EGU24-7810, updated on 14 Mar 2024
https://doi.org/10.5194/egusphere-egu24-7810
EGU General Assembly 2024


# Multidisciplinary approach to assess the far-field effects of sand extraction in the Belgian part of the North Sea.

**Benjamin Van Roozendael**[1], Koen Degrendele[2], Florian Barette[2], Helga Vandenreyken[2], Anne-Sophie Piette[2], Vera Van Lancker[1], Lars Kint[1], Katrijn Baetens[1], Pauline Denis[1], Peter Urban[3], Nore Praet[4], and Marc Roche[2]

[1]Royal Belgian Institute of Natural Sciences, OD Nature, Brussels, Belgium
[2]Federal Public Service Economy (SPF Economy), Continental Shelf Service, Brussels, Belgium
[3]Ghent University, Faculty of Bioscience Engineering, Department of Geology / Department of Data Analysis and Mathematical Modelling (UGent), Ghent, Belgium
[4]Flanders Marine Institute (VLIZ), InnovOcean Campus, Ostend, Belgium

Sand extraction on the sand banks in the Belgian part of the North Sea has various impacts on the marine environment. The direct near-field effects in areas where extraction takes place, are regularly monitored for at least two decades and well understood. In contrast, several important questions remain regarding the far-field impact associated with the dispersion of suspended particle matter (SPM) plumes. On the longer term, these SPM plumes could significantly change the integrity of the seafloor and damage the ecological valuable habitats bordering the exploited sand banks. Therefore, the Continental Shelf Service of the SPF Economy, responsible for the management of the sand extraction, instigated a project to define the range and significance of the far field impact of this activity. In close partnership with RBINS, UGent and VLIZ, a number of controlled measurements were devised to validate models predicting far field dispersal and, if necessary, improve them. Based on these models, frequency and magnitude of disturbance on nearby marine protected areas can then be determined for all sand extraction sectors.

In order to characterize SPM plumes and to estimate their dispersion distance, several experimental setups were developed, combining continuous and point measurements with the use of a quasi-real-time dispersion model. The measurements were performed on board the RV Belgica during two campaigns in November 2022 and March 2023 following dredging vessels performing extraction operations.

During the experiments, the dispersion model mapped the estimated trajectory, extension, and the deposition of the SPM plumes in real time, using a combination of hydrodynamic, waves and wind data, estimated sediment properties and the position and activity of the dredging vessels. This real-time information allowed us to position the vessel in the ideal location to validate the presence of the plume and its properties using an experimental set-up of combined acoustic and in-situ measurements. Continuous acoustic measurements of the water column involving a Kongsberg EM2040 dual RX multibeam echosounder (MBES), a Simrad EK80 single beam echosounder (SBES) and a Teledyne Acoustic Doppler Current Profiler (ADCP) were carried out

jointly to map the actual position, extent and density of the plumes. These continuous measurements were completed with in situ point measurements of the water column properties through the use of several acoustic (Aquascat 1000R) and optical (LISST-200X, OBS) sensors mounted on a carousel. Additionally, water samples were collected using Niskin bottles that were filtered on board for further analyses (SPM, particulate organic carbon and nitrogen, Chlorophyl a), and analysed using a Hach turbidimeter. Samples of the extracted sediments were collected on the seafloor and onboard the extraction vessels for granulometric analysis.

The first analysis of the November 2022 and March 2023 experiments indicate the good performance of the used dispersion model and the excellent concordance between the continuous acoustic detection of the sediment plumes with the MBES, SBES and ADCP. Additionally, our results show the importance of a profound knowledge of the spatial configuration of the involved instruments and the impact of the research vessel itself on the water column.