The discovery of tectonic tremor in Japan little more than a decade ago and subsequently around the world offers new insights into not only faulting processes but also the earthquake cycle. The proximity of tremor (slow slip) to the earthquake nucleation zone (brittle slip) has raised important questions about its relationship to earthquake occurrence. For example, it is known that earthquakes can trigger tremor activity but not fully understood if tremor activity can influence the earthquake cycle. If the latter relationship exists, then tremor activity can provide much needed information for seismic hazard assessments. In this study, I investigate the interaction of local earthquakes and tremor in 9 fault systems around the world – 7 subduction zones, 1 arc-continental collision zone, and 1 transform fault. I utilize tremor catalogs from the world tremor database, formed by detecting tremor with the envelope correlation method. For earthquakes, I acquire catalogs from sources that recorded the most events in the time frame of the tremor catalogs, e.g. Advanced National Seismic Systems, Incorporated Research Institutions for Seismology, GeoNet, and Japan Meteorological Agency. Using the earthquakes and tremor catalogs, I determine criteria for clustering events in space and time using a nearest-neighbor (single-link) method. Then, for each study region, these criteria are applied to group events that are close in space and time, i.e. into a family. I then explore characteristics of tremor-earthquake families - times between, separation distances, and sizes - and evaluate the statistical significance of the links between them.

Figure 1. (top left) Conceptual fault model of silent slip (white arrows), tremor (yellow patches), repeaters (orange patches), and a characteristic earthquake (red patch), modified from Figure 9 of Ide [2014]. (right) Study regions investigated in this study. Parkfield is a transform fault, and Taiwan is an arc-continental collision zone. All others are subduction zones. (bottom left) An example of a nearest-neighbor distribution for tremor in Manawatu, showing a clear separation of tremor events close in space and time (clustered) and those that are not (background).