In the quest of understanding the enigmatic seismicity of the New Madrid Seismic Zone (NMSZ), we study the velocity structure and anisotropy beneath this region. The study region spans longitudes 86 to 94 degrees west and latitudes 33.8 to 40 degrees north. We use data from the Northern Embayment Lithospheric Experiment (NELE), which is a lithospheric-scale passive array experiment in the northern Mississippi Embayment. The first phase of this experiment involved 6-month deployments of 6 flex array (FA) stations to fill in the Transportable Array (TA) grid stations over a period of two years (September 2011 to October 2013). The second phase is a 2 - year deployment which began in July 2013 with the installation of 51 broadband seismometers along three profiles with an average station spacing of 20 km. The Cooperative New Madrid Seismic Network (CNMSN) stations operated by the Center for Earthquake Research and Information (CERI) are also used to augment the NELE stations. In order to map the orientation and strength of mantle fabrics beneath this region, we use the SplitLab processing environment to measure shear wave splitting parameters of teleseismic SKS phases recorded from January 2011 to date. We also use arrival times from local earthquakes and travel time residuals from teleseismic earthquakes to perform a joint local and teleseismic P and S wave velocity (Vp and Vs) inversion. A comparison of the splitting measurements across different terrains within the study region indicates a complex pattern of anisotropy beneath the NMSZ (Figure 1). There is little to no agreement of the splitting patterns with the absolute plate motion directions and upon entering the embayment, we observe a change in fast axis directions from south-west to north-south and an increase in magnitude of the delay times. From the tomography study we image a prominent low velocity anomaly in both the Vp and Vs results concentrated at a depth of about 200 – 300 km. Combining the splitting results with these new, detailed Vp and Vs models will provide detailed knowledge of upper mantle structure, which may further our understanding of the driving mechanism of the NMSZ intraplate earthquakes and allow us to better assess the associated seismic hazard.

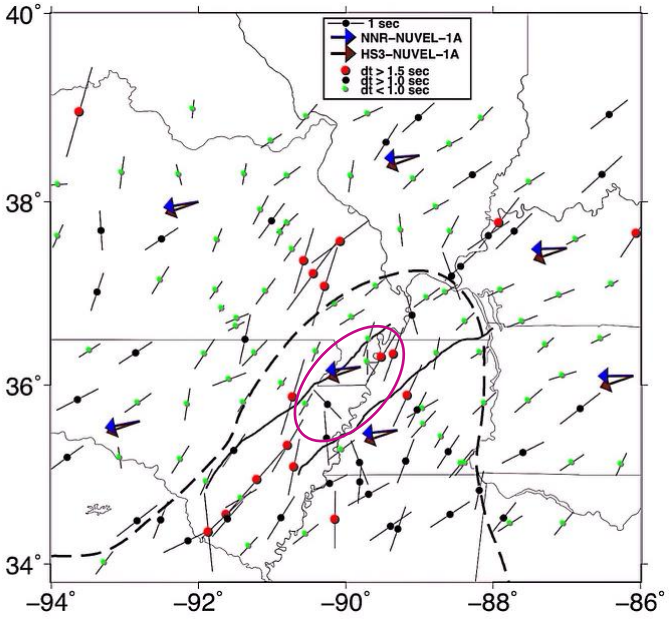

Figure 1: Map of average splitting parameters. Estimates were obtained by a simple average of the highest quality measurements at each station. Symbols are color coded by the magnitude of the delay time. The orientation of the bar corresponds to the fast direction. The magenta circle shows the approximate location of the low velocity anomaly from the body-wave tomography study. The dotted black line delineates the Mississippi Embayment.