

Aqua Planet Experiment

Initial CAM 3.1 / HOMME Results

Mark Taylor and Jim Edwards

● Model Details

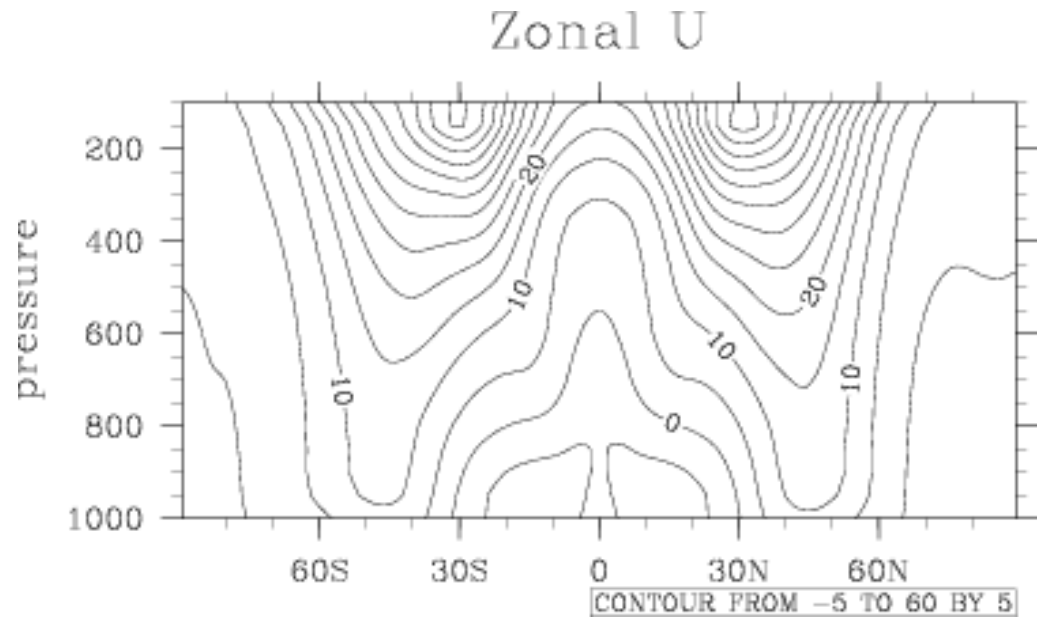
- CAM 3.4.10 (Same physics as CAM 3.1)
- HOMME Spectral Element (mass and energy conserving formulation)
- 1.4 degree average grid spacing at the equator (~T85 grid)
- mass weighted ∇^4 hyperviscosity
- 4th order elements. NE=21
- Dynamics timestep: 2m
- Physics timestep: 60m, 20m and 4m. (note: values given in figure captions are incorrect)
- 12 month averages shown (last 12 months of 14 month run) initialized from an earlier APE run.
- SYPD: 22.1 (Thunderbird 400 cpus)

Initial CAM 3.1 / HOMME Results

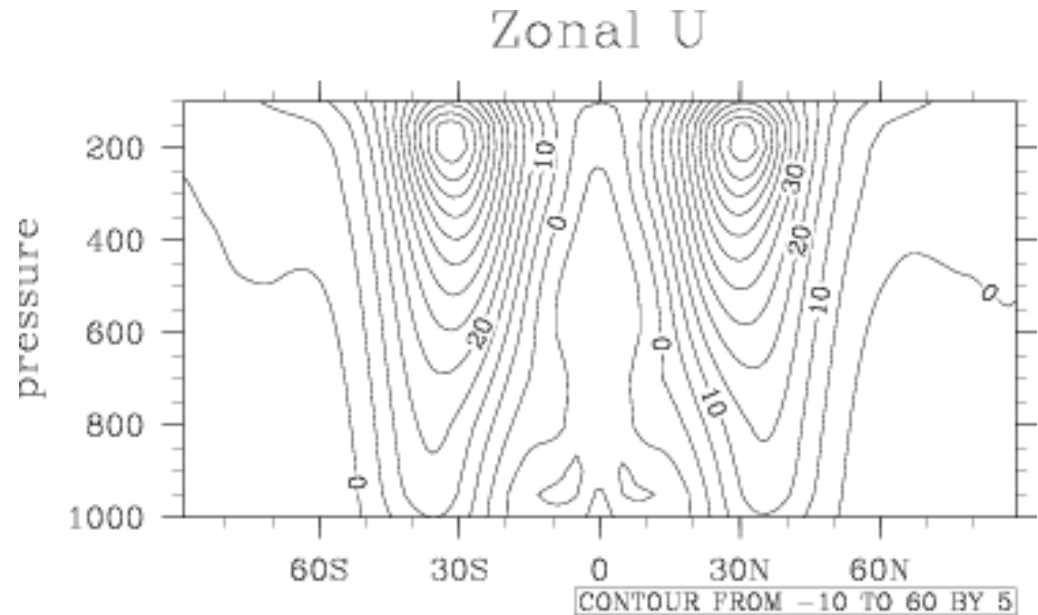
- No mass/energy fixer. Last year of simulation:
 - $\Delta E/E = -8e-4$
 - Total mass exactly conserved (same as Eul run: $1.0e4 \text{ kg/m}^2$).
 - Dry air mass: $\Delta M/M = -2e-6$.
- Large differences (see next slides).
- Some tunings we've run (with little impact on the above differences):
 - Physics turnings; 3.1 T85 & Eul default (and CAM 3.5.1 physics)
 - Viscosity: $3e15$ & $5e15$
 - Ozone: CAM_3_4_10 & a symmetric dataset
 - Physics timestep: sensitivity shown in following slides.

