

EGU2020-16468

<https://doi.org/10.5194/egusphere-egu2020-16468>

EGU General Assembly 2020

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



Sediment sampling and soil properties of sediments in the Hamburg port and the river Elbe in comparison with hydro-acoustic measurements

Nino Ohle, Thomas Thies, Rolf Lüschow, and Ulrich Schmekel

Hamburg Port Authority, Neuer Wandrahm 4, 20457 Hamburg, Germany (nino.ohle@hpa.hamburg.de)

For future strategies in water depth maintenance in the Port of Hamburg, determining the navigability limit (i.e. the nautical safe depth) is of major importance. For this purpose, a project "Nautical Depth" was set up at the Hamburg Port Authority (HPA), which is dedicated to dealing with this issue. The aim is to measure a nautical safe depth under various boundary conditions and to identify limits for a safe passage of high concentrated soil suspensions. Among other things, the project cooperates with the Antwerp Port Authority, the Port of Rotterdam and the TU Delft. The project is also embedded in a research platform or network called MUDNET (www.tudelft.nl/mudnet).

In order to achieve the required acceptance for a reassessment of the nautical depth, it is necessary to determine the rheological properties of soil suspensions in-situ. The rheological parameters - which will be used to describe the nautical depth - have still to be determined. For a permanent identification of nautical relevant rheological properties of the soil suspensions, existing in-situ measuring devices have been tested and, under certain circumstances, new equipment has to be developed. However, these devices cannot be used for the spatial determination of the rheological properties but will reproduce these on cross-sections and depth profiles. Therefore, new evaluation algorithms should be developed in echo-sounding technology - which have to be correlated with the in-situ rheological properties - in order to ensure spatial representations of a safe nautical depth.

In a first step, measurements of nature conditions in the water column and at the riverbed were carried out in 9 areas and in 12 measuring campaigns in 2018 and 2019 in the Hamburg Port. Therefore, different sediment profiler devices (Rheotune, Graviprobe, Admodus USP) have been tested. Sediment samples were taken with a modified Frahm-Lot. All investigations were combined with hydro-acoustic measurements which includes multibeam echo-sounders and sub-bottom profilers with Silas processing software.

The presentation will give a closer look to the sampling strategies and results of the different soil properties within the Hamburg port and the river Elbe, which serves as fairway to the port. The investigations show that the soil properties are dependent from local and regional boundary conditions, as flow velocity, grain size distribution and especially in Hamburg from the organic

matters and nutrients within the suspended and the soil material. Moreover, the laboratory data will be compared with hydro-acoustical and in-situ monitoring devices. Advantages and disadvantages of the different systems will be discussed.

Kamphuis et al. (2013) Fluid Mud and Determining, Nautical Dept Hydro International, 22-25;

Malcherek, A. et al. (2011) Zur Rheologie von Flüssigschlick: Experimentelle Untersuchungen und theoretische Ansätze, Mitteilungen des Instituts für Wasserwesen der Universität der Bundeswehr, München 111:1-191;

Metha et al. (2013) Fluid Mud Properties in Nautical Depth Estimation, Journal of Waterway, Port, Coastal & Ocean Engineering, 140:210-222;

Ohle, N. et al (2019) Introduction and first results within the project "Nautical Depth" in Hamburg, 11th International SedNet conference, 3-5 April 2019, Dubrovnik;