

Paraná Basin Structure from Multi-Objective Inversion of Surface Wave and Receiver Function by Competent Genetic Algorithm

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Abstract

The joint inversion of receiver function and surface wave is an effective way to diminish the influences of the strong tradeoff among parameters and the different sensitivity to the model parameters in their respective inversions, but the inversion problem becomes more complex. Multi-objective problems can be much more complicated than single-objective inversion in the model selection and optimization. If objectives are involved and conflicting, models can be ordered only partially. In this case, Pareto-optimal preference should be used to select solutions. On the other hand, the inversion to get only a few optimal solutions can not deal properly with the strong tradeoff between parameters, the uncertainties in the observation, the geophysical complexities and even the incompetency of the inversion technique. The effective way is to retrieve the geophysical information statistically from many acceptable solutions, which requires more competent global algorithms. Competent genetic algorithms recently proposed are far superior to the conventional genetic algorithm and can solve hard problems quickly, reliably and accurately. In this work we used one of competent genetic algorithms, Bayesian Optimization Algorithm as the main inverse procedure. This algorithm uses Bayesian networks to draw out inherited information and can use Pareto-optimal preference in the inversion. With this algorithm, the lithospheric structure of Paraná basin is inverted to fit both the observations of inter-station surface wave dispersion and receiver function.