

# EFFICIENT INVERSION WITH COMPLEX GEOSTATISTICAL PRIORS USING NORMALIZING FLOWS AND VARIATIONAL INFERENCE

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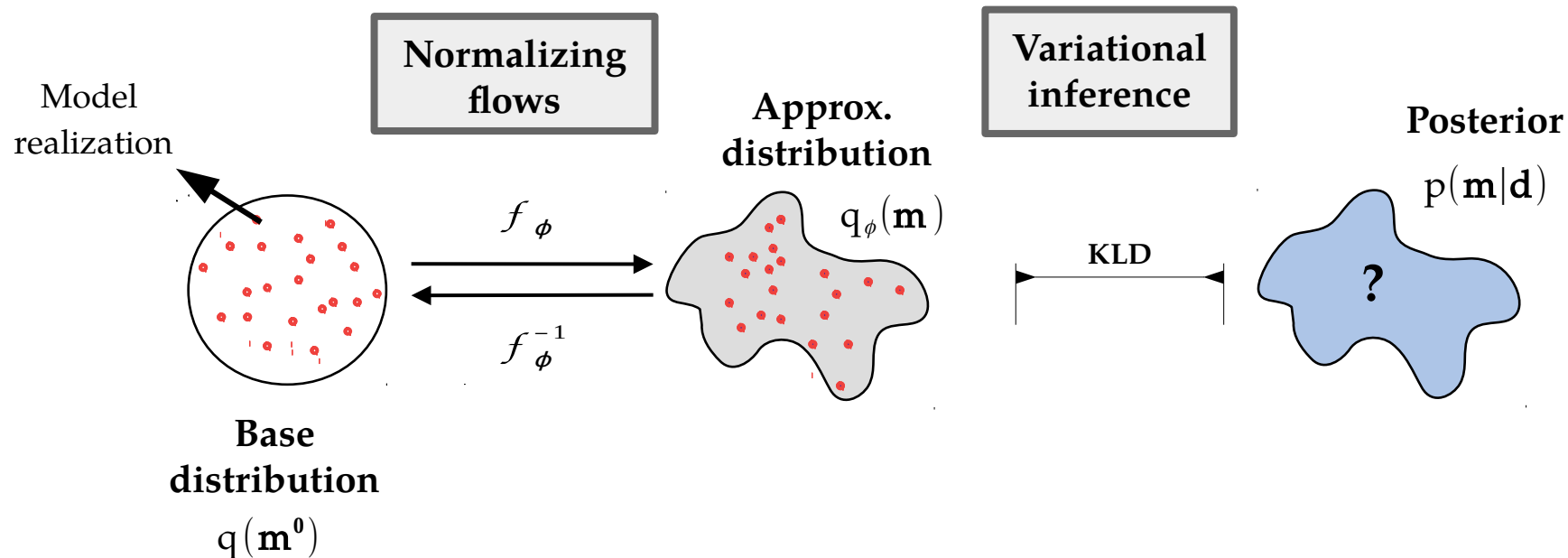




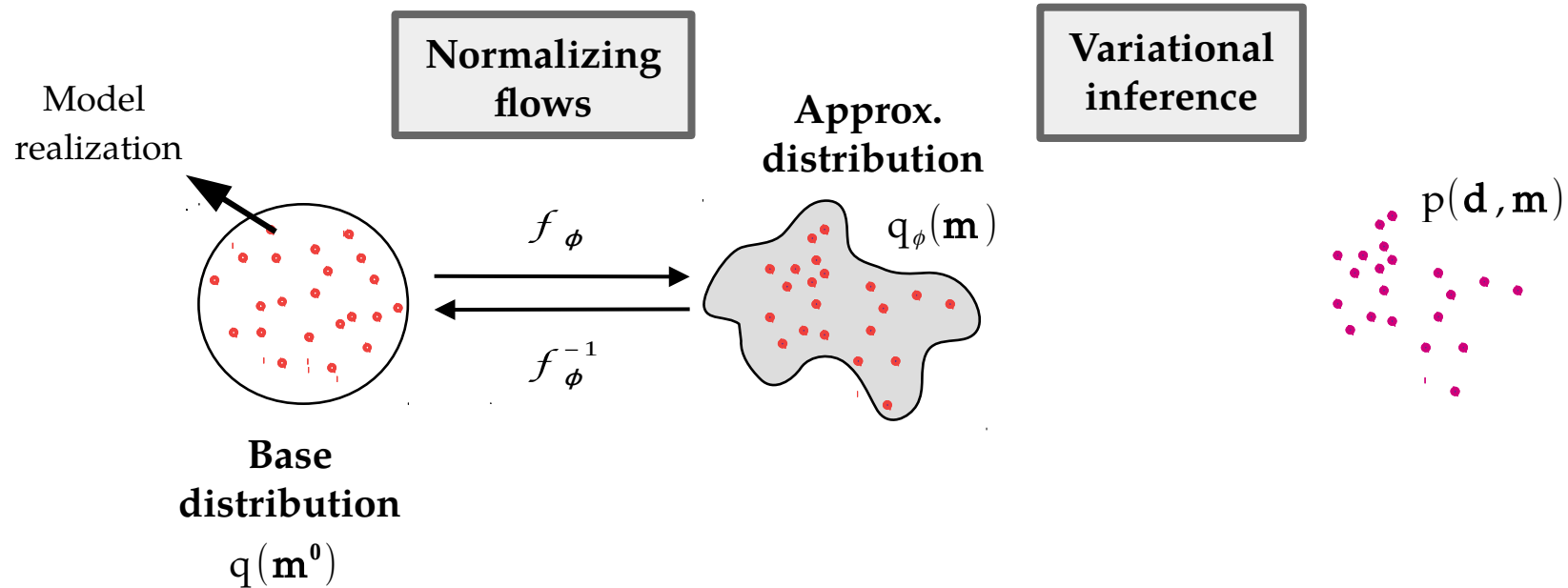
Introduce an inversion approach that is **efficient** and **scalable** to high-dimensional geophysical problems:

