

Interactive comment on “Characterising energy budget variability at a Sahelian site: a test of NWP model behaviour” by Anna Mackie et al.

Anonymous Referee #2

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The present study analyses the impact and the importance of radiative and non-radiative parameters affecting the radiation fields within the Earth-Atmosphere system using both model (ECMWF Integrated Forecasting System cycle 43r1) and observations (ARM and GERB/SEVIRI). The manuscript is very well structured and the presentation of the obtained results is excellent providing to the reader all the relevant information. Nevertheless, the scientific importance of the submitted text is restricted by the fact that the results are representative only for a specific site (Niamey). Even though the existence of this limitation I think that this work can be published in ACP after considering the minor comments listed below.

Abstract: It would be useful to add a sentence mentioning the biases for the surface radiation as you did for TOA.

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Lines 9-13: The observed discrepancies in radiation fluxes, particularly during the dry period, are also attributed to the misrepresentation of aerosol fields in the model since it is utilized a climatology instead of a dynamic approach.

Line 16: Replace “A proportion of incoming...” with “A proportion of the incoming...”.

Introduction: A short paragraph must be added describing how meteorological variables (e.g. humidity), clouds, aerosols and surface albedo can affect the SW and LW radiation in the Earth-Atmosphere system. This will provide a link with the discussion in the Results section.

Line 45: I don't think that this sentence is useful there. It is better to move it in the relevant part (Section 4.1) of the manuscript.

Lines 53-58: This part of the text can be extended by adding 2-3 sentences providing some information regarding the progression of the West African monsoon (this can be mentioned also in lines 88-91) as well as the seasonal variation of aerosols' regime (aerosols' type and intensity).

Line 65: Why is specified only for the Sahel and not for the Earth-Atmosphere system?

Lines 68-71: This sentence causes some misunderstandings and is better to remove it. Under clear-sky conditions the impact of aerosols and gases on the SW radiation is more important compared to water vapour which plays a key role at longer wavelengths as you are correctly stating in Line 82.

Line 80: Figure 1 describes the key features of radiative transfer within the Earth-Atmosphere system and not only for Niamey. Your description is generic and should not be restricted for a specific location (Niamey).

Lines 99-101: Due to clouds the RSR also increases attributed to the reflection of the incoming solar radiation.

Lines 139-140: In Table 1 are listed only the non-radiative data. You should add also

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the radiative variables.

Lines 161-162: The uncertainties of AMF variables are not provided in Table 1. Which are the uncertainties for the IWP and LWP?

Line 170: This sentence can be removed.

Line 213: Remove “the” after “than”.

Line 221: Replace “However, the the majority” with “However, the majority”.

Lines 229-230: During wet season, the simulated DLR and ULR reveal higher temporal variability compared to observations. More specifically, during the first half of the wet season (days 100-200), the model underestimates DLR and ULR while the opposite is found between days 200 and 300. Therefore, the zero and negligible biases for DLR and ULR, respectively, result from the counterbalance of the negative and positive model discrepancies and do not indicate a good performance of the model since the temporal variability is not captured.

Lines 232-235: Please rephrase this part of the text.

Lines 259-261: I would say that negative biases are found between 500 - 700 hPa and positive between 200 - 400 hPa.

Line 270: Remove the blank.

Line 293: The discrepancies are not defined as observations - model throughout the analysis? Why in Sections 4.2.1 (Surface downwelling shortwave radiation) and 4.2.2 (Surface upwelling shortwave radiation) are defined as model-observations?

Lines 311-312: Replace “0.29-0.14” with “0.14-0.29”.

Lines 373: When you are referring to the total downwelling radiation do you mean the net radiation at TOA? If so, then the term total downwelling radiation is not correct.

You should re-organize the order of the tables and figures in the manuscript. More

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specifically, tables must be presented first (after references) and then the figures.

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