

SIOS Marine Infrastructure Workshop

Kongsfjorden modeling (K160)

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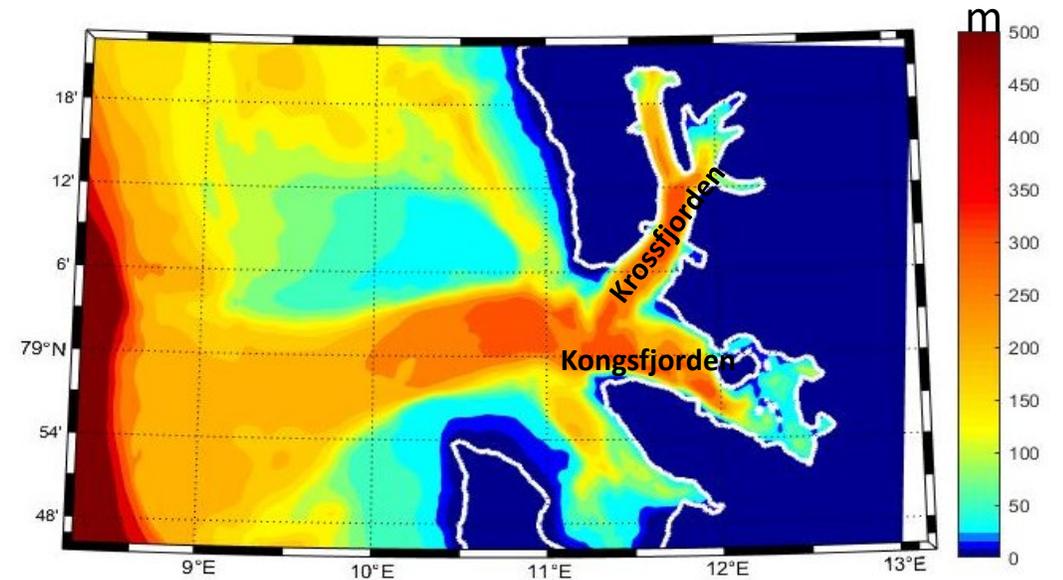
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Overview of Kongsfjorden modeling

- The K160 model was implemented with the Regional Ocean Modeling System (ROMS) with 160 m horizontal resolution (Sundfjord et al. 2017; Torsvik et al. 2019)
- The model is forced by atmospheric conditions, ocean boundaries and glacier discharges
- A sub-glacial discharge parameterization was implemented recently to account for sub-grid scale processes associated with the entrainment of sub-glacial plumes (Duarte et al, in prep)
- The model was coupled with biogeochemical processes using a nutrient-phytoplankton-zooplankton-detritus model (Duarte et al, in prep)

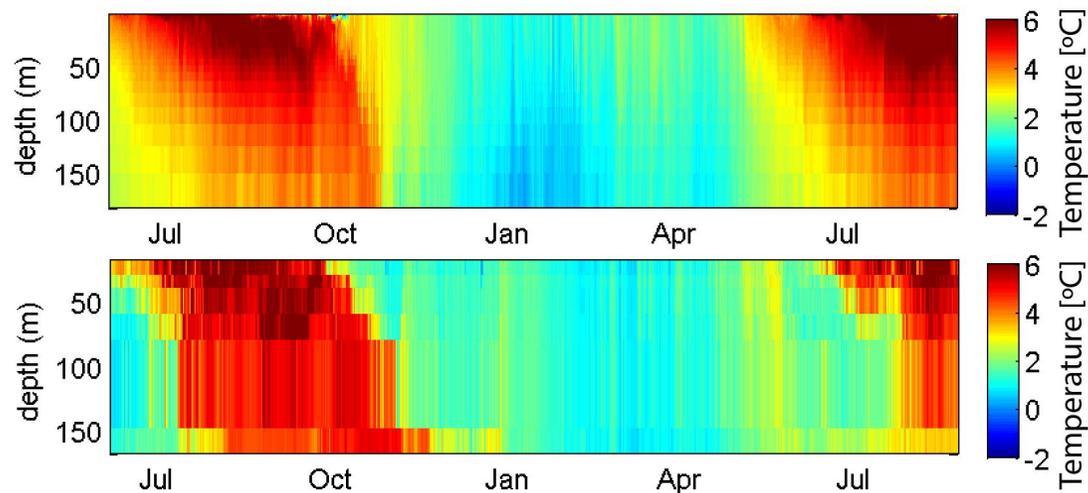
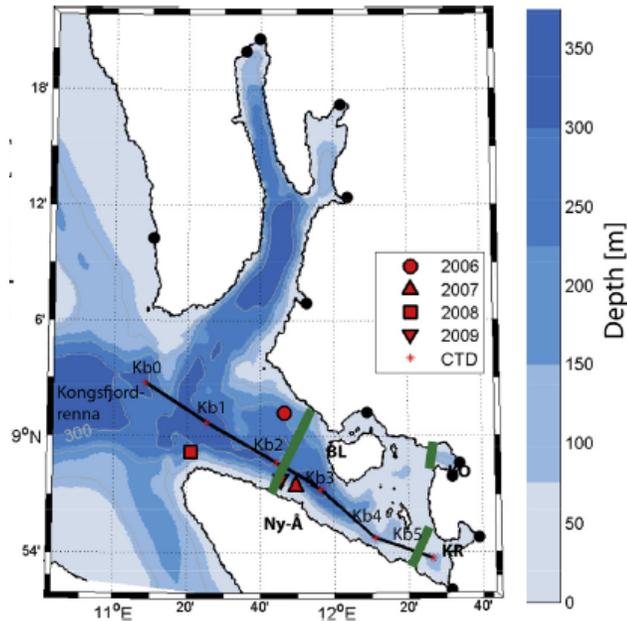


