ESC2016-229, 2016
35th General Assembly of the European Seismological Commission

35th General Assembly of the European Seismological Commission
4–10 September 2016 Trieste

Fast and cheap approximation of Green functions uncertainty for waveform-based earthquake source inversions

Miroslav Hallo and František Gallovič
Charles University in Prague, Prague, Czech Republic (hallo@karel.troja.mff.cuni.cz)

Green functions (GFs) are an essential ingredient in waveform-based earthquake source inversions. Hence, their error due to imprecise knowledge of a crustal model is the major source of uncertainty of the inferred earthquake source parameters. Strategies how to incorporate the modeling error (uncertainty) of the GFs in waveform inversions have been introduced by Yagi and Fukahata (2011) and Duputel et al. (2014). They rely on statistical description of the GFs uncertainty by means of the covariance matrix. This study is devoted to estimation of covariance matrix of full wavefield GFs (describing the effect of velocity model uncertainty) and application into the seismic source inversion. Since the covariance matrix estimation by Monte-Carlo simulations is numerically very demanding, we propose simplified analytical approach. The results of the analytical approach exhibit very good agreement with the Monte-Carlo simulations, and may be easily implemented in currently existing inversion techniques. Furthermore, we will show the implementation in the case of the moment tensor inversion on real dataset from Greece. The application demonstrates ability of this method to incorporate uncertainties of GFs in inversion and also advantages of such approach.

Duputel, Z., Agram, P.S., Simons, M., Minson, S.E. Beck, J.L., 2014. Accounting for prediction uncertainty when inferring subsurface fault slipl, Geophys. J. Int., 197 (1), 464-482.

Yagi, Y. Fukahata, Y., 2011. Introduction of uncertainty of Green's function into waveform inversion for seismic source processes, Geophys. J. Int., 186 (2), 711-720.