Experiments in Simulating Atlantic Water Circulation in the Arctic Ocean

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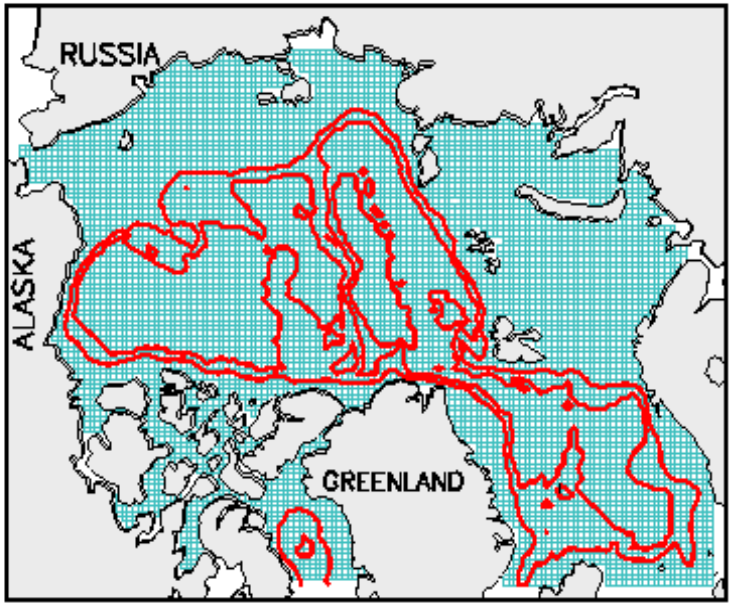
Motivation

- Arctic Ocean circulation (including Atlantic Water circulation in the Arctic) is strongly baroclinic, influenced by initial density field.
- What would happen with a model driven by uniform initial density field?
- Model behavior with different forcing conditions and with uniform initial density field.

Model Description

- 40 km horizontal resolution.
- Open boundaries at Bering St., Denmark St., Davis St. & Faroe-Shetland Passage.
- AOMIP forcing (NCEP, river, radiation, precipitation).
- Uniform, stratified initial T and S fields from model-domain average of PHC.
- Four experiments.

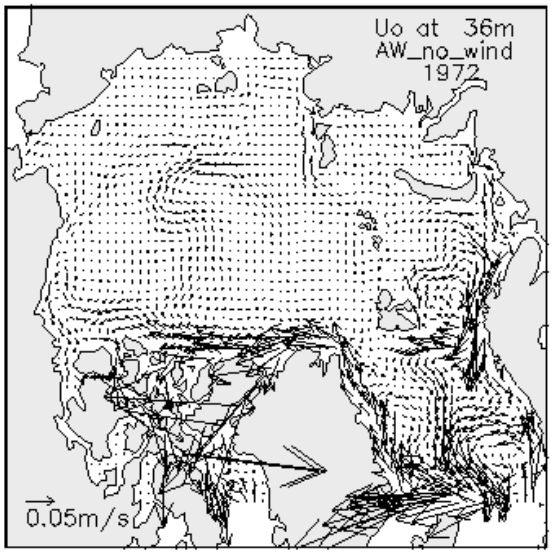
Gird configuration of a 40km-resolution ice-ocean model

