The McIntyre Creek Hydrology Research Project: First annual report (2020-2021)

In the fall of 2020, the YukonU Research Centre (YRC) initiated a hydrology education and research project below Yukon University Ayamdigut Campus. The objective of the project is to support scientific education and training, to improve our knowledge about cold regions hydrology, as well as to answer specific questions related to the McIntyre Creek (Chasàn Chùa) channel and watershed.

During the first hydrological year of the project (from Oct. 1, 2020 to Sept 30, 2021), portions of the Creek were characterized, water quality and quantity parameters were monitored (temperature, conductivity, levels, ice coverage), and discussions were initiated with different right holders and stakeholders about their interests in the Creek. This document aims at presenting a few concepts as well as some results and their meaning from different perspectives.

Aquatic habitats, like those found along the various segments of McIntyre Creek, are defined by several interacting parameters that are evolving throughout the year within a specific range. Figure 1 represents the complex interactions taking place in the McIntyre Creek watershed.

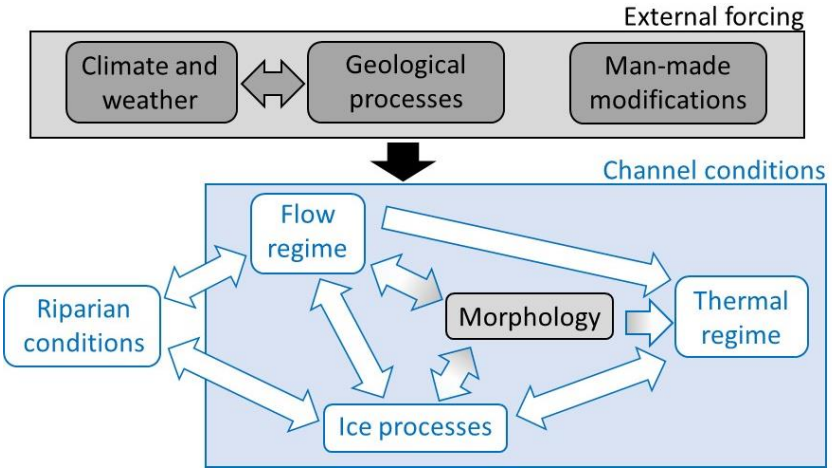
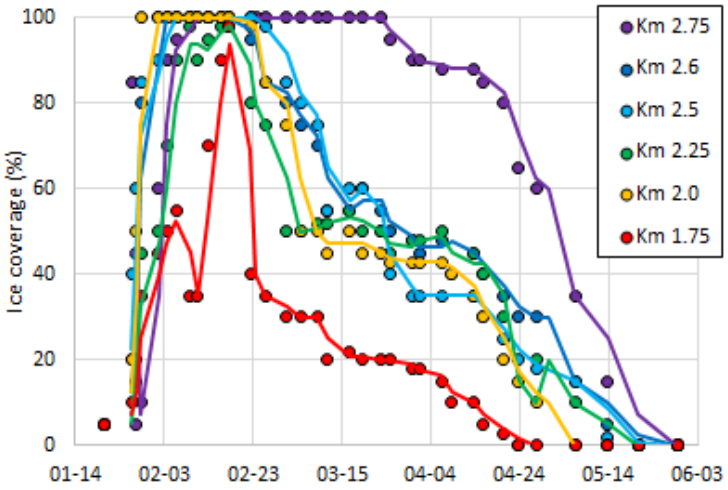


Figure 1. Diagram presenting interacting parameters that influence and define a stream channel

The annual hydrological year begins with early winter conditions, when the water temperature cools down to 0°C and ice production begins. This transition involves ice production that has a profound impact on aquatic conditions. Figure 2 shows a picture of an anchor ice dam that was holding more than one metre of water, generating overbank flooding. The size of these ice dams generally depends on local morphological conditions as well as on the duration and intensity of early-winter cold spells, but in McIntyre Creek, high winter discharges caused by flow regulation also have an impact on their formation and breaching cycles. This will be documented in more detail during subsequent winters using water level loggers and cameras.

Figure 2. Ice dam observed in January 2021 downstream of the second pedestrian bridge crossing McIntyre Creek (referred to as Km 2.75, a creek distance measured downstream from the Alaska Highway).

