HIGH RESOLUTION FINITE DIFFERENCE
GLOBAL WAVE PROPAGATION THROUGH THE
WHOLE EARTH: THE AXI-SYMMETRIC PSV AND
SH CASE

G. Jahnke, H. Igel
Department fuer Geo und Umweltwissenschaften, Ludwig-Maximilians Universitaet
Muenchen, Germany

Axi-symmetric methods of global seismic wave propagation allow for much higher
frequencies compared to full 3D methods, since computation and storage of the model
properties can be done on 2D domains. In contrast to 2D Cartesian methods point
sources and the correct 3D geometrical spreading can be simulated. Despite the re-
striction to axi-symmetry many interesting questions in global seismology can be in-
vestigated. Some of them are: diffractions at the CMB, teleseismic effects from sub-
duction zones and scattering within the mantle caused by small scale heterogeneities.
To compute seismograms for such geometries we developed algorithms for the SH
and the PSV case. Since SH waves exist solely in the mantle only this region has to
be included in the SH case simulations. For PSV waves the whole Earth must be dis-
cretized which leads to a more complex scheme. In order to cover the whole Earth we
enhanced the acoustic multi-domain method used by Thomas et al. (2000) to the PSV
case. This method uses multiple grids defined in polar coordinates. To avoid numerical
instabilities due to the decreasing grid spacing towards the center, a grid refinement
is done several times at different depth levels. The Earth’s center itself is treated in
Cartesian coordinates. We present verifications of the SH and the PSV scheme. As an
application, modeling of some of the teleseismic questions mentioned above are pre-
sented. Finally, a comparison of synthetic and real global data for different frequencies
is made.