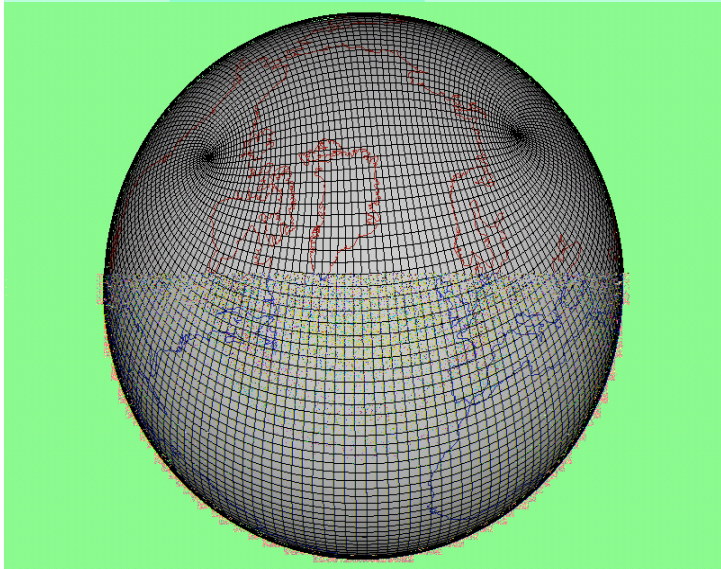# Performance-Portable POP

The Developer's Response to John Levesque's "State of the POP"

Philip Jones

Los Alamos National Laboratory

Boulder, Colorado

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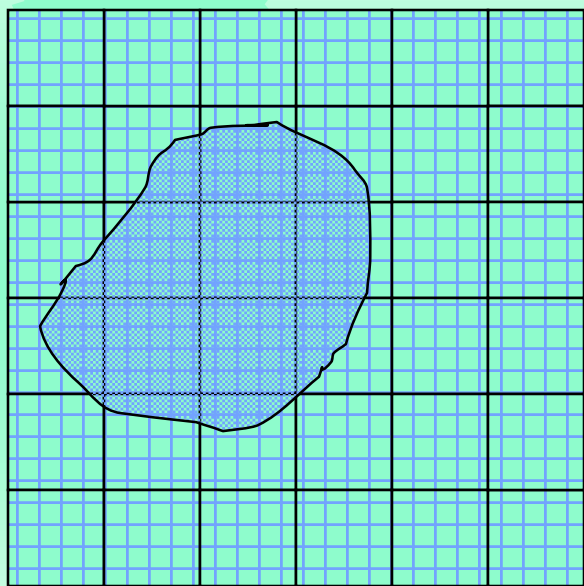
POP 2.0
(End of Feb or die trying)

- Sub-block decomposition scheme for performance

- Partial bottom cells

- Tripole grids

- Anisotropic GM

- New Jackett et al. EOS

- Manuals

  http://climate.acl.lanl.gov/models/pop/current_release/

- netCDF output option

- F90 free-form with self-documenting ProTex

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Performance Portability

❑ Sub-block decomposition

- Domain decomposed into blocks sized for cache (or vector)

