

Atmospheric Components of Ice Sheet Biases: Status and Tools

A. Gettelman, NCAR

Thanks to J. Lenaerts, N. Miller

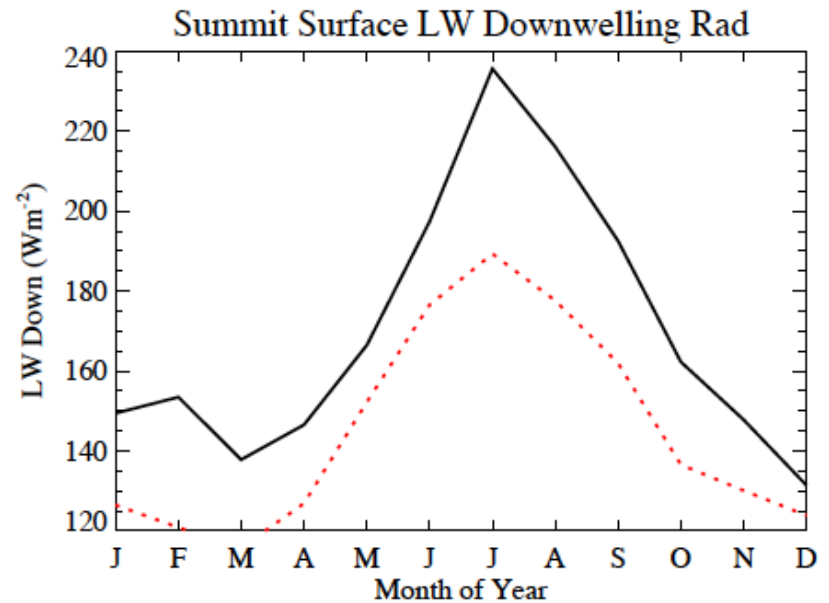
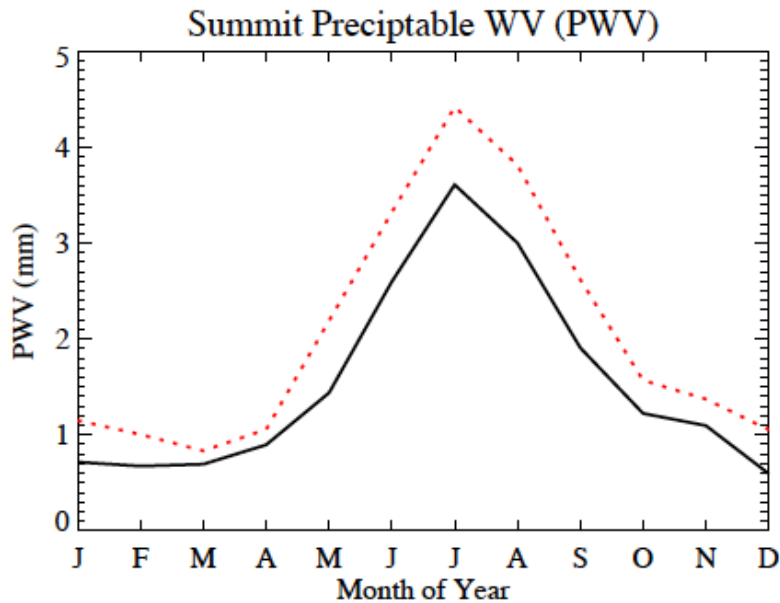
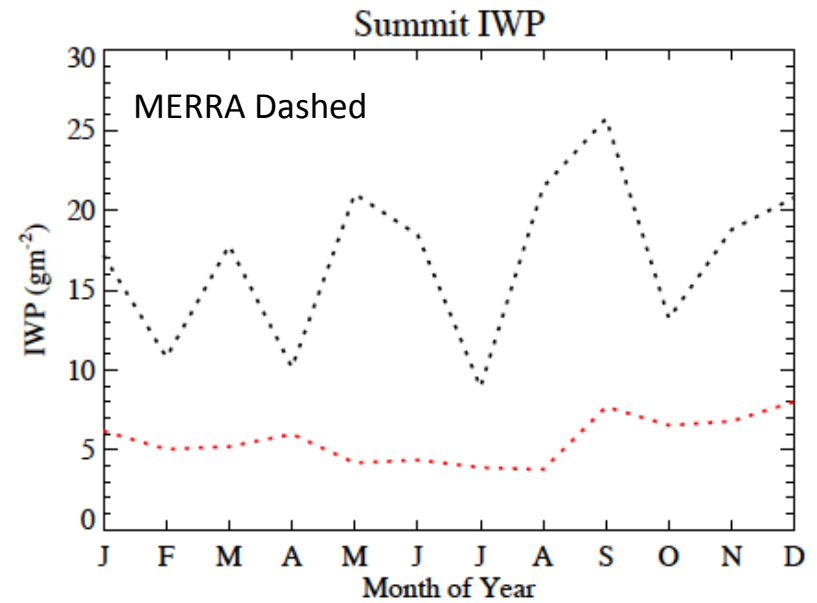
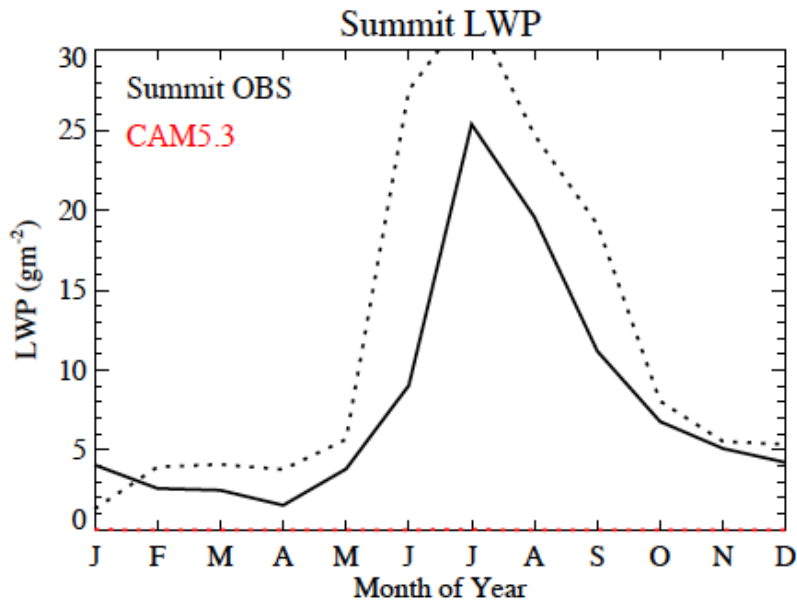
Outline

