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Hydrology and Earth System Sciences
Discussions

# *Interactive comment on* "The challenges of an in situ validation of a non-equilibrium model of soil heat and moisture dynamics during fires" *by* William J. Massman

**Anonymous Referee #2**

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This manuscript makes novel and useful contributions toward an improved understanding of how soils are impacted by wildfire. But the contributions are actually much broader than that. This work addresses a number of key issues relevant to general topic of coupled heat and water flow in soils. As such, the work most certainly falls within the scope of Hydrology and Earth System Sciences.

The manuscript is well written, the experimental work is described in sufficient detail, and the changes made to the HMV model are described clearly and with appropriate mathematical notation. The comparisons between the modified HMV model and the experimental data provide sufficient support for the interpretations and conclusions of



this study.

Although this manuscript is in excellent shape, the following issues need to be addressed before this manuscript is in suitable form for publication:

1) The Abstract needs to be revised to include a description of the changes made to the forcing function and the parameterization of the surface energy balance. This is a major component of the study, yet receives no mention in the Abstract.

2) Lines 60-63: It is not clear how the parameterization of the surface energy balance was improved. On lines 243-244 we read that the surface energy balance formulation is slightly different than in previous work, but it is not clear how this "improved" the parameterization of the surface energy balance. This requires clarification.

3) Lines 195-196: It would be appropriate to point out here that this observation differs from what Massman (2012) concluded regarding the effects of infrared radiation on soil thermal conductivity.

4) Lines 533-534: The thermal conductivity model contains no explicit dependency on bulk density, but it does include porosity. Why not incorporate the effect of bulk density on conductivity via the effect it has on porosity, as was done for the WRC, hydraulic function, and the source term? This seems rather odd to me. Is there a reason why such an approach would not (or perhaps did not) work? If so, that certainly needs to be addressed in the text of the manuscript.

Technical corrections:

Line 13: "calibration the sensors" should be "calibration of the sensors"

Line 40: "soil vapor" should be "soil vapor density"

Lines 47: Something is amiss here. Is it possible that (Massman, 2015) should instead be Massman (2015)?

Line 53: Replace equal sign with a comma

Line 227: “stead state” should be “steady state”

Line 228: What does BFD stand for?

Line 236: “define later” should be “defined later”

Line 341: Replace “MEF” with “Manitou Experimental Forest (MEF)”

Line 382: The section number here should be 3.2.2 instead of 3.3. It needs to be a sub-section of 3.2 since it addresses instrumentation.

Line 404: The section number here should be 3.2.3 instead of 3.4. It needs to be a sub-section of 3.2 since it addresses instrumentation.

Lines 452-453: This sentence requires clarification. To understand the context of this statement, it would useful to how much vertical structure in lambda-sub-s is included in the model.

Line 519: “feedbacks occur” should be “feedback that occurs”

Line 589: “overwhelm” should be “overwhelms”

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