

# The Fehmarnbelt fixed link and a new topography of the Baltic Sea

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## I. FEHY – Fehmarnbelt Hydrographic Services

The Danish state-owned company Femern A/S is designing and planning a fixed link between Denmark and Germany across the Fehmarnbelt in the western Baltic Sea. Among other things, the documents needed for final approval by the national authorities in the two involved countries Denmark and Germany are based on background studies which describe the environment of the area that may be impacted by the project (baseline descriptions) and assessing the expectable impacts (impact assessment). In a consortium with the Danish DHI Group, LICEngineering and Bolding & Burchard, the Leibniz Institute for Baltic Sea Research Warnemünde has been involved in preparing a comprehensive report on the hydrographical and biogeochemical state of the Baltic Sea, and the Fehmarnbelt area in particular. ■

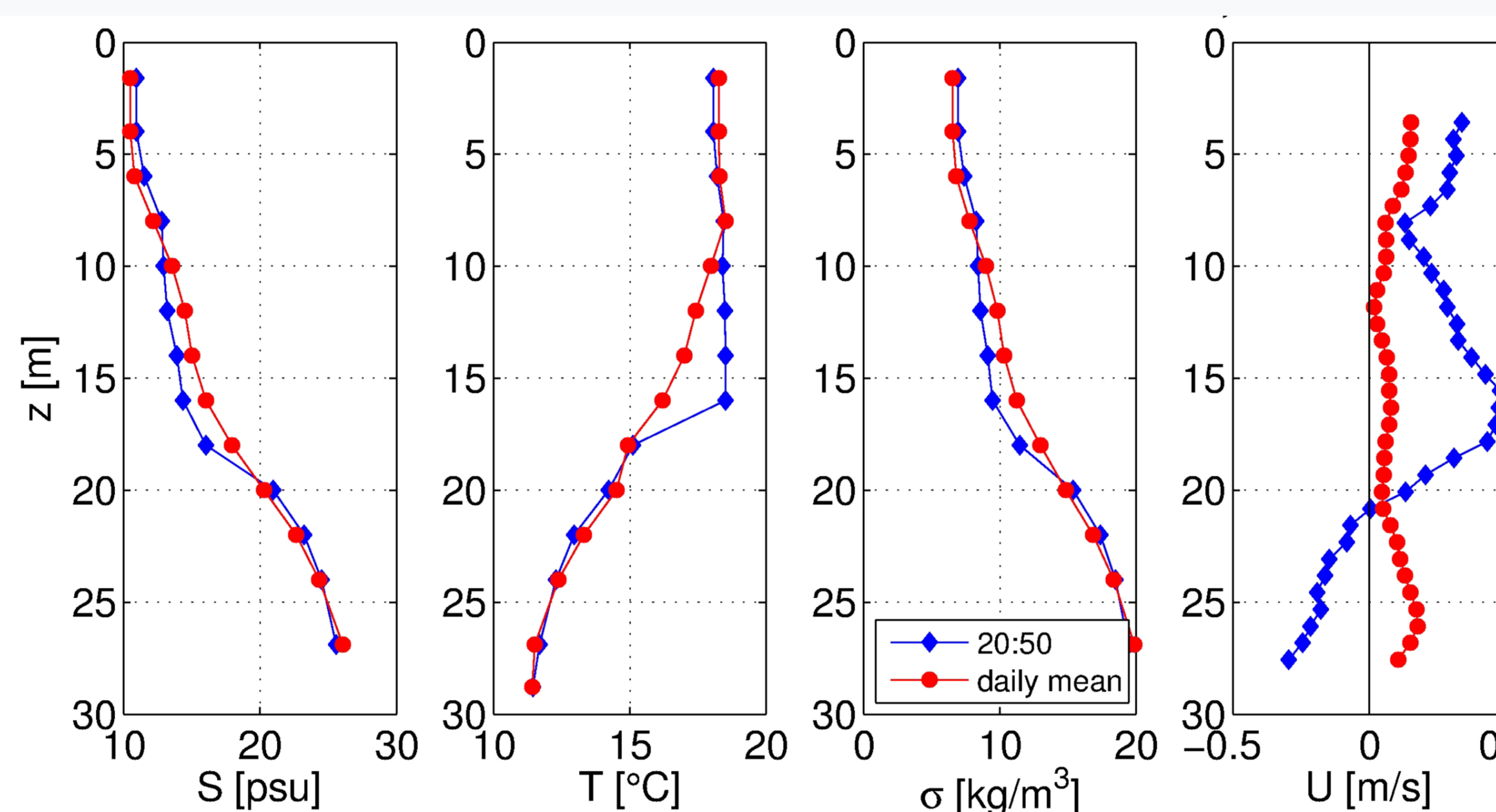


Figure 1: Inflow at surface and outflow at seabed as observed in the southern Fehmarnbelt on 2009-07-20 at 20:50 (blue line) and daily mean (red line). The daily mean current speed is much lower than the instantaneous values which include highly-frequent signals like tides and possibly internal waves, and it only shows inflow throughout the water column. The density stratification however remained stable on that day indicating two oscillating water masses in the respective layers.

