Project acronym: EMPTY

# Project title: Microscale impacts of groundwater/hyporheic upwelling on stream temperature under varying discharges

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Discipline: Earth Sciences & Environment

Station(s): Svartberget Research Station (Sweden)

Arctic river temperatures are expected to warm substantially under future climate change. This will have an adverse effect on temperature-sensitive organisms that inhabit these ecosystems. Despite this concern, some rivers contain strong thermal habitat heterogeneity (the presence of alternating warm-cool zones) which will help to protect biota from high temperature extremes. Although groundwater (GW) or hyporheic processes are known to be responsible in part for driving this temperature heterogeneity, little is currently known about how GW/hyporheic exchanges influence river temperature patterns at the microhabitat scales used by keystone freshwater species (eg. salmonids). There is therefore an urgent need for more research into this topic. We propose a multi-technique approach combining thermal infrared imagery, distributed temperature sensing (DTS), and tracer injections to determine the role of GW/hyporheic exchanges in driving micro-scale river temperature heterogeneity.

Our project has four key objectives. First, we will use DTS observations and tracer injection experiments to identify the location and magnitude of GW/hyporheic upwellings in a 1.4 km stream reach in the Krycklan Catchment, Svartberget Research Station. Next, we will use thermal infrared imaging to characterise how these GW/hyporheic exchanges influence patterns of water temperature heterogeneity. These experiments will be repeated at a range of different flood pulses released into the stream from a v-notch weir in order to determine the impact of different hydrometric regimes on the stream temperature response. Finally, we will use a deterministic temperature model to understand the energy transfers by which the GW/hyporheic upwellings induce temperature heterogeneity.