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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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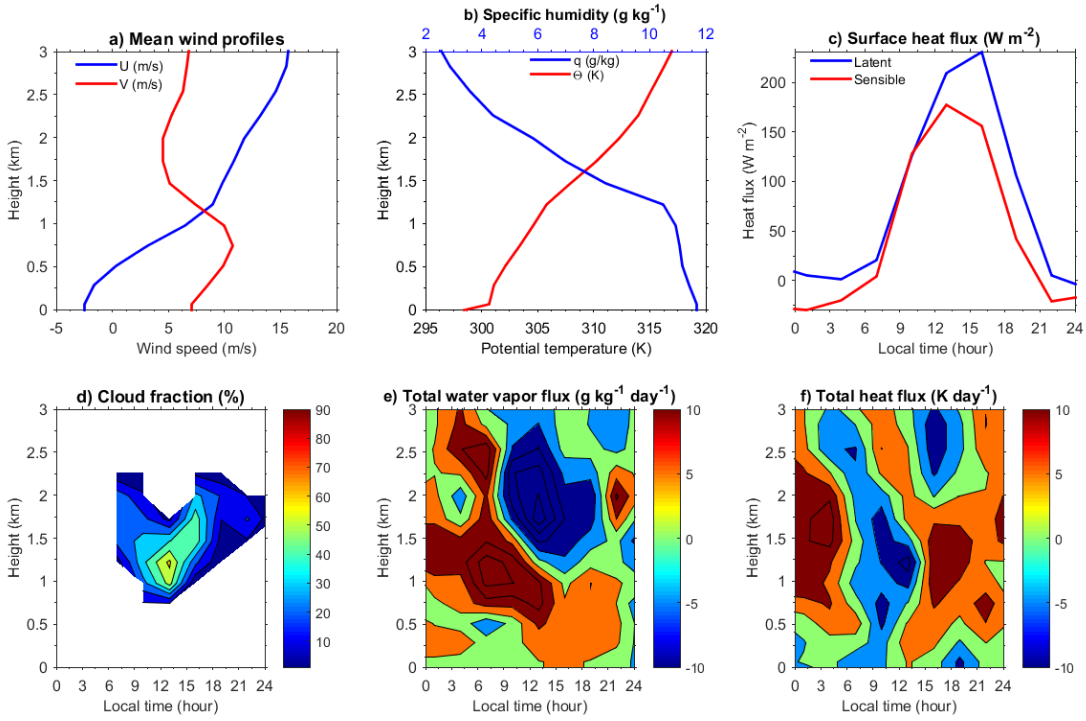

Figure S1. (a) Mean observed wind profiles from 10:00-19:00 (local time) on May 27th, 2011. (b) Mean observed potential temperature and specific humidity profiles from 10:00-19:00 (local time) on May 27th, 2011. (c) Observed surface latent and sensible heat fluxes. (d) Observed cloud fractions. (g) Total advected (horizontal+vertical) water vapor flux and (f) heat flux from the objective variational analysis (*Xie et al.* 2014).