- **Normalizing flows** trained using **variational inference** (established in previous research, see Rezende and Mohamed, 2015; Papamakarios et al., 2021; Hoffman et al., 2019)
- **deep generative networks** (reduce the dimensionality of the problem)

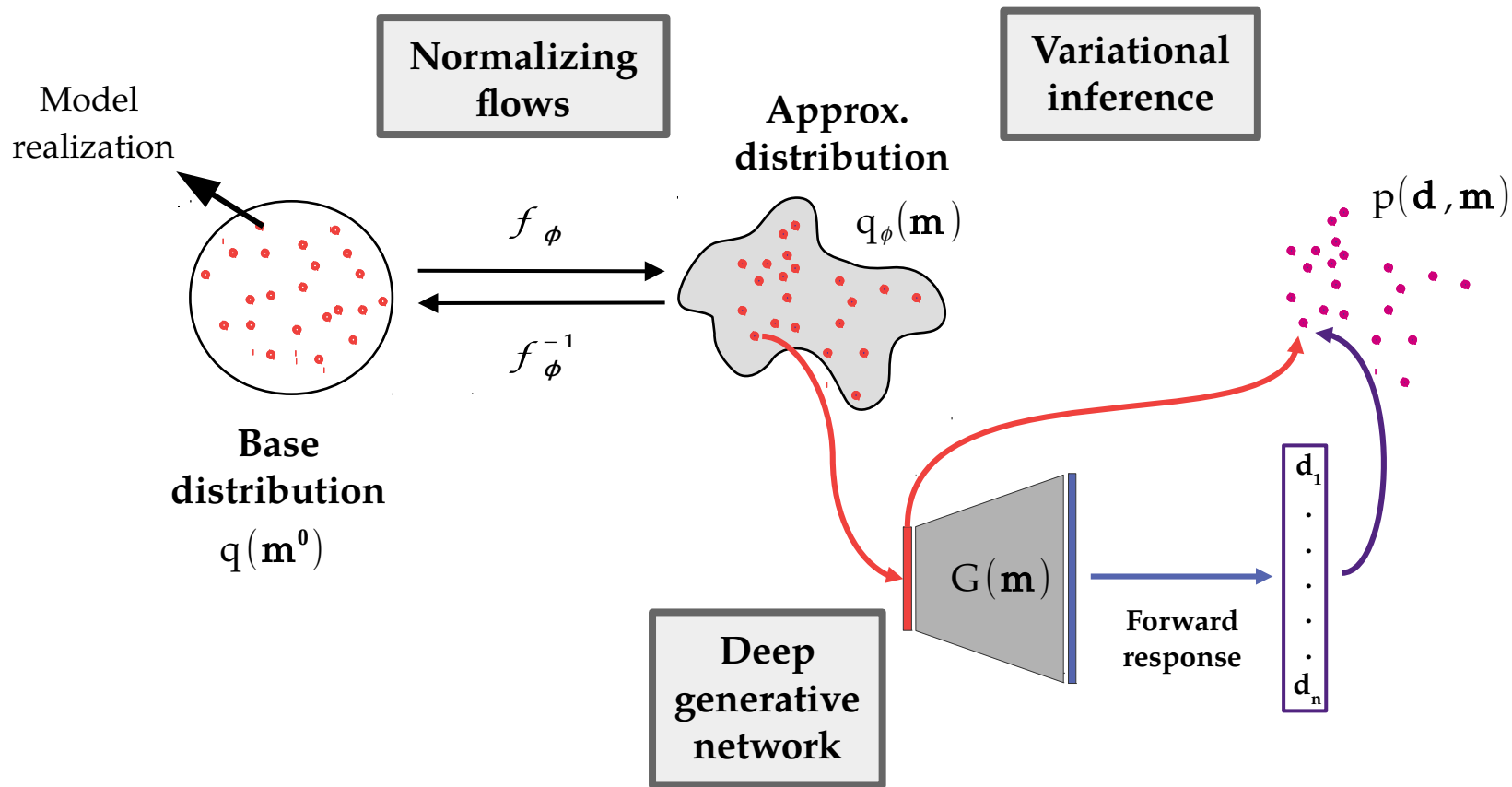
# METHODOLOGY



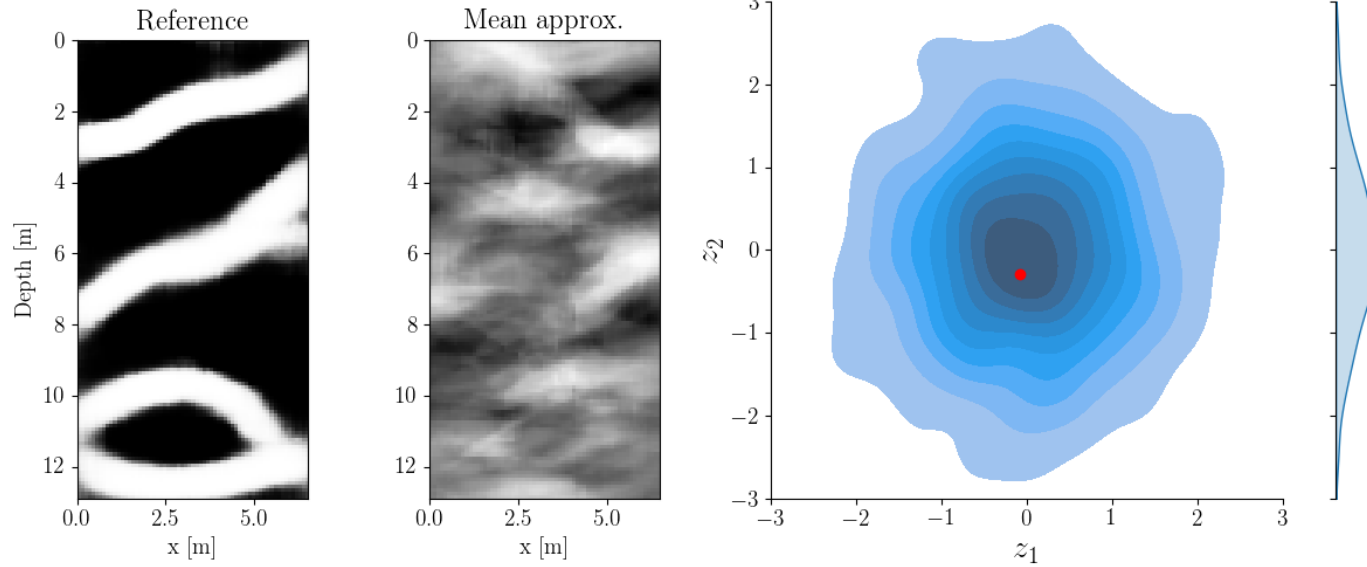
# METHODOLOGY



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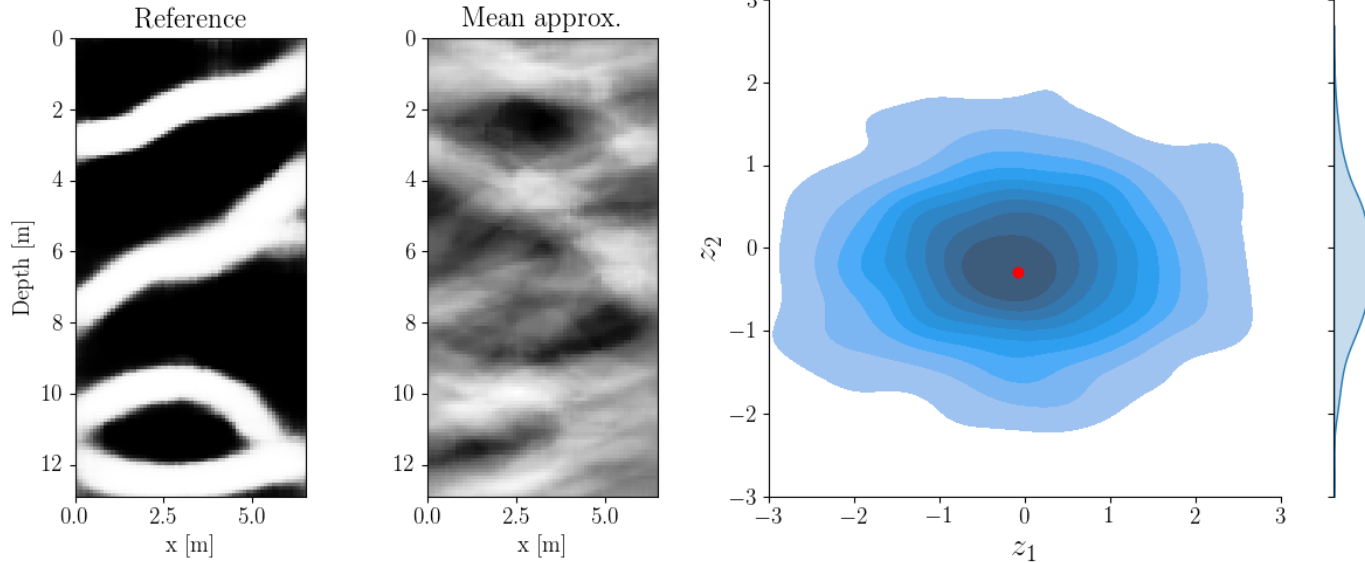


