#2: Conservation Tests

- DCMIP-2012 baroclinic wave idealized test, dry and moist (4.1 and 4.2) run at 13 km resolution. Simple moist physics (large-scale condensation only) included.
- Conservation of total energy, entropy and dry mass measured
- Extra advected tracer added, initialized with θ_e (difference between advected and diagnosed θ_e measured)
- 'Grid imprinting' (signal of truncation errors at cube corners and pentagons of icosahedral grid) assessed

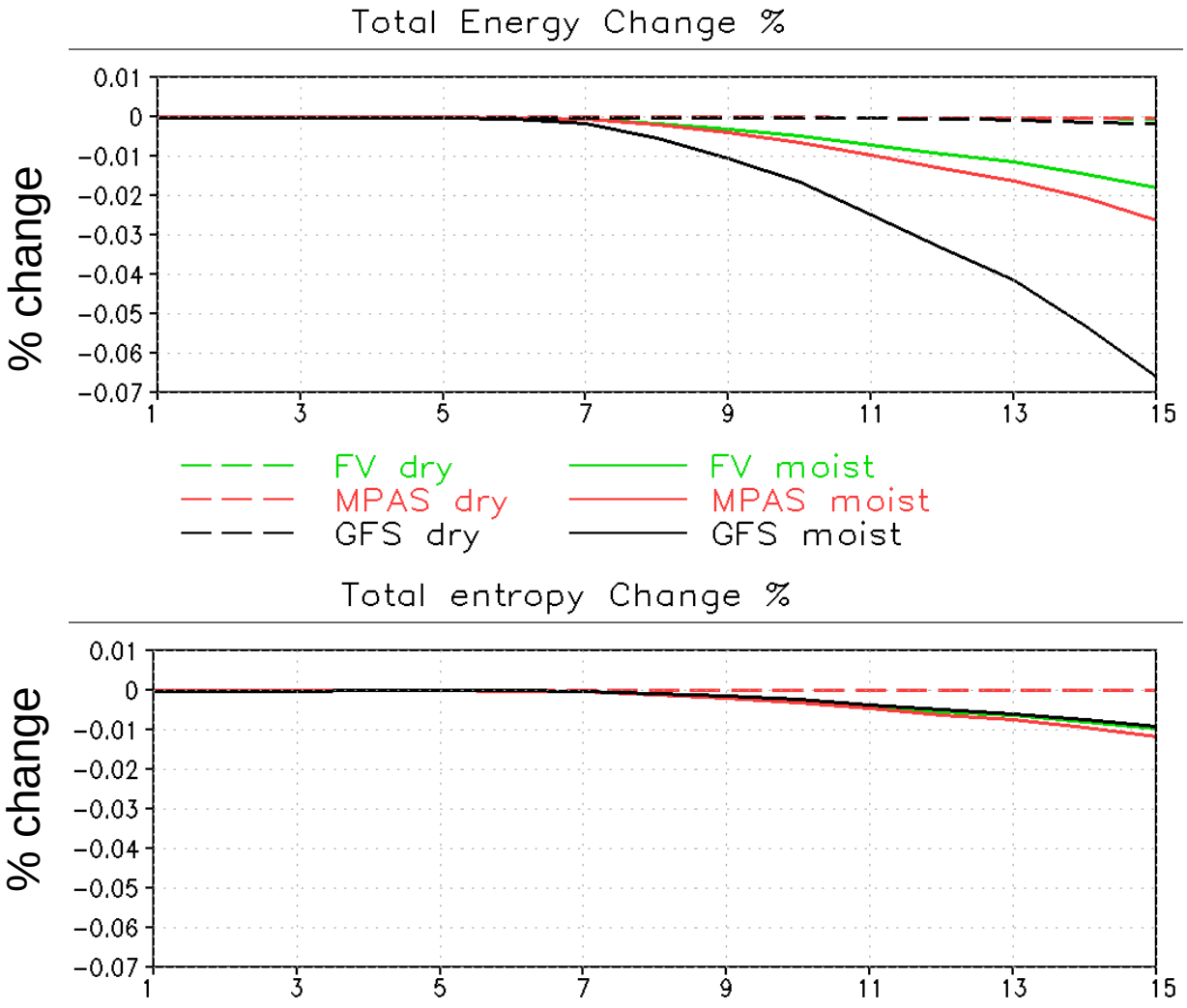
#2: Conservation Tests
Change in Total Energy and Entropy

Change in total energy (top) and entropy (bottom) as a percent change from the initial value.
Note very tiny range on y axis.

