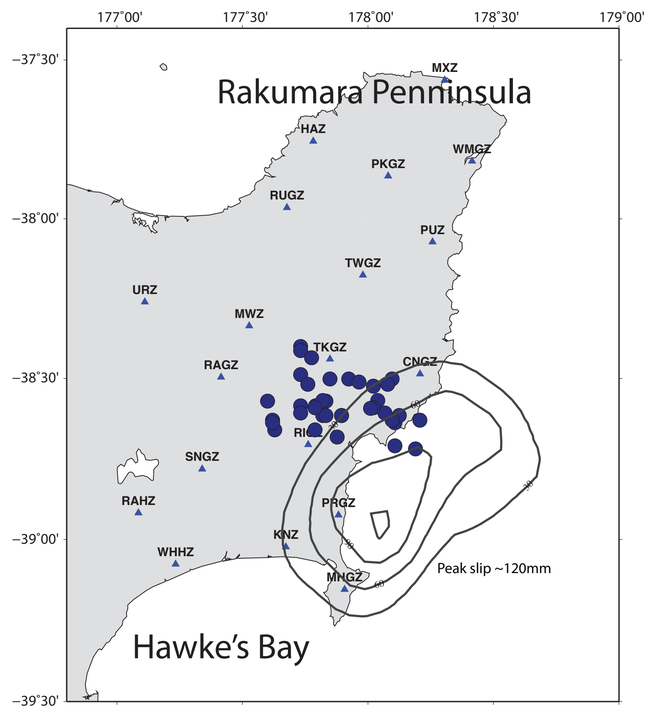
Tectonic tremor related to 2010 and 2011 Gisborne slow slip events

Erin K. Todd[1] and Susan Y. Schwartz[1]

[1]*University of California Santa Cruz*

Motivation & Methods

Tectonic tremor has been identified in New Zealand, both along the Alpine Fault (*Wech et al.* 2012) and the Hikurangi subduction margin (*Kim et al.* 2011). This work builds upon the results of *Kim et al.* (2011) for the March 2010 SSE to investigate patterns in tectonic tremor in the Gisborne region of New Zealand. We used the same codes as *Kim et al.* 2011 (a modified verions of the popular envelope cross correlation method by *Wech & Creager* 2008), but preformed many different runs while varying the input parameters and contouring the output of a combination of different runs.

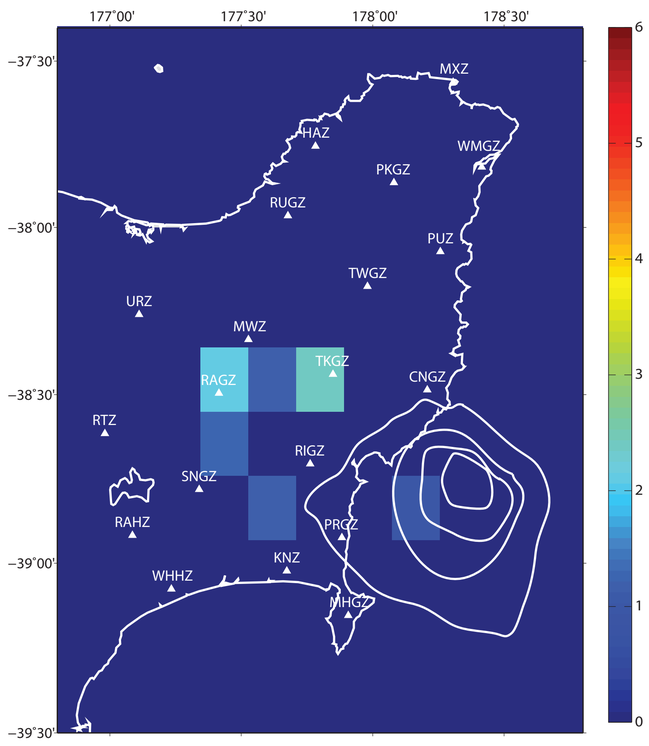


March 2010

Tremor locations (*Kim et al.* 2011) and slow slip contours (*Wallace and Beavan* 2010) for the March 2010 Gisborne SSE. The tremor occurs predominantly during the geodetically detected SSE at the downdip edge of the rupture patch. The 2010 SSE (Mw=6.7) is larger in magnitude than the 2011 Gisborne SSE (Mw=6.48).

December 2011 Tectonic Tremor

We analyzed data for 28 days and detected tectonic tremor before, during, and after the December 2011 Gisborne SSE (peak slip ~50 mm). The tremor migrates from north to south of the downdip edge of the rupture patch. The tremor during the 2011 SSE is also more dispersed than during the 2010 SSE.

