

# ***Interactive comment on “An Estimate of Ice Wedge Volume for a High Arctic Polar Desert Environment, Fosheim Peninsula, Ellesmere Island” by Claire Bernard-Grand’Maison and Wayne Pollard***

## **Anonymous Referee #1**

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Overall quality of the discussion paper ("general comments"): This paper by Bernhard-Grand’Maison & Pollard aims (1) to develop and test semi-automated GIS methods for mapping ice-wedge polygons by the delineation of ice-wedge polygon troughs and (2) to estimate the ice-wedge ice volume for the Fosheim Peninsula on Ellesmere Island in the Canadian High Arctic by using high resolution satellite imagery and 3D sub-surface models. Therefore they build upon a formerly published methodological GIS approach for ice-wedge volume calculations. The authors found that, in comparison to manual polygon trough delineation, their self-developed semi-automated polygon de-

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lineation approach based on a watershed segmentation algorithm provides generally better results in polygon geometry and thus allows more accurate ice-wedge volume calculations than mapping by Thiessen polygons at their study sites. Finally, they provide amounts of ice-wedge coverage and volume for the Fosheim peninsula, which are pretty close to previous estimated amounts of ice-wedge ice volume. Even if this methodology-focused paper based in large parts on a formerly published methodological approach it provides new insights and data of ground-ice conditions in the Canadian High Arctic and new possibilities in semi-automated methods by simple GIS analyses for mapping polygonal networks on large scale. This is in particular an important issue in thinking about time-efficient automatic methods for a Circum-Arctic mapping of ice-wedge polygonal networks in relation to the better understanding of ground-ice conditions, permafrost landscape sensitivity to thaw and not at least the large-scale calculations of permafrost carbon stocks. Overall, I think that's a simple, short but nice methodological article. The simple and easily comprehensible GIS method is well presented in an easily accessible style. I have only a few suggestions and comments and can therefore imagine that this article will finally be published in The Cryosphere.

Individual scientific questions/issues ("specific comments"): P2/L1: Please include "soil type" or an adequate term in the list of main permafrost and active layer controlling factors. P2/L28-29: Do you talk about the High Arctic here? Please be more specific here. There are large areas in Siberia, for instance, in which syngenetic and epigenetic ice wedges equally widespread or even syngenetic ice wedges are representing the much larger proportion of ground ice. P6/L12-16: What time period is used to refer to the information given here? P6/L22: Here and/or even somewhere in the results, I miss information about the polygon sizes at the different study sites. I realized there are mean polygon areas in the supplement information but something related to polygon diameter and its variance at the individual sites would be good to have within the main text. P12/L6-12: I wonder what will be the effect on the watershed segmentation method of more complex contrast differences in satellite data, for instance, with regard to existence of water bodies in the center and the troughs typical for low-centered tun-

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dra ice-wedge polygons. I think more discussion about the applicability of the methods (especially the novel water segmentation method) beyond the Canadian High Arctic would be useful. General on section 5.2: If possible, I would like to see a little bit more discussion here about polygon size and geometry differences as well as ice-wedge volumes in relation to the site specific differences of the four study sites and vulnerability to thaw as done more generally in section 5.3. P13/L28-30: Please could you provide references here? P14/L3-4: And vice versa! There is not always a correspondingly large ice wedge below every crack and trough.

Technical corrections at the very end ("technical corrections": typing errors, etc.): P10/L2: Please change "Manual" to "manual" P10/L10: "Watershed Segmentation" is sometimes capitalized, sometimes small or one big and the other small. Please be consistent in spelling. See also the figures and captions. Figure 4 top: Please change "Thiesen" to "Thiessen" Figure 5a: Please change "Bassin" to "Basin"

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