

New RV Belgica

Specific call for research proposals 2021



PiNS

Particles in the North Sea

DURATION

15/12/2021 - 15/03/2025

BUDGET

€ 499 722

PROJECT DESCRIPTION

Suspended Particulate Matter (SPM) dynamics is primarily controlled by tidal and meteorological forcing, biological activity, and the physical and chemical properties of the particles. Measurements of SPM, particulate organic carbon (POC), nitrogen (PON) and transparent exopolymer particles (TEP) concentrations can be used to provide mathematical descriptions of complementary information, such as the fresh and mineral-associated fractions of the particulate organic matter (POM). This mathematical description can be applied to measurements from optical or acoustic sensors or satellites to generate further secondary data products that cover larger areas and a high time resolution. The aim of the proposal is to change the scope of in situ observations from merely the collection of data towards the improvement and validation of mechanical models that describe fundamental aspects of SPM composition and its fluxes in whole the North Sea and the English Channel.

The inorganic and organic components of the SPM have different origins. The inorganic particles may have a detrital or biogenic origin. The detrital PIM typically incorporates clays, quartz and other minerals, while biogenic PIM consists of minerals such as carbonates and amorphous silicates. The POM is a mixture of compounds derived from marine photosynthesis or terrestrial sources. It is a combination of diverse detrital organic substances as well as of living organisms such as bacteria, phyto- and zooplankton. The POM can be discriminated between a labile and a more refractory fraction. The labile or fresh part of the POM (POM_f) is subject to seasonal variations, as it is produced by primary production, and has a high susceptibility towards microbial degradation. The refractory or mineral attached POM (POM_m) is particularly bound to the clay minerals, entering and leaving the water column through resuspension and deposition of sediments.

The main objective of the proposal is to validate and refine the model of Fettweis et al. (2022) for the whole North Sea and the English Channel. With the validated and refined data-model syntheses relationships can be applied to SPM concentrations derived from other sources, like remote sensing (satellite) products or high-resolution in-situ time series of calibrated optical and acoustic instruments. The final syntheses products will yield spatial and temporal compositional changes of the SPM, both on large scales and for anomalous events.

A combination of field measurements, laboratory methods, data analysis and a mechanistic modelling approach will be used. Ship-based campaigns will allow mapping the concentration and variability of particulate and dissolved matter along horizontal and vertical gradients, at tidal and seasonal scales in the English Channel and in the North Sea (2×Seine Bay, 3×Belgian coastal area, 3×German Bight, 2×East Anglia plume, 1×Central North Sea). The measurements and the data analysis will be done in collaboration with scientists from Ifremer, Helmholtz Centre Hereon and Helmholtz Centre Geomar.

RV/21/PiNS

The project aims at gathering new data from the North Sea and the English Channel and to address issues which are still little understood at the global level. The methodologies used in PiNS already exist but their level of transdisciplinary integration in this project, which includes sedimentologists, biogeochemists and biologists, is rather unprecedented. PiNS is directly addressing the topics of the FSI (RBINS) research strategy, bringing new knowledge to complement the understanding of the marine system. Further it will make use of existing marine data available in the digital collection of RBINS

The outcome of PiNS will have a major scientific impact, not only because it addresses a large marine area, but also because it does so in different fields of science. Policy makers will directly benefit at regional and national levels. It will also orient the policies and conventions at international level (EU Commission, OSPAR, ICES). PiNS will help define a safe operating space for human activities (marine and coastal), increasing the chance to conduct activities while preserving the habitability of the coastal system (European Green Deal). We expect impacts for the private sector, especially engineering consultants that perform monitoring and modelling in the context of dredging, wind farm, coastal erosion or sea farms.

The availability of POM proxies along the nearshore to offshore gradient from a domination of mineral-associated POM towards a domination of fresh POM could have important implications for future monitoring, as they may fill the lack of continuous long-term data of POM properties and as such could help to identify more efficient locations for water sampling or for the deployment of observational instruments.

CONTACT INFORMATION

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