A Compromise Low Resolution Version of FV-CAM

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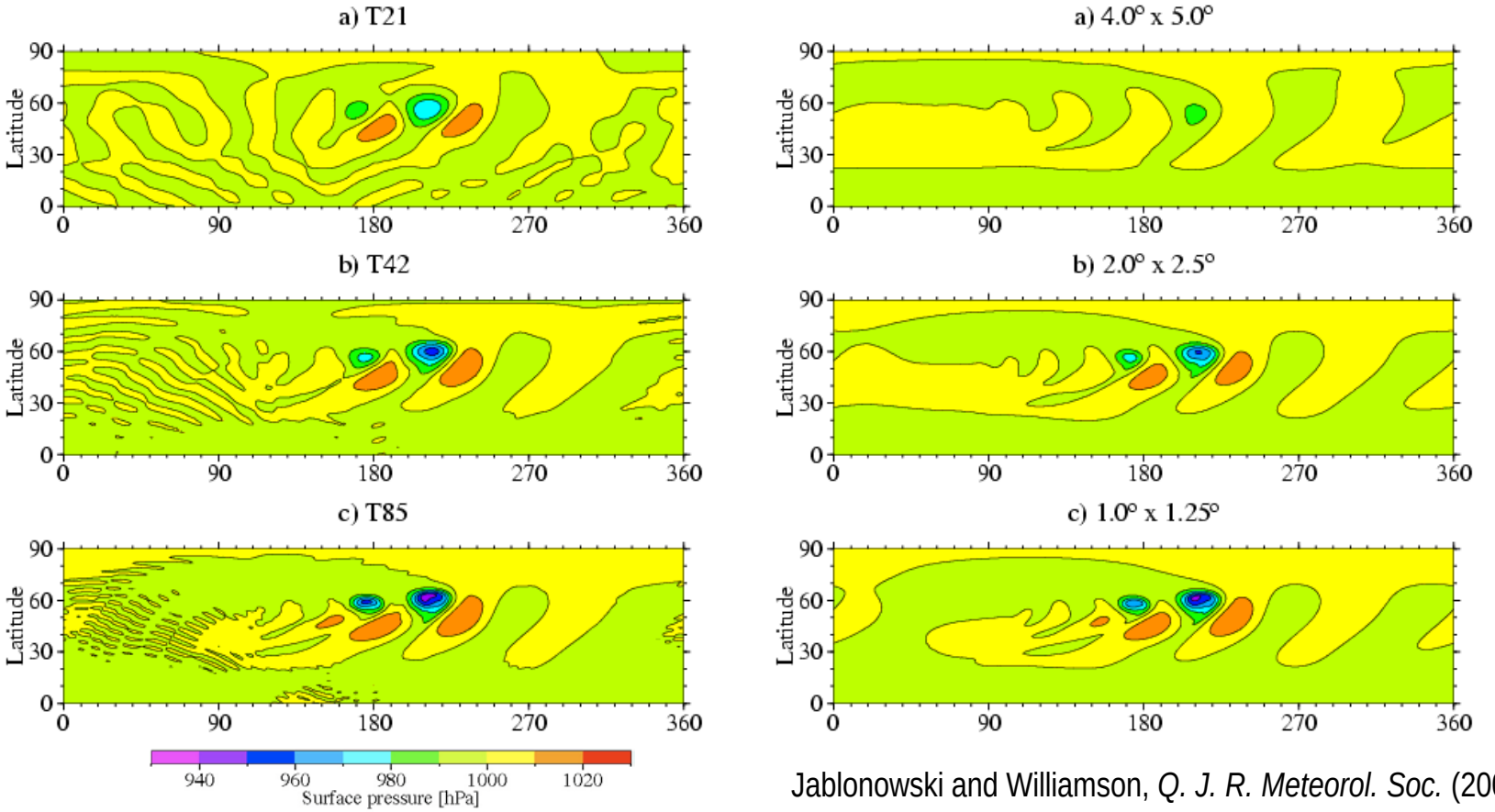
- *Compromise low-resolution version of CAM4 and CAM5*
- *Applications that require good conservative transport properties*
- *Applications that require complex physics*
- *Applications that require long-integrations*
- *WACCM, CAM-chem, paleo, BGC (CAM4 and CAM5)*

In idealized tests (adiabatic baroclinic wave and aquaplanet with physics)

