VeWa: Investigating effects of Vegetation on Water flows and mixing in northern ecosystems using stable isotopes and conceptual models

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Background
As a step towards integrating insights from tracers and modelling studies in northern landscapes, we provide a preliminary analysis of six well-known experimental catchments (Fig. 1). These are part of the VeWa (Vegetation effects on water flow and mixing in high-latitude ecosystems) project, which aims to understand the nature of water partitioning along cross-regional hydroclimatic gradients of moisture and temperature and to assess the role of vegetation, soils and other landscape features. Our goal in carrying out this comparative analysis was to identify open research questions on the ecohydrological partitioning and coupling of waters in northern catchments and assess research priorities.

HBV modelling
- Reasonable model performance: mean NS >0.6 for Dorset, Krycklan and Girnock, but only ±0.5 for Baker Creek, Wolf Creek and Dry Creek. Lower efficiency for Baker Creek and Wolf Creek is mainly due to difficulties measuring winter low flows when stream is frozen. For Dry Creek the initial model structure might be too simple given the large elevation differences and associated vegetation distributions.
- Snow dynamics were well captured by model with largest snow packs at Wolf Creek, Krycklan and Dorset (Fig. 3).
- The uncertainty in storage values for the different model runs was large. However, for the soil moisture store all model runs showed similar dynamics. The dynamics in the groundwater stores changed between model runs, especially in the Girnock (Fig. 3).

Data and approach
- Sites cover range of climates, with contrasting snow influence and flow regimes (Table 1 and Fig. 2)
- Precipitation and stream water sampled for isotope analysis
- HBV-light model applied to all sites (Seibert & Vis, 2012) with
- Precipitation and stream water sampled for isotope analysis

Conclusions
This meta-analysis of six northern catchments has shown that snowpack accumulation and melt typically dominate the catchments’ runoff and isotope dynamics. While simple input – output relationships can link stream flow generation to hydrological flowpaths that route water to streams, fractionation at each site is indicative of more complex internal processes that can be influenced by energy inputs and catchment characteristics. How such small scale processes affect stream water dynamics, and whether and how they should be conceptualised in models, are questions that provide an opportunity for hypothesis-driven isotope studies in northern environments.