

Inversion of ice stream surface measurements for basal conditions

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Virtually all studies of ice stream dynamics depend on characterizations of subglacial conditions that cannot be directly observed. This difficulty motivates a wide range of methods designed to estimate subglacial conditions from surface measurements. One class of these methods, least-squares inversion of surface velocity data with prescribed surface geometry, depends significantly on the quality (i.e., errors and resolution) of surface geometry and velocity determined by remote sensing. In this presentation, we shall investigate the degree to which estimates of subglacial conditions (a parameterization of basal friction) depend on various aspects of newly derived surface measurements acquired for Bindschadler Ice Stream (a.k.a., ice stream D). Comparisons between 4 distinct digital elevation models (DEM's) ranging from a 1990's "bedmap" product to the latest product available from IceSat radar altimetry, show distinct patterns of inversion performance which warn the user of the methodology about error and resolution issues in the estimates of basal friction. Further analysis will be presented to show the effect of model-resolution on surface velocity matching in lateral shear layers where ice-stream dynamics is only partially addressed by the inversion physics. As a final point, we shall present 3 inversions of surface data to estimate parameters associated with simple basal friction laws to be used in potential forward models of ice-stream change in the future.