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waveform modeling for small-scale source complexity at teleseismic distances

In order to improve event detection, location, and identification, we need to better understand the complexities governing high frequency teleseismic wavefields. However, despite rapid hardware and software developments, capturing a broad range of heterogeneities with conventional seismic wave propagation remains computationally prohibitive on the global scale. To bridge the gap between complexity and computational cost, we present a global Instaseis-based (van Driel et al. 2015, www.instaseis.info) injection type hybrid method. The modified Instaseis interface couples the global wave-propagation solver, AxiSEM (Nissen-Meyer et al. 2014, seis.earth.ox.ac.uk/axisem), with an arbitrary three-dimensional solver of choice (in this work we use WPP), and thus embeds a heterogeneous 3D domain within a spherically symmetric Earth model either around the source, at depth or on the receiver side. Complex structures can be accounted for in the source region in order to model specific seismic observations that are caused by near-source phenomenology, like topography and 3D geology. Such hybrid simulations provide more insight into understanding and quantifying how structures contribute to waveform characteristics at teleseismic distances (such as amplitude, dominant frequency, onset form and pulse duration), and thus could refine our detection, location and identification capacities in nuclear explosion monitoring using seismology.

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