Plans for *global* high-resolution using CAM

**Other efforts**
NASA
GFDL

**Goals**
Better seasonal means?
Regional predictions?
Better statistics/extreme events?

**Parameterization Issues**
Evaluation and tuning

**Proposal:** ...
Plans for global high-resolution: Other efforts

**NASA/GMAO**

FV dycore on cubed sphere grid, - 14, 10, 7 and 3.5-km resolutions, 10-day runs at 3.5-km and longer runs monthly to seasonal at 7- to 10-km, and a series of year-long runs at 14-km. **Nonhydrostatic core** for resolutions finer than 14 km. Projecting “operational” use at 14 km soon.

Physics: Stochastically-modulated RAS, prognostic clouds, Lock PBL,

**GFDL**

FV dycore on cubed sphere grid 50, 25, 12, and 5-km resolutions. AR5 timeslices with 25 km resolution later this year. NWP runs at 12 km.


*Running coupled with AM2 physics at 50 km - “looks pretty good” except for tropical cyclones*
Plans for **global** high-resolution using CAM: **Goals**

**High frequency Statistics**
Precipitation intensity and timing

**Improved Seasonal Means in Global Simulations**
Probably requires retuning of convection and GW schemes at a minimum

**Specific phenomena/Regional climate**
- Typhoon, hurricane climatologies
- Midwest MCCs
- Continental diurnal cycles
- Coastal upwelling regimes
PDFs of precipitation intensity (log-log) 30S - 30N

- control
- TRMM
- MERRA
- no deep con
- control ZM only
Seasonal Mean precipitation JJA
1997

A real seasonal mean difference/improvement due to increased resolution!!!
Plans for *global* high-resolution using CAM: Parameterization Issues

**Deep Convection**
More intermittency seems required. Tuning of this could probably take place in CAPT framework

**Gravity Waves**
Difficult. Direct global observations of key quantity ($\rho u'w'$) not available. Climate effects ($P_{sfc}$, $U_{200}$) require multiple seasons to establish with confidence.
- Cross-grid effects
- resolved vs unresolved (for orographic, convective, frontal sources)

**Shallow convection/PBL**
No special concerns as DX~10 km

**TOA balances/Coupled tuning /Aerosols ...**
Sea-level pressure
CAM3.5 (DJF zonal average over years 2-11)
Sea-level pressure
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Sea-level pressure
CAM3.5 (DJF zonal average over years 2-11)

“ Appropriately re-tuned” GW
8*kwv
4*kwv

Std GW

0.25 degree
NCEP

0.5 degree
As grid size decreases, subgrid orographic variance $h'$ decreases. Orographic stress $\rho u'w' \sim \rho N U k h'^2$ so decrease in $h'$ should be partially offset by increased $k$ (wavenumber) of unresolved waves.

Unfortunately, even at 0.25 we aren’t finished with orographic GW tuning.
Plans for *global* high-resolution using CAM: Proposed *short term* plan

Scalable Dycore (HOMME, MPAS) + CAM5 physics with minor mods.

**Concrete Goal: Good typhoon/hurricane climatology (as honestly as possible)**

Deep Convection
Stochastic or other grid dependent inhibition applied to ZM/NR and/or modified UW scheme. Org variable?

Prescribed aerosol option
Plans for *global* high-resolution using CAM: **How to stay honest**

**CAPT runs**
Current problems in convection statistics show up immediately. Improve things in CAPT mode first.

**Satellite radiance simulators (e.g. COSP)**
CAPT results compared versus high resolution satellite data in case-study mode. YOTC data sets (Hi res analyses satellite data sets)

**Doubly-periodic CAM configuration with idealized forcing for physics testing at high resolutions (quasi-CRM).**
Gravity Waves

Catch up with WACCM
Frontal, convective sources

High resolution/future version
Less arbitrary orographic forcing – anisotropy? Replace TMS with blocking and non-local (e.g. Beljaars) stress

Horizontal non-locality??

Novel Validation ideas?
Test in doubly-periodic CAM (quasi-CRM)??
High-res satellite data (e.g. AMSU) for $T'$
0.25 degree resolution, del2 configuration: U & PSL

CAM3.5 (DJF zonal average over years 7-8; using “spun-up” initial condition from a 6 year del2 run with del2=4e6)

8*kwv

Del2=3e5

Del2=4e5 (years 2-6)

NCEP