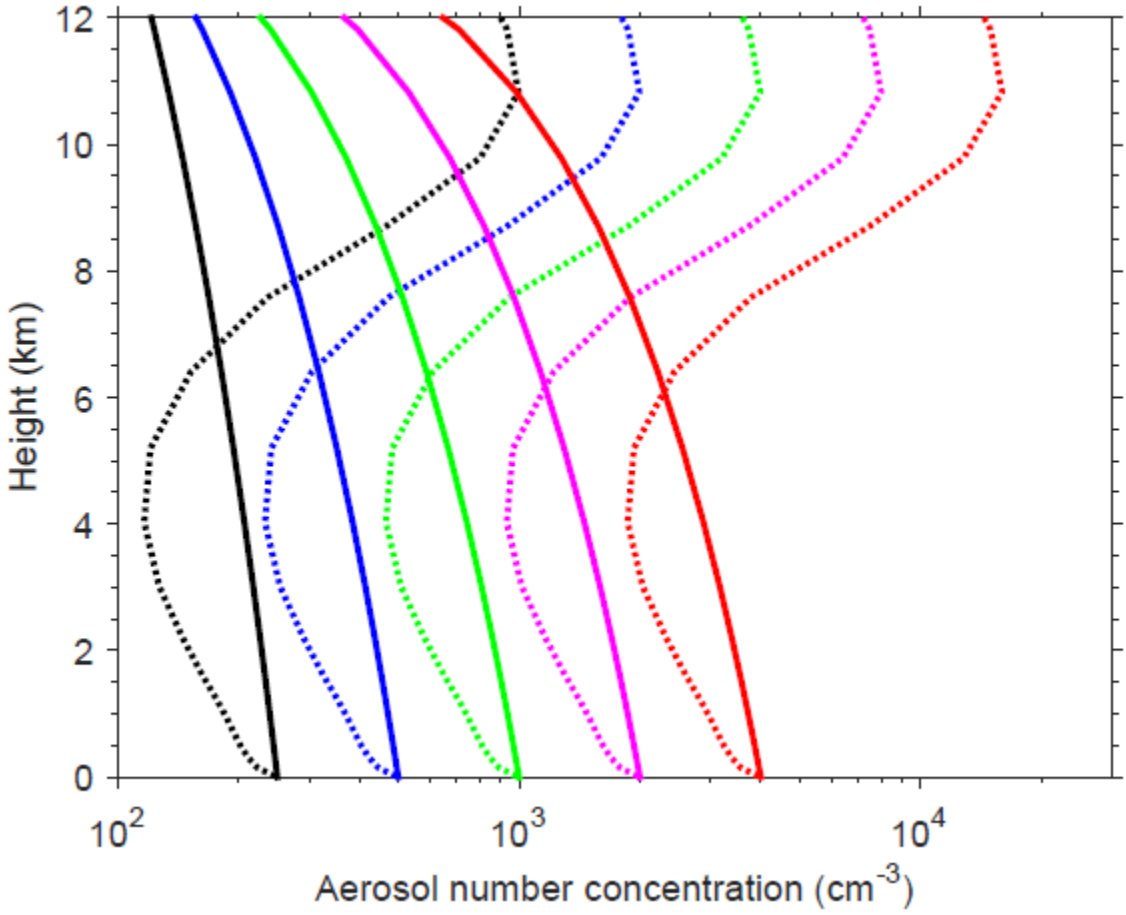

Figure S2. Profiles of aerosol number concentation used in the CRM (solid) and CAM (dotted) with five different surface number concentrations (250 cm^{-3}, 500 cm^{-3}, 1000 cm^{-3} , 2000 cm^{-3} and 4000 cm^{-3}).

