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Inversion of synthetic geodetic data for planar fault events: clues on the effects of lateral heterogeneities and model selection.

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In geodetic data inversions the medium is often represented as a homogeneous, isotropic, and elastic half-space or as a layered medium, and their elastic parameters are considered to be standard. The slip distribution on the fault plane is obtained by dividing the fault into (an arbitrary number of) sub-faults and minimizing a cost function which includes a smoothness (laplacian) term and a data-misfit one. The smoothing parameter is usually selected from the trade-off between the two terms when varying its value.

The use of layered models neglects many of the real characteristics in the crust, as the lateral heterogeneities; thus computed displacements and observed data may differ more than hypothesized measurement errors, using a layered although standard model. Moreover, choosing an improper number of sub-faults may lead to wrong reconstructed slip distributions.

We aim to quantify the effects of using standard layering when assessing source features from co-seismic deformation data, in geological environments typical of the Apennines (Italy). For this purpose, we invert synthetic co-seismic displacements at the surface - computed by a finite element model (MARC) for some source parameters and complex crustal structures - for a planar fault embedded in a standard layered medium. The blind inversions are performed using the ANGELA code following a two-step procedure: (i) global optimization, without the smoothness constraint, for a fault divided into a small number (6 max) of equally-sized sub-faults and selection of the best-model fault (AIC, Akaike Information Criterion), (ii) slip distribution on the (expanded) best-model fault from step (i) for different values of the smoothing parameter, choice of the best smoothing parameter from the trade-off curve and selection of the optimal number of sub-faults (AIC).

Results from several tests will be shown.