decisions and policymaking in the marine domain

NOOS is a regional collaboration network organised under the umbrella of EuroGOOS, with **focus on describing and forecasting the past, present and near-future state of the European North West Shelf Seas (NWS)**. Since its foundation in 2002 centred around the subject of operational physical oceanography including observations and modelling, NOOS has gradually expanded into closely related topics, such as marine ecology, marine plastics and offshore renewable energy where work interests and/or obligations of network members overlap or have developed.

NOOS consists of **more than 20 member institutes** (partners) from the nine countries bordering the **North West Shelf Seas (NWS)**, covering the **Greater North Sea**, the **Celtic Seas**, **Irish Sea**, **North Atlantic** and the **Faroes**. All relevant institutions from these countries, having this shallow water body or part of it as a field of work, may apply to join and become a partner by signing a mutual agreement (MoU). A list of NOOS members can be found at the end of this document.

NOOS is based on collaborative efforts of governmental agencies, research centres and Universities with no commercial interest or direct funding. Each partner allocates resources as seen fit, under the assumption that the associated marine service or research for which said partner is responsible in return benefits from the network. This pool of manpower and scientific skill constitutes our resources and NOOS relies on the delegation of work on a volunteer basis, with no authority over its members.

The NOOS activities take place in a number of ongoing thematic working groups, each managed by a group leader and oversighted by the **NOOS Steering Group**. Working groups provide a forum for cooperation and knowledge on best practices, unlock marine data, advance modelling and forecasting capabilities, and deliver common strategies/priorities and standards for an integrated sustainable and fit-for-purpose NWS operational oceanographic systems.



“

NOOS overlaps geographically and partner wise (double membership) with similar regional networks (ROOS) of the European Atlantic coast (IBI ROOS), the Arctic (Arctic ROOS), and the Baltic Sea (BOOS)

VISION

— **To establish and sustain** ocean observing systems and operational oceanography services that benefit the European society

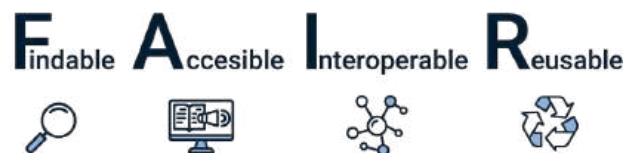
NOOS is, through its members, concerned with the safety for people, property and goods at sea and at the coast. The sustainable use of the sea, e.g. for traffic, exploitation, coastal development and leisure is important to us. NOOS aspires to be the backbone in operational oceanography in the NWS area, increasing insight into processes of the sea for preservation and preparedness for future development, and connecting regions and national services.

NOOS stimulates the continuous development process for improved monitoring and forecast services for waves, surge, coastal flooding, substance spreading and object tracking including search-and-rescue, counter pollution, sea-temperature, and ecosystem health for the NWS region. NOOS acts as a forum for innovation, and facilitates partners and agencies in carrying out the process.

NOOS acknowledges the diversity of its members, who engage in common activities on a best endeavour basis. The diversity and the heterogeneity of members' national operational oceanographic systems enable us to learn from each other and work towards our goals. The sharing of expertise and best practices builds a strong foundation for providing knowledge based advice for policy makers and facilitate fruitful collaborations within the NOOS community and other partners.

NOOS fully underlines the principle of **FAIR data management policy** and aims to support its members in the ambition to follow these principles in data management implementation.

NOOS participates in established and emerging European networks and will continue to support the EuroGOOS mission and strategy.



MISSION

— **To cooperate** in the development and implementation of sustained and coordinated operational oceanography across the North West European Shelf region

The NOOS mission is to build and support systems that complement and supplement national level data dissemination, information and downstream services relying on Copernicus Marine Core services and NOOS member services in synergy with European Research Infrastructures. We aim to increase cooperation on marine monitoring and modelling, and develop, implement and maintain online operational marine data and information services.

These services provide a reliable description of the actual marine condition of the European North West Shelf Seas (NWS), including physical, sedimentological, and ecosystem variables. We establish a marine database from which statistical analyses can be obtained to study trends and changes in the marine environment, and evaluate impacts in economic, environmental, and social areas.

