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Seven years of postseismic deformation following the 2009 Mw 7.8 Dusky Sound earthquake from GPS, InSAR and dynamic models

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The Mw 7.8 Dusky Sound earthquake of 2009 July 15 is the largest event ever recorded at the Puysegur subduction zone, where the Australian Plate is obliquely subducted beneath southwestern New Zealand. This event ruptured a patch of the plate interface about 80*50 km with a maximum slip of 6 m (Beavan et al. 2010) and may have induced significant afterslip and viscoelastic relaxation, therefore the surface deformation following this earthquake may yield unique insights into the rheology of this region.

In this paper, we firstly present the results of seven years of postseismic surface displacements from continuous GPS (Global Positioning System) and InSAR (Interferometric Synthetic Aperture Radar) observations; After that we construct a class of physical models of the deformation driven by coseismic stress change where afterslip and viscoelastic flow are fully coupled to (1)explore the characteristic of the model needed to explain the main features of the observed postseismic deformation, and (2) investigate the relative contribution of afterslip and viscoelastic flow. Lastly, we discuss the implication of the inferred parameters for the upper mantle rheology as well as the frictional properties of the fault zone.