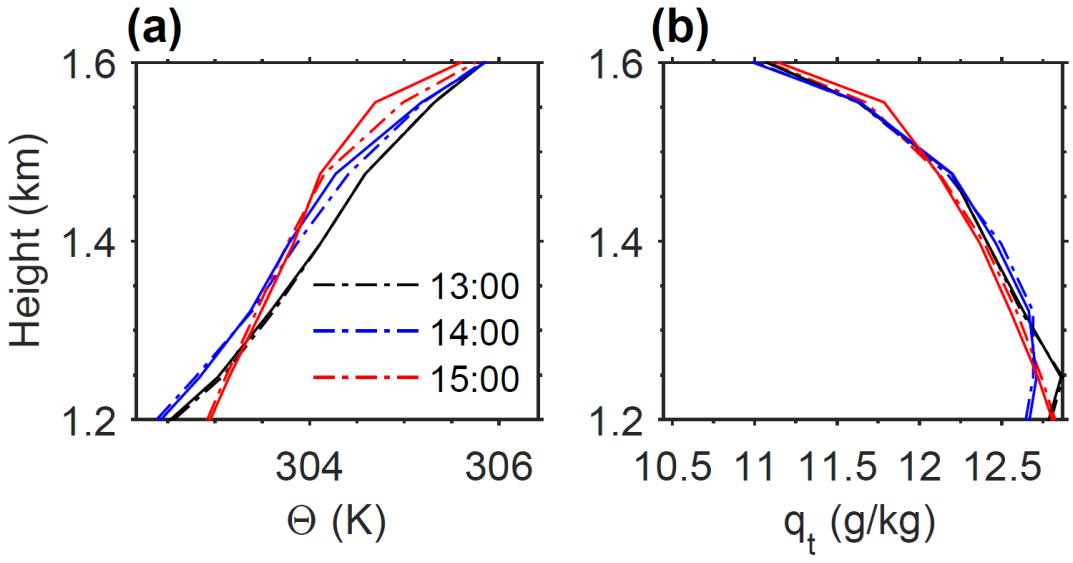

Figure S3. An enlarged portion of Fig 2a and 2b showing the (a) domain averaged potential temperatures (θ) and (b) total water specific humidity (q_t).

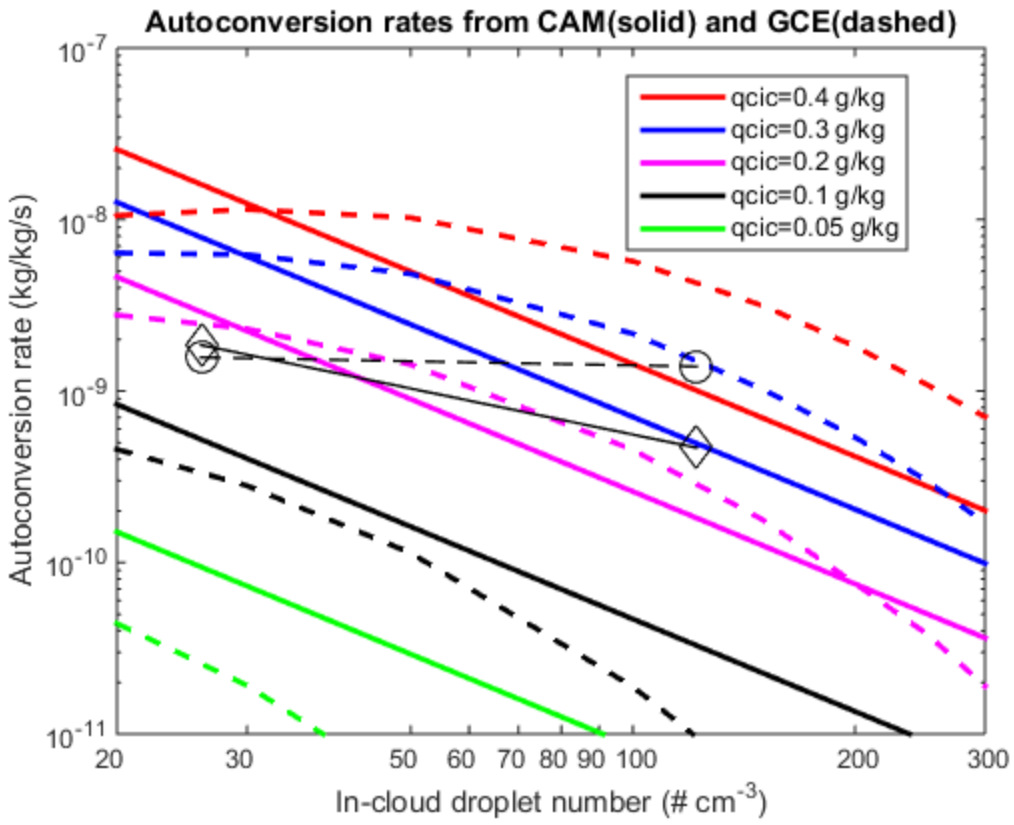

Figure S4. Autoconversion rates from the Khairoutdinov and Kogan [2000] scheme used in CAM (solid curves) and from the stochastic collection equation solutions used in GCE (dashed curves) as functions of in-cloud cloud mass mixing ratio and number mixing ratio. An air density of 1.0 kg/m3 is used. The 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.