

***Interactive comment on “Comment on
“Exceptionally high heat flux needed to sustain
the Northeast Greenland Ice Stream” by
S. Smith-Johnson et al., The Cryosphere, 14,
841–854, 2020” by Paul D. Bons et al.***

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Dear Bons et al.

On behalf of my co-authors and myself, we would like to make a general remark about your comment. We agree with your conclusions that the extremely high geothermal heat flux needed to sustain NEGIS in our model is geologically unfeasible. We appreciate your effort to put the 970mW/m² value into context, providing a detailed background and explaining how unrealistic it is. However, we think you might have overlooked our

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manuscript and not appreciated the extent of the limitations we detail in this manuscript. We are very aware of the extremely high value such a geothermal flux represent and thus repeatedly stated this in our paper, starting in the abstract: ‘The value cannot be attributed to geothermal heat flux alone and we suggest hydrothermal circulation as a potential explanation for the high local heat flux.’ . We deliberately changed the language from the first draft (after valuable comments from Nicholas Holschuh) specifically to underline that this is a model experiment. Another study we performed shows that NEGIS can be reproduced in ISSM with a much lower geothermal heat by for example reducing basal friction within reasonable bounds (e.g. Smith-Johnsen et al. 2020). We therefore do not agree that our study shows that there is a critical component missing in ISSM, as you state in your conclusion. Hopefully the base of EastGRIP will be reached in the near future to provide more constraints on heat flux and basal melt, aiding us to understand the drivers of NEGIS and the role of geothermal flux. I would also like to mention that my name is misspelled throughout your comment (Smith-Johnsen not Smith-Johnson).

Cheers

Silje Smith-Johnsen

Smith-Johnsen, S., Schlegel, N.-J., de Fleurian, B., and Nisancioglu, K.: Sensitivity of the Northeast Greenland Ice Stream to Geothermal Heat, *J. Geophys. Res.-Earth*, 125, e2019JF005252, <https://doi.org/10.1029/2019JF005252>, 2020.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2020-339>, 2020.

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