[EJ] Evening Poster | S (Solid Earth Sciences) | S-CG Complex & General

[S-CG57]Dynamics in mobile belts

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The dynamic behaviours of mobile belts are expressed across a wide range of time scales, from the seismic and volcanic events that impact society during our lifetimes, to orogeny and the formation of large-scale fault systems which can take place over millions of years. Deformation occurs on length scales from microscopic fracture and flow to macroscopic deformation to plate-scale tectonics. To gain a physical understanding of the dynamics of mobile belts, we must determine the relationships between deformation and the driving stresses due to plate motion and other causes, which are connected through the rheological properties of the materials. To understand the full physical system, an integration of geophysics, geomorphology, and geology is necessary, as is the integration of observational, theoretical and experimental approaches. In addition, because rheological properties are greatly affected by fluids in the crust and fluid chemical reactions, petrological and geochemical approaches are also important. After the 2011 great Tohoku-oki earthquake, large-scale changes in seismic activity and regional scale crustal deformation were observed, making present-day Japan a unique natural laboratory for the study of the dynamics of mobile belts. This session welcomes presentations from different disciplines, such as seismology, geodesy, tectonic geomorphology, structural geology, petrology, and geofluids, as well as interdisciplinary studies, that relate to the dynamic behaviour of mobile belts.

[SCG57-P25]Spaciotemporal Stress Change during the 2016 Mw 7.8 Kaikoura earthquake, New Zealand

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New Zealand lies across the Pacific-Australia plate boundary. The northern South Island overlies a transition between subduction beneath the Hikurangi margin and dextral transpression along the Alpine fault. On November 13, 2016, the Mw 7.8 Kaikoura earthquake occurred near the east coast of the northern South Island. Ten or more faults with various geometries ruptured in a mixture of strike-slip and reverse-slip. Stress orientation and magnitude are critical to understanding this complex multiple rupture.

In this study, we determined stress tensors before and after the Kaikoura earthquake using data collected by our own temporary seismic stations (deployed more than 2 years prior to the earthquake), which recorded the earthquake and aftershocks, as well as using data recorded by the New Zealand GeoNet seismometers. We derived focal mechanisms using HASH (Hardebeck, 2002), supplementing those mechanisms with CMT solutions derived by GeoNet. The full time period covered by our analysis is from Apr. 1, 2014 to Jun. 30, 2017. We subsequently used SATSI (Hardebeck and Michael, 2006) for stress tensor inversion. To divide the focal mechanisms to form an adequate number of clusters, we used the k-means method based on hypocenter location. The number of clusters was determined by the elbow

method and silhouette methods. We merged the data before and after the mainshock into one dataset and applied the k-means method, obtaining 6 clusters. Of those, 3 clusters had enough earthquakes to allow comparisons to be made before and after the mainshock.

Before the main shock, horizontal maximum compressional axis is oriented at c. 120°, consistent with previous studies (e.g., Sibson et al., 2012; Townend et al., 2012). For the southern and central clusters, stress tensors before and after the mainshock did not change significantly. This has the implication that for this area the change in differential stress accompanying the mainshock was probably small compared with the prefailure differential stress. For the northern cluster, the axis of horizontal maximum compression seemed to rotate anticlockwise implying that there, the change in stress was probably comparable to the prefailure differential stress.