

Interactive comment on “Atmospheric aerosols in the earth system: a review of interactions and feedbacks” by K. S. Carslaw et al.

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We are grateful for the constructive comments.

The referee comments that the review contains little information on the nitrogen cycle.

We aim to review the impact of climate change on natural aerosol, rather than all aerosol processes. We have changed the title to reflect this emphasis (**A review of natural aerosol interactions and feedbacks within the earth system**), which two of the referees have suggested. Since nitrate aerosol is mostly affected by anthropogenic emissions, the effect of these particles on the biosphere is outside the scope.

The referee also wanted to see a wider discussion of aerosols, meteorology, and clouds.

C8225

Again, with the emphasis on natural aerosol, we feel a discussion of the wider impacts of aerosol on clouds is out of scope. But in many places we do highlight where natural aerosol might specifically impact clouds (primary biological aerosol, SOA and CCN, dust as IN, etc), but do not discuss the fuller problem of aerosol-cloud interaction.

P11089, line 14. Andreae and Rosenfeld review is now cited.

P11093, line 1. We change from 3 to 2 significant figures “with an estimated total global source of carbon of 1100 Tg a⁻¹ (Guenther et al., 1995)”. We add text to emphasise the uncertainty in BVOC emission estimates:

“There is considerable uncertainty in estimates of the global flux of BVOCs. For example, the global flux of isoprene has been estimated at 412-601 Tg C a⁻¹ and monoterpenes at 30-128 Tg C a⁻¹ with the range due to different emission algorithms, vegetation distributions, climatology, basal emission rates, temporal and spatial resolutions (Arneeth et al., 2008; Schurgers et al., 2009).”

P11093, line 9. We cite Hallquist et al. (2009) as update to Goldstein and Galbally (2008). (VOC can oxidise to form products that partition into the particulate phase.)

P11093, line 15. We change “SOA” to “Oxidised organic aerosol” as suggested by the referee. We add a citation to the new paper of Chen et al. (2009) which reports submicron organic aerosol over Amazonia.

P11094, line 4. Hallquist et al. (2009) has now progressed to ACP.

P11094, line 13-16: We include a discussion on the poor representation of organic aerosol in models:

This lack of knowledge results in models poorly representing organic aerosol, typically underpredicting the magnitude of observed organic aerosol [de Gouw et al., 2005; Heald et al., 2005; Johnson et al., 2006; Volkamer et al., 2006] and not capturing observed variability [Heald et al., 2006].

C8226

Section 2.1.2 to section 2.1.3.1. We have significantly condensed these sections by referring to the table and added results from monoterpene projections from the text to Table 1.

P11096, line 27. We have removed the reference to Back and Hari 2008.

P11099, line 9. The rewrite of text above has removed this line.

P11099, section 2.1.3.2 We have included a discussion of the very uncertain emission fluxes of BVOC including a reference to Arneth et al. (2008) as suggested by the referee.

P11000-11001 This section has been removed.

P11101, line 12-13 This section has been removed.

P11102 We include information from Winiwater et al. (2009): Winiwater et al. (2009) used atmospheric concentrations of cellulose observed in Europe to estimate a plant debris emission rate of $6 \times 10^{-3} \text{ g m}^{-2} \text{ a}^{-1}$. Using atmospheric concentrations of fungal spores at a site in Europe they estimate a fungal spore emission rate of between $3 \times 10^{-3} - 0.08 \text{ g m}^{-2} \text{ a}^{-1}$. They scaled these flux estimates to give a European PBAP emission of 0.2 Tg a^{-1} and a global source of 3 Tg a^{-1} .

P11103. We don't want to add more text on the general effects of wildfires, given the length of the article already.

P11109. Deposition of nutrients. The referee suggests saying more about nitrogen deposition. Actually, in line with the emphasis of the paper this section has been rewritten to emphasise the impact of natural aerosol deposition (dust, biomass burning etc) and to de-emphasise anthropogenic aerosol, including nitrates.

P11110. The referee makes an important point about the Magnani paper. However, we have now removed this paragraph because it focused too much on anthropogenic aerosol.

C8227

P11126. Reference added.

P11135. Dust-nitrate reference added.

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