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Inferring glacial flow pathways with DNA-labelled microparticle tracers at the Wolverine Glacier in Alaska

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Though recent advances have been made in the understanding of glacial hydrologic pathways, accurate predictions and descriptions of glacial hydrologic processes remain a challenge. The most common method to investigate subglacial pathways tends to be dye tracing. Due to the limited number of unique dye tracers, the photodegradability of some, and the typically long breakthrough times associated with such pathways, dye tracing experiments tend to be restricted to only a few injections, and therefore the contribution of only a few pathways can be investigated at a time. Five uniquely DNA-labelled microparticle tracers were injected in five different locations throughout the Wolverine Glacier ablation zone, one of two "benchmark glaciers" in Alaska and the subject of long term study by the United States Geological Survey. Stream water was sampled several hundred meters downstream at regular intervals and later analyzed for the presence of each tracer. Since each tracer was tagged with a unique sequence of DNA, the contribution of each to the total outflow can be quantified independently. Preliminary results indicate relatively short transit times, suggesting that the ablation zone is characterized by a high-volume (low pressure) subglacial hydrologic network (i.e. conduits). Here we present the results of the study, the challenges faced, and a discussion on the potential of the DNA-labelled microtracer technology.