-EUL-T85 is equivalent to FV-1.0x1.25
-EUL-T42 is equivalent to FV-2.0x2.50
-EUL-T21 is NOT equivalent to FV-4.0x5.0

Williamson (2008)

Day 9 baroclinic wave test case

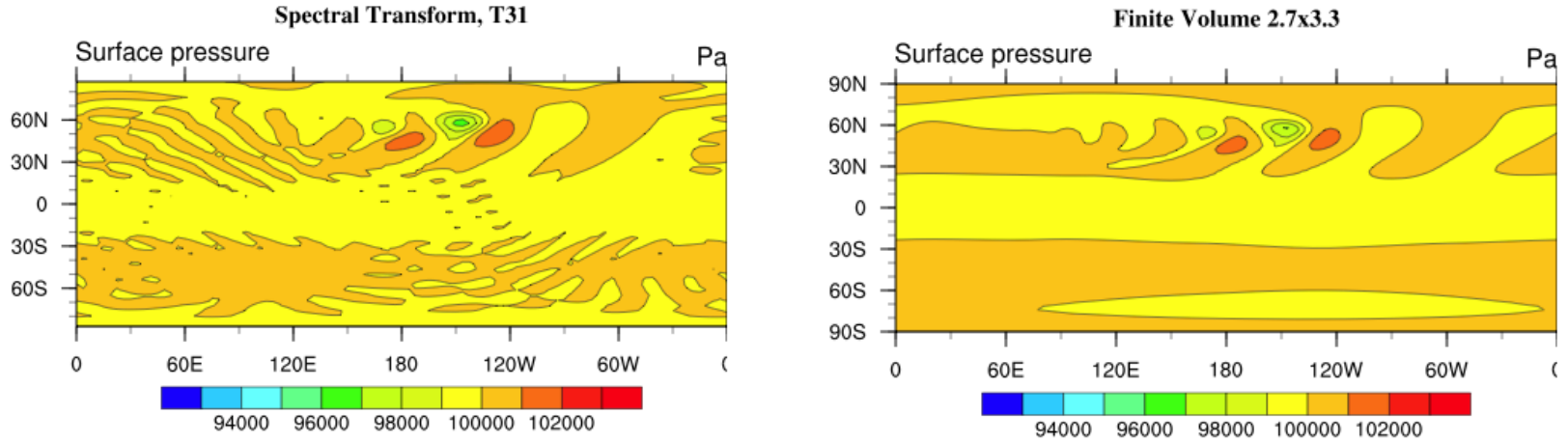


Jablonowski and Williamson, *Q. J. R. Meteorol. Soc.* (2006)

NCAR

EUL-T31 dynamical core is currently used for low resolution CCSM applications

Is there a FV resolution that is equivalent to EUL-T31?



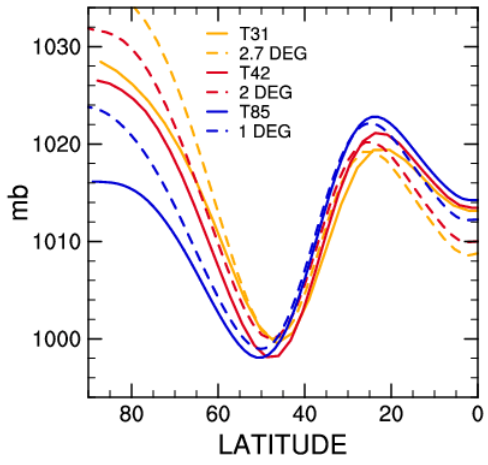
Day 9 baroclinic wave test case

Aqua-planet simulations (Neale & Hoskins, 2000)

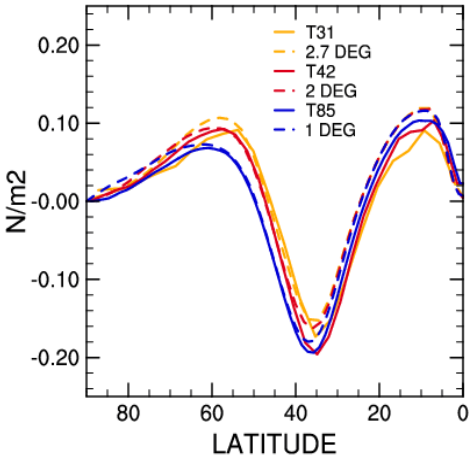
Time average, zonal average for PS and surface stress

