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Advanced global P and S wave body wave tomography for monitoring applications

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We continue to develop more advanced models of Earth's global seismic structure, specifically focused on improving predictive capabilities for future seismic events (Simmons et al. 2011, 2012, 2015). Our most recent rendition combines high-quality P and S wave body wave travel times into a joint (simultaneous) inversion process to tomographically image Earth's crust and mantle (Simmons et al. 2015). The new model (LLNL-G3D-JPS) consists of 59 surfaces and ∼1.6 million model nodes from the surface to the core-mantle boundary, overlaying a 1-D outer and inner core model. The model architecture is aspherical and we directly incorporate Earth's expected hydrostatic shape (ellipticity and mantle stretching). We also explicitly honor surface undulations including the Moho, several internal crustal units, and the upper mantle transition zone undulations as predicated by previous studies. The explicit Earth model design allows for accurate travel time computation using our unique 3-D ray tracing algorithms, capable of tracing more than 20 distinct seismic phases including crustal, regional, teleseismic, and core phases. Thus, we can now incorporate certain secondary (and sometimes exotic) phases into source location determination and other analyses.

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