We develop best practices for use of our combined and individual assets (observations, models, knowledge, staff), and encourage and demonstrate the value of an 'open science' approach to research-into-operations development of systems for monitoring and forecasting the oceanography of the NWS.

We collaborate with national and multinational agencies in the NWS area to maximise the efficiency of the ocean observing system, and to optimise the value of the marine information products. NOOS acts as a voice within EuroGOOS national programmes to propose and evaluate a coordinated observations programme for the NWS region and to influence national and European developments in the area of operational oceanography. We support the Copernicus Marine Services (CMEMS).



NOOS 2030

– Objectives

To achieve our **Mission 2030**, four strategic objectives are defined. These were developed by reflecting on experiences gained through the implementation of past NOOS strategies, as well as surveys and discussion sessions with NOOS members. This strategy aims to follow the principle structure of the **EuroGOOS strategy**, while focussing on the specific needs and ambitions of NOOS.

1. Cooperate as NOOS community of experts

2. Improve operational oceanographic data and information services

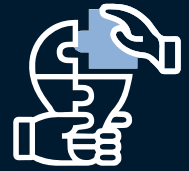
3. Build NOOS community products and services

4. Support European partners and networks

These four objectives are closely connected to the **EuroGOOS 2030 Strategy** and contribute to the implementation of several EuroGOOS objectives in the **NOOS region**.

1. Cooperate as NOOS community of experts

NOOS aims to promote emerging services in operational marine ecology, climate scale, and the sharing of best practices in national services.



Knowledge exchange is at the very heart of NOOS. Sharing knowledge and information from partners is relevant and beneficial, even if collaboration is not immediately on the agenda. This is how new ideas emerge and new projects start up. Many fruitful discussions between NOOS experts over the last 20 years built the foundation of the community.

We will give special attention to early career scientists in our organisations for NOOS, so that the younger generation will experience the benefits of this cooperation and carry on the responsibility for it.

In general, it takes at least two and preferably three partners with a vested interest in a subject before it becomes a natural field of work within NOOS. Otherwise, a common effort is either not required or not attainable, and any project associated with the topic in question will probably not develop into a working group but remain at the information sharing stage.

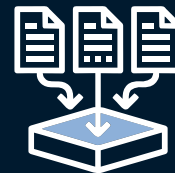
Focus activities in this objective are to:

- Encourage sharing knowledge and information on recent developments
- Encourage the cross-coordination and co-development of new ideas and suggestion for working groups
- Stimulate in-depth face-to-face meetings between partners to feedback on current practises
- Identifying key-experts for different topics and links to relevant sources of information
- Initialise knowledge development on topics of interest
- Work FAIR-DATA principles out in our work and share experiences on this
- Create Living Documents on the themes of the working groups as easy reference source

The main venue for this is the NOOS annual meeting, to a growing extent supplemented by online group meetings.



2. Improve operational oceanographic data and information services



NOOS aims to continue developing state-of-the-art operational oceanographic data services and to play a major role in future information services.

The utilisation of marine data has an unfulfilled potential in two areas: **optimisation of service**, and **building derived products designed for specific requirements**, which includes a tighter connection with (potential) stakeholders.

NOOS has been developing data and information services over the years, supporting operational forecasting and model development of the real-time exchange of measurements and simulation of water levels, tides, waves and other relevant parameters and the exchange of operational forecast ensembles for enhancing forecast capacities

The objective is to continue with these services and also to embrace new focus areas of knowledge development over the next years. NOOS members have identified the following areas of interest for possible services:

- Services suitable for climate adaptation and mitigation, coastal defence strategies
- Services suitable for offshore renewable energy (working group established 2022)
- Services suitable for marine ecology (ocean health)
- Atmospheric Boundary Layer topic (open questions on air-sea coupling physics)

The objective is to establish a concerted effort of some duration, including the exchange and/or establishment of:

- Methods applied in quality assurance of observational data
- Methods and routines applied in model validation
- A NOOS case study catalogue of extreme events of various kinds (wave, heat, sea level), and dispersion of spills and drifting objects

