

This document includes reviewer 1 and reviewer 2 comments. To each comment is associated an answer from the authors and the modifications performed in the text.

Reviewer 1 comments and answers are located from pages 2 to 10.

Reviewer 2 comments and answers are located from pages 11 to 37.

Answers to Anonymous Referee #1

The presented study have aim to reveal the impact of plume of a desert dust on temperature and thermal comfort during specific few-day meteorological event by model tools. Although the topic could be interesting, the level of manuscript is rather as report. There is nearly no discussion of results, no comparison with other similar studies, even it they surely exist, some figures are superfluous but some of them unclear. There is also lot of excessive statements, which are not well supported by results. The conclusion is wrongly written. The specific major and other comments are listed below. In the current state, the manuscript is not suitable to be published as a research article, it must be significantly improved or submitted again.

Answer: We would like to thank the reviewer for her/his review and comments on our manuscript. The manuscript has been significantly improved thanks to both reviewer comments. To each comment is associated an answer and the corresponding modifications in the manuscript. Note that the figures readability is not described as a major comment but is present in the reviewer summary. Thus the figure readability has been improved by adding night-time periods for all figures having a temporal x-axis.

Specific major comments:

1/ Description of model – the inclusion of aerosols in the model, described not very clearly in two distinct paragraphs, does not introduce some important notes. It is not clear, if aerosol arrays are modified by the model or only driven by CAMS data. Also, it is not written how model works with aerosols, if includes aerosol-radiation feedback (or first aerosol effect) only, or if aerosols impact clouds and precipitation (second aerosol effect) due to micro-physics scheme in the model and how. Finally, starting describing of experimental setup and CO simulation is problematic, because aerosol set to zero is non-realistic situation (without cloud and precipitation formation), so first rather describe model (including used aerosol climatology) and the experimental setup later. All mentioned features should be considered as well as all results commented with regard to those features in discussion.

Answer: We indeed did not provide enough information on the description of the model. Here are some answers to the main concerns of the reviewer and the modifications brought to the manuscript are described afterward.

1a) It is not clear, if aerosol arrays are modified by the model or only driven by CAMS data.

Answer: The atmospheric model modifies the desert dust aerosols distributions by advection. The CAMS data are only used at the start of the simulation to initialize the position of the plume, and on the outer boundaries (for E, W, S and N boundary conditions) at each coupling step (3 hours).

The other aerosols (rural, urban, marine) are not provided by CAMS and come with the Tegen et al. (1997) climatology.

References:

Tegen, I., Hollrig, P., Chin, M., Fung, I., Jacob, D., & Penner, J. (1997). Contribution of different aerosol species to the global aerosol extinction optical thickness: Estimates from model results. *Journal of Geophysical Research: Atmospheres*, 102(D20), 23895-23915.
doi.org/10.1029/97JD01864

1b) Also, it is not written how model works with aerosols, if includes aerosol-radiation feedback (or first aerosol effect) only, or if aerosols impact clouds and precipitation (second aerosol effect) due to micro-physics scheme in the model and how.

In this article, only the first aerosol effect (aerosol-radiation feedback) is activated, even if more options could be used to activate the second aerosol effect. The reason not to activate the second effect in our simulations is that we focus on a heat wave condition and radiative effect of the desert dust aerosols on thermal comfort. For this purpose, the chosen days do not show a significant cloud cover in the domain of interest.

References:

Tegen, I., Hollrig, P., Chin, M., Fung, I., Jacob, D., & Penner, J. (1997). Contribution of different aerosol species to the global aerosol extinction optical thickness: Estimates from model results. *Journal of Geophysical Research: Atmospheres*, 102(D20), 23895-23915.
doi.org/10.1029/97JD01864

1c) Finally, starting describing of experimental setup and C0 simulation is problematic, because aerosol set to zero is non-realistic situation (without cloud and precipitation formation), so first rather describe model (including used aerosol climatology) and the experimental setup later.

The simulation setup is probably unclearly presented. Between C0, C1 and C2, only dust aerosols content is different. Rural, urban and marine aerosols contents are the same for all simulations and they are provided by the climatology. Therefore, **the C0 simulation do have a quite common aerosol content for the season and is then completely realistic** (C0 represents the most usual case in the Paris region, where the climatology do not have desert dust aerosols at all).

The interest to initialize desert dust aerosols from CAMS is to be able to study these rare events when desert dust from the Sahara desert (more than 2000km away) are advected above Paris region. The C1 and C2 simulations only differ from C0 by these desert dust plume, but all 3 simulations have the same climatology for the common types of aerosols (rural, urban, marine) in the region.

Modifications: The method section has been reorganized to better identify how work each part of the model and how the model has been used to run the described experiment.

Old organization:

2-1 Meteorological overview

2-2 Model and numerical experiments

2-3 Observation network

New organization:

2-1 Meteorological overview

2-2 Model description

2-2-1 Atmospheric model

2-2-2 Dust scheme

2-2-3 Surface Model

2-2-4 Thermal comfort

2-3 Numerical experiment

2-4 Observation network

Moreover, new informations have been added concerning the aerosol model (in the dedicated new section) and also concerning the aerosol data used as input.

2/ Discussion section – discussion of results is missing, there is no discussion section, but the results section has only few explanation of achieved results and comparisons with other previous studies in different aspects. Also, general differences between urban and rural temperature daily cycle should be taken into consideration.

Answer: The conclusion of the original manuscript included some discussion items but it was too short to create a dedicated section.

Modifications: A discussion section has been created, the discussion paragraph initially located in the conclusion has been moved to this section and two new paragraphs have been added to further described the results in relations to those found in additional literature references. The last paragraph is dedicated to the effect of the aerosols on the UHI intensity both during the day and during the night since the air temperature in rural and urban areas might be affected differently by an air pollution episode.

3/ Dividing of results into sun and shaded is not introduced, defined and motivated in methodology section and it is unclear how it is selected from model simulations.

Answer: You are right, the description was missing.

Modifications: A subsection (2.2.4) describing what is the UTCI and how it is calculated by the model has been added in the model description. Motivation of dividing UTCI for sun and shade is explained in section 2.2.4 and reminded in section 3.4.

Other comments and technical correction:

Line 23: I don't think that unit format W/m² is preferable by ACP, moreover in italics. Also

hyphen instead of dash and two near braces don't look well.

Answer: OK.

Modifications: The units format have been corrected here and everywhere in the text. The two near braces were due to a wrong use of the tools used for referencing. It has also been **corrected**.

Line 53–61: The research gap and also aim of the study would be better explained.

Answer: OK

Modifications: The introduction now contains a dedicated paragraph to introduce urban climate issues. This allow to better describe the research gap regarding the aerosol / human thermal comfort issue. To this aim, additional references treating this topic as well as their limitation have been introduced.

Line 77–78: The sentence have no sense – no aerosols before 17 June?

Answer: You are right, the sentence might not be clear for a reader. We wanted to indicate that the level of dust aerosol is very low before the 17th but in the original sentence the term dust was missing.

Modifications: We have specified that there was no **dust** aerosols instead of aerosols. the end of the sentence accordingly.

L 79–83: It would be appropriate to write, why to choose those models for a comparison. E.g. are they operational system for air-quality predictions through Europe with publicly available results?

