Review of: Seismic wave propagation in anisotropic ice: Part I. Elasticity tensor and derived quantities from ice-core properties
Authors: A. Diez and O. Eisen
The Cryosphere Discuss., 8, 4349-4395, 2014

General comments
This paper presents a method to determine the elasticity tensor for the calculation of the seismic properties of ice using COF eigenvalues derived from ice core measurements. The effects of anisotropy on seismic velocities and reflection coefficients are then investigated. This work presents in a glaciological framework what is an established technique in seismology, that is, linking crystal anisotropy with seismic observations. The method is applied to a comprehensive data set in the companion paper "Seismic wave propagation in anisotropic ice – Part 2: Effects of crystal anisotropy in geophysical data".

The manuscript is well-structured and presents the method in detail and from first principles. As such, it is a useful reference paper for both the glaciologist and seismologist, many of whom will be encountering the other discipline for the first time. As this paper will likely be read by both audiences, not necessarily with a background in both fields, some aspects need further clarification and explanation (see major comments below). For example, what is the significance of the three fabrics selected in the glaciological context: what stress regimes in glaciers/ice divides etc could result in these fabrics? Nomenclature in each discipline is also different – VTI/HTI/LPO vs COF/VSM/cone/girdle or cluster-cone etc. This is an opportunity to bridge the gap between the disciplines and facilitate future collaborations.

Combined with Part 2 this paper presents a comprehensive example of the modelling, interpretation and integration of ice core, seismic and radar data with consideration of the influence of measured anisotropy in ice. I propose some specific comments and suggestions which I believe will make this very useful reference material for anyone seeking to undertake investigations of anisotropy in ice or attempting to improve on these evolving methodologies. This is a thorough and informative piece of work and I suggest the manuscript is accepted for publication once these comments have been addressed.

Specific comments
P4355-L3 onwards:
There are a number of issues with this paragraph which need clarification. Why three out of eight fabrics selected? Cone and cluster name interchanged but not clarified as the same. How do these fabrics relate to the stress regimes found in ice divides? Section 2.1 is written in the language of a glaciologist so needs context for the seismologists without this background.

P4357-L1 onwards:
This paragraph is for me where the style of writing transforms from that of a glaciologist writing about anisotropy to that of a solid Earth /exploration seismologist, introducing terms such as LPO and VTI/HTI. It is also the key point where readers without a seismological background can have terms used in seismic anisotropy clarified. This is done in more detail in Section 2.1 but in the language of a glaciologist. A table comparing nomenclature would be helpful, as would further embellishment of Fig. 1.

P4390 - Fig. 1:
This diagram could be enhanced with additional information such as VTI/HTI labels, eigenvalue

range labels. Otherwise, put this in a table for reference. Maybe present the isotropic and extreme VTI cases? Is the geophone line label necessary or just confusing? As stated above, this diagram could be the bridge between readers with different backgrounds. It is also useful to get the concept of the envelope across, probably done most clearly by demonstrating how isotropic and VSM.

P4364 Limitations:
One of the major limitations of this method is the classification of eigenvalue distributions into discrete fabric categories. This has the potential to introduce discontinuities (as per Part 2). This is of course valid but inherent in the methodology applied here. This is discussed in the final paragraph of the conclusions but should be mentioned here as it becomes clear in Part 2 that this is critical.

I have not verified the accuracy of the appendices.

Technical comments
These are annotated on the attached pdf. The entire manuscript needs careful editing for grammar and spelling mistakes.