

## ***Interactive comment on “Which are the highest peaks in the US Arctic? Fodar settles the debate”*** **by M. Nolan and K. DesLauriers**

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General: This is a well written paper that tells a simple but compelling story about accurately mapping mountainous terrain around and ranking the peak elevations of the highest peaks in the Alaskan Arctic at unprecedented vertical and horizontal accuracy. The real excitement of this work, however, lies in this paper’s potential of becoming the final landmark corner stone (for mountainous terrain after previous publications on less steep terrain) that demonstrates convincingly that low-cost fodar technology developed by the first author can outperform the order of magnitude more expensive lidar technology for any terrain in terms of DEM accuracy and resolution. Based on this presentation of results (and as pointed out by the authors) the additional high resolution photographic layer fully registered to the DEM should tip the scale firmly towards fodar

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for most natural terrain applications also in my opinion. Having done ample glaciological research with numerous hours of fieldwork in this particular geographic area in the 1990s, much of which involved tedious ground-based and airborne topographic mapping, I find the conclusions of the authors on repeat fodar maps revealing real change from snow deposition and avalanching both convincing as presented, as well as compatible with quality and magnitude of surface changes I observed on the ground in this region. I have to say that while being rather sceptical by nature in this case I must share in the authors’ enthusiastic conclusion about fodar being a technology that will be highly disruptive to competing airborne technologies of DEM generation such as lidar and single-pass InSAR, while at the same time (through the much lowered cost and the simultaneous photo mosaics) providing new opportunities for cryosphere applications that are simply mind-boggling in their scope and potential. While I think that the authors have successfully demonstrated better than 20 cm vertical and geolocation accuracy for fodar overall, I would like to strike a slightly more cautious note on the potential of bias (in addition to the higher random noise levels there that is noted by the authors) in areas sub-optimal to feature matching such as deep shadows inside steeper gullies etc. By bias I mean the possibility of subtly but systematically higher or lower elevation results correlated with low amplitude or other data properties. The real changes that the authors clearly demonstrate likely would not allow to measure or exclude such effects with the present datasets. An ideal final test to check for such biases would probably be a repeat fodar test on the same day with significantly different sun angles to produce complementary shadows. While this is of course beyond the scope of the current presentation; the potential of bias and how it could be assessed should at least be mentioned.

Specific comments: \* Abstract: Elevations in short summary should be consistent with abstract; currently they differ by 0.4 m \* Introduction: (p6875,l26): the emphasis on software is misleading (makes one think of differences in the price of software at first) ; suggest changing to: “. . . the difference in price is the Structure-from-Motion algorithm allowing for prosumer grade cameras to be used without . . .” \* Methods: (p6879, l9):

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“... based on co-registration with the poor 2008 DEM ...”; do not understand: why poor if the claimed accuracy is 16 cm and the posting is finer for the 2008 DEM? \* Discussion: (p6885, l28): replace “boost” with “back-project”; (p6886, l) “. . . We tested the experimental 15B model and found it gave all peaks 1.4m downward shift, but given that the current models indicates a 1.5m gradient over this distance, future higher resolution data could yield gradients of that size but with opposite sign, suggesting that this debate is not fully settled . . .”: The discussion on the implications of using different geoid models is not clear: is it “current model” (not models) and does this refer to the currently used geoid? Is “gradient” a spatial gradient and if yes over which distance does it apply (some remark on the spatial resolution of the geoid models in question is warranted). What is the spatial gradient across the 40 km from Mt Chamberlin to Mt Hubley?

Technical corrections: \* Abstract: (p6872, l1) Grammar of first sentence is incorrect, suggest changing to : “While being outstanding accomplishments of their time, the United States Geological Survey’s topographic maps of the eastern Alaskan Arctic nonetheless had significant errors introduced when made in the late 1950s.” \* Introduction: (p6873,l6); typo “mounatins”. (p6873,l11 ff): change ‘ to ft?. (line 24): “on an annual basis” or “annually”. \* Methods: (p6876,l16): drop the ‘ symbol; (p6879, l10); typo: “. . . based on some limited ground control . . .” \* Discussion: (p6885,l25); duplicated word: “that” \* Tables and Figures: (Table 1 caption): “. . USGS peak elevations in feet are from labels of the printed map sheets, except for Mt Okpilak at 1:63630, which was interpolated from the contours bracketing the symbol for peak on the map; Mt Okpilak is our unofficial . . .”; (Figure 3 caption): “. . . The consistency of color shift between mountain faces is not due . . .” (“s” was missing); “. . . Again, there is a lot of real change . . .” (“lots” is colloquial); typo: “guassian”

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Interactive comment on The Cryosphere Discuss., 9, 6871, 2015.