Answer: The model name was not important to understand what we were trying to highlight and the model origin was poorly described.

Modifications: Instead of model name, we remind that the CAMS data were compared to the 16 models simulation data available on the Barcelona dust regional center, represented by the min and max models for the period and the AOD median value (called MULTI-MODEL). We have modified the Figure accordingly.

L 89: The word part-ly divided.

Answer: OK

Modifications: The word has been corrected.

Fig. 3 caption: The last sentence seems to be describing rather Fig. 2

Answer: Figure 3 is also based on data and figures provided by the WMO Barcelona dust regional center. It is the sentence that we should add when using their data or figures (cf.

<https://dust.aemet.es/products/products/daily-dust-products/@@documentation#data-policy>).

But it can indeed be more adapted to our case

Modifications: The sentence now reads “The figure is adapted from data and images provided by the WMO Barcelona Dust Regional Center and the partners of the Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) for Northern Africa, the Middle East and Europe.”

L 102: Why the line is terminated, when model description continues?

Answer: The line end was added to distinguish the atmospheric from the surface model description. But indeed there was no alinea to show that it was a new paragraph.

Modifications: The model description section (2.2) has been rewritten and now contains dedicated subsections to distinguish each model part: Atmosphere (2.2.1), Surface (2.2.2), Dust (2.2.3) and Thermal comfort (2.2.4)

L 122: 0.75 degree in lon/lat is not directly 80 km, please improve the sentence.

Answer: Reviewer 1 is right, this information was not accurate. At this latitude, 0.75° is about 57 * 80 km.

Modifications: The manuscript has been modified accordingly.

L 178–179: The statement is excessive, once there are missing data about midnight 17/18 June.

Answer: You are right, this statement is excessive. The previous sentence is more a fact and is sufficient to show that June 17 and June 18 differ in terms of correspondence between observed and simulated AOD. Concerning the 17/18 June night data, as every other night data, it is missing since observation is not possible during the night.

Modification: We have removed the excessive statement sentence. We have also added a sentence about the missing night-time data at the end of the AOD figure caption.

L 202: I would not say ‘slightly’ – the differences between simulated and observed direct / diffusive radiation are significant.

Answer: It is difficult to visually attribute the difference between simulation and observation to the clouds of the reference day (15 June) or to the simulation “bias”. So you are right it is difficult to use the word slightly.

Modification: the entire paragraph has been reformulated in order to be clearer and avoid excessive statements.

L 208 and 209: The hyphen is not a minus.

Answer: OK

Modification: Each occurrence has been replaced by the mathematical sign “-”.

L 221–223: The sentence is excessive, not clear and the final suggestion not well documented

Answer: You are right.

Modifications: The entire paragraph (as well as the previous ones) have been modified in order to focus on quantitative informations instead of qualitative statements. The figure (as well as all figure having the time as x-axis) has been modified in order to better highlight the night-time, increasing readability of the figure.

L 242–244: The statement is also not well supported by results.

Answer: The entire paragraph has been rewritten, including exact referencing to abcd-subplots and more clear statements.

L 255–257: It is better to link to figures than to sections

Answer: OK

Modification: The reference is now to section instead of figure.

L 260: Why simulation C2 is not considered?

Answer: The reason was indeed not clearly given.

Modifications: The following paragraph has been added at the beginning of the thermal comfort section in order to explain this choice.

In previous sections, the effect of dust aerosols on individual meteorological variables has been investigated. In the present section, we analyze the spatial and temporal variations of the UTCI bioclimatic index (see Sect. 2.2.4), which aggregates the effect of several meteorological variables on human thermal comfort. Previous results suggest that the C1 simulation is the one that catches the best the effect of aerosols on global, direct, and diffuse solar radiation (Fig. 7). However, the near-surface air temperature is closer to the observation with C2 (Fig. 8). This is probably due to the fact that Meso-NH overestimates the entrainment at the top of the boundary layer, causing extra heating near the surface (Fig. 9). Increasing the aerosol quantity in the atmosphere, as done

in C2, reduces the radiations reaching the surface, and therefore partially compensates for this bias, but this remains unrealistic. Moreover, the mean radiant temperature is known to be the main variable responsible for the spatial and temporal variability of human thermal comfort (Lindberg et al. (2025)). Thus, only C0 (without dust) and C1 (considered as the most realistic one regarding radiation) are used for this section.

Fig. 11 + 12: Why there are missing data in plots, when it comes from model simulations?

Answer: In the present configuration (multilayer version of TEB), the UTCI calculation is only available in the tile fraction where the fluxes are calculated by TEB, not by ISBA. Missing data are located in rural areas and correspond to grid cells where the fluxes are calculated only with ISBA. Although this is a limit, it does not significantly impact the present work as its purpose was to investigate the UTCI variability in urban areas.

Modifications: A sentence has been added to the caption-text of Figs 11 and 12: “Missing data correspond to rural grid cells where the surfaces fluxes are calculated with ISBA only and therefore where no UTCI can be calculated by the model”

L 281–283: You should distinguish between relative and absolute humidity. The equation 1 and also Fig. 12 include the relative, which could be affected by temperature only, but then you describe absolute humidity, also no clear to what refers ‘moister boundary layer’.

Answer: The moister boundary layer actually refers to the results obtained near the ground. But during the day, the air humidity near the ground is impacted by the humidity of the whole boundary layer through mixing. Yet, the air in the upper atmosphere being dryer than near the surface and the boundary layer height being higher in C0 than in C1, more dry air is incorporated in the boundary layer, inducing an overall dry atmosphere near the ground.

Modifications: The paragraph has been rewritten in order to make clearer the distinction of the two processes impacting the relative humidity.

L 286–288: I don’t understand the meaning of the sentences.

Answer : Mixing R1 and R2 comments we have decided to removed reference to LCZ, which may be misleading for non urban climate audience. The paragraph has also been rewritten

Modifications: The paragraph now reads “Two stations located in different environments were chosen to illustrate the temporal variability of the UTCI offset from 15 to 18 June: i) the Lariboisière station, located in a dense and non-vegetated urban environment within the city of Paris ; ii) the Palaiseau station, a suburban site with grass and sparse and low-rise buildings (see their location in Fig. 4. ”

Fig. 13: It is not clear what difference is shown and the reason why it is shown. If it is UTCI offset, I am not sure about relevance of such evaluation, moreover only in shade.

Answer: The reviewer is right, the figure is confusing. This is the UTCI offset in the shade. The previous focus has been made on a time range where people are most likely to be outside, going from their work to their home. However, the maximum effect of the aerosol is not at this time but at 10.30. The figure allow to better visualize how much the effect of aerosol on thermal comfort varies along the day. The choice of shade is two-folds: first the effect in the sun is less pronounced, second people in Paris are most likely to walk and then choose to walk in shadow areas during such event.

Modifications: The figure has been splitted into two figures to simplify its readability: one is the UTCI offset in the shade at the suburban site, the other at the urban site.

Fig. 14B: The word each has lost.

Answer: Correct.

Modifications: The figure has been corrected.

L 338–341: The sentence is not logical, because AOD is directly connected with radiation impact on the specific wavelength, not with aerosol size.