# INVERSION EXAMPLE



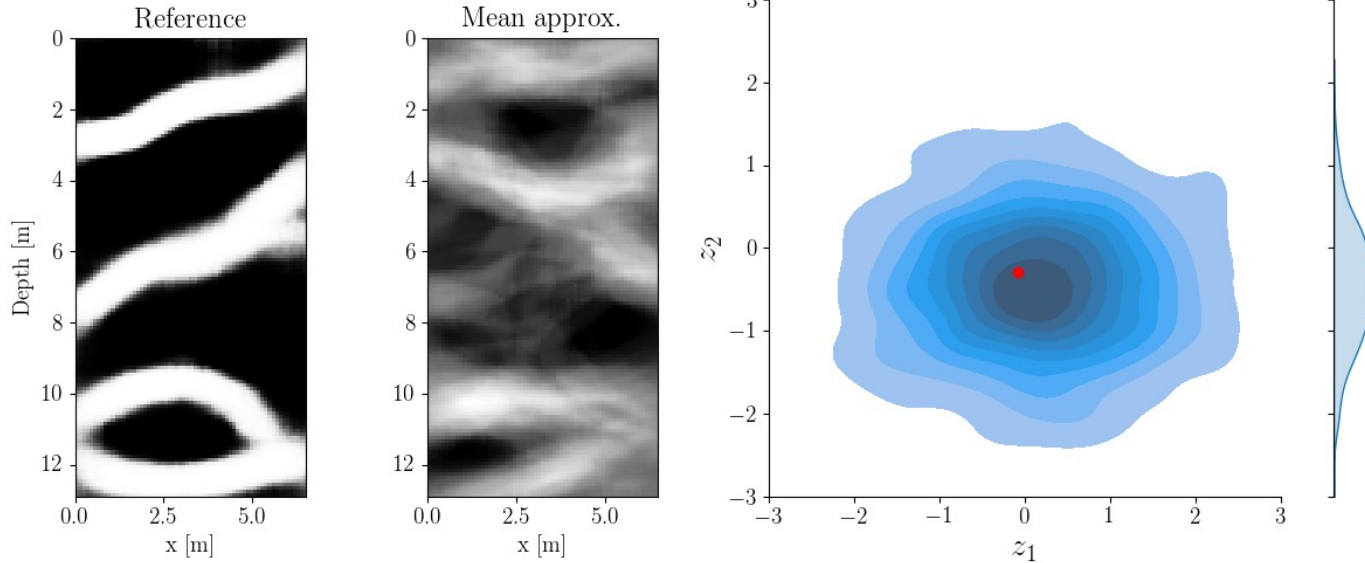
# INVERSION EXAMPLE

10 iterations



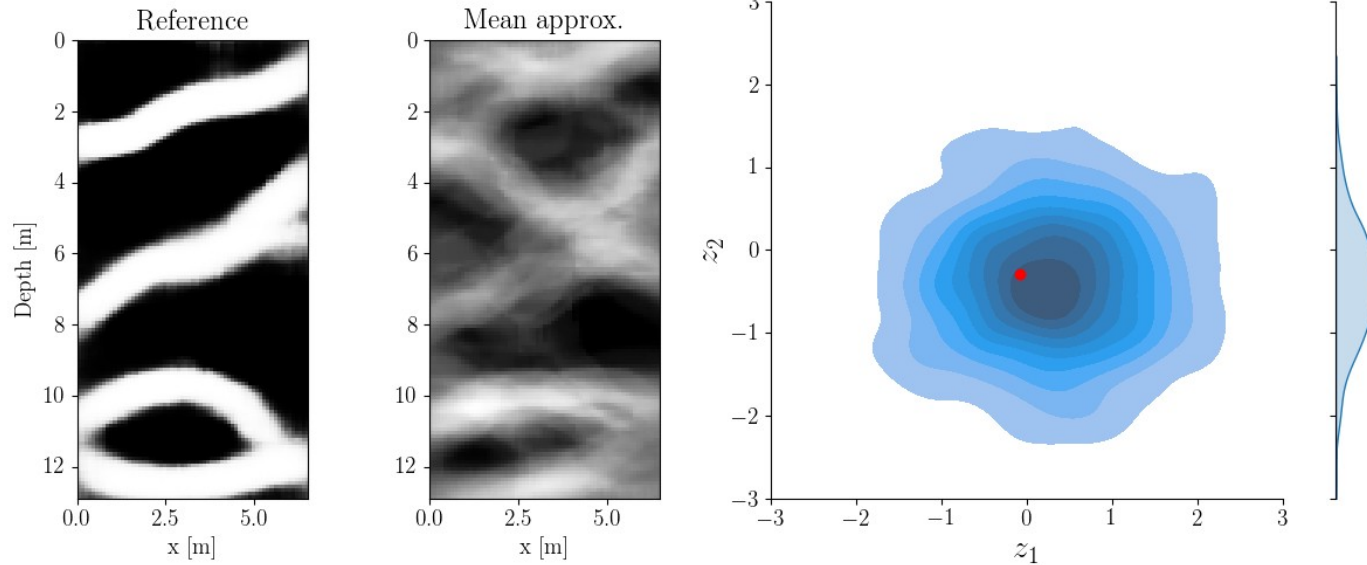
# INVERSION EXAMPLE

30 iterations



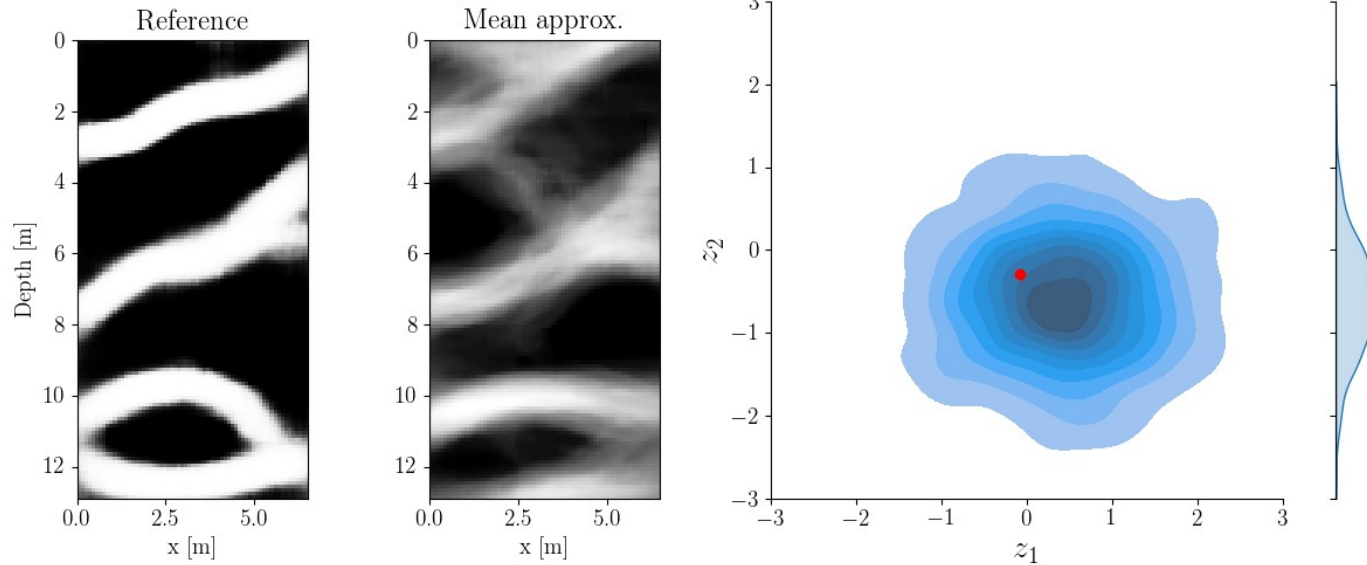
# INVERSION EXAMPLE

50 iterations



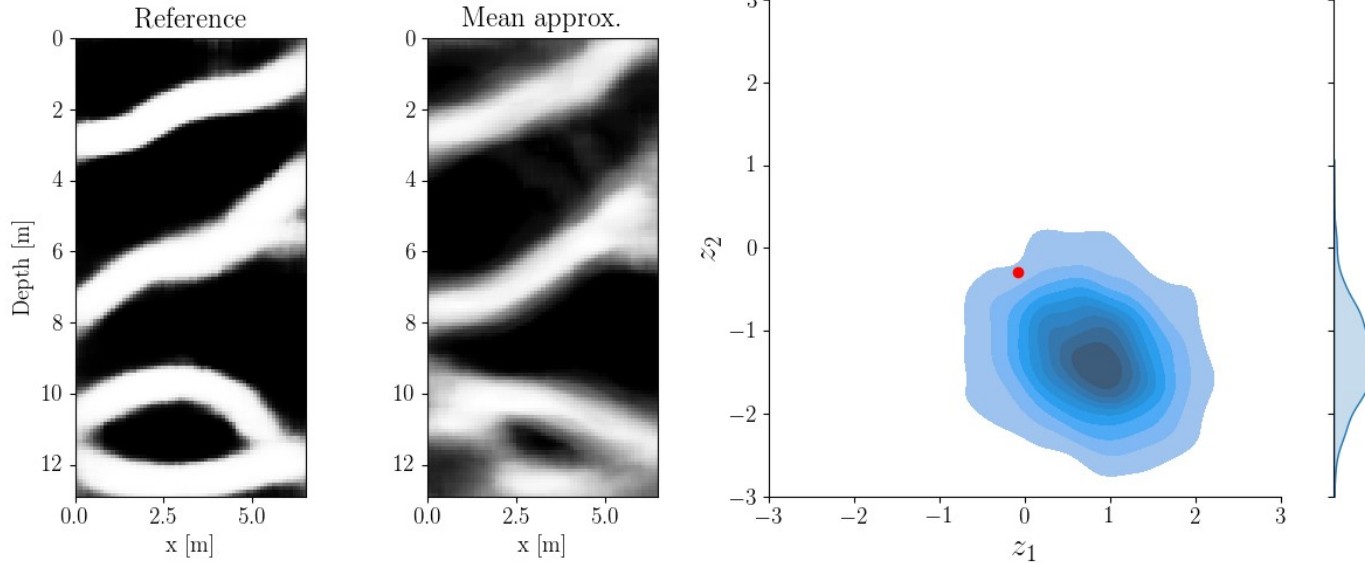
# INVERSION EXAMPLE

70 iterations



