Preliminary Results Using Regionally Refined Ocean and Sea-ice Meshes for the E3SM v2 Cryosphere Science Campaign

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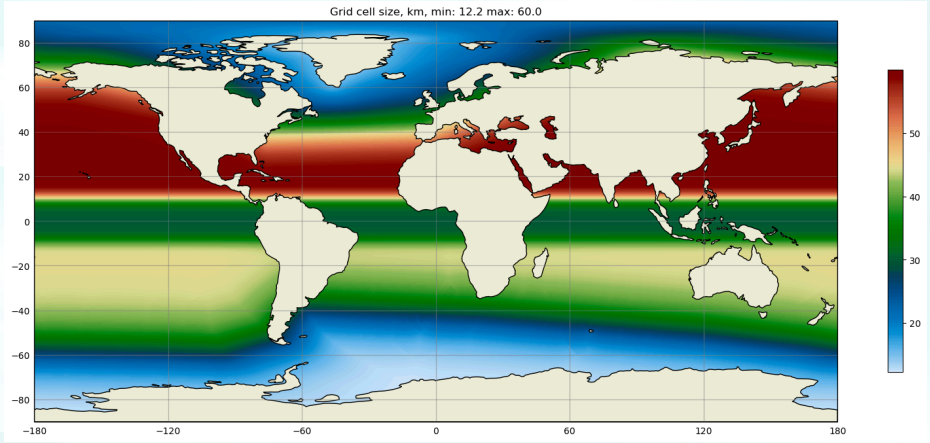


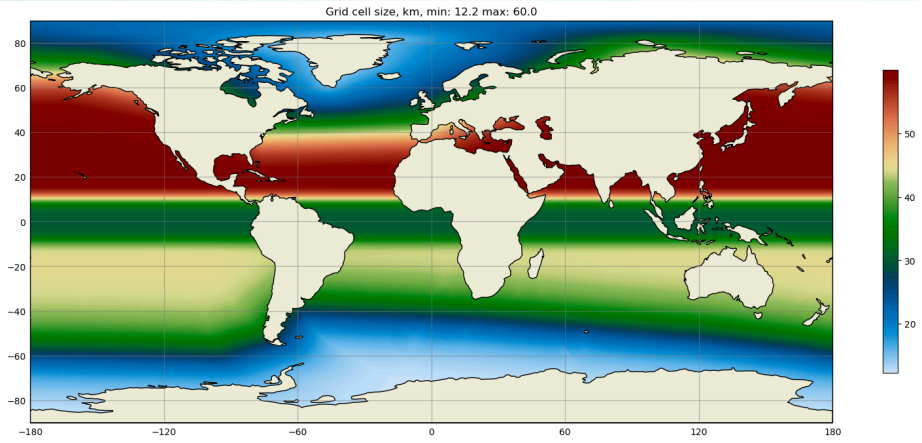
Companion poster to “Designing Regionally Refined Ocean and Sea-ice Meshes for the E3SM v2 Cryosphere Science Campaign “ , Xylar Asay-Davis et al, in this same session

