

Clouds and Climate Breakout Summary

Chris Bretherton
(presented by Mike Pritchard)

3 tropical convection talks

Mike Pritchard, UC Irvine: Causal evidence that horizontal moisture advection is critical to the superparameterized Madden-Julian Oscillation

MJO in SPCAM is sensitive to rescaling tropical rotational moisture advection, supporting the hypothesis that moisture advection drives MJO propagation.

Emily Riley, U. Miami: The effects of organization on convective and large-scale interactions using cloud-resolving simulations with parameterized large-scale dynamics

CRM-simulated deep convection coupled to a parameterized gravity wave. Wave growth/period is sensitive to CRM domain shape, because of its effect on convective organization within domain.

Anning Cheng, SAIC: An explicit representation of vertical momentum transport in a Multiscale Modeling Framework model through its 2D cloud-resolving model

MMF with CRM domain orientation chosen in each GCM column based on expected convective organization, using the vertical wind shear profile. This approach significantly affects the simulated rainfall distribution compared to a fixed CRM orientation. Use of CRM-predicted (rather than GCM-parameterized) momentum transports has a minor additional effect.

2 cloud feedbacks talks

Peter Blossey and Chris Bretherton, U. Washington: SPCCSM cloud feedback analysis

Cloud feedbacks in 150 yr SPCCSM simulation after step $4xCO_2$ increase. Major reduction in midlevel clouds almost everywhere, except increases in cloud at all heights in polar regions; weakly positive shortwave cloud feedback. Response linear in global temperature increase even at long times and ECS = 2.8 K.

Chris Bretherton and Peter Blossey: Entrainment-liquid flux (ELF) adjustment: a thermodynamic mechanism for decreasing subtropical low cloud in a warmer climate

LES simulations of stratocumulus to cumulus transition in control and warmed climate. Presented an ELF mechanism for cloud reduction in warmer climate based on a given cloud field creating more turbulence and entrainment in a warmer climate, due to Clausius-Clapeyron effects on its horizontal liquid water and temperature variability, forcing an adjustment that dries out the cloud layer.