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Determining changes in the sources of fine-grained sediment in a large regulated watershed in British Columbia using the sediment fingerprinting technique

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Fine-grained fluvial sediment represents a problem in most watersheds, due to its impact on habitats (e.g. sedimentation) and water quality (e.g. carrier of contaminants). Thus, determining the sources of fine-grained sediment represents an important requirement for watershed management. Sediment source tracing, or sediment fingerprinting, is a tool that offers the potential to identify sediment sources in watersheds. We present results on the sediment sources for fine-grained sediment transported in the Nechako River watershed in British Columbia (BC), Canada.

The Nechako watershed (area 52,000 km2), exhibits over ∼1400 m of topographic relief, and forms the second largest sub-watershed of the Fraser River Basin. The eastern slopes of the Kitimat Range of BC's Coast Mountains form the source of the headwaters for the watershed and feed the main stem Nechako River and its tributaries. With the construction of the Kenney Dam, the Skins Lake Spillway, and the Nechako Reservoir in the 1950's to generate hydroelectricity at the Kemano Powerhouse for ALCAN's aluminum smelter in Kitimat, the watershed became a regulated river system. Outside of mountain ranges, land use is mainly forested (natural and managed) with some mining and agricultural land near to small towns; there are no main urban areas in the watershed. Fine-grained sediment has been identified as a major problem, particular in terms of its impacts on the habitats of key aquatic species such as salmonids and the Nechako white sturgeon.

Time-integrated sediment traps were used to collected samples of fine-grained sediment at numerous sites in the watershed over a 2-year period. Preliminary results show that geochemical properties have the ability to distinguish between several key source groups, such that a sediment fingerprint can be established to help identify the sources of the contemporary fine-grained sediment. Moreover, to investigate historical changes in sediment origin, sediment cores were collected from floodplains along the lower reaches of the Nechako River and dated using fallout radionuclide measurements. Combining sediment core dating and sediment fingerprinting helps to explain the change in sediment dynamics over the last few decades in this regulated watershed.