ID: Type: **Oral**

learning for emulation of seismic-phase travel times in 3-D earth models

Wednesday, 26 June 2019 19:30 (15 minutes)

We develop a machine learning approach to emulate seismic-phase travel time calculation through a 3-dimentional (3-D) Earth model. Our goal is to establish a computationally efficient way to implement 3-D Earth models in real-time monitoring systems and enable routine utilization of 3-D models in basic research. Seismic-phase travel times computed using a 3-D Earth model can reduce travel-time prediction error to approximately 0.6 seconds on average, leading to median event epicenter error of approximately 6 km for a network with azimuth gap less than 120°. Computation of travel times through a 3-D model can take 0.1 to 1.0 seconds, which is orders of magnitude too slow for real-time monitoring systems. We train a gradient-boosted regressor using travel times computed through the LLNL-G3D model. The training set is millions of travel times from randomly selected event locations to each network station, as well as randomly selected station locations. Preliminary tests find that machine learning effectively captures global effects like ellipticity and event depth. The effects of the 3-D model can be emulated with resulting errors dominated by the 3-D model itself, and computation time on the order of 10 micro-seconds. On-going research efforts include optimization of training-set sampling.

Primary author: MYERS, Stephen (Lawrence Livermore National Laboratory)

Presenter: MYERS, Stephen (Lawrence Livermore National Laboratory)

Session Classification: T3.5 Data Analysis Algorithms, Artificial Intelligence, Big Data and Deep Learning

Track Classification: Theme 3. Verification Technologies and Technique Application