ECCO Projects Meeting

MITgcm model development

Caltech, Nov 06, 2017
MITgcm development

- seaice (Martin L.)
- bling (Matt M.)
- darwin (Chris H.)
- coupled stream-ice / ice-shelf / ocean (Patrick H.)
- implicit bottom friction (small partial-cell at the bottom)
- mixing parameterisations
- update on MITgcm code repository (moving from CVS to git)
- compressibility in EOS: an other motivation for p-coordinate
- other (pkg/exf, diagnostics)
Implicit bottom friction:
usefull with small partial-cell at the bottom or large bottom friction

\[ u^{n+1} = U^{-1}L^{-1} \left( u^n + \Delta t G^{n+1/2}_u \right) - \frac{g \Delta t}{\Delta x} U^{-1}L^{-1}(\delta^i \eta^{n+1}) \]

Accounting for partial cell in vertical viscous and diffusive flux

- bottom stress (no-slip BC) with hFac (bottomVisc_pCell =T):
  \[-viscAr_k u_k/(drF_k/2) / hFac_k\]
- hFac in interior viscous flux (interViscAr_pCell =T)
  \[viscAr_k (u_k - u_{k-1})/drC_k / hFac_k^k\]
- hFac in interior diffusive flux (interDiffKr_pCell =T)
  \[diffKr_k (T_k - T_{k-1})/drC_k / hFac_k^k\]

Increasing viscosity and diffusion near bottom

- numerical ”trick” for too thin bottom cell (small hFac)
- ensure a smooth evolution as hFac get smaller
- increase near bottom interior viscosity and diffusivity by:
  \[recip_hFac^n (n = pCellMix_select)\]
- also available for too thin surface grid cell
pCellMix test:

2-D flow over a sill, linear dynamics with quadratic bottom drag

Melting rate in 2-D shelf ice set-up with or without: SHELFICE boundary layer, Wet-Point $U^*$, pCell-Mix.
Mixing parameterisations

- Sub-Meso (within pkg/gmredi, using advective form)
- Mixing by internal-wave breaking
  (pkg/kl10, Klymak & Legg, Ocean Mod., 33, 2010)
- Improved Leith scheme (Baylor F.K.)
  Bachman et al, JGR, 2017
  tested in GCM: Pearson et al, Ocean Mod., 115, 2017
  ← not yet in repository
- Mixing due to Langmuir Circulation effect
  in TKE: Axel, JGR, 107, 2002 (in NEMO); Noh et al, JPO, 46, 2016
  ← not in MITgcm
  time to get an updated version of KPP?
Update on MITgcm code repository

- moving out of old hardware (mitgcm.org): almost done
- moving code repository from CVS to git (github)
  motivation:
  - a better and more modern tool (e.g., local ”clone” contains the full history)
  - new capabilities: e.g., ”travis” tool
  - used for many other projects
  - easier to incorporate contributions from others (”pull request”)
  - easier to maintain (e.g., no need to get a login to contribute)

prototype: https://github.com/altMITgcm/MITgcm
for now main code only (MITgcm, exclude MITgcm_contrib);

- moving latex based documentation to Sphinx & Read-The-Docs
  easier to generate html manual ; less obvious regarding pdf

prototype: https://gud.mit.edu/doc/mitgcm/en/
conversion of the full manual is in progress.

- target date for making the switch:
toward the end of this year?
Other development

- pkg/exf: improved, without pkg/cal,
  basic S/R used by other pkgs (with their own parameters and variables)
  i.e., in: bling, darwin, icefront

- pkg/diagnostics: option for hFac weighted average
Plans:

- consolidate wetting and drying; test with tides
- 2-way nesting
- vertically varying gravity: P-coords → Mass coords?
- Re-work 2-D & 3-D solver: solve for increment $\delta\eta$, $\delta P_{nh}$
- Improve 3-D solver efficiency
- Non orthogonal grid
Thanks!