ID: Type: **Poster**

P-Wave Tomography Model for Improved Regional and Teleseismic Travel Time Prediction

We develop a global-scale P-wave velocity model designed to accurately predict seismic travel times at regional and teleseismic distances simultaneously. The model provides a new image of Earth's interior, but the underlying practical purpose of the model is to provide enhanced seismic event location capabilities. The LLNL-G3Dv3 model is based on ~2.8 million P and Pn arrivals that are re-processed using our global multiple-event locator called Bayesloc. We construct LLNL-G3Dv3 within a spherical tessellation based framework, allowing for explicit representation of undulating and discontinuous layers including the crust and transition zone layers. We demonstrate the impact of Bayesloc multiple-event location on the resulting tomographic images through comparison with images produced without the benefit of multiple-event constraints (single-event locations). We find that the multiple-event locations allow for better reconciliation of the large set of direct P phases recorded at 0-97° distance and yield a smoother and more continuous image relative to the single-event locations. Travel times predicted from a 3-D model are also found to be strongly influenced by the initial locations of the input data, even when an iterative inversion/relocation technique is employed.

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Track Classification: Theme 1: The Earth as a Complex System