

# Inference of mantle properties with an evolving dynamic model of the Antarctica-New Zealand region

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We develop time-dependent mantle convection models of the Antarctica (ANT)-New Zealand (NZ) region constrained by plate motions from 80 Ma to present using global *CitcomS Version 3.0*. With a convection model, we interpret anomalous NZ-ANT geophysical observations [Sutherland *et al.*, 2009]: (1) ANT margin being 0.5-1.0 km shallower than the conjugate Campbell plateau; (2) Ross sea region geoid low (-60 m); (3) slow S-wave velocities in the upper and mid mantle and fast S-wave velocities in the lower mantle; (4) Campbell plateau 500-1000 m excess tectonic subsidence.

Present day geoid and dynamic topography can be reproduced in a mantle convection model in which an upwelling rises above a cold downwelling, attributed to the last stage of the Gondwanaland subduction [Spasojevic *et al.*, 2009]. The mantle upwelling creates a dynamic topography high with maximum amplitude of 1 km, and results in a large present-day geoid low (Fig. 1). Our preferred model has a strong gradient in mantle viscosities with ratio of lower:upper mantle viscosities of 100:1 and with respect to an absolute viscosity of  $10^{21}$  Pa s (Fig. 2). The excess subsidence of the Campbell plateau occurs as a result of northward drift of NZ away from a long-lived dynamic topography high created by the mantle upwelling.

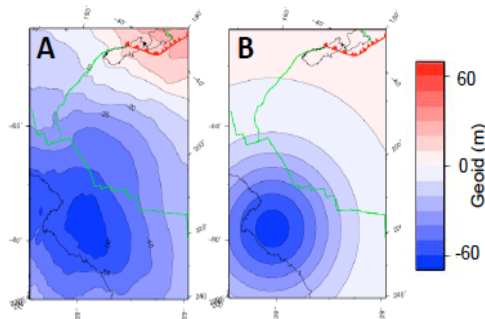
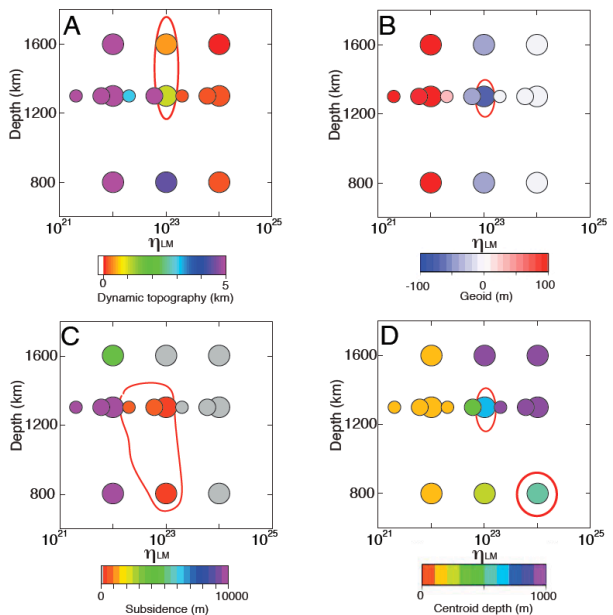


Figure 1. Comparison between observed (A) and predicted geoid at 0 Ma.

Figure 2. Constraining mantle viscosity (Pa s) and initial upwelling depth based using dynamic topography (A), geoid (B), borehole subsidence (C) and seismic tomography (D) as constraints. Red outlines indicate predictions that match observations.



## References

- Spasojevic, S., M. Gurnis, and R. Sutherland. Inference of mantle properties with an evolving dynamic model of the Antarctica-New Zealand region, *Journal of Geophysical Research*, to be submitted, 2009.
- Sutherland, R., Spasojevic, S., and M. Gurnis, Mantle upwelling after Gondwana subduction death may explain anomalous topography of West Antarctica and subsidence history of eastern New Zealand, *Geology*, to be submitted, 2009.