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Interactive comment on "Measurement of fracture toughness of an ice core from Antarctica" *by* J. Christmann et al.

Anonymous Referee #1

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general comments The paper by Christmann et al. presents an interesting data set on fracture toughness of bubbly ice (not an ice core). The carefully measured data add to the knowledge on fracture properties of ices. This preliminary study, where samples were measured at one temperature and one strain rate, supports earlier data.

specific comments The title is misleading. The data are _from_ an ice core, but only a very short section! "Measurement of fracture toughness of bubbly ice from Dronning Maud Land, Antarctica" would be more appropriate.

The introduction is very short, a reader not familiar in fracture mechanics will have difficulty to follow. It would also be a welcome addition to hint the reader to the rather special properties of ice, namely its extremely high temperature and plasticity. It is

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by no means clear at which strain rate the plastic component of ice fracture can be neglected, and this section should be extended.

The author should be very clear that the data presented by Schulson and Duval (2009) are copy-paste from the Rist et al (1999) data set. I suggest that the authors only cite the Rist et al data, as this is the original source.

I was also slightly puzzled by the last sentence of the introduction. Are the measurements purely estimates? So then there would be no need to measure again the fracture toughness of ice at all, and even less to get this article published. Please explain and detail the limitations, and explain the expected uncertainty.

The density measurement using X-ray adsorption across the core diameter should be explained in more detail and referenced (p 614, l 13). The density -depth profile also shows several missing parts, but in line 16 it is mentioned that the entire core was weigthed? So it remains unclear why there are missing parts in the radiographic density measurements.

I am also wondering why there were not micro-CT measurements of the samples performed, as AWI is well equipped with such instruments? This would give a much more detailed and complete bubble size distribution and statistics.

In this context the spatial variability of the density within the used samples would be of interest - the figure shows relatively large variations? Could you characterize the trend and variability within your samples?

- The paragraph (p. 614 l 22 ff) is clearly of introductory nature.

The section Results and Discussion is very short and results superficially described. Especially p 618, l 25 ff "... the critical fracture toughness values is relatively small,..." When I compare this statement with Fig. 7, then the distribution for one density shows a variation of almost 40%? I think this is not "small" and needs more explanation.

The comparison between the Rist data set and this new data set is also necessarily

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biased because Rist et al measured at -20°C, while the measurements here were at -15° C. A direct comparison, without taking into account a temperature correction, seems to me not correct and needs explanations.

A similar point is that Rist et al had an almost 10-times smaller strain rate than in this paper, also a point that requires detailed comment and discussion.

("technical corrections": typing errors, etc.). p 613, l 21ff: The sentence is not logical, "where ... has a completely different subject than the main sentence". The description of the location of the core belongs to section 2 (including coordinates), Fig. 1 can be deleted, as of no use to the reader. p 613, l 13: experientially -> experimentally p 613, l 20: circulatory notch -> peripheral notch p 616, l 10: I can't understand the sentence "... that the states grain size distribution is representative..." What do you mean by "states"?

Interactive comment on Earth Syst. Sci. Data Discuss., 7, 611, 2014.

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