- Constrained Simulations: Methodology
- Current Biases
- Some sensitivity tests
- Thoughts on paths forward

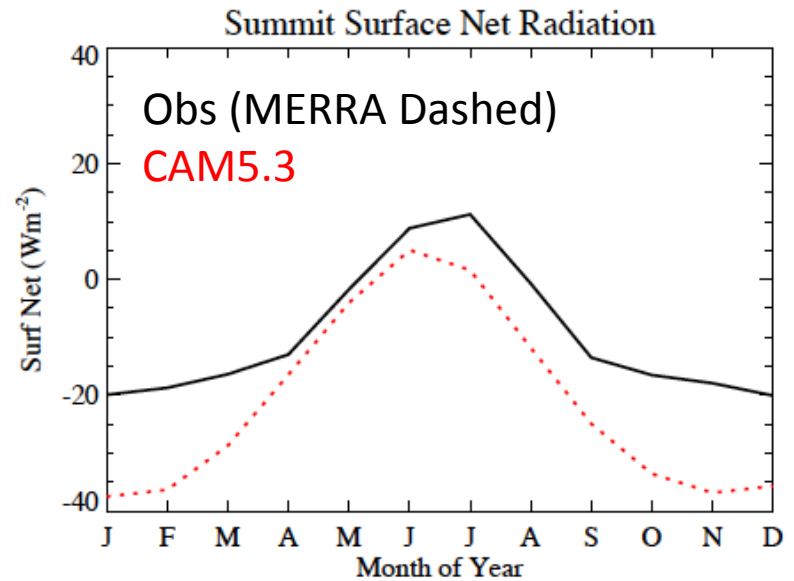
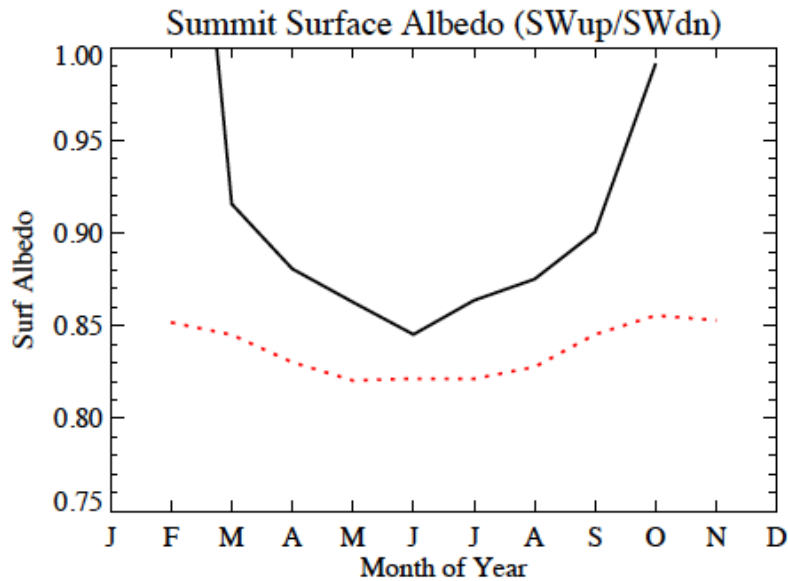
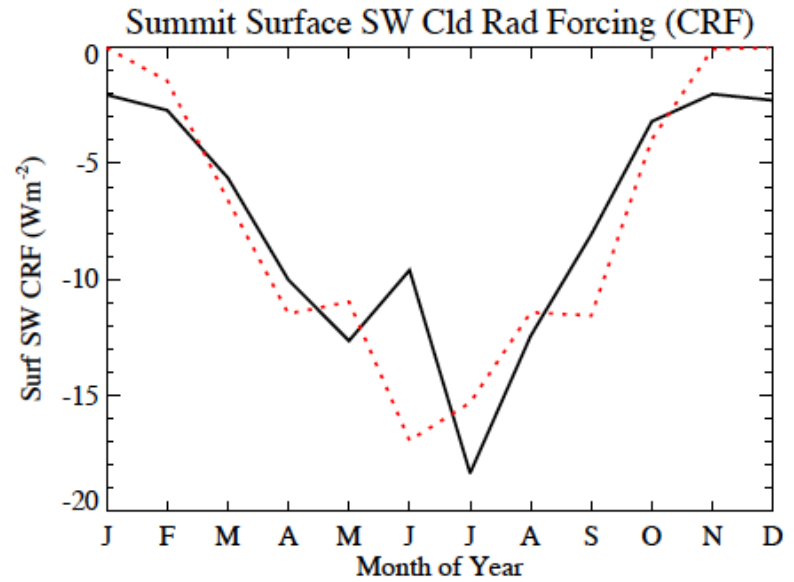
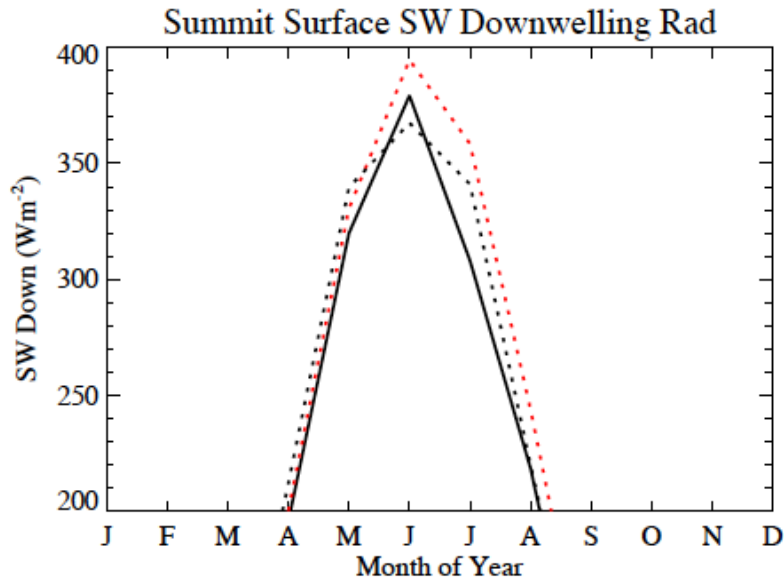
Methodology

