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Geoscientific Model Development Discussions

Interactive comment on "StreamFlow 1.0: An extension to the spatially distributed snow model Alpine3D for hydrological modeling and deterministic stream temperature prediction" *by* Aurélien Gallice et al.

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We wish to thank the reviewer for his/her comments and his/her interest in our work. Below are our responses to the points raised by the reviewer. Each original remark of the reviewer is indicated in bold italics and directly followed by our corresponding answer. The modifications brought to the manuscript are indicated in blue.

"Page 2 - Line 25 – The authors mention there is a strong correlation between stream temperature and air temperature. This is true; however, this does not

always imply causation (Johnson, 2003). Recent work has demonstrated how important this fact is in terms of modelling and in understanding stream temperature response to environmental change. It would be useful to expand this discussion within the context of this particular model."

We fully agree with the reviewer that correlation does not imply causation and acknowledge that the original sentence in the manuscript was wrong. We therefore replaced "result in" with "be associated with" in the original phrase "the increase in air temperature is expected to result in globally higher stream temperatures over the year." We however believe that a further discussion of correlation and causation would not be particularly relevant in the present paper which focuses on the presentation of a deterministic model, regardless of the fact that the manuscript is – in our opinion – already very long.

"Page 3 - Paragraph 2 – I am not sure why this paragraph is here. It seems out of place."

Following the reviewer's advice, we entirely removed the paragraph.

"The use of the term 'subsurface runoff' has been applied throughout. This is a strange use of the word runoff given that it typically applies to shallow or overland flow. Perhaps consider using the word 'flow' rather than 'runoff'."

We wish to thank the reviewer for his/her remark. As non-native speakers, it indeed did not occur to us that the use of the term 'subsurface runoff' was strange. We therefore replaced all occurrences of this term with 'subsurface water flux', which actually better describes what we really mean.

"The T_{subw} description is fairly vague. I imagine sub watershed temperature

plays a substantial role in the overall stream energy balance, yet it is not well described. Further explanation is required."

We recognize that the original sentence in which T_{subw} was defined might have lacked some clarity. The new sentence, which we hope is now clearer, reads: "In StreamFlow, the discharge Q_{subw} ($\text{m}^3\,\text{s}^{-1}$) of the subsurface water flux generated by each subwatershed is computed independently from its temperature T_{subw} (K)."

"Overall, the manuscript would greatly benefit from a more formal sensitivity analysis so that the reader can understand how each of the terms used can influence stream temperature in this model."

We agree with the reviewer that a formal sensitivity analysis would be a nice complement to our work. However, in our opinion, this analysis should be the subject of a second paper rather than being inserted in the present manuscript. As a matter of fact, the present manuscript appears to us as already very large. In addition, its main purpose is to describe the components and structure of the model rather than to make an exhaustive assessment of the model characteristics.

"It is not clear how each of the terms is being simulated and what their relative influence on temperature is. For example, the authors suggest that the underestimation of the diurnal temperature pattern is likely due to stream width and depth, or subsurface temperature. There is no discussion of how the influence of the radiative balance (by far the largest term). It's also not clear how hyporheic fluxes play a role. Quantifying these various fluxes and their role in governing stream temperature would be an excellent use of this modelling tool."

We agree with the reviewer that the use of the model to quantify the various heat fluxes would be a nice application. However, as stated above, the present paper is aimed at describing the model components, and not so much at studying stream temperature

dynamics using the model. This is the reason why we decided to submit our manuscript to GMD, which specifically focuses on model descriptions. The model application does, in our opinion, not fit in the present paper and would need to be presented in a separated article.

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