Time average, global average

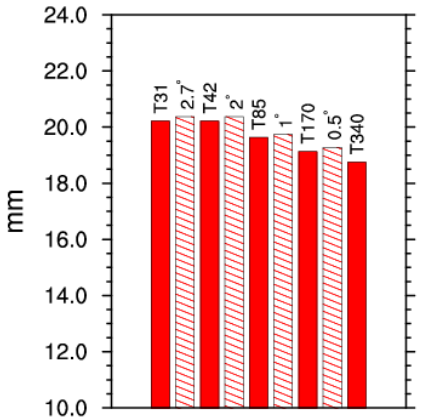
SURFACE PRESSURE



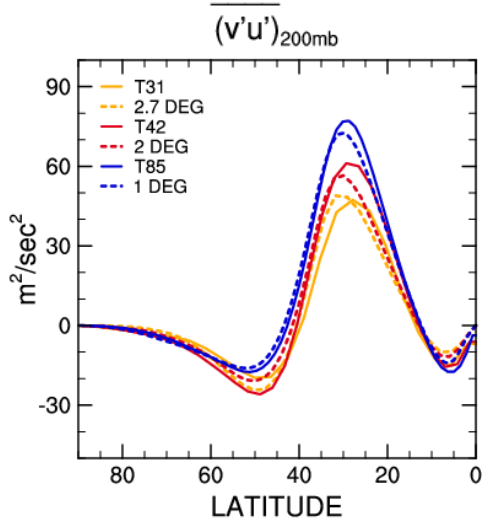
ZONAL SURFACE STRESS



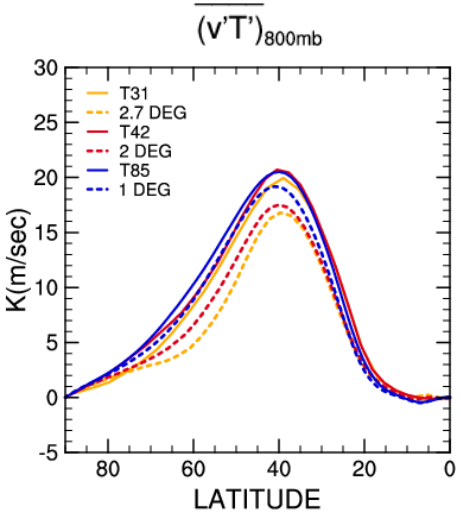
PRECIPITABLE WATER



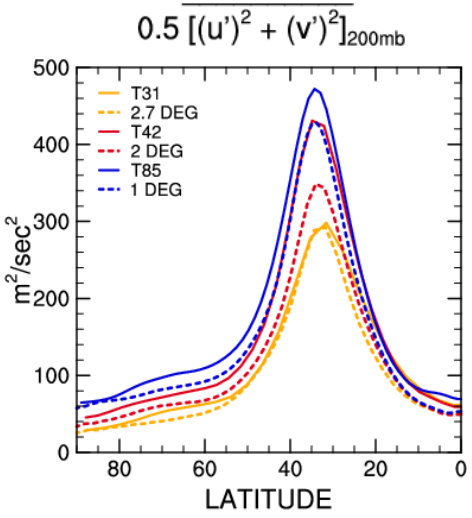
Zonal average meridional eddy statistics



