

Along-strike Variations in the Hikurangi Subduction Zone: The 2017-2018 SHIRE Seismic Onshore-Offshore Imaging Experiment

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Slip along subduction zone slab interfaces exhibit a range of styles, including destructive coseismic earthquakes, slow slip events, tremor, and aseismic creep. These slip processes are influenced by factors such as local stress state, physical properties including friction and elastic properties, presence of lubricating fluids, and mineral composition of rocks filling the fault zones where the slip occurs. Estimations of these factors can be made using geophysical and geological methods. The Hikurangi subduction margin at eastern North Island, New Zealand, represents an excellent system to examine these physical processes that govern slip. Significant along-strike variation is present with stick-slip (coseismic earthquakes) in the southern portion of the system to aseismic creep (slow slip events) to the north. Several other major earthquake and tectonic factors also vary from south to north, either influencing the change in slip behavior or being the result of this lateral change.

The multi-disciplinary, multi-national SHIRE (Seismogenesis at Hikurangi Integrated Research Experiment) project examines these factors that influence slip plus the relationship between this slip and long-term deformation. SHIRE has research activities in active and passive source seismology, paleoseismology, and geodynamics; US team members are from UTIG, Penn State, USC, Cal Poly Pomona, and U. Southern Mississippi. Just recently (Oct 2017-Feb 2018) SHIRE carried out a large seismic onshore-offshore experiment of the Hikurangi margin (Fig. 1) with international partners GNS Sciences, JAMSTEC, ERI, and VUW. This experiment involved (A) the R/V Langseth to collect 4046 km of MCS profiles (see Fig. 1), (B) OBS instruments to collect airgun refraction/wide angle reflections, and (C) portable land instruments to record the same airgun sources plus four months of local earthquakes. In this poster we describe the SHIRE science goals, the large seismic onshore-offshore experiment and its field components, and then present examples of these data and early results. We also describe the upcoming SHIRE land explosion experiment plus the existence of synergistic large colocated field efforts including a community 3D seismic reflection survey, IODP drill sites, and slow slip earthquake studies.

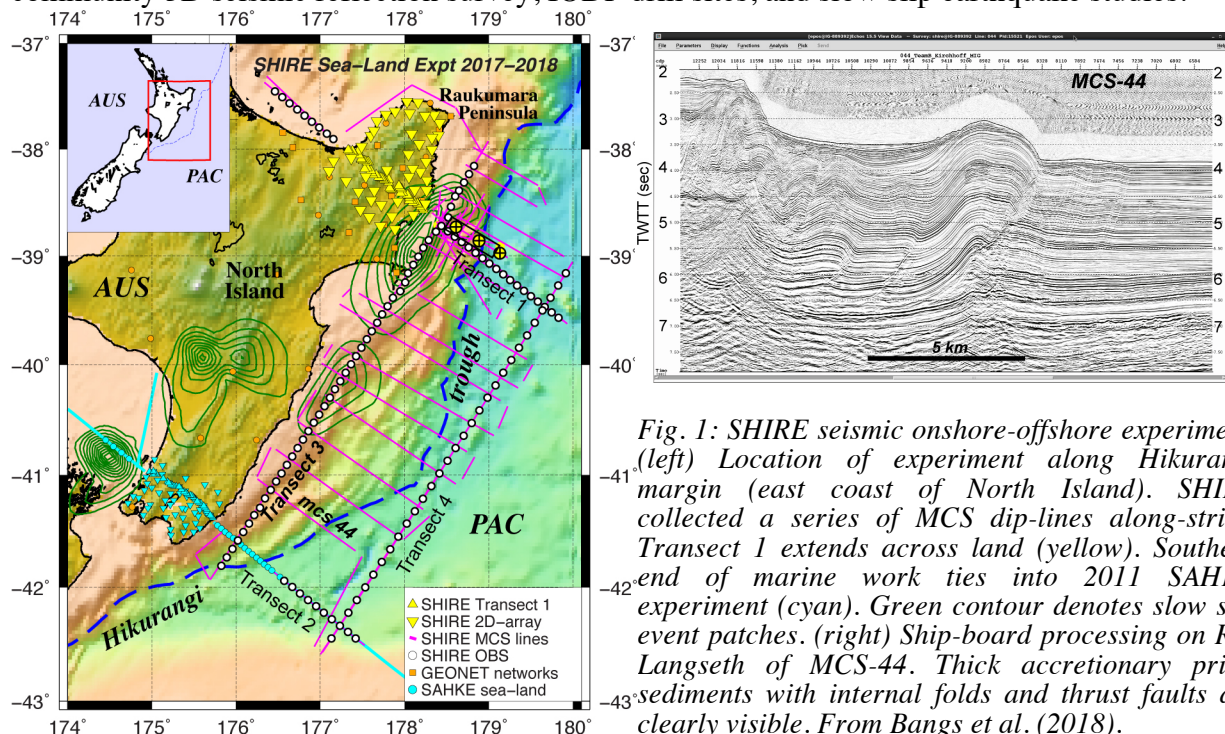


Fig. 1: SHIRE seismic onshore-offshore experiment. (left) Location of experiment along Hikurangi margin (east coast of North Island). SHIRE collected a series of MCS dip-lines along-strike. Transect 1 extends across land (yellow). Southern end of marine work ties into 2011 SAHKE experiment (cyan). Green contour denotes slow slip event patches. (right) Ship-board processing on R/V Langseth of MCS-44. Thick accretionary prism sediments with internal folds and thrust faults are clearly visible. From Bangs et al. (2018).