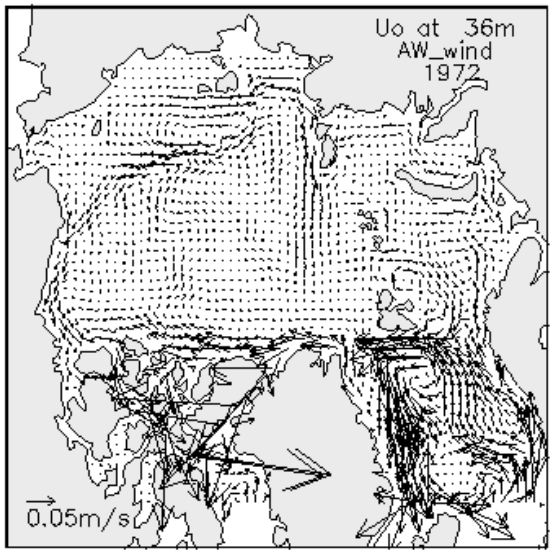


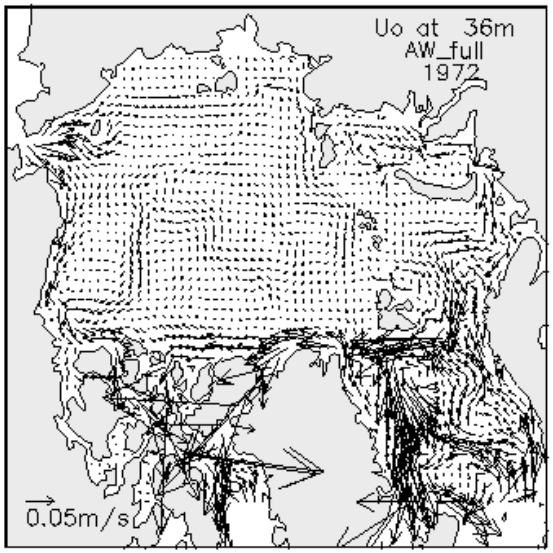
Description of Experiments

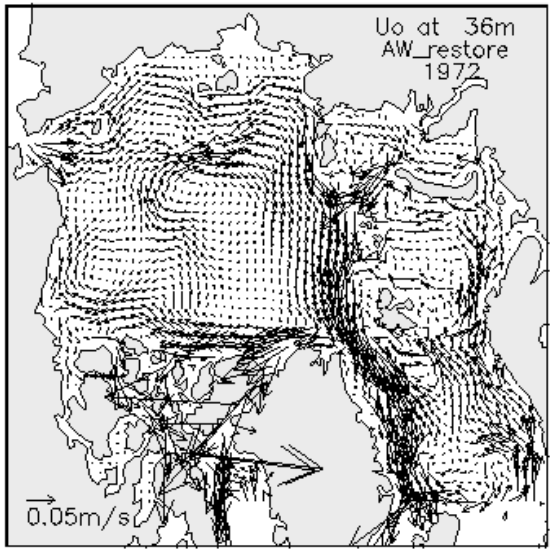
- AW_no_wind: no winds, no river runoff, no open boundaries.
- AW_wind: with winds, no river runoff, no open boundaries.
- AW_full: with winds, river runoff, and open boundaries.
- AW_restore: same as AW_full, but with 180 day surface restoring of ocean temperature and salinity.
- All are integrated for 25 years using 1948 forcing and then for 25 years using 1948-1972 forcing.

