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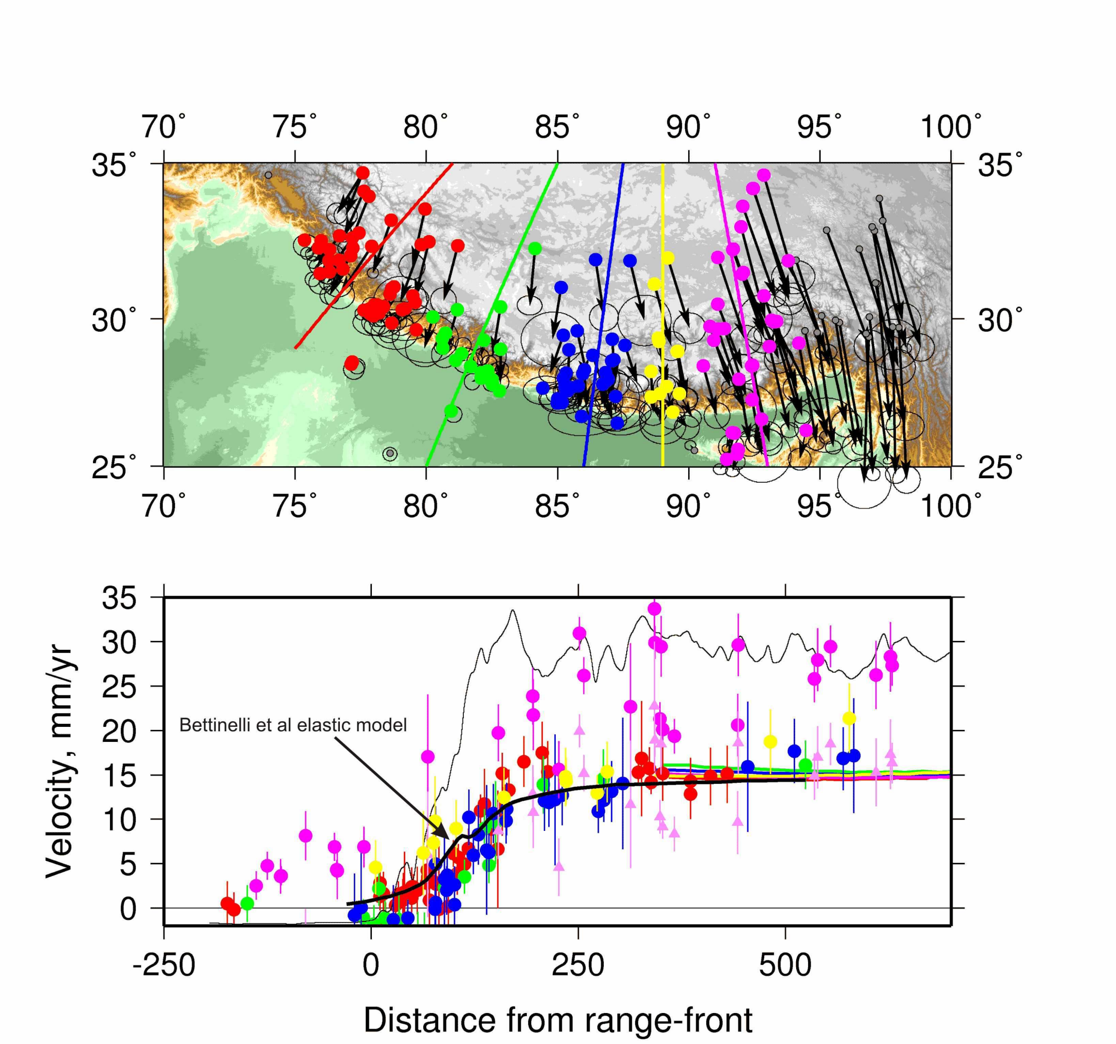
Supplemental material for Copley et al, Evidence for mechanical coupling and strong Indian lower crust beneath southern Tibet

