Geophysical Research Abstracts
Vol. 21, EGU2019-1879, 2019
EGU General Assembly 2019

Radio-wave attenuation in fast-flowing ice

Benjamin Hills (1), Knut Christianson (1), Nicholas Holschuh (1), and Sridhar Anandakrishnan (2)

(1) Department of Earth and Space Sciences, University of Washington, Seattle, WA, United States (bhills@uw.edu), (2) Department of Geosciences, Pennsylvania State University, University Park, PA, USA

Because radio-wave attenuation is temperature dependent, radar methods offer one alternative to obtain spatially distributed ice temperature measurements rather than using isolated borehole temperature logs. Here, we use attenuation calculations to constrain ice-sheet temperature in two dynamic regions – the shear margins of the Northeast Greenland Ice Stream and the grounding zone of the Whillans Ice Stream. In order to increase confidence in our result, we assess three separate attenuation models: (1) a linear fit of bed-returned power as a function of ice thickness over a zone of assumed constant basal reflectivity; (2) the ratio of power returned from the primary bed reflection and its first multiple; and (3) the diminution of internal reflector power (assumed to be specular) as a function of depth. Our results indicate high sensitivity to model assumptions, and suggest that multiple attenuation methods should be employed. For northeast Greenland, we calculate an increase in attenuation rate by up to 5 dB/km within the shear margins, corresponding to the warmer ice there. These results are consistent with the thermal structure simulated using a steady-state full-stress thermomechanical model, but present challenges for simple analytical models of ice temperature. Our future work aims to recover depth variation in attenuation rate through the ice column, which we hope will allow use of radar to verify hypothesized presence of temperate ice in shear margins.