

The Cryosphere Discuss., referee comment RC1  
<https://doi.org/10.5194/tc-2021-340-RC1>, 2021  
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## **Comment on tc-2021-340**

Anonymous Referee #1

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Referee comment on "Recovering and monitoring the thickness, density, and elastic properties of sea ice from seismic noise recorded in Svalbard" by Agathe Serripietri et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-340-RC1>, 2021

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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  $910 \pm 82 \text{ kg.m}^{-3}$  for the EW direction, and  $908 \pm 80 \text{ kg.m}^{-3}$  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.