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Interactive comment on "The Copernicus Polar Ice and Snow Topography Altimeter (CRISTAL): Expected Mission Contributions" *by* Michael Kern et al.

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The CryoSat SARIn mode has been successful in demonstrating that coherent interferometric radar altimetry is better than traditional radar altimetry in monitoring change in glacial height, particularly at the periphery of the large ice caps and for glaciers and smaller ice caps. The problem remains that often the point-of-closest-approach (POCA) in these areas is at a cross-track look angle greater than that corresponding to a differential phase of -π to +π radians. For the CryoSat baseline this look angle is $\pm$0.54°. A reference digital elevation model (DEM) can be used to help resolve the 2π phase ambiguity but height blunder errors can still exist, particularly with cross-track

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slopes of greater than 1°. However, if the Ka-band channel on CRISTAL could be made interferometric then there is a straightforward approach which would remove the need for a reference DEM and allow an improved and more reliable mapping solution for glacial ice.

The advantages of this approach to the mapping of glacial height and height change are significant:

1. There is no need for a reference DEM.

2. There will be two solutions, both more reliable than that possible from a single frequency system, therefore, a more precise and accurate result. The Ka-band result in particular should be more accurate then the Ku.

3. The possibility of serious mapping errors which exist with a single frequency SIRAL-like system will be reduced.

4. The approach can also be used to improve the reliability of swath mode results.

5. Having two SARIn frequencies will also improve the ability to calibrate both systems.

Further details and an initial evaluation are given in the supplement. I hope that the CRISTAL programme is still at a stage where ESA can study this option more fully.

Please also note the supplement to this comment:
https://www.the-cryosphere-discuss.net/tc-2020-3/tc-2020-3-SC1-supplement.pdf

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