Answer: You are right. The idea was to discuss the fact that the aerosol size might affect different wavelengths of the solar radiation spectrum and as the solar energy spectrum is not constant over wavelength, the resulting effect on the global radiation might differ a lot. However, this sentence added confusion and was not a major part of the discussion.

Modification: The sentence has been removed.

Conclusion, second paragraph: It seems as discussion section, but statements are often out of paper topic.

Answer: It is indeed a discussion paragraph because initially the conclusion was a conclusion and discussion section, even though not called like this.

Modification: The paragraph has now been modified and moved to the discussion section, along with new paragraphs in order to better discuss and compare our results to the existing literature and better connect the initial discussion paragraph to the study objective.

Answers to Anonymous Referee #2

The authors would like to thanks reviewer 2 for her/his careful review.

Concerning the major concerns, the three first are consistent with those of reviewer 1:

Major comments:

(1) Section “Material and method” should have included detailed description/ explanation on how physics core of the MesoNH model “handles” aerosols vs. radiation vs. clouds vs. precipitation.

Answer : We agree that the “Material and method” section lacked of clarity and of some essential explanations. This part has been substantially restructured and rewritten.

Modifications: The method section has been reorganized to better identify how work each part of the model and how the model has been used to run the described experiment.

Old organization:

- 2-1 Meteorological overview*
- 2-2 Model and numerical experiments*
- 2-3 Observation network*

New organization:

- 2-1 Meteorological overview*
- 2-2 Model description*
 - 2-2-1 Atmospheric model*
 - 2-2-2 Dust scheme*
 - 2-2-3 Surface Model*
 - 2-2-4 Thermal comfort*
- 2-3 Numerical experiment*
- 2-4 Observation network*

Moreover, new informations have been added concerning the aerosol model (in the dedicated new section) and also concerning the aerosol data used as input.

(2) Section “Results” (or “Results and Discussions”) should also include more in details elaborated discussions and explanations on obtained results in this particular study vs. other studies.

Answer : This is consistent with reviewer 1 second major comment.

Modifications: we have created a discussion section which now contain:

- some of the discussions that were currently located in the results or in the conclusion

sections

- more discussion to put our results into perspective with regard to other studies

(3) Section “Conclusions” should be re-written completely, including a short sum-up of the study done, findings of key importance and of secondary importance, with more elaborated future work/directions and applicability of results.

Answer : OK

Modifications: The whole conclusion has been rewritten as proposed.

(4) It is unclear, if the Meso-NH output (or post-processed output from performed simulations) available/ stored somewhere. Only information about observation data is available.

Answer: You are right. The datasets used as input or obtained as output are quite large but are not confidential. Thus they can be provided to anyone on request. Moreover, a long-term repository (with DOI - <https://zenodo.org/records/19374105>) has been created to describe how the simulations and post-processing can be reproduced, which data is necessary and where to download them. It includes a link to the MesoNH version, the MesoNH source files which has been modified, and namelists used to set the simulations.

Modifications: The information about output data availability on request and the informations concerning the zenodo repository (+ url) have been added to a new “code and data availability” section.

Other comments:

Section: Abstract

L1: unify throughout the text of the manuscript: “heatwave” vs. “heat wave”

Answer : OK

Modifications : We chose to set “heatwave” all along the manuscript.

L10: unify throughout the text of the manuscript: “HH:MM UTC” (for example, 16:00) vs “HH” (16 UTC); is the using of MM (00) is really needed in this study?

Answer : OK

Modifications: We chose “HH UTC” all along the manuscript.

L11: unify throughout the text of the manuscript: “relative air humidity” vs. “relative humidity” (as meteorological variable)

Answer : OK

Modifications: “relative humidity” is now used all along the manuscript

Section: Introduction

L17: clarify: “an other”?

Answer : OK

Modifications: Change “an other” in “another”

L23, L24, etc.: unify throughout the text of the manuscript: units (for example, W/m²) in one style

Answer : OK

Modifications: The unit style now follows the ACP guidelines

L24: replace: from “Barcelona” to “Barcelona (Spain)”

Answer : OK

Modifications: We have added “(Spain)” at the first Barcelona occurrence

L33: clarify: “observational estimates” vs. “observed estimates”?

Answer : The use of one or the other may be misinterpreted

Modifications: We have changed to “observations”

L34: clarify: “dust was located” vs. “dust was observed/distributed”?

Answer : You are right located is not the appropriate word

Modifications: We have replaced the word by “distributed” instead.

L36: replace: from “Wang et al. (2022) emphasizes that” to “Wang et al. (2022) emphasized that”

Answer : OK

Modifications: Change “emphasizes” in “emphasized”

L45: replace: from “Thus the trend” to “Thus, the trend”

Answer : OK

Modifications: The comma is now present in the sentence

L46: replace: from “Zhao et al. (2019) have investigated” to “Zhao et al. (2019) investigated”

Answer : OK

Modifications: We have followed recommendations of the reviewer

L48: replace: from “green house gases” to “greenhouse gases”

Answer : OK

Modifications: We have followed recommendations of the reviewer

L50: clarify: “more frequent (12 more per year)”, rewrite more clearly

Answer : OK

Modifications: We have added that 12 is related to the number heat wave days

L50-51: reformulate/rewrite part: “These changes will also be further aggravated by aerosol reductions,”

Answer : We suppose the misunderstanding was related to the previous comment.

Modifications: We have added the information that all the informations given is related to heat waves and precise that the frequency lead to more heat wave days per year.

L53: reformulate/rewrite part: “Although there is a quite dense literature”

Answer : Not sure to understand what is the issue with this sentence.

Modifications: We have added the word scientific before literature.

L54: clarify: “most of them are performed”, them? Or “most of studies were performed”?

Answer : Right a word was missing.

Modifications: We have replaced “them” by “the simulations”.

Section: Material and method

Section: 2.1 Meteorological overview

The is section should be rewritten in the past tense.

Answer : OK

Modifications: We have rewritten in the past tense.

L64 vs L70 vs 73: clarify and unify: “heatwave period” vs “episode” vs “heatwave episode”

Answer : OK

Modifications: Only heatwave is now used in the manuscript

L65: clarify: “The temperature” vs “The air temperature”?

Answer : OK

Modifications: “The air temperature” is now written in the manuscript

L67: clarify: “from North Africa” vs “Northern Africa”?

Answer : Ok

Modifications: “Northern Africa” is now written in the manuscript so that is consistent with other occurrences

L71: clarify: “leading to important rainfall” – what does it mean? heavy rainfall?

Answer : Yes, it can be assimilated to heavy rainfall (up to 3 mm/h at certain location)

Modifications: “important” has been changed to “heavy”

Figure 1: What is the source of these plot son Figure 1? Are these replotted or extracted as figures-plots and combined on one figure? Why the colorbar has such scale with strange-looking values? Where is the zero-value? Vertical title for colorbar is missing text as “air temperature”; at the end of caption-text to figure replace from “geopotential height.” to “geopotential height, respectively.”

Answer : The data come from ERA5, this is written in the caption-text. Plots (maps) are then made using a Python script. Such kind of figure can be found in other ACP articles (see Haeffelin et al. 2024, for instance).