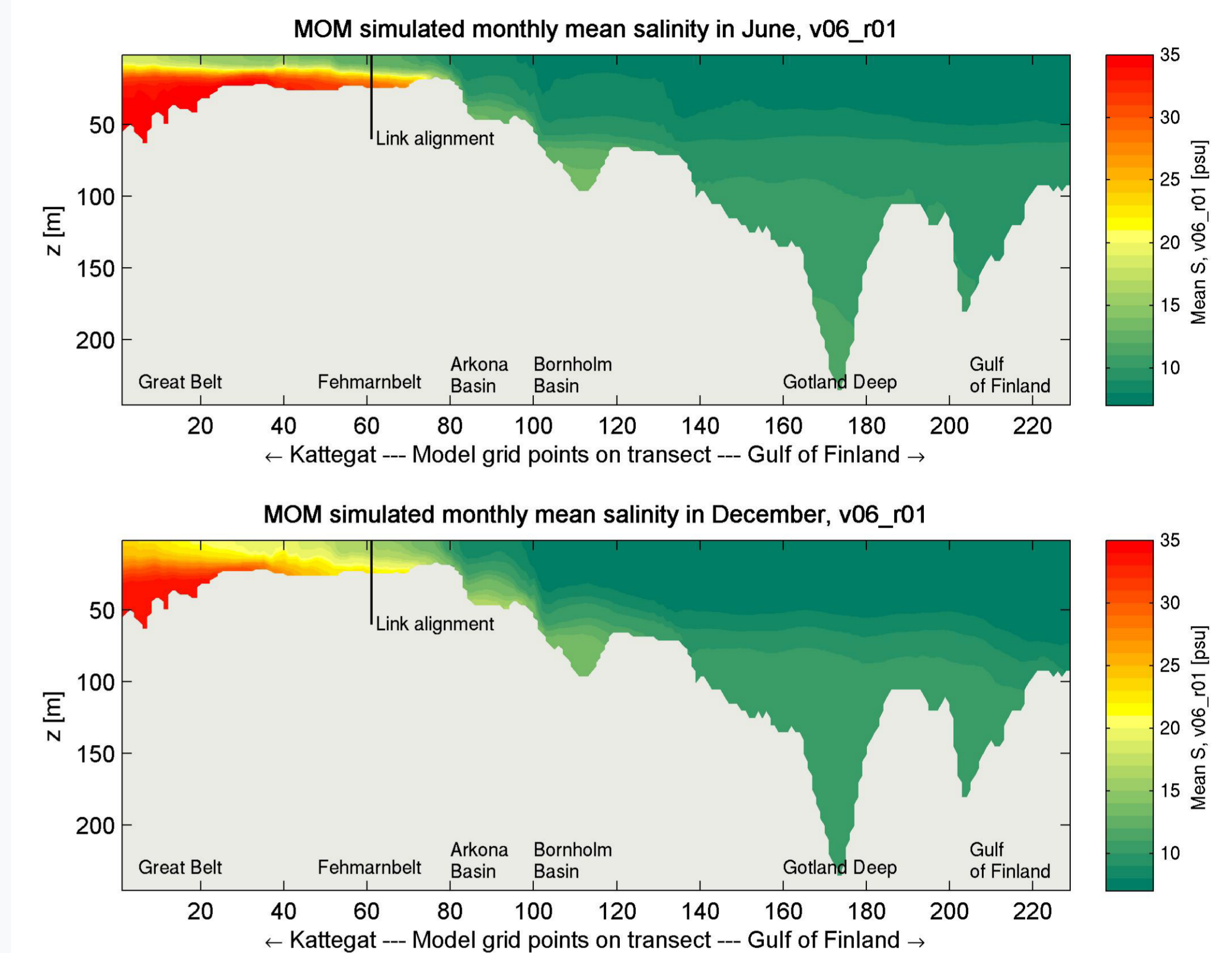


Figure 2: Cross-section showing simulated salinity distribution as monthly means from 1970 to 1999, from Great Belt through Fehmarnbelt and into the Baltic Proper, where the vertical line shows the position of the planned link.

This report in two volumes includes data from historical measurements and from the ongoing monitoring of the Fehmarnbelt area by IOW (figure 1). Additionally, numerical model studies of the Baltic Sea and the Fehmarnbelt area have been conducted which included simulations with the Modular Ocean Model MOM and the ERGOM biogeochemical module at IOW (figure 2). ■

## II. A new high-resolution digital topography of the Baltic Sea

The current digital topography used for long-term simulations at IOW has a horizontal resolution of approximately 2 km. With this resolution, small-scale hydrographic processes in the narrow Danish straits have so far been underrepresented in IOW's numerical circulation model MOM. For a more detailed study of processes like saline inflows and turbulence in the order of the baroclinic Rossby radius of 1 to 7 km, a topography of the Baltic Sea on a finer horizontal grid is therefore needed. With the increase in high-end computational power we are now able to apply a refined horizontal resolution to our model grids. ■

