

README

Introduction

This data repository supports a paper by Luwei Yang, Maxim Nikurashin, Andrew McC. Hogg, and Bernadette M. Sloyan, accepted for publication in the Journal of Physical Oceanography, doi: <https://doi.org/10.1175/JPO-D-20-0263.1>.

This repository contains model solutions for a series of MOM6 ocean model simulations and other information needed to reproduce results shown in the paper. These simulations are carried out in an idealized periodic channel configuration that is representative of the Southern Ocean to investigate the impact of lee waves on the Southern Ocean circulation.

Model configuration

The model domain is in Cartesian coordinate. The domain size is $L_x \times L_y \times L_z = 4000 \text{ km} \times 2500 \text{ km} \times 4 \text{ km}$. The horizontal resolution is 10 km . There are 72 vertical layers. The vertical grid spacing ranges from 5 m at the surface to 140 m near the bottom. The layer depths are provided in [Vertical_coordinate.nc](#) and layer densities are provided in [coord.nc](#). The model is forced by surface wind stress, surface temperature restoring, and a sponge layer located in the northernmost 100 km of the domain. The wind stress τ and the SST profile used to restore the surface temperature are saved in [forcing.nc](#). The vertical diffusivity is elevated in the northern sponge layer to represent the downward flux of heat due to the interior mixing in the ocean basins to the north of the Southern Ocean. The topography is provided in [topog.nc](#).

List of netCDF files

1. Model configuration
 - [Vertical_coordinate.nc](#): Layer depths
 - [coord.nc](#): Layer densities
 - [forcing.nc](#): Wind forcing and buoyancy forcing
 - [topog.nc](#): Topography

2. Reference experiment

The following data files are used to produce Fig. 3 in the paper.

- [diffu_w2_quad_cd3_streamline.nc](#): Baroclinic stream function in units of Sv
- [diffu_w2_quad_cd3_b5EKE.nc](#): Bottom-500m-averaged EKE in units of $m^2 s^{-2}$
- [diffu_w2_quad_cd3_moc.nc](#):
 - vrho: Meridional stream function in density space in units of Sv
 - rhon: Minimum density at the surface
 - rhom: Maximum density at the surface
- [diffu_w2_quad_cd3_b5N.mat](#):
 - nsm: Stratification field in units of s^{-1}
 - nsm_b5_ave: Bottom-500m-averaged stratification

3. Lee wave experiments

*_avg.nc holds data which has been averaged over the last 5 years of each experiment (years 246-250).

- [full_avg.nc](#): lee-wave-drag-only experiment
- [drag_avg.nc](#): lee-wave full parameterization experiment
- [mixing_avg.nc](#): lee-wave-driven mixing-only experiment

These files include the following variables:

- rhoinsitu: In situ density
- lw_TKE: Bottom energy flux into lee waves
- Kd_Yang: Lee Wave Driven Diffusivity derived from energy dissipation rate
- lw_epsilon: Energy dissipation rate due to lee waves breaking
- lw_drag_coeff: Lee wave drag coefficient
- vh_rho: Meridional volume transport in pure potential density coordinates