

PhD proposal at University of Tours

River temperature modeling at regional scale: application for rivers with contrasted hydrological regimes

Research laboratory: Continental Géo-Hydrosystems (www.geosciences.univ-tours.fr)

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Proposed project

River water temperature is a primary variable in driving ecosystems functioning and of major importance in many socio-economic activities. River water temperature is also highly sensitive to natural environmental factors and human impacts. However, there is no information about river water temperature variations at regional and national levels where management decisions are taken, because of the lack of regular and continuous monitoring. The objective of this PhD is to improve the knowledge of the spatial variability metrics of river temperatures across France by improving and implementing a physical and regional model.

A physical model based on the energy balance, was recently developed in our laboratory and applied to the Loire River basin (110 000 km²). It includes exchanges at the water-atmosphere and water-groundwater interfaces using a network topology and a fine discretization across the river network. The model was developed in a compiled (C++) language for use in parallel computing to accelerate computation time. Despite the good performance simulations for large rivers, it still needs to be improved, especially for smaller drainage basins i.e. <1000 km².

The thesis work will consist of further development, testing and applications of the model to: 1) improve the parameterization of groundwater-river interactions and vegetations 2) include the snow melting processes for mountain rivers; 3) include the influence of water temperature in reservoirs and slope disruptions. The temporal dynamic of the simulated water temperature will be tested on hourly data from the thermal national monitoring network established by ONEMA in 2008. The capability of the model to simulate spatial discontinuities in thermal regime will be tested with in situ thermal infrared imaging and fiber optics.

Once the model is validated on contrasted catchments, it will be used to reconstruct thermal regimes across France under current conditions and to forecast future river water thermal regimes under climate change scenarios.

PhD candidate will have a master degree in hydrology, hydrogeology, or environmental sciences with a particular focus on physics and numerical modelling or similar discipline.

The position is for 3 years with a yearly remuneration of 18 000 €. Application is open to any nationality.

Send a CV, motivation letter and references before 1st December 2014