Meridional eddy momentum flux



Meridional eddy heat flux



Eddy kinetic energy

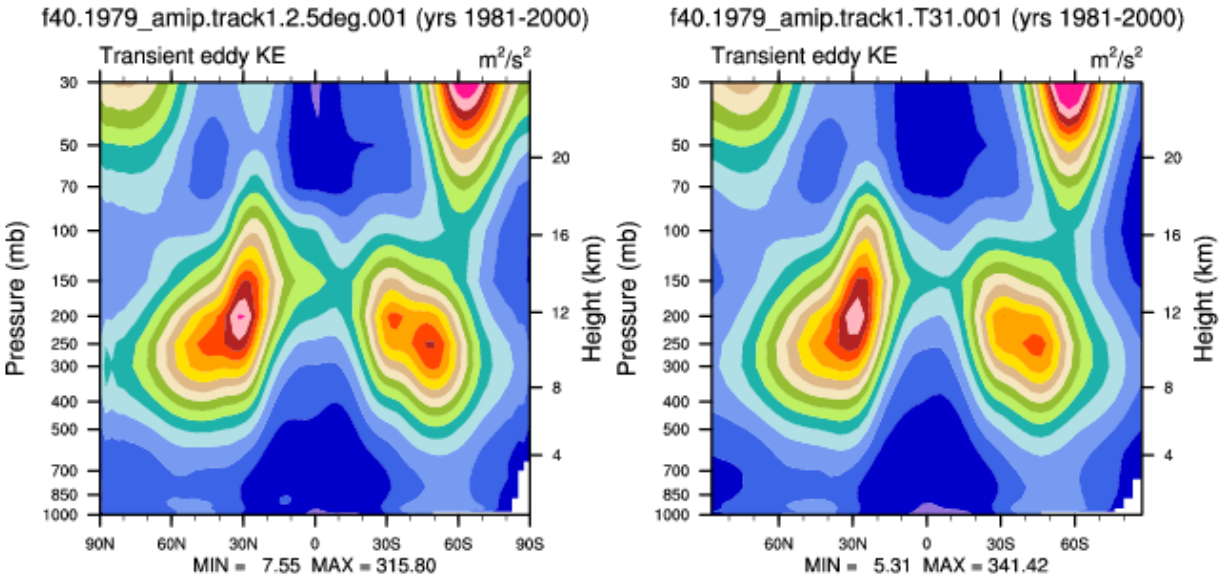
Variation with Resolution

20 year CAM4-AMIP (1981-2000) L26

NAME	CAM4 res.	YRS/DAY	#grid points	RMSE	Bias
1^{o}	FV 0.9x1.25	3	55296	0.937	0.905
2^{o}	FV 1.9x2.5	12	13824	1.023	1.175
2.5^{o}	FV 2.5x3.33	25	7776	1.028	1.231
T31	T31 (3.75^{o})	47	4608	1.051	0.938

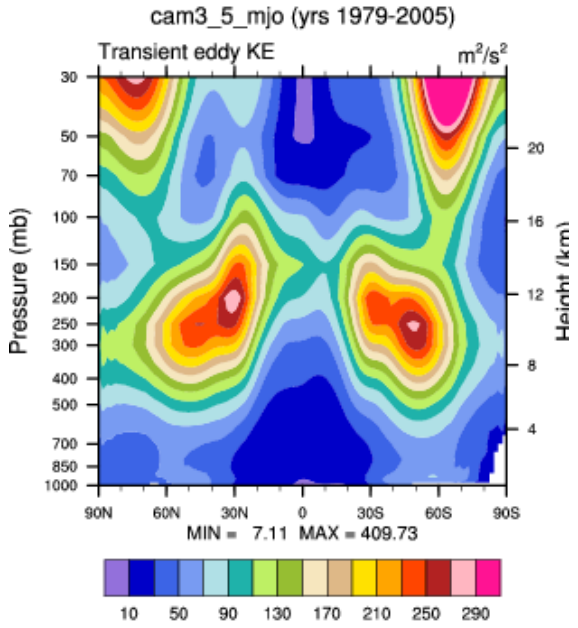
Eddy Kinetic Energy Errors (ERA40)

T31



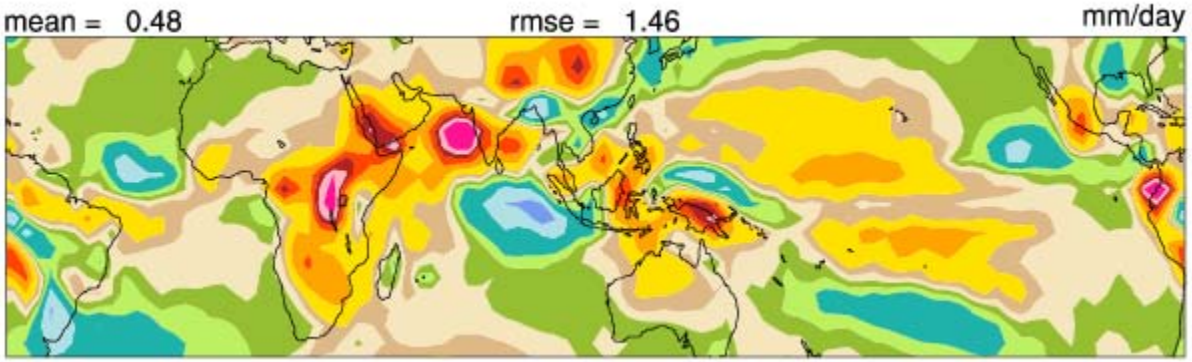
2.5º

2º



Annual Precipitation Errors (GPCP)

