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Creating realistic models and resolution assessment in tomographic inversion of wide-angle active seismic profiling data

T. Stupina (1), I. Koulakov (1), and H. Kopp (2)

(1) Trofimuk IPGG SB RAS, Novosibirsk, Russia (stupinata@ipgg.nsc.ru, KoulakovIY@ipgg.nsc.ru), (2) IFM-GEOMAR, Kiel, Germany (hkopp@ifm-geomar.de)

We consider questions of creating structural models and resolution assessment in tomographic inversion of wide-angle active seismic profiling data. For our investigations, we use the PROFIT (Profile Forward and Inverse Tomographic modeling) algorithm which was tested earlier with different datasets. Here we consider offshore seismic profiling data from three areas (Chile, Java and Central Pacific). Two of the study areas are characterized by subduction zones whereas the third data set covers a seamount province. We have explored different algorithmic issues concerning the quality of the solution, such as (1) resolution assessment using different sizes and complexity of synthetic anomalies; (2) grid spacing effects; (3) amplitude damping and smoothing; (4) criteria for rejection of outliers; (5) quantitative criteria for comparing models. Having determined optimal algorithmic parameters for the observed seismic profiling data we have created structural synthetic models which reproduce the results of the observed data inversion. For the Chilean and Java subduction zones our results show similar patterns: a relatively thin sediment layer on the oceanic plate, thicker inhomogeneous sediments in the overlying plate and a large area of very strong low velocity anomalies in the accretionary wedge. For two seamounts in the Pacific we observe high velocity anomalies in the crust which can be interpreted as frozen channels inside the dormant volcano cones. Along both profiles we obtain considerable crustal thickening beneath the seamounts.