Ocean velocity at 36 m, Jan/1972

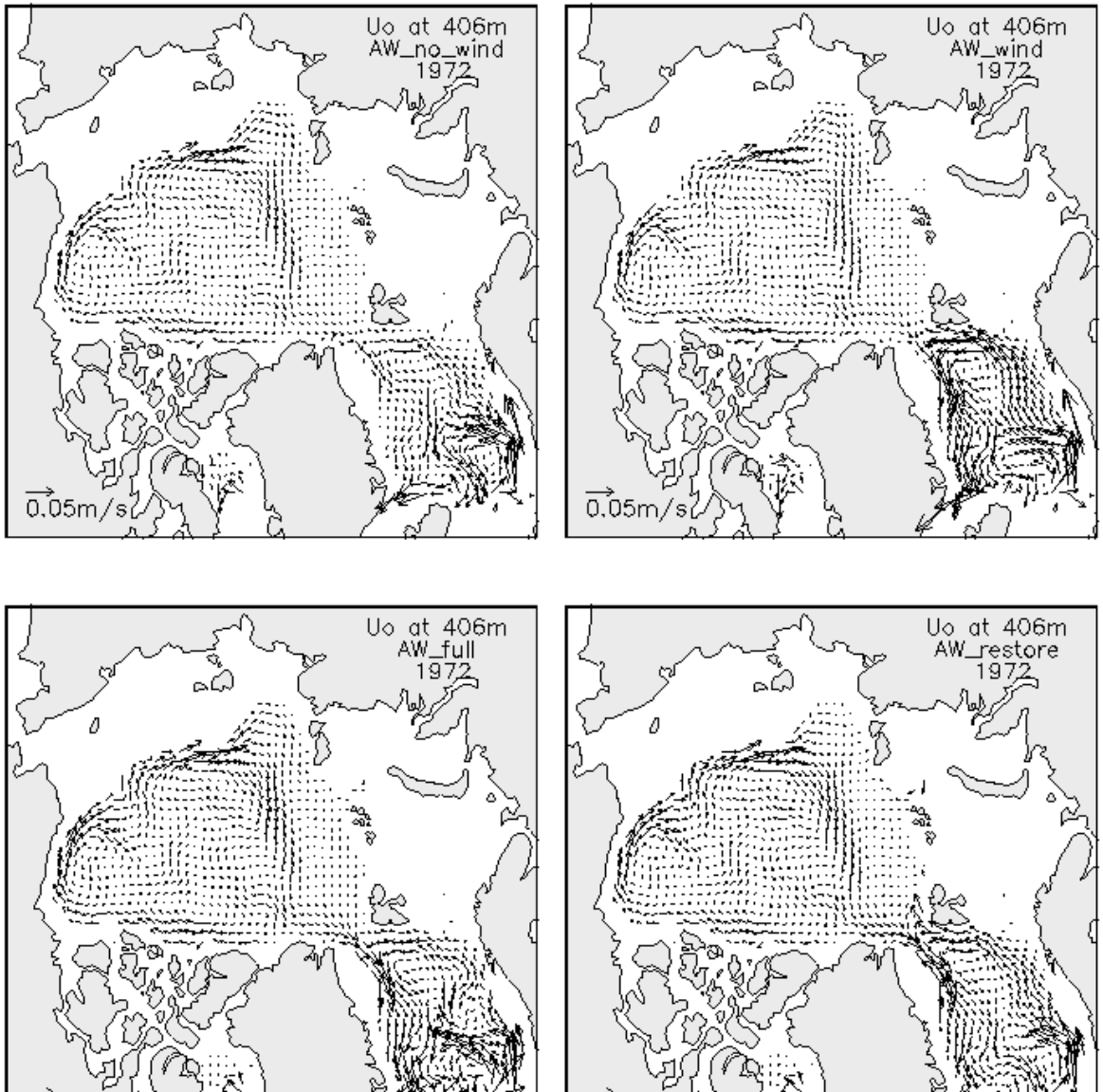




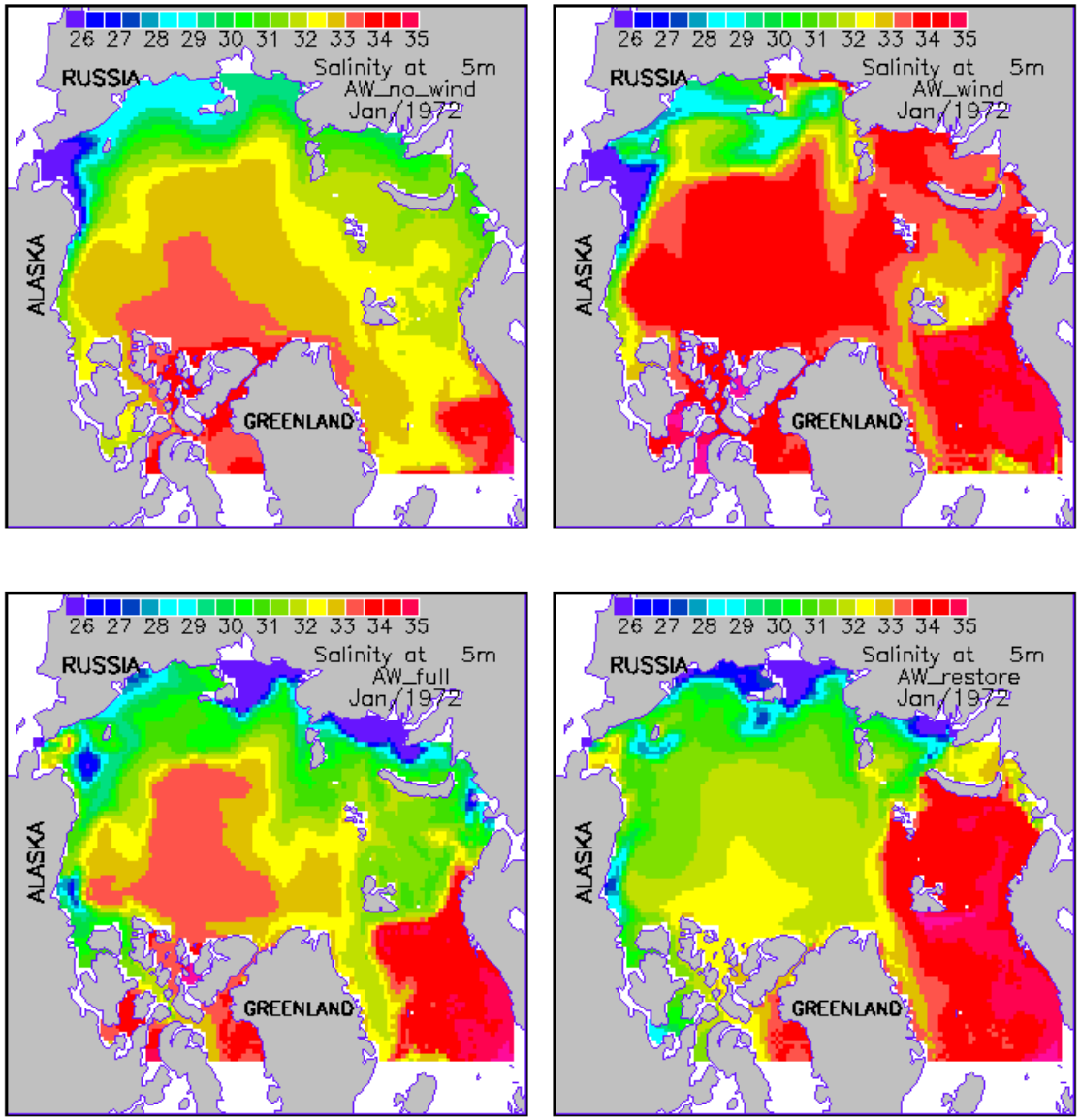




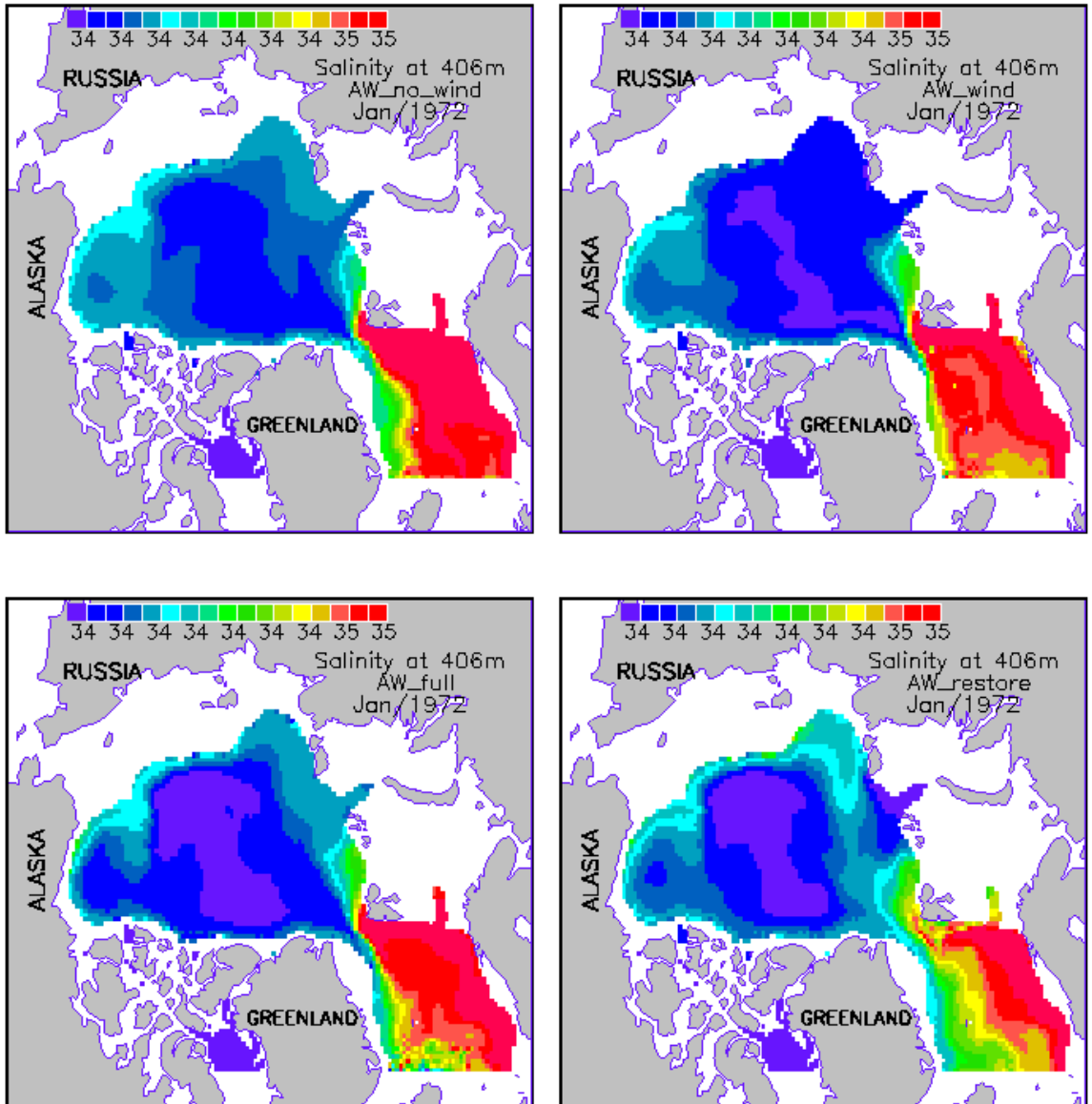
