MJO Focus Theme Breakout

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During the past 5 years or so, greatly increased international interest/activity in tropical convection, its large-scale organization, MJO and their global effects

... backdrop for the CMMAP MJO Theme
Strategic goals

• Understand the MJO and its lifecycle at a basic level (mathematical-dynamical analogs)

• Simulation of the MJO in MMF (explicit convection)

• Validation of MJO in MMF (satellite data)

• Further development of MMF: GCRM, superparameterization

• MJO in high-resolution deterministic NWP models

• Improve traditional convective parameterization
Science questions

• What’s the importance of: i) upscale effects of convective organization; ii) effects of the extratropics on the MJO

• Can the MJO be properly and consistently represented in global models by: i) parameterized convection, ii) explicit convection?

• Is the MJO predictable?

• Is the MJO significant in the genesis/demise of El Nino Southern Oscillation (ENSO), and by what mechanism(s)?
Agenda: MJO Breakout Session

Validation of MMF the main theme:

Kate Thayer-Calder (CSU): Moisture budgets and the MJO CAM and SP-CAM

Duane Waliser (JPL/CalTech): US CLIVAR MJO Working Group activities

Tom Ackerman (UW): Comparisons between MMF and CloudSat

Yunyan Zhang (LLNL): Diurnal cycle in MMF vs. nature

Trude Einhammer (CSU) Microphysics issues
Progress since August 2007

• Continued verification of SP-CAM and comparison with CAM … Kate Thayer-Calder

• Application of CLIVAR MJO Working Group diagnostics to SP-CAM, observed MJOs and parameterized models…. Duane Waliser

• Validation of MMF using CloudSat data … Tom Ackerman

• Comparison of diurnal cycle in MMF with nature using TRMM measurements…Yunyan Zhang

• Nested domain simulation of natural MJOs - role of mesoscale organization, … Mitch Moncrieff & Hsiao-ming Hsu)
Ongoing & near-term work

- **MMF validation:**
  - CLIVAR MJO WG diagnostics (Duane Waliser and the group)
  - Validation against CloudSat data (Tom Ackerman)
  - Validation of MMF at CSU (Kate Thayer-Calder & Jim Benedict)
  - ISSCP (Bill Rossow)

- **CRM and superparameterized simulation:**
  - MMF simulations with T85 truncation (Marat)
  - Complete simulation of natural MJO (Mitch & Hsiao-ming Hsu)
  - Analysis of *Deep and Shallow Convection Theme* very high-resolution CRM simulations (cumulonimbus parameterization)

- **NWP:**
  - High-resolution NWP analysis/forecasts and multi-sensor satellite data (Duane Waliser, Mitch Moncrieff, Bill Rossow)
Why are MJOs too active in CRMs (and GCRMs)?

... and troposphere too moist

... suggestive of a convection--mean-state feedback issue
Representation of precipitating convection in CRMs

Cumulonimbus is sub-grid scale

Meso-convective organization resolved (scales > 20 km)

Latent energy (J/kg)

Horizontal scale

1 km ~ 10 – 100 km

Cumulonimbus

Microscale

4 km

20 km

Large scale
Latent energy and the mean state

Latent energy

Parameterized cumulus convection

Organized precipitating convective systems

Explicit mesoscale organization

Δ\( \bar{M}_e \)

Cumulonimbus parameterized, no mesoscale organization

Δ\( \bar{M}_p \)

‘Physical aliasing’: cumulonimbus represented as resolved meso-convective organization

Change in mean state:

Δ\( \bar{M}_e \) \neq Δ\( \bar{M}_p \)