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Interactive comment on "Monitoring the temperature dependent elastic and anelastic properties in isotropic polycrystalline ice using resonant ultrasound spectroscopy" *by* M. J. Vaughan et al.

Anonymous Referee #1

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This paper presents measurements using resonant acoustic spectroscopy on an artificial ice core. The approach can be used to calibrate field data from seismic and sonic logging of ice sheets and glaciers. The experiment is carefully done, the paper is thoughtful and thoroughly referenced. The work is novel and in my opinion qualifies for publication, however I'd like to see the authors address a few points. My main complaint is that most of the conclusions are qualitative and it seems much more might have been done, even with the measurements already taken.

The authors estimate averaged elasticity parameters (disregarding mode conversion),

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Discussion paper

but it's really the temperature dependence, particularly for the anelastic properties, that is most useful for studies of real ice sheets. The authors explain that the Q values they found and the temperature dependence of those values exhibit bimodal distributions. I was expecting a plot of temperature dependence for the extensional modes at least, since these are relevant for seismic studies.

Why weren't measurements made below pre-melt temperatures, since as the text mentions this can cause an interesting mechanical transition? For pure ice this would be around -30 C, only 5 degrees colder than was measured (according to Peters et al. and references). Would it be possible to repeat measurements for other grain sizes or ice compositions, or speculate how grain size (curvature) and impurities affect premelting and Q? Perhaps this is planned in future work?

The paper explains that an identical ice sample in the same part of the freezer was monitored by thermocouples frozen into its core, as the temperature was slowly increased. How slowly? Is it possible that conduction through the thermocouple leads biased the temperature measurements? The authors might want to discuss this.

4.2 line 20 typo: "...must exist within in an ice body..."

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