Moment Microphysics in CAM3

First Global Test...

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Test Run Details

- Morrison Moment Microphysics
- 15months, 2x2.5deg, finite volume
- ‘Std’ CAM3 physics, new interfaces (cam3_2_50)
- New Prognostic: Ice#, Liq#, Rain#, Snow#

- Comparisons of 1 yr vs. Control
- Snapshots of cloud properties (Liq,Ice)
## Timing

<table>
<thead>
<tr>
<th></th>
<th>Old (CAM3_2_50)</th>
<th>New Microphysics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>100%</td>
<td>126%</td>
</tr>
<tr>
<td>Routine (% of total)</td>
<td></td>
<td>(% of total)</td>
</tr>
<tr>
<td>Microphysics</td>
<td>4.1%</td>
<td>11%</td>
</tr>
<tr>
<td>Radiation</td>
<td>32.5%</td>
<td>30.4%</td>
</tr>
</tbody>
</table>
Global Numbers

- TOA balance: -2.2W m⁻²
- Total Cloud Fract +7%
- LWCF & SWCF increase by 5W m⁻²
- Tot Cloud LWP increases ‘substantially’
Liquid

15 Dec, 800mb

- CLOUD

- $R_e$ (liquid)
Liquid
15 Dec, 800mb
• CLOUD

• Liq Number
Liquid, 800hPa

Effective Radius ($R_e$)

Number

Note: Fixed subgrid $w$!
Ice

15 Dec, 200mb

- CLOUD

- \( R_e \) ice
Ice

15 Dec, 200mb

- CLOUD

- Ice Number
Ice, 200hPa

Re Number

Note: Fixed subgrid w!
Cloud Fraction

ANN

cam3_2_50_fv_new_micro (yrs 1978)
cam3_2_50_fv_old_micro (yrs 1978)

(cam3_2_50_fv_new_micro - cam3_2_50_fv_old_micro)
Total Cloud

- cam3_2_50_fv_new_micro (yrs 1978)
  - Total cloud
  - mean = 66.39
  - percent
  - Min = 10.16 Max = 97.47

- cam3_2_50_fv_old_micro (yrs 1978)
  - Total cloud
  - mean = 58.90
  - percent
  - Min = 5.98 Max = 88.58

- cam3_2_50_fv_new_micro - cam3_2_50_fv_old_micro
  - mean = 7.49
  - rmse = 9.23
  - percent
  - Min = -13.54 Max = 36.04
Cloud Water
Temperature
Precipitation

May be missing some H\textsubscript{2}O in diagnostic output
Your Favorite Diagnostic?

• AMWG Diagnostics
Preliminary Summary

• New microphysics runs globally
• Looks like planet earth (maybe)
• Number concentrations reasonable
• Effective Radii have ‘some outliers’
• Both of above need variable subgrid w
• Precip reasonable (missing piece)
• More High Cloud: esp polar regions
• Still some work to do…. 
To Do (partial list):

• Conceptual issues:
  – Prognostic v. Diagnostic Rain
  – Vapor deposition (Bergeron Process)

• Subgrid W development (adds variability)

• Understand high lat diffs
  – SCAM polar IOP studies

• Understand total LWP diffs

• Detailed timing for parts, some optimization

• Test interaction w/ new Cloud Fraction