EXAMINATION OF THE HIGH RESOLUTION CAM EASTERN TROPICAL PACIFIC PRECIPITATION BIAS VIA CAPT FORECASTS

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Standard CAM 5.2

0.25 degree Finite Volume Dynamical Core
1 degree physics tuning parameters
15 minute physics time step

5-day forecasts initialized from
ECMWF YOTC analyses
00Z January 3 to January 24, 2009

Compared to
Precipitation from 3-hourly 0.25 degree TRMM (3B42)
State from ECMWF and GMAO YOTC analyses
VERTICAL INTEGRAL OF MOISTURE DIVERGENCE (mm/day)

**RAIN REGION**

**NO-RAIN REGION**

**TOTAL REGION**

∫V·(Vq) dp (mm/day)

∫V·(Vq) dp (mm/day)

∫V·(Vq) dp (mm/day)
RAIN REGION

PRECIPITATION (mm/day)

COLUMN WATER (mm)

DAYS

NO-RAIN REGION

DAYS
SPECIFIC HUMIDITY “ERROR”
RAIN REGION

VERSUS ECMWF

VERSUS GMAO

CAM5.2
60 versus 30 levels
RAIN REGION        DAY 3

HEATING

OMEGA

$qV$ DIVERGENCE
MOIST PARAMETERIZATION HEATING

RAIN REGION

TOTAL

DEEP CONVECT

SHALLOW CONVECT

MACROPHYSICS

MICROPHYSICS
Decrease maximum shallow convection updraft fractional area by a factor of 2 and 10
Decrease maximum shallow convection updraft fractional area by a factor of 2 and 10

**TOTAL**

**DEEP CONVECT**

**SHALLOW CONVECT**

**MACROPHYSICS**

**MICROPHYSICS**

RAIN REGION    DAY 3
Deep convection time scale
60 min, 15 min, 5 min

Precipitation (mm/day)

Column Water (mm)
Deep convection time scale  
60 min, 15 min, 5 min  
RAIN REGION  
DAY 3

**TOTAL**

**DEEP CONVEXT**

**SHALLOW CONVEXT**

**MACROPHYSICS**

**MICROPHYSICS**
Decrease parameterization time step
15 min, 15/4 min, 45 sec
Decrease parameterization time step  15 min, 15/4 min, 45 sec
RAIN REGION  DAY 3
Increase deep convection evaporation efficiency by a factor of 5
Increase deep convection evaporation efficiency by a factor of 5

RAIN REGION  DAY 3

TOTAL

DEEP CONVECT

SHALLOW CONVECT

MACROPHYSICS

MICROPHYSICS

RELATIVE HUMIDITY
Where it is not raining, precipitable water is correct.

Where it is raining,
  precipitable water is too large
  rain is too strong  (although region is reasonable)

Resolved dynamics transports moisture
  from no-rain region to rain region

Resolved low level moisture convergence is forced by
  release of latent heat in lower troposphere

Elevating the heating breaks the dynamical feedback
  and results in correct precipitation and precipitable water

Two possible sources: resolved dynamics and parameterization