Developing stream network topologies for the Yukon and Kuskokwim rivers

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Project Period: June 1, 2016 – June 30, 2018

Abstract:

A central challenge to developing a comprehensive understanding of the river systems of the Arctic-Yukon-Kuskokwim (AYK) region, and the natural resources they support, is a robust analytical framework that accounts for and takes advantage of the spatial connectivity of rivers. The basis of such a framework is a topologically correct stream network, which explicitly defines the multi-dimensional spatial relationships of dendritic river networks, such as longitudinal connectivity, branching networks of streams, and abrupt changes at tributary confluences. In the last five years, a new class of powerful geostatistical models have been developed for river systems – spatial stream network models (SSNMs). Enabling the application of such a framework throughout the AYK region would pave the way for substantial advances in the research and management of this region's natural resources, including Chinook salmon. However, there are few clean stream network topologies compatible with SSNMs in Alaska – especially in the AYK region. The central objective of this project is to perform the spatial data syntheses needed to produce topologically correct stream networks for the Yukon and Kuskokwim rivers. These topologies will be used in other currently funded projects in the AYK region, and will enable a broad array of potential new investigations aimed at understanding spatial processes within each of these rivers. For example, the data products generated from this proposal can be used to develop 'isoscapes' of strontium isotope ratios against which the strontium isotopes in Chinook salmon otoliths can be compared to assign individual adult salmon to their natal origins across the river basins. Further, the geospatial products derived from this work also have wide-ranging applications for other aspects of the AYK region, including better monitoring and prospective modeling of temperature patterns, pollutant transport, and stream flows – all critical aspects of the ecology of Chinook salmon and of human health in the region.

Project Objectives:

Objective 1: Produce a topologically correct stream network for the Yukon and Kuskokwim rivers, which is compatible with the STARS (Spatial Tools for Analysis of River Systems) (Peterson and Hoef 2014) and SSN (Spatial Stream Network) (Hoef et al. 2014) models. To be met by December 2017.

Objective 2: Synthesize the set of geospatial data products that will be used in the STARS and SSNMs as potential predictors in models, including permafrost extent, geologic heterogeneity, recent glaciation history, gridded precipitation and temperature estimates, vegetation cover, and DEMs for the Yukon and Kuskokwim rivers. To be met by December 2017.

Objective 3: Make the geospatial data products produced during this project publically available via data clearinghouse sites, such as the National Stream Internet (NSI) project.