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# Bayesian estimation of basal conditions on Rutford Ice Stream, West Antarctica, from surface data

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The determination of basal properties on ice streams from surface data is formulated as a Bayesian statistical inference problem. The theory is applied to a flow line on Rutford Ice Stream, West Antarctica. Estimates of bed topography and basal slipperiness are updated using measurements of surface topography and the horizontal and vertical components of the surface velocity. The surface topography is allowed to vary within measurement errors. We calculate the transient evolution of the surface until rates of surface elevation change are within limits given by measurements. For our final estimation of basal properties, modelled rates of elevation change are in full agreement with estimates of surface elevation changes. Results are discarded from a section of the flow line where the distribution of surface residuals is not consistent with error estimates. Apart from a general increase in basal slipperiness toward the grounding line, we find no evidence for any spatial variations in basal slipperiness. In particular, we find that short-scale variability ($< 10\,h$) in surface topography and surface velocities can be reproduced by the model by variations in basal topography only. Assuming steady-state conditions, an almost perfect agreement is found between modelled and measured surface geometry suggesting that the Rutford Ice Stream is currently close to a steady state.