Time averaged,
zonally averaged U

HOMME



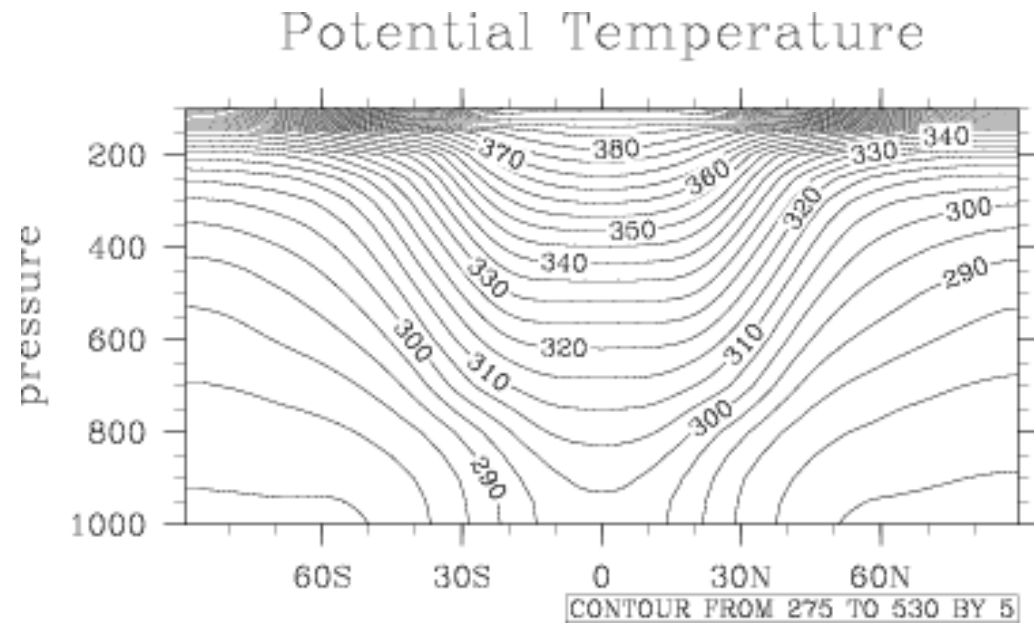
EUL



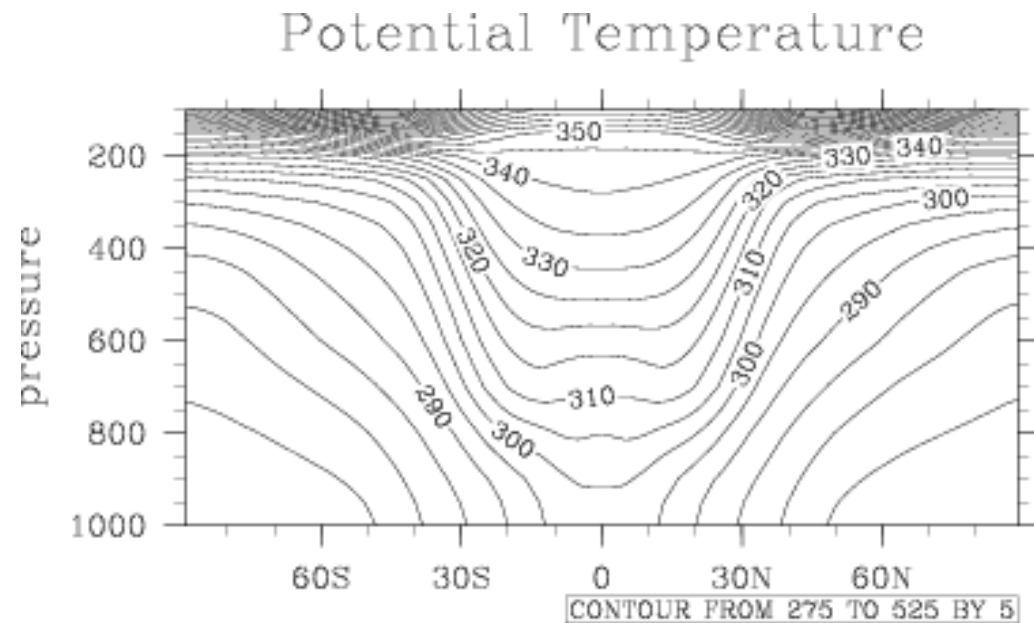
Compare to Fig 1 (a) in Neale & Hoskins, *A standard test for AGCMs including their physical parametrizations. II: Results for The Met Office Model*, 2001.

