Regularization techniques for ground conductivity data inversion

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Electromagnetic induction measurements are often used for non-destructive investigation of soil properties, like the electrical conductivity and the magnetic permeability. Inversion of electromagnetic data allows one to theoretically determine the electromagnetic parameters of the subsurface, and so to ascertain the presence of particular substances and to identify their spatial position. These data are often measured by a ground conductivity meter, and two models can be found in the literature to describe its behaviour: a nonlinear model, arising from Maxwell equations, and a linear one, that may be used under suitable assumptions. The inverse problem is severely ill-conditioned in both cases, so regularization is needed. We computed the solution of the linear model by TSVD and Tikhonov regularization, whereas in the case of nonlinear model a Tikhonov-Newton methods has been implemented. Both the models will be described and we will present the results of numerical experiments in realistic applicative settings, for which experimental data are available.