In winter, the channel ice coverage increases downstream along the studied reach below the Ayamdigut Campus (Figure 3). This mainly depends on local heat fluxes and morphological conditions, but it is also influenced by flow conditions and riparian vegetation (Figure 1). At some locations (e.g., Km 1.75), the formation of stationary ice only occurs during the coldest weeks, revealing complex heat fluxes.



The spring freshet is mostly absorbed by the Fish Lake hydroelectric system and laminated by the wetland complex of East McIntyre Creek (the original, pre-regulation watershed). This means that the spring flow (and water levels, Figure 4) is relatively low despite significant snowmelt, and that summer rain events generally do not produce large runoff events. Stable seasonal flow conditions combined with high winter water levels create unique habitat conditions that will be documented in more detail during future hydrological years.

Figure 3. Ice coverage along McIntyre Creek during the second part of winter 2020-2021 and into the spring between the upstream (Km 1.75) and the downstream (Km 2.75) pedestrian bridges.

The water temperature during winter months is close to 0°C at all sites. During the spring and summer, water temperatures are responsive to air temperatures (Figure 5), are generally above 8°C, and can be as high as 25°C.

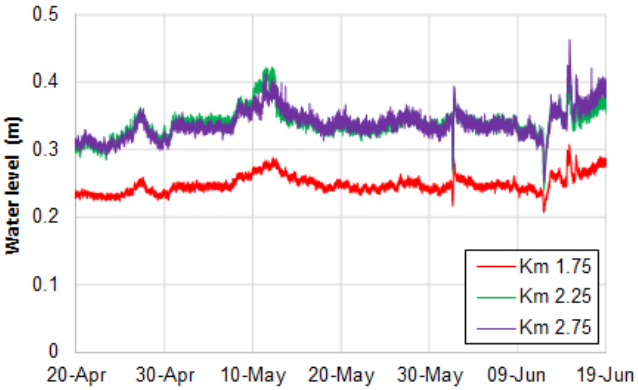
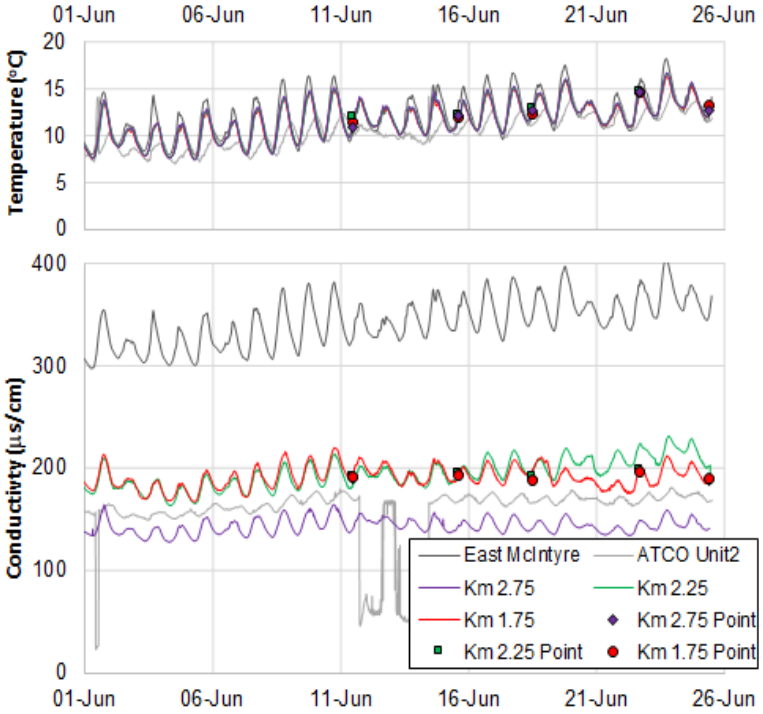


Figure 4. Continuous (10-minute intervals) water levels measured at 3 locations along McIntyre Creek during the spring and early summer of 2021.



Water conductivity, an indicator of dissolved minerals, is much higher in East McIntire Creek than in the Fish Lake system (Figure 5), a reality that seems to apply year-round. This difference may influence aquatic life in the watershed.

The project has received the support of the Scholarly Activity Grant in 2020-2021. During the 2021-2022 hydrological year, more instruments will be deployed, research plans will be developed to answer specific questions from partners, and the education mission of the project will reach a new level.

Figure 5. Continuous summer water temperature (above) and conductivity (below) data sets obtained from 5 different sites along McIntyre Creek.