Quantifying tectonic tremor in southern Mexico and its lack of correlation with slow slip

AUTHORS
Stefany M. Sit and Michael R. Brudzinski
Miami University, Department of Geology
Oxford, OH

ABSTRACT
Tectonic tremor, formerly known as non-volcanic tremor, along with slow slip episodes represent key new discoveries assisting in our abilities to learn more about how faults account for slip at major tectonic boundaries. Observations of tremor and slip were first made in Cascadia, but have now been observed in a variety of other subduction zones. Recent studies in Oaxaca, Mexico reveal both slow slip and tectonic tremor, but analysis of the most prominent tremor finds it recurs as often as every 2-3 months in a given region while slow slip occurs much less frequently on the order of 12-24 months. This result was surprising considering that tremor and slip are so well correlated in Cascadia that a linear relationship exists between the number of tremor hours recorded and the moment of concurrent slow slip. In contrast, the first study of tremor in Oaxaca found prominent tremor episodes were only slightly more common during the 2 month slow slip event than the 6 months before or after. However, tremor is more difficult to detect in Oaxaca than Cascadia considering the frequent microseismicity, seasonal storms, and limited seismic network. In this study, we investigate whether there were smaller periods of tremor that went undetected during the slow slip in the initial study, which was based on scanning average absolute amplitudes in the tremor passband. As an alternative, we will utilize a recently developed technique for detecting tremor that takes advantage of the narrow frequency content by calculating the ratio of amplitudes in the tremor passband relative to amplitudes in higher and lower passbands where microseismicity and surface waves are more common, respectively. In Cascadia, this frequency ratio method has been successful in the detection of low amplitude, short duration inter-ETS tremor and may assist in the detection of less prominent tremor in Oaxaca. Moreover, it will provide a more thorough estimate of tremor prevalence over time to test whether tremor is at all correlated with GPS-detected slow slip and if it provides any proxy to the degree of strain release on the deeper portion of the plate interface. Such a technique will also provide insight into the degree to which tremor is tidally modulated in Oaxaca, as recent modeling has indicated such a triggering relationship could be used to examine the state of stress and frictional properties on the fault interface.