Time averaged,
zonally averaged θ

HOMME



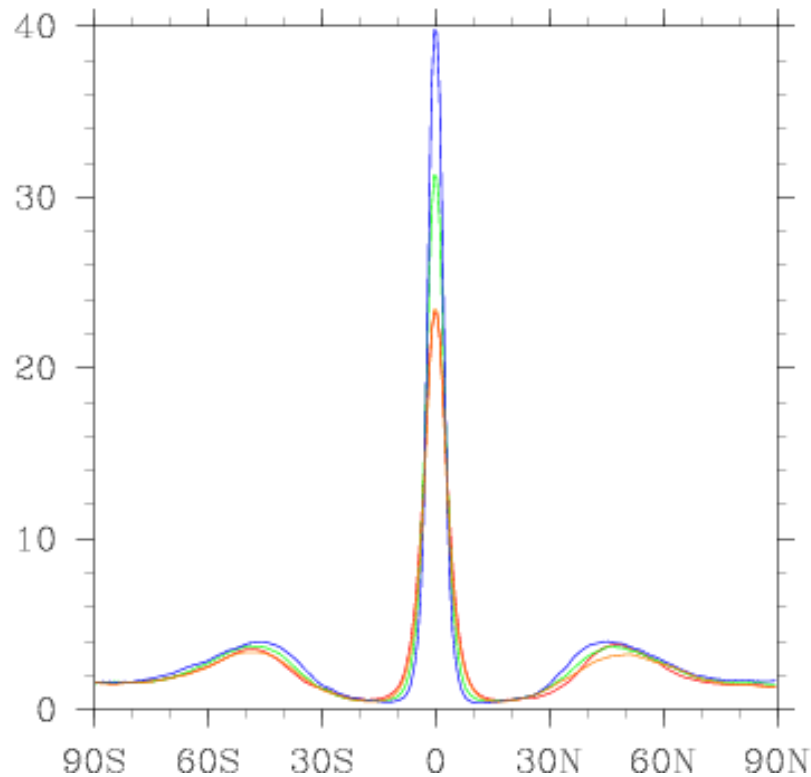
EUL



Compare to Fig 1 (b) in Neale & Hoskins, *A standard test for AGCMs including their physical parametrizations. II: Results for The Met Office Model*, 2001.

Time averaged, zonally averaged PRECT

DT=60m (red) 5m (green) 1m (blue)