E3SM Energy Exascale Earth System Model

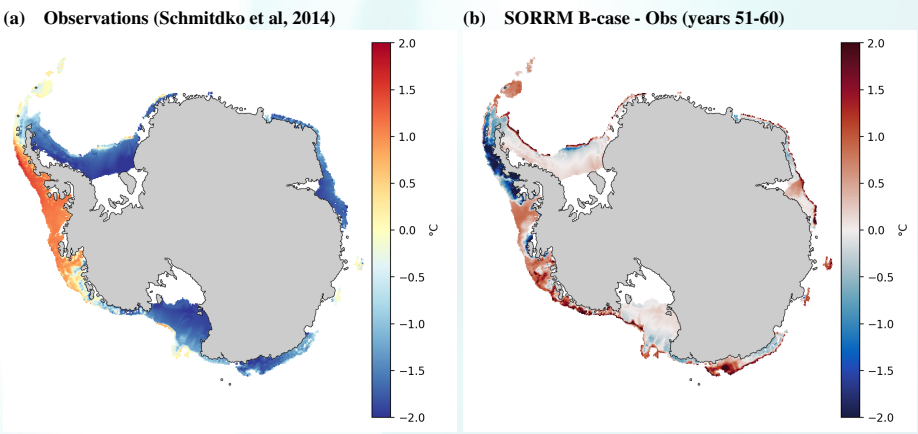
U.S. DEPARTMENT OF ENERGY

Preliminary simulation results

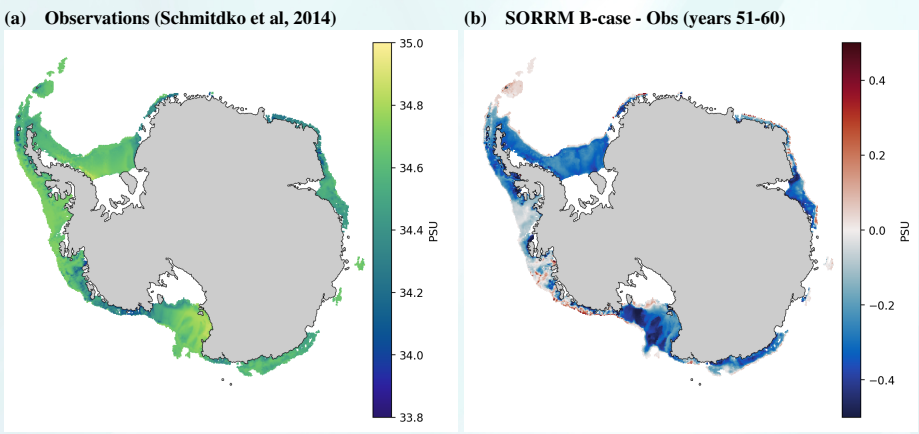
- Simulations use third revision of the Southern Ocean Regionally Refined Mesh (SORRM), with resolution around 12km in Southern Ocean and Arctic/North Atlantic, down to 60km elsewhere
- Simulations run off an early version of v2 atm/ocn (code base 5.29); results will likely change with v2 code base
- B-case (fully coupled), G-case (active ocean/ice only) were run, as well as a low-resolution run with the same code base for direct comparison of resolution; last decade of 60 year runs are compared