T31



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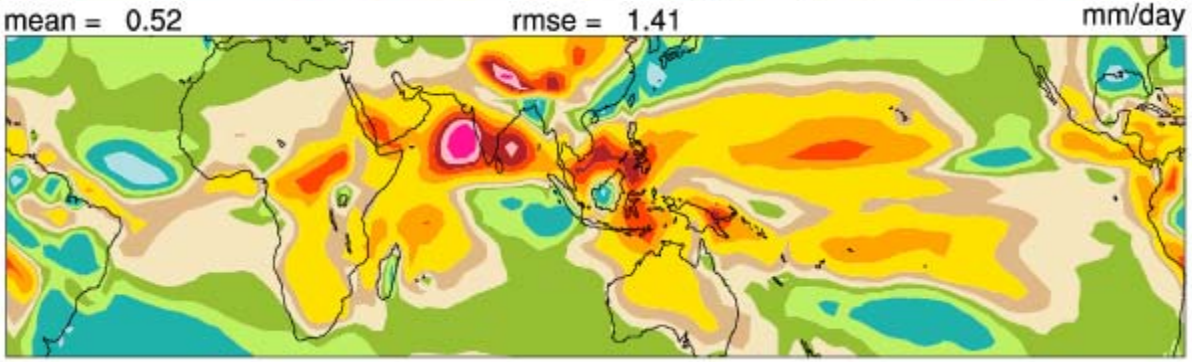

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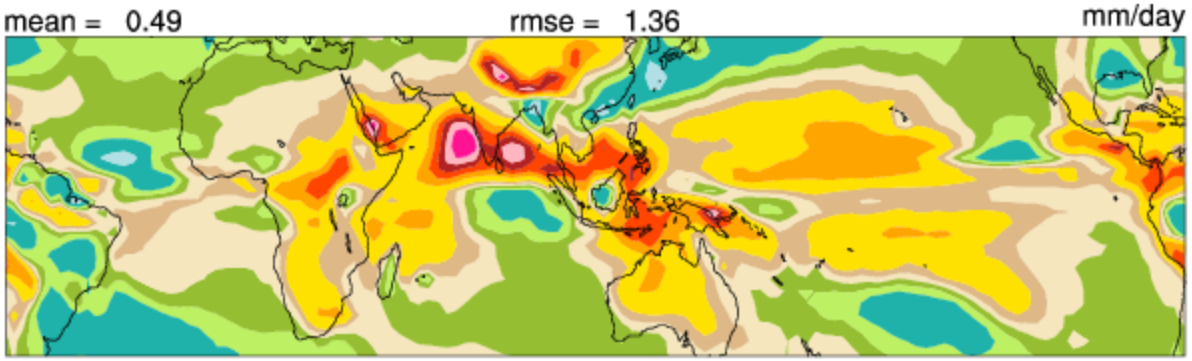
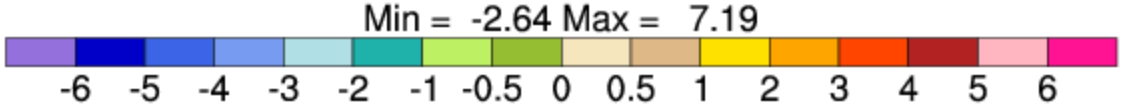
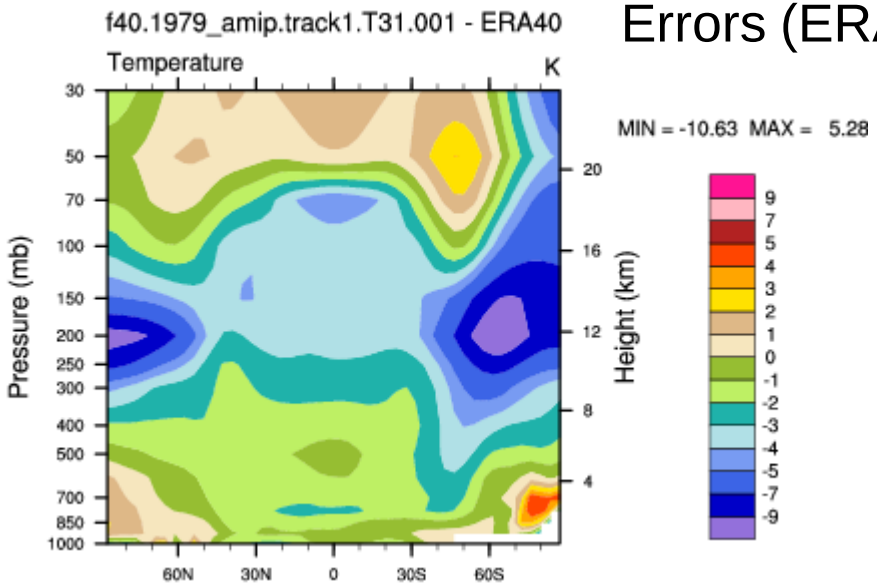