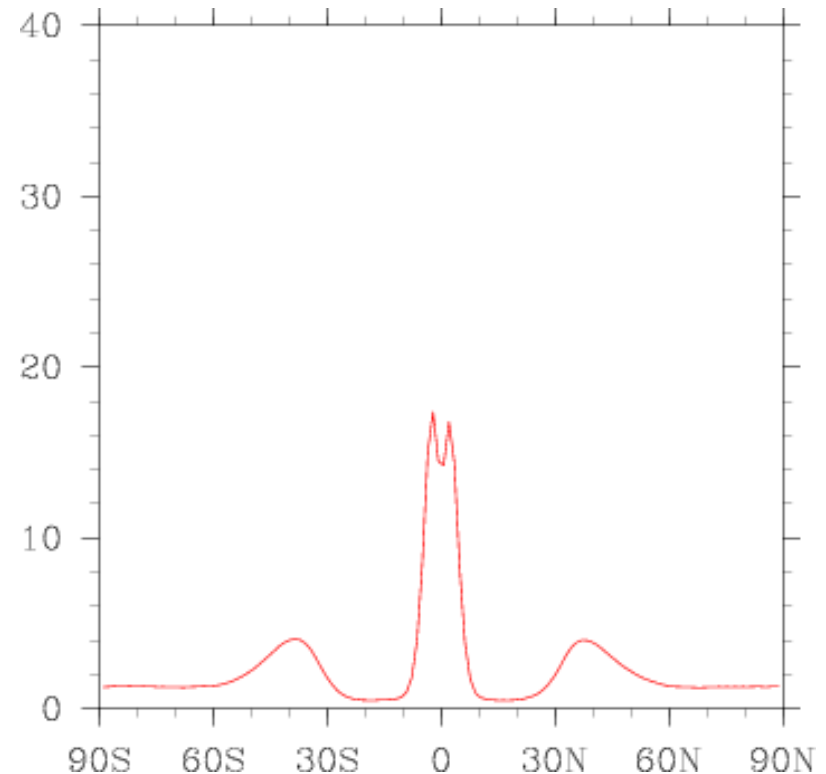


HOMME

Global average

PRECC 0.5

PRECL 3.1



EUL

Global average

PRECC 1.6

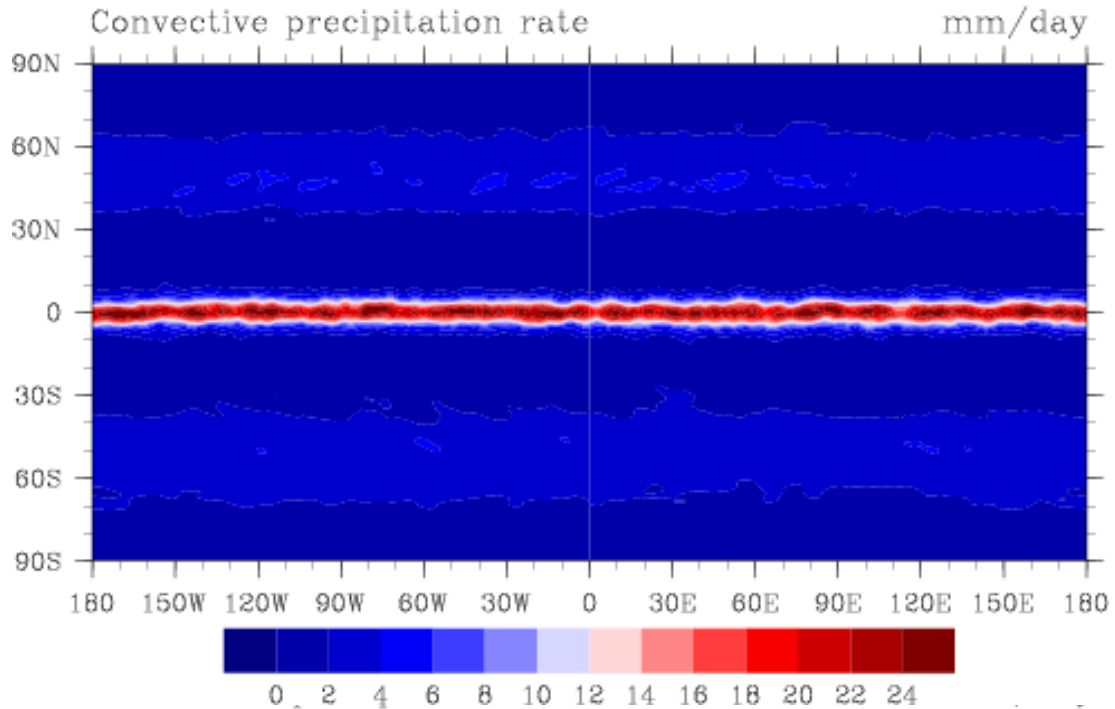
PRECL 1.4

Compare to Fig 2b in Williamson, *Convergence of aqua-planet simulations with increasing resolution in the Community Atmospheric Model, Version 3, in review*

