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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Chemically aged and mixed aerosols over the Central Atlantic Ocean – potential impacts" *by* M. Astitha et al.

Anonymous Referee #2

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This work explores the origin and fate of continental aerosols transported over the Central Atlantic Ocean in terms of number and size distribution and chemical composition. The methods used involve chemistry-transport modelling, the use of aerosol measurements and data retrieved from satellite observations, focusing on August 2005, a month with intense hurricane and tropical storm activity over the Atlantic Ocean. The results indicate rather small amounts of accumulation mode desert dust, sea salt and chemically aged dust aerosols in this Atlantic Ocean region. Aerosols of smaller size (Aitken mode) are more abundant in the area and in some occasions sulphates of anthropogenic origin and desert dust are of the same magnitude in terms of number concentrations. The anthropogenic sulphate aerosol can be transported within a thick layer and enter the cloud deck through multiple ways (from the top, the base of the cloud and entrainment). The sodium (sea salt related) aerosol is mostly found below

the cloud base.

Generally, I believe that the objectives pursued are clearly defined and I think the contribution strongly deserves publication in ACP after some minor revisions (detailed below). My overall impression of the manuscript is quite satisfactory, especially as a reference for further developments related to studies considering aerosol influences on cloud processes and storm development. All the sections are well described and defined; however I miss a discussion about the description of how some physico/chemical processes are included in the modeling system presented. Also, further research should be devoted to study aerosol/radiation/cloud processes, which are not featured in this manuscript.

One of the new topics included in the manuscript is the use of SKIRON/Dust fluxes, which are converted to emissions of crustal material and they imported into the CAMx model for the simulation set up. However, there is no interaction between CAMx and the meteorological driver SKIRON/Dust. As also pointed by Dr. Levin in his review (and also shown by Alpert et al., 1998. Nature 395, pp. 367-370 or Perez et al., 2006. JGR, D162006, doi:10.1029/2005JD006717), the inclusion of mineral dust radiative effects could lead to a significant improvement in the radiation balance of numerical weather prediction models with subsequent improvements in the weather forecast itself. It should be clearly stated in the manuscript.

As pointed by the authors, the resolution used somehow hampers the validation efforts carried out. The 0.24° resolution of the modelling system may not be fine enough to describe the aerosol concentration in the area analysed, especially when using daily PM10 measurements in the Canary Island (ES0886A), Tenerife (ES1133A) and Madeira (PT0133A and PT0135A). Due to their location in the Atlantic Ocean, these stations are important for identifying the dust transport towards the west. But at this model resolution, the orography of the Canary Island or Madeira is not accurately captured and therefore the concentrations may not be precisely reproduced by the models. Also, futher discussion is required about the criteria for the selection of the stations

where the model validation is performed.

Minor comments:

1) Sometimes there is some confusion for the reader when using "concentration" (between mass concentration and number concentration). This should be addressed in the revised version of the manuscript. 2) I miss further discussion on how the model and satellite observations are compared, and if any statistical comparison has been carried out, trying to quantify the errors. 3) There are sentences, especially in the introduction section, needing improvements in order to be clarified. I recommend a further revision throughout all the manuscript.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 5185, 2010.