- Land blocks eliminated

- Remaining blocks distributed in load-balanced manner using a rake algorithm

- Priorities can be set to maintain some locality during rake

- Many blocks on each node provide OpenMP parallelism

- Block loops at high level to amortize OpenMP overhead

- Different block distribution used for barotropic solver to optimize for communication rather than load balance
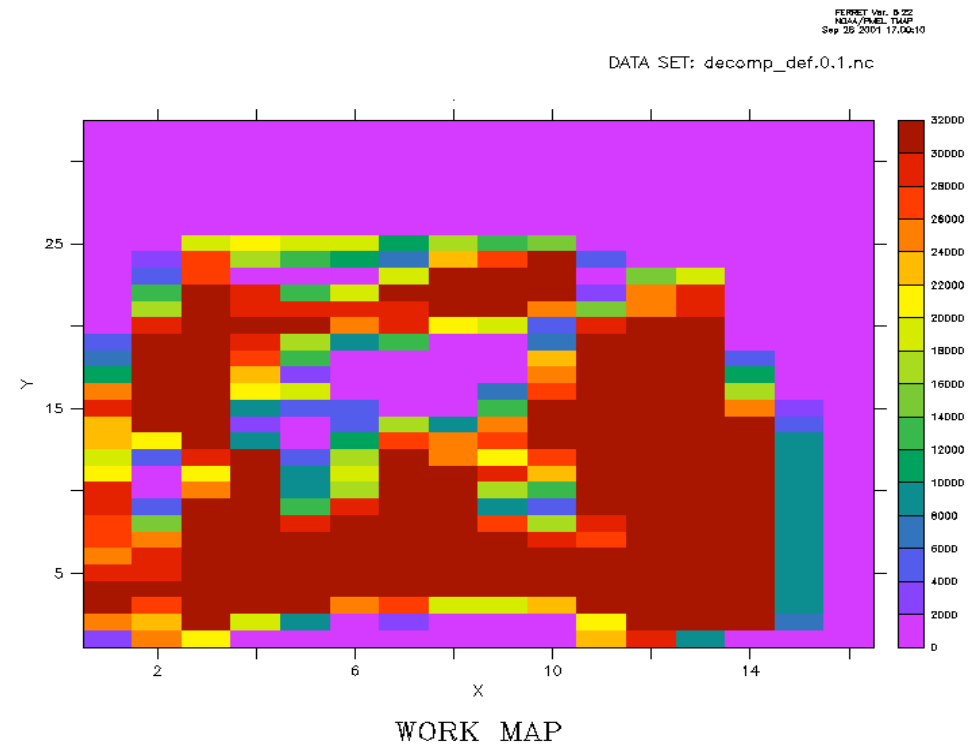
Sub-blocks: The Bad Cartoon

Any resemblance to continents, real or imagined, is purely coincidental.
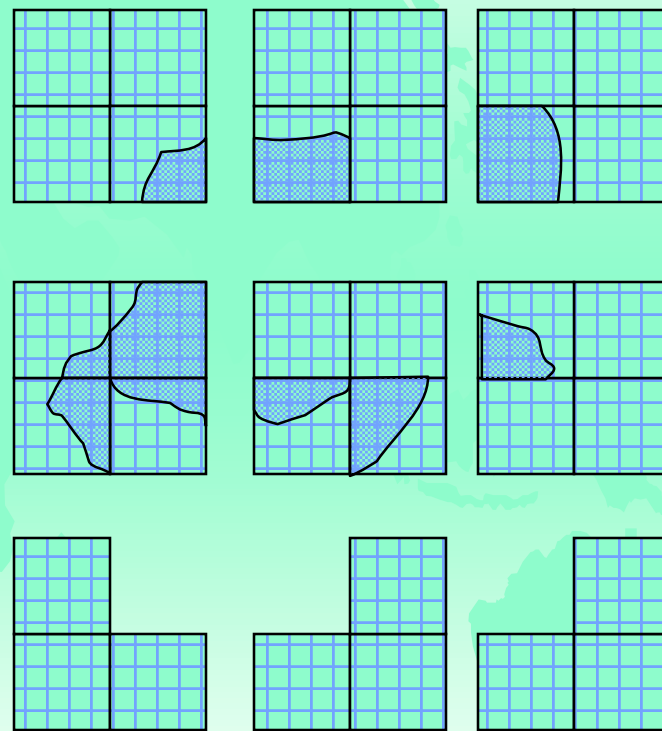
Actual Performance

- 0.1 Global

	old	new
Total	115s	55s
Baroclinic	93s	38s
Barotropic	9s	7s

DATA SET: decomp_def.0.1.nc

WORK_MAP

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POP 2.0 Performance

- 0.1 Global (3600x2400x40 on 480 procs)
  - 2x improvement on 02k
  - 30% improvement on IBM (Eagle)
- 1 degree
  - Little opportunity for land elimination
  - Improvement at small processor counts
  - No degradation at large processor counts
- OpenMP - not
- Vector – identical to POP 1.4.3

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