Ocean velocity at 406 m, Jan/1972



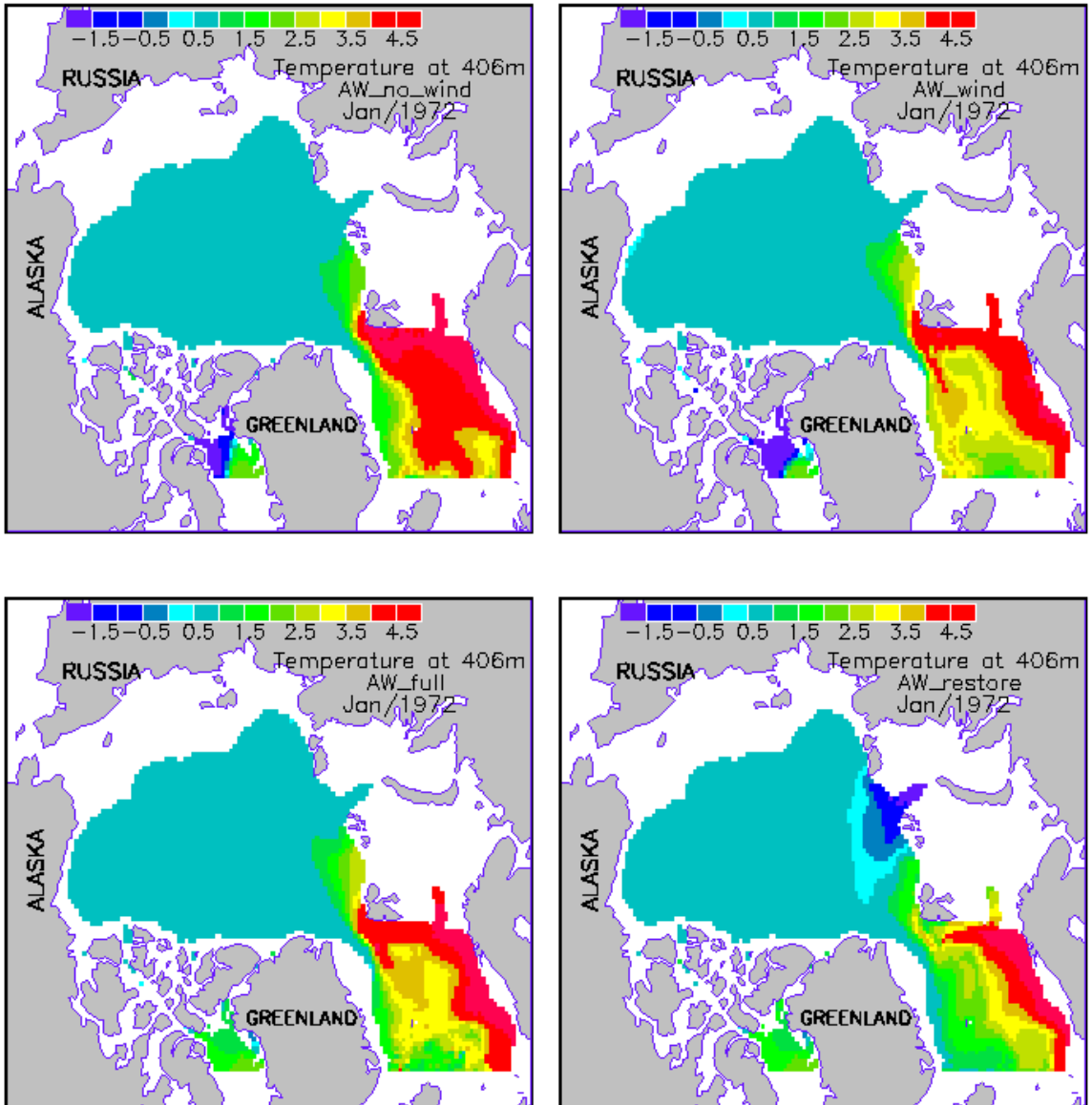
Surface salinity, Jan/1972



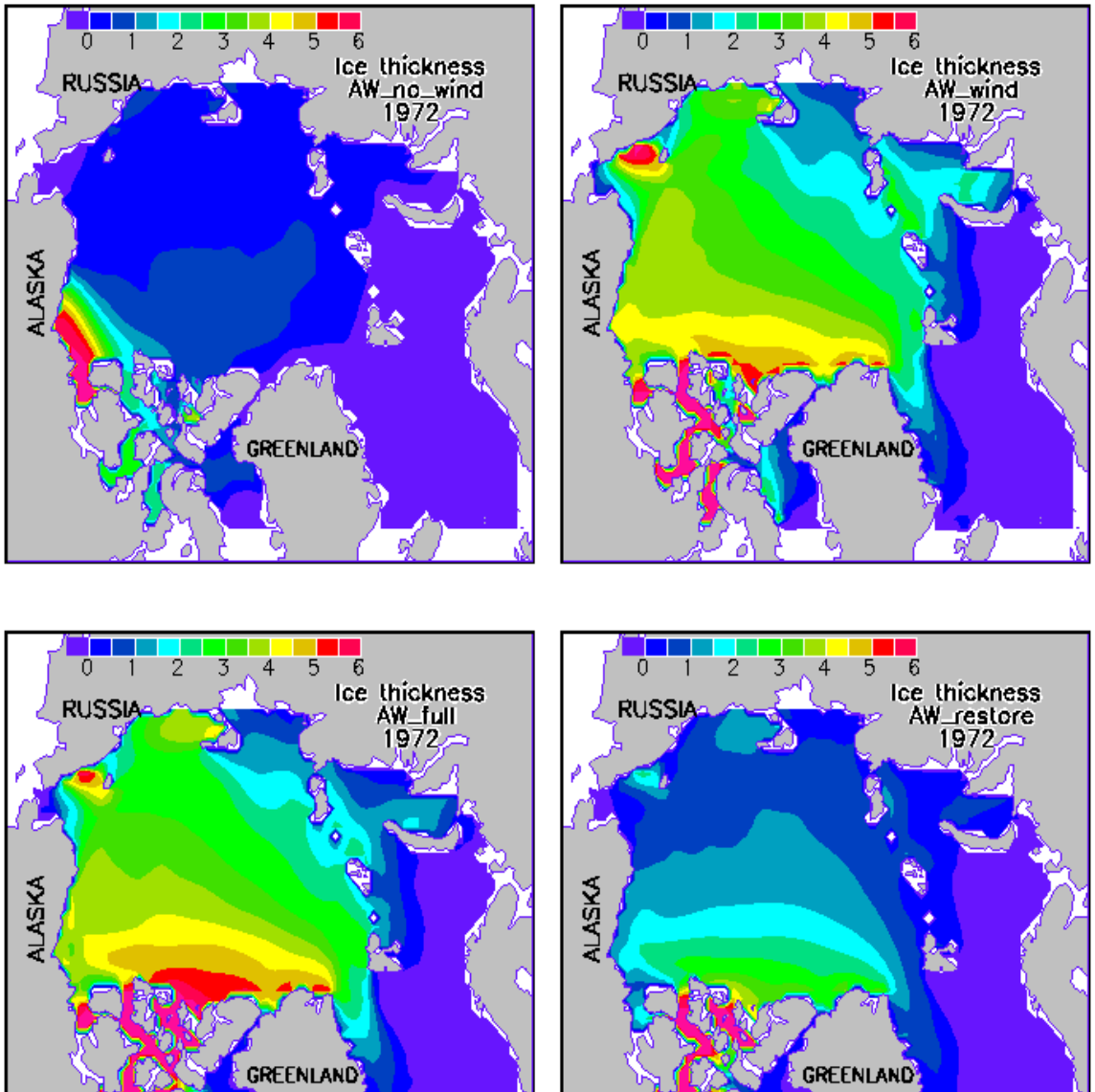