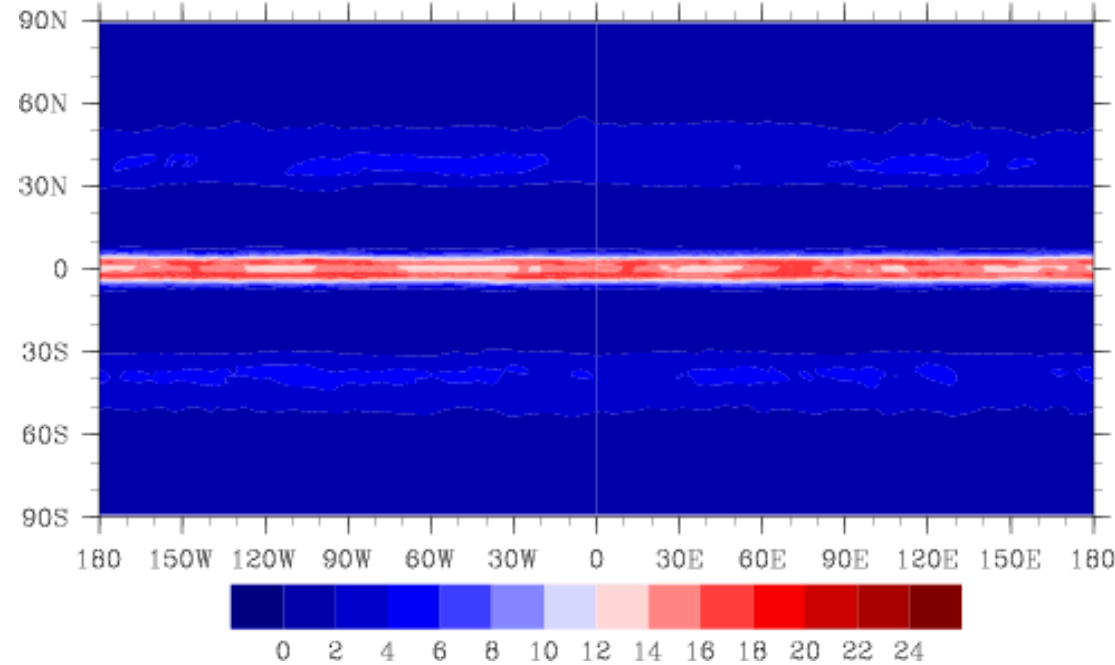
PRECT HOMME 1.43°

**Time averaged
PRECT**

HOMME

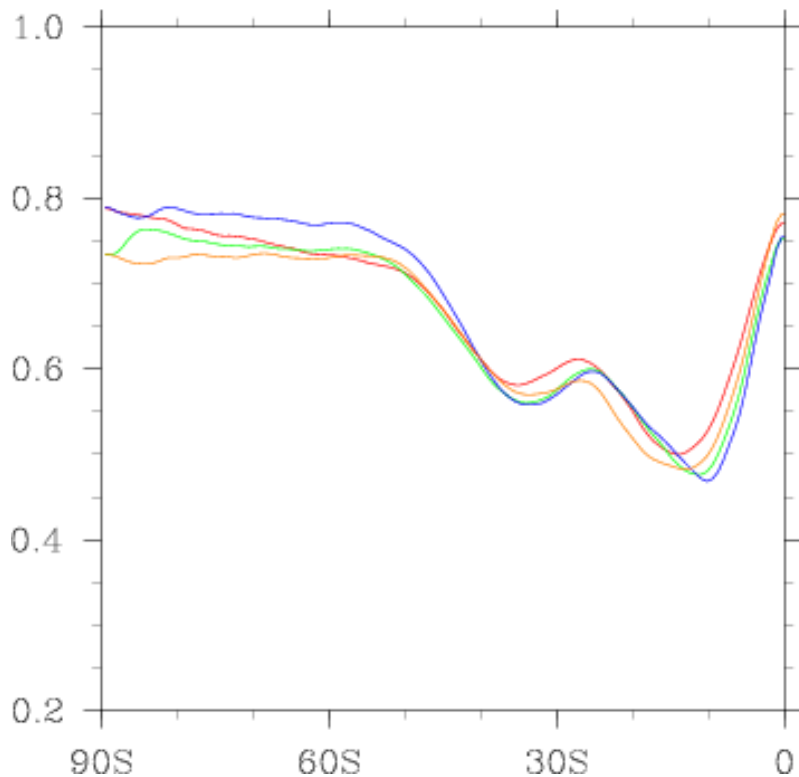


EUL



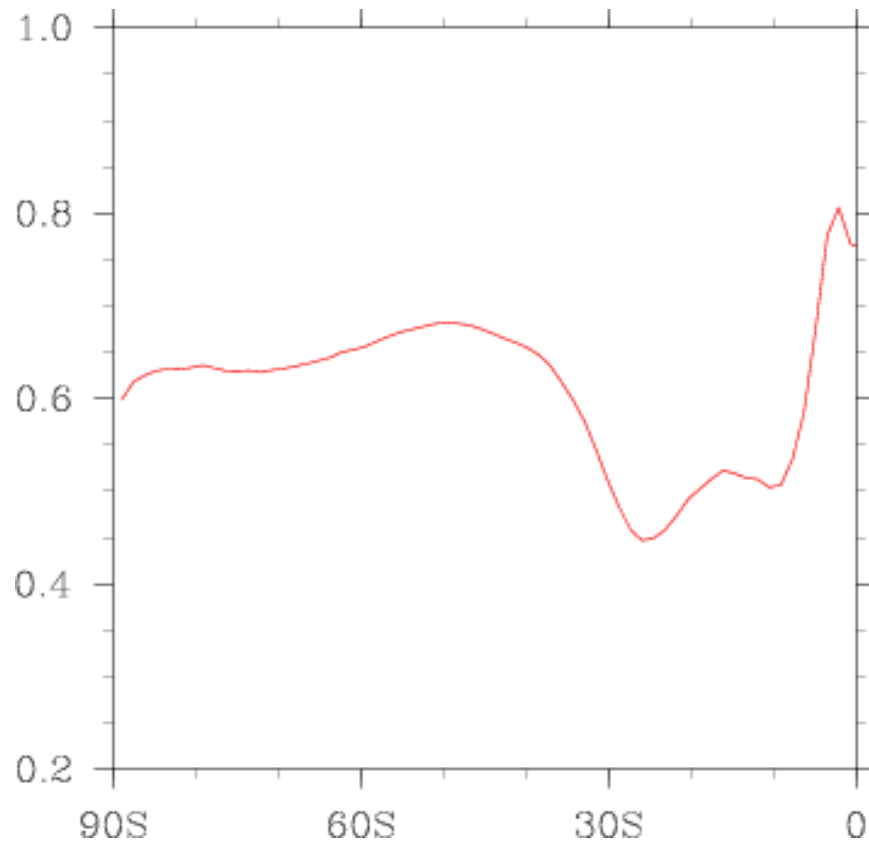
Time averaged, zonally averaged CLDTOT

DT=60m (red) 5m (green) 1m (blue)



