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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Can explicit convection improve modelled dust in summertime West Africa?" *by* Alexander J. Roberts et al.

Anonymous Referee #1

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The paper focuses on the improvement in modelled dust that could be achieved when the convection is explicitly represented. A total of 8 simulations run with the UM model over a warm season (May-September 2011) are assessed in terms of dust AOD and near-surface wind speed. These simulations differ with the horizontal grid spacing (40, 12 and 4 km) and the use of a convection parameterization. Against expectation, no significant improvement in modelled dust is achieved with the convection permitting simulation. Whatever the grid spacing, the dust AOD is poorly reproduced by the UM model. The study points out two major drawbacks: a too low wind speed and a wrongly fixed bare soil parameterization. While there is no attempt to solve these issues, the study is tough of interest in the way the assessment is performed.

Specific comments

Abstract

Page 1, line 12, the cold pool outflows can have an important role in raising dust. However, it is not well established that their contribution can be over 50%. For example, Chaboureau et al. (2016) estimated the role of harmattan to 80% of dust emission (over the western Sahara and in June 2011).

Introduction

Page 2, line 30, Chaboureau et al. (2016) evaluated not only dust, but also 10-m wind speed. Even if the evaluation was done between models only (not against observations), this is of great interest as it differs much from your results (see comment below on Figure 7).

Section 2.1

Page 4, line 18, please give the height of the first model level. How is the calculation of the surface friction velocity $U^{\star}$ sensitive to the model level?

Page 5, line 16, the issue is not to make give a fair comparison. Instead, it is to simulate AOD well for the right reasons. The question is thus on the scale awareness of the dust scheme. As the dust scheme depends on the surface friction velocity, which depends itself on the grid spacing, this requires an adjustment of the model values. So does the mixing length of the 3D scheme (page 5, line 30).

Section 3.1

Page 10, Figure 2, does the MODIS AOD provide a reliable reference for model assessment? It should be of interest to show as well the other product you use, the SEVIRI AERUS-GEO AOD. This is valid also for Figure 6.

Page 10, Figure 3, why the models are quite good in May and very poor the other months? This seems to be due to a decrease in $U^{\star}$. So, why does $U^{\star}$ decrease with month?

Section 3.2

Page 12, Figure 7, Chaboureau et al. (2016) compared the 10-m wind speed over western Sahara for models with parameterized convection and without and found wind speed up to 15 m/s. This is the case for the ALADIN model run with a 24-km grid spacing for which cold pools were not expected to be simulated. This result strongly contrasts with the one shown for the UM model. This suggests a drawback in the UM model wind speed that would be not specifically related to the representation of cold pools. Further, the convection-permitting models in Chaboureau et al. (2016) show wind speed up to 25 to 30 m/s (due to cold pools), a much larger value than obtained from the UM model.

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