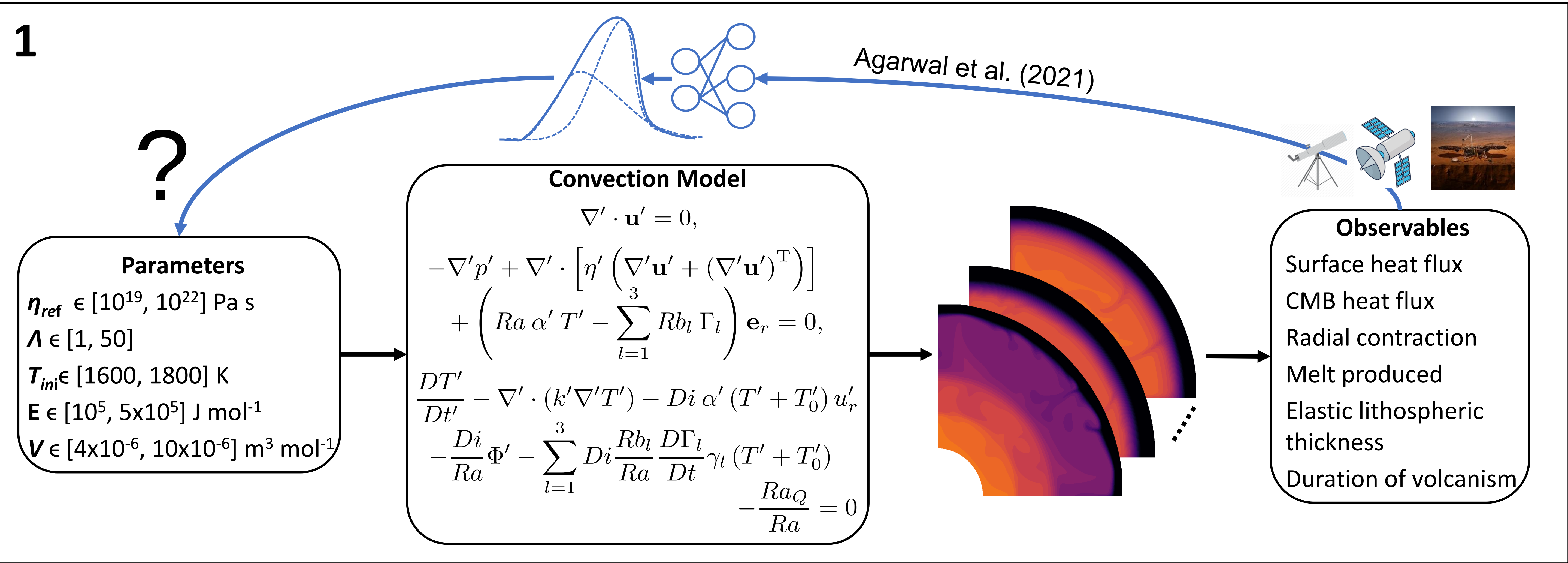
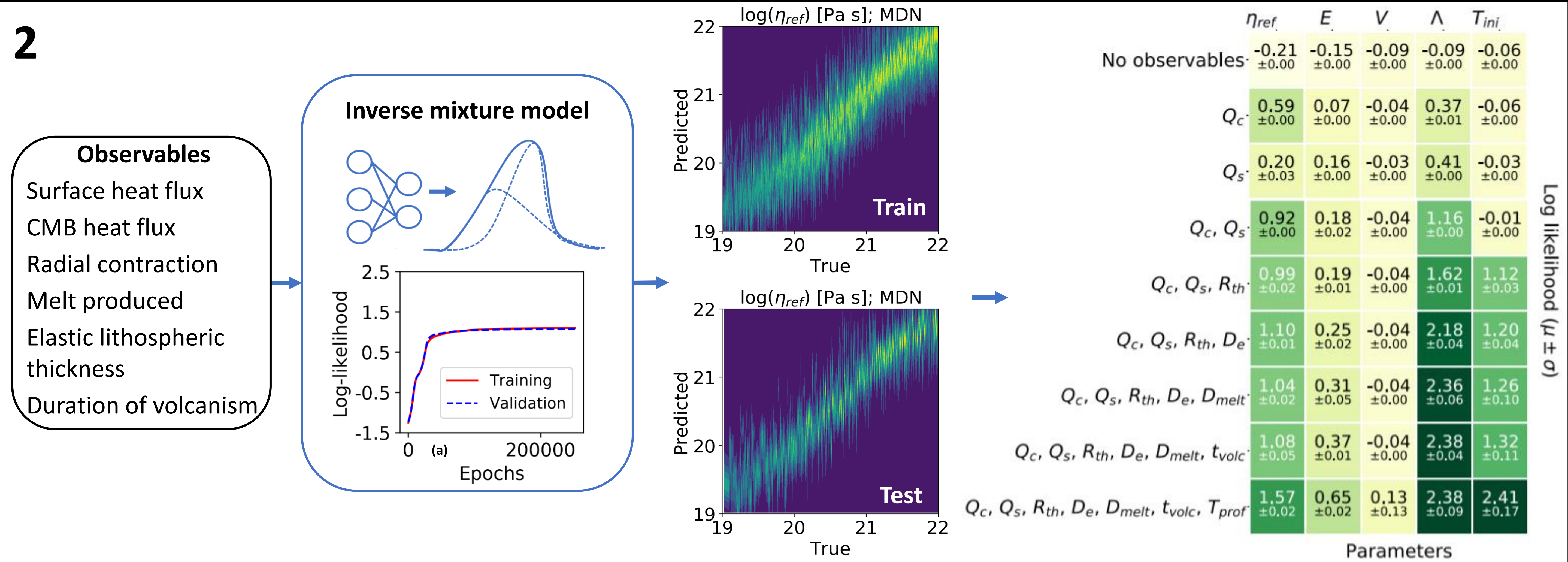
