Resolution and informational aspects of surface inversion on ice streams

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A Bayesian inversion framework for inverting surface data from active ice streams for both basal perturbations and basal slipperiness is presented. I consider a number of general questions related to this problem, such as how retrieval is affected by the accuracy of measurements, and to what extend bedrock and slipperiness perturbations can be separated (mixing effects). This is done using a linearized forward model including all terms of the momentum equations. The Bayesian inversion procedure uses full covariance matrices. I find that mixing effects do not seem to pose any significant problem if data on both surface geometry and surface velocities are available, but are significant if only data on surface geometry is known. For a flow-line inversion the only fundamental limit to retrieval is the spatial resolution. The spacial resolution of slipperiness retrieval is about an order of magnitude less than for a bed-line retrieval. Furthermore, even when accurate data on surface geometry and surface velocities are available, basal slipperiness retrieval still requires an a priori knowledge off ice thickness to within about 10%.