

***Interactive comment on* “The observed diurnal cycle of nocturnal low-level stratus clouds over southern West Africa: a case study” by Karmen Babić et al.**

Anonymous Referee #2

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Review of the article titled “The observed diurnal cycle of nocturnal low-level stratus clouds over southern west Africa: a case study” by Babić and coauthors for publication in the journal atmospheric chemistry and physics. The authors have used data collected during the DACCIWA field campaign during a single day to understand the causes for the presence of low-level clouds. They have used radiosonde data to do budgets of relative humidity and heat. The main conclusion from the study is that the advection of colder air from the ocean to the site to lead to the formation of the clouds. The article is relatively straight-forward to understand and the authors have clearly described the data and methods used in the study. The overall scientific novelty of the study is however unclear. As they have analyzed a case with low level wind jet with a

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southerly flow, it is apparent that it will have large warm and moist advection from the ocean. Hence, I don't think the main conclusion that advection is important for the formation of low-level clouds is novel. I recommend this article for major revisions. Major Comments The title is confusing as it has diurnal cycle and nocturnal in it. The two words sort of contradict each other. Maybe you can use something like "A case-study of the nocturnal low level stratus clouds over the West Africa from the DACCIIWA field campaign." This is a mere suggestion, please feel free to use something else. The main concern I have is that that the conclusions are solely based on centered difference taken from the radiosonde data. This makes the study weak, as there are no uncertainty estimates and also no verification from other variables. To get around this issue, maybe you can i) show the ECMWF model reported largescale temperature, moisture and winds in the study area, and/or ii) propagate the uncertainty in all of the variables in equation i) and equation ii) to show some variability in the terms shown in Figure 7, 8 and 9. The way you have setup SBDART, there will be large uncertainty in the radiative fluxes. Also, please mention the assumed cloud droplet effective radius. The assumed profiles of sensible heat fluxes also make a huge difference in the calculations. It is not clear why the authors have chosen to use different profiles of sensible flux for different atmospheric phases that are only few hours apart. Section 4.2: you have calculated the RH budget to understand whether q or T has greater impact on the RH. I agree with you regarding the premise that a moisture advection can happen but it wouldn't necessarily lead to saturation and clouds, however I disagree the way you have gone about it. The (II) and (III) terms in equation i) have the tendency terms of water vapor mixing ratio and temperature in them. Now as you have shown in the section 4.2, the tendency of temperature also depends on the advection. So I recommend you not to use the basic Clausius-Clapeyron equation, but do a classical moisture budget assuming a well-mixed boundary layer. See Caldwell et al. (2005 JAS) or Kalmus et al. (2014 J. Climate). This will enable to understand if the changes in the moisture are locally generated or a result of large-scale advection. In the same vein, it will be great if you can show the sensible and latent heat fluxes during the study period. Thanks.

It will be great if the authors can calculate the lower tropospheric stability of the study area including for the soundings launched in Accra. The last two sections (5 and 6) are unnecessarily long and do not add any value to the manuscript. They have several repetitions and I think could be severely shortened and merged together. Thanks.

Minor Comments Page 2, Line 8: I think you should add the “in that area” to this sentence. Otherwise the sentence is very generic. This doesn’t apply to all of the LLC. Page 2, Line 32: “processes that” instead of “processes which”. Section 2.2: Please mention the frequency, temporal resolution and range resolution of the cloud radar. Same for the ceilometer and IR camera. Page 6, Line 22: Please remove the word “apparently” Page 9, line 9: “deck” not “decked”. Figure 1: Please make the distance on the x- and the y-axis the same. Currently the aspect ratio is not one. Figure 2: The caption needs to mention what is shown in all panels. Currently it is not clear what is shown. Figure 3: Please change the color-scale of panel (b) from -50 to 10 dBz. It will be nice if you can clean up the data to only show returns from hydrometeors. The SNR can do that. It will be also nice if you can zoom-in the panel (d) and show a color-scale for the panel (d). thanks. It will be nice if the authors also put this study in perspective of those done during the RADAGAST campaign (Miller and Sling, 2007 BAMS; Collow et al. 2016 QJRMS etc.)

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