**Atmospheric
Chemistry
and Physics
Discussions**

Interactive
Comment

Interactive comment on "Increase of the aerosol hygroscopicity by aqueous mixing in a mesoscale convective system: a case study from the AMMA campaign" *by* S. Crumeyrolle et al.

Anonymous Referee #2

Received and published: 6 July 2008

Review

The paper describes aerosol measurements that were taken during the AMMA campaign in Africa. The focus of this study is the modification of aerosol due to a mesoscale convective system (MCS). The authors find that the observed MCS adds an additional aerosol layer to the vertical aerosol profile and mixing processes within the convective system changes the hygroscopic properties of the aerosol and their vertical distribution. The study is certainly within the scope of Atmospheric Chemistry and Physics. However, I have several comments and suggestions that will improve the readability of the paper and remove obscurities and ambiguities. In addition to addressing my com-

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Interactive Discussion

Discussion Paper

ments below, I suggest that the paper should be carefully checked for proper English since it contains numerous errors.

General comments 1) The term 'aqueous mixing' is only used in the title and in the conclusions. I suggest to change it to 'cloud processing'. While 'cloud processing' has been used throughout the paper, you only give a vague description on the processes that are involved. Given that you explain the observed effects on aerosol modification by cloud processing, you should give a more detailed discussion on possible processes that occur in the cloud. In the abstract and introduction it is mentioned that the 'main microphysical processes that affect aerosols'; will be identified. Later you suggest a 'physical-chemical mechanism' (p. 10070, l. 8-12) that causes aerosol modification. And finally you state that 'aerosols have been cloud-processed' (p.10079, 4). Are both physical and chemical processes included in the model? Can chemical processes in the cloud explain (some of) the observed aerosol modification?

2) The term 'mixing' is used for quite different processes. You should be more specific on what processes/properties are described, e.g., p. 10059, l. 25/26: 'Mixed aerosols are modified... and their properties are dependent on the mixing'. Do you mean that the mixing state of aerosols will be modified by differently mixed air masses? p.10070, l. 9: what is meant by 'Mix particles and nitrates together'? p. 10077, l. 5: 'due to the mixing of marine and anthropogenic aerosols'. Is it simply 'due to the presence of aged marine and anthropogenic aerosols'? p. 10079, l. 6: The MCS leads to a mixing of the air masses. However, the aerosol must undergo some kind of processing (chemical or physical) in order to change their properties.

3) The expression 'elemental composition' is used several times. What has been really determined in the single particle analysis? Indeed the elemental composition or compounds? E.g., sulfur is not a soluble element (p. 10068, l. 12; p. 10069, l. 8, p. 10079, l. 11). You should change it to 'sulfate' or - more general - soluble salts/compounds.

Specific comments

Abstract, l. 18: CCN is not defined previously. p. 10062, l. 11: What is he uncertainty on the supersaturations? Recently it has become evident in several CCN studies that the actual supersaturation values can differ significantly from nominal values. Was this deviation taken into account?

p. 10065, l. 4: Specify 'microphysical properties'. Size, hygroscopicity...?

p. 10066, l. 7/8: Rephrase '...tool to follow the intensity of aerosol cloud interactions' to something like 'measure of the hygroscopicity/CCN ability of the aerosol population'

p. 10066, l. 18: Replace 'chemistry' by 'chemical composition'.

p. 10068, l. 22-24: Where all these compounds, including sea-salt, externally or internally mixed, i.e., does 'fraction of particles' refer to 'number fraction' or 'mass fraction'?

p. 10070, l. 12-15: Even though it becomes clear in Figure 6, also the text should reflect why the CCN fraction increases. Is it an addition of new CCN or remains the CCN number the same and the fraction only increases because the total CN number decreases due to sedimentation of insoluble particles?

p. 10074, l. 9: Is the 5h shift between observations and model taken into account in Fig. 10? According to the Figure, the 5 h delay cannot be 'clearly retrieved'.

p. 10075, l. 15-21: Can you give any reason why the BL thickness differ by a factor of 2?

p. 10077, l. 15: Does the increase in CCN/CN fraction and decrease on CN number mean that the air mass that was down-transported contains a lower particle concentration, diluting the current particle concentration?

p. 10079, l. 12 and 18: Do you mean 'modified particles' or 'newly formed particles' (but hose are usually too small to act as CCN).

p. 10080, l. 9: Replace 'polluted gas' by some other expression. 'Trace gas'? 'Gas phase precursor for particles' or can you even list specific gases?

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p. 10080, l. 24/25: Is an increase of the volume concentration of the coarse mode due to (chemical?) mass addition in clouds?

p. 10080, l. 26: Freshly emitted dust particles should be rather hydrophobic, not hygroscopic.

p. 10081, 8/9: Replace 'hygroscopic characteristics' by 'hygroscopicity'

Figures 5 and 6: Could you add the legends to the plots? What are the different symbols, triangles (Fig, 5), squares and dots? It might also help if you could add a horizontal line marking the BL.

Technical comments

p. 10058, l. 13: coating by soluble material (coating 'of' might imply that soluble material might be coated).

p. 10060, l. 26: aerosol processes (not aerosols)

p. 10062, l. 5: particle diameters (not particles)

p. 10062, l. 20: provides

p. 10063, l. 1: depending on (not of)

p. 10063, l. 12: Libya

p. 10066, l. 8/9: Replace 'when' by 'if'

p. 10067, l. 28: several tens (not tenths)

p. 10068, l. 14: increase in (not of)

p. 10072, l. 7: Lagrangian (check remainder of the manuscript!)

p. 10072, l. 11: Replace 'performed' by 'used'

p. 10073, l. 7: ..in more detail.

p. 10073, l. 24: Replace 'cycle of life' by 'life cycle' or 'evolution'

p. 10074, l. 12: Remove the degree symbol between 9 and K etc (check remainder of the manuscript)

p. 10074, l. 24: Remove 'modeled'

p. 10075, l. 9: Contradiction: is it 12-15 h after the passage or do you refer to 7:00-11:00 UTC?

p. 10075, l. 12: Replace 'within a range of particles' by 'for particles'

p. 10076, l. 5/6: Replace 'the order of magnitude of the aerosol mass concentration' by 'the aerosol mass concentration within xx %). (I believe your model predictions are more accurate than factor of 10).

p. 10076, l. 27: Replace 'few' by 'little'

p. 10078, l. 4: Do you really mean 'behind' (i.e. locally) or 'after' (temporal)?

p. 10078, l. 13: in Fig. 15 (not on)

p. 10078, l. 17: liquid water and ice content

p. 10078, l. 19: Replace 'under' by 'below'

p. 10078, l. 20: Replace 'latter' by 'later'

p. 10078, l. 20: 'important' sounds odd in this context. Replace by 'significant' (also later in the same section).

p. 10079, l. 13: Remove 'a'

p. 10080, l. 5: Replace 'explored' by 'analysed' or 'interpreted'

p. 10081, l. 10-12: Replace this sentence by something like 'In addition, it has been shown due to the African MCS additional dust particles are added to the gust front'.

p. 10082, l. 10: Parameterization

p. 10082, l. 23: GOCART

p. 10082, l. 26: hydrostatic

Fig. 7: Move (a) and (b) in form of the description ((a) Average number concentration...(b) volume-size distribution)

Figure 8: Photographs

Figure 10: There is no part c) but twice a).

Figure 12: Add x-axis label to b)

Figure 15: Use a larger font for axis label.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 10057, 2008.