Salinity at 406 m, Jan/1972



Ocean temperature at 406 m, Jan/1972



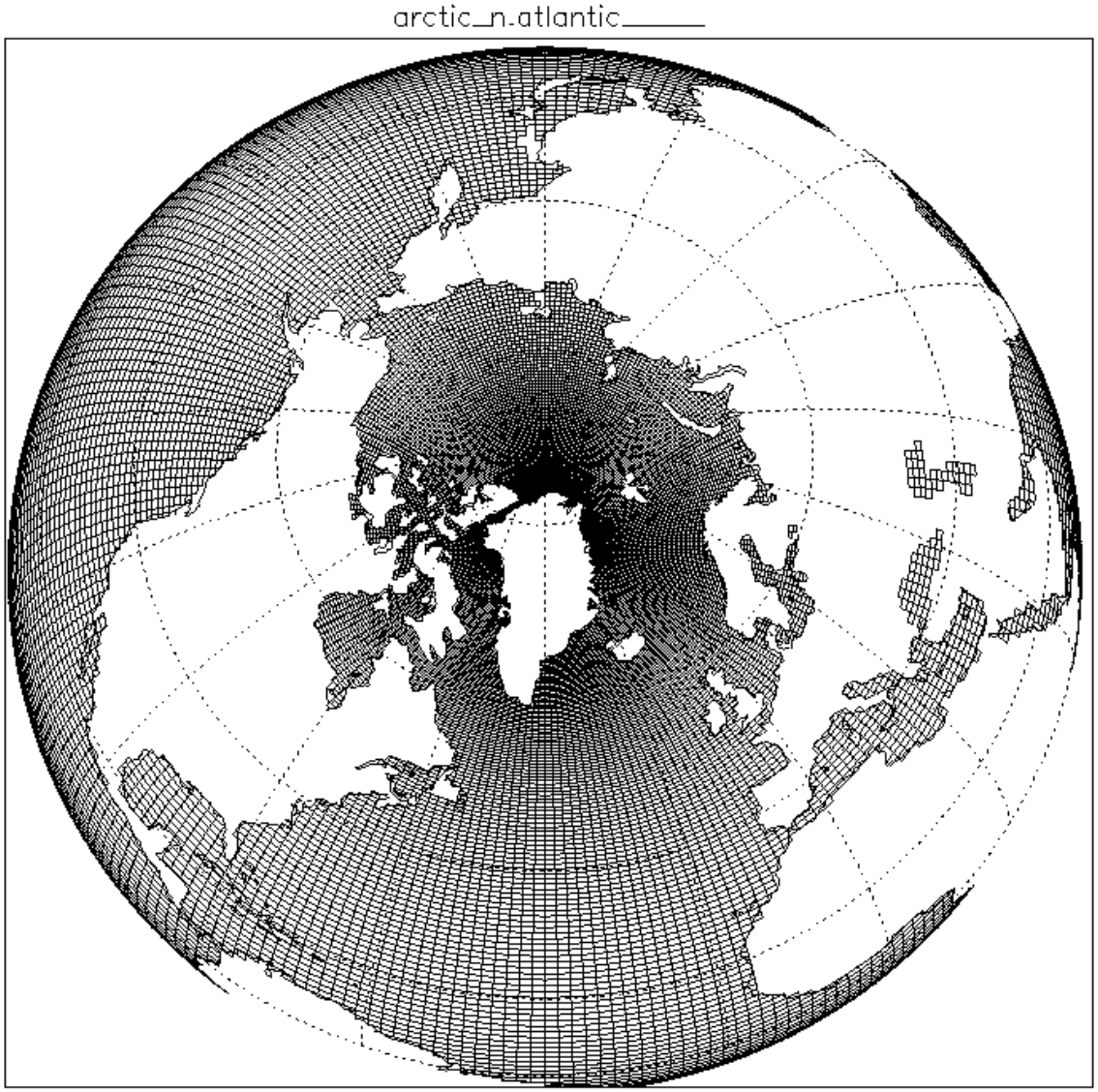
Ice Thickness (m), 1972



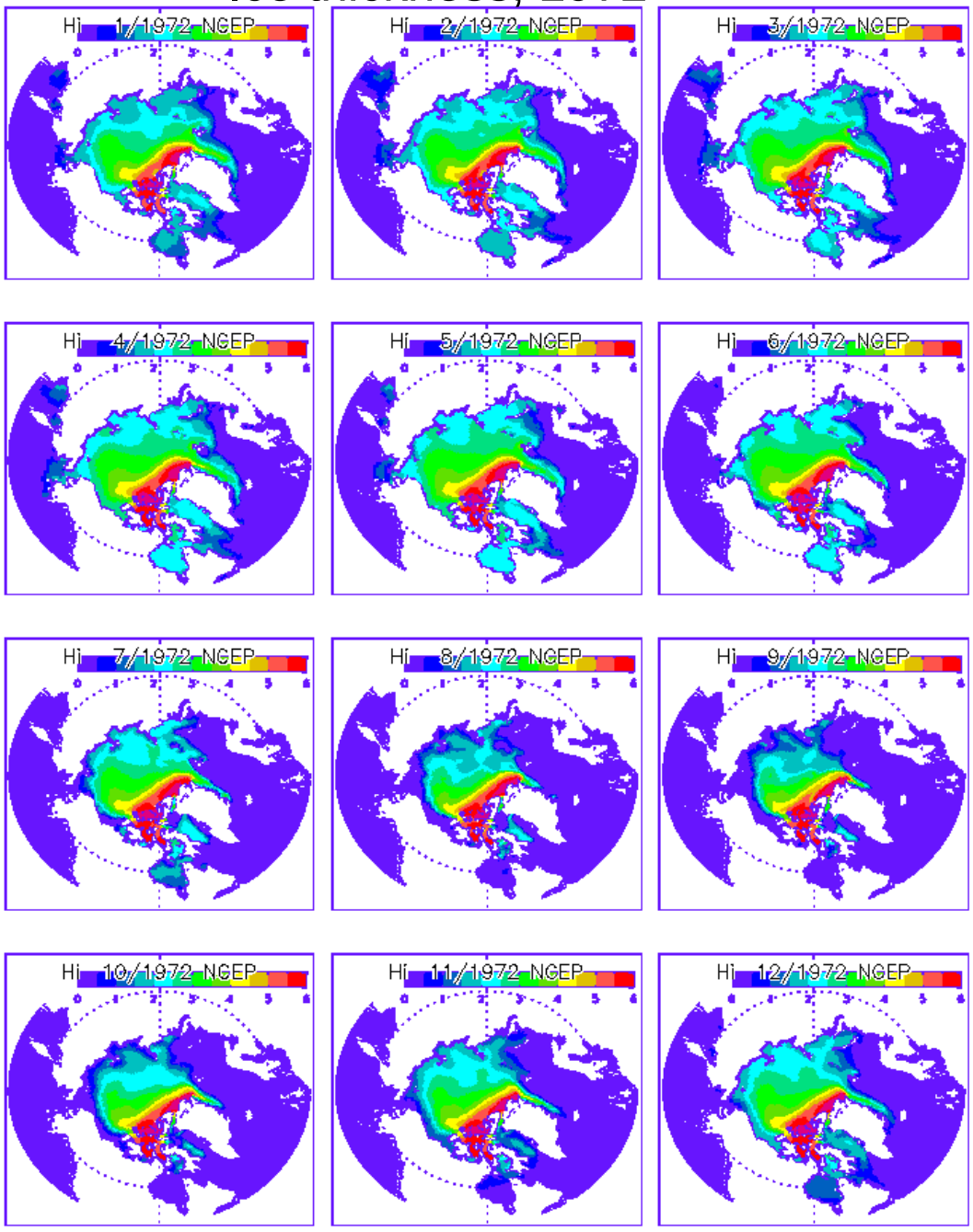
AW Circulation in a Global Parallel Ocean and Ice Model (POIM)

- POP ocean model.
- 8-category thickness and enthalpy distribution (TED) sea-ice model.
- Efficient parallel LSR (line successive relaxation) ice dynamics solver.
- Generalized curvilinear coordinate system.
- Displaced north pole grid.
- Grid size: 240 x 216

