We appreciate the reviewers‘ close reading of the manuscript, and constructive criticism to improve the manuscript. Our responses are in red.

The manuscript by Zhang et al.\ has improved considerably in this version, compared to the original version. Especially the English, that has been a bit rough in the first version, has improved a lot. Also, the authors have answered all my points of criticism, as well as those by the other reviewer.

We worked hard to revise the manuscript following the reviewers’ helpful comments.

To me there remains one small point: I think the authors did not quite get what I meant with my first criticism. The point that I wanted to make is that the model treats every element within dust as variable that is advected and diffused independently from the other elements. In reality the elements are bound together as dust particles, and the proper currency for the advection operator would be particles of differing elemental composition. This situation is similar to that encountered in modelling plankton cells with varying elemental composition in the ocean, and here this error has been assessed by Jim Christian in the paper that I pointed to in my first review (n.b.\ that is not my paper). To quote from J.\ Christians abstract: "In a population of cells with varying elemental quotas, the proper currency of the advection operator is subpopulations of similar cells. The spatial gradient in total C, N, or P summed over the spectrum of such subpopulations is identical to that calculated for the population means, so treating the various elements as independent should generally be a valid approximation. However, errors can arise in high-order advection schemes with nonlinear corrector terms, which are not additive across the subpopulations. Some numerical examples indicate that these errors are relatively small (O(10$^{−3}$–10$^{−4}$)] but can be as high as O(10$^{−2}$) in certain cases. As grid resolution varies, the error scales approximately to the Courant number."

To this, the authors answer by referring to the more general problem that no numerical advection oprators is perfectly mass conserving, monotonic, shape-preserving and computationally efficient. While this is certainly true, it misses a bit the more specific point I wanted to make (and then citing the Christian paper does not quite fit). This is only a question of a little bit reformulation. The main point, that this error is likely small compared to the main error from uncertainty in the source distribution of minerals is correct. I would suggest the authors change one or two sentences here for their final version.

The reviewer is correct that we missed slightly her/his point, and we appreciate the reviewer bringing this up again. For individual elemental deposition to the oceans, our response was correct, but once we are looking at the ratio of elements, then because of the inevitable errors in the numerical algorithms, advecting the dust as minerals would maintain the correct ratio of elements (or % of elements) better than how we are doing it. We propose to revise our ‘revised’ text in the method section as follows.

**original revised text:**“By splitting the dust into its different mineral elements, we may add in additional numerical errors, because the elements are transported separately. There has been considerable work on improving advection algorithms in atmospheric models, and here we use the finite volume advection algorithm as part of the CAM [[*Lin and Rood*, 1997](file:///E%3A%5CPaper%5C03%20Published%5C15%20global%20dust%20elements%5CBiogeoscience_a%5Csubmission%20to%20BG%5Cresivison%5C20150807%5CResponse%20to%20reviewersnmm.docx#_ENREF_2)]. While no advection scheme is perfectly mass conserving, monotonic, shape preserving and computational efficient, this scheme does a good job of balancing these multiple goals and maintaining strong gradients required in modeling atmospheric constituents (e.g. [[*Rasch et al.*, 2006](file:///E%3A%5CPaper%5C03%20Published%5C15%20global%20dust%20elements%5CBiogeoscience_a%5Csubmission%20to%20BG%5Cresivison%5C20150807%5CResponse%20to%20reviewersnmm.docx#_ENREF_3)]). Studies focused on elemental distributions in ocean models have suggested the relatively small uncertainties associated with these types of numerical errors (e.g. [[*Christian*, 2007](file:///E%3A%5CPaper%5C03%20Published%5C15%20global%20dust%20elements%5CBiogeoscience_a%5Csubmission%20to%20BG%5Cresivison%5C20150807%5CResponse%20to%20reviewersnmm.docx#_ENREF_1)]), and compared with the errors in the source distribution of the minerals, errors from advection are likely to be small and are neglected here.”

**To:” There has been considerable work on improving advection algorithms in atmospheric models, and here we use the finite volume advection algorithm as part of the CAM [**[***Lin and Rood*, 1997**](file:///E%3A%5CPaper%5C03%20Published%5C15%20global%20dust%20elements%5CBiogeoscience_a%5Csubmission%20to%20BG%5Cresivison%5C20150807%5CResponse%20to%20reviewersnmm.docx#_ENREF_2)**]. While no advection scheme is perfectly mass conserving, monotonic, shape preserving and computational efficient, this scheme does a good job of balancing these multiple goals and maintaining strong gradients required in modeling atmospheric constituents (e.g. [**[***Rasch et al.*, 2006**](file:///E%3A%5CPaper%5C03%20Published%5C15%20global%20dust%20elements%5CBiogeoscience_a%5Csubmission%20to%20BG%5Cresivison%5C20150807%5CResponse%20to%20reviewersnmm.docx#_ENREF_3)**]). By splitting the dust into its different mineral elements, we may add in additional numerical errors, because the advection will not conserve the fraction of elements within dust aerosols due to small numerical errors. For the discussion of the ratios of elements, it would be better to advect the minerals themselves, and evaluate the ratio of elements later, since this would better conserve the ratios. Studies focused on elemental ratios and their distribution in ocean models have suggested there is a relatively small uncertainties associated with these types of numerical errors (e.g. [**[***Christian*, 2007**](file:///E%3A%5CPaper%5C03%20Published%5C15%20global%20dust%20elements%5CBiogeoscience_a%5Csubmission%20to%20BG%5Cresivison%5C20150807%5CResponse%20to%20reviewersnmm.docx#_ENREF_1)**]), and compared with the errors in the source distribution of the minerals, errors from advection are likely to be small and are neglected here.**

Else I have just one stylistic comment: The authors sometimes use a percent sign in sentences where they should have used the word percentage.

We carefully go through the text and correct the text in three places to use percentage when % is used.