Modifications: Figure 1 has been modified: Vertical title for colorbar now includes “air temperature”, the zero-value has been added in the colorbar, value are not strange-looking anymore. The end of the caption-text has been modified following the reviewer remark.

L75: Acronym was introduced, but was not declared: “CAMS” vs “Copernicus Atmospheric Monitoring Service (CAMS)”; same should be done throughout the text of the manuscript for all first time introduced acronyms; see further lines L80 for SILAM, L81 - ZAMG-WRF-CHEM, L82 – MULTI-MODEL, L – 82 CAMS-IFS, etc.

Answer : Indeed, corrections have been made. However this does not apply to MULTI-MODEL as it is not an acronym.

Modifications: All the acronyms have been declared in the text

Figure 2: in the caption-text for figure replace: from “WMO Barcelona Dust Regional Center” to “World Meteorological Organization (WMO) Barcelona Dust Regional Center”

Answer : OK

Modifications: “World Meteorological Organization (WMO)” has been added to the text

L89: clarify/correct: “part ly”?

Answer : OK

Modifications: The word has been corrected

L90: clarify: “spatial resolution” vs “spatial resolution differences”?

Answer : OK

Modifications: The expression has been corrected to “spatial resolution difference”

L90: clarify: “to 0.75° for CAMS” vs “to 0.75° for CAMS-IFS”?

Answer : This number is referring to the Figure 3 where the data are CAMS-IFS.

Modifications: CAMS has been changed to CAMS-IFS.

Figure 3: the vertical and horizontal ticks/lines are missing for horizontal axis as well as for vertical axis; it is not easy/ complicated for reader to work with such figure and extract values; tick-marks should be added; caption-text to figure: clarify: “The choice of the models was performed in order to illustrate the variability” vs “The used models illustrate the variability”?

Answer : OK

Modifications: The sentence has been changed to: “The min, max and MULTI-MODEL models illustrate the variability and the median dust AOD values of the 16 models proposed on the Barcelona Dust Regional Center plat-form.”

What does it (see text) mean on figure 3? “Dust data and/or images were adapted from the WMO Barcelona Dust Regional Center and the partners of the Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) for Northern Africa, the Middle East and Europe”. Is it a part of the plotted figure, or it should be moved to the text of the manuscript?

Answer : It is the generic sentence that we should write when using WMO Barcelona dust regional center data or figures (cf. <https://dust.aemet.es/products/products/daily-dust-products/@@documentation#data-policy>). But Reviewer 2 is right, it can better adapted to our case. Therefore the sentence has been slightly modified.

Modifications: The sentence now reads “The figure is adapted from data and images provided by the WMO Barcelona Dust Regional Center and the partners of the Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) for Northern Africa, the Middle East and Europe.”

Section 2.2: Model and Numerical experiments

L92: clarify: “non-hydrostatic research atmospheric model Meso-NH” vs. “Mesoscale Non-Hydrostatic model (Meso-NH)”?

Answer : As described in Lac et al. (2018) Meso-NH can be applied to a broad range of resolutions, from synoptic to turbulent scales so it is not – anymore – only a mesoscale model

Modifications: None

L103: clarify: “Surface physics is handled by the last version of SURFEX (V9.0)”; do you refer to to Surfex v9.0.0, Latest update : 5 Sep 2022, or something else?

Answer : Yes, absolutely.

Modifications: “Surface physics is handled by SURFEX V9.0.0, ...”

In the section 2.2 there are many acronyms introduced from the start, but these are not declared at all; should be done accordingly; fx. L104 – ECOCLIMAP, L105 – TEB, L130 – AROME, etc.

Answer : Reviewer 2 is right. This has been corrected. However, ECOCLIMAP is not an acronym.

Modifications: All the acronyms have been introduced

L108: clarify: “Soil-Biosphere-Atmosphere interaction land surface model (Noilhan and Planton, 1989, ISBA)” vs. “Interaction-Soil-Biosphere-Atmosphere (ISBA) land surface scheme (Noilhan and Planton, 1989)”

Answer : OK

Modifications: “Soil-Biosphere-Atmosphere interaction land surface model (Noilhan and Planton, 1989, ISBA)” has been changed to “Interaction-Soil-Biosphere-Atmosphere (ISBA) land surface scheme (Noilhan and Planton, 1989)”

L113: clarify: “dusts (Fig. 3)” vs “dust (Fig. 3)”

Answer : As the section has been rewritten, this error does not appears anymore.

L116: clarify: acronym “PANAME-Urban framework” vs. “PARis region urbaN Atmospheric observations and models for Multidisciplinary rEsearch (PANAME-Urban) framework”

Answer : OK

Modifications: The sentence has been removed but “PARis region urbaN Atmospheric observations and models for Multidisciplinary rEsearch (PANAME-Urban)” has been added to the manuscript at its first occurrence.

L117: replace: from “as temperature” to “air temperature”

Answer : OK

Modifications: “temperature” has been changed to “air temperature”

L118: replace: from “approximately 17,500 m” to “approximately 17500 m”

Answer : OK

Modifications: The comma has been removed

L121: clarify/ recalculate: “(80 km by 80 km)” ? 1 degree of latitude near Paris is about 111 km & 1 degree of longitude is about 73 km

Answer: Reviewer 2 is right, this information was not accurate. At this latitude, 0.75° is about 73 * 111 km.

Modifications: The manuscript has been modified accordingly.

L125-127: your text: “Due to the short period of simulation and the fact that the aerosols are outside of the boundary layer, the modification of the aerosols content by deposition, aggregation or chemical reaction is not simulated.” How many days of spin-up were used in Meso-NH simulations for 4-days of C0, C1, C2? Make more clear justification (dust episode is considered in simulation) on ignoring deposition (dry and wet)? Why is dust considered here as “passive” aerosol?

Answer : Based on previous work within the PANAME framework, the spin-up time of the present configuration is quite short. Initialized at 00 UTC, spin-up for near surface variables such as temperature is up to 6 hours (i.e when diurnal heating starts) as it can be observed in Fig 8.a.

Dry deposition is considered by default by the model so it has been added to the text. For the sake of simplicity and because we are focusing on radiative effect of the aerosols, dust is indeed considered has an ‘passive’ aerosol.

Modifications: added the information that only wet (and not dry) deposition is not simulated.

L127 (+L174, +L188): clarify/ rename/ rewrite: “non-desertic” – to what do you refer?

Answer : “non-desertic” is indeed not appropriate

Modifications: “non-desertic” has been changed to “aerosols other than dust”, here and for the other occurrences

Section 2.3: Observation network

L133: clarify: “presented” vs. “described”

Answer : OK

Modifications: “presented” has been changed to “described”

Figure 4: is heavily overloaded with multiple details on maps; needs to be simplified to keep only the needed information (used/referenced in the text of the manuscript)

Answer : OK

Modifications: The map has been updated to replace the initial OpenStreetMap data shown in background by only two categories of land cover: built-up areas and water bodies. Both are derived from the Local Climates Zones map produced by Demuzere et al. (2022).

Reference: Demuzere, M., Kittner, J., Martilli, A., Mills, G., Moede, C., Stewart, I. D., van Vliet, J., and Bechtel, B. (2022): A global map of local climate zones to support earth system modelling and

urban-scale environmental science, Earth Syst. Sci. Data, 14, 3835-3873,
<https://doi.org/10.5194/essd-14-3835-2022>.

