Second-order smoothness prior over the Delaunay Tessellation and its application to gravity Bayesian inversion

*Yuanyuan Niu[1], Jiancang Zhuang[2,1]

1. SOKENDAI, 2. ISM

Prior information is always used to add constraints in Bayesian geophysical inversions to solve the non-uniqueness problem of the solution. A commonly used constraint is on the smoothness (second-order derivative) of the model parameters. The smoothness is usually calculated through interpolation over regular grids for the reason of easy implementation in numerical calculations. When observed data are irregularly distributed such as in geodetic data, interpolation based on a Delaunay tessellation (DT) over the observation locations is popularly used to avoid additional interpolations and to maintain the flexibility in the resolution of the model solution. However, calculating the smoothness of a function based on DT-based interpolation is more difficult than calculating the flatness (first-order derivative). We propose two interpolation methods for calculating the smoothness with DT-based interpolators: the double linear and the quadratic interpolators. These two methods are tested through numerical experiments. We also apply the DT-based interpolation methods to a gravity Bayesian inversion problem, in which the Bouguer gravity anomaly and the near-surface density structure are estimated.