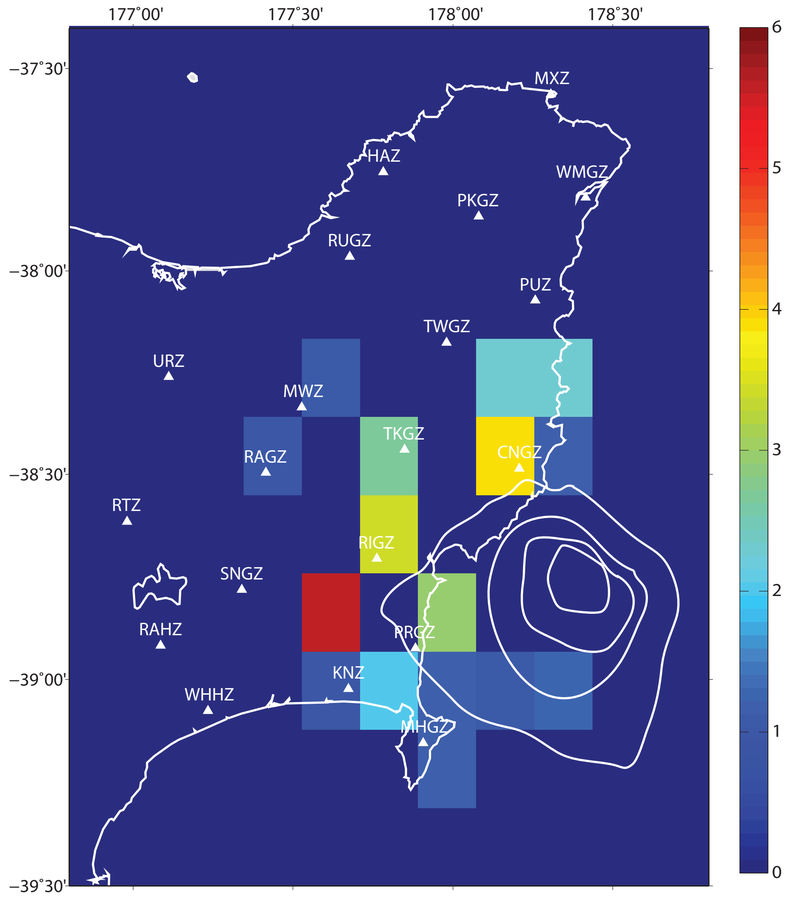


5-11 December 2011 -- Before

We analyzed data from 7 days before the geodetically detected slow slip and located tremor at the downdip edge of the northern edge of the rupture patch. The tremor is present a few days before the SSE begins, but is not present in the 2 days immediately preceding the SSE. The colors represent counts of tremor locations within the highlighted area and the white contours represent the geodetically determined slow slip patch.

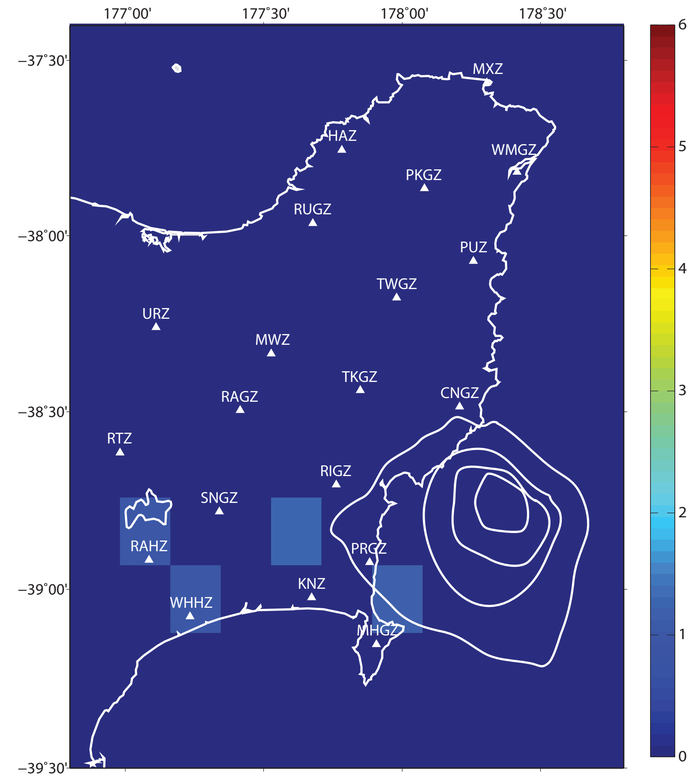
12-23 Dec. 2011 -- During

Areas of detected tremor during the Gisborne SSE. Similar to the tremor observed for the March 2010 Gisborne SSE, the regions with the highest tremor counts is at the immediate downdip edge of the geodetically detetermined SSE. Unlike the tremor for the 2010 SSE, the termor detected for 2011 is more dispersed across the downdip edge of the rupture patch.



24-30 December 2011 -- After

We analyzed data from 7 days after the end of the geodetically detected SSE and located tremor in the first 3 days at the southern end of the rupture patch. These locations are quite dispersed along the northern end of Hawke's Bay.



References

--*Wallace et al.* (2012), Simultaneous long-term and short-term slow slip events at the Hikurangi subduction margin, New Zealand: Implications for processes that control slow slip event occurrence, duration, and migration, *J. Geophys. Res.*, **117**, doi:10.1029/2012JB009489.

--*Kim et al.* (2011), Non-volcanic tremor associated with the March 2010 Gisborne slow slip event at the Hikurangi subduction margin, New Zealand, *Geophys. Res. Lett.*, **38**, doi:10.1029/2011GL048400.

--*Wech & Creager* (2008), Automated detection and location of Cascadia Tremor, *Geophys. Res. Lett.*, **35**, doi:10.1029/2008GL035458.

--*Wech et al.* (2012), Tectonic tremor and deep slow slip on the Alpine Fault, *Geophys. Res. Lett.*, **39**, doi:10.1029/2012GL051751.

Conclusions

Tectonic tremor accompanies slow slip in the northern Hikurangi subduction zone. Tremor locations are at the downdip edge of the slow slip rupture patch for both the 2010 and 2011 events, but are more dispersed for the 2011 event.