Geophysical Research Abstracts
Vol. 19, EGU2017-19299, 2017
EGU General Assembly 2017

Flow structure at an ice-covered river confluence

Nancy Martel (1), Pascale Biron (2), and Thomas Buffin-Bélanger (1)

(1) Département de biologie, chimie et géographie, Université du Québec à Rimouski, Québec, Canada (Nancy.Martel@uqar.ca, thomas_buffin-belanger@uqar.ca), (2) Department of Geography, Planning and Environment, Concordia University, Québec, Canada (pascale.biron@concordia.ca)

River confluences are known to exhibit complex relationships between flow structure, sediment transport and bed-form development. Flow structure at these sites is influenced by the junction angle, the momentum flux ratio (Mr) and bed morphology. In cold regions where an ice cover is present for most of the winter period, the flow structure is also likely affected by the roughness effect of the ice. However, very few studies have examined the impact of an ice cover on the flow structure at a confluence. The aims of this study are (1) to describe the evolution of an ice cover at a river confluence and (2) to characterize and compare the flow structure at a river confluence with and without an ice cover. The field site is a medium-sized confluence (around 40 m wide) between the Mit is and Neigette Rivers in the Bas-Saint-Laurent region, Quebec (Canada). The confluence was selected because a thick ice cover is present for most of the winter allowing for safe field work. Two winter field campaigns were conducted in 2015 and 2016 to obtain ice cover measurements in addition to hydraulic and morphological measurements. Daily monitoring of the evolution of the ice cover was made with a Reconyx camera. Velocity profiles were collected with an acoustic Doppler current profiler (ADCP) to reconstruct the three-dimensional flow structure. Time series of photographs allow the evolution of the ice cover to be mapped, linking the processes leading to the formation of the primary ice cover for each year. The time series suggests that these processes are closely related with both confluence flow zones and hydro-climatic conditions. Results on the thickness of the ice cover from in situ measurements reveal that the ice thickness tends to be thinner at the center of the confluence where high turbulent exchanges take place. Velocity measurements reveal that the ice cover affects velocity profiles by moving the highest velocities towards the center of the profiles. A spatio-temporal conceptual model is presented to illustrate the main differences on the three-dimensional flow structure at the river confluence with and without the ice cover.