HOMME

Global average: 0.61



EUL

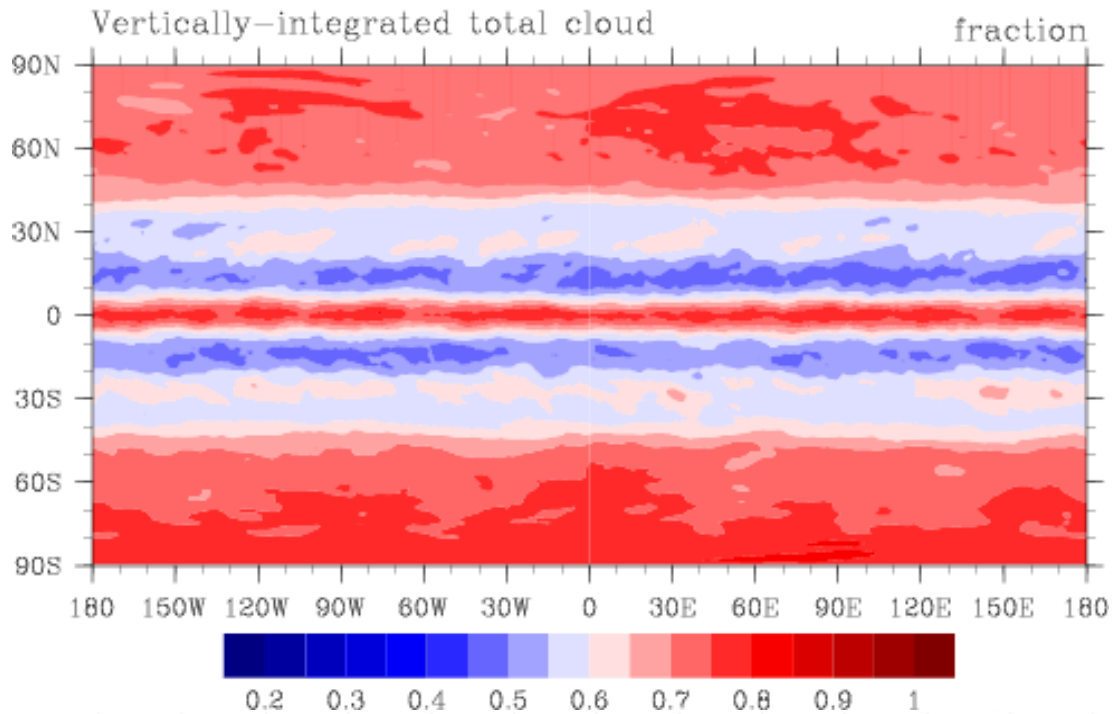
global average: 0.59

Compare to Figs. 3 and 4 in Williamson, *Convergence of aqua-planet simulations with increasing resolution in the Community Atmospheric Model, Version 3, in review.*

