

Implementation and testing of an ice nucleation scheme in SAM

Sonia Kreidenweis, J. Carpenter, P. DeMott, M. Branson

- Focus on Arctic mixed-phase clouds.
- Can linking ice formation to observed aerosol and IN improve our ability to simulate a long-lived, mixed-phase cloud?

Cloudy updraft cores in the Giga-LES

Steve Krueger and Ian Glenn

Conclusions

- 3D cloudy updraft cores consist of two distinct groups that are associated with active and dissipating life-cycle stages.
- A parcel model can predict updraft core vertical velocity profile with MAE ~ 1 m/s given actual total buoyancy profile and best-fit fractional entrainment rate.
- The MAE for Alison Stirling's estimate $W = C * B_{\text{unloaded}}$ is only slightly larger, and W requires only the "unloaded" buoyancy.
- Analyzing 3D cloudy updraft cores provides context, such as cloud base, cloud vertical extent, and cloud shape, that is not available from 1D and 2D core analyses.

Paths to accuracy for radiation for global models

Robert Pincus

- Tried out his Monte-Carol radiation scheme in ECHAM6
- Found problems over land, diurnal cycle...

Performance of SPCAM and SPCAM-IPHOC at high vertical resolution in the low troposphere

Kuan-Man Xu

- SPCAM-12L results are similar to SPCAM-IPHOC-6L results

Sensitivity of a simulated squall line to parameterization of microphysics and horizontal resolution

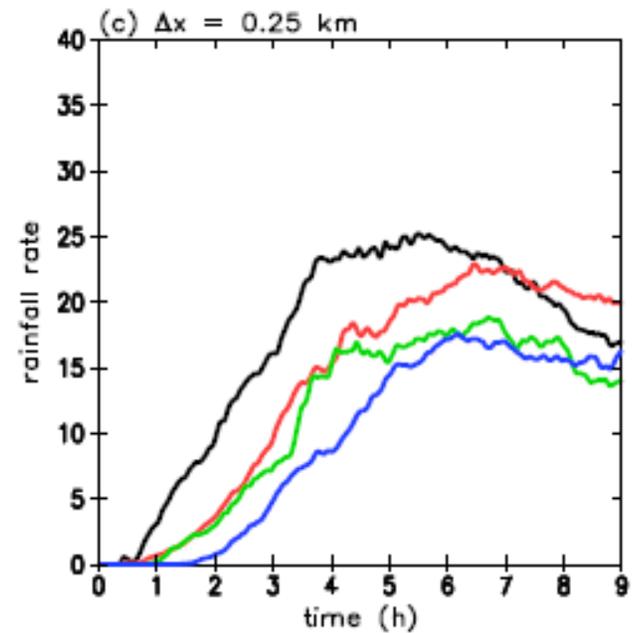
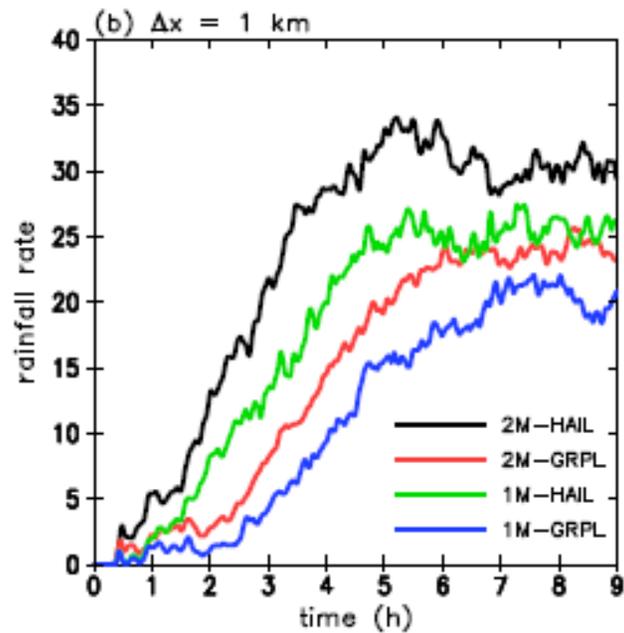
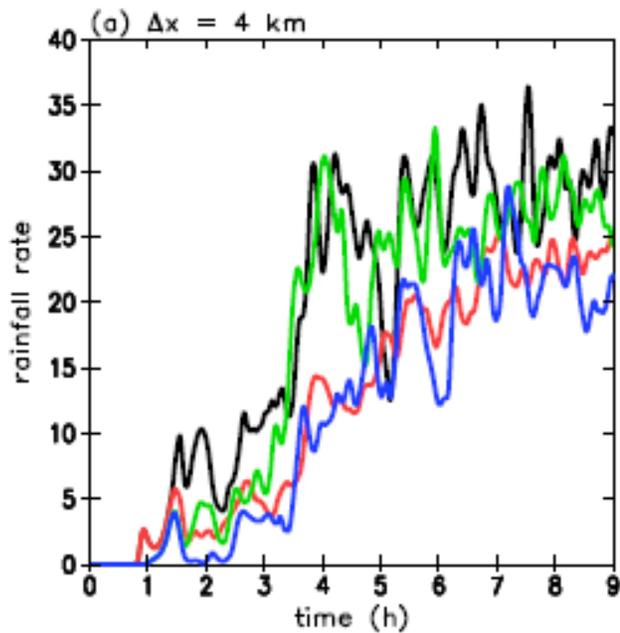
Bryan and Morrison, 2012, MWR

