

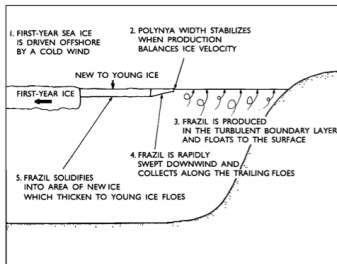
Modeled ice production and brine release in Hornsund

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September 29, 2014

- 1 Model, domain and input data
 - The model
 - Input data
- 2 Results and validation
 - Comparison with satellite data
 - Year-to-year variations
- 3 Discussion, conclusion, goal of task....

Model developed Skogseth et al. 04 and Haarpaintner et al. 01, for Storfjorden



Schematic of wind-driven coastal polynya processes with water at the freezing point and air below freezing (Pease 1987)

Main driving force:

- Wind and Air temperature

Two algorithms:

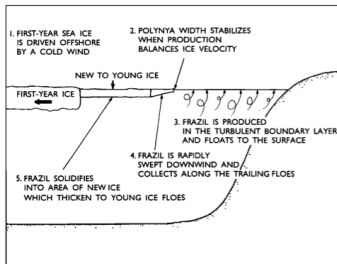
- Opening/closing:

$$\frac{dW_p}{dt} = FB_1 U_t \cos(\phi_t - \phi_0)$$

- Open water/ Frazil ice:

$$\frac{dW_o}{dt} = B_2 U_t \cos(\phi_t - \phi_0) - \frac{\Delta h_f}{h_c}$$

Heatflux and ice production

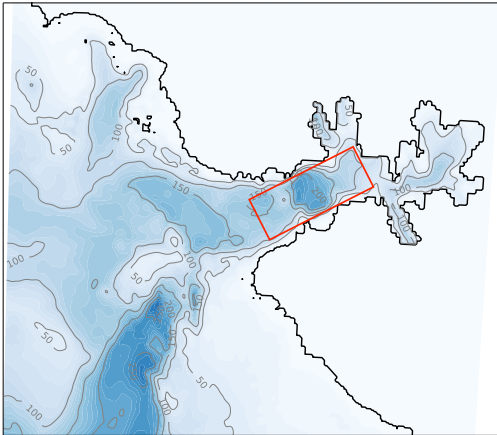


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Ice produced in three different areas:

- Open water
- Thin ice
- Fast/pack ice

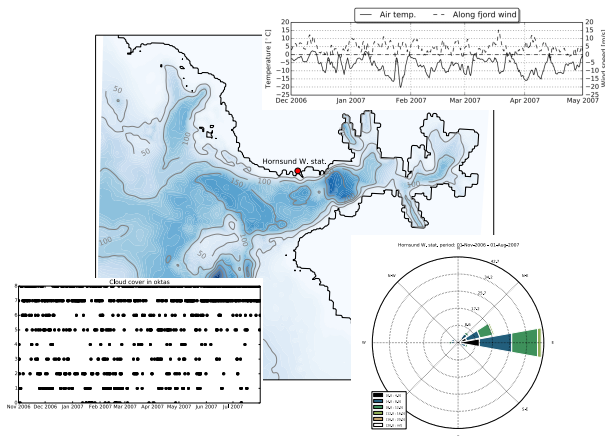
Model domain



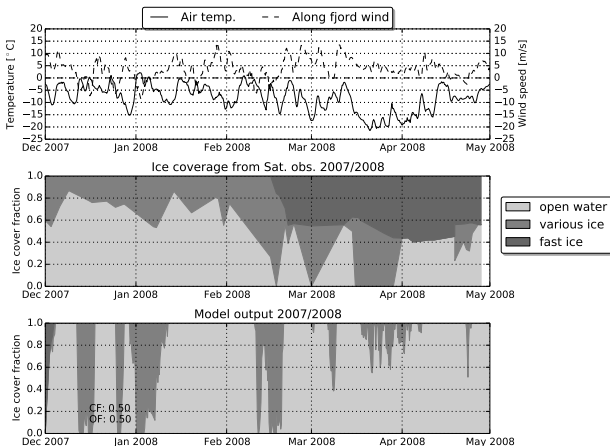
- Simple geometry
- Need to know dominant wind for ice transport
- Model only gives 1-D opening of polynya

Ice and brine production modeled for area of size as red rectangle.

