Properties of Stratiform Areas Associated with Tropical Convection in TWP-ICE Observations and Simulations by Four CRMs—Evaluating GCM Components in a FASTER Framework

Ann Fridlind, Tony Del Genio, Andy Ackerman—NASA GISS
Aga Smith-Mrowiec, Catherine Rio, Yonghua Chen—Columbia University
Adam Varble, Ed Zipser—University of Utah
Adrian Hill, Jon Petch—UKMO
Jean-Pierre Chaboureau, Jean-Pierre Pinty—CNRS
Convective systems in GCMs

Rio et al, GRL, 2009
Convective and stratiform areas
Precipitation, winds, and cold pools
Precipitation, winds, and cold pools
Objectives

• Compare simulated downdraft properties to LMDz and GISS ModelE assumptions
• Identify factors controlling convective/stratiform
  – confirm model variables underlying reflectivity
    • compare model Z-PR-RWC with surface disdrometer
    • map convective and stratiform areas in terms of PRs
    • intercompare model Z-PR-IWC in stratiform areas aloft
    • intercompare PDFs of up/downdrafts, cold pools, stratiform area
  – perform sensitivity tests with DHARMA model
    • single-moment, two-moment, bin microphysics tweaks
    • resolution, domain size, boundary conditions, forcing ...
Uncertainties in forcing derivation
FASTER Framework

• Are multiple CRMs a surrogate ensemble of reality?
• Example of TWP-ICE
  – bigger ensemble, bigger range of reality?
  – stratiform area right, then model right?
  – but convective area wrong
  – conclusion #1: big uncertainties in CRMs
  – conclusion #2: also important uncertainties in forcing

• Added measurements to constrain CRMs
  – targets (e.g., convection structure, aerosol effects) should seek strong CRM-measurement connections
  – availability of measurements (including scanning radar, satellite, in situ data) should influence foci
  – Harnessing added measurements is not FAST