Energy loss nearly zero in dry case, FV3 and MPAS lose less energy than GFS in moist case.

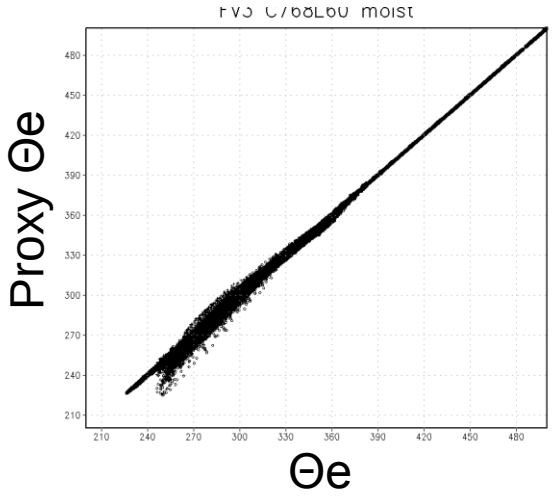
Energy loss in moist case for FV3 and MPAS is consistent with the energy removed along with condensate. Entropy changes for moist case are very small, and consistent with thermodynamic approximations made in entropy definition.

Dry mass (not shown) is conserved exactly in both FV3 and MPAS, GFS gains 0.05 hPa during integration.

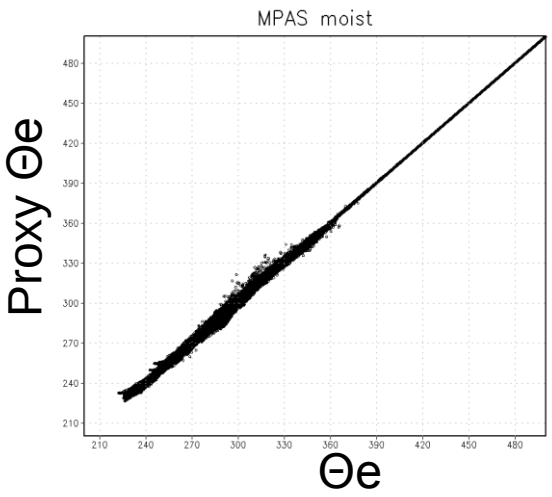


#2: Conservation Test: RMS Difference Between Advected Tracer and Dynamical Field (Day 15)