Seafloor temperature

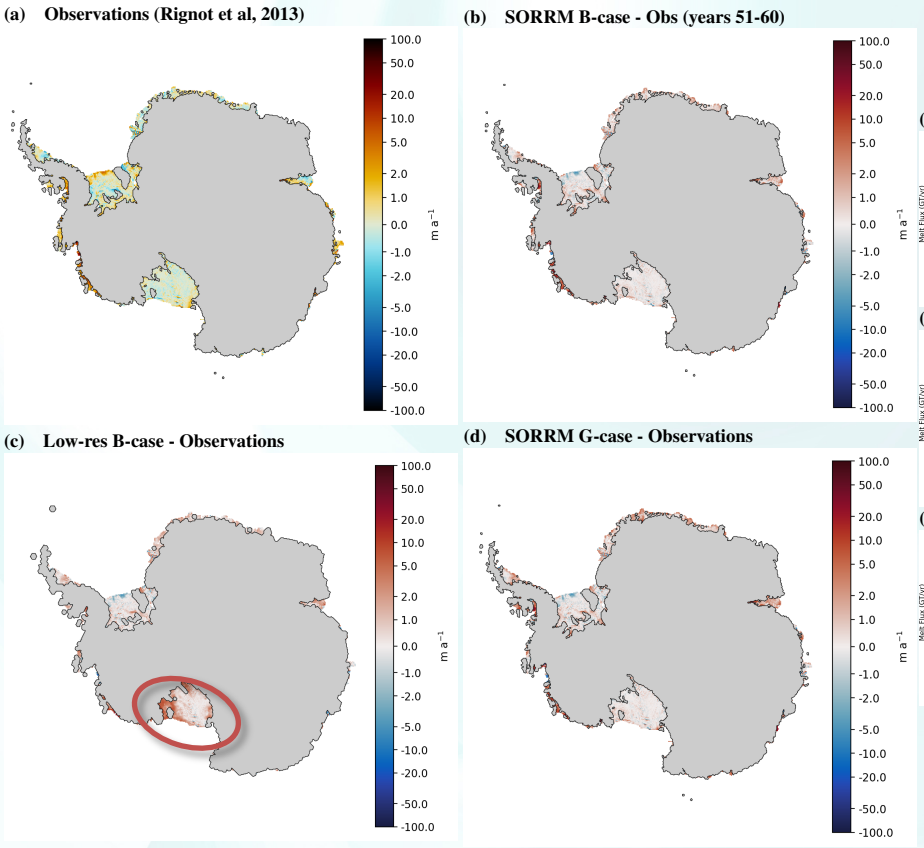


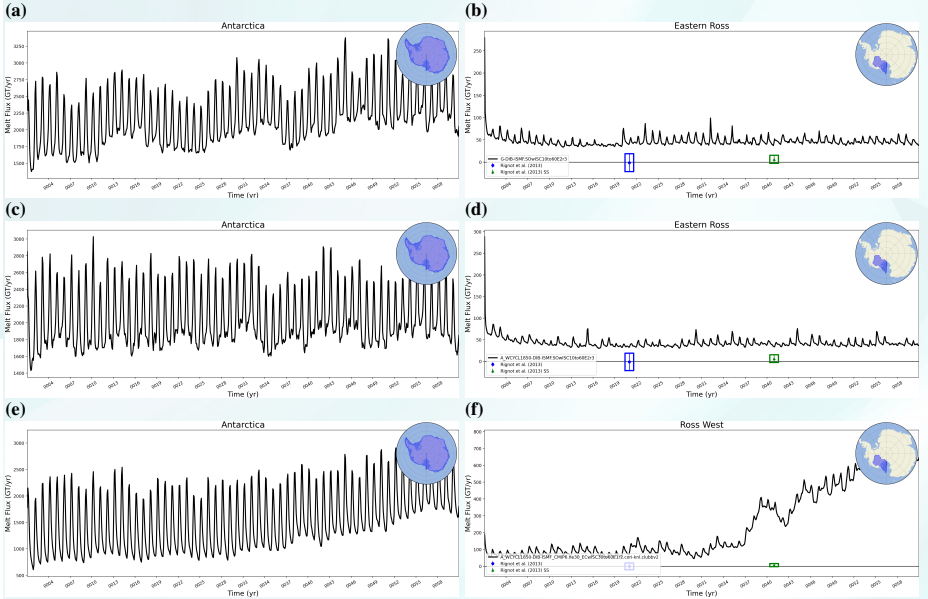
Seafloor salinity



SORRM simulations show improvement in key biases under Ross Ice Shelf (red) and Filchner-Ronne Ice Shelf (green)

Ice-shelf melt rates





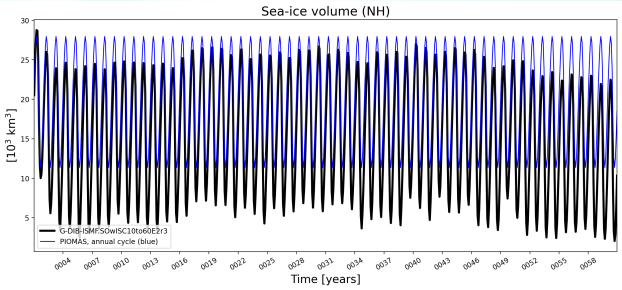
The high temperature bias in the low-res B-case result in a transition to high melt-rates under the Ross Ice Shelf (f), not seen in the SORRM simulations. Other SORRM melt rates are generally too high, but stable.

