Geophysical Research Abstracts, Vol. 8, 01450, 2006
SRef-ID: 1607-7962/gra/EGU06-A-01450

Balancing the plate motion budget in the South Island, New Zealand using GPS, geological and seismological data

L. M. Wallace(1), J. Beavan(1), R. McCaffrey(2), K. Berryman(1), and P. Denys(3)

(1) Inst. of Geological and Nuclear Sciences, Lower Hutt, New Zealand, (2) Dept. of Earth and Env. Science, Rensselaer Polytechnic Inst., Troy, NY, USA, (3)School of Surveying, U. of Otago, Dunedin, New Zealand (l.wallace@gns.cri.nz / Phone: +64 4 570 4534)

The landmass of New Zealand (NZ) exists as a consequence of transpressional collision between the Australian and Pacific plates, providing an excellent opportunity to quantify the kinematics of deformation at this type of tectonic boundary. An elastic, rotating block approach is implemented to integrate GPS velocities, geological slip rates, and earthquake slip vectors describing the active deformation in the South Island, NZ, which concomitantly allows the Pacific/Australia relative plate motion budget to be balanced. The data in NZ are fit to within uncertainty when inverted simultaneously for angular velocities of rotating tectonic blocks and the degree of coupling on faults bounding the blocks. We find that most faults in the South Island are undergoing some degree of interseismic coupling. Interseismic coupling on the Alpine Fault appears to be lower in the central portion compared to the northern and southern portions of the fault, consistent with evidence for elevated heat flow and high fluid pressures in the region of the central Alpine Fault. We find that most of the plate motion budget has been accounted for in geological studies, although we suggest that the Porter's Pass/Amberley Fault zone in Marlborough, and a zone of faults in the foothills of the Southern Alps may have slip rates twice that of the geological estimates. Up to 5 mm/yr of distributed deformation within the Southern Alps $<$50 km to the east of the Alpine Fault is possible. Vertical axis rotation rates of most tectonic blocks in the South Island are similar to that of the Pacific Plate, suggesting that edge forces dominate the block kinematics there. The GPS-derived kinematics of block rotations in the South Island argue against the existence of a broad zone of mantle lithosphere deformation (e.g., $>$100 km wide) beneath the South Island.