Geophysical Research Abstracts,
Vol. 11, EGU2009-2984-8, 2009
EGU General Assembly 2009

Observability of multiple P waves reflections

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In order to constrain the shallow structure of the Earth in global tomography, Love and Rayleigh waves are often used. However, these waves are only sensitive to the S wave velocity structure. Unfortunately, we do not have surface waves that are sensitive to mantle P velocity and that allow us to constrain the shallow P velocity structure. For that reason, to study the shallow P velocity structure of the Earth, we need to study P-waves at regional distances or multiple P reflections at teleseismic distance when regional data are not available, as in the oceans. Our work first of all consists in calculating synthetics seismograms using Chapman's WKBJ method. This allows us to study the behavior of such multiple P-waves reflected at the surface. With each reflection at the free surface these P-waves lose a part of their energy by conversion to S-waves. We want to know the maximum epicentral distance where these multiple phases are completely damped, and study their sensitivity to the upper mantle structure in order to include them in tomographic interpretations. Our synthetic results show that the PP (or 2P) and 3P phases appear clearly between 40 and 80 degree of epicentral distance. Synthetic results also show the presence of the 4P phase, which appears between 100 and 140 degree epicentral distance. Because of their trajectories in the Earth, these multiple P-waves are very sensitive to upper mantle structure. We are comparing the synthetic predictions with observed seismograms and shall present our final conclusions on observability at the conference.