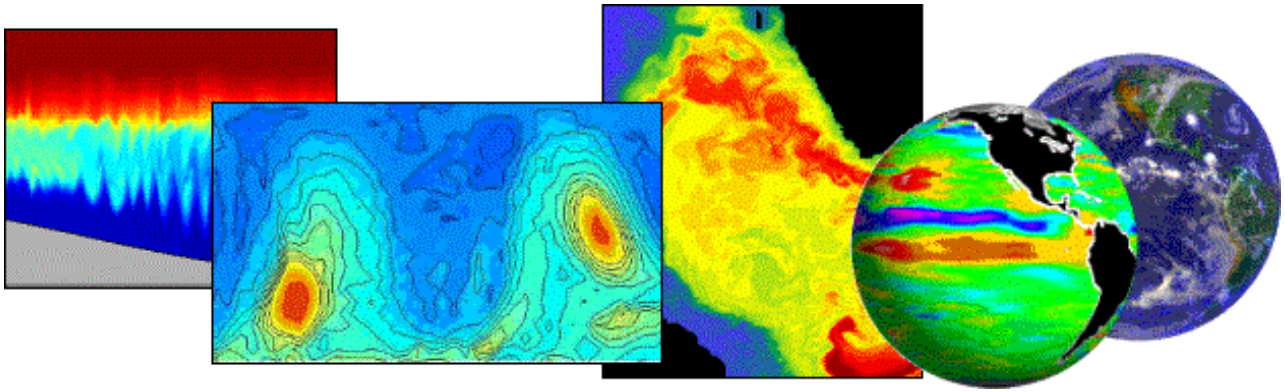
ECCO Projects Meeting

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

$$u^{n+1} = \mathbf{U}^{-1}\mathbf{L}^{-1}\left(u^n + \Delta t G_u^{n+1/2}\right) - \frac{g\Delta t}{\Delta x}\mathbf{U}^{-1}\mathbf{L}^{-1}(\delta^i \eta^{n+1})$$

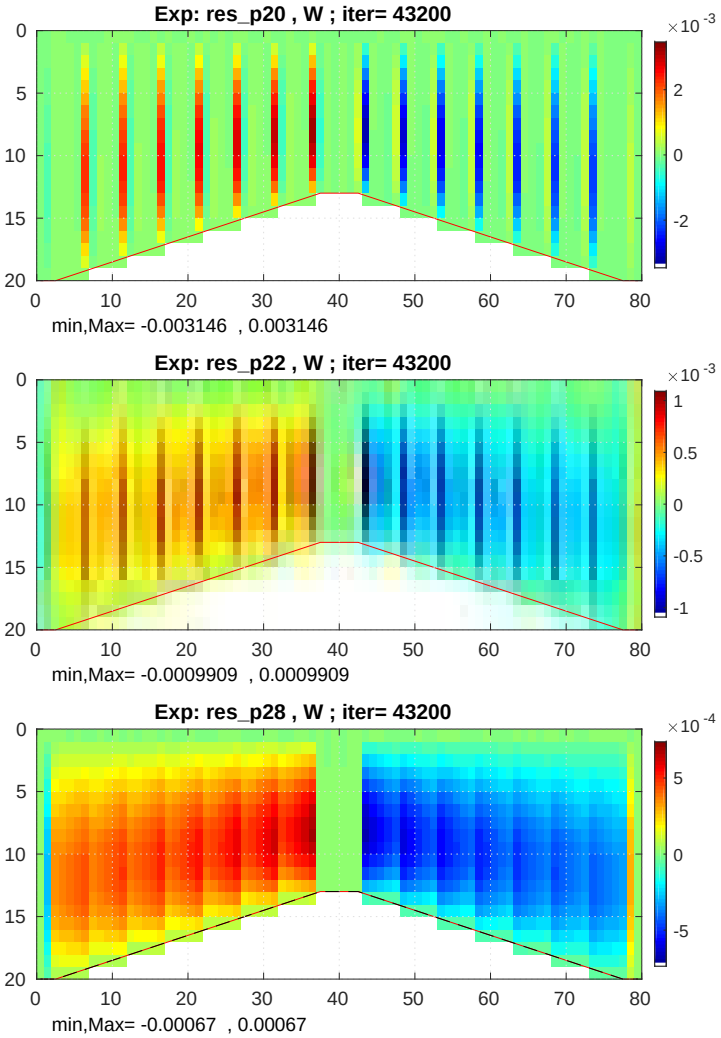
Accounting for partial cell in vertical viscous and diffusive flux

- bottom stress (no-slip BC) with hFac ($bottomVisc\_pCell$ =T):
  $-viscAr_k\, u_k/(drF_k/2) \quad / hFac_k$
- hFac in interior viscous flux ($interViscAr\_pCell$ =T)
  $viscAr_k\,(u_k - u_{k-1})/drC_k \quad / \overline{hFac}^k$
- hFac in interior diffusive flux ($interDiffKr\_pCell$ =T)
  $diffKr_k\,(T_k - T_{k-1})/drC_k \quad / \overline{hFac}^k$

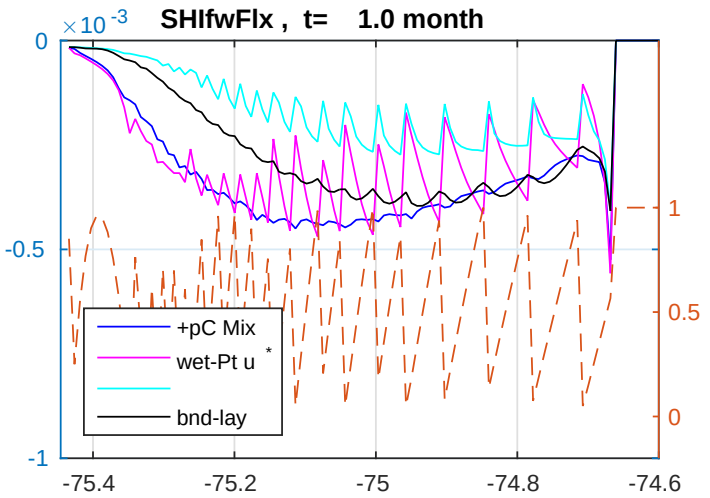
Increasing viscosity and diffusion near bottom

- 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 shelfice set-up with or without: SHELFICEboundaryLayer, 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 etal, JGR, 2017
  tested in GCM: Pearson etal, Ocean Mod., 115, 2017
  $\leftarrow$ not yet in repository
- mixing due to Langmuir Circulation effect
  in KPP: McWilliams & Sullivan, Spill Sci & Tech. Bull., 6, 2000.
  in TKE: Axel, JGR, 107, 2002 (in NEMO); Noh etal, JPO, 46, 2016
  $\leftarrow$ 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 $\rightarrow$ Mass coords ?
- Re-work 2-D & 3-D solver: solve for increment $\delta\eta$, δP_{nh}
- Improve 3-D solver efficiency
- Non orthogonal grid

Thanks !