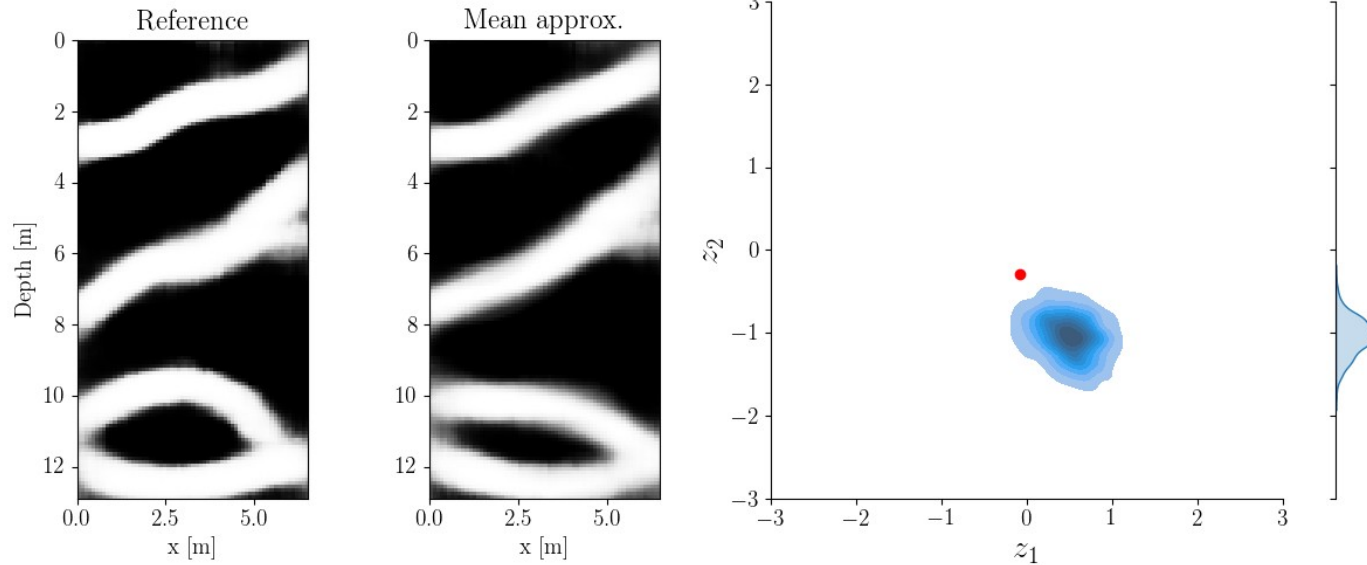
# INVERSION EXAMPLE

100 iterations



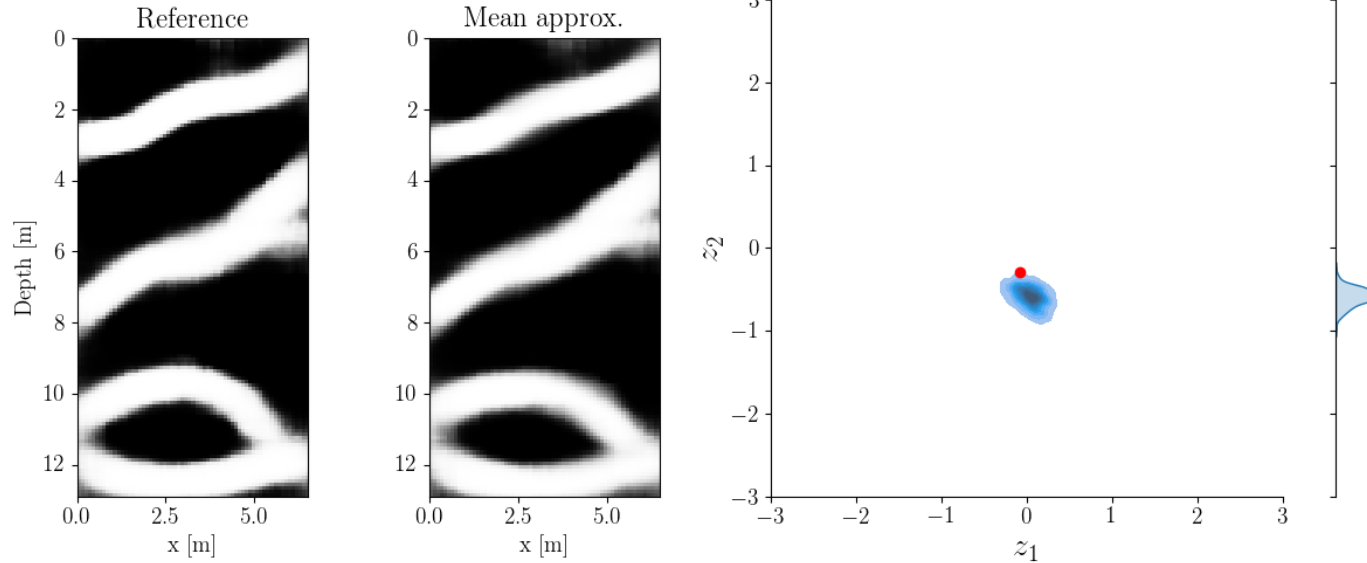
# INVERSION EXAMPLE

200 iterations



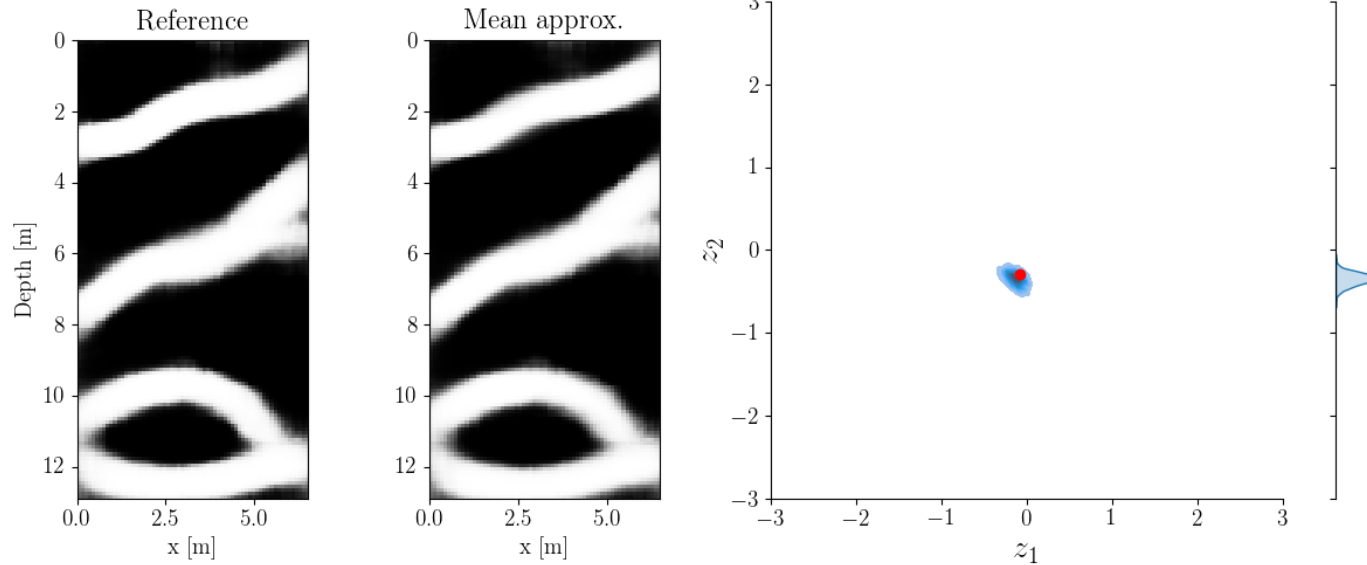
# INVERSION EXAMPLE

300 iterations



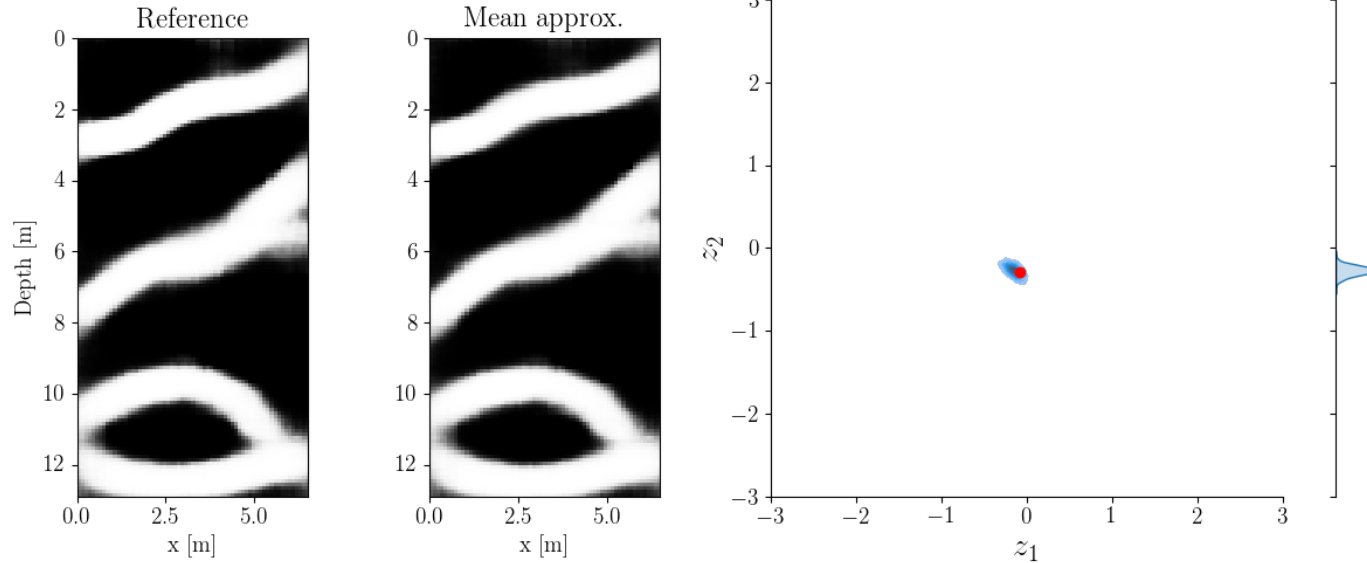
# INVERSION EXAMPLE

400 iterations