Sundfjord et al (2017). Estuarine Coastal and Shelf Science, 187, 260-272

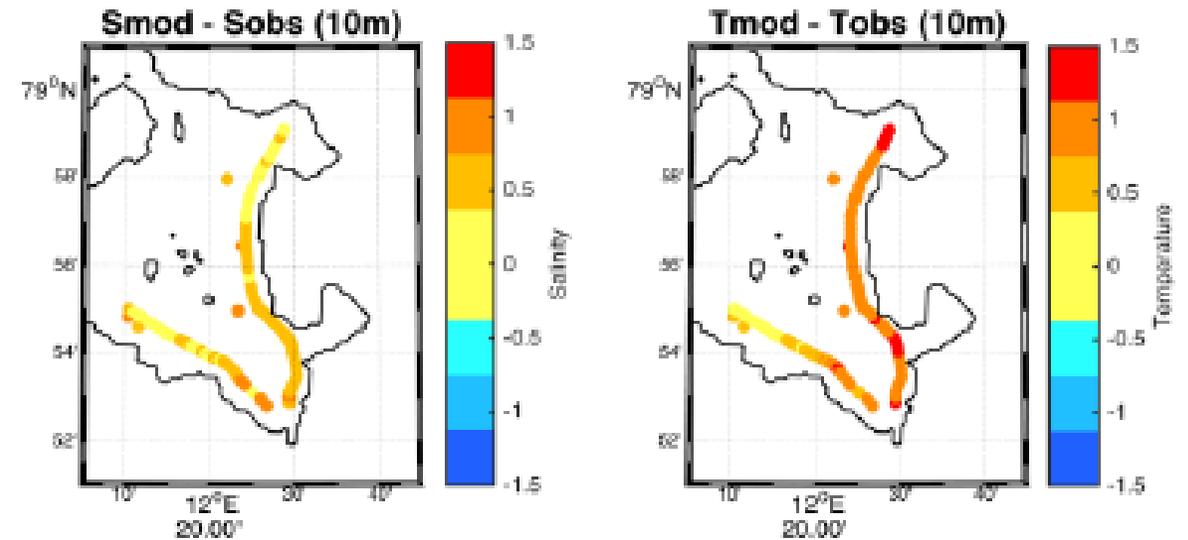
Torsvik et al. (2019). Estuarine Coastal and Shelf Science, 220, 152-165.

Overview of Kongsfjorden modeling

Sundfjord et al. (2017) compared model results with current velocity, salinity and temperature mooring data



Torsvik et al. (2019) and Duarte et al. (in prep) compared salinity and temperature profiles with CTD profiles in the vicinity of tide water glacier fronts



Model surface salinity and temperature bias suggest that thermodynamic exchanges between the calving ice and the water column must be included in the model and water turbidity properly parameterized.

Outlook, future perspectives

Improving water column stratification and biogeochemistry in K160

- Parameterize heat and freshwater exchanges between calving ice and the water column
- Include a sediment sub-module to simulate suspended matter loads and light extinction in the water
- Optimize the simulation of biogeochemical processes in order to make it as realistic as possible and useful to interact with ongoing monitoring surveys, while keeping complexity within reasonable limits
- Use K160 as a «model template» for other Arctic fjords

Main logistical challenges and wishes

Improving model forcing

River discharges are poorly characterized in terms of suspended matter and chemical loads – this requires further field data. However, it is very difficult (if possible, at all) to sample subglacial discharges.

Ocean forcing through the open boundaries relies on larger scale models. Ideally, field data should be used to provide some reliable data assimilation product to guarantee boundary accuracy for hindcast simulations.

Model validation

Having a validated model is a necessary condition for its usage as a reliable tool. However, whilst there is an increasing amount of available physical data that may be used to compare model and observations, biogeochemical data is still a bit limited both temporarily and spatially.

What you hope to get out of a Svalbard marine infrastructure network

We hope that it will:

- be an interdisciplinary network with physicists, chemists and biologists working together and producing common data sets
- be an efficient hub between observationalists and modelers, with available data products (observations and model data) according to agreed specifications
- use state-of-the-art technology and monitor the usual physical variables (current velocity and direction, salinity, temperature,...) plus variables allowing to characterize water column optical properties (such as spectral light transmission) and biogeochemistry (such as chlorophyll a, nutrients and zooplankton)
- combine automatic sampling from moorings and other platforms with other types of sampling in a way that data from various sources may be aligned spatially and temporarily at high vertical and horizontal resolution