- A living catalogue of ocean observation technologies implemented by the NOOS members
- Methods applied in marine ensemble modelling, including interpretation, presentation, and dissemination of results
- Data-driven methods, either based on data assimilation in high resolution coastal models or in machine learning applications
- Assess the potential for and potentially build a NOOS wave multi model ensemble
- Collaboration on, or at least, overview of efforts within marine biogeochemistry, observational, modelling, and relation to river loadings

We aim to ensure that efforts resulting in a NOOS product are sustained (without expiry date), **document methods and information channels are sustainable** for the future, and **covered by support and maintenance**. We want to establish an overview of industry partners and clients and work towards harmonisation of operational products, in order to facilitate both internal and outgoing cooperation. The participation in EU-projects to create a strong network on knowledge and provide funding of operational services should be increased.

3. Build NOOS community products and services



NOOS is the focal point for all partners to cooperate on operational services, to help each other with community products and to exchange knowledge on all relevant topics.

NOOS appreciates any service as a contribution to a cross-national pool of data, and facilitates the merging into common “multi-model”, or “multi-service” ensemble products, which may be promoted to the public, directly and/or through interpretation by each national service. The variety of methods applied and data sources used gives an additional uncertainty estimate of the service provided, acknowledging that all models have strengths and weaknesses. In this way, NOOS supplements or counterbalances the Copernicus approach of one ground truth, represented by one selected “best” model.

To facilitate this approach, **the collaboration aims to harmonise data formats, and to increase product quality in general through best practice definition and sharing.** We consider this one of the main benefits of the NOOS approach.

Main activities are:

- To provide analysis, forecasts, and model-based products describing the marine condition of the North West European Shelf area at kilometre scale or finer
- To provide long term high quality observations required to advance scientific understanding of the NWS area
- To provide insight into the variability across models
- Find pathways to include industry in NOOS, and links to industry partners. Help to enlarge the community of end users for operational oceanographic products

NOOS has established already a number of community products and services:

- Our main NOOS-Data portal at noosportal.bsh.de
- A distributed, fully operational **Multi-Model Ensemble Forecast System** (MME), built as a superstructure upon

national services. This implies an internal, operational marine forecast distribution system

- **Real-time water level forecast exchange** and a **NOOS poor-man’s ensemble forecast** based on BMA-methods for main tide gauge stations in the NWS area

We have and will document said superstructure leading from national services to multi-service, including communication gateways and the ensemble method applied. Further, the quality of such an ensemble system forecast by regular verification efforts is to be documented. We intend to expand the system into any marine parameter, basic physical (such as wave forecasts) or bio-geochemical, or derived, regarded as sufficiently important to merit a concerted effort as described. To ensure functional stability of the ensemble effort, and sustainability in the sense that the effort has no expiry date, efforts are needed by the whole **NOOS community**. We aim to harmonise and share experiences with other ROOS'es, in particular **BOOS** and **IBI ROOS**.

4. Support European partners and networks



NOOS is a reliable and pro-active partner in European networks and supports all main EU initiatives with various contributions.

NOOS supports European partners and networks with its well established partnership and cooperation, and by common (gathered, unified) products and services. The cooperation with national agencies and multi-national organisations in the NWS region has the goal to maximise value of information products, improve the efficiency of the ocean observing system, and facilitate access to both. The NOOS services and products supplement European services like CMEMS, the Copernicus Maritime Surveillance service by EMSA and others. From the regulatory perspective in the NWS region (of OSPAR, MFSD, MSP, ICES) NOOS supports as an adviser, with its existing data and products and its closely connected community that is responsive to emerging questions from these bodies.



NOOS is an active ROOS within EuroGOOS, with members involved in EuroGOOS Task Teams and Working Groups. These experts act as ambassadors, ensuring a two-way update on new developments and initiatives.

Co-operation is close with neighbouring ROOSes (**BOOS**, **IBI ROOS**, **Arctic ROOS**) in overlapping scientific questions, technical solutions, and geographical interests.



NOOS maintains a close connection with the GOOS National Focal Points from the NWS countries. In most countries, the GOOS National Focal Point is commonly a NOOS member delegate.