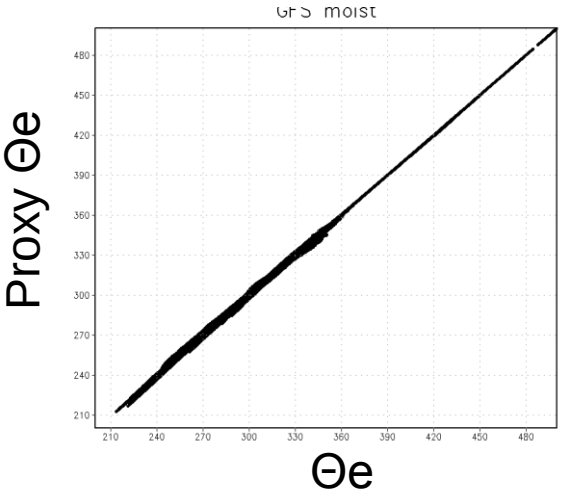
FV3 RMS=0.232



MPAS RMS=0.126



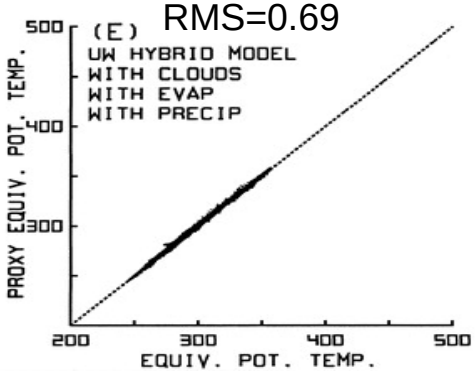
GFS RMS=0.202



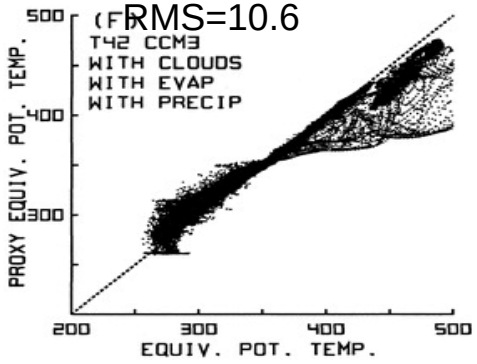
Scatterplots of Θe and proxy Θe (tracer) at day 15 for the moist baroclinic wave (DCMIP test 4.2). Compare with Figure 1 of Johnson et al. 2000.

FV3, GFS and MPAS are similar, much better than CCM3 result from Johnson et al.

