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Interactive comment on "Seismic wave propagation in anisotropic ice – Part 1: Elasticity tensor and derived quantities from ice-core properties" *by* A. Diez and O. Eisen

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General Comments. This manuscript presents a methodology suitable for estimating the elastic properties and resulting seismic wave velocities and seismic reflection coefficients for a given distribution of crystal orientations. The authors do this by assembling the relevant material from the solid earth, exploration geophysics, and crystallographic community, and then explore the most relevant scenarios for the cryospheric community. In this way the authors make a worthwhile contribution to the literature and a useful reference piece for those practicing active source seismology in the cryosphere. In particular, the presentation of the angle of incidence – velocity relationship for girdled fabrics fills an existing gap in the glaciological literature. Also, the analyses of the influence of anisotropy on seismically obtained bed properties and potential for estimating

englacial crystal orientation fabric contrasts is a useful contribution.

The manuscript is well laid out and generally well written but could benefit from some improvements. It is targeting a small readership and would perhaps grow its readership through increased accessibility. (This has already been pointed out by another reviewer but is worth reiterating here.) The fields of anisotropy and crystallography have a plethora of acronyms (COF, LPO, VSM, VTI, HTI) and anything the authors can do to clarify these terms would be useful (Tables, glossary, etc... Especially important when it comes to identifying synonyms in other disciplines.)

Sec. 1. Improving the readability of the abstract and introduction would also aid accessibility. All the information is there but typographic errors and ambiguous statements sometimes detract from the content. Some detail on laboratory-based studies, which provide the most information on the anisotropic flow properties and seismic properties could be included here.

Sec. 3. From my understanding, crystallography typically uses the Orientation Distribution Function (ODF) to quantify the CFO distribution. (The ODF can be calculated from a pole figure.) I believe the ODF can then be used to calculate the elasticity tensor. Would this simplify the process and eliminate the need for the threshold classification? If not, then it would be useful if the authors detailed the advantages and disadvantages of their methodology over one that employs ODFs such as that presented by Mainprice et al., 2014 (Geological Society, London, Special Publications, August 1, 2014; doi 10.1144/SP409.8) and available for determining elasticity tensors through the MTEX package.

Technical Comments:

Throughout manuscript the reference to Bennett 1988 should instead be 1968.

The specification of 'ice-core properties' in the title is perhaps unnecessary as the observables required are the crystal orientations regardless of the sample origin and

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no analysis of ice core properties is undertaken.

A couple of repeated statements could be removed (Sec.3 L17 & Sec. 3.3 L20. Sec 4.4 L19 & Sec 4.5 L25)

Figure 1. The geophone line is redundant, increase line weights.

Figure 2. Fully words in legend

Fig 3. Last sentence in caption not needed.

Fig 4 & 5. Add some contour to help see differences between subplots.

The manuscript requires detailed proofreading. Specifically attention should be paid to the use of definite and indefinite articles and ambiguity should be eliminated where possible. I will not list the required changes at this stage but am happy to do so as the paper progresses.

Interactive comment on The Cryosphere Discuss., 8, 4349, 2014.