Summary of Ocean0-2_COM_MOM6 Results

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1 Model Details

- Model and version: Modular Ocean Model v. 6 (MOM6).
- Repository: https://github.com/gustavo-marques/MOM6/releases/tag/ISOMIP.v1.0
- Model configuration and input files:
  - https://github.com/gustavo-marques/ISOMIP/tree/master/setup/Ocean0/COM
  - https://github.com/gustavo-marques/ISOMIP/tree/master/setup/Ocean1/COM
  - https://github.com/gustavo-marques/ISOMIP/tree/master/setup/Ocean2/COM
- Vertical coordinate: layered isopycnal (density) coordinate with a bulk mixed layer scheme.
- Horizontal mixing: harmonic (del2); along-isopycnal for diffusivities and along-layer for viscosity.
- Vertical mixing: del2 with COM constant viscosity and diffusivity set as background values. Additional vertical mixing is also applied based on the parameterization developed by Jackson et al. (2008), more details below. Within the mixed layer, vertical mixing is also controlled by the bulk mixed layer scheme described in Hallberg (2003).
- Advection schemes: momentum - second-order centered; tracers - piecewise linear method.
- Equation of state: linear with ISOMIP+ coefficients.
- Convection parameterization: based on the parameterization developed by Jackson et al. (2008) using a critical Richardson number of $Ri_c = 0.25$.
- Bulk mixed layer: minimum thickness of 10 m and the minimum vertical viscosity of 10^{-2} m^2/s.
- Melt parameterization: T_w, S_w and u_w were averaged within 10 m of the ice draft; u_w was averaged the to the tracer grid using four horizontal neighbors. Melting was set to zero in regions where the ice depth was less than 90 m and when the total water column thickness was less than 10 m.
- Modifications to Topography: Interpolated to 2-km grid using a spline method[1] then smoothed the ice thickness using a Gaussian filter[2] with half-width of 1 and 5 km for the

[1] http://docs.scipy.org/doc/scipy/reference/generated/scipy.interpolate.interp2d.html#scipy.interpolate.interp2d
[2] http://docs.scipy.org/doc/scipy-0.16.1/reference/generated/scipy.ndimage.filters.gaussian_filter.html

y and x direction, respectively. An offline calving criterion was used where ice thinner than 100 m was removed. To minimize pressure gradient errors due to a step-like ice cliff, this criterion was not applied near the ice front, which remained smooth. A minimum thickness of $\sim$ 40 m was maintained by decreasing the ice thickness near the grounding line.

- Maintaining sea level: mass fluxes were used and no corrections were applied to maintain the sea level unchanged.
- Deviations from COM: the model deviated from the COM vertical mixing and convection parameterization. Instead of prescribing the COM vertical viscosity/diffusivity when the local stratification was unstable, we applied the parameterization developed by Jackson et al. (2008) using a critical Richardson number of $Ri_c = 0.25$. Within the mixed layer, vertical mixing is also controlled by the bulk mixed layer scheme described in Hallberg (2003).
- Parameter values:

Γ_T	0.1423
Γ_S	4.743×10^{-3}
$C_{D,\mathrm{top}}$	2.5×10^{-3}

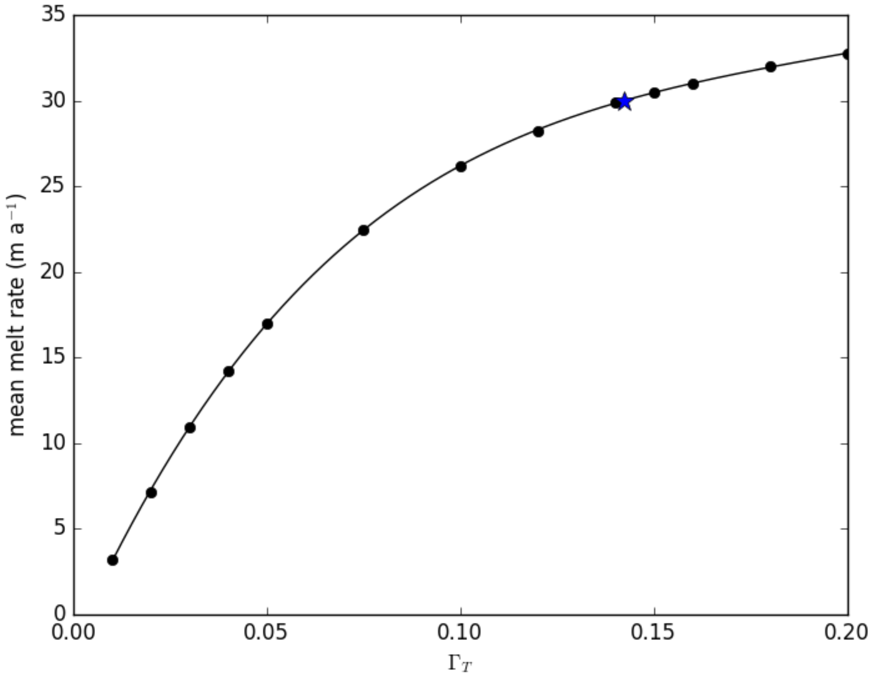

Figure 1: The dependence of the mean melt rate averaged over locations below z_d = -300 m and over the final six months of the simulation for various values of the turbulent heat-transfer coefficient Γ_T . Based on these results, the value of $\Gamma_T \sim 0.1423$ (blue star), corresponding to a mean melt rate $m_w \sim 30$ m a^{-1}, was used in Ocean1 and Ocean2.

Bibliography

Hallberg, Robert (2003), “The ability of large-scale ocean models to accept parameterizations of boundary mixing, and a description of a refined bulk mixed-layer model.” In *Proceedings of the 2003 Aha Hulikoa Hawaiian Winter Workshop*, 187–203.

Jackson, L, R Hallberg, and S Legg (2008), “A parameterization of shear-driven turbulence for ocean climate models.” *J. Phys. Oceanog.*, 38, 1033–1053.