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Influence of climate change and morphological heterogeneity on the temperature of rivers: high resolution modeling(T-NET model) and application to the Loire basin

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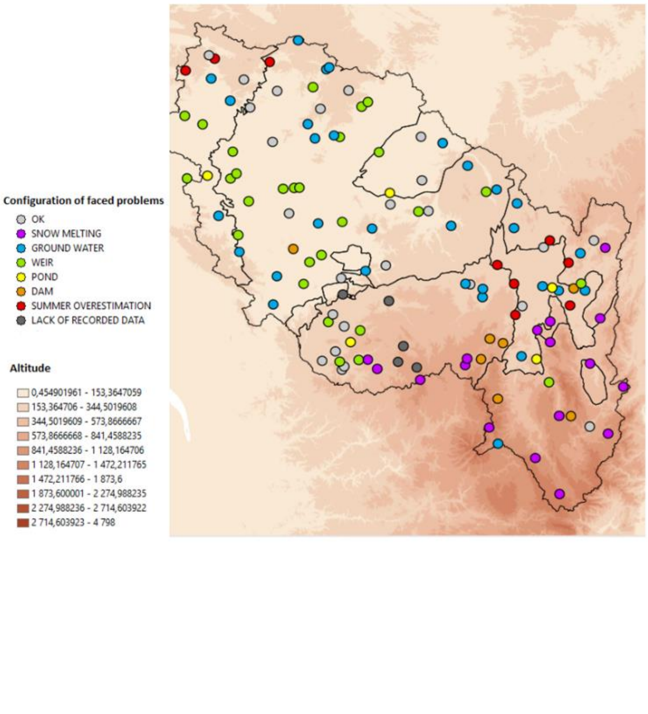
The thermal regime of streams is the mainstay of preserving water quality and sustaining the health of aquatic ecosystems. These regimes inevitably fall under the significant influence of anthropogenic activities that give rise to climate change. Some efforts have already been put into the evaluation of the impacts of climate change on the distribution of different fish species at the regional scale, by considering air temperature as a proxy for stream temperature mainly due to the lack of access to sufficient recorded thermal data. In reality, air temperature is not the only factor that influence thermal regimes of streams. The role of other determinants such as vegetation cover, geomorphology and groundwater inputs (and their interaction with air temperature) in shaping a thermal regime have to be investigated as well.

The present study has employed a coupled semi-distributed hydrological model and a physically based thermal model, T-NET (Temperature-NETwork), to simulate discharge and water temperature at the regional scale within Loire basin in France. The depth and width of each reach is calculated by ESTIMKART model. Comparison of simulated thermal regime with observations is done by different metrics (such as magnitude, frequency, duration and timing of changes in temperature). In the first try, A. Beaufort et al (2016) has assessed the performance of this model for 128 stations in terms of bias on the whole study period, from 2008-2012. In continue, we surveyed the seasonal bias of the model on the same period. The exact sources of biases have been recognized based on the knowing that the model is not capable of capturing the anthropogenic effects such as dams, ponds and weirs. In this configuration, we were facing to stations with not knowing the exact reason of the bias. As a result, we did field study to not only find out the source of these biases and local effects but also decide about the proper places for putting loggers of water temperature. On the other hand, applying some modifications in the model is needed to capture better the influences of the other factors such as snow melting, vegetation cover and ground water inputs. This step will be done after analyzing spatial and temporal variability of simulated water temperature at the location of more stations, around 250, scattered on the whole study area for recent years 2009-2018.

In the next step, the impact of climate change by climatic and hydrological projections based on several scenarios (downscaled Euro-cordex projections, Météo France) will be studied.



Configuration of faced problems in each 128 stations

Presence of macrophytes in one the locations of field study. If the loggers are located close to it, the observed water temperature will be very lower than the other parts of the stream.

The location of present (128) and new (around 250) stations

Refrences:

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