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Conference Abstract

Water Temperatures Across All Compartments of the Critical Zone in the Context of Global Change: Application to the Seine Hydrosystem

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Abstract

Temperature is a critical factor at the interface between water and energy stakeholders. It plays a vital role in enabling them to sustain and develop their activities without competing for resources, particularly during periods of crisis. Both surface water bodies and subsurface compartments (<200 m), essential for maintaining aquatic ecosystems and supporting human adaptation to global changes, are utilized for a range of purposes. These include low-impact thermal energy production (e.g., river uses and shallow geothermal energy), drinking water supply, irrigation, and industrial applications. However, these diverse uses by water and energy stakeholders, along with their associated infrastructures, lead to thermal interferences. These interferences are

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superimposed on broader climatic variations and trends, further complicating resource management.

In the Seine basin, observed trends are projected to persist and intensify. These include rising average temperatures, decreasing summer rainfall, and the increasing frequency and severity of extreme events such as floods, droughts, and heatwaves. The sustainable management of water resources will hinge on our collective ability to anticipate and mitigate the effects of these changes.

To better predict the Seine basin’s responses to climate change, it is crucial to deepen our understanding of heat transfers between the atmosphere and the various compartments of the hydrosystem. This knowledge will be key to developing strategies that balance the needs of all stakeholders while preserving vital ecosystems and ensuring resilience against global change.

In this presentation, we will present data collection, the development of numerical tools, and the evaluation of the evolution of the Seine's temperatures over 100 years. Physical models and simulations help quantify thermal fluxes, highlighting the main sources of heat input and heat losses. The use of machine learning models in projecting the Seine's temperatures in Paris by 2100 adds a predictive dimension. Future developments to achieve modeling that allow us to produce numerical simulations necessary for the integrated management of surface and groundwater in quantitative, qualitative, and thermal terms will be presented.

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Presented at

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Conflicts of interest

The authors have declared that no competing interests exist.