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Application of the CRS stack to deep marine seismic reflection data from the Hikurangi margin, New Zealand

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The Common Reflection Surface (CRS) stack - an alternative multi-parameter stacking method - has recently been developed (e.g. Müller, 1999; Mann, 2002). The CRS stack does not require an explicit knowledge of a stacking velocity model; only the near-surface velocity has to be defined. Using a semblance analysis three CRS stacking parameters are determined, defining an arbitrary curved reflector (the CRS) and its kinematic reflection response. This multi-coverage stacking method provides significant improvement of the signal-to-noise ratio by considering a larger data range in the stacking process compared e.g. to a conventional CMP stack. It is suited for processing low-fold crustal reflection data from complex environments, as no *a priori* information on the sub-surface structure is necessary. Further, the automatic stacking provides additional parameters that can be subsequently used for e.g. multiples suppression or CRS tomography (e.g. Duveneck, 2004).

Over the last few years marine deep seismic reflection data has been collected along the Hikurangi subduction zone, New Zealand, where the Pacific Plate is currently being subducted beneath the Australian Plate. There, the subducted crust is a thickened, oceanic, plateau (the Hikurangi Plateau), rather than normal oceanic crust. It is Cretaceous in age (Mortimer and Parkinson, 1996) and thickens from 10 km in the north to 15 km in the south. Most of the convergent component of Australia/Pacific relative

motion is thought to occur on the subduction thrust (Nicol and Beavan, 2003). Knowledge of the structural nature of the plate interface, of the thrust faults in the overlying crust, and of the relationship of structure to the slow slip earthquakes, is critical for understanding the earthquake cycle along the Hikurangi subduction margin.

Seismic images using new reflection data offshore North island show the top of the subducted plate as a shallow dipping ($\sim$ 3 degree) strongly reflective interface that becomes less visible at a depth of $\sim$12 km, $\sim$120 km from the trench (Henrys et al., 2006, Bannister et al., 2006). The most recent CM-01 marine seismic data, acquired in 2005 (Barker et al., 2006; Barker et al, in prep), directly target the subduction interface, as well as the overlying crust. Parts of the CM-01 data set were reprocessed using the CRS stack. The reprocessing yielded improved reflection images of the subduction interface, enhancing the fine structure close to the subduction interface. Further, splay fault structures in the overlying crust are clearly imaged over their extend from the plate interface up to the surface.

Literature

Bannister, S., Toulmin, S., Henrys, S., Reyners, M., Pecher, I., Barker, D., Sutherland, R., Uruski, C. and Maslen, G., 2006. Imaging the subduction decollement, Hikurangi subduction zone, New Zealand. *EoS Trans. AGU, 87*(52), Fall Meet. Suppl., Abstract T21A-0394.

Barker, Sutherland, Bannister et al., Seismic reflection imaging of along-strike changes in the Hikurangi Margin Subduction Interface, North Island, New Zealand. *EoS Trans. AGU, 87*(52), Fall Meet. Suppl., Abstract T21A-0393, 2006.

Beavan, J., Wallace, L., Fletcher, H. and Douglas, A., 2007. Slow slip events on the Hikurangi subduction interface, New Zealand. *J.Geod*, in press.

Henrys,S., Reyners, M., Pecher, I., Bannister, S., Nishimura, Y. and Maslen, G., 2006. Kinking of the subducting slab by escalator normal faulting beneath the North Island of New Zealand, *Geology*, 34(9): doi:10.1130/G22594, 777-780.

Mann, J., 2002. Extensions and Applications of the Common-Reflection-surface Stack Method. Logos Verlag.

Mortimer, N., and Parkinson, D., 1996. Hikurangi Plateau: A Cretaceous large igneous province in the southwest Pacific Ocean. *J.Geophys.Res.*, 101, 687-696.

Müller, T., 1999. The Common Reflection Surface Stack Method. Seismic imaging without explicit knowledge of the velocity model. PhD Thesis, University of Karlsruhe.

Nicol, A. and Beavan, J., 2003. Shortening of an overriding plate and its implications for slip on a subduction thrust, central Hikurangi Margin, New Zealand, *Tectonics*, 22(6), 1070, do:10.1029/2003TC001521.