Annual Temperature Errors (ERA40)

T31



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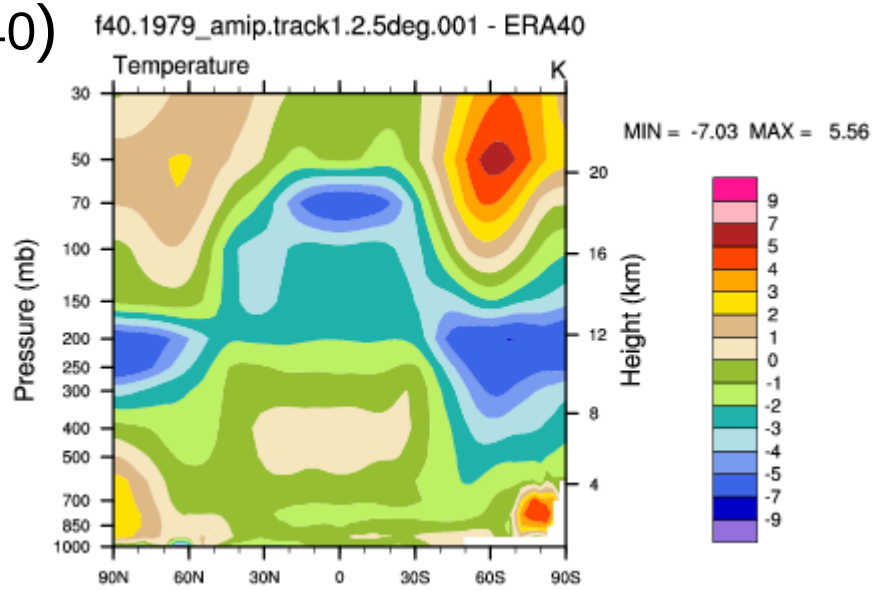

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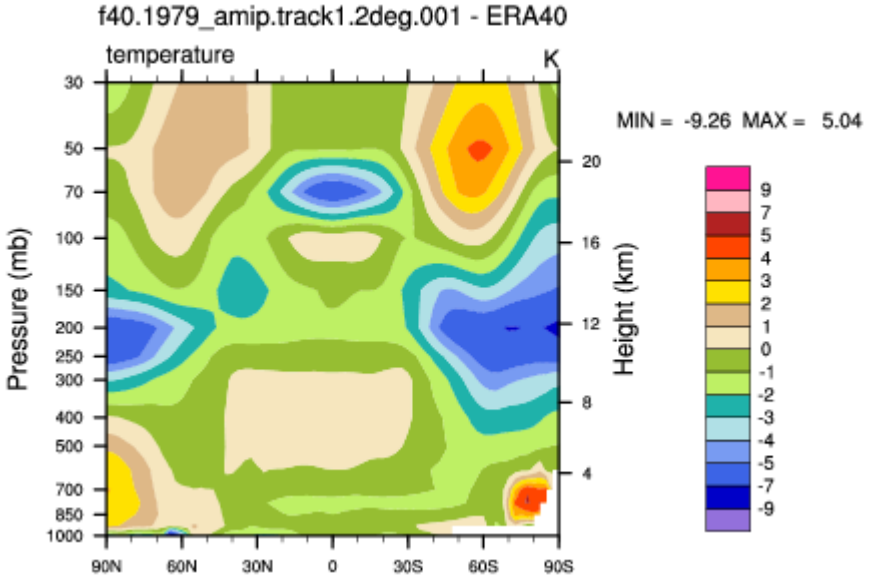
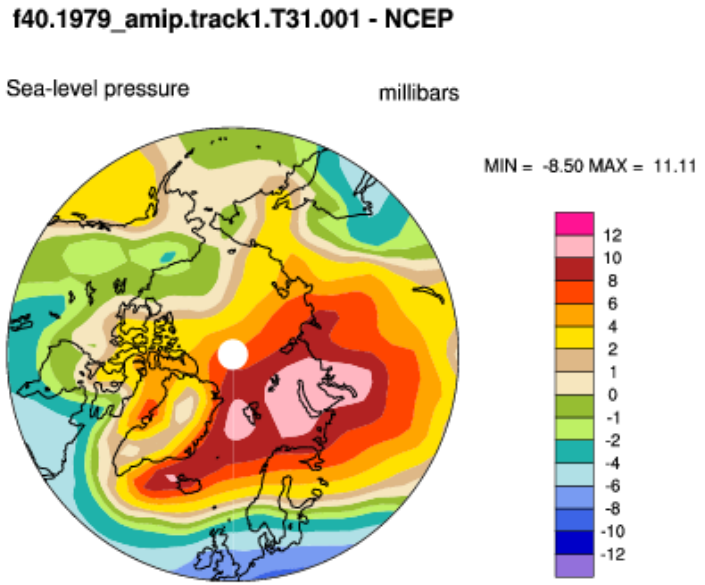


