

## Electrical Resistivity Tomography regularisation for piecewise smooth models

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The regularisation terms used in the inversion of geophysical data affects the structure visible in the solution. Where the subsurface is smooth or piecewise constant, the  $L_2$  and  $L_1$  norms of the model gradient effectively introduce this information into the inversion. However, where the subsurface is heterogenous, containing of both sharp and gradational changes, these established regularisation terms produce unrepresentative solutions. This has implications in infrastructure monitoring, where smooth wetting fronts or contaminant plumes appear alongside the sharp contrasts of engineered structures, as well as in lithological layering partially affected by weathering.

The Total Generalised Variation (TGV) functional is a convex, higher order generalisation of the  $L_1$  gradient norm, favouring piecewise smooth solutions. We use second order TGV regularisation to solve the electrical resistivity tomography inverse problem. Our alternating-minimisation algorithm decouples the second order calculations from the main Gauss-Newton iterations, allowing efficient performance. We will demonstrate the improved performance of TGV over  $L_1$  and  $L_2$  regularisation in the case of piecewise smooth models.