Domain-total surface precipitation rate

4 km

1 km

250 m

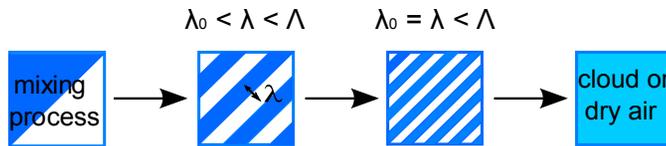


Units: 10^6 kg/s

Microphysical effects of entrainment in large-eddy simulation of boundary layer clouds

Dorota Jarecka, W.W. Grabowski, H. Morrison, H. Pawlowska, A. Wyszogrodzki

- New model variable: λ - spatial scale of the cloudy filaments during turbulent mixing



$$\frac{d\lambda}{dt} = -\gamma \epsilon^{\frac{1}{3}} \lambda^{\frac{1}{3}}$$

Broadwell and Breidenthal (1982);
Grabowski (2006)

- Mixing scenario in 2-moment warm-rain scheme (Morrison and Grabowski, 2008)

change of the droplet concentration due to the subgrid scale turbulent mixing. It depends on the mixing scenario.

$$N_c^i - \Delta N_c^{mix} = N_c^i \left(\frac{q_c^i - \Delta q_c^{mix}}{q_c^i} \right)^\alpha$$

parameter determines the mixing scenario:
 $\alpha = 0$ - homogeneous mixing
 $\alpha = 1$ - extremely inhomogeneous mixing

- Predicting the mixing scenario in the LES

- Characteristic times scales can be derived from model variables

$$\tau_{evap} = \frac{r^2}{A(1 - RH_d)}$$

$$\tau_{mix} = \frac{\lambda}{u(\lambda)} = \frac{\lambda^{2/3}}{TKE^{1/2} \Lambda^{1/3}}$$

- Using DNS results from Andrejczuk et al., 2009 α parameter can be derived as a function of the time scales