The GOOS national focal points are key persons appointed by their countries. They work at national levels towards implementation of the GOOS strategic goals. They develop a national hub for the coordination of integrated ocean observing across disciplines and sectors, with representatives of national ocean observing programmes or systems, across open ocean, coastal, physical, biogeochemical, and biological realms. They advocate for national investment in sustained ocean observing systems and promote nationally and/or regionally coordinated strategies and implementation for a operational ocean observing system delivering the needed information to users.



The European Ocean Observing System (EOOS) is a coordinating umbrella that integrates all the communities and organisations operating, supporting and maintaining ocean observing infrastructures and activities. Its activities are coordinated by a steering committee, an operations committee, a funding committee and an advisory committee.

NOOS and GOOS NFPs are members of the EOOS operations committee.



The NOOS data exchange was initiated 2002 and has emerged with a robust infrastructure for later services like the Copernicus Marine Service (CMEMS) to build upon. In particular, the CMEMS in situ data TAC focusing on near real-time data service is fully aligned with the operational approach of NOOS. CMEMS members from the North-West Shelf

4. Support European partners and networks



NOOS is a reliable and pro-active partner in European networks and supports all main EU initiatives with various contributions.

INSITU TAC (Thematic Assembly Center) participate in NOOS annual meetings / general assembly to address questions and problems directly.

NOOS also actively contributed to the development of the CMEMS NWS-MFC. After an unilateral decision of the CMEMS entrusted entity, CMEMS will temporarily or definitively stop operating an independent NWS-MFC at the end of 2023. NOOS shall pay a particular attention to the future of this MFC.



CMEMS and EMODnet Physics have formalised their cooperation to avoid double efforts regarding the regional data supplier. Of the seven thematic portals of EMODnet, NOOS is mainly involved in the physical one. NOOS-Data provided to CMEMS is harvested regularly by EMODnet Physics. There is an emerging demand for biogeochemical and river discharge data. NOOS aspires to have a more focused effort on this topic.



Model studies and field observation made by NOOS partners suggest that the on-going massive development of the offshore renewable energy sector in the North Sea induces locally and remotely changes in the wind and current pattern, stratification, turbidity, front structures, and primary production. All these impacts have to be monitored, assessed and reported in the framework of the 7th descriptor of the Marine Strategy Framework Directive.

OSPAR is working on the establishment of an ICG-MSFD D7 in the framework of which NOOS experts and national MSFD-D7 assessors shall collaborate.

European and Pan-european projects and initiatives

Many NOOS member agencies are actively involved in European projects and Programmes, such as **Jericoo-S3**, **Jerico-DS**, **NEA PANACEA**, **E-MSP**, **SEAMLESS**, **Lighthouses**, **EuroSea** and **EDITO-infra** (Digital Twin of the Ocean). These members are systematically invited to share the main project outcomes with the NOOS community and/or suggest new activities to capitalise on these projects' legacy in the NWS.

However, as a NOOS entity itself we do not participate at the moment in European projects. For the future it is our ambition to create a strong network on knowledge and operational services by jointly participating in EU-projects.

Implementing the Strategy

Implementing our strategy is done in different ways. There is no direct finance for the work done within the NOOS community. All efforts rely on the possibilities and willingness of NOOS members to take steps on their own account.

To ensure progress towards the strategy goals, there are some cornerstone of our **NOOS activities** that support the implementation process:

- We aim to have at any time an up-to date strategy, preferable with a 10-year horizon. Responsibility for that lies with the steering group (SG) of NOOS
- The SG should update the strategy every 5 years, including a progress report of what was achieved, what was not, and what is underway
- At the forum of the Annual Meeting, a one-year work plan is agreed upon
- Working Groups may outline a work plan spanning several years as seen fit (for projects e.g.)

In the implementation process we can define different phases. The more concrete **implementation actions are detailed in yearly working plans.**

- The first phase concerns existing products/ services, also called maintenance phase. This phase includes providing monitoring and forecasting products such as BMA and MME, as enrichment to individual model results. Also the continuation of standard community activities such as the annual meetings or stimulating the connection to EuroGOOS and partner organisations will be continued and maintained in the future.

