

In Beaufort *et al.* the authors compiled stream temperature data for the entirety of France and Corsica, calculated an ecologically relevant summarizing metric (“the thermal peak”), and compared predictive models and an air proxy to determine the best model structure and predictor variables for extrapolating the thermal peak metric to all rivers in France/Corsica. Although the work done within is a valuable contribution, the manuscript would be improved by (1) altering the climate-change framing of the paper, (2) including a specific question or hypothesis, and (3) increasing specificity and clarity of the presentation. Regarding the first point, the paper frames the research as important for understanding stream thermal regimes under climate change. However, the authors calculate a metric which does not help us understand how climate change alters stream temperatures. This is a major issue. Additionally, there lacks a clear question or hypothesis in the introduction – another major issue.

(1) Comments regarding emphasis on climate change:

The introduction leads me to think that the authors would be explaining how stream temperature is changing in France/Corsica as a result of climate change. For example, see:

Line 36-37: “However, the magnitude and direction of these expected changes will depend strongly on patterns of stream temperature change”

Line 38: “Hence it is critical to describe and analyze the spatiotemporal variability of river thermal regimes.”

Line 71-74: “Indeed, stream temperature metrics that focus on extreme periods [...] are likely adequate to understand trends of increasing pressures on aquatic ecosystems.”

And in the Methods:

Line 102-103: “To address ecologically meaningful temperature metrics under climate change, we focused on the two hottest stream temperature months, ...”

However, the metric the authors calculate does not describe temporal stream temperature changes. The described calculation of the thermal peak is an average of peak temperature across years for each logging station. The metric is thus only useful for understanding the spatial pattern of the thermal peak across France/Corsica for the years in this study. Although the compiled database itself may be a useful source for studies on climate change, the thermal peak metric calculated in this study does not describe changes in stream temperature through time. Indeed, the authors even admit to this shortcoming in the discussion:

Line 315-316: “The downside of the current approach is that it remains based on interannual metrics. Indeed, the non-concomitance of the time series does not allow us to compare extreme years (hot vs. cold).”

More emphasis should be put on the thermal peak being a good comparison metric for rivers across space and may help managers understand which rivers currently exceed thermal tolerances of important biota.

(2) Comments regarding lack of question/hypothesis:

- a. An objective is stated in the introduction (Line 73-74) but no specific question, hypothesis or prediction is explained. This left me wondering throughout the paper what the purpose of the research was. What questions motivated this research? What did you expect to learn from research at hand? What do you expect the thermal peak tell us about rivers in France/Corsica?
- b. Section 4.3 of the discussion aims to attach meaning to the most important explanatory variables across each model. There was no hypothesis about which explanatory variables were thought to be the most important predictors, therefore it seems the authors are fishing for an explanation without having a clear question, hypothesis or prediction about these explanatory variables. Since the author's purpose for making these models was to predict the thermal peak across all rivers of France/Corsica, it is inappropriate to interpret the explanatory variables in this way.

(3) Comments regarding improvements on clarity and specificity:

- a. Line 88, sentence starting with "Hence, our main challenge was to pool...": This sentence was difficult to understand. Improve with a more thorough explanation, possibly breaking up this sentence into multiple.
- b. Line 99, "data were ... averaged into mean daily stream temperature data". Do you mean "daily mean" here? It is unclear if it is meant to be the mean daily temperature (averaged across years for a particular day) or the daily mean temperature (average temperature of a specific date).
- c. Line 100, "(1) hourly  $T_w$  anomalies". If  $T_w$  is defined as the daily mean temperature, how can you see *hourly* anomalies if there is one mean temperature per day? May need to define another variable to use here.
- d. Line 101, " $T_{air}$ ": Need to define this variable because it is the first time it is used.
- e. Section 2.2, first paragraph. Why hold back on defining the "simple metric" within the first sentence? It is odd to hold back on defining the metric and then reveal the big mystery of what the metric is.
- f. Section 2.2, second paragraph.  $\overline{T_{w,30}}$  is defined as the "mean temperature of the 30 hottest consecutive days of each year". However, the data have already be constrained to July and August. How can you be sure that the 30 hottest consecutive days occur completely within the window between July 1 and August 31? In the last sentence you conclude that the hottest day of the year always occurred between July 28 and August 30. This implies that for the temperature time-series in which August 30<sup>th</sup> is the hottest day of the year, the 30 hottest consecutive days would include days in September. So,  $\overline{T_{w,30}}$  should be re-defined in the paper as the mean temperature of the 30 hottest consecutive days in July and August. Be more specific about defining  $\overline{T_{w,30}}$ .
- g. Line 164, "SAFRAN data". Define what this data is.
- h. Line 198, "... all possible variables." Very broad. More specificity would be helpful, such as "all possible variables characterized in Table 2."
- i. Line 236-238, "This bias ... in the regressions." These sentences are difficult to understand. Be more specific to improve clarity. The ending of one sentence is "...with

only one year of observation.”, and the next sentence begins, “In contrast, when there is only one year available...”. These aren’t contrasting clauses, thus making it difficult to understand what is being contrasted.

- j. Sentence starting on line 260, ending line 263, “The two most relevant...”. Break into 2 sentences to improve clarity.
- k. Line 281: use of 14°C. Explain why 14°C important and why this value chosen as a cut-off point.
- l. Figure 6C. Figure 6c shows probability distributions for extrapolated thermal peak. Firstly, the bins are not of equal size: the first bin (labeled <14) includes all temperatures between 6.3 (minimum temperature reported on line 277) and 14, a range of 7.7 degrees; the second through fifth bin have ranges of 3 degrees; and the final bin includes temperatures from 22 to 27, a range of 5 degrees. The 14- and 22-degree cut-off is not explained and thus seems arbitrary. Secondly, since temperature is continuous, it shouldn’t be binned in this way, unless for some specific reason. Continuous distributions should be portrayed as “probability density functions”. Each model would then have a continuous distribution, and each can be plotted on the same graph for comparison.
- m. Line 301, first sentence in discussion. Be more specific about the timeframe of the dataset: “the largest, regional *summertime* stream temperature datasets”
- n. Line 326. Which “metrics based on observations”, specifically, are you comparing to estimates of  $T_p$ ?
- o. Line 328. Further explain what is meant by “when applied at scale”. How does that relate to figure 6B?
- p. Line 352: “Higher minimum flows” would make more sense than “Larger minimum flows”
- q. Line 354: Change “greater” to “more”. “Great” implies a quality of shade and not a quantity. “More” implies a quantity.

#### (4) Technical Corrections

- a. Line 21: Use of “However” does not belong because this sentence doesn’t relate to previous
- b. Line 27: “..., ~~and~~ decomposition rates, ~~and~~ dictates animal ... “
- c. Line 33: “and levels” is repetitious with flows
- d. Line 96: “... were previously...” change to “have been”. “were previously” implies that a different study excluded these data. If that is the case, cite that study.
- e. Line 155: “is not clear” should be “was not clear”
- f. Line 221, equation 7: regression coefficient “a” is in the equation twice and “c” is missing.
- g. Line 229: “cross-validation ~~this~~ 100 times”
- h. Line 321: insert “between” between “correlation” and “ $T_{air}$ ”
- i. Line 325: remove “particularly”
- j. Line 326: remove “a robust interannual metric”. Only need to say “... sufficient to estimate  $T_p$ ”

- k. Line 329: change “to” to “of” in “climate corrections to temperature metrics”
- l. Line 352: change “following” to “followed”
- m. Line 373: change “representativeness” to “representation”