Time-reversal and Bayesian inversion

Wojciech Debski

Institute of Geophysics PAS, Dept. of Theoretical Geophys., Warsaw, Poland (debski@igf.edu.pl)

Probabilistic inversion technique is superior to the classical optimization-based approach in all but one aspects. It requires quite exhaustive computations which prohibit its use in huge size inverse problems like global seismic tomography or waveform inversion to name a few. The advantages of the approach are, however, so appealing that there is an ongoing continuous afford to make the large inverse task as mentioned above manageable with the probabilistic inverse approach. One of the perspective possibility to achieve this goal relays on exploring the internal symmetry of the seismological modeling problems in hand – a time reversal and reciprocity invariance. This two basic properties of the elastic wave equation when incorporating into the probabilistic inversion schemata open a new horizons for Bayesian inversion. In this presentation we discuss the time reversal symmetry property, its mathematical aspects and propose how to combine it with the probabilistic inverse theory into a compact, fast inversion algorithm.
We illustrate the proposed idea with the newly developed location algorithm TRMLOC and discuss its efficiency when applied to mining induced seismic data.