

Report #1

Our replies to the last comments in red.

Submitted on 12 Aug 2025

Anonymous referee #2

Anonymous during peer-review: **Yes** No

Anonymous in acknowledgements of published article: **Yes** No

Checklist for reviewers

1) Scientific Significance

Does the manuscript represent a substantial contribution to scientific progress within the scope of this journal (substantial new concepts, ideas, methods, or data)?

Excellent **Good** Fair Poor

2) Scientific Quality

Are the scientific approach and applied methods valid? Are the results discussed in an appropriate and balanced way (consideration of related work, including appropriate references)?

Excellent **Good** Fair Poor

3) Presentation Quality

Are the scientific results and conclusions presented in a clear, concise, and well structured way (number and quality of figures/tables, appropriate use of English language)?

Excellent Good Fair Poor

For final publication, the manuscript should be
accepted as is

accepted subject to technical corrections

accepted subject to minor revisions

reconsidered after major revisions

rejected

Were a revised manuscript to be sent for another round of reviews:

I would be willing to review the revised manuscript.

I would not be willing to review the revised manuscript.

Suggestions for revision or reasons for rejection

(visible to the public if the article is accepted and published)

The authors replied adequately to most of my comments and I attach a few more comments related to my previous input or the new text, but these should not hinder eventual publication.

Comments:

- My comment on L. 24 was not corrected. Please change to “but also in rivers where...”

Corrected

- L. 499-500: double use of “from”

One deleted

- L. 601-604: These two sentences are a bit unclear and I’m not sure if this in line with the models used. I am not an expert in these models, but as far as I understand, air2stream/water do not explicitly simulate individual heat flux components, but estimate a total heat flux based on air and water temperature (modified by factors such as those described in the sentence before this one). Sentence 603-604 would therefore be a good argument for reliable future predictions, IF this air-water temperature relation is (roughly) maintained in a future climate. If the relative contributions of the heat budget change strongly, this might not be the case; is this what you are trying to say? Please see if you can clarify these sentences.

Section now reads:

The use of semi-empirical models by definition means that some of the physical processes affecting heating are simplified under parameterization and some are directly resolved. The models air2stream and air2water resolve the effect of river depth, discharge, thermal signals from tributaries, inverse stratification in lakes during winter, and seasonal cycles. The heat flux between the atmosphere and surface waters (latent and sensible heat, short and longwave radiation) is not directly resolved by air2stream and air2water. However, indirectly we consider climate related heat budget changes in our method, through the use of high-quality projections of air temperature and discharge as model input. Glacier retreat is included in the hydrological models providing discharge projections to this study (eg. Muelchi et al., 2021), however for temperature this effect is only indirectly considered in air2stream through reduced water availability in summer. The cooling effect on river water caused by meltwater from snow and ice does not change in our method, as snow and ice recede in a future climate it is expected that warming in high altitude rivers is larger than projected in this study. Therefore, if the relationships between discharge and air temperature towards water temperature remain similar in the future, our method can be used to reliably project future river temperatures. Importantly, the lower fidelity water temperature model approach used here combined with high-fidelity climate/hydrological model outputs as input enable the principle of multi-model ensemble, comparison and analysis that is required for robust climate change impact assessments (Duan et al., 2019).

- L. 636-639: The authors still switch between 15 and 16 Alpine stations; in their reply, you mention that station 2462 was left out of some figures, but in these sentences, the difference is still confusing. Please shortly clarify in the text.

It is 16 Alpine Stations. Manuscript has been corrected and notation for Figure 4, 6, 7 improved to enhance clarity.