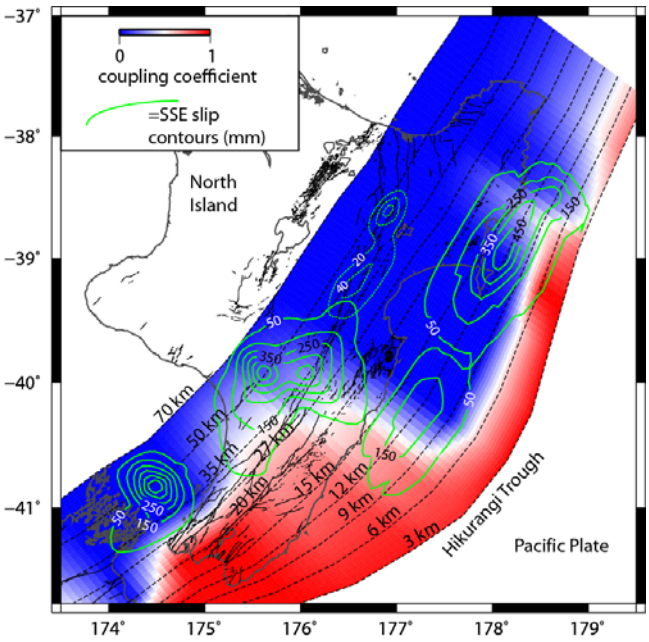
Geodetic constraints on the seismic cycle: Implications for seismic hazard assessment and future directions

[a] Ian Hamling, [a,b] Laura Wallace, [a] Sigrun Hreinsdottir

[a] *GNS Science, Lower Hutt, New Zealand, I.hamling@gns.cri.nz,* [b] *University of Texas at Austin, Austin, USA*

Many recent devastating earthquakes, such as the 2010-2011 Canterbury earthquake sequence, have occurred on faults which were previously unknown or on faults whose hazard had been underestimated. Poor estimates of recurrence intervals and slip rates along faults, incomplete earthquake catalogues and missing active faults all lead to significant uncertainties in estimating the seismic hazard for a given region. While geodetic data cannot help in all these areas, our ability to measure the deformation of the Earth's surface has dramatically improved over the last 20-25 years. However, there is still some debate over how representative the relatively short time-span of geodetic observations is of long-term fault behavior.



Coupling and slow slip on the Hikurangi subduction thrust estimated from campaign and continuous GPS data (after Wallace et al., 2014).

We will discuss ways in which geodetic data (InSAR and GPS) can help inform seismic hazard assessment and some of the uncertainties which need to be considered. We have already used geodetic data in New Zealand's National Seismic Hazard Model (NSHM) in a variety of ways. These include use of interseismic coupling on the Hikurangi subduction thrust and Alpine fault determined from GPS measurements to inform rupture dimensions and scenarios. We have also used GPS data to determine slip rates on some active faults in New Zealand for the NSHM from elastic block modeling, where such rates were not possible to determine with other methods (such as active fault geology studies). We are developing approaches to incorporate strain rates (converted to moment rate), derived from New Zealand's extensive campaign GPS velocity field, into future versions of the NSHM. There is also a great need to incorporate the occurrence of slow slip events at New Zealand's Hikurangi subduction zone into time-dependent seismic hazard models; this is particularly the case as New Zealand SSEs are often accompanied by abundant triggered seismicity.