Feingold et al.

Precipitation Susceptibility

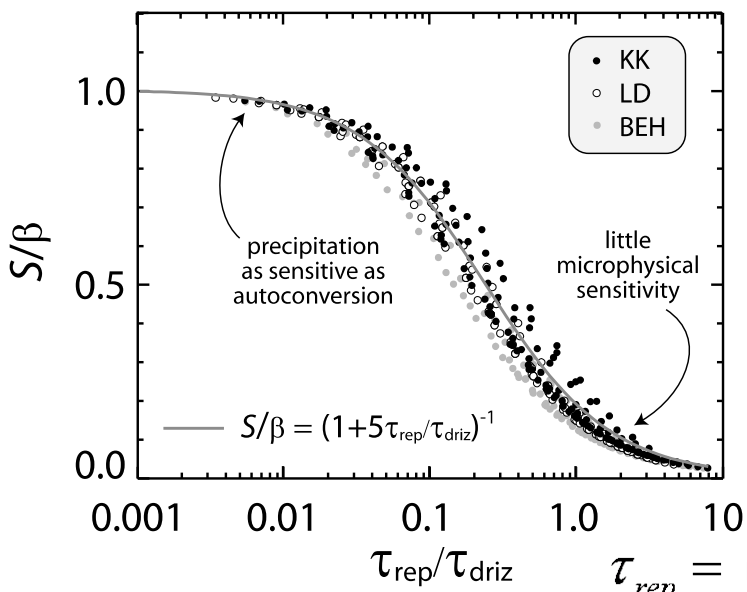
Precipitation Susceptibility

Hypothesis: Clouds within a limited range of conditions are susceptible to aerosol (vis-à-vis precipitation)

$$S_o = -\frac{d\ln R}{d\ln N}$$

R = rainrate

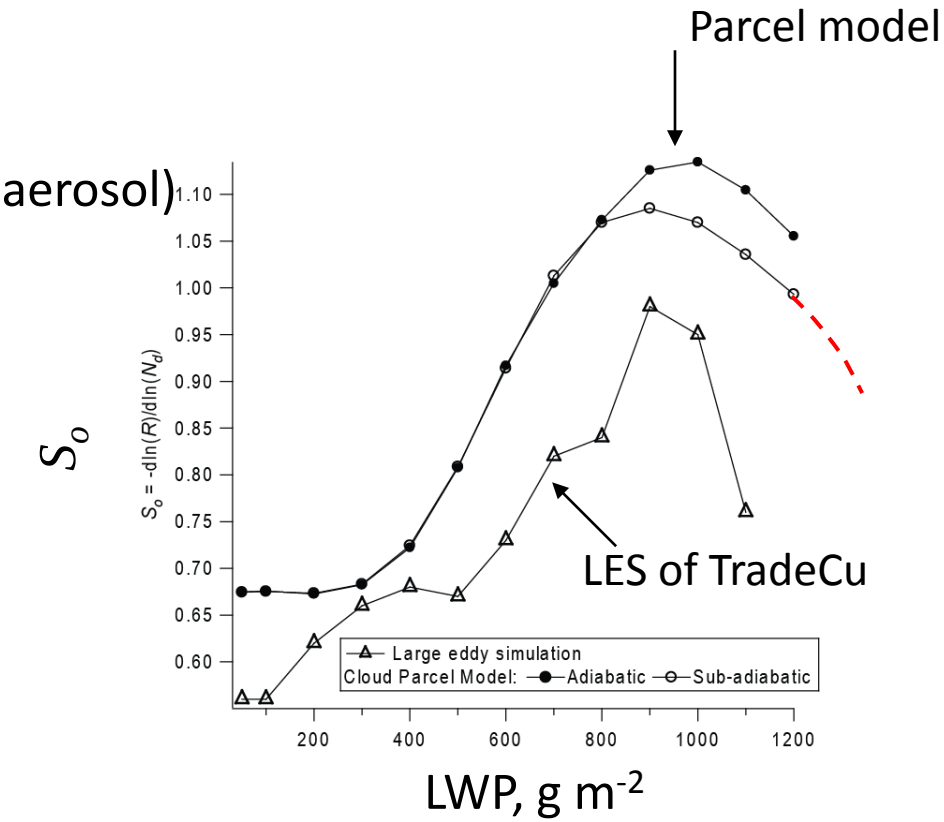
N = drop conc. (or aerosol)