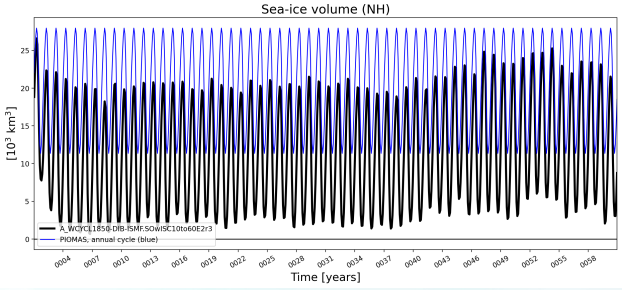
Arctic sea ice volume

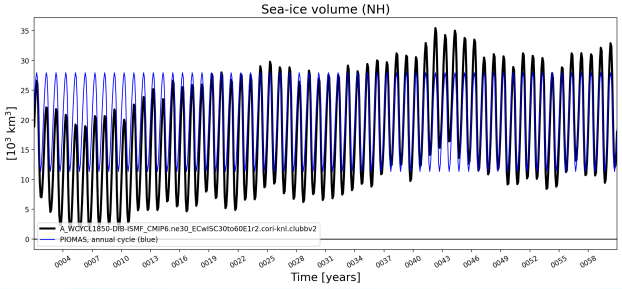
SORRM G-case

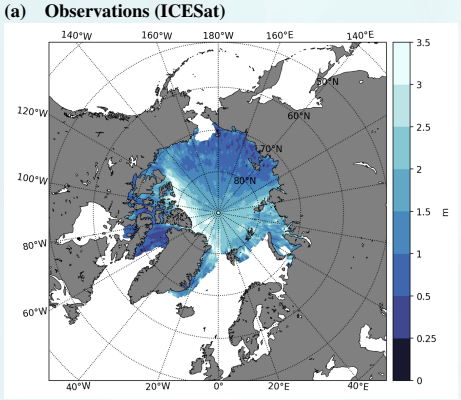
SORRM B-case

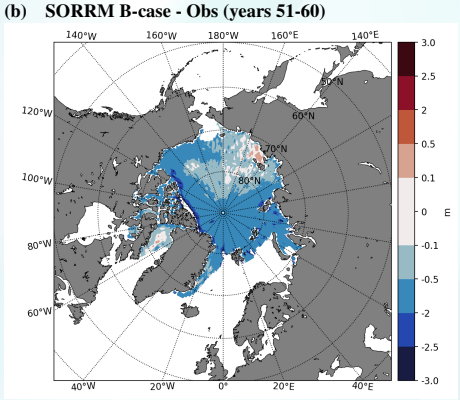
Low-res B-case

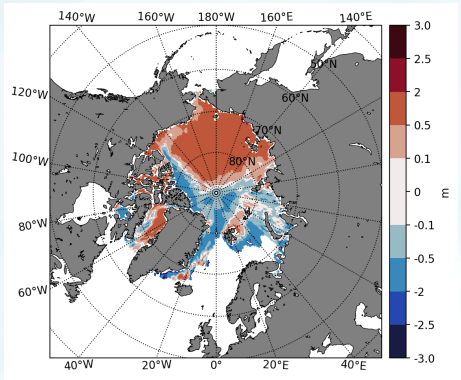


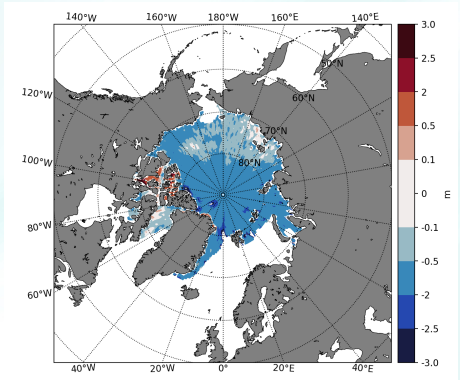








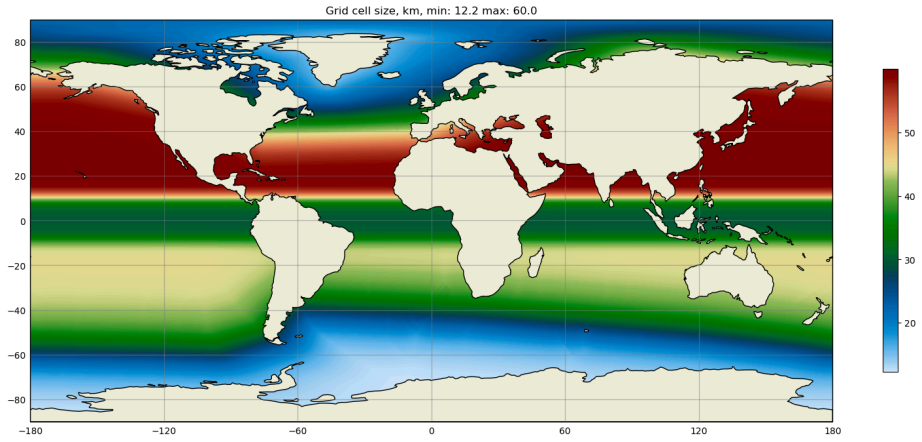




Arctic sea ice is far too low in the SORRM simulations; recent changes to E3SM v2 code base may impact these results.

Summary

- Southern Ocean temperature & salinity biases improved in SORRM vs. low-res; bias is considerably better in SORRM G-case
- Melt rates seem stable in SORRM runs, but generally too high; low-res counterpart experiences high melt instability
- Arctic sea ice is far too low in SORRM runs, not showing sign of recovery
- New E3SM v2 tunings will likely impact preliminary results presented here, but results are encouraging for achieving a stable pre-industrial climate



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