- Free Running Simulations (Fixed SSTs)
 - AMIP or Climatological SSTs
- Specified Dynamics 2008-2013
 - MERRA Reanalysis winds and temperatures: 5 hour relaxation. Tune clouds a bit (different humidities).
 - Single column output for Summit Station
 - 3 hourly output
- Single Column
 - 2008-2013 Summit Station forcing (From SD run)
 - Testing now. Allows rapid sensitivity tests.

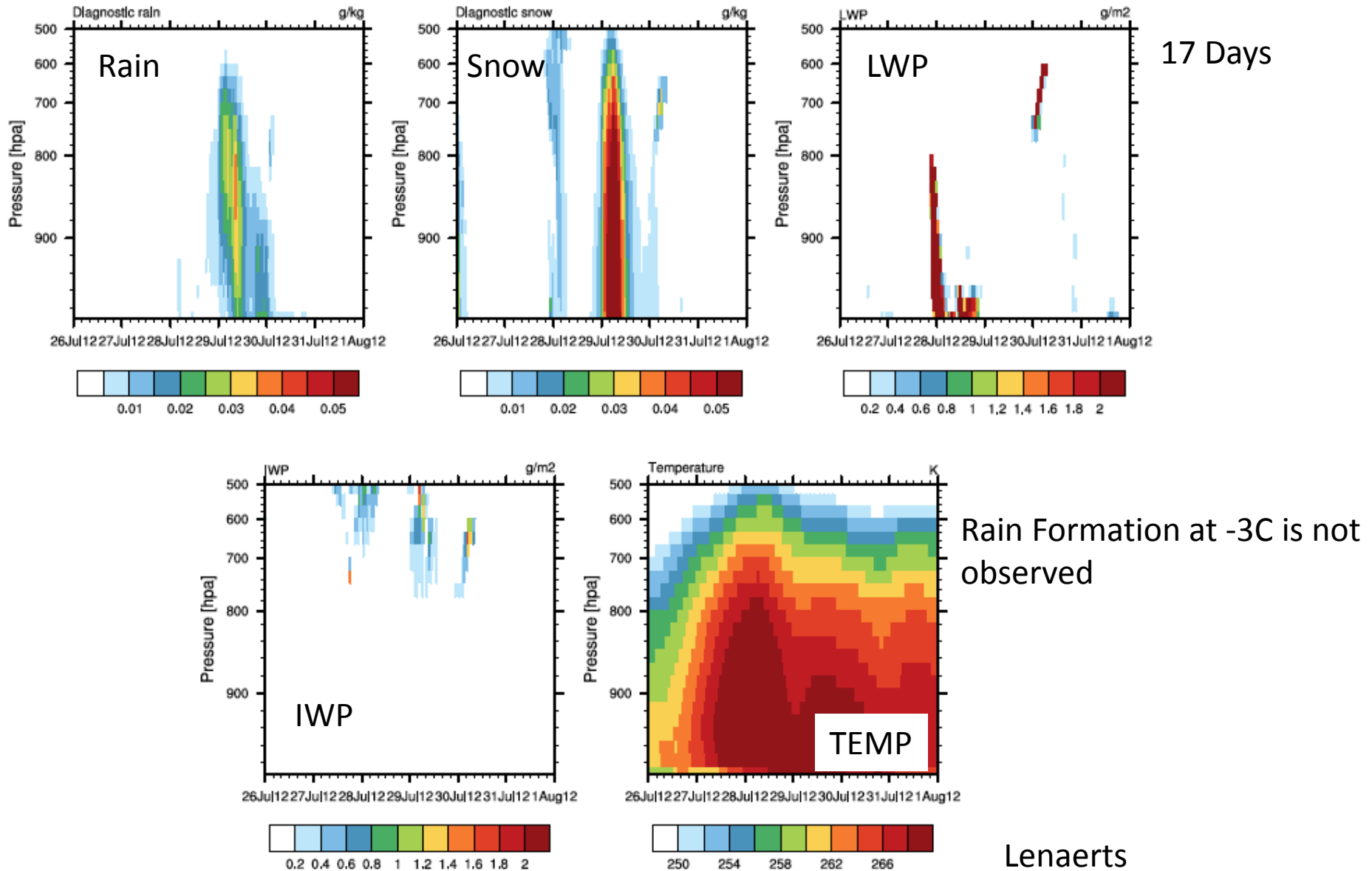
CAM5.3



CAM5.3



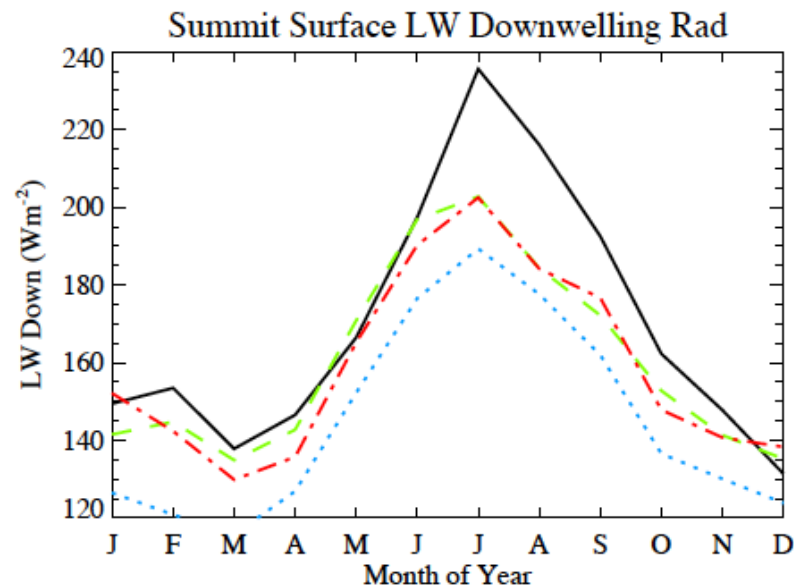
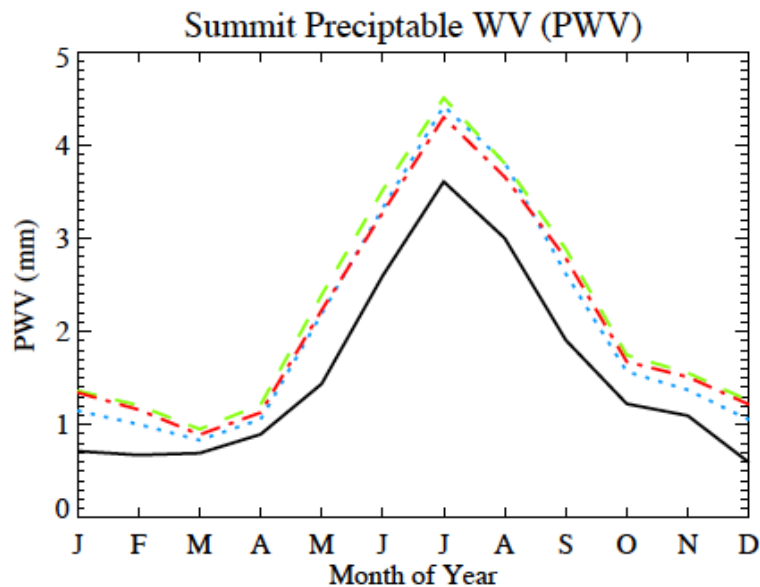
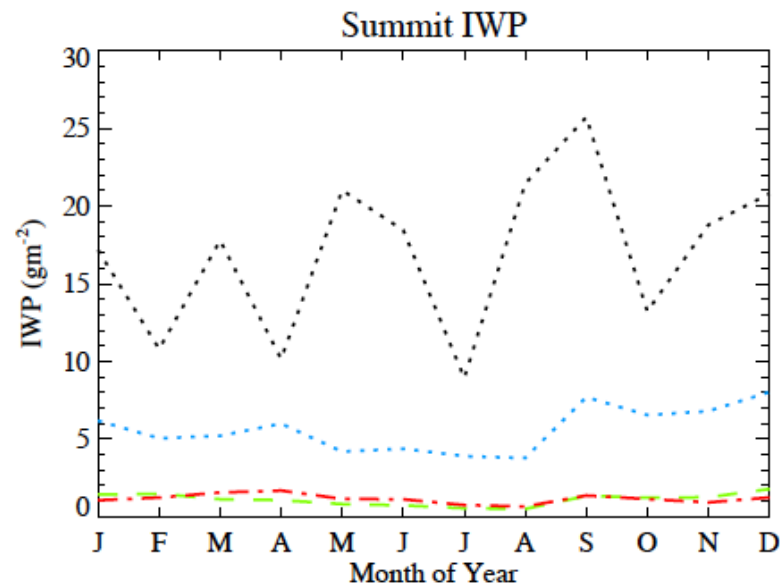
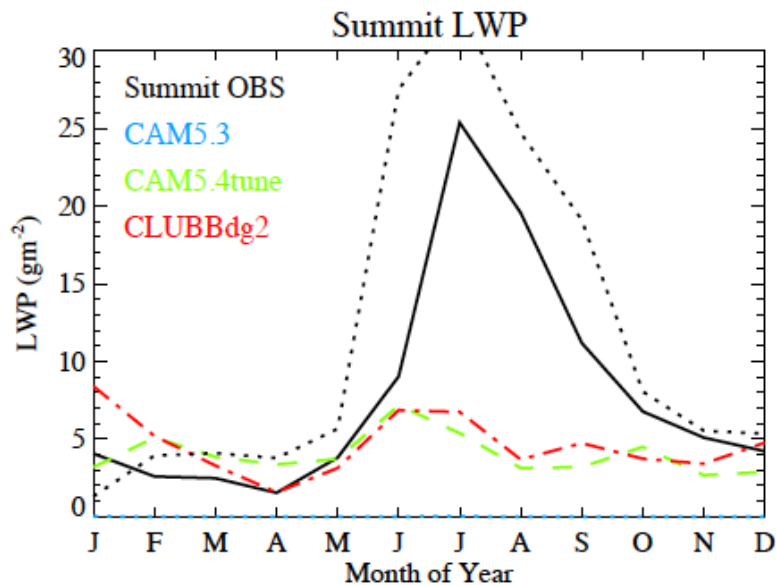
Summit Case Study