L136, L138: acronyms are introduced but not declared: AERONET, RADOME

Answer : RADOME is not an acronym but the name of the Météo-France ground observational network. Capital letters were indeed not appropriate, it is now written Radome.

Modifications: AERONET has been declared: “AErosol RObotic NETwork (AERONET)”

L139: clarify: “Two of them” vs. “Two of these”?

Answer : It refers to the nine AWS stations presented before. In that case it seems that Two of them is correct even though two of these might also be used.

Modifications: None

L142-143: “the World Meteorological Organization” was already declared above & hence, only acronym can be used “WMO”

Answer : OK

Modifications: The sentence now reads: “Indeed, to follow the WMO recommendations, ...”

L144: clarify: “Finding sites that” vs “Finding stations that”?

Answer : The sentence was not clear, it has been modified

Modifications: “Locations that match these constraints are complex to find in or near urban areas, ...”

L150: clarify: “impossible” vs “complicated”?

Answer: Impossible was indeed not appropriate.

Modifications: It has been changed to “non-relevant”

L151-152: is it necessary to use ‘rural’ (with 20% of surface covered by urban features) and ‘urban’ (with 100%) instead of words: rural and urban? What is about the suburban stations (between 20 and 80%?; clarify)?

Answer : The fraction correspond to the model land cover. In the model, a station is retained as ‘rural’, when the corresponding model grid cells have less than 20% of their surface covered by urban feature (and where the fluxes are calculated with TEB). Over the Ile-de-France

administrative region, only 18 station locations of the Radome network match that criteria in the model. Similarly, a station is considered as 'urban', when the corresponding model grid cells have 100% of their surface covered by the urban cover (and the fluxes are calculated with TEB). This happens for one station only (Lariboisière), because it is not located in an urban park but on a small patch of grass in an hospital open courtyard. All of this choices are obviously dictated by the quite large model resolution of 1.2 km.

Modifications: For the sake of clarity, the sentences have been rewritten and now read: "To prevent this inconsistency, only in-situ stations where the corresponding model grid cell surface cover matches their immediate surroundings are used for the air temperature evaluation. This results in 18 'rural' stations and a unique 'urban' station (Lariboisière, see Fig. 4). The 'rural' stations are located away from Paris, whereas the 'urban' site is located in a non-vegetated part of Paris city center (i.e. the surface fluxes in the corresponding model cell are calculated only with TEB). In the model, because of the 1.2 km of resolution, suburbs have often a mix in surface cover between rural and urban features, therefore suburban in-situ stations of the Radome network are excluded from the comparison."

Section 3. Results

Use unified words in writing "Sect. #" or "section #" throughout the text of the manuscript

Answer : OK

Modifications: Following ACP guidelines, "Sect." is now used in the manuscript

L161: replace: from "observations on" to "observations in"

Answer : Done

Modifications: Changed from "observations on" to "observations in"

L166: clarify: "agree well" vs "agree relatively well"; provide short statistical summary on corrections (calculate correlation coefficients and estimate statistical significance) between observed and modelled data, which are shown on figure 5.

Answer : Pearson correlation coefficients is on average 0.58, 0.86 and 0.86 for C0, C1 and C2 respectively, with p-values much lower than 0.01.

Modifications: This information has been added in the text (at the end of the corresponding sentence).

L167: replace: from "of 16 June2 to "of 16 June 2022"

Answer : OK

Modifications: The “2” has been removed

L170: replace: from “the location of” to “the locations of”; check correct usage of singular vs plural throughout the text of the manuscript

Answer : This paragraph has been totally rewritten according to other comments of reviewers 1 and 2. The use of location has not been conserved.

Modifications: The use of singular vs plural has been checked throughout the text.

L177: clarify: “by the low resolution of the initial field” vs. “by the low horizontal? resolution (add value here) of the initial field”

Answer : OK

Modifications: Modifications has been performed according to reviewer’s comment.

L179: clarify: “surface variables” vs. “meteorological variables” or “thermal comfort related variables”?

Answer : OK

Modifications: It has been replaced by “the meteorological variables near the surface”

Figure 5: Caption-text needs clarification; Are these plots show the time-series of AOD? In this case caption-text to be as “Time-series of aerosol optical depth observed ...”; re-draw 4 plots on figure with max at vertical axis corresponding to 0.8 & change ticks-intervals on vertical axis on AOD from 0.2 to 0.1; the observations are plotted with a light orange/yellowish colour, and it is difficult (if printed on paper – impossible) for reader to see/ interpret such data; replot curve with observations, for example, with green-colour

Answer : The plots are indeed showing the time-series of AOD

Modifications: Caption text beginning now reads “Time-series of aerosol optical depth observed...”. Proposed modifications for axis (range and tick intervals) have been taken into account.

Section 3.2: Radiation

Preferably, use the past tense.

Answer: We think that using the past tense renders the reading more complicated

Modifications: No modifications are brought.

L184-185: Why the South-West, Western, Eastern are written in capital letters? (same for caption-text of Figure 6) instead of south-west, western, eastern; unify

Answer : OK

Modifications: Directions are now written without capital letter, both in the text and the caption-text.

Figure 6: Caption-text uses words “global downward solar radiation”, but vertical axis has title as “Global solar radiation” and text of the manuscript (L196 + in Table 1) as well as “global radiation” (L191, L192); should be unified – preferably as “global solar radiation”; clarify: “observation line” vs. “observation curve”?

Answer : OK

Modifications: Global solar radiation has been used throughout the manuscript. Line was referring to a previous version of the curve where the hourly mean was calculated. We have removed this reference to the line and we have written “the observation curve is delineated at the bottom and at the top”.

L186: clarify: “where there is” vs. “when there is”?

Answer : The sentence has been reformulated

Modifications: The sentence now reads “For the first two days, there is a limited amount of aerosols in the atmosphere and no significant differences between C0, C1 and C2.”

L188: clarify/ rewrite: What does mean “non-desertic AOD”? Does it exist in atmospheric sciences?

Answer : The expression was indeed not appropriate and has been modified

Modifications: The sentence now reads “The underestimation of AOD for aerosol other than dust (see Sect. 3.1) could also contribute to this bias.”

L193: replace: “nine in situ AWS” to “nine in-situ AWS”

Answer : OK

Modifications: The sentence has been modified and “in-situ” is no longer written there

Figure 7: unify caption-text for plotted titles of vertical axes as well as use the same

terminology/wording in the text of the manuscript, otherwise it looks very messy; replace: from “by the line” to “by the curve”

Answer : OK

Modifications: Choice has been made to use solar radiation and long-wave radiation all along the manuscript. Moreover, “air temperature” and “mean radiant temperature” are now used (no more “temperature” only).

L206: clarify: “Tab. 1)” vs “, as seen in Tab. 1)”?

Answer : OK

Modifications: Following the reviewer comment and the ACP guidelines it is now written “as shown in Table 1”

L208: Where the “downward infrared radiation is minor” was calculated; to which exactly figure it is referenced?

