J. <u>List of Preprocessor Options</u>

Numerical Options

The user must select the first option and any or all of the remaining options.

congrad5pt - Use 5-point conjugate-gradient elliptic solver for barotropic streamfunction.

islands - Include islands in relaxation topography.

fourfil - Fourier filter the prognostic variables in the longitudinal direction at high latitudes.

northpole - No island at the North Pole; see Section H.

taperhrzvd - Taper horizontal and isopycnal mixing coefficients at high latitudes; see Section H.

upwind3 - Use third-order upwinding option; see Section H.

Model Resolution

Default model resolution is 2×2. Option *model3×3* has been extensively tested; option *model1×1* has not.

model1×1 - Select default parameter values for 1×1 resolution.

model3×3 - Select default parameter values for 3×3 resolution.

Vertical Sub-grid-scale Mixing Schemes

One of the first two options must be selected. If *kmix* is selected, then *implicitmix* must also be selected. Multiple sub-options, which are indented following the major option, may be selected.

constvmix - Constant vertical profiles for $fkpm$ and $fkph$.

implicitvmix - Implicit vertical mixing; convective adjustment is bypassed.

kmix - Mixing scheme based on the K-profile planetary boundary layer scheme by Large, McWilliams, and Doney; see Section G.

> *kmixcheckekmo* - Check Ekman Layer and Monin-Obukhov length scales.
>
> *kmixnori* - The vertical viscosity and diffusivity below the boundary layer do not depend on the local Richardson number, but are set to the background values, *fkpm* and *fkph*.
>
> *kmixdd* - Include double-diffusion contribution to vertical diffusivity.

Horizontal and Isopycnal Sub-grid-scale Mixing Schemes

One of the first two options must be selected. In addition, *isopycmix* may be selected.

biharmonic - Constant coefficient biharmonic horizontal mixing (∇^4).

consthmix - Constant coefficient Laplacian horizontal mixing (∇^2).

isopycmix - Mesoscale eddy parameterization; see Section F. This only applies to the tracer equations, and it is recommended that the coefficient *ah* is zero when this option is chosen.

> *isopycmixspatialvar* - Taper the isopycnal mixing coefficient to zero when isopycnal slopes become steep. This option is valid only when *isopycmix* is set.

Surface Forcing Options

The surface forcing options are described in Section I. Only one of the first four major options should be selected. *sflxiceflx* and *sflxsw* may be selected in addition.

sflxcombo - Specify type of tracer forcing data: This is a combination of air-sea fluxes (based on air temperature, specific humidity, solar short wave flux, cloud fraction, precipitation, and windspeed) and restoring terms (due to restoring fields of SST and SSS).

> *sflxcomboavan* - Compute annual averages of several surface tracer fluxes for diagnostic purposes.

> *restormed* - Restore sea-surface temperature and salinity back to specified values in the Mediterranean Sea (the 3×3 model does not have a Mediterranean Sea).

sflxpvm - Provide all surface fluxes via the Flux Coupler.

> *sflxpvmicetilt* - Compute the tilt of the sea surface; necessary for some ice models.

restorst - Restore sea-surface temperature and salinity back to specified values globally.

sflxdataflx - Specify all fluxes from data: forcing data consist of non-solar heat flux, solar heat flux, and net freshwater flux.

sflxiceflx - Check for ice formation in the uppermost *kmxice* layers in the ocean model, change temperature and salinity if ice forms or melts, and keep track of previously formed ice. Can be used either for ocean only model runs and should be used for coupled runs.

sflxsw - Treat solar short wave flux differently from all other surface heat fluxes: this flux appears as a right-hand-side term in sourct and is allowed to penetrate the water with an exponentially decreasing absorption factor. The Jerlov water type, *jwatertype*, is specified in blkdta.F.

Boundary Conditions

cyclic - Impose cyclic longitudinal boundary conditions.

Input/Output

crayio - Use I/O based on Cray getwa and putwa commands for out-of-core computations.

diskless - Simulate disk storage using memory array for in-core computations.

Model Performance and Monitoring

multitasking - Allow parallel processing via latitude bands.

> *readchunk* - Specify the chunk size for each set of latitudes so that the computational load is balanced among all of the processors. Presently, this option is valid only when using the 2×2 model, with ntasks=4,8, or 16; the chunks are defined in blkdta.F.

keepterms - Use arrays to retain terms in momentum and tracer equations, instead of recomputing via statement functions.

testcfl - Test whether any velocity exceeds the local CFL criterion by a factor of *cflcrt*.

timing - Compute the time spent per gridpoint per timestep; report cpu and wall-clock times. Valid for Cray Y-MP systems.

Conveniences

autorestart - Provide an automatic restart from the latest model restart files.

readrmsk - Read in region information from the file "regionmask".

time_average - Create time averages of the model fields, forcing and poleward transports, see Section H.

Internal options

hmixalreadyset - An internal option set in the files fdifm.h and fdift.h

ioalreadyset - An internal option set in the file odam.F

Unsupported Options

The following options exist in the NCAR CSM ocean model, but they are not supported by the NCAR CSM developers and should be activated by the user only after careful testing to ensure correctness.

congrad9pt - Use 9-point conjugate-gradient elliptic solver for barotropic streamfunction.

constvmixdmxl - Enhance vertical diffusivity in the top 50m (3 or 4 layers).

constvmixvmxl - Enhance vertical viscosity in the top 50m (3 or 4 layers).

extras - Provide extra diagnostic information.

fio - Fortran direct-access I/O.

firfil - Finite-impulse filter.

insitu - Compute polynomial expansion coefficients for the equation of state using in-situ temperature.

knudsen - Use Knudsen equation of state for sea water.

multitaskqueue - Monitor the status of the NCAR Cray multitasking queue; shut down and exit upon receiving the proper signal.

nlhmix - Nonlinear horizontal sub-grid-scale mixing.

nohilats - Drop metric nonlinear terms in the momentum equation.

ppvmix - Use Pacanowski and Philander vertical mixing.

sflxtharm - Use annual and first two harmonics of the seasonal cycle for restoring of the surface tracer fields.

sflxwharm - Use annual and first two harmonics of the seasonal cycle for wind stress forcing.

skipland - Perform computations only over ocean points.

symmetry - Symmetric boundary condition about the northern model boundary.

tcvmix - Mellor-Yamada turbulence closure scheme.

lalg - *tcvmix* suboption.

leq - *tcvmix* suboption.

REMARK: The NCAR CSM model only runs with a rigid lid. However, the old MOM preprocessor option named *rigidlid* no longer needs to be specified, and has been removed from the NCAR CSM ocean code.