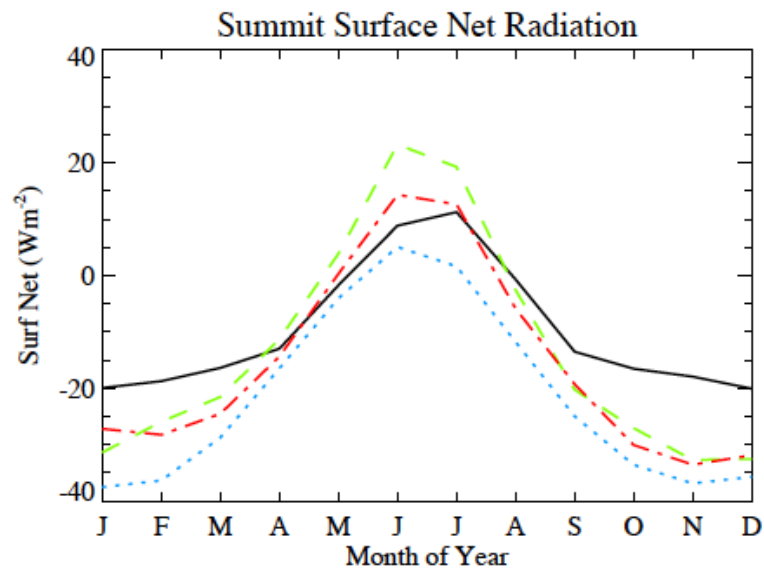
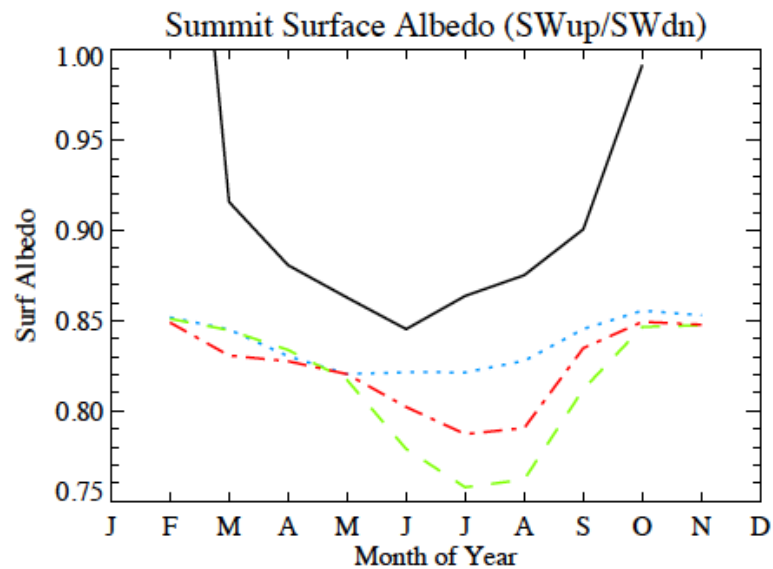
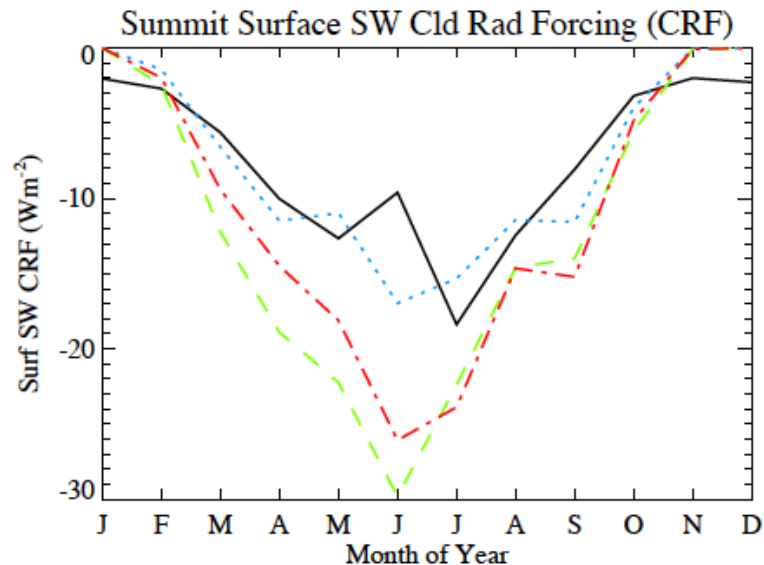
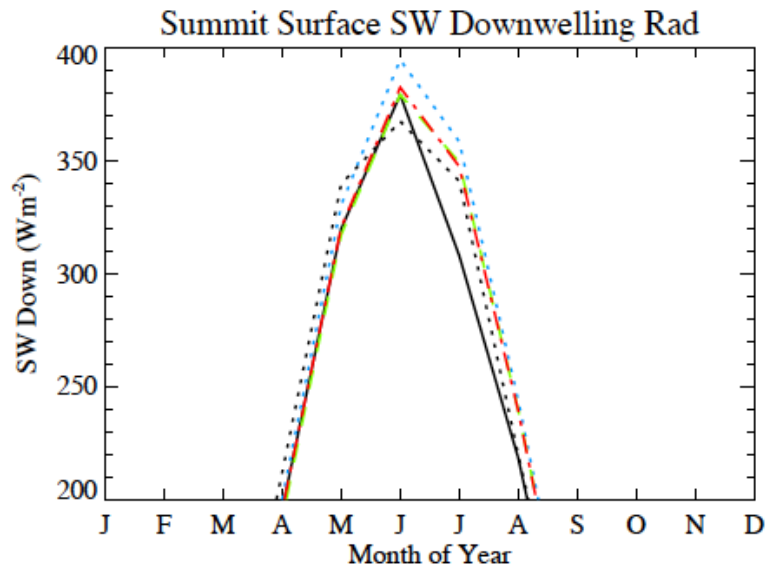
CAM Development

