Detailed inversion of a shallow slow slip event at the Hikurangi subduction zone, New Zealand, using numerical Green’ s functions and absolute pressure gauge data

*Charles A Williams[1], Laura M Wallace[1], Spahr C Webb[2], Yoshihiro Ito[3], Kimihiro Mochizuki[4], Ryota Hino[5], Stuart Henrys[1]

1. GNS Science, 2. Lamont-Doherty Earth Observatory, 3. Disaster Prevention Research Institute, 4. Earthquake Research Institute, 5. Tohoku University

Slow slip events (SSEs) have been observed throughout the world, and the existence of these events has fundamentally altered our understanding of the possible ranges of slip behavior at subduction plate boundaries. SSEs are typically observed via continuous GPS (cGPS) observations. Although much has been learned in recent years, the slip distributions for shallow SSEs are still poorly understood due to the lack of offshore data to constrain the slip estimates. Most importantly, it has been difficult to determine whether shallow SSEs extend to the trench, or whether they terminate at some distance inboard of the trench. Constraining the slip distribution is critical to our understanding of the physics underlying SSEs.

Recently, absolute pressure gauges (APGs) were deployed offshore near Gisborne, New Zealand, as part of the HOBITSS experiment, capturing a SSE event during September and October 2014. The APGs provide a record of vertical deformation during the event, allowing much better constraints on the offshore slip distribution. Initial inversions using an elastic half-space model based on these observations indicate that slip occurred within 2 km of the trench. We here describe a more detailed inversion procedure where we include the effects of detailed fault geometry, bathymetry/topography, and material property variations to provide a more accurate estimate of the slip distribution during this event. We use the PyLith finite element code to generate Green’ s functions for use in our inversions. We find that inversions that take into account material property variations require larger amounts of slip, with predicted seismic potencies approximately 40% greater than homogeneous models.

Keywords: Slow slip, Hikurangi, Inversion, Numerical Green's functions, Absolute pressure gauge, Finite element