DJF SLP Errors (NCEP)

T31



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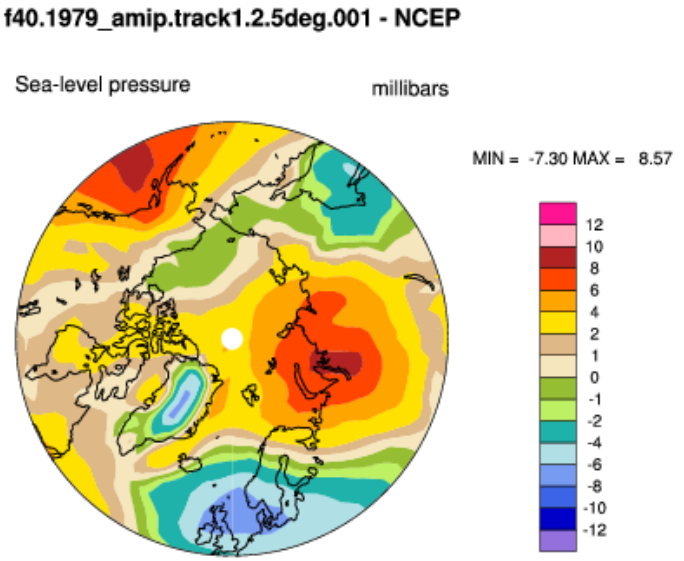

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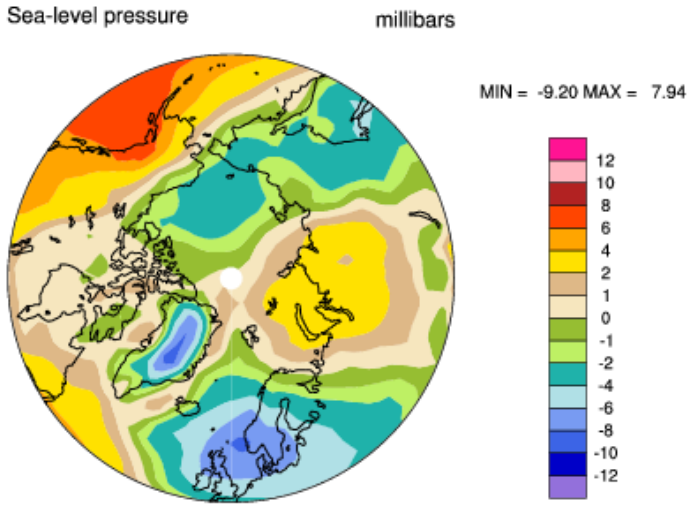

SUMMARY

- ✓Build lower resolution FV model
- ✓Useful for resource-intensive research (WACCM, Chem, length)
- ✓Lowest resolution with T31 equivalent baroclinic eddies
- ✓2X faster than FV 2^o similar climate (RMSEs)
- ✓2X slower than T31: similar climate (RMSEs)
- ✓Effects of coupling?
- ✓Some benefit for polar climate; upper troposphere
- ✓Need to examine CAM5 2.5^o