SOME OVERARCHING THEORETICAL CONSIDERATIONS

1. Upscaling from the small-scale process studies that have pre-occupied cold climate sediment budget studies for over half a century; to larger scale sediment systems which couple headwaters to oceanic sinks ('true' source to sink science at a globally meaningful scale). Drainage basin scale is important in determining the relative importance of such processes because as basin size increases valley floor and channel processes become more significant (Church & Ryder 1972; Church & Slaymaker 1989).

2. Establishing better integrated sediment budget studies uniting glacier and periglacial sediment systems.

3. The modelling of future sediment fluxes in response to changing climate needs to be developed. There is now a sufficient body of knowledge knowledge in cold climate sediment budget studies to facilitate modelling of future sediment flux scenarios.
4. Assessing the significance of changing ground ice conditions on sediment flux in different cold regimes (continuous permafrost – seasonal frost layers). The response may be negative or positive given the particular combination of ground ice, local relief and vegetation.

5. Further development of innovative field methods for use in cold climate sediment budget investigations. Examples include further development of geophysical methods for estimating sediment storage volumes (Schrott et al., 2003) and ground ice distributions; remote sensing for characterising rapid change in glacier systems (Quincey et al., 2005) and better dating techniques for examining longer-term changes in sediment delivery (e.g. Blake et al., 2002).

SEDIBUD HYPOTHESES (In no particular order of importance)

Hypothesis #1: Increased winter snowfall will be the primary driver of nival and glacial processes and will increase catchment fluxes of all types.

Hypothesis #2: Glacial and nival catchment fluxes will respond to different climatic forcings, and hence, may demonstrate divergent flux responses.

Hypothesis #3: The nival freshet will continue, or increase, as the dominant period of fluxes, in the absence of glaciers.

Hypothesis #4: Active permafrost degradation will have an indirect role in fluxes during the nival freshet, but should increase fluxes overall at multi-year time scales.

Hypothesis #5: Interannual variability in fluxes will continue to be the dominant form of change in watershed fluxes despite ongoing global climate changes.

Hypothesis #6: Interannual and long term flux variability will vary according to catchment geomorphic and hydroclimatic conditions.

Hypothesis #7: Weathering, erosion, and associated fluxes will continuously change landscape structure and are major controls on (terrestrial and aquatic) ecosystem dynamics within catchments.

References:

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