

## ***Interactive comment on “Can riparian vegetation shade mitigate the expected rise in stream temperatures during heat waves in a pre-alpine river?” by H. Trimmel et al.***

### **Anonymous Referee #1**

Received and published: 28 July 2016

#### General comments:

This paper looks at different forest canopy (no vegetation, maximum vegetation and actual vegetation) on river water temperatures within a 49 km reach of the Pinka River (Austria). A 5-day heat wave period was studied under observed condition (2013), and under climate change (three different periods; 2016-2045, 2036-2065 and 2071-2100). In general, this paper was difficult to read and review because it lacked focus and a clear explanation of the research actually carried out. The objectives of study were not clearly presented; this was a climate change type study (and the title should have reflected this). A lot of results and discussion material focused around a model which was not described within the present study. As such, this aspect was not evaluated.

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Nevertheless, authors presented R2, RMSE and model uncertainties, etc., which was somewhat confusing to the reviewer. The heat fluxes presented in this study were all positive, (section 3.1) which is clearly not the case in reality (not sure how authors could model river temperatures with such fluxes). The result section was difficult to follow, as authors presented both results from the present study and results from Trimmel et al. (2016). The text was almost presented as a part 2 of that paper, so reviewer was not always able to follow in the results presented were from this study or from the previous study. The results section also contained discussion material, and then separate discussion section was also presented. Finally, the reviewer is not sure of the scientific novel contribution which this present brings.

#### Specific comments:

Pg. 1, line 13-14: “and turbulent energy fluxes analysed”. Not clear, something is missing here.

Pg. 1, line 14: “Minor stream water temperature increases are modelled within”. Authors are presenting result in the present tense; it should be in the past tense. This applies throughout the document.

Pg. 1, line 14-15: “Minor stream water temperature increases are modelled within the first half of the century, but a more significant increase is predicted for the period 2071–2100”. Sentence which is not saying anything, please be more specific.

Pg. 1, line 16: “to be in the region of 3 °C”. In the range of 3°C?

Pg. 1, line 16: “Additional riparian vegetation”. Not clear how this will be accomplished, regrowth, re-vegetation, etc., please clarify.

Pg. 2, line 4: “riparian ecosystems play a superior role in climate change”. Riparian ecosystem plays a superior role in climate change to what?

Pg. 2, line 11: “21st century are nearly certain”. Not sure about this level of certainty.

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Pg. 2, line 19: "winter half-year". Not sure about the meaning of this term winter half-year, please clarify.

Pg. 2, line 23: "Long term increases of wind speeds or storm activity cannot be detected." Not clear.

Pg. 2, line 26: "dominant energy input causing diurnal fluctuations". Energy inputs are contributing to both diel and seasonal water temperature variability.

Pg. 3, line 1: "Since 1980 Austrian river temperatures have increased on average by 1.5 °C during". Here I would be more specific, one, XX or all Austrian rivers.

Pg. 3, line 6: "affect discharge volume and velocity". I would delete velocity, as it is implied.

Pg. 3, line 10-12: The information related to changes in sediment transport and climate change is not important, unless authors are implying that it has an impact on water temperatures, and clearly this study is not addressing this.

Pg. 3, line 33: "microthermal gradients in the river profile". Not clear.

Pg. 4, line 16-24: Too many vague statements within this paragraph. Be more specific, how many sites within the Pinka River, which regional climate scenarios?

Pg. 4, line 26-32: No need to describe the upcoming sections. Delete this whole section.

Pg. 5, line 9-10: "In this region the highest temperature increases and the largest precipitation reductions in Austria have been observed (Böhm et al. 2009)." Be more specific, by how much?

Pg. 5, line 30-33: "The average difference in stream temperature between no vegetation and maximum vegetation during the maximum heat wave of 2013 was calculated to be 3.81 °C by Trimmel et al. (2016)". Here the reviewer is confused, results from the present study are being reported or this analysis has been carried out before, not

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clear.

Pg. 6, line 1-6: This information does not belong here. This information should have been presented in the introduction or in the discussion section.

Pg. 6, line 7-9: Is this what is new in the present study compared to Trimmel et al. (2016), i.e., studying a reach of 49 km rather 22.5 km?

Pg. 6, line 27-28: "These comparisons showed a high consistency, so the INCA data set was used". Vague statement, please be more specific and quantitative.

Pg. 7, line 11: "Stream temperature and flow volume were used as upstream boundary condition". Authors should use the term discharge or river discharge, rather than flow volume.

Pg. 7, line 17-20: It would be better if authors would have presented root mean square errors (RMSE) rather the R2, or presenting both, as the R2 is not very informative on a model's performance. Also, not sure about the reported RMSE of 0.08 (°C? maybe). If it is an RMSE of 0.08°C, it does not fit with R2 values of 0.92 to 0.96.

Pg. 7, line 22: "The substrate temperature was initialized with the upstream model boundary temperature". Not clear about the substrate temperatures, where and at which depth?

Pg. 7, line 27: "Tributaries are defined by their water temperature and discharge values." Vague statement. Were they measured and then used in the model?

Pg. 7, line 28-29: Not exactly clear on what the boundary station means.

Pg. 8, line 9-10: Information presented within these two lines and related to the climate change aspect of this study should have been clearly stated in the introduction.

Pg. 8, line 26-27: "The most important influences of atmospheric energy fluxes and vegetation shade on stream temperatures are depicted in Fig. 2.". There is an issue with this figure, as three different vegetation scenarios were presented in Figure 2a

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and only one heat flux scenario is presented in Figure 2b. Also, all heat fluxes presented in Figure 2b are positive, which is not possible. Generally, some fluxes will be positive (incoming shortwave radiation); however, other will be negative (longwave radiation/evaporative flux), while sensible heat, for instance, will be both positive and negative.

Pg. 9, line 1-11: All reported fluxes are positive within this paragraph (see comment above). How can authors have possibly fitted river temperatures, with such fluxes?

Pg. 9, line 13-14: "This leads to a rapid increase in the water temperature of the cool spring water." Authors do not have the data to support such statement.

Pg. 9, line 32-33: "Future boundary water temperature increases by the end of the century by up to 4.1 °C (Table 2)". Not clear.

Pg. 10, line 9-10: "The stream temperatures increase from the upstream model boundary at DFS 13 to DFS 62 during the 2013 heat wave event was about 7 °C (Fig. 2)". Was the water temperature increase due to tributary inflows (with different water temperatures) or due to the surrounding meteorological conditions (most likely tributary inflow)?

Pg. 10, line 14-15: Not sure why water temperature would drop from 25.0°C to 24.8°C (middle period) when the climate is warming from 22.4°C to 22.6°C.

Pg. 11, line 5: "additional vegetation becomes more distinct in the downstream sections". Not clear about additional vegetation, please clarify.

Pg. 11, line 12-32: This whole section on model uncertainties does not seem to belong in this paper. How can a reviewer assess a model uncertainties when no information was presented on the model?

Pg. 11, line 30-32: "overhang caused changes in water temperature of +/-0.40 °C, +0.44 /-0.46 °C and +0.01 /-0.05 °C respectively". It is at times difficult for the reviewer to understand which data come from the present study or Trimmel et al. (2016).

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Authors should remember that this section is the results section and most of the information presented here seems to be discussion material.

Pg. 12, line 12-13: "As the air–water temperature difference – unlike the absolute temperature level – is not expected to increase, no increase in sensible heat flux can be predicted.". Not sure what authors mean, please clarify.

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