Regional and Seasonal Cycles of AOD and Precipitation from Satellite Retrievals and in a Global Climate Model: Uncertainty Associated with Convective Wet Scavenging Parameterizations for Aerosols Entrained above Cloud Base

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1) Background:
- Aerosols influence clouds and precipitation (Twomey, 1991). Conversely, aerosols are modified by cloud and precipitation processes, which are the focus of this study (Engström et al., 2008; Croft et al., 2009, 2010).

2) Setup of the Model Experiments:
- Assumptions about entrained aerosols for purposes of wet scavenging (Croft et al., 2012) are:
  - CDB: Cloud-Droplet Borne
  - ICB: Ice-Crystal Borne

3) Results: Zonal and Annual Mean Aerosol Mass Concentrations

4) Results: Annual Mean AOD

5) Results: Regional and Seasonal Mean AOD and Precipitation
- A factor of two uncertainty in regional and seasonal mean AOD is attributed to different assumptions about the removal of aerosols entrained above convective clouds.
- The uncertainty is greatest during the rainy season, when greater amounts of convective precipitation occur.
- Precipitation over-estimation contributes to the AOD bias.

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References:

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Summary and Outlook:
- A factor of two uncertainty in simulated regional and seasonal mean AOD is attributed to different assumptions about the removal of aerosols entrained above convective clouds.
- The uncertainty is greatest during the rainy season, when greater amounts of convective precipitation occur.
- Precipitation over-estimation contributes to the AOD bias.
- Our findings motivate the need for ongoing work to better understand and model the activation and impaction processes that aerosols undergo after entrainment into convective updrafts.