Geophysical Research Abstracts,
Vol. 10, EGU2008-A-05398, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-05398
EGU General Assembly 2008

Identification of adverse effects of wrong sensitivity kernels in 3D-tomographic inversion.

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In 3D tomographic inversion of wave traveltimes it is still common to compute sensitivities as ray curve integrals of slowness anomaly, yet it is well known that the actual traveltime sensitivity is distributed in a more or less tube-like shape along the mathematical ray. The adverse effects of the ray approximation depend on ray density and ray orientation as well as the data noise correlation and the model regularization.

We analyze this by use of *the distortion spectrum approach*. This allows us to analyze the more generic case of dense and isotropic ray coverage as well as the special cases of irregular and possibly sparse station locations and ray directions encountered in given more local studies, and the intermediate case of experimental design in planned temporary arrays.

We find that even when traditional checkerboard tests look good the ray approximation may lead to distortions in the model estimate aligned with the dominant ray directions. Note that this effect comes on top of the well known smearing along rays.