Grid configuration of a global ice-ocean model

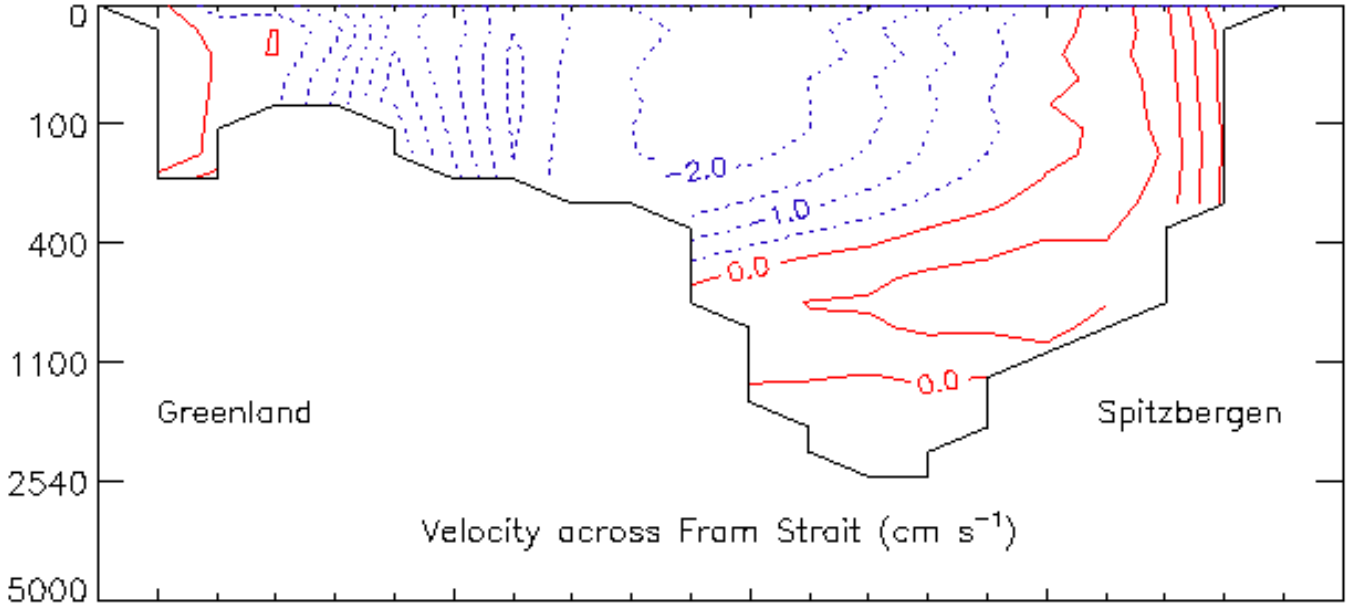


Ice thickness, 1972

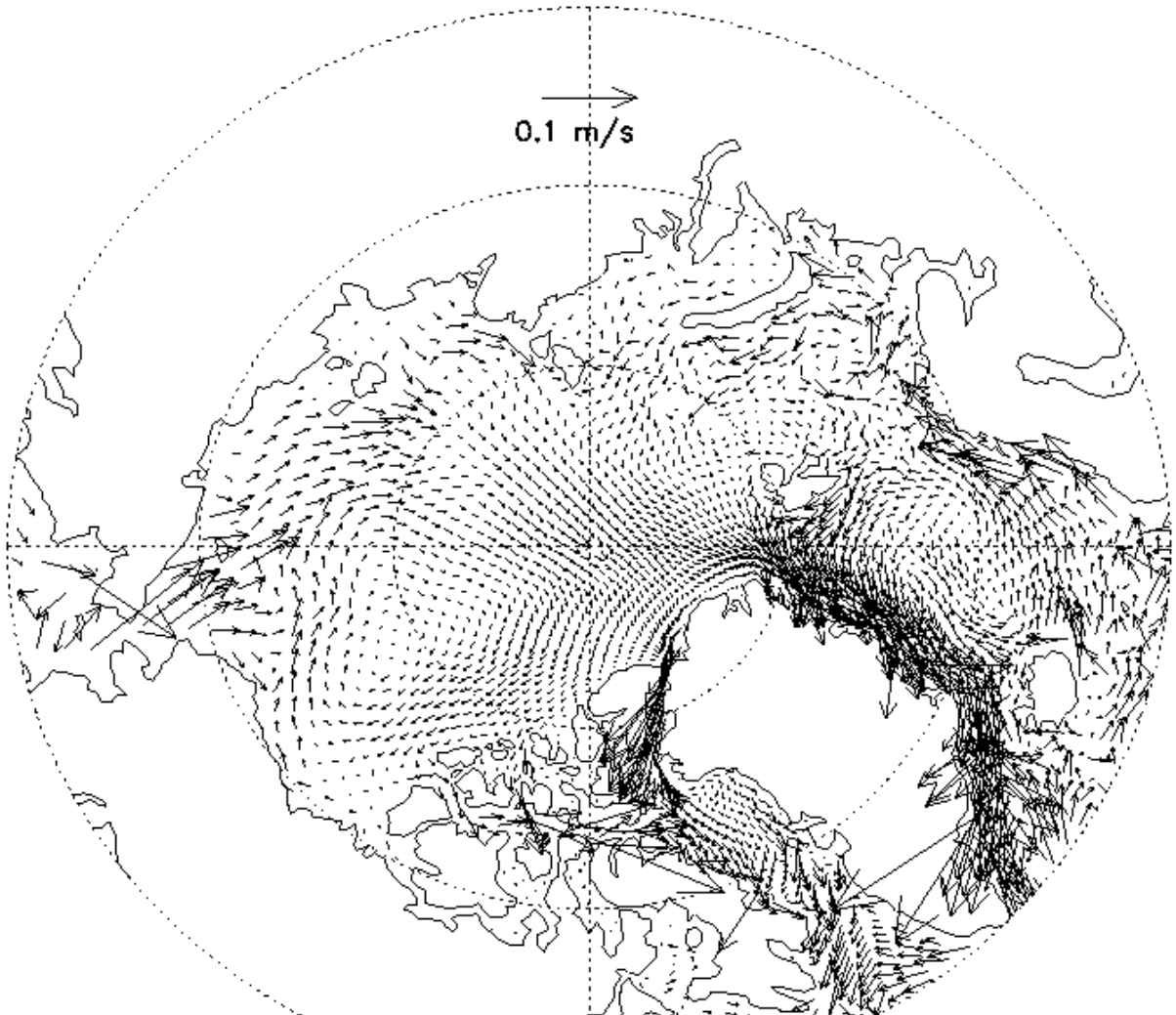


Ocean velocity across Fram Strait

1972



Surface ocean circulation, 1972



Ocean circulation at 400 m, 1972