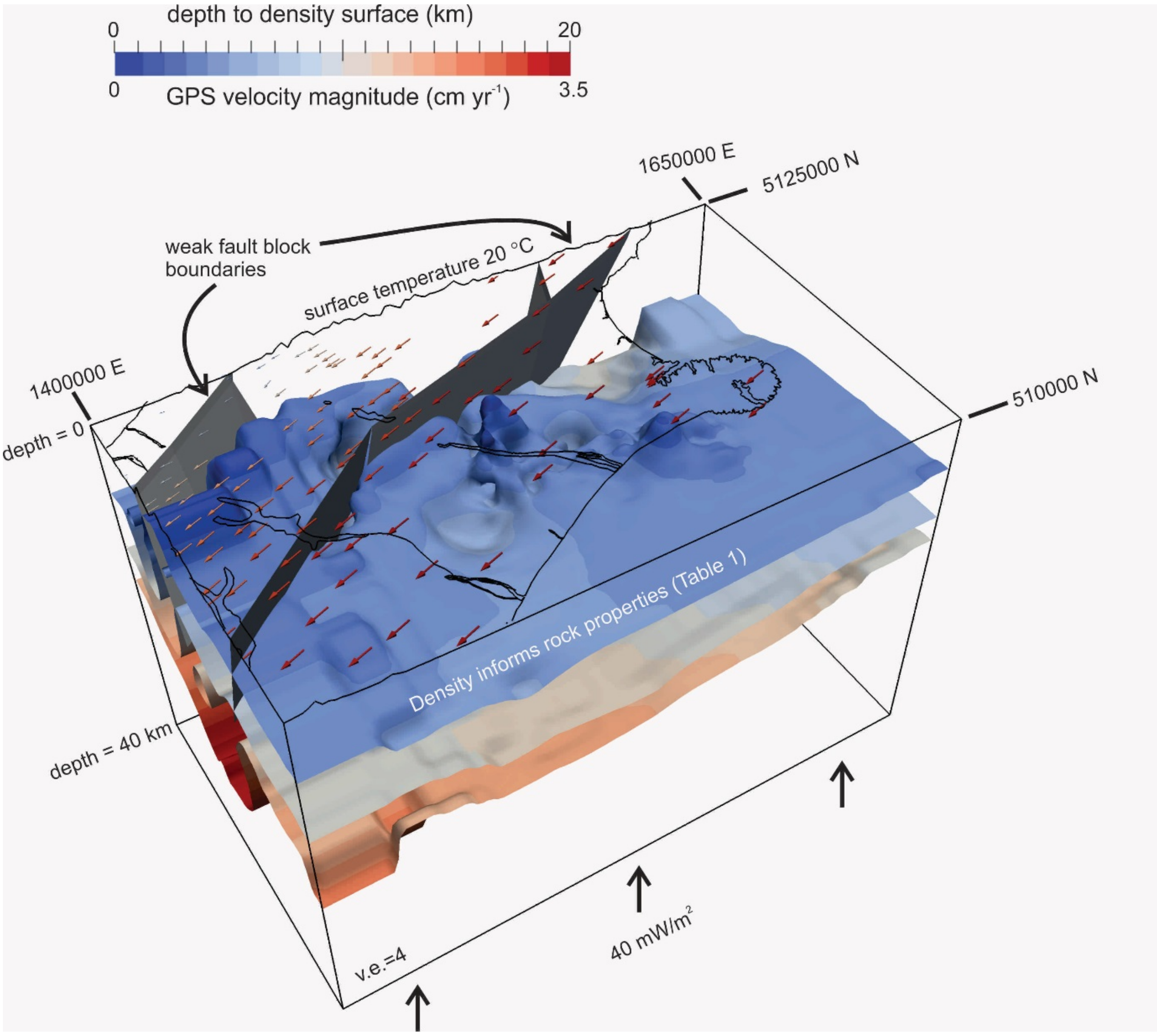

Figure S1. Setup of the numerical model (SULEC) used to compute regional long-term stresses (Ellis et al. 2011; Buiter & Ellis 2012). Perspective view showing density isosurfaces (2700, 2800, and 2900 kgm^{-3} with colours indicating depth) which are prescribed based on the NZ seismic velocity model for Canterbury (Eberhart-Phillips et al. 2010; Reyners et al. 2014). Figure vertical exaggeration × 4. Material properties are listed in Table S1. Grid spacing is 2 km horizontally and vertically giving a total of 187,500 elements. The base (at 40 km depth) is fixed vertically but allowed to move freely in the horizontal direction. The top of the model is a free surface and gravity is included. The finite element mesh at the surface conforms to the surface topography from 90m resolution SRTM data, but bathymetry is not represented. We assume uniform basal heat-flow, average radiogenic heat production of 1.8 µW m^{-3} and thermal conductivity of 2.5 Wm^{-1}K^{-1} (Pandey, 1981). Average surface heat-flow predicted by the model is 56 mW m^{-2}, similar to values compiled for northern Canterbury by Pandey (1981) and Funnell & Allis (1996). Grey dipping polygons indicate imposed frictionally weak fault zones based on simplified block boundaries from Wallace et al. (2007); the Alpine fault has dip of 45°SE; PPAFZ 45°NW. The vectors show GPS velocities from campaign data (1995-2012; Wallace et al., 2012), a smoothed and interpolated version of which were used to constrain boundary conditions on the sides of the model.