Comment on tc-2021-340
Anonymous Referee #1

This paper presents a novel seismic approach aiming to temporally monitor the formation of sea ice through the deployment of a dense nodal seismic network. Thorough processing of ambient noise through beamformed cross-correlations resulted in the recovery of waveguided modes that were subsequently used as the basis for a Bayesian inverse scheme.

The paper is well written and constructed, as are most coming out of this group, and is suitable for publication upon very minor revisions. My few questions/comments are as follow:

1) On paragraph 165: consider describing a bit better in math the procedure related to the SVD decomposition of the FK transform.

2) Could additional dispersion information have been retrieved by simply picking the maximum of the beamformer at every frequency?

3) Why pose as an MCMC instead of a full grid search? In your case, your forward model is purely analytical unless I am mistaken, which means that a quick parallel implementation of a grid search should be quite feasible.

4) I’m curious as to why things seem to be generally insensitive to density, since this is an important stated objective of your study. I would recommend you explaining what you mean by “The inversions give a value that is very stable, at around 910±82 kg.m−3 for the EW direction, and 908 ± 80 kg.m−3 for the NS direction” on 320, and a second (perhaps unintentionally repeated) time: “Nevertheless, the actual uncertainty is probably much smaller, as all of the inversions give a very stable value” on 325, and again . The posterior density is more or less flat, and thus the mean value here, regardless of its consistency across lines, should probably not be treated as a constrained parameter. Perhaps an added statement as to why you think the inversion fails to robustly constrain
density might be helpful, or in what ways it could be accounted for.