

On the Possibility of a Long Subglacial River Under the North Greenland Ice Sheet

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At the base of the Greenland ice sheet there is a long segmented valley extending from Petermann Fjord far into the center of Greenland that appears to be blocked by topographic rises at many points along its route. However, these blockages are artificial consequences of data interpolation and the available flight radar data contains no evidence to suggest that the valley is blocked. Therefore, to test whether opening up this valley could affect the subglacial water distribution and ice sheet sliding, SIMulation COde for POLYthermal Ice Sheets (SICOPOLIS) simulations are utilized with a valley adjusted to be unblocked from the deep interior to Petermann Fjord. The simulations show that opening up this valley creates an uninterrupted subglacial water pathway from central Greenland to Petermann Fjord suggesting that water could flow along its length [Figure 1 a) and b)]. This occurs because the valley tracks below a gentle downward ice surface slope [Figure 1 c)]. The valley redistributes subglacial water towards Petermann Glacier leading to increased sliding there. The relatively flat valley base following a path that roughly intersects the east and west basal hydrological basins could be indicative of a subglacial origin. Though considerable uncertainty remains, the results are consistent with a present day active long subglacial river system that, if confirmed with further radar bed observations, could be over 1600 km long. However uncertainty remains over whether adequate water is available at the bed, whether water escapes from the valley, and over what form a hydrological conduit would take along the valley base.

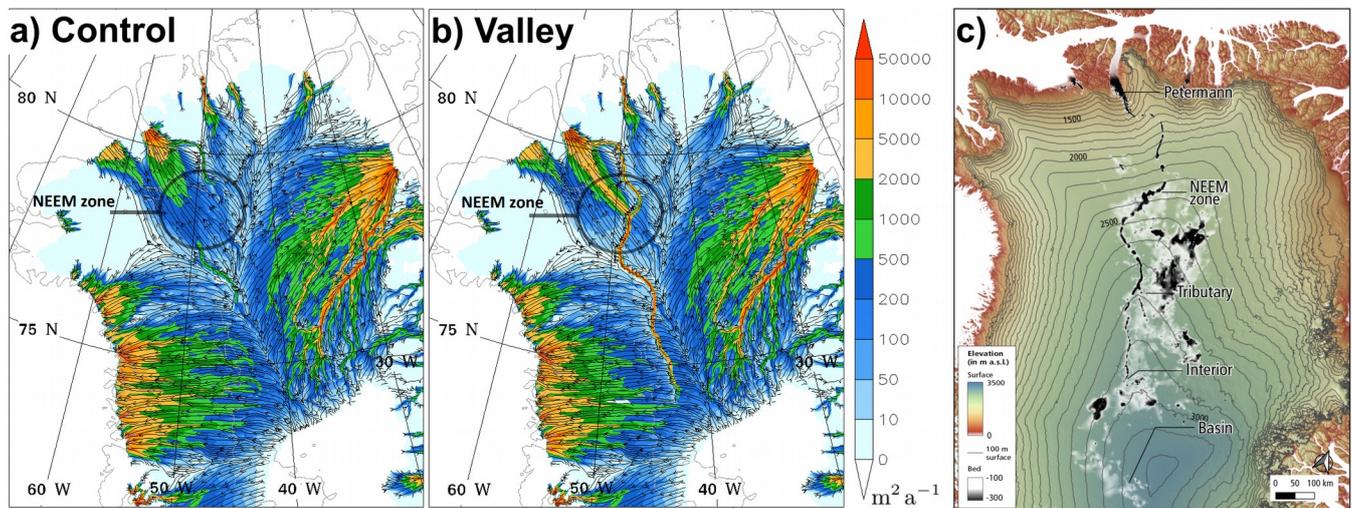


Figure 1. Basal water flux magnitude (m^2a^{-1} colours) and streamlines in north Greenland for a) the standard basal topography and b) with the valley adjusted to be open. Surface elevation (m) with bed elevation for -100 m or lower overlaid in grey to indicate the path of the valley, is in panel c).