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

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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 restriction to axi-symmetry many interesting questions in global seismology can be investigated. Some of them are: diffractions at the CMB, teleseismic effects from subduction 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 discretized 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 presented. Finally, a comparison of synthetic and real global data for different frequencies is made.