Validation of a global finite element sea ice-ocean model

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1. Introduction
Results from a global Finite Element Sea–Ocean Model (FESOM, Timmermann et al., 2009) are evaluated using eulerian and lagrangian datasets. We demonstrate that the model captures many of the typical features of sea ice distribution and global ocean circulation, but also shows a couple of weaknesses. Local refinement of the grid is expected to improve results further.

2. Model Description: Finite Element Sea Ice Ocean Model (FESOM; Timmermann et al. 2009)
- hydrostatic, free-surface, primitive-equation Finite Element Ocean Model (grown up from FENA model of Danilov et al., 2004)
- tetrahedral mesh, P1-P1 discretization
- global domain, 1.5° horizontal resolution, 26 layers, shaved cells
- dynamic-thermodynamic Finite-Element Sea-Ice Model (FESIM)
- Heat storage in ice/snow neglected
- EVP rheology
- atmospheric forcing from NCEP reanalysis 1948-2007

3. Results: Ocean circulation, meridional overturning and bottom water formation
- Annual mean velocity at 150 m depth after 10 years of integration (displayed on 3x3 grid)
- Antarctic Circumpolar Current (ACC)

4. Results: Sea ice cover
- Simulated and observed minimum and maximum sea ice extents

5. Results: Estimating net freezing rates
- Annual mean ice growth rate

6. Conclusions
- good representation of ocean general circulation; subsurface velocities on the small side. Strong AABW cell, ventilation at correct locations.
- summer ice extent too small, winter ice extent excellent. Realistic trends. Ice thickness comparison for Weddell Sea very good, except for northwestern corner.

7. Outlook
- Local refinements in the Weddell Sea
- Implementation of ice shelf-ocean interaction
- Coupling to COSMO (coop. with D. Schröder / G. Heinemann, Uni Trier)

Further reading:

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