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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Simulation of the mineral dust content over Western Africa with the CHIMERE-DUST model from the event to the annual scale" *by* C. Schmechtig et al.

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Reply to Reviewer 3

1/ The paper entitled "Simulation of the mineral dust content over Western Africa with the CHIMERE-DUST model from the event to the annual scale" by Schmechtig et al. presents the implementation of the CHIMERE-DUST model for the simulation of mineral dust load and surface concentrations during 2006. The model outputs are compared with AOD and surface concentration measurements as obtained for different time scales (hourly, daily, etc). The paper does not introduce a new model development, since CHIMERE-DUST with the currently-used characteristics has been previ-

ously described (e.g. Menut et al., 2009). However, an extensive evaluation study is presented here with the aid of a great database of observational measurements that cover surface, as well as higher level data. The main advantage of implementing the CHIMERE-DUST model, as supported by the authors, is the efficiency to investigate long periods, in contrast with more resolved regional models that are considered as very time-consuming. As shown from the presented results, the model outputs have good agreement with the observations in specific cases, while the overall model performance is often non-satisfactory. Thus, I believe that the argument that highlights the reliable utilization of the present model in long-period evaluation studies should be better supported.

Reply : We do not really conclude that the model as it is can be used reliably for long-period studies since our conclusion mainly draws some perspectives of improvement of the model. We checked the text to remove any text in this direction.

Specific comments

2/ Introduction: There are several sections that should be better explained. For example, in p. 8029 lines 4-10, the meteorological parameters that control the dust cycle need to be reported.

Reply : A sentence was added to highlight the direct or indirect dependence with meteorological parameters.

3/ In p. 8030 lines 12-23, please elaborate more on the limitations of a regional CTM, such as the absence of interaction processes between dust and atmospheric parameters.

Reply : A discussion on the estimation of the feedback between dust and dynamics by meteorological models has been added before line 12. Depending on the model this feedback is estimated as positive (increased dust emissions) or negative (decreased dust emission). And the fact that this feedback cannot be accounted for when using a

CTM is now clearly stated as a limitation.

4/ Tools and methods: In p. 8036, it is not clear how the eq. (1) was derived and which is the applicability of the equation in the present analysis.

Reply : Additional explanations on the way equation (1) was established and applied are given in the revised manuscript.

5/ The comparisons of AOD values presented throughout the whole paper are reported for different wavelengths between model and measurements. The interpolation formula of Iqbal (1983) could be tested for calculating AOD at the required wavelength based on the AOD values at two adjacent wavelengths.

Reply : The AOD are measured at 665 nm while the modelled AOD is defined at 550 nm. However, the spectral dependence of the AOD is very low for mineral dust, so the AOD at these two wavelengths do not differ much. An estimation of the possible bias has been made by comparing the AOD measured at 675 and 440 nm. For the three stations, the AOD at 675 and 440 nm associated with mineral dust are significantly correlated (r^2 0.99) with slopes ranging from 1.04 in Cinzana to 1.06 in M'Bour. The difference induced by the comparison of modelled AODs at 550 nm and AODs measured at 675 nm should therefore not exceed 6%.

6/ Results: In the present analysis, the correlation coefficients, as well as the slopes of the linear regressions are calculated in many cases. For example, the respective values calculated for Figure 9 (R=0.68, slope=0.99) reveal a very good agreement between simulated AOD and observational data that is not reflected in the figure. It would be interested if the intercept of the linear regression is also reported in these cases and investigated, since it provides a measure of the difference between the compared sets.

Reply : The slope, correlation coefficient and intercept are now given in Table 1.

7/ Technical corrections The manuscript should be carefully scrutinized so as to correct

some typing errors. Few examples are reported below: p.8029, line 3: : : :phosphorus, (Jickells et al., 2005 : : : – omit the comma p.8031, line 3: 20001 p.8034, line 3: Thes simulated: : : p.8038, line 13: 44 nm Figure 8: The caption for left and right figures should be reversed.

Reply : All technical corrections have been done.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 8027, 2011.