High Resolution Modelling of the Canadian Arctic Archipelago using AGRIF

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Model Configuration/Setup

- Pan-Arctic: 1/6° resolution
- CAA/Beaufort: 1/3 grid spacing
- Max. 46 z-levels

- NEMO version 2.3, LIM2
- Initialization: Jan. T-S from PHC 3.0, sea ice from ORCA025 global simulation
- OBC: monthly T, S, velocity, and sea level from ORCA025 (Flather radiation for barotropic velocity)
- Surface forcing: CORE normal year forcing (NYR); “corrected” CORE real forcing (1998-2007)
Barrow Strait Transport

Model, mean=1.23 Sv

Obs., mean=0.68 Sv

Reduce Bering Strait transport

(R=0.70)

Model (reduced Bering Strait transport), mean=0.89 Sv

Reduce Barrow Strait transport
Annual Mean Circulation

50 m

400 m
Landcaster Sound: Seasonal Variability

Observed by Hamilton et al. 2002

http://www.nunatsiaqonline.ca/
Barrow Strait: Surface Circulation

From Arctic Oceanographic Data Report, 1978
Barrow Strait Along Channel Velocity

http://www.nunatsiaqonline.ca/
Ice Thickness and Ice Extent (1998-2007)
Ice Extent
Model vs. NSIDC, 1998-2007

Winter Maximum
Summertime Minimum

Year
CAA Ice Concentration

Observations (CIS), 2007

Model, 2007
Pan-Arctic Ice Drift
Oct 2001 to May 2002

Richter-Menge et al., 2002

5-12 cm/s
Summary

• Circulation
  – Realistic large scale circulation for Arctic using 18 km resolution.
  – Credible circulation in the CAA with 6 km resolution.
  – Boundary conditions in Bering Strait influence Lancaster Sound transport... Need to get North Pacific right!

• Sea-Ice
  – Realistic ice concentration within CAA.
  – Obtain realistic ice drift patterns in both Arctic and CAA.

• Time for quantitative validation
Next Steps

• Pan-Arctic + AGRIF model
  – Include tides
  – Neptune (?)
  – Expand the AGRIF domain
  – Continue with validation
  – Particle trajectory analysis

• 6 km Pan-Arctic Model!!! ...... Stay tuned.
Figure 1. Maps of the Arctic sea ice drift field as represented in observational data from (left) CERSAT and (right) NSIDC. An average of winter 1994/1995 (November–April) is shown, and both data sets have been reduced for clarity. Additionally, bold black vectors mark the mean drift of buoys of the IABP that fully cover the same period.

Pan-Arctic Ice Drift

Model: Nov. 2006 - Apr. 2007
CAE Ice Drift/Thickness