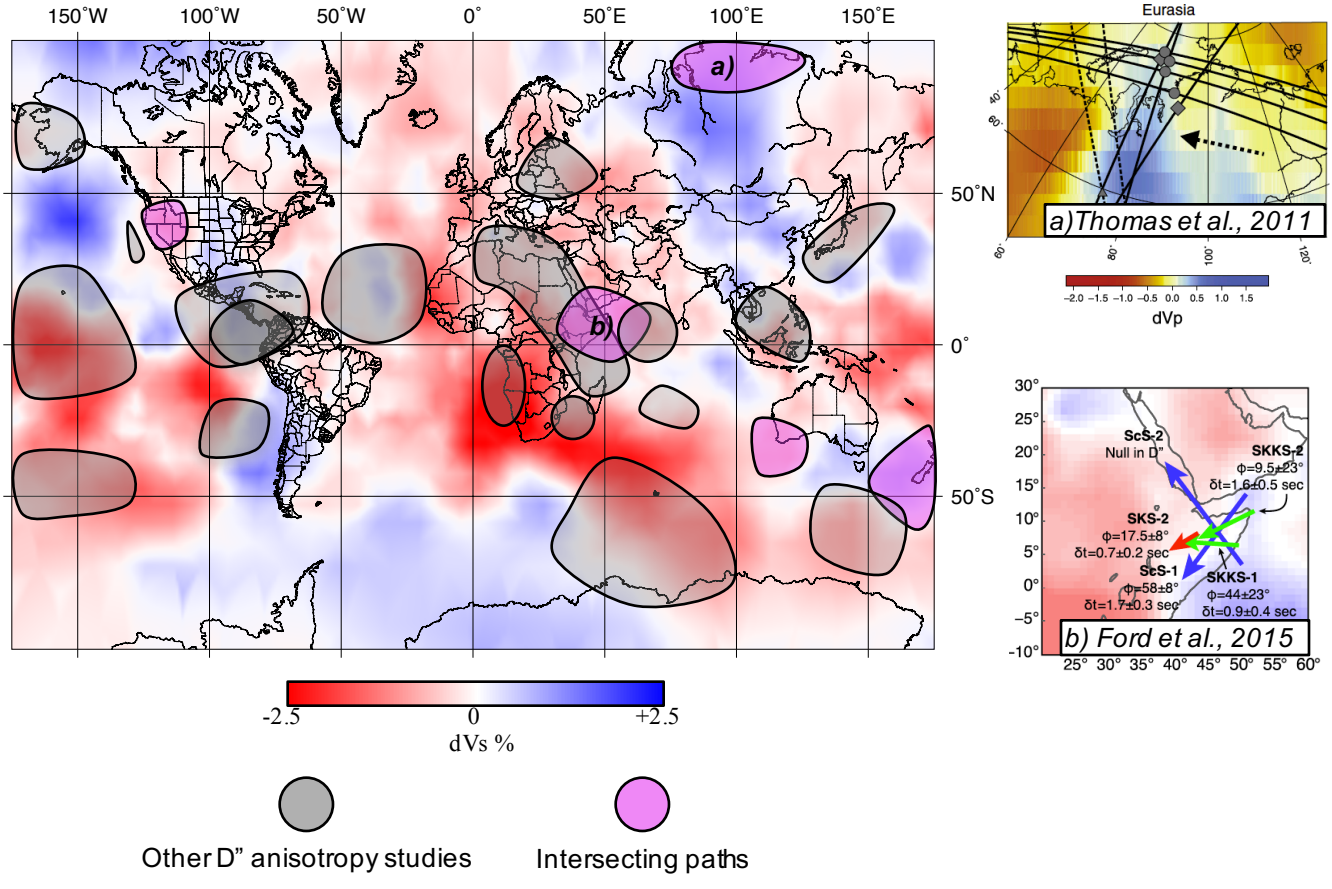
Constraining Lowermost Mantle Anisotropy: A Combination of Body Wave Methods

A variety of different mechanisms have been proposed as explanations for seismic anisotropy at the base of the mantle, including crystallographic preferred orientation of various minerals (bridgmanite, post-perovskite, and ferropericlase) and shape preferred orientation of elastically distinct materials such as partial melt. Investigations of the mechanism for D" anisotropy are usually ambiguous, as seismic observations rarely (if ever) uniquely constrain a mechanism. Observations of shear wave splitting and polarities of SdS and PdP reflections off the D" discontinuity are among our best tools for probing lowermost mantle anisotropy; however, using only one of these techniques is usually not enough to constrain the complexity of D" anisotropy. Through synthetic modeling, we have determined what types of body wave observations are required to uniquely constrain any particular mechanism for D" anisotropy. We find that having an assortment of SKS, SKKS, and ScS measurements and reflection polarity measurements dramatically increases the probability of uniquely constraining a potential mechanism of D" seismic anisotropy. Our current focus is studying a region in the lowermost mantle where all of these methods intersect, specifically D" beneath Siberia, Caribbean, and Japan



(Figure above) Summary of all D" seismic anisotropy studies (gray) with studies using intersecting raypaths highlighted in pink. Background dVs% tomography of GyPSuM (Simmons et al., 2010) at 2700 km depth.