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AUSGeoid2009 – the challenges set by GRACE and EGM2008

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The excellent performance of EGM2008 sets down new challenges to the regional quasigeoid modelling community, with the question of what can regional data really contribute over and above EGM2008, especially in places where largely the same data were used as is the case for Australia. We describe our regional refinement to EGM2008, called AUSGeoid2009. The main improvement is in the short wavelengths, where much of Australia has been gravity-surveyed at a higher resolution (typically 2-4 km) and a 250 m digital elevation model is available. The medium and long wavelengths are more challenging, where modified kernels and limited spherical caps have to be used to filter long and medium wavelength systematic errors from the Australian data, thus allowing more reliance on the GRACE-based components in EGM2008. This is a slightly different philosophy on the use of kernel modifications, where their filter properties have to be tuned instead of the age-old reduction of the truncation error. Empirical optimisation of the filter parameters was achieved through comparisons with GPS-levelling, where the levelling is from a free-network adjustment of the Australian national levelling network, as opposed to the distorted Australian Height Datum (AHD). In order to provide a 'product' that is useful for GPS users for the direct determination of AHD heights, the gravimetric quasigeoid was fitted to a few thousand GPS-AHD points using least-squares collocation in cross-validation mode, where the noise and correlation length were determined by using points not used in the surface-fitting procedure.