Review of: "Annealed Stein Variational Gradient Descent for Improved Uncertainty Estimation in Full-Waveform Inversion"

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Potential competing interests: No potential competing interests to declare.

The authors proposed annealed Stein variational gradient descent to improve uncertainty estimation in FWI. The authors performed single-scale and multi-scale experiments on the convergence and uncertainties. The proposed method is very interesting and addresses some key concerns in FWI uncertainty.

To further improve the draft, I would suggest

- To better communicate with the geophysical community, it would be good to add**depth uncertainty** of the key shallow and deep horizons to mitigate drilling risks.
- It would be good if the authors could discuss the scalability of the proposed method to 3D large-scale FWI and include anisotropic parameters. The anisotropic parameters are also associated with the depth uncertainty.
- In Figure 4, some uncertainty ranges are unrealistically large. It would be good to discuss some possible physical constraints and the elimination of the models with extremely low probabilities in the algorithm.

Overall, this draft illustrates a great study on FWI uncertainties using an innovative approach.