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Interactive Comment

Interactive comment on "Importance of stream temperature to climate change impact on water quality" *by* A. Ducharne

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First of all, the author wishes to thank the referee for his insightful comments, which were useful to improve the manuscript. A detailed answer is provided below.

This paper is a valuable contribution to the climate change impact on impacted river basins and can be accepted in HESSD as such but it could be improved if the authors could:

- (table 1) : Explain why the biases of the linear relationships between water temperature on the one hand and the lagged moving average of air temperature on the other hand for different Strahler stream orders are always negative.

ANSWER: This bias is negative in 87 stations over 88, always between 0 and -0.56°C.

In the remaining one, the bias is 0.0002°C. I agree that this result raises questions, and I first started to carefully check all the calculations. They are correct. After close examination of all the relationships between water temperature WT and lagged air temperature AT, the explanation that seems the most likely to me is that the above biases result from a departure of the WT-AT relationships from the straight line, as developed in the following text, added in section 5.2: "Biases are always negative and range between -0.56 and 0°C, with a mean of -0.18°C over the 88 couples of AT-WT stations. These biases can probably be attributed to departures from linearity of the actual relationship between WT and lagged AT. As shown by Mohseni et al. (1998), this relationship is generally S-shaped, with variations of WT that are slower than the ones of lagged AT at the two bounds of the temperature range. In particular, WT decreases less that lagged AT at low temperatures, as water freezing prevents WT from dropping below 0°C. In such a case, Eq. (1) underestimates WT, which can induce a negative bias. This behaviour is noticeable in some of the studied stations, and it might exist in all of them even if not clearly detectable within the noise of the relationship. The other departure from linearity, at high temperatures, conversely induces an overestimation of WT as predicted from Eq. (1), but this behaviour was not found in the Seine river basin, probably because it did not experience warm enough conditions during the analysed period.

The selected linear relationship is thus a satisfactory approximation of the actual S-shaped relationship if the temperature range is reduced enough to prevent the above inflexions from being significant, which is true of most stations in our case study. An implication of this choice for linearity is a loss of accuracy at the extreme bounds of the temperature range, even if compensation can arise in terms of bias between overestimated high temperatures and underestimated low temperatures. In the Seine River basin, however, the latter underestimation is dominant, which certainly explains a large part of the negative biases. Another possible explanation is related to thermal pollution, which can increase observed WT over the entire temperature range, and which certainly exists in the Seine River basin, especially at low Strahler orders, the most

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impacted by urbanization and industrialization. "

- Page 2438: equation 1: define the index "i"

ANSWER: The index i is defined above equation 1 (p2428, L1). It designates the Strahler stream order. Emphasis is added as follows: "with parameters (slope a, y-intercept b, and lag L) that depend on Strahler stream order, designated by the index i:"

Cited references

Mohseni, O., Stefan, H.G., and Erickson, T.R.: A non linear regression model for weekly stream temperatures, Water Resources Research, 10, 2685-2692, 1998.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 4, 2425, 2007.