

---

**The effects of thaw lake drainage on Arctic  
river channel morphology, Yukon coastal plain,  
western Canadian Arctic**

---

LAWRENCE PLUG AND DAVID GARDNER  
*Life Sciences Centre, Dalhousie University, Halifax, NS,  
B3H 4J1 <lplug@dal.ca> <dwgardne@dal.ca>*

We hypothesize that the morphology and evolution of low-order stream channels in lowland permafrost regions are principally shaped by short-lived, massive floods that occur when thaw lakes drain. Thaw lakes, which form by thawing and collapse of ice-rich frozen ground, are known to drain into either other lakes or river channels and tributaries. The imprint of thousands of drained basins on these landscapes underscores the possible importance of these events to stream channels. However, the influence of floods on channel and valley morphology has been poorly investigated to date. To investigate these effects we use dual frequency differential GPS measurements (accurate to within  $\pm 5$  cm) of valley morphology from lower order channels of the Running River drainage basin, Yukon Coastal Plain, Canada. The Coastal Plain is characterized by continuous permafrost (MAAT =  $-9.9^{\circ}\text{C}$ ), and extensive thaw lake development. A flood from a recently drained thaw lake with water volume of approximately  $27 \times 10^6 \text{ m}^3$ , incised an approximately 10 m deep and by up to 18 m wide and 300 m long channel. In comparison, maximum limit of flood volume from spring melt is approximately  $3 \times 10^5 \text{ m}^3$ , assuming instantaneous melt of average snow pack in the entire drainage basin. Using maximum snow depth from 50 year record available, flood volume is approximately  $6 \times 10^5 \text{ m}^3$ , still far below thaw lake flood volume. GPS measurements also show large flood terraces on Grayling Creek, a tributary to the Running River. Sedimentary sections in flood terraces reveal numerous series of flood deposits of Holocene age. Massively over-fit river valleys are unlikely to have been incised by the small amount of precipitation and melt water runoff that occur in the dry climate of the western Arctic. Thaw lake drainage has a large affect on river channel morphology and acts as a primary architect in shaping low order Arctic rivers and landscapes.

---

---