- Some implementation activities have already started and need to be continued to reach a mature level. Examples are knowledge development around planning and effects of wind farms (new WG), the use of (Copernicus) satellite data by developing downstream services, the establishment of efficient communication with communities active in BCG modelling and climate activities, and the promotion and coordination of EU projects in which NOOS members work together.
- The third phase is the planning phase, this includes activities that are planned but still need to start up. For example, as mentioned in our objectives, the NOOS community plans to expand observation and forecast services and create operational bio-geo-chemical modelling services. In the same way NOOS would like to establish a BMA forecast product for wave forecasts and enhance attention on drift modelling. More insight into the operational impact and adaptation of climate change on the NWS area should be addressed, new technologies need to be picked up by NOOS. Unfortunately, in many cases missing funding and capacity is limiting the speed to bring our ideas and plan into action.

NOOS

— members

Belgium

- Agency for Maritime and Coastal Services (MDK)
- Royal Belgian Institute of Natural Sciences (RBINS)

Denmark

- Danish Meteorological Institute (DMI)
- Joint GEOMETOC Support Centre

France

- Ifremer
- Service Hydrographique et Oceanographique de la Marine (SHOM)

Germany

- Federal Maritime and Hydrographic Agency (BSH)
- Helmholtz-Zentrum Hereon GmbH
- University of Oldenburg – UNI-Oldenburg

Ireland

- Marine Institute (MI)
- Met Eireann

Netherlands

- Rijkswaterstaat, Ministry of Infrastructure and Water Management (RWS)
- National Institute for Coastal and Marine Management – Deltares
- Koninklijk Nederlands Meteorologisch Instituut (KNMI)

Norway

- Norwegian Institute for Water Research (NIVA)
- Institute of Marine Research (IMR)
- Norwegian Meteorological Institute (MET Norway)
- Nansen Environmental and Remote Sensing Center (NERSC)
- Norwegian Research Centre (NORCE)

Sweden

- Swedish Meteorological and Hydrological Institute (SMHI)

United Kingdom

- Centre for Environment, Fisheries and Aquaculture Science (Cefas)
- National Oceanography Centre (NOC)
- UK Met Office
- Plymouth Marine Laboratory (PML)

NOOS

— working groups

NOOS working groups are the backbone of the NOOS cooperation. Currently, there are seven working groups:

1. Water level, tide and waves



2. Multi Models Ensemble (currents, temperature, salinity and transport)



3. Offshore renewable energy



4. NOOS data portal



5. Rivers discharge



6. Drift



7. Modelling and model verification



The following pages contain the main focus areas, gaps and needs for the topics covered by the current working groups. The 5 strategic objectives of NOOS are implemented by concrete actions of the working groups.

1. Water level, tide and waves

Leading experts: Jacob Woge Nielsen and Marc Philippart



The working group started in 2020 by merging previous working groups on "Water level data exchange", "Wave data exchange" and "Wave forecast exchange".

Objectives of the working group are:

- Gather individual observations of water level & waves and guard continuous delivery
- Harmonize data, present them on the NOOS website and deliver to NWS portal
- Gather individual forecasts of water level & waves and guard continuous delivery
- Present them on the NOOS website and deliver to NWS portal
- Assemble a new Bayesian Model Averaging forecast based on individual national forecasts, redistribute and display information with the MATROOS data server of Rijkswaterstaat
- Evaluate forecasts and find clues for improvement
- Assess the quality of the exchanged forecasts and a multi-model ensemble product
- Insight in wind forecast as basis for our water level and wave models

The exact scope is in development. At the starting meeting of March 9th 2021 we agreed on the following subjects for the coming years:

- Data exchange
- Reference levels
- BMA (water levels and waves)
- Evaluation, quality control
- Visualisation
- Wind
- Relation to other European data projects

2. Multi Models Ensemble (currents, temperature, salinity and transport)

Leading experts: Tabea Rebekka Panteleit, Ina Lorkowski



Several NOOS partners provide operational model forecasts for the North Sea area on a daily basis. A range of information and emergency response systems is based on the available forecasts. All these systems can benefit from a systematic combination of the variety of forecasts in a Multi Model Ensemble (MME).

