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Comparison of global synthetic seismograms calculated by the spherical 2.5-D finite-difference method with observed wave

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We have been developing accurate and efficient numerical schemes using the finite-difference method (FDM) in spherical coordinates to simulate global seismic wave propagation thorough laterally heterogeneous realistic Earth models. The so-called axisymmetric modeling is known as a traditional approach which efficiently solves the 3-D elastodynamic equation in spherical coordinates on a 2-D cross-section of the Earth assuming structures to be invariance with respect to the axis through the seismic source, although it essentially contains a severe demerit that asymmetric structures about the axis cannot be incorporated. Our scheme is based on the framework of the axisymmetric modeling but has extended to treat asymmetric structures (Toyokuni et al., 2005, GRL), arbitrary moment-tensor point sources (Toyokuni & Takenaka, 2006, EPS), anelastic attenuation (Toyokuni & Takenaka, 2008, AGU Fall Meeting), and the Earth's center which is a singularity of wave equations in spherical coordinates (Toyokuni & Takenaka, 2009, AGU Fall Meeting). All of this kind of schemes which solve 3-D wavefields on a 2-D model cross-section are classified into the 2.5-D modeling, so that we call our scheme spherical 2.5-D FDM.

In this presentation, we compare synthetic seismograms calculated by our FDM scheme with three-component observed long-period seismograms including data from stations newly installed on Antarctica in conjunction with the International Polar Year (IPY) 2007-2008. Seismic data from inland Antarctica is expected to bring images of Earth's deep interior with enhanced resolution due to the high signal-to-noise ratio and wide extent of this region, in addition to rarity of their sampling paths along the rotation axis of the Earth. We will show some numerical examples with the standard Earth model PREM and more realistic Earth models with lateral heterogeneity using a moment-tensor point source which has the same mechanism as a November 9, 2009 Fiji earthquake (Mw=7.3).

Keywords: seismology, synthetic seismogram, finite-difference method (FDM), global modeling, IPY2007-2008, Antarctica