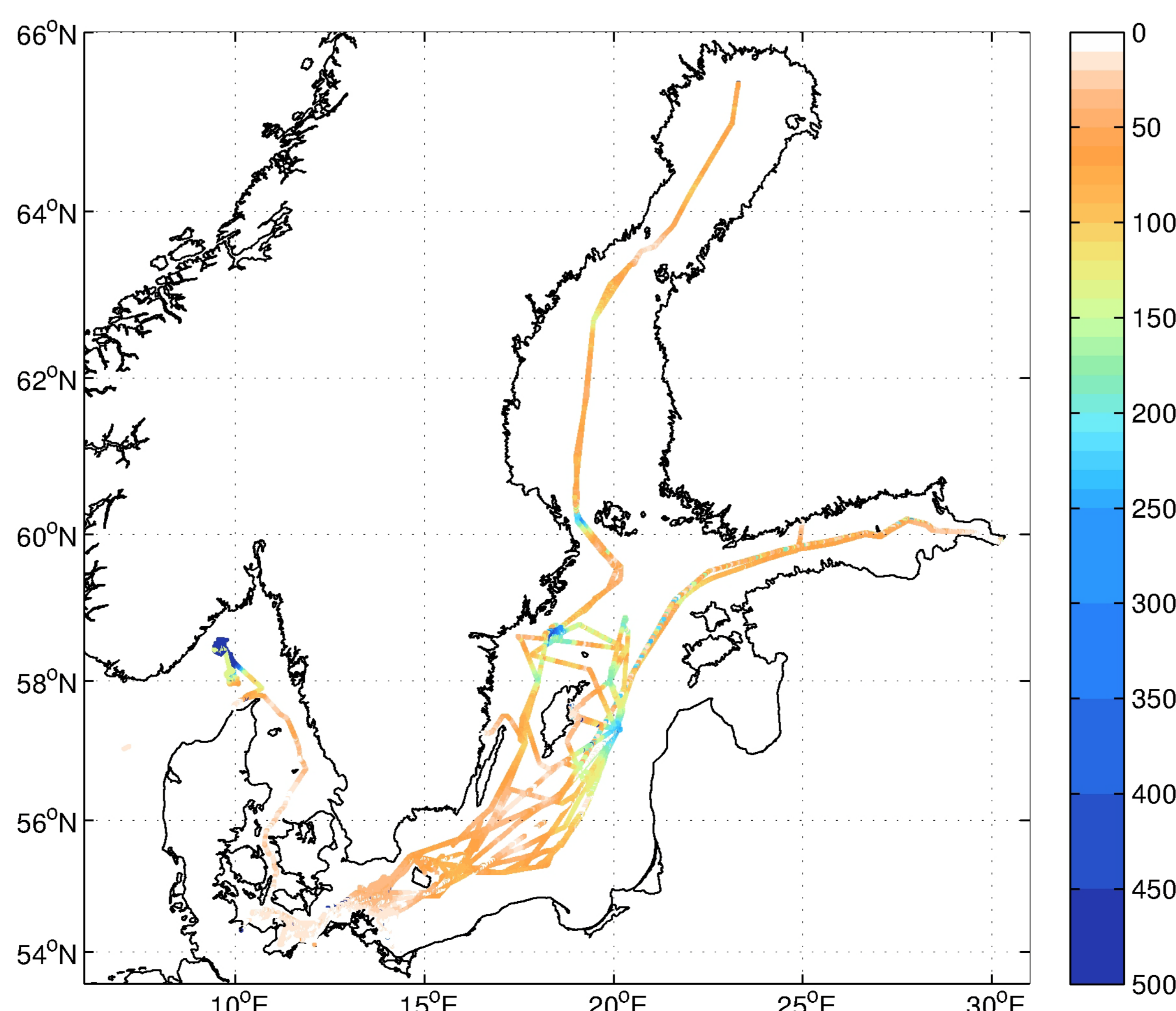


Figure 3: Water depth samples derived from echo soundings during several research cruises in 2011. Such raw data contains artifacts and needs to be cleaned.

Dr. Torsten Seifert who compiled the current topography "iowtopo2" (Seifert et al., 2001), and Jochen König are now working on a new digital bathymetric data set for the Baltic Sea with a horizontal resolution of one third of an arc-minute. This includes newly available data like routinely made echo sounding tracks from research cruises conducted by IOW, existing bathymetric information from Germany's federal agency for shipping and hydrography (BSH), or freely available data from The General Bathymetric Chart of the Oceans (GEBCO). These data sets have to be cleaned from spikes, offsets, etc., (figure 3) and will then be merged and statistically evaluated. After that, a second topography that is adjusted to the special requirement of the MOM numerical model can be derived from this basic set. The overall aim of this project is to be able to operate stable long-term simulations of the hydrography and biogeochemistry of the entire Baltic Sea and its ecosystem on a high horizontal resolution. ■