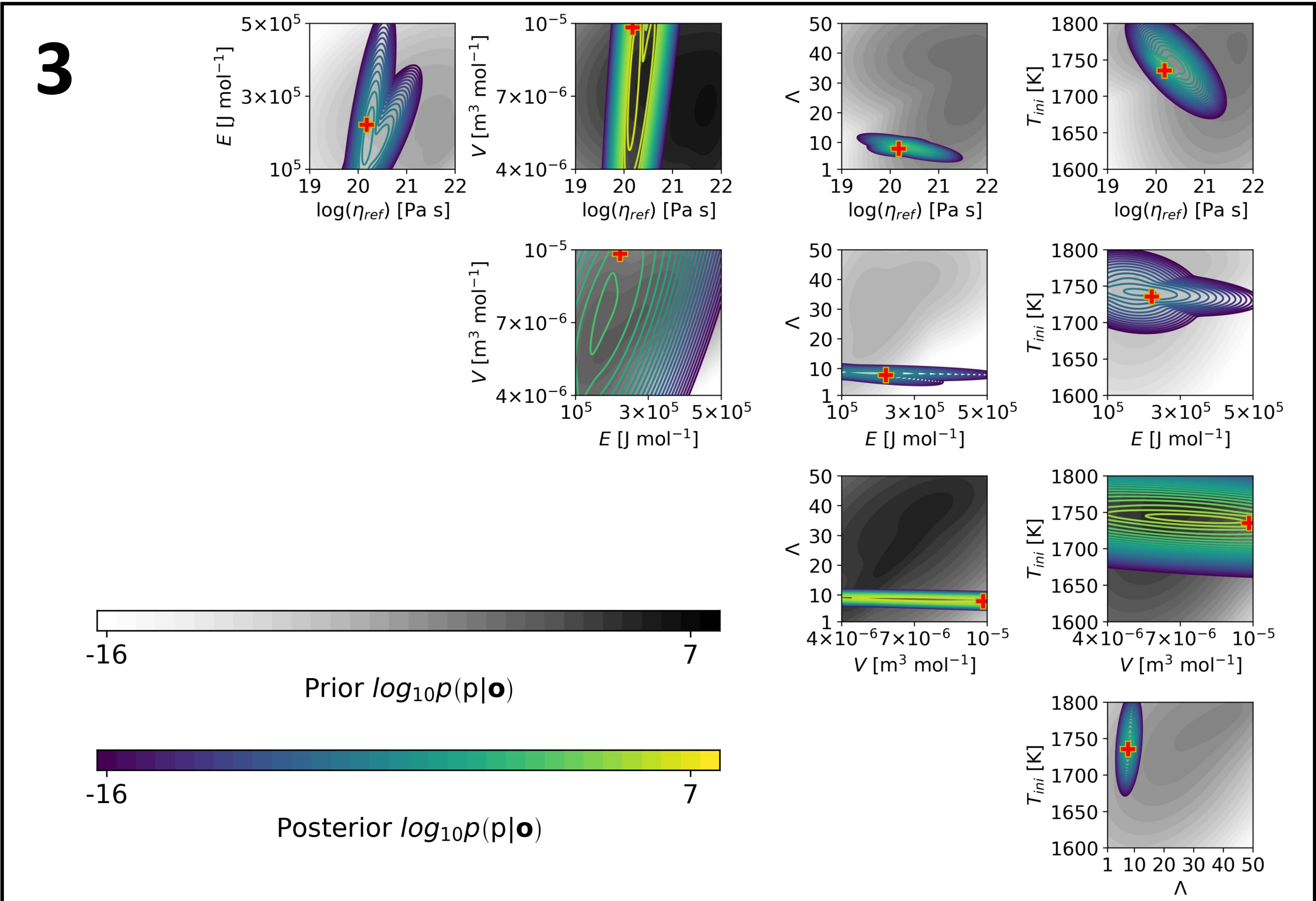




