

## ***Interactive comment on “Uncertainty analysis for estimates of the first indirect aerosol effect” by Y. Chen and J. E. Penner***

**Anonymous Referee #2**

Received and published: 26 July 2005

### General Comment

This work is a useful attempt at quantifying various sources of uncertainty associated with estimation of the first indirect aerosol effect. The results are insightful and helpful for further research along similar lines. That said, the following points (specific comments) need to be addressed.

### Specific Comments

1. The dispersion effect considered in this work, in fact, represents the effect of ignoring the mean increase of the relative dispersion of the cloud droplet size distribution, not the uncertainty resulting from uncertain relationship of dispersion (or  $k$ ) to the droplet

Full Screen / Esc

Print Version

Interactive Discussion

Discussion Paper

concentration. At present, this relationship is highly uncertain, depending on cloud dynamics and aerosol properties. A sensitivity study can be performed as did in Rostayn and Liu (2003) by changing this relationship.

2. The work uses a Gaussian PDF of vertical velocity as the reference and the “TKE” treatment as the perturbation. However, it seems to me that the TKE method is better suited as the reference because both the mean velocity and TKE can be derived from GCMs. Furthermore, there should be a relationship between velocity standard deviation and TKE, and therefore, the PDF method is more general.

3. The quantities that are discussed include aerosol/precursor emissions, aerosol mass concentration (from different chemical transport models), mode radius and geometric standard deviation assumed for the lognormal number size distributions as related to the transformation from aerosol mass to aerosol number, droplet number activation scheme, representation of cloud updraft velocity, dispersion effect (relationship between effective radius  $r_e$  and volume mean radius  $r_v$ ), cloud liquid water path (LWP), cloud fraction, and the change of the cloud single scattering albedo due to black carbon presence. An implicit assumption is the mutual independence of these quantities. This assumption of independence is questionable for some quantities. The other questionable assumption is that of no black carbon for preindustrial aerosols (biomass burning certainly occurred during the pre-industrial period). It would be interesting to examine, or at least discuss, the influences of these assumptions on the results.

4. P4509, Section 1: Please use the same measure for uncertainties of indirect aerosol forcing and greenhouse gas forcing, instead of a range for aerosol forcing but a percent for greenhouse forcing. A range of values for the greenhouse forcing seems appropriate.

5. P4511, Section 2 and the following: The letter “k” is used to denote the ratio of effective radius and volume mean radius in this work, which may cause unnecessary confusion. For consistency with previous work, I would suggest using  $b$  to denote this

[Full Screen / Esc](#)[Print Version](#)[Interactive Discussion](#)[Discussion Paper](#)

ratio as in Liu and Daum (2002), because “k” has been often used to denote “rv3/re3 since Martin (1994) ( $k = b-3$ ).

6. P4510, 12th line from the top: What does “2/3” mean here? It seems to be a typing error?

7. P4516, 6th line from the bottom: The word “humidity” is missing ?.

---

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 4507, 2005.

Full Screen / Esc

Print Version

Interactive Discussion

Discussion Paper