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Interactive comment on "Effect of biomass burning on marine stratocumulus clouds off the California coast" *by* J. Brioude et al.

Anonymous Referee #2

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This paper blends satellite data with a transport model for several aerosols types in order to deduce the radiative impact of indirect effect specifically attributable to biomass burning aerosols. The novel aspect of this paper is the use of a continental tracer that is separate from the biomass burning aerosol tracer in the model in order to separate satellite cloud properties specifically impacted by biomass burning aerosol from cloud properties impacted by other continental influences. The authors further sort cases into low/high humidity, low/high static stability, and low/high surface temperature. This is a valuable contribution and illustrates an approach that adds new information to the discussion of aerosol/cloud interaction in marine stratocumulus clouds. In general, however, I found it quite difficult to trace the quantitative results reported in the abstract to the methods described in the text. I also had difficulty following the explanation of how the meteorological contribution was isolated, which made it difficult for me to

evaluate authors' conclusion that the meteorological bias is small.

The abstract states of the effect near the coast, "the combined effect of an indirect radiative forcing of -7.45% on average with a bias due to meteorology of +0.89%." Is this per cent of the average value? Can this be reported in W mˆ-2? And I do not follow where the 0.89% meteorological bias comes from. Does the 0.89% follow from the multi-variate regression analysis? If so, I could not follow the connection of this quantity to the discussion of the regression analysis.

In line 610 the authors argue that "the difference in specific humidity is small . . . with an average difference of +0.15g kgˆ-1. The difference in LTS is small too". Is +0.15g kmˆ-1 for high biomass burning aerosol minus low? How big is this difference compared to the mean value, and is it really the case that high BB aerosol air masses are more humid than low BB aerosol air masses? This seems unlikely, at least near the coast. Is this true of continental air masses in general? Or just BB laden air masses? If the methodology employed in this study could demonstrate that continental air masses in general are not sufficiently different from maritime air masses in terms of humidity and LTS to meaningfully impact cloud properties, that would be a very useful result.

On line 564 it states: "On average, the highest impacts of biomass burning on cloud are found at high humidity and low LTS. High humidity promotes greater cloud fraction and thus larger differences in cloud fraction can occur in the presence of BB aerosol." The logic of the second sentence is not clear to me. Why does enhancing the LTS with BB aerosol above the boundary necessary lead to a greater increase in cloud cover when the humidity and cloud cover are already high?

Finally, the authors use MODIS mass concentration product to convert the arbitrary units of the tracer concentration from the model to realistic values of biomass burning concentration. MODIS, of course, does not measure mass concentration, it retrieves aerosol optical depth and then makes a host of additional assumptions to report mass concentration. Are there published values for the estimated uncertainty of this product?

If, indeed, there is a substantial random error in the MODIS mass concentration product (which I am assuming is the case) would that translate into random error in the biomass burning concentration used to separate clean from polluted clouds in the analysis? The authors should address the errors in the MODIS data and discuss any impacts it might have on their conclusions.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 14529, 2009.