The Seismically Slow Feature in the Asthenosphere Beneath Southern New England is Small and Intense

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Previous studies of the seismically slow feature (a.k.a. “divot”) in the mantle beneath southern New England have relied upon low-resolution surface wave tomography to determine its shape. Using higher-resolution teleseismic P and S wave travel times, we find that it is much smaller, much sharper-edged and much stronger than hitherto fore has been appreciated. The feature causes a clear, spatially coherent “late” anomaly, of up to 1 s for P waves and 3 s for S waves. Placed in the asthenosphere, it is centered at a depth of ~200 km beneath central New Hampshire (43.62N, 72.02W). When modeled as Gaussian in shape, it is about 150 km wide and 190 km high and has a minimum compressional wave speed 0.43 km/s below the AK135 global model. These parameters have been estimated by comparing the observed travel time anomalies with those determined by 3D ray tracing through hypothetical models, and especially by matching parallax and maximum delay. S and P wave travel time anomalies scale across the Quebec-New England region with an average ratio of 3.51 +/- 0.74 (95%). The lack of anomalously high ratios for ray paths crossing the center of the feature argues against the presence of melt. No “fading” of the feature’s travel time anomaly is detected for earthquakes with shallow rays, suggesting it is not due to seismic anisotropy with a sub-vertical

slow axis. The strength of the shear wave anomaly is comparable to that of the much larger slow anomaly beneath Southern California (up to 9%), which suggests that, like Southern California, it has a thermal origin. Previous authors have argued for a connection between NESSI and the Great Meteor hotspot, which crossed New Hampshire at 109 Ma. Our improved location places it exactly on the hotspot track. However it is far too small, sharp-edged, and strong to be a relic thermal anomaly from hot material emplaced 109 million years ago. We propose it represents a modern asthenospheric “hot zone”, whose location has been steered by the much older hotspot track.