Wood et al. 2009

$\tau_{rep} =$ replenishment time scale

$\tau_{driz} =$ drizzle time scale

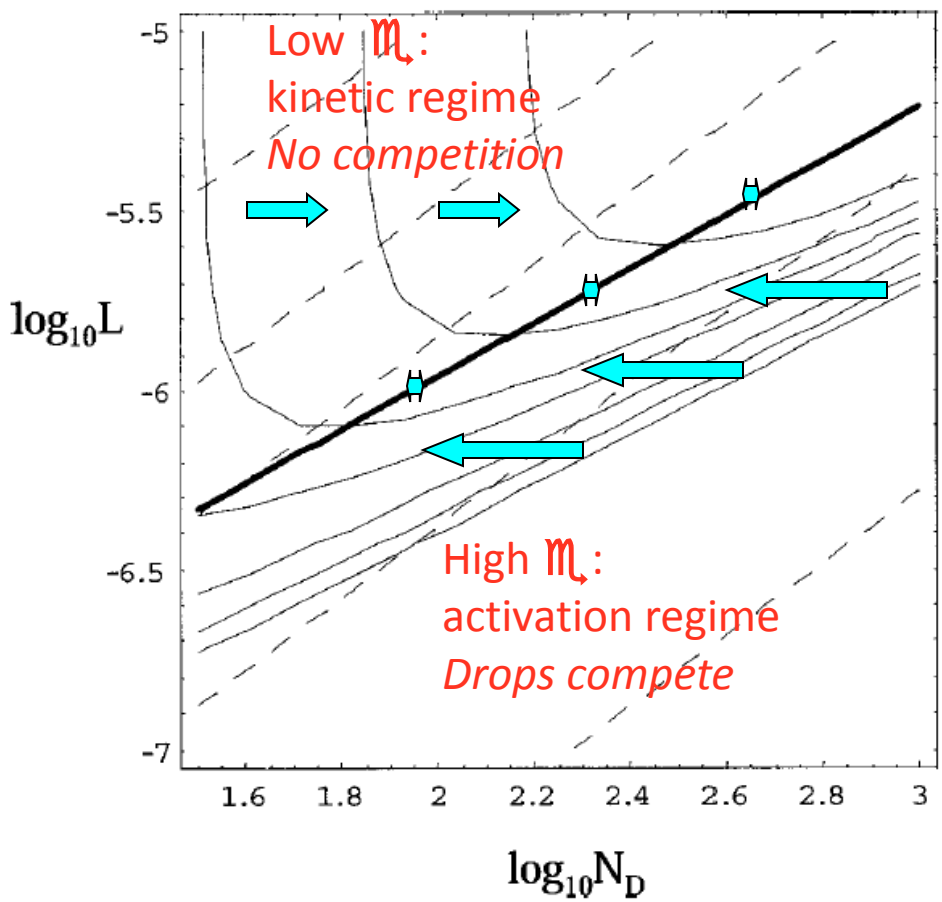


Feingold and Siebert 2009

Sorooshian et al. 2009

Nucleation Analog Robert McGraw (PRL 2003; 2004)

Contours of constant drizzle formation rate (radius 50 micron)



$$\left(\frac{\partial \ln J_{ss}}{\partial \ln N_D}\right)_L = \frac{9}{4} - \frac{v_c}{\bar{v}}$$

Arrows, point in direction of increasing rate depict sign and magnitude of the relative rate sensitivity

The thick line marks the cross-over boundary:

$$\varepsilon = \left(\frac{v_c}{\bar{v}}\right)^2 = \left(\frac{9}{4}\right)^2$$

$\bar{v} =$ mean cloud droplet volume

$v_c =$ critical cloud droplet volume

$N_D =$ cloud droplet number conc.

$J_{ss} =$ steady state drizzle rate (drops/cc-s)

$L =$ liquid water fraction

$\varepsilon = (v_c / \bar{v})^2$