Assessing the Importance of Basal Topography for Greenland Ice Sheet Margin Hydrology

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Nearly half of the Greenland ice sheet's total mass loss is controlled by surface mass balance, primarily driven by meltwater runoff exiting at its margin via supra-, en-, and sub-glacial drainage networks into fjords and pro-glacial lakes and rivers. Despite the importance of meltwater runoff, Greenland's hydrologic drainage patterns are not well understood. This is partly due to a scarcity of ice sheet meltwater runoff observations and detailed information about supra- and sub-glacial topography, which are responsible for dictating runoff flow patterns. However, such data are available locally in southwest Greenland for the Akuliarusiarsuup Kuua (AK) River watershed. Here, NASA IceBridge supra-glacial (Airborne Topographic Mapper (ATM)) and sub-glacial (Multichannel Coherent Radar Depth Sounder (MCoRDS)) topography and in situ hydrologic data are used to study three nested riverine systems within the AK River watershed ranging from 8 to 101 km^2. Examination of relationships between drainage patterns modeled from topographic data and actual ice sheet runoff losses provide insight into drainage basin delineation accuracy, scale-dependency, and surface and sub-glacial topography controls on ice sheet margin hydrology. Lastly, this study will determine the importance of incorporating basal topography within meltwater runoff models and will serve to improve our understanding of Greenland's hydrology.