- Beyond CAM5.3:
- CAM5.4 most important changes are:
 - MG2 microphysics (prognostic precipitation)
 - Mixed Phase Ice nucleation
- CAM5.5
 - Adds CLUBB unified moist turbulence scheme.

CAM5.4+ Water Paths & LW



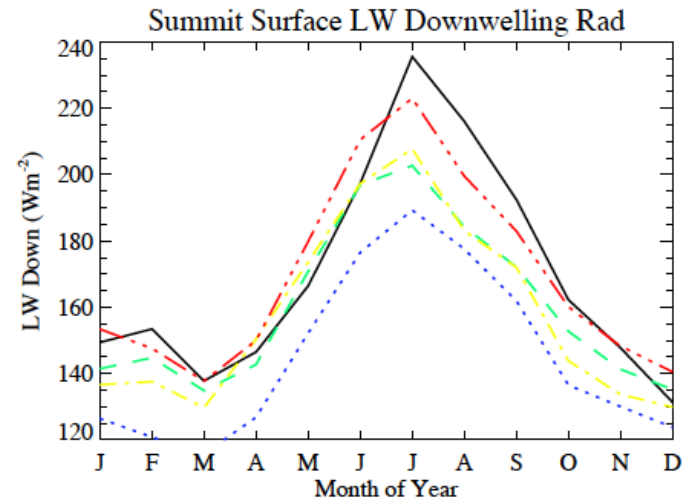
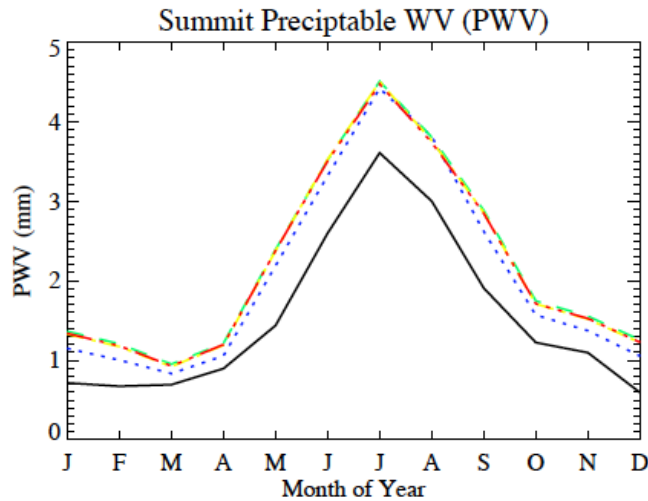
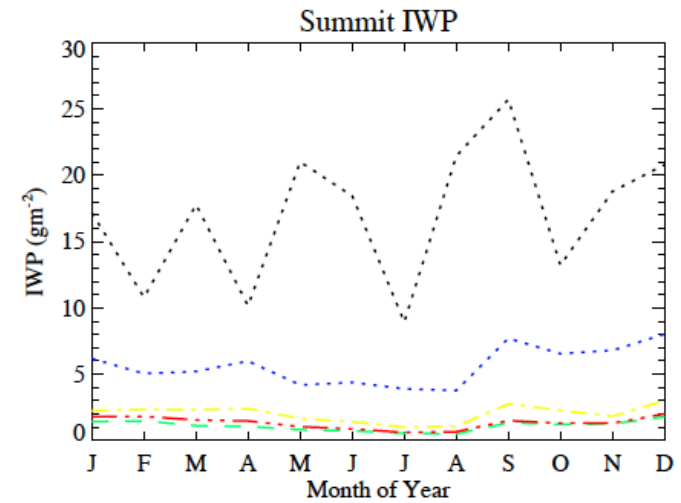
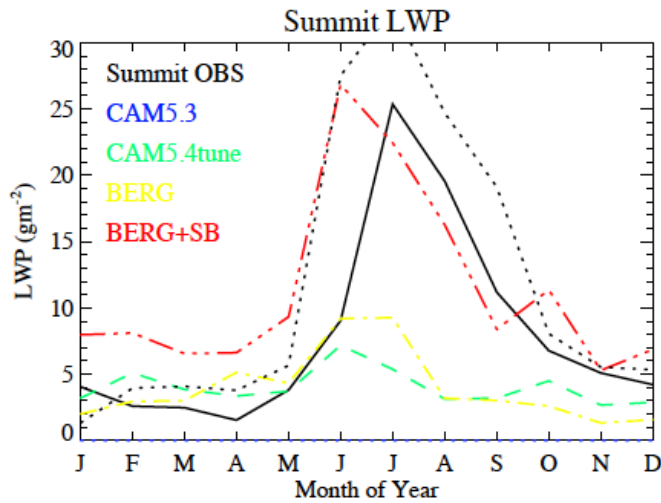
CAM5.4+ Radiation