Supplemental Figures:



Supplemental Figure 1: GPS velocities relative to India (an adaptation of figure 2 of Banerjee et al 2008). The upper panel shows the velocity vectors, and the lower panel shows the variation in profile-parallel velocity for the five profiles shown as coloured lines on the upper panel. The pale pink triangles correspond to the measurements shown as pink circles, but with the velocity reduced by 11 mm/yr to account for the shortening in the Shillong Plateau described by Banerjee et al 2008. The thin black line shows the topography along the line of the blue profile. The thick black line on the lower

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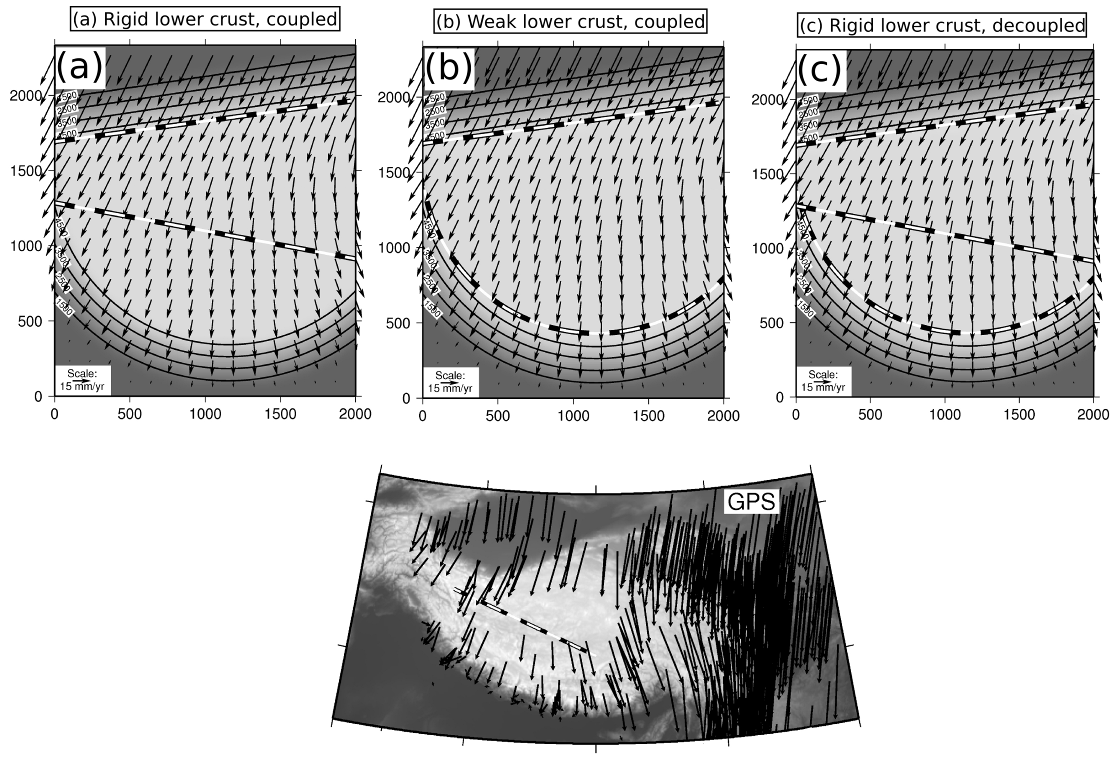
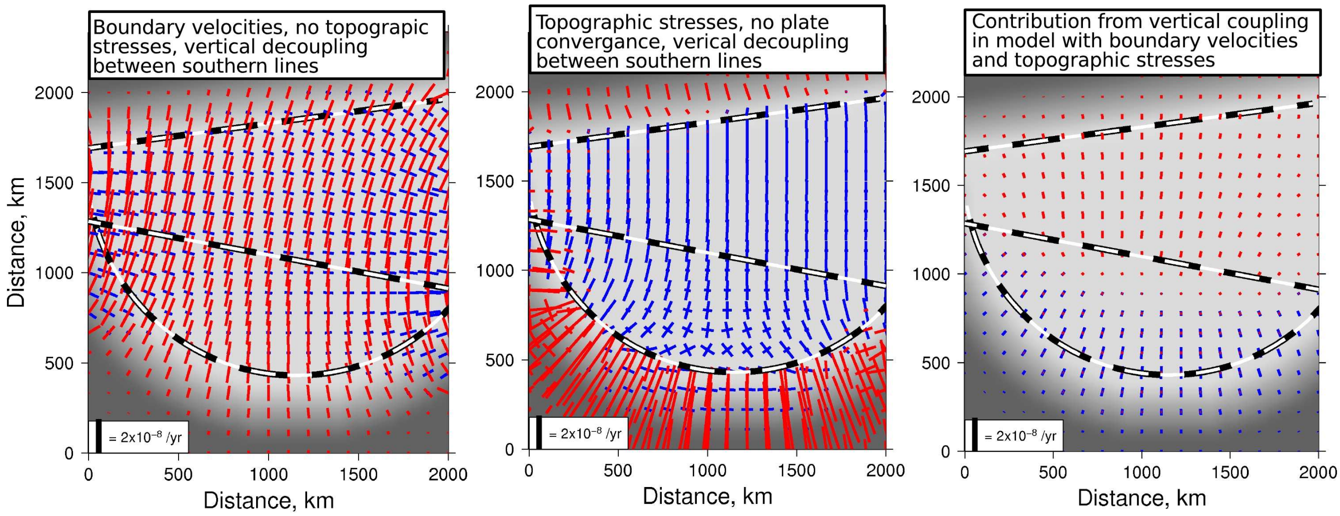
panel shows a model of elastic strain build-up around the thrust faults in the Himalaya based on GPS observations in the Nepal Himalaya (Bettinelli et al 2006). This particular model assumes a long term shortening rate of 16mm/yr and a locked fault zone extending from the surface to a depth of 20km and dipping 10 deg. The five coloured lines at distances greater than 300 km show the velocities from our model at positions equivalent to the GPS profiles. We have not shown these in the region of elastic strain in the Himalaya because our viscous model of permanent deformation is not applicable to observations of elastic strain build-up. The total rate of shortening we calculate is consistent with the GPS data. The ability of Bettinelli et al's elastic model to explain the geodetically-observed compression in southern Tibet, and the N-S trending normal faulting indicated by seismicity and active fault mapping, suggests the active tectonics within the southern plateau is dominated by E-W extension.



Supplemental Figure 2: The model velocities from which the strains shown in Figure 2 in the main paper were calculated (plotted at every fourth model gridpoint). Contours of model topography are labelled in metres. Also shown are GPS velocities from the Tibetan region, expressed in an India-relative reference frame (Gan et al 2007, Bettinelli et al 2006).



Supplemental Figure 3: The contribution to the model strain rates of imposed boundary velocities, topographic effects, and the shear stresses arising from coupling to the underthrust rigid lower crust (symbols equivalent to Figure 2 in the main paper). In the middle panel, there is zero velocity parallel and perpendicular to the model boundaries, except for the eastern and western boundaries where no constraints are imposed on the component of the velocity parallel to the boundary (as is the case with the models shown in the main paper). The right-hand panel shows the contribution of vertical mechanical coupling to model A in the main paper (i.e. the difference between model A and model C). This pattern of strain is equivalent to the central plateau moving more slowly southwards in model A than model C. This has the overall effect of rotating the maximum principle stress direction in the southern part of the plateau from a horizontal N-S orientation to the vertical.

Sources of earthquake focal mechanisms

The focal mechanisms shown on Figure 1 were compiled from the literature listed below, complemented with well-constrained CMT solutions [www.globalcmt.org].

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