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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Dependence of solar radiative forcing of forest fire aerosol on ageing and state of mixture" *by* M. Fiebig et al.

Anonymous Referee #1

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The paper looks at the changes in the solar direct radiative forcing due to ageing and changes in the state of mixing in a large biomass-burning haze layer that was transported over Europe during summer 1998 as a consequence of extensive boreal fires over Canada. The case study has an interest in itself because the plume is one of the oldest ($>$ 6 days) ever sampled, and because it extended over a large geographical area. Furthermore, it addresses a crucial scientific question, that is, how does the radiative forcing of a biomass plume changes as the aerosol microphysical and optical properties evolve with time after emission.

I do recommend the paper for publication in ACP. A few specific points that I would like the authors to address or clarify are:

1. Pg. 1277-1278: it is not clear which is (are) the value(s) of the aerosol refractive

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index used to estimate the horizontal error bars in Fig. 1, and the contribution of the accumulation mode to scattering. Was it calculated as described in pg. 1278 as an external mixture of soot and ammonium sulfate?

2. Pg. 1278: "a similar analysis for the upper sub-layer..for the absorption coefficient available". Have you tried and verify if the aerosol composition obtained for the lower sub-layer (externally mixed ammonium sulfate and soot, percentage of soot fixed by matching the measured absorption coefficient) is consistent with the scattering and backscatter coefficient in the upper sub-layer?

3. Pg. 1286, lines 22-25: "ultimately become internally mixed". When ultimately? Up to this point the discussion had shown that even after more than 6 days of transport absorbing and non absorbing components remain externally mixed.

4. Pg. 1289, lines 24-28: "should be treated with caution". Could the authors provide a range of variability for the estimated heating rate when using different (most plausible) scenarios?

5. Table 1-2. For sake of clarity, the authors should consider merging Tables 1 and 2, so that values obtained in this study could be readily comparable to those from the literature.

6. The authors state that the microphysical parameters obtained for the upper sub layer are not significantly different from those obtained by Formenti et al. (2002a), who sampled the plume over Greece. Would the temporal evolution of the median diameter of the accumulation mode as described by scenario 3 on a longer time scale (up to 8-10 days after emission, that is, after 2-4 days after having been sampled during LACE) support this statement?

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 1273, 2003.

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