Answer : It was referring to Table 1 but it was not written explicitly. Moreover, the Table caption was missing the information about infrared (now called longwave) radiation.

Modifications: These informations have been now added.

L209: clarify: “makes these long-wave impacts” vs. “makes these impacts of LW”?

Answer : OK

Modifications: The second version has been adopted.

Section: 3.3. Air temperature

Section: 3.3.1. Near ground air temperature

L212: exclude ‘ ‘ for words rural and urban

Answer : OK

Modifications: the ‘ ‘ have been removed

L214: clarify: “very well” vs “relatively well”; do you have calculated correlations? provide a short sumup statistics on calculated correlation coefficients

Answer : The reviewer is right, this section was missing objective informations.

Modifications: The entire paragraph has been rewritten and has now more objective informations instead of “very well”.

L214-217&L222-223: Why degrees K are used in text of the manuscript, but degrees C on Figure 8?; all units should be unified throughout the text of the manuscript

Answer : The reviewer is correct.

Modifications: degrees C is now used throughout the text of the manuscript

L215: clarify: “decreases in the afternoon for all simulations” vs “decreases from HH? UTC until HH? UTC for all simulations”?

L216: clarify: “the night-time simulated air temperature” vs. “the night-time (from HH? UTC until HH? UTC) simulated air temperature”; night-time as a time from sunset to sunrise; which exactly UTC hours (for Paris urban area)?

Answer : The entire paragraph has been rewritten. The UTC hours are now explicitly written

Modifications: “Comparison of near-surface air temperature is performed for the 18 rural sites and for the single urban site. When there are no dust aerosols in the atmosphere (15 June), the air temperature simulated by the model for urban and rural stations is underestimated from 06 to 12 UTC (00 - 06 UTC being the spin-up time it is not considered) and overestimated the rest of the day (about 1.75°C for the rural median value - Fig. 8a). For the night between 15 and 16 June (20 UTC - 04 UTC) the bias is close to zero. The daytime (from 04 UTC to 20 UTC) warm bias increases in rural areas on 17 and 18 June, as temperatures rise, but differently depending on the simulations : it is maximum for C0 (without dust aerosols) and minimum for C2 (by doubling CAMS dust aerosols). Although trends are quite similar at the urban site for the three simulations (Fig. 8b,d), biases are lower. A warm nighttime bias with similar distinction between the simulations appears on 17 and 18 June for urban and rural stations.”

Figure 8: Caption-text: what do you mean by “absolute air temperature”? (used only twice in the caption-text); you refer here to 18 stations as rural, but you declared early the 17 rural stations + 1 urban; is the median value correctly calculated? clarify/or recalculate/ and modify results of analysis; replace: from “the line and” to “the curve and”

Answer : Reviewer is right. 18 rural stations (and not 17) are considered everywhere in the manuscript. It was a typo and it has been corrected.

Modifications: The word “absolute” has been removed. 17 corrected in 18 for the station number. “the line and” has been changed to “the curve and”.

L219: clarify: “distinction between simulations” vs “differences between simulations”?

Answer : indeed, distinction was not the appropriate word

Modifications: The sentence now reads “As with solar radiation, the air temperatures in the simulations with and without aerosols start to diverge on 17 June, and this difference increases on 18 June.”

L221: clarify: “throughout the simulation period” vs “for the simulation period”?

Answer : OK

Modifications: “throughout the simulation period” has been removed

Section: 3.3.2 Upper atmosphere air temperature

L229: is it really necessary? to use “:00” for UTC terms included in the text of the manuscript

Answer : No, indeed.

Modifications: “HH UTC” is now used all along the manuscript.

L234: clarify: “simulated profiles of temperature are similar and very good.” vs “simulated vertical profiles of temperature are very similar and in good agreement with observations.”

Answer : OK

Modifications: The sentence now reads: “Above 1000 m, in the free atmosphere, the simulated profiles of potential temperature are very similar and in good agreement with observations.”

L235-L247: Paragraph refers to description/ analysis of Figure 9, but written text is confusing/ misleading/ messy, referencing to exact abcd-subplots of Figure 9 is not given/ provided. Some statements are vague: “huge development” (rapid?), “boundary layer extend” (extent?), “strong inversion” (place arrows on plots to show inversion layers depth), “too high extension” (depth? or top of boundary layer?), “largest disagreement” (where the values? compared with other plots at other UTC terms). The paragraph needs to be re-written more clearly.

Answer : Ok

Modifications: The entire paragraph has been rewritten, including exact referencing to abcd-subplots and more clear statements

Figure 9: Caption text for each figure should be a self-explanatory written text! For example: Figure 9. Vertical profile of the potential air temperature simulated by the Meso-NH model at the Jussieu station and observed by a radiosonde on 18 June at (a) 00, (b) 12, (c) 16 and (d) 20 UTC terms. Is it necessary to use for UTC terms the additional “:00”? or these can be omitted?

Using simultaneously the red and pink colours on the plots for lines and curves complicates the inspection/ interpretation/ analysis. Preferably, use another colour, for example – green (instead of pink).

Answer : OK

Modifications: The caption now reads “Vertical profile of the potential air temperature simulated by the Meso-NH model at the Jussieu station location and observed by a radiosonde on 18 June at (a) 00, (b) 12, (c) 16 and (d) 20 UTC terms”. The observation line color has been changed

The term “potential air temperature” is used. Or it is just an air temperature? It is very confusing; make clear declaration and how it was calculated. Is it the one called as “theta” and calculated in deg K? and then, you converted to deg C?

Answer : Potential air temperature is a common variable used in meteorology. In our study, we have indeed converted it into °C for convenience.

Modifications: A short definition of potential air temperature has been added as footnote when first used in the manuscript.

L248: clarify: “vertical structure of the atmosphere” or “vertical structure of the boundary layer”?

Answer : OK

Modifications: It has been precised that the first 4500 meters of the atmosphere have been “plotted”.

L249: clarify: “observed by the Jussieu station ceilometer” vs. “observed by ceilometer at the Jussieu station”

Answer : OK

Modifications: “observed by the Jussieu station ceilometer” has been changed to “retrieved from the ceilometer at the Jussieu station”

L251: clarify: “during the two days with significant dust plume (17 and 18 June)” vs. “during the two days (17 and 18 June) with significant dust plume”

Answer : OK

Modifications: the sentence has been rewritten and “during the two days with significant dust

plume (17 and 18 June)” is not written anymore

L252: clarify: “compared to the simulation without dust” vs. “compared to C0”

Answer : OK

Modifications: “compared to C0” is now written

Figure 10: Do you mean? “Time-series of vertical variation of the potential air temperature difference between the simulations C1 and C0 at the Jussieu station” Is it necessary to use “:00” on the figure? or simply 00, 12, 00, 12, etc. for each date

Answer : the “:00” have been removed.

Modifications: The caption now reads “Comparaison of time-series of boundary layer height simulated (C0 and C1) and observed at the Jussieu station, and vertical variation of the potential air temperature difference between C1 and C0 at the the same location”

Section 3.4: Thermal comfort

L254: clarify: “is now being investigated” vs. “was investigated in this study”?

Answer : OK

Modifications: The sentence needing clarifications has been removed from the manuscript

L254-255: clarify: “Previous sections showed ... (Sect. 3.2)” vs. “Sections 3.2 showed ...”