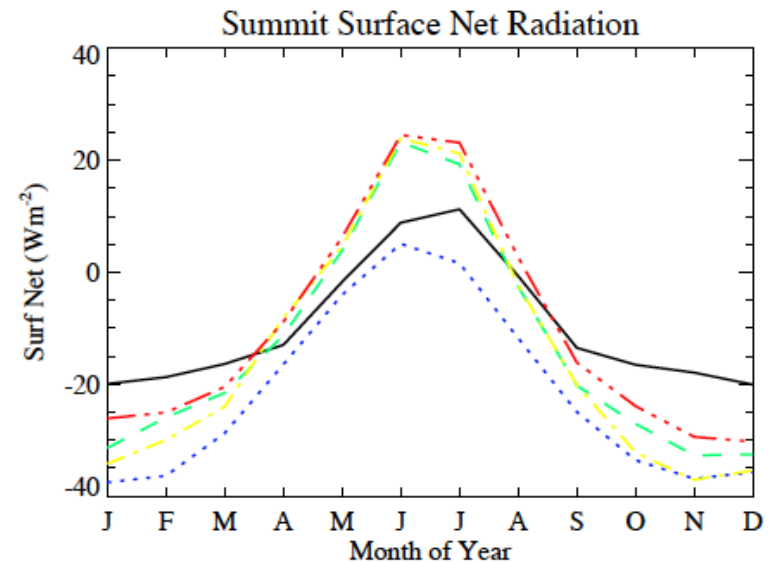
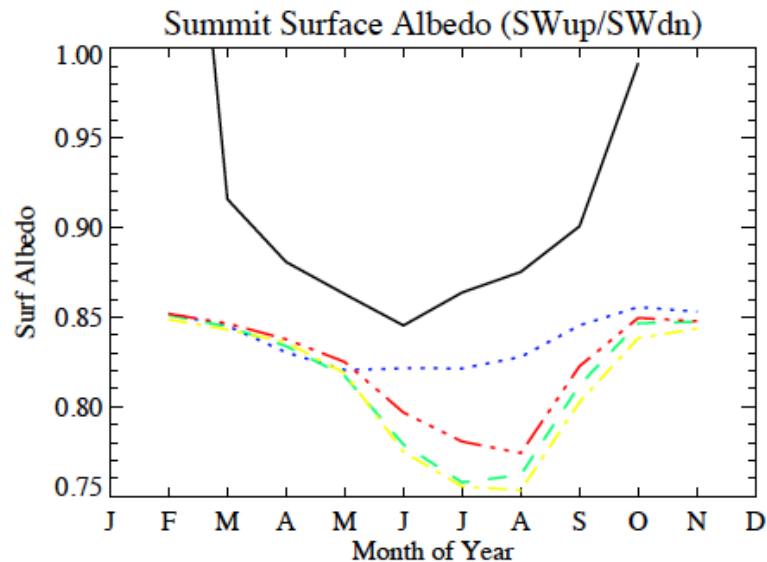
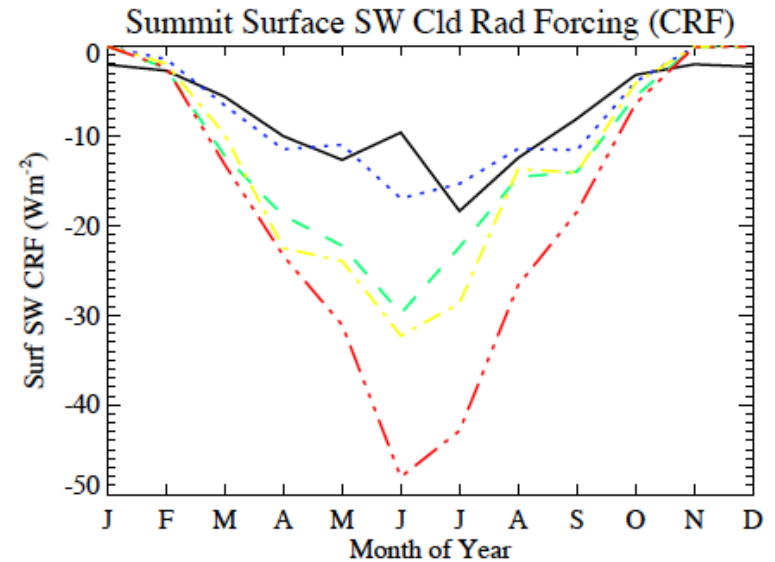
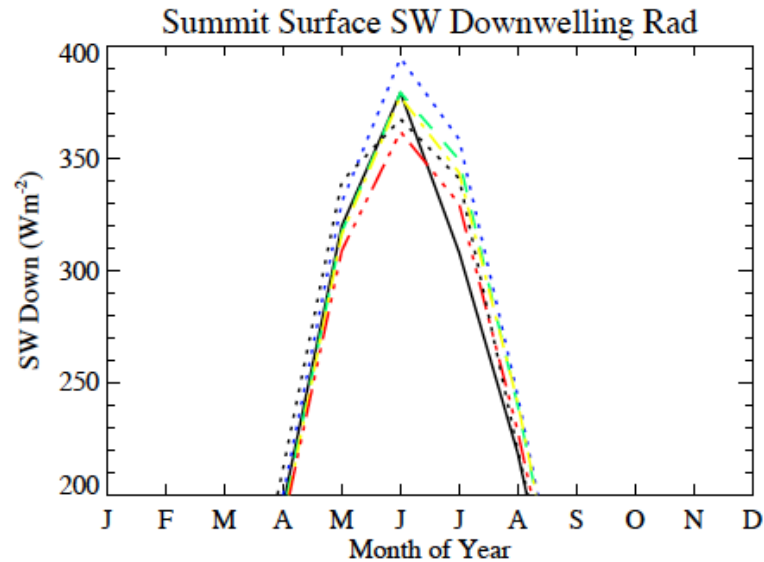
Sensitivity Tests

- CAM5.4 code
- BERG= Reduce Vapor Deposition process by 90%
- SB=alter auto-conversion and accretion to use Seifert & Behang 2001
 - reduces autoconversion with low LWP and RWP

Sensitivity Tests: Water Paths



Sensitivity Tests: Radiation



Summary/Thoughts

- Not enough LWP
 - Can adjust vapor deposition, but clouds globally are then too thick
 - Too strong SW CRF
- Surface albedo is low?
 - Might be supercooled rain hitting surface
 - Not much we can do about this in microphysics
 - Raise albedo in surface models?
 - May help reduce cloud forcing too.
- To Do:
 - See if we can focus on cloud optical thickness
 - Single column model studies
 - Update to current CAM5.5