

Interactive comment on “Aerosol liquid water content in the moist southern West African monsoon layer and its radiative impact” by Konrad Deetz et al.

Anonymous Referee #2

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Water uptake onto aerosol may increase the size of the aerosol population as well as their impact on global radiative budget. However, the models used nowadays do not take this effect in account properly. This study is based on simulations results to evaluate the impact of Aerosol Liquid Water Content (ALWC) on shortwave and longwave radiations over Southern West Africa. The authors try to estimate the effect of cloud presence, aerosol size and dynamical processes on ALWC. The manuscript is well written and definitely within the scopus of ACP. Therefore I recommend publishing this work after the authors address the following comments.

Major comments:

C1

There are a lot of figures in this paper and I felt like most of them were not correctly described in the text. Indeed, each line drawn on a plot deserves at least a small explanation otherwise there is no need to plot it.

This kind of study is highly dependent on RH fields. In this manuscript, only profiles observed on July 2, 3, 5 and 6 2016 were compared to simulations results at two different locations (Lamto and Abidjan). Could you compare horizontal RH fields over West Africa for both periods?

Could you add more explanation about the dynamics of the Atlantic inflow? Indeed, sea breeze could be comparable to the Atlantic inflow but the occurrence time is not exactly the same. The AI front is moving inland during the night, which is quite unusual. During the night the ground temperature is getting colder in comparison to sea surface temperature. Therefore, I would rather imagine a land breeze. In few words, what is dynamically explaining this inflow?

P7 L 15-24 : The Aerosol Inflow involves an increase of RH a decrease of temperature but also brings different types of aerosols inland. You discuss the meteorological conditions that have for sure an influence on the ALWC but you never suggest that aerosol components may also have an impact. Section 3.3 (Impact of aerosol modes) : First, you should details the different types of aerosols that are predominant during each phase and the mean size distribution associated with each phase. Do you separate the aerosol modes in term of chemistry within your model? It seems, according to P8 L25, that coarse mode is only made of sea salt particles. How do you take into account dust then? The comparison with chinese field campaigns need to be clarified. Are the different types of aerosols similar in China and Africa? Did Chen et al. (2012) performed their measurements during the monsoon period?

P10 Section 4.2 : In this section, you are using 3 different figures to describe the effect of ALWC on the shortwave, longwave radiations and 2-m temperature. However, I felt like I did not have any explanations on what you observed. As an example, L16-18 ‘a

C2

decrease in SSR can be observed when considering ALWC for ICA and OCA'. Could you explain why you have the same order of magnitude for OCA and ICA (where the RH should be higher)? 'A change in the cloud cover' – the cloud is disappearing or strengthening? These are examples, but the entire section is written the same way.

According to your conclusions it seems that the cloud presence doesn't affect much the effect of ALWC on radiation. Could you provide anywhere in your manuscript the meteorological and aerosol size distribution differences between OCA and ICA?

Minor comments : Page 2 L10 : replace natrium by sodium

Page 3 L14-16 : I'm not sure I understand this sentence. You claim : " The RH increasingly affects the relationship between the amount of aerosol and the cloud droplet number concentration". I believe that larger RH could involve more or larger cloud droplets. These results are not from 2015. . .

Page 3 L28 : I believe that there were no GF measured during AMMA.

P5 L4 : Could 5% of the mass concentration of soot particle be defined considerable ?

P5 L16-17 : 'Furthermore, . . . process studies'. I do not understand this sentence. The undisturbed moosoon condition favor NLLS presence? Also, NLLS is not defined in the acronym list.

P5 L28 : please remove 'by a a decrease'

P9 section 3.4 : Is this AOD within cloud ? Are you talking about interstitial aerosols? Then the clouds are just considered as a vector for RH increase? There are numerous studies that have shown the contribution of the ALWC to the total AOD (Brock et al., 2015 and 2016; Crumeyrolle et al., 2014; Beyersdorf et al., 2016; Orozco et al. 2016; Eck et al. 2014).

P12 L22 : please remove 'The' : 'on THE one hand'

P13 L3 : please replace 'AI affected' - 'AI affects'

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Figure 4 : I'm sure this is a typo : ' same ass ' Relative ALWC should be a proxy for the hygroscopicity of aerosols right ? If yes then it needs to be stated somewhere. And you should present mean aerosol size distribution before this figure for the different phases.

Figure 5 : You should add on the different figures 'TOTAL' , 'AIT' , 'ACC' and 'COARSE'

Figure 6 : Could you add the RH on this figure ?

Figure 9/10/11 : Could you add on the figure ICA and OCA . I'm sure that will also be clearer if there is REF and REF-No_ALWC

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