

Summary NCK Theme day 'Mud dynamics in the Southern North Sea and its interaction with ecological processes'



netherlands centre for coastal research

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Location: Schielandshuis, Rotterdam

On a beautiful summer day, approximately 40 participants gathered in Rotterdam to discuss the latest insights on mud dynamics and ecological impacts in the Southern North Sea. The theme day attracted researchers, ecologists and engineers from The Netherlands, Belgium and the UK. The day itself was divided into two main parts: keynote lectures were given in the morning session, while the afternoon session consisted of interactive workshops.

Morning session

Bram van Prooijen opened the theme day by introducing the topic and addressing its societal relevance. He shortly discussed previous work carried out in the Dutch Coastal Zone, and lessons learned from measurements and modelling. Mud dynamics and its interplay with ecological processes has proven to be a relevant topic for assessing the impact of human activities in the Southern North Sea. Therefore, we should critically judge which knowledge we still need to manage human activities, so they are carried out in a sustainable way.

After the introduction, **Michael Fettweis** kicked off the keynote lectures by presenting results from long-term measurements in the Belgian Coastal Zone. Measurements have been carried out for over 15 years, creating a unique dataset which allows studying seasonal variations in SPM characteristics. Variations in SPM characteristics occur in time (seasonal cycle) and along cross shore gradients (nearshore towards offshore). Floc size and strength vary seasonally, related to the availability of organic matter. Vertical concentration profiles are also influenced by these changes in floc characteristics. Measurements will be continued in the coming year, with particular focus on understanding biogeochemical variations of suspended particles over the cross-shore gradient.

Sytze van Heteren continued the keynotes by addressing the geological development of the Southern North Sea. The North Sea bed is continuously developing, with morphological changes in the seabed topography taking place on short timescales. These morphological developments may lead to burial or exposure of older geological units. Hence, the material present at the seabed surface may not be in equilibrium with short-term hydrodynamic processes. A promising way to couple geological maps with numerical models is through the use of voxel models. These are currently being developed by TNO.

This proved to be a good bridge to the talk of **Johan van der Molen**, who presented recent developments of the ERSEM model. Since suspended particulate matter influences light penetration, and thereby phytoplankton growth, it also affects ecosystem behaviour. Therefore, SPM dynamics are included in the ERSEM model as well. A particular feature is the exchange of fines with the bed, which is modelled using an active layer concept. The thickness of this active layer depends on predicted ripple heights, as the sandy bed needs to be mobilized to release the fines present in the bed. Model developments are ongoing, with benthic-pelagic coupling as one of the main points of interest.

The final keynote was given by **Claire Chassagne**, who addressed the role of algae in flocculation processes. From field data, it is concluded that freshwater fronts influence flocculation by supplying different sorts of algae. Furthermore, floc pictures indicate that floc shapes may differ from long and thin filaments to more densely packed flocs. Combining field work with laboratory work is important to understand complex systems as flocs that are composed of

mineral and organic material. Furthermore, flocs are extremely dependent on environmental conditions. The creation, growth and break-up of flocs can only be understood in a controlled environment.

Afternoon session

In the afternoon, three parallel workshops discussed three different themes related to mud dynamics: (1) in-situ measurements & remote sensing, (2) ecology and (3) numerical modelling. During the workshops, participants discussed about the current state-of-the-art, steps essential for future developments and opportunities for collaboration with the other disciplines. Some of the findings are presented below:

Several developments taking place may influence mud dynamics in the North Sea. On larger scales, subsidence and sea-level rise can alter sediment transport patterns. Additionally, development of wind farms in the North Sea and ongoing nourishments are human activities that need to be closely monitored, as their potential impact is significant.

The footprint of these human activities is determined by hydrodynamics and sediment transport. However, the impact on food chain (through primary production) is needed as input from ecologists. Additionally, sediment transport is also influenced by biological processes, through formation of algae and their impact on flocculation. This is a topic that requires more fundamental research. From numerical modelling, the wish arises to develop better formulations for erosion and water-bed exchange.

Changes in mud dynamics on the North Sea may also exert an influence on adjacent estuaries, as these water bodies exchange sediments continuously. When assessing the environmental impact of human activities taking place on the North Sea, this should be carefully considered. There is a strong wish to work in interdisciplinary research teams. However, it is noted that in-depth collaboration is only possible through joint research projects. Furthermore, all three workshop groups advised to develop permanent monitoring stations in the North Sea. These will aid in developing fundamental knowledge, but can also provide validation data for numerical models.

Closure

The day was closed by Bram van Prooijen, who thanked the keynote speakers and participants for this interesting and inspiring day. The interdisciplinary nature of the topic has been highlighted in the keynotes and also led to interesting discussions during the afternoon. Hopefully, interdisciplinary initiatives arise from these discussions, which may lead to new fundamental knowledge on the topic.