Weather data from Hornsund weather station

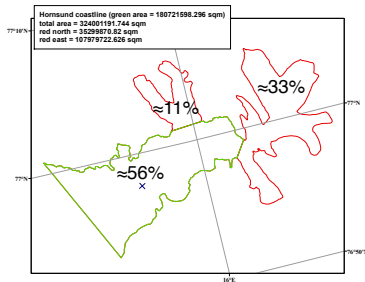
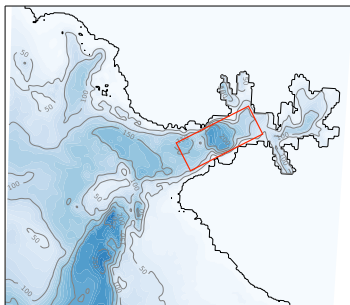


An example of model output: Satellite observations vs. model output

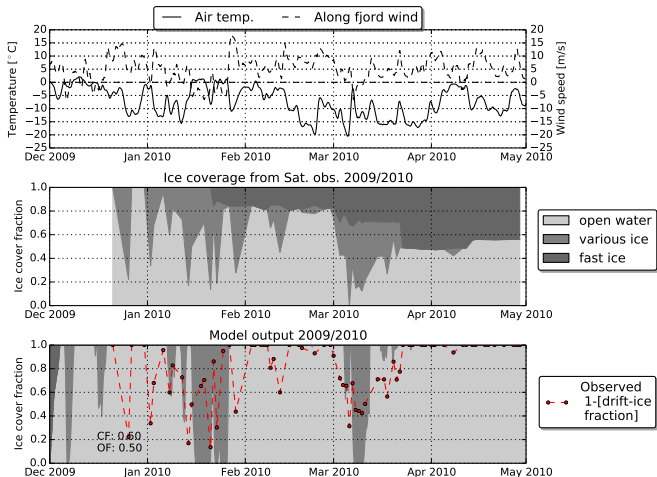


Different areas considered

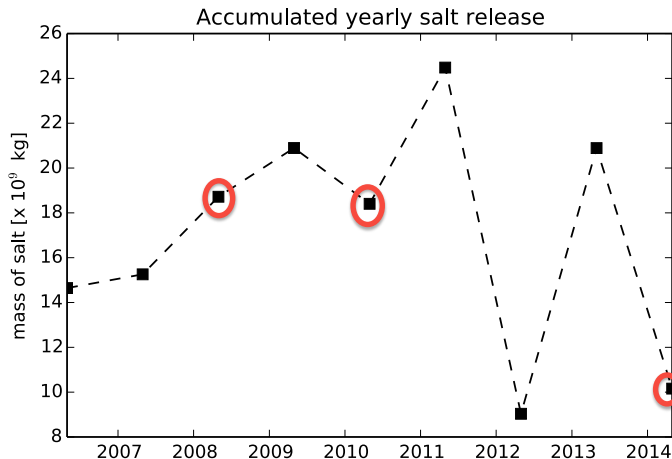
Where can we assume water at freezing point?
Fast ice limits the polynya area.