- Mixture Density Networks (Bishop 1994) provide a probabilistic framework for inverse problems in Geodynamics (e.g. Atkins et al. 2015).
- Using 6130 2D simulations of the thermal evolution of Mars' interior run in GAIA (Hüttig et al. 2013), we invert present-day synthetic observables to constrain key parameters as defined by the log-likelihood.
- Reference viscosity, crustal enrichment in heat-producing elements and initial mantle temperature can be well constrained.
- Activation energy of diffusion creep can be weakly constrained; constraining activation volume requires new observational signatures.

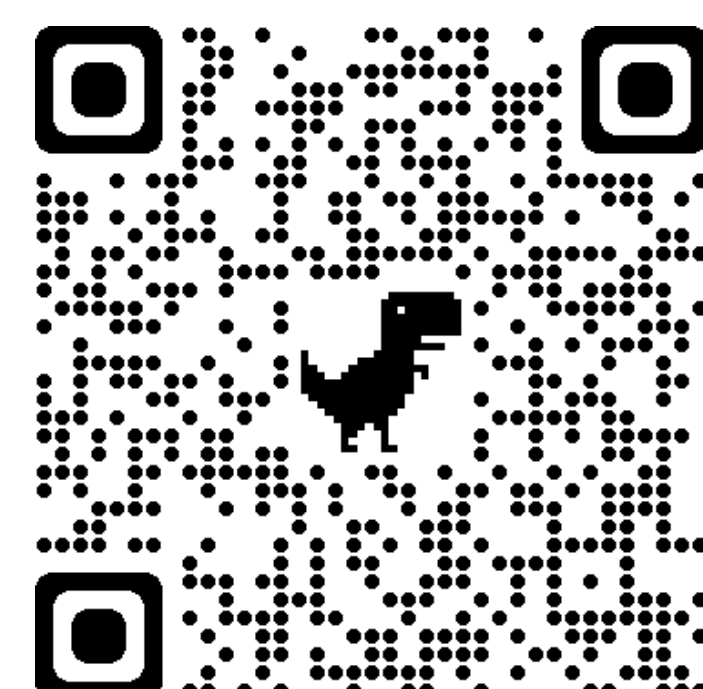


Acknowledgements

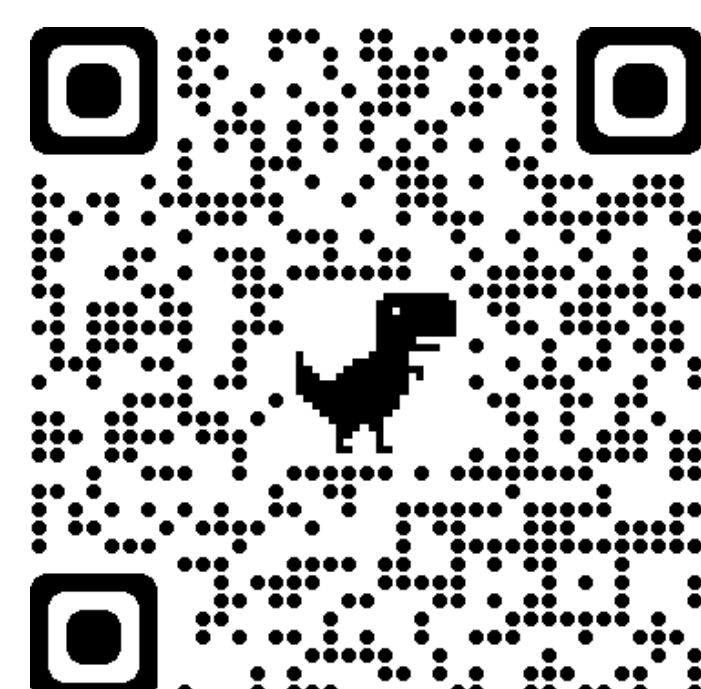
We acknowledge the support of the Helmholtz Einstein International Berlin Research School in Data Science (HEBRIDS), DLR and TU Berlin, as well as the North-German Supercomputing Alliance (HLRN) for providing the HPC resources.



Complete paper



Researchgate



References

- Image top right: "InSight Mission Overview." NASA, NASA, 30 Nov. 2018, mars.nasa.gov/insight/mission/overview/.
- Hüttig, C., Tosi, N., & Moore, W. B. (2013): An improved formulation of the incompressible Navier-Stokes equations with variable viscosity. *Physics of the Earth and Planetary Interiors*, 220, 11-18.
- Atkins, Suzanne, et al. "Using Pattern Recognition to Infer Parameters Governing Mantle Convection." *Physics of the Earth and Planetary Interiors*, vol. 257, 2016, pp. 171-186., doi:10.1016/j.pepi.2016.05.016.
- Bishop, Christopher M. "Mixture Density Networks." *Neural Computing Research Group*, Feb. 1994, doi:https://www.microsoft.com/en-us/research/wp-content/uploads/2016/02/bishop-ncrg-94-004.pdf.