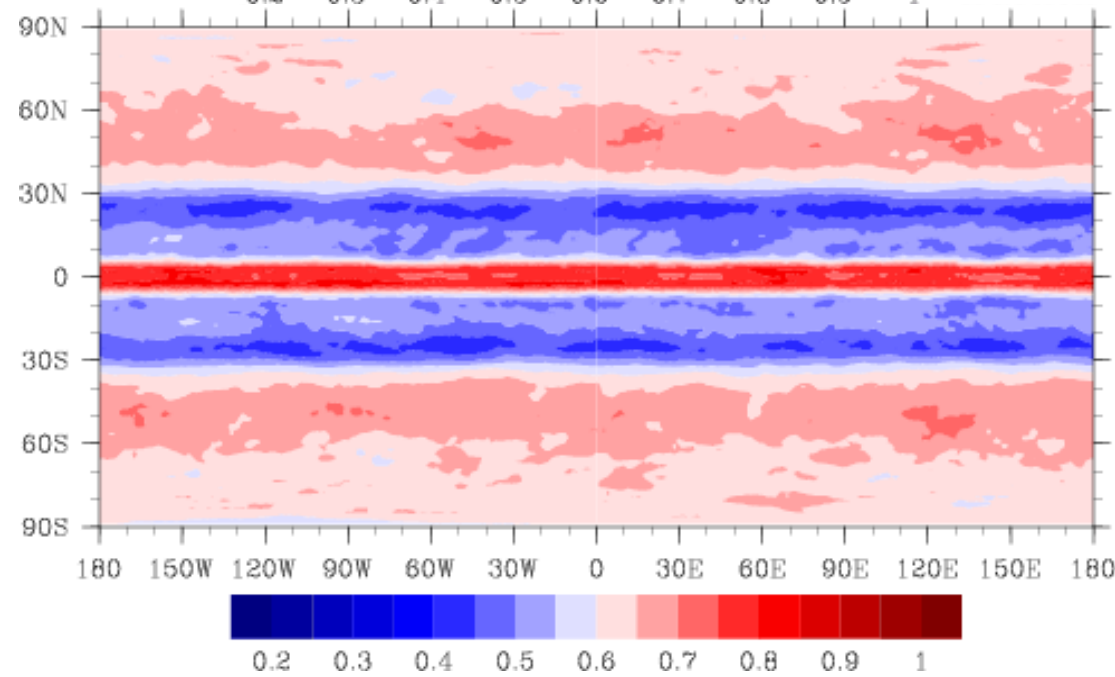
PS HOMME 1.43°

Time averaged
CLDTOT

HOMME

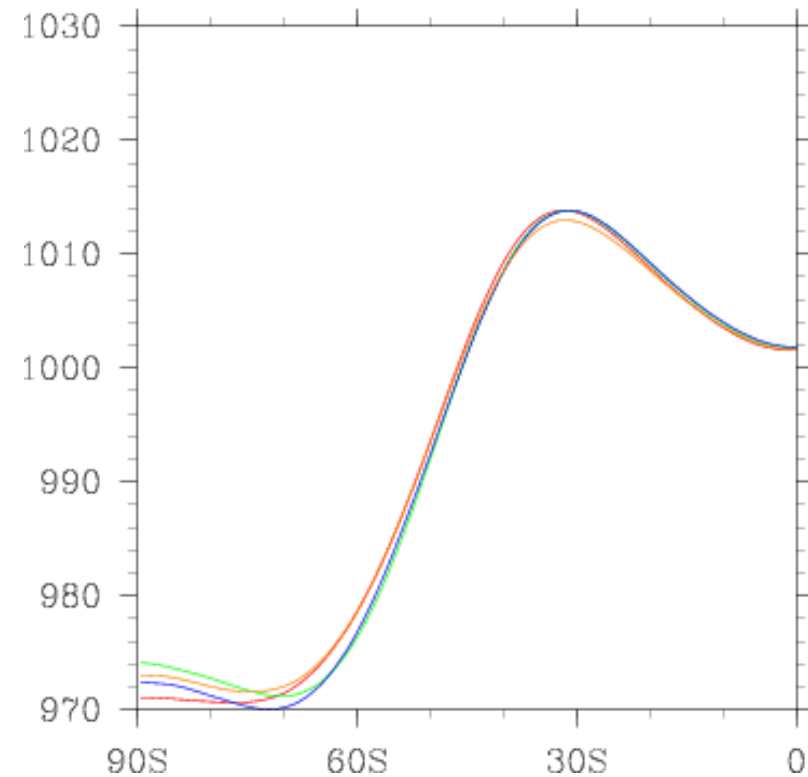


EUL

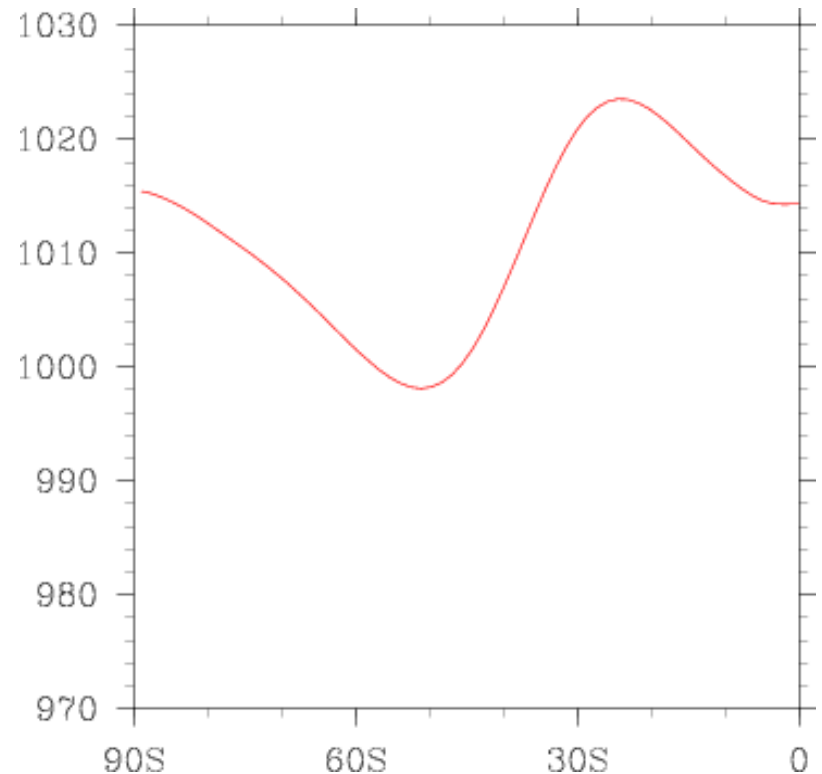


Time averaged, zonally averaged PS

DT=60m (red) 5m (green) 1m (blue)