The Working Group aims at providing a Multi Model Ensemble (MME) which shall serve two main purposes:

- The MME shall provide the basis for the development of uncertainty estimates for all forecast products
- The MME system shall provide an estimate of the best overall forecast, i.e. have a reduced overall error compared to every single ensemble member

The working group accomplished the following products:

- Poor man's ensemble: independent model of various institutes
- Uncertainty estimation of various models
- MME offers a forecast with an overall smaller error than each single product
- Can be used as a reference dataset to validate single models

3. Offshore renewable energy

Leading expert: Johannes Schulz-Stellenfleth



This working group started in 2022. Offshore renewable energy sources become increasingly important to Europe's economy. The Esbjerg Declaration signed in March 2022, includes the following statement:

“Therefore, we will increasingly replace fossil fuels, including Russian oil, coal and gas, with European renewable energy from the North Sea, including offshore wind and green hydrogen, contributing to both EU climate neutrality and energy security. To achieve this and to pave the way for the further expansion of offshore wind, we have decided to jointly develop the North Sea as a Green Power Plant of Europe, an offshore renewable energy system connecting Belgium, Denmark, Germany and the Netherlands and possibly other North Sea partners, including the members of the North Seas Energy Cooperation (NSEC).”

Main objectives of the working group are:

- Meet at least once a year to exchange information about recent developments in the member states and to give a respective report at the annual NOOS meeting
- Collect information about OWF plans in the North sea and develop a number of likely scenarios, which can be used as a reference in future studies (e.g., environmental impact)
- Exchange information about relevant research activities and publications
- Interface with other relevant organisations (e.g. OSPAR), industry and the meteorological community
- Identify specific requirements and existing deficits concerning observations and modelling
- Discuss and develop common metrics and best practices to be used for environmental impact studies
- Identify priority areas

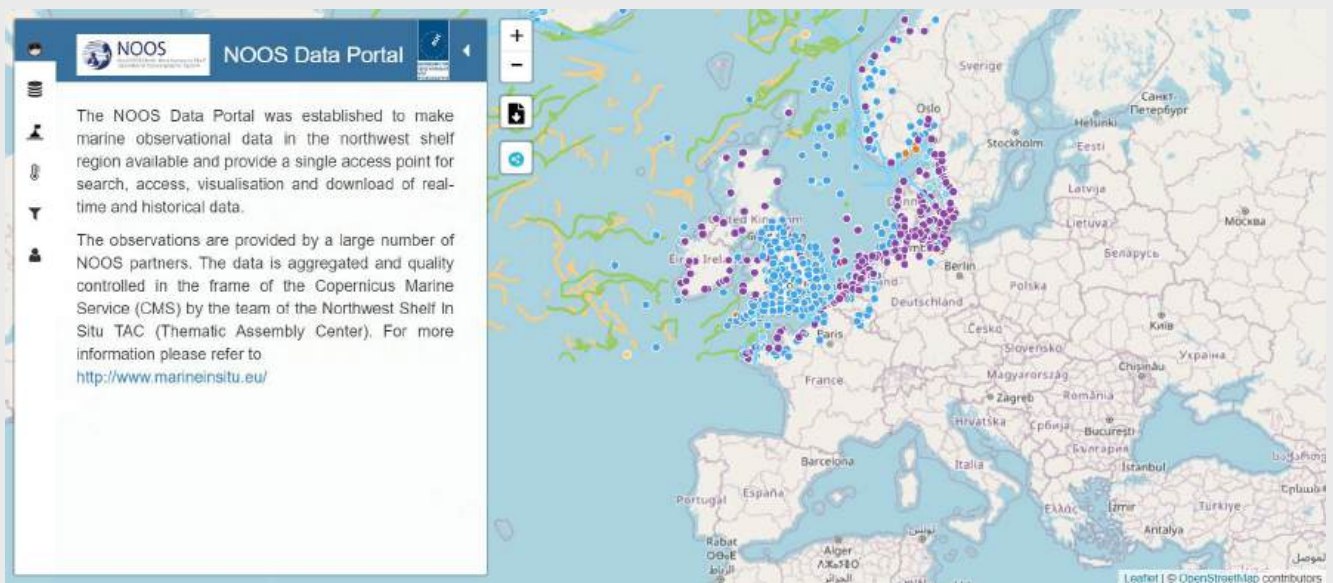
The working group is working on a "Living Document", summarising status/plans/challenges in different countries on this topic.