UW RMS=0.69

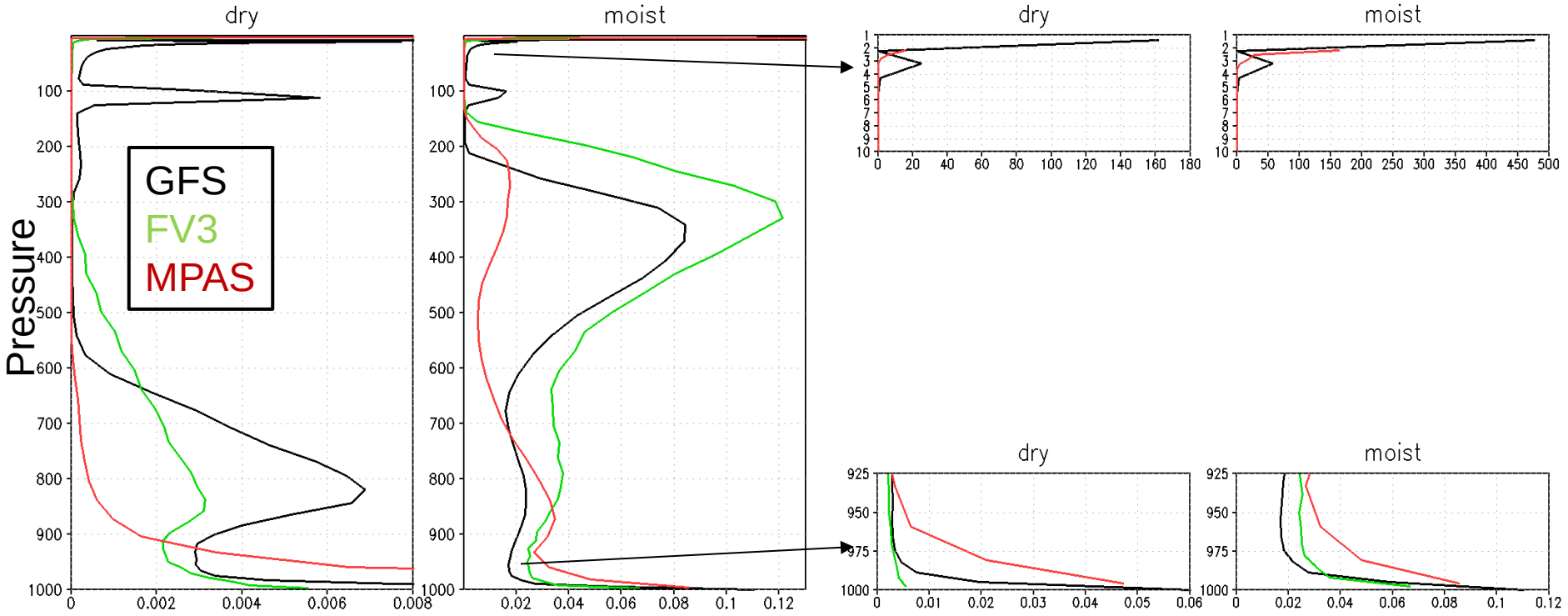


CCM3 RMS=10.6



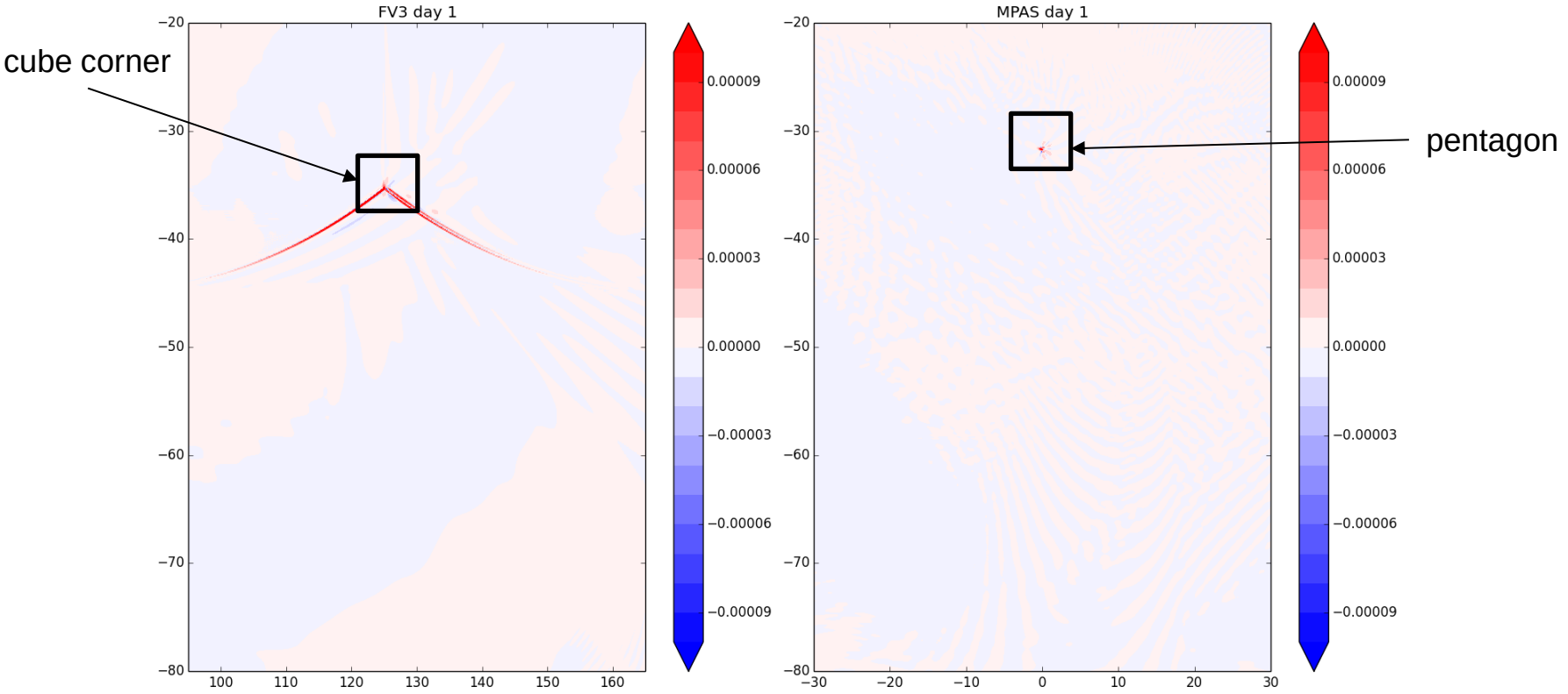
Day-10 scatter plots from Johnson et al. 2000

#2: Conservation Test: RMS Difference Between Advected Tracer and Dynamical Field (Day 15)

