Atmos. Chem. Phys. Discuss., 9, C8858–C8860, 2009
www.atmos-chem-phys-discuss.net/9/C8858/2009/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Do biomass burning aerosols intensify drought in equatorial Asia during El Niño?" *by* M. G. Tosca et al.

Anonymous Referee #1

Received and published: 22 December 2009

Anonymous Review for "Do biomass burning aerosols intensify drought in equatorial Asia during El Niño?" by M. G. Tosca et al.

This paper discusses the impacts of Indonesian biomass burning on the climate of equatorial Asia. The study uses the CAM atmospheric GCM with a slab ocean to investigate the response of the model to biomass burning aerosol by considering a high biomass burning El Niño year (1997) to a low biomass burning La Niña year (2000). The authors find that their simulated biomass burning aerosols tend to decrease surface temperatures and reduce convection and precipitation over the region. They support their findings by analyzing relationships between satellite observations of precipitation and aerosol optical depth.

This study represents an additional important contribution to the growing body of liter-

ature on the affects of absorbing aerosols on the Asian region. It is very well written, and should be considered for publication in ACP after some mostly minor revisions.

Specific Comments:

Abstract line 14: Is the 10% decrease you refer to the effect of high-low fire years? You should make this clear. Introduction, Page 23322, Paragraph 2: You should make it clear that "smoke" aerosols contain OC+BC. Introduction, Page 23323, First paragraph (continued from previous page): You have a good discussion of the literature regarding affects of aerosol absorption over the Asian region; however, you may be omitting some important studies that draw a different conclusion – namely that aerosol absorption may increase precipitation (particularly in Asia [e.g. Lau et al., 2006; Randles and Ramaswamy, 2008]. I think that there is still considerable debate on the response of regional climates to aerosol absorption, and it is highly dependent on the region and the time of year considered. This point is worth mentioning here, rather than just citing papers that support the conclusions of this paper. Introduction, Page 23323, Second paragraph: You state "Surface cooling and tropospheric heating increase atmospheric stability and reduce convection." This is not entirely clear, and there is a large body of literature that contradicts this statement, particularly if you are considering the 3-D world rather than just a single atmospheric column. For example, see Lau et al., 2006. I would not make this statement without caveats. Methods, Page 23326, Paragraph 2: How were SSTs handled, exactly? Were boundary conditions exactly the same for the El/La Niño/a years (i.e. were the only differences due to the response of the slab ocean to the aerosol forcing)? Please make this perfectly clear, so the reader can attribute your results to only aerosol forcing. Methods, Page 23326, Paragraph 3: I think here, or in the discussion, you should speculate on the sensitivity of your result to the assumption that emissions are in the boundary layer. Section 3.1, Page 23327, Line 17: Why not give ASO precip anomaly for 2006 so I can compare it to the ASO precip anomaly for 1997 as "apples to apples"? Also, comment on the similarity between 1997 (strong El Niño) and 2006 (moderate El

Niño) year precipitation anomalies. Section 3.1, Page 23327, Line 25: This whole paragraph is discussing observational precipitation anomalies, right? Please make this clear. Section 3.1, Line 16: define PPT acronym (first use). Section 3.2: Page 23329, First Paragraph: You discuss in detail your simulated AODs, but what about your simulated AAODs (or, alternatively, aerosol single scattering albedo)? The affects of these aerosols on the regional climate are primarily sensitive to their aerosol absorption (AAOD) [see, e.g. Randles and Ramaswamy, 2008]. Section 3.2, Page 23329, Paragraph 2: Can you comment on the lag of the SST response to aerosol forcing. How does this affect your results when you consider ASO averages rather than considering the three months separately? I ask this because other studies have shown, over south Asia, that aerosol absorption contributes to increased precip over south Asia in May and June but decreased precip in July and August [e.g. Ramanathan and Carmichael, 2008]. Section 3.2, Page 23331, Line 5: Can you comment (here or in discussion) about the contrasting result you have with other studies like Menon et. al. [2002] that found increased rising motion (and convection) with increased aerosol absorption? Section 3.2, Page 23331, Line 26: Since your precip lags the aerosol forcing a month like your SSTs, can you comment on the linkage between SSTs and precip in this region? Section 4, Page 23335: Can you speculate what your results may have been if your AODs were higher and actually more representative of a high 1997-like El Niño year? Section 4, Page 23334, Paragraph 1: This is a very important point! Most models really underestimate biomass burning AODs! I wonder how they do on the absorption then!

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/9/C8858/2009/acpd-9-C8858-2009-supplement.pdf

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Interactive comment on Atmos. Chem. Phys. Discuss., 9, 23319, 2009.