Answer : OK

Modifications: Following ACP guidelines and the reviewer suggestion, it is now written “Section 3.2 ...”

L257: replace: from “and 3.3.2 respectively” to “and 3.3.2, respectively”

Answer : OK

Modifications: The comma has been added to the sentence

L260: replace: from “is calculated” to “was calculated”

Answer : OK

Modifications: The sentence has been removed from the manuscript

L263: units for listed meteorological variables are missing; for example, air temperature in degree C; and should be all included; air temperature, relative humidity, wind speed - at which level above the ground?

Answer : This part has been moved to the model description (2.2.4) but all of the reviewer comments have been taken into account.

Modifications: Add units and levels at which variables are calculated in TEB.

L264: clarify: “can be seen” vs “can be calculated”?

Answer : OK

Modifications: “can be seen” has been modified into “can be calculated” in section 2.2.4

L266: clarify: “show the UTCI on 18 June simulated by C1” vs Did you simulate UTCI? Or did you calculate UTCI using Eq.(1) based on results from the C1 simulations; confusing/ reformulate/ write clearly

Answer : UTCI is calculated in TEB using the operational procedure described in Bröde et al [2012]. Clarification have been made in the new section 2.2.4 and “Calculated” is now used along the manuscript.

Modifications: “simulated” has been changed into “calculated”

L266: define clearly for readers the meaning of “in the sun” and “in the shade”

Answer : In addition to clarifications given in section 2.2.4, the paragraph present in section 3.4 has been rewritten

Modifications: “Figures 11a,b show the UTCI calculated by TEB on 18 June for C1, for a person standing within the urban canyon in the sun and in the shade, respectively (see Sect. 2.2.4). The distinction between sun and shade is made because the mean radiant temperature, a very important driver for daytime outdoor thermal stress (Thorsson et al., 2014), is substantially reduced by shadow patterns created by obstructing objects such as buildings (Lindberg and Grimmond, 2011, Lindberg et al, (2025)). ”

L267: clarify: “The results are averaged from 15:00 to 17:00 UTC.” vs “The results are averaged for time period from 15 to 17 UTC.”?

Answer : OK

Modifications: The sentence now reads “The results are averaged for the time period from 15 to

17 UTC (17 to 19 LT)”

L268: clarify: “large number of people in France usually move from their workplace to their home” vs. Do you mean at during 15-17 UTC (or = 15-17 pm of local time) people are usually travelling from work to home? rewrite more clearly; fx. “starting to move”? Time should be used in unified units – coordinated universal time (UTC), or local standard time (LST), or American AM and PM, but not as s mixture of everything in the manuscript

Answer : The mention of the 2h difference between UTC and LT for summertime in Paris was missing. It has been added. We have carefully used the UTC unit.

Modifications: “The results are averaged for the time period from 15 to 17 UTC (17 to 19 LT). This choice is justified by two reasons: it is the hottest time of day, and it is also the preferred time for commuting from work to home.”

L268: clarify: “during this time slot.” vs “during this time period”?

Answer : OK

Modifications: “time slot” has been changed to “time period”

L270: replace: from “results in” to “resulted in”

Answer: We think that using the past tense renders the reading more complicated

Modifications: No modifications are brought.

L273: it would be preferably to use the past tense instead of the present for completed research you have done; “dust aerosols decreases” vs “dust aerosols decreased” & similarly through the text of the manuscript, where it is applicable

Answer: We think that using the past tense renders the reading more complicated

Modifications: No modifications are brought.

Figure 11: Vertical and horizontal axes on each plot should have the values of coordinates plotted; without referencing to coordinates it is complex to interpret shown data. The caption-text is not self-explanatory; should be re-written (see comments for L266 and L267)

Answer : OK

Modifications: A grid with lat/lon coordinates has been added to the Figure. The caption-text is now self-explanatory: “UTCI bioclimatic index calculated by TEB on 18 June for the C1 simulation, for a person standing within the urban canyon: (a) in the sun and (b) in the shade. Difference

between simulations C1 and C0 in the sun (c) and in the shade (d). The results are averaged for the time period from 15 to 17 UTC (17 to 19 LT). Missing data correspond to rural grid cells where the surfaces fluxes are calculated with ISBA only and therefore where no UTCI can be calculated by the model"

L274: clarify: "contribution of this variable" vs "contribution of this temperature"?

Answer : OK

Modifications: It now reads "The contribution of the near-surface air temperature to UTCI can be removed in order to focus only on the UTCI offset term in Eq. 1."

L275: clarify: "Then the results are more contrasted:" vs "In this case the results are more contrasted:"?

Answer : OK

Modifications: The sentence has been removed.

L275-275: clarify: "while it has a null or positive impact (up to 1.5°C) everywhere in the shade (Fig. 12b)"; "null" – do you mean negligible (impact)? Value of 1.5? the max shown on does not show dark-red coloured place on the plot; confusing/ rewrite/ reformulate

Answer : The sentence was indeed confusing. The value of 1.5 was a typo.

Modifications: The paragraph has been totally rewritten , including the typo correction. In addition, each occurrence of "negative" or "positive" have been replaced by more objective information (eg: positive or negative impacts on UTCI have been replaced by UTCI decrease or increase, respectively).

Figure 12: Vertical and horizontal axes on each plot should have the values of coordinates plotted; Sub-plots "c"&"d"- clarify "mean temperature radiant" vs "mean radiant temperature", replot names of vertical axes; Sub-plot "f" - clarify "air humidity" vs "relative humidity", replot vertical axis. Caption-text should be self-explanatory; Fx. "Difference between Meso-NH C1 and C0 simulations for the UTCI offset (a) in sun and (b) in shade, mean radiant temperature (c) in sun and (d) in shade, (e) wind speed, and (f) relative humidity."

Answer : OK

Modifications: A grid with lat/lon coordinates has been added to the Figure. The caption has been changed following the reviewer comment and now reads "Difference between Meso-NH C1 and C0 simulations for the UTCI offset (a) in sun and (b) in shade, the mean radiant temperature (c) in sun and (d) in shade, (e) wind speed and (f) relative humidity"

L283: clarify: unify from “at 4 pm” and “at 10 am”; 16 UTC? and “10 UTC”? time should be used in unified units - UTCs, of local standard time, or American AM and PM, but not a mixture of everything.

Answer : OK

Modifications: Time units have been changed to UTC

L284: replace: from “are chosen” to “were chosen”

Answer : OK

Modifications: The reviewer proposition has been adopted.

L285-285: clarify: “Its environment is composed of compact mid-rise buildings (Local Climate Zone (LCZ) type 2 - Stewart and Oke (2012)).” vs. “According to Stewart and Oke (2012), its environment includes compact mid-rise buildings (Local Climate Zone, LCZ, type 2).”

Answer : Mixing R1 and R2 comments we have decided to removed reference to LCZ, which may be misleading for non urban climate audience. The paragraph has also been rewritten

Modifications: The paragraph now reads “Two stations located in different environments were chosen to illustrate the temporal variability of the UTCI offset from 15 to 18 June: i) the Lariboisière station, located in a dense and non-vegetated urban environment within the city of Paris ; ii) the Palaiseau station, a suburban site with grass and sparse and low-rise buildings (see their location in Fig. 4.”

