

Interactive comment on “Calculating human thermal comfort and thermal stress in the PALM model system 6.0” by Dominik Fröhlich and Andreas Matzarakis

Anonymous Referee #1

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This paper describes the development of the biometeorological module within the PALM modelling system. This new module will provide multiple new and existing applications within the outdoor urban thermal comfort research area. However, this manuscript requires extensive improvements and clarifications before I can recommend it to be accepted in GMD. I have listed my points of concern below in particular order.

1. The description on how mean radiant temperature (T_{mrt}) is derived from each voxel in PALM4U is not described. As this is one of the essential parameters when estimating outdoor thermal comfort this needs to be addressed and discussed. Also, as

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in the results section, Tmrt derived from PALM4U deviates considerably from Rayman/SkyHelios as is used for comparison.

2. The other meteorological parameters needed for the thermal comfort indices (air temperature, humidity, wind speed) should also be described in detailed, and especially how they are used in the biomet module (e.g. what height are they derived from etc.). One follow-up question on this matter is based on a resolution in PALM test case of 2 meters; is the derived values coming from the center of a voxel (i.e. 1 meter height) of the corners (2 meter height)? Please clarify and discuss implications.

3. The authors state that UTCI is not suitable in some cases as the narrow range of valid input values are problematic. I assume this is mainly based on wind speed which has a lower limit of 0.5 m/s. But then comes the question how wind speed is recalculated up to the appropriate height which the regression model for UTCI is based upon, namely 10 meters above ground? Please clarify and justify the treatment of wind speed for UTCI. Furthermore, a “workaround” is mentioned (page 5, line 9). What workaround is this (never heard about this)?

4. IPT included in the methods section is not represented in the results and discussions and conclusions sections. Please insert examples of this or remove from methods or explain why this is not shown.

5. The input parameters in test_urban_p3d used (page 9 and 10) need further explanations. Please include.

6. The test runs are only presented for two occasions (0700 and 1300). What is interesting here is both the spatial variations as currently presented but also the temporal development of the input parameters as well as the resulting thermal indices. The model should be runned for a whole 24 h period so that the temporal variation can be examined and discussed. It is only then that solid conclusions and comparisons with other models can be made.

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7. Page 10, line 23. What program is this referring to? Give more details.
8. Page 10, line 26. I totally disagree that figures 4-6 reveals that the cycle of thermal conditions is well reproduced. This is just 2 points in time and such conclusions cannot be drawn. See bullet point 6.
9. What wind direction and wind speed are used for the runs presented? This makes it hard to interpret the results. I cannot find this information anywhere in the text.
10. Where is the test-case located, Hannover?
11. The results when comparing SkyHelios and PALM4U outputs are confusing. Are the authors stating that the SkyHelios model and Rayman produce accurate results for the input parameters needed (e.g. Tmrt and wind) as well as the calculated thermal indices? This need to be discussed as providing Tmrt and wind are not trivial tasks and has been shown to give large deviations between models and field observations. Please elaborate and possible also include other models for comparison (Envi-met, SOLWEIG etc.) as well as field observations.
12. Why not include the COMFA model for deriving thermal comfort? This is a widely used index outside of Germany and could results in that more people will make use of this biomet module.
13. The clear-sky radiation in PALM seems to have a large effect on e.g. air temperature and Tmrt. Does this includes anisotropic sky irradiance and what levels of direct solar radiation is this clear-sky condition producing as input for the comfort calculations?
14. The PALM4U model results regarding the input parameters needs to be addressed, e.g. the large difference of air temperature (page 12, line 5-7) should be considered as unreasonable. Please discuss.
15. When comparing SkyHelios with PALM4U, please provide difference maps.

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16. Section 3.2 is trivial and should be removed. That result can briefly be mentioned in the beginning of the results. However, it should also be stated that this comparison is made above roof level and is not representing a real street-level case which would probably change the result as surface temperatures etc. should be taken into consideration.

17. Matzarakis is present in more than 50% of the references which result in a way too high level self-referencing. This could undermine this work and not give it the high scientific quality that this work should have. Why not replace some of the references with work from other research groups e.g. Israel, Arizona, Gothenburg, Mainz etc.

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