Trans-dimensional Bayesian inversion of subsurface density structure and its geometry using gravity data

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Gravity anomalies are crucial observation to infer the subsurface density structure and its geometry. However, the inversion of gravity data is a non-linear and can be an underdetermined problem resulting in non-unique solutions. Additionally, the number of anomalies and their geometries are unknowns in the case of observed data and estimation of rigorous uncertainties is challenging using linearized inversion. In order to address these challenges, we develop a trans-dimensional Bayesian inversion of gravity data in which the number of anomalies also becomes unknown in the inversion, and unknown geometry and its complexity are naturally determined based on the observed data. We further extend this approach such that the noise in the data also estimated in the inversion. We first present the applicability of this algorithm through synthetic experiments and then apply it to the observed data collected from the gravity survey in Southern Utah.