Comparison with satellite data

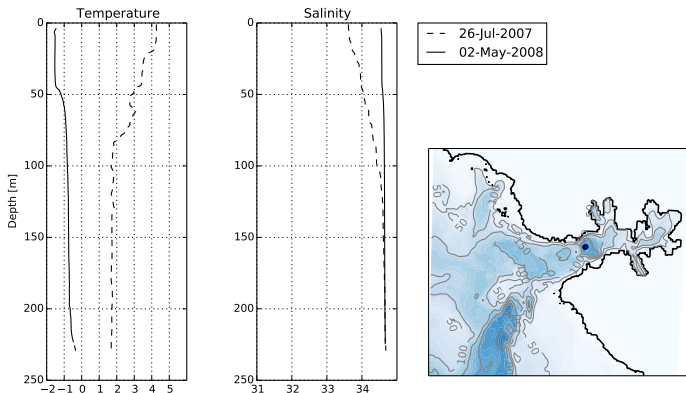


Another example of model output: Yearly salt release



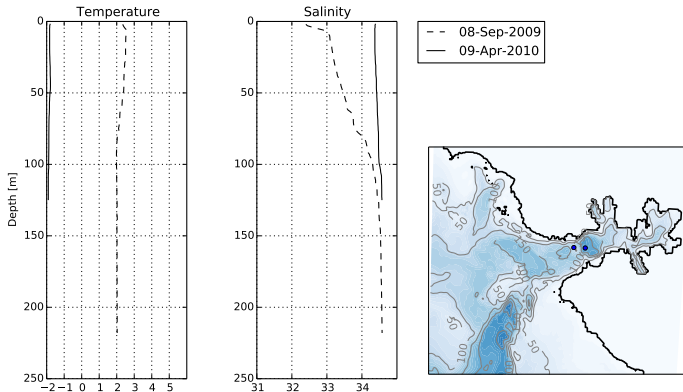
Year-to-year variation in salt release (Absolute values need to be taken with a pinch of salt).

Hydrography - Fall to spring variation - 2008



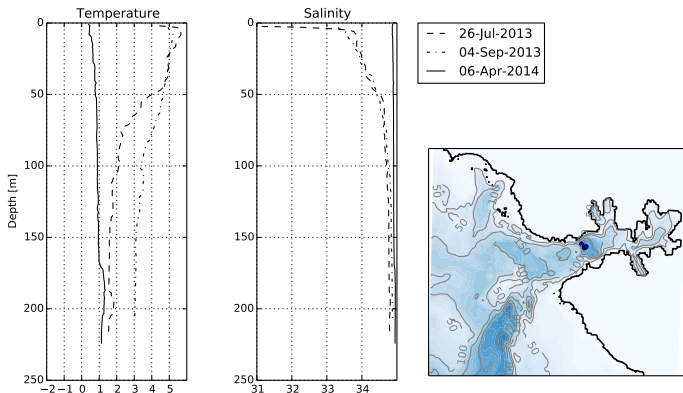
Cooling and salinification of the water column through the winter, starting at the surface

Hydrography - Fall to spring variation - 2010



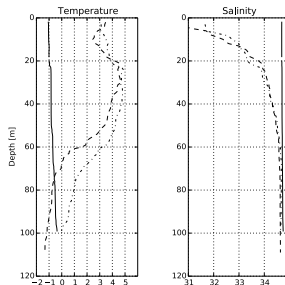
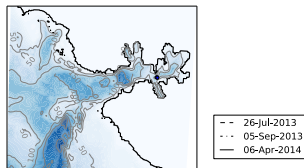
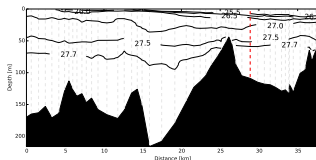
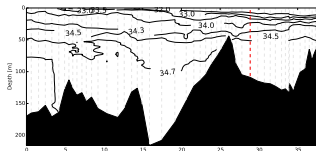
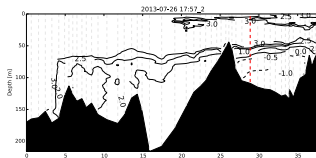
Certain years with whole water column at freezing point

Hydrography - Fall to spring variation - 2014



Other years warmer water, and model assumption of water on freezing point, may not be fulfilled.

Short memory storage of water history in Brepollen?



Outline for thesis

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- Compare with ROMS-model for validation
- Improve input data
 - Wind and temperature from Treskelodden, if available
 - Use fast ice area observation to limit polynya area?
 - Hydrography time series/ROMS data to determine freezing period (Water at freezing point)