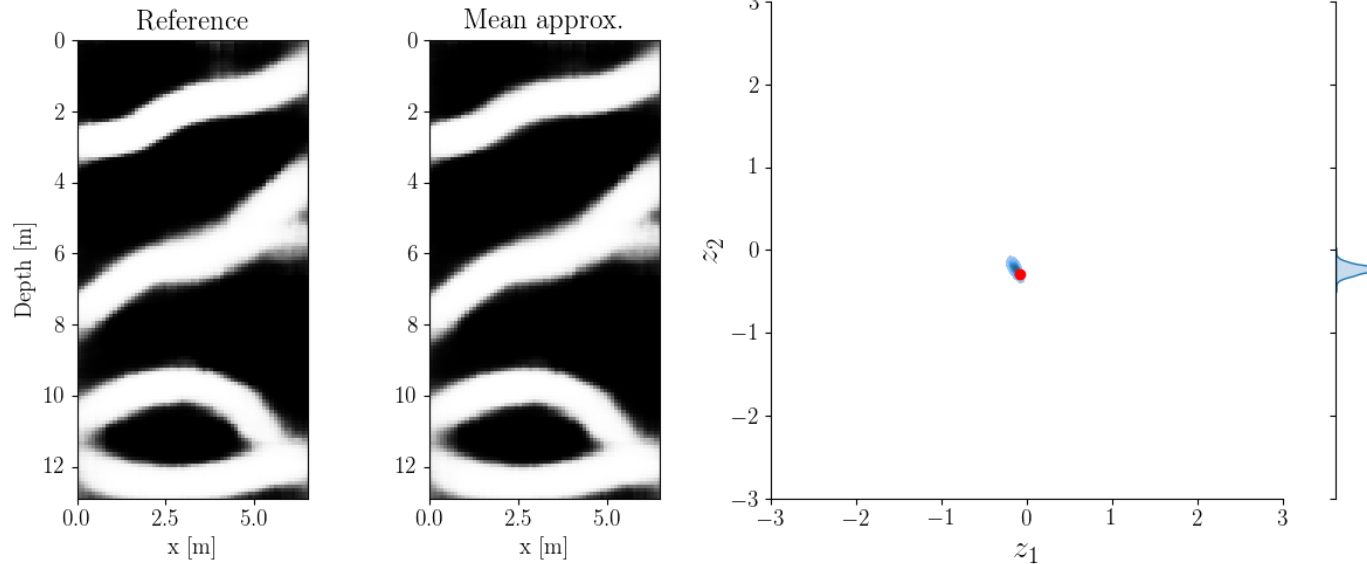
# INVERSION EXAMPLE

500 iterations



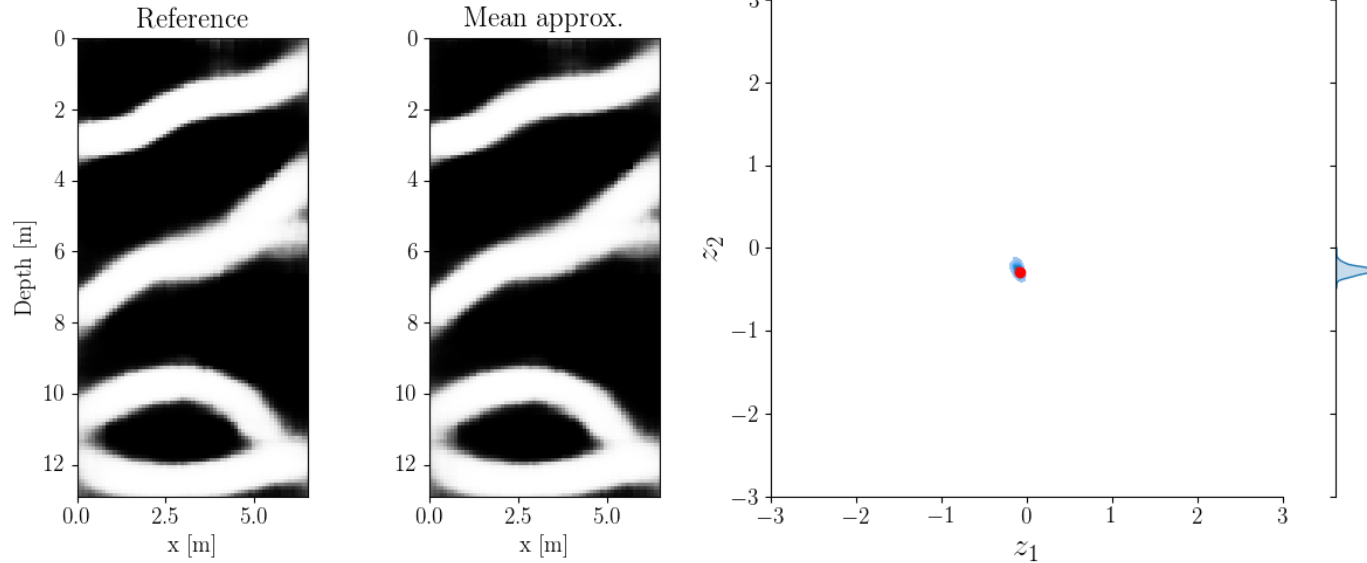
# INVERSION EXAMPLE

1000 iterations



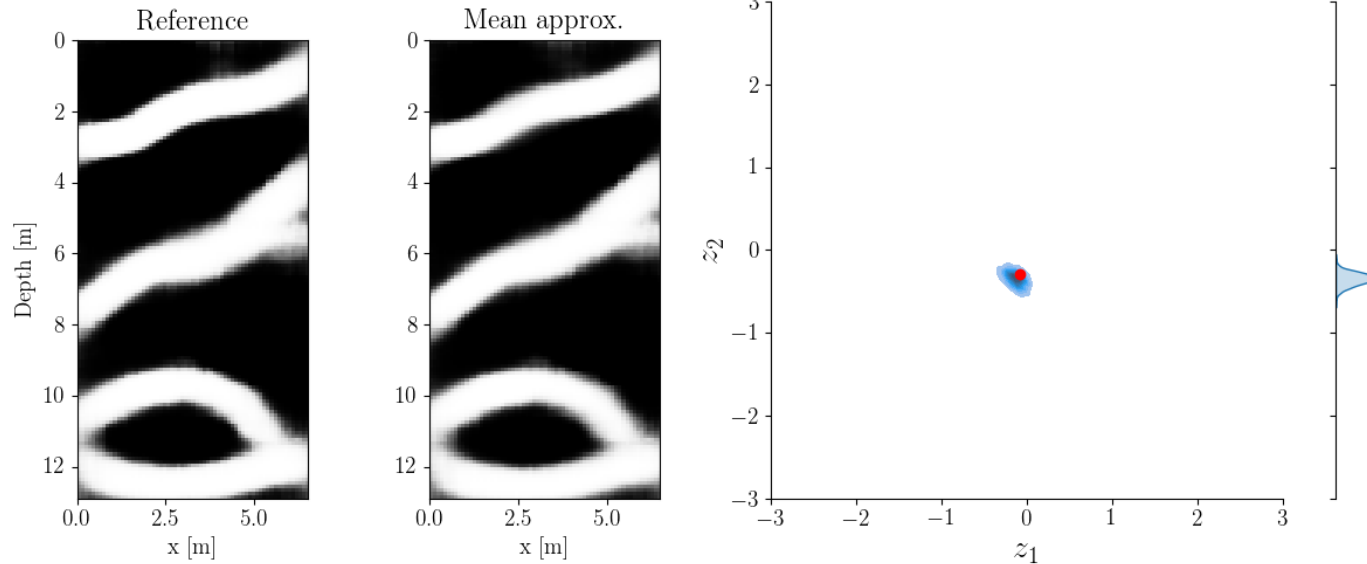
# INVERSION EXAMPLE

2000 iterations



# INVERSION EXAMPLE

400 iterations



# Thank you for your attention!



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# REFERENCES

- Hoffman, M., Sountsov, P., Dillon, J. V., Langmore, I., Tran, D., and Vasudevan, S. (2019). Neutra-lizing bad geometry in hamiltonian monte carlo using neural transport. arXiv preprint arXiv:1903.03704.
- Papamakarios, G., Nalisnick, E., Rezende, D. J., Mohamed, S., and Lakshminarayanan, B. (2021). Normalizing flows for probabilistic modeling and inference. *Journal of Machine Learning Research*, 22(57):1–64.
- Rezende, D. and Mohamed, S. (2015). Variational inference with normalizing flows. In *International Conference on Machine Learning*, pages 1530–1538. PMLR.