

***Interactive comment on* “Brief communication: Sampling c-axes distributions from the eigenvalues of ice fabric orientation tensors” by Martin Rongen**

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This brief communication describes a method to generate arbitrary c-axis orientations from eigenvalues of ice fabric orientation tensors. I understood that the novelty of this study is to combine girdle and unimodal Watson distributions to generate the arbitrary c-axis orientations. Although there is a limitation in a specific case, the method can produce c-axis orientation distributions similar to those with input eigenvalues. However, the author should rewrite or reconsider the manuscript for the publication of The Cryosphere. The main reasons are the following.

1. There have been several methods for describing arbitrary c-axis orientation distri-

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bution of ice (e.g., Seddik et al., 2008; Gagliardini et al., 2009). The author should write appropriate research backgrounds and point out current problems. This could better convey the importance of the study, namely, combining two Watson distributions to sample c-axis orientations.

2. Following the references the author cited in the manuscript (Fisher et al., 1987 and Best and Fisher, 1986), the distribution is bipolar (unimodal) if the parameter κ (kappa) is positive, while the distribution is girdle if the kappa parameter is negative. The kappa parameter in the manuscript is k in equation (2). The relationship between k and the distributions (unimodal and girdle), described in page 4 line 1 and in Figure 2, is opposite to what is written in the references (Fisher et al., 1987 and Best and Fisher, 1986). Why are they different? I have to suspect that the estimation of k is appropriate because the estimation is based on a study of Best and Fisher (1986).

Minor comments and corrections

1. Do the words “sampling c-axes distribution” (e.g., in the title, page5-line20) express what the author would like to? One would usually say “sampling c-axes (or c-axis orientations)” and then obtaining those distributions which he or she assumes the population of c-axis orientations. If this comment is not appropriate, please ignore it.
2. The author could write about the examples of c-axis orientation sampling (Section 4) in the Abstract. Some spaces remain there.
3. “N” should be written with italic style as it is variable (page 2-line 2).
4. The author could consider replacing “&” with “and” as use of “&” is not official in some cases (e.g., page 2-line 7; page 3-figure caption 1; page5-line1, -line2, -line20).
5. “ln” should be written with block style as it is not variable (page 2-line17, -line18, line21; page 5-line20).
6. The citation of Donald E., Voigt (2017) may not be a very appropriate example because Donald E., Voigt (2017) does not show scatter plots of the fabric data in the

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Woodcock's coordinate system. The author could consider adding a more appropriate reference.

7. The author should explain the variables in equation (2) briefly (page3-line7), maybe together with a coordinate system, and show the coordinate system (axes) in Figure 2 and 3.

8. "exp" in equation (2) should be written with block style as it is not variable (page3-line7).

9. The third term in the second equation in equation (3) may be mistyping (page5-line3).

10. The author should consider showing the derivation of equation (7) briefly (page5-line14). It would be more reader-friendly.

11. "BMBF" should be spelled out, or its meaning should be translated to English (page6-line12).

References Seddik, H., Greve, R., Placidi, L., Hamann, I., & Gagliardini, O. (2008). Application of a continuum-mechanical model for the flow of anisotropic polar ice to the EDML core, Antarctica. *Journal of Glaciology*, 54(187), 631-642. Gagliardini, O., Gillet-Chaulet, F., Montagnat, M., & Hondoh, T. (2009). A Review of Anisotropic Polar Ice Models: from Crystal to Ice-Sheet Flow Models in "Physics of ice core records II (ed. Hondoh, T.)", 149-166.

I hope the above comments are useful. Wataru Shigeyama

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