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Quantifying the change in water temperature in Switzerland during the last 60 years

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Water temperature is a crucial parameter of ecosystem and water quality in river systems. It directly influences the fauna and flora along with biogeochemical cycles. In a warmer climate, river water temperature is generally assumed to increase due to the change of the energy budget but also to anticipated streamflow reductions during summer months (low base flow, droughts). The amplitude of these changes is however hard to quantify given the complexity of the system and the natural climate variability. In addition, many anthropogenic activities (hydropower plants, river correction and lake regulation) significantly impact river systems and associated water temperatures.

In the present study, we propose a countrywide historical analysis of water temperature in Switzerland. The data set is composed of more than 50 gauging stations measuring water temperature and discharge. The oldest temperature records, dating back to 1960, enable a long-term and robust trend analysis. The stations, covering all climatic conditions from lowland to mid-altitude and alpine catchments, are clustered into coherent entities based on their hydrological regime (snow or ice vs rain-dominated, natural vs disturbed discharge). Thanks to a seasonal-trend decomposition (STL), we show how climate change differently impacts the various types of rivers. Additionally, a joint analysis of water temperature and discharge highlights an annual hysteresis. This feature varies not only according to the regime type but also in time because of ongoing climate change. Such data set is quite unique for water temperature and can serve as a base for future analysis.