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Supplement of

Why do general circulation models overestimate the aerosol cloud lifetime effect? A case study comparing CAM5 and a CRM

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Contents of this file:

- Figures S1, S2, S3, S4

**Figure S1.** (a) Mean observed wind profiles from 10:00-19:00 (local time) on May 27th, 2011. (b) Mean observed potential temperature and specific humidity profiles from 10:00-19:00 (local time) on May 27th, 2011. (c) Observed surface latent and sensible heat fluxes. (d) Observed cloud fractions. (g) Total advected (horizontal+vertical) water vapor flux and (f) heat flux from the objective variational analysis (Xie et al. 2014).
Figure S2. Profiles of aerosol number concentration used in the CRM (solid) and CAM (dotted) with five different surface number concentrations (250 cm$^{-3}$, 500 cm$^{-3}$, 1000 cm$^{-3}$, 2000 cm$^{-3}$ and 4000 cm$^{-3}$).
Figure S3. An enlarged portion of Fig 2a and 2b showing the (a) domain averaged potential temperatures (θ) and (b) total water specific humidity ($q_t$).
Figure S4. Autoconversion rates from the Khairoutdinov and Kogan [2000] scheme used in CAM (solid curves) and from the stochastic collection equation solutions used in GCE (dashed curves) as functions of in-cloud cloud mass mixing ratio and number mixing ratio. An air density of 1.0 kg/m³ is used. The two pairs of diamond and circle points are autoconversion rates from the two different schemes (diamond: CAM, circle: GCE) using simulated in-cloud droplet number/mass mixing ratios ([26 cm⁻³, 0.167 g/kg] and [122 cm⁻³, 0.293 g/kg]) which are extracted from the center layer of clouds at the 11:30 hour from the two CAM cases with surface aerosol number equal to 250 cm⁻³ and 1000 cm⁻³, respectively.

References are listed in the manuscript.