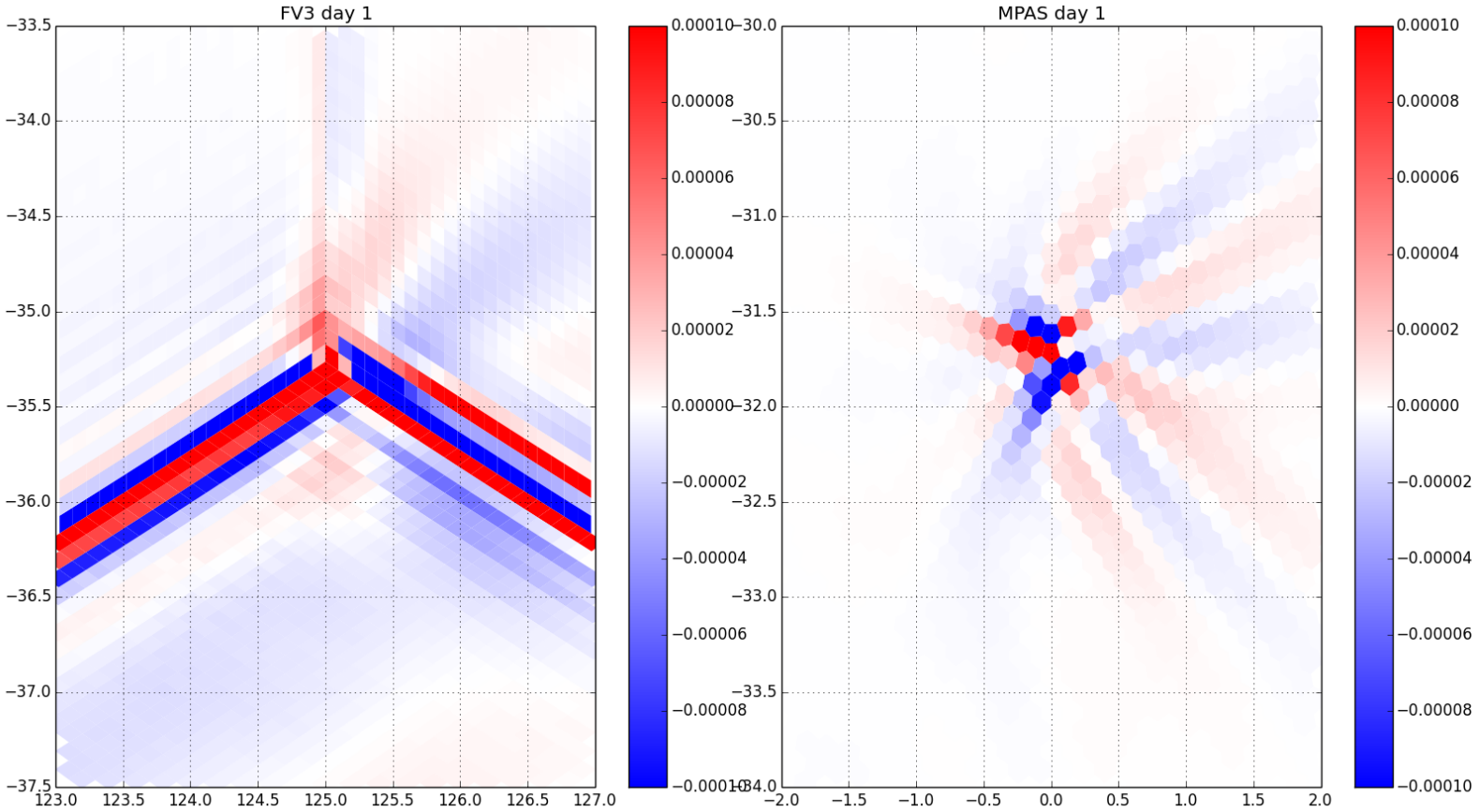


Global average RMS difference between prognostic equivalent potential temperature and tracer equivalent potential temperature calculated for each model level. Insets on right show detail at lower and upper levels of model, note that x-axes scales are much larger in insets.

#2: Conservation Test Case (Grid Imprint Assessment): *Dry Case* (Southern Hem) Vertical Velocity at Lowest Level, Day 1 (Zonal Mean Removed)



#2: Conservation Test (Grid Imprinting Assessment): Zoom-in on Cube Corner, Pentagon (Level 1 w)



#2: Conservation Test (Grid Imprinting Assessment): Animation of Level 1 w