

***Interactive comment on* “Black carbon ageing in the Canadian Centre for Climate modelling and analysis atmospheric general circulation model” by B. Croft et al.**

Anonymous Referee #1

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General Comments

The paper addresses an important point in climate modelling namely the aging process of black carbon. The aging has an impact both on the so called direct and indirect effect. Since up to now it is not possible to treat the aging process in a climate model explicitly it is necessary to apply parameterizations. However, the errors caused by the parameterizations currently used in climate models are not known. Therefore, the sensitivity studies carried out in this paper are quite interesting and important. In addition to a case where no aging of black carbon was assumed, a simple scheme with

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a fixed exponential decay, a coagulation and condensation scheme, and an oxidation scheme were applied. In addition sensitivity runs were carried out to take into account the uncertainties of the applied parameterizations and the emission of black carbon. The paper should be published in ACP after some modifications which are discussed in the following:

The parameterizations of the oxidation process are still very uncertain. Therefore, choosing the parameter 0.01 in the OXID case seems to be rather subjective. From that point the statement ‘The contribution of oxidation to the BC ageing process was shown to be small’ given in the conclusions needs a rethinking. On the other hand the paper by Saathoff et al. (Geophys. Research Lett. 28, 1957, 2001) has shown that the oxidation process of soot might be rather unimportant.

The model description should be extended by a more detailed explanation of the equations which were used to describe the black carbon. Although a number of references were given where one might find these equations I would prefer to add at least the most important ones. For example applying the parameterization given by equations (1), (2), and (3) one needs the number densities. Please explain how they are determined in the climate model. It would be also useful to give equations for the wet deposition for the aged and for the non aged soot, respectively. These equations would be much more important than the equation for s given at page 1387 which is a technical detail. In that case the reference is sufficient.

In my opinion the outlook given in the conclusion (page 1400) on work that should be carried out in future could be shortened.

Specific Comments

The abbreviations for the individual sensitivity runs are too long and might be changed in the following way:

NO-AGE into NA, FIXE-LIFE into FL, COND-COAG into CC, OXID into OX, COND-

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COAG-OXID into CCOX, MODR-COND-COAG into RCC, MODB-COND-COAG into BCC, 0.5xEMISS into EM0.5, 1.0xEMISS into EM1.0, 2.0xEMISS into EM2.0, FIX-LIFE1 into FL1, FIX-LIFE2 into FL2.

In addition it would be very helpful to add a table where the individual model runs and their assumptions are summarized.

Figure 2. On page 1388 it is mentioned that the open burning emissions are added into layers up to 6 km above the surface. Therefore the figure for 1000-2000 m AGL should be replaced by the corresponding one for 1000-6000 m AGL.

Figure 3. The ordinate should be labelled.

Figure 5. The ordinates should be labelled.

Figure 7. Check the headings of the figures on the left hand side.

Figures 9 and 10. Legends would support the understanding of the figure. They should be possible if the proposed abbreviations given above are used.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 1383, 2005.

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