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Source-inversion blindtest: initial results and further developments

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A number of methodologies have been proposed in the past to image the earthquake rupture process using seismic and/or geodetic data. Linearized inversions (with fixed timing information) and fully non-linear inversion show that slip is variable at all scales, but also that it is inherently difficult to (a) reliably estimate the temporal rupture evolution and (b) achieve consensus models among different researchers. The variation in slip maps, obtained by different research teams for the same earthquake potentially using identical data, is still very large, despite more sophisticated inversion approaches and larger computational facilities. However, well resolved, robust, and hence reliable source- rupture models are an integral part for dynamic rupture modeling, earthquake physics in general, and seismic hazard in particular.

We recently started a blind test inversion exercise in which several research groups derive a kinematic rupture model from synthetic seismograms calculated for an input model unknown to the source modelers. The first results, for an input rupture model with heterogeneous slip but constant rise time and rupture velocity, reveal very large differences between the input and inverted model in some cases, while a few studies achieve high correlation between the input and inferred model.

Here we report on the statistical assessment of the set of inverted rupture models to quantitatively investigate their degree of (dis-)similarity. Furthermore we discuss the different inversion approaches, their possible strength and weaknesses, and the use of appropriate misfit criteria. We also show a novel approach to quantifying parame-

ter uncertainties in terms of a posteriori probability distributions. Finally we present new blind-test models with increasing source complexity and ambient noise on the synthetics, potentially showing also first initial inversion results for this set of more complicated, but also more realistic, earthquake ruptures.