4. NOOS data portal

Leading expert: Susanne Tamm



The [NOOS data portal](#) represents the members in situ data and makes it findable and accessible



5. River discharge

Leading expert: Jacob Woge Nielsen



This working group started out in 2005. It is and always was very much a single person project when it comes to setting targets. The achieving of the targets and keeping up a sustained service may be carried out with responsibility elsewhere. When this is the case, the working group acts as an information channel.

The main objective is to make river run-off data - freshwater flux and nutrient/pollutant loading - available to NOOS partners for use in ocean hindcasting and forecasting. The data may be historical or real-time. It may be observational, or modelled. Sub-objectives are:

- Make observations of river volume flux available to partners in near-real-time
- Make high quality historical data sets of observed fluxes and loadings available to partners for hindcast studies
- Assess the availability and applicability of prognostic river runoff data and make recommendations for further effort
- Develop best practices for applying river runoff data in coastal ocean forecasting
- Gather individual observations of water level & waves and guard continuous delivery
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- Insight in wind forecast as basis for our water level and wave models

Main results from a recent survey on the utilisation of river data in ocean models:

- There is a demand for a reliable, basin-wide data source of both easy-to-access real-time and historical (or climatological) river discharge data
- Observational discharge data is spread out on a number of agencies. A basin-wide real-time service is hard to maintain
- Observational discharge data is mainly required to quality assure model data
- There is a scarcity of river loadings data, observational and modelled alike
- There is no consensus on methods applied in ocean models to import river data

6. Drift

Leading expert: Sébastien Legrand



The **NOOS Working Group on Drift** is a focal point centralising all possible collaborations and cooperations between NOOS member institutes and NOOS associated member institutes that could improve the accuracy of operational drift forecast services operated on the Greater North Sea. Those services have proved their interest as a support tool to decision makers in various fields such as oil and chemical pollution, search and rescue activities, fish stock management (fish larvae transport), water quality management (harmful algae blooms transport), marine litters management, etc.

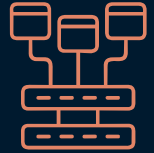
The general objectives of the Working Group are:

- The promotion and the facilitation of information exchange on drift modelling, data, databases and validation cases (real cases and benchmarks)
- The sharing of best practices and operational experiences
- The coordination of model to model comparison and validation studies as well as post-crisis assessments
- The coordination of common experiences at sea with drifters
- The promotion of interoperability of the different operational model systems and services operated on the Greater North Sea

NOOS-Drift, a on-demand multi-model ensemble system for drift forecast, has been jointly developed by NOOS members from Belgium, France and Norway. This system has been designed as a one-stop-shop service allowing users to compare several drift forecasts for a same event and to assess the different forecast uncertainty. Although this system is still in a demonstration phase, the European Maritime Safety Agency (EMSA) considers NOOS-Drift as a key building block for developing a new EMSA drift forecasting service.

7. Modelling and model verification

Leading experts: Kevin Sheehy and Rik Verboeket



The modelling working group has been established as a network of scientific interchange in topics that are of a common interest among the community. The group meets 3 to 4 times a year in the format of focus sessions, where the participants present the status and plans about specific areas with the aim to share knowledge and promote collaboration between NOOS members. It has been acknowledged that the different systems implemented at each institution makes it challenging, in the scope of the working group, to extend the interaction to technical areas (e.g. joint model development). However, it is encouraged for partners to engage in specific actions or projects resulting from the interaction within the group.

Upon its formation, the members were surveyed about the modelling areas, spatial scope, and topics of their interests. These are presented below, loosely ordered by relevance:

Core modelling

- Waves
- Ocean
- Surge

Extend regional modelling

- Iceland
- Arctic waters

Ensembles

- Implementation
- Multi-model
- Uncertainties

Climate change

- Medium range trends due to SLR
- Water heat waves

Modelling tides

Modelling coastal processes

Observations & quality control

Sharing best practice

Forecast validation

Integration river discharge

Artificial intelligence & Machine learning

Digital Twins of the Ocean

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