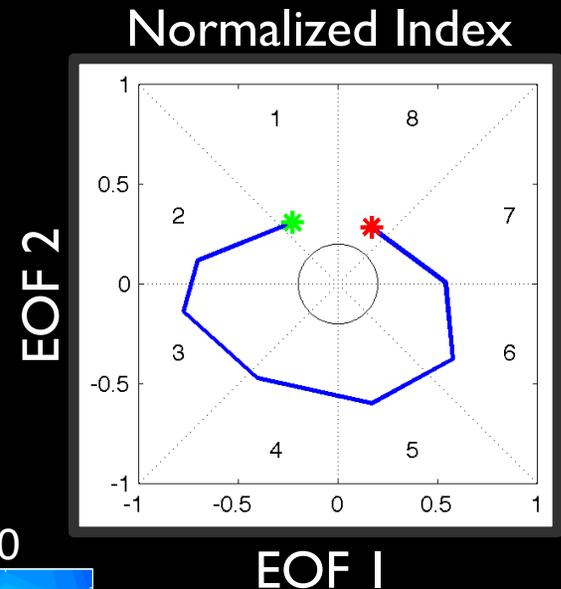
$$\alpha = f(\tau_{mix}, \tau_{evap}) = f(\lambda, TKE, RH_d, r)$$

Parameter α and the mixing scenario can be predicted locally from model variables!

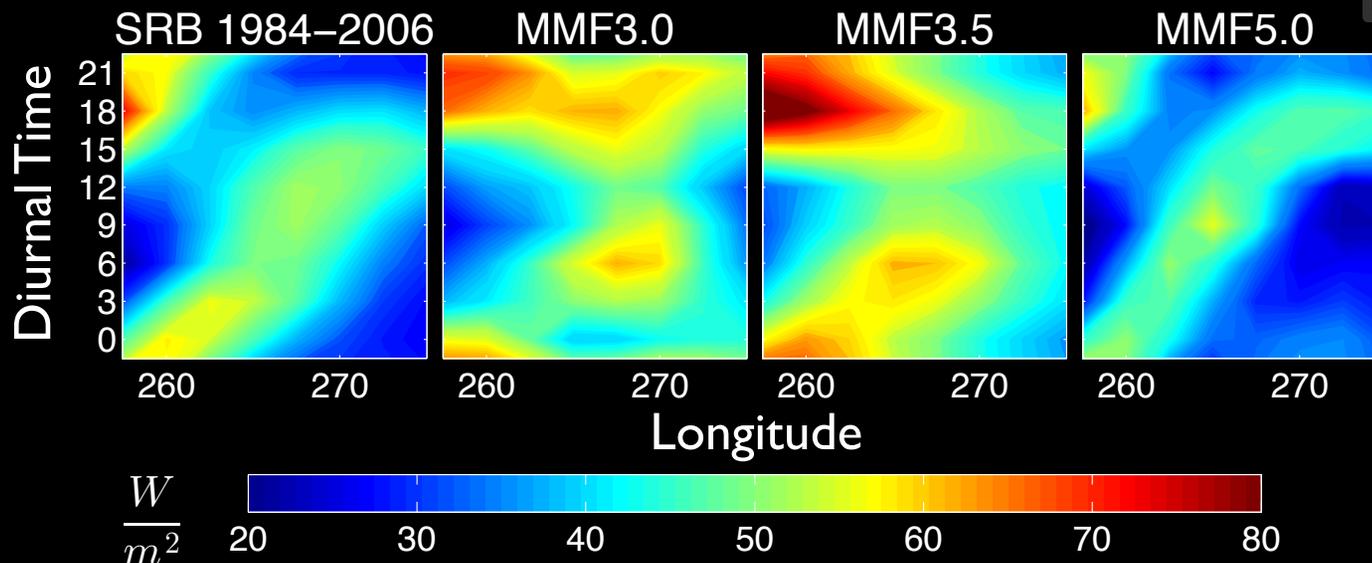
Assessing the Central US summer mesoscale convection signal in observations and across several versions of SP (CAM) using a Wheeler-Hendon type index

Gabe Kooperman, Mike Pritchard, and Richard Somerville

- Leading EOFs of filtered meridional averaged longwave cloud forcing in the central US represent a propagating pair.
- PC time series of EOFs 1 and 2 can be used to make a WH type index.



LWCF Diurnal Composite (Index > 0.2)



- Nocturnal US convection is evident in many versions of the MMF(3,3.5,5).