L287-288: clarify: “definition of each site is given using aggregated spatial information using the 1.2 km resolution grid cells” vs. “definition of each station is given based on aggregated spatial information from 1.2 km resolution grid cells”.

Answer : OK

Modifications: The sentence now reads “Note that the definition of each station environment is given based on aggregated spatial information from 1.2 km resolution grid cells.”

Figure 13: clarify: text vs. legend “sparse buildings” + “compact mid-rise buildings” vs “Sparsely built” + “Compact mid-rise”; unify and replot; change from “for two sites for” to “for two stations for”; clarify on caption-text to figure

Answer : OK. This figure has been criticized by the other reviewer. The use of compact mid-rise and sparsely built was also complicated to understand for readers not familiar with Local Climate Zone (LCZ) classification.

Modifications: The figure has been updated to be more understandable. Moreover, the use of sparsely built and compact mid-rise were replaced by suburbs and city-center, respectively.

L298: clarify: “in an almost no effect” vs “in negligible effect”

Answer : OK

Modifications: Negligible effect has been adopted.

L298-300: rewrite 3-lines sentence more clearly

Answer : OK

Modifications: The sentence has been reformulated: “Seen from a different perspective, in terms of thermal comfort for areas in the shade, the level of dust aerosols observed on June 18 is equivalent to a 1.5 °C increase of air temperature.”

L301-302: “i” symbol is declared but not used; modify from “is performed for Ta,” to “is performed for i Ta,”.

Answer : OK

Modifications: The “I” symbol has been replaced by a “*”, which is used in the text: “To identify the contribution of each variable to the effect of aerosols on UTCI (referred to as $\text{\$Ct_}\star\text{\$}$ with the indice $\text{\$}\star\text{\$}$ for the variable considered)...”

L311: clarify: “Palaiseau site” vs “Palaiseau station”?

Answer : OK

Modifications: “site” has been changed to “station”

L313: preferably use term “relative humidity” instead of “relative air humidity” everywhere throughout the text of the manuscript

Answer : OK

Modifications: “relative humidity” is now used all along the manuscript

L318: clarify: “with greater importance” vs. “with larger contribution”?

Answer : OK

Modifications: Proposition adopted

L319: clarify: “all variable contributions to” vs. “contributions of all variables to”?

Answer : OK

Modifications: “all variable contributions to” has been changed to “the contributions of all variables to”

L319: clarify: “urban and suburban cases” vs. “urban and suburban stations”?

Answer : OK

Modifications: “cases” has been changed to “locations”

Figure 14: on plot “b”, the y-axis title has missing fragment in text, replot; Caption-text, rewrite; Fx. “Contribution of all and each meteorological variables and cross-terms to the effect of aerosols on the UTCI on 18 June at (a) 10 UTC and (b) 16 UTC.”

Answer : OK

Modifications: The y-axis title has been updated. The caption-text has been modified and now reads “Contribution of all and each meteorological variables and cross-terms to the effect of aerosol on the UTCI on 18 June (a) at 10 UTC and (b) at 16 UTC”

Conclusions

Use past tense in this section.

L324: clarify: “case of strong heatwave over the Paris region.” vs. “case of strong heatwave reached the Paris region from 15 to 19 June 2022.”

L325: clarify: from “Simulations without and with dust aerosols” vs “The Meso-NH model simulations without aerosols (C0), with dust aerosols (C1), and with CAMS’s dust aerosols (C2)”?

L326-327: clarify: “The simulations perform correctly” vs “The simulations performed relatively well” & “except the afternoon of the last day” vs “the afternoon of the last day (18 June 2022)”

L328: replace: from “decrease of the AOD” to “decrease of the aerosol optical depth”

L336: clarify: “of other types of aerosols” – which other types?

L339: replace: from “,both closer to the Sahara desert.” to “(both cities are closer situated to the Sahara desert).”

Answer : OK for all comments.

Modifications: The conclusion has been completely rewritten according to reviewer's major comment (4). In the new version, we have carefully paid attention to respecting the comments made for the initially submitted conclusion.

Section: Data availability

Only observation data are mentioned here. What is about availability of output (or post-processed output) from the mentioned model simulations (C01, C1, C2)?

Answer : Reviewer 2 is right. We have created a long-term repository (with DOI - <https://zenodo.org/records/19374105>) containing description of how the simulations can be reproduced, which data is necessary and where to download them. It include a link to the MesoNH version, the MesoNH source files which has been modified, the namelists used to set the simulations. The output data are available upon request.

Modifications: The section has been changed to Code and Data availability. We have added the following content: *The Meso-NH code is maintained and updated by CNRM and LAERO, and it is freely available for download at <https://zenodo.org/records/15095131>. Météo-France data such as RADOME observations, and AROME analyses and forecasts are available online at <https://meteo.data.gouv.fr>. Raw observational data from the PANAME-Urban campaign are available from the AERIS data centre catalogue at <https://paname.aeris-data.fr/data-catalogue-2>. The modified sources of the Meso-NH code, the configuration files and the CAMS data used to run the simulations are freely available for download at <https://zenodo.org/records/19374105>. Output data are available upon request.*

Section: Acknowledgements

Only financial support and discussions are acknowledged. What is about performed Meso-NH model simulations: at which computing center/cluster, at which supercomputer/ computer (its architecture), used computing resources, technical advice/assistance, etc.? Have you used initial/ boundary conditions to perform the model runs, from where (? which archive) these ICs/BCs were extracted, what is about data assimilation (which observation data for meteorology were assimilated) in the model runs?

Answer : Numerical simulations have been undertaken on the Belenos HPC facility of Météo-France (Atos Bull Sequana with AMD Rome processors). This is the standard way of performing HPC at Météo-France and therefore we don't need special technical advices or assistance. The initial conditions for the atmospheric and surface fields, as well as the atmospheric boundary conditions, come from the analysis output of the french numerical weather prediction model AROME-France. A link has been added in the Code & Data availability. A 3DVar data assimilation scheme is used in AROME, however data assimilation is not performed directly in Meso-NH.

Modifications: It is now written in section 2.3 of the manuscript: "The initial conditions for the

atmospheric and surface fields, as well as the atmospheric boundary conditions, come from the analysis output of the french numerical weather prediction model AROME-France (Application of Research to Operations at Mesoscale, Seity et al., 2011), which uses a three-dimensional variational (3DVar, Brousseau et al., 2016) data assimilation scheme and is also coupled with SURFEX. Data assimilation is not performed directly in Meso-NH.”

Moreover, “Numerical simulations have been undertaken on the Belenos HPC facility of Météo-France (Atos Bull Sequana with AMD Rome processors). ” has been added to the Acknowledgment section.

Finally: “Météo-France data such as RADOME observations, and AROME analyses and forecasts are available online at <https://meteo.data.gouv.fr/>” has been added to the Code and Data availability statement.

Section: References

References to papers are written in different styles. Double-check all references. Use the style of this journal. Multiple papers in this section are missing doi's, although these are available by simply searching in the internet.

Answer : OK

Modifications: The references have been harmonized, adapted to the style of the journal and missing DOI's have been added.