HOMME

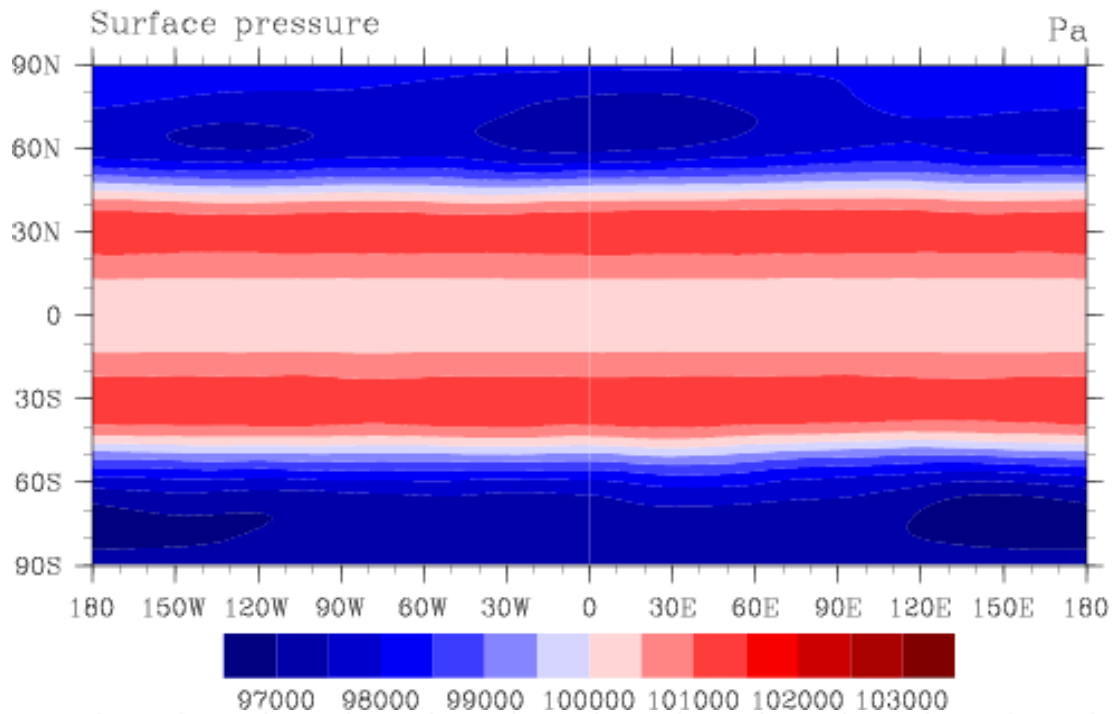


EUL

Compare to Figs. 3 and 4 in Williamson, *Convergence of aqua-planet simulations with increasing resolution in the Community Atmospheric Model, Version 3, in review.*

Time averaged PS

HOMME



EUL

