Surface Wave Relocation Methods On Remote Continental Earthquakes

Jonas Kintner[1], Charles J. Ammon[1], K. Michael Cleveland[2]

1. Department of Geosciences, Pennsylvania State University, University Park, PA, 16802, jvk5803@psu.edu and charlesammon@psu.edu
2. Los Alamos National Laboratory, Los Alamos, NM, 87545, mcleveland@lanl.gov

Accurate hypocenter locations are an essential parameter needed for seismic event characterization and analysis. Traditional single-event location estimation methods provide relatively imprecise results in remote regions, where there are an insufficient number of seismic stations near the events. Previous work has demonstrated that improvements in relative hypocentral precision can be refined by using cross correlation measurements from body and surface waveforms. In this work we use intermediate-period regional and teleseismic Rayleigh and Love waves to estimate relative locations of moderately-sized seismic events in regions around Iran's Zagros Mountains. Applying this method to continental regions provides the opportunity to compare the surface-wave based relative locations with InSAR centroid location estimates. Large variations in faulting orientation, depth, and differences in intermediate-period dispersion make event relocation a challenging task in the Zagros Mountains region. This study explores the potential of using these relocation methods for smaller earthquakes ($M < 4.0$). Among the additional considerations needed for these relocations, we explore the effects of shifting the bandwidth from the 30-80 second band to short periods to accommodate for smaller magnitudes. We show that frequency dependent observations can support previous estimates of distance and velocity between events. Inter-event phase observations can potentially allow for the verification of surface wave dispersion estimates at shorter periods. We additionally explore some of the details involved with calibrating the mainshock of an earthquake sequence to the centroid of a given InSAR fault model. These additional comparisons between surface wave based relocations and InSAR hypocentroids are important for estimating absolute locations of nearby events. We explore these ideas using earthquake sequences in regions around the southern Zagros Mountains of Iran. Our ultimate goal is to gain insight on additional considerations needed to estimate precise locations of remote continental seismic events.