Corrigendum to Featherstone (2006) "Yet more evidence for a north-south slope in the Australian Height Datum" Journal of Spatial Science 51(2): 1-6

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Abstract

Since the publication of Featherstone (2006), it has been discovered that 339 astrogeodetic vertical deflection stations in Western Australia were omitted. This corrigendum adds these data to the analysis in Featherstone (2006), which slightly lessens the power of the original conclusion of a north-south slope in the AHD. There definitely is a slope in the AHD, but the new evidence is not as compelling as first thought.

INTRODUCTION

As part of the evaluation of the EGM07 global geopotential model, which is being computed by the US National Geospatial Imagery Agency (NGA) in conjunction with SGT Inc., it was discovered that Featherstone (2006) had omitted 339 astrogeodetic vertical deflection stations in Western Australia. These new data were supplied by Landgate (Morgan, 2007 pers. comm.), with a few additional observations from SGT Inc (Holmes, 2007 pers. comm.).

As such, Figure 1 in Featherstone (2006) is incorrect and the actual coverage of the 741 astrogeodetic vertical deflection stations is produced in Figure 1 here. The coverage of the complete set of 1080 astrogeodetic vertical deflection stations is shown in Figure 2 here, demonstrating that Featherstone (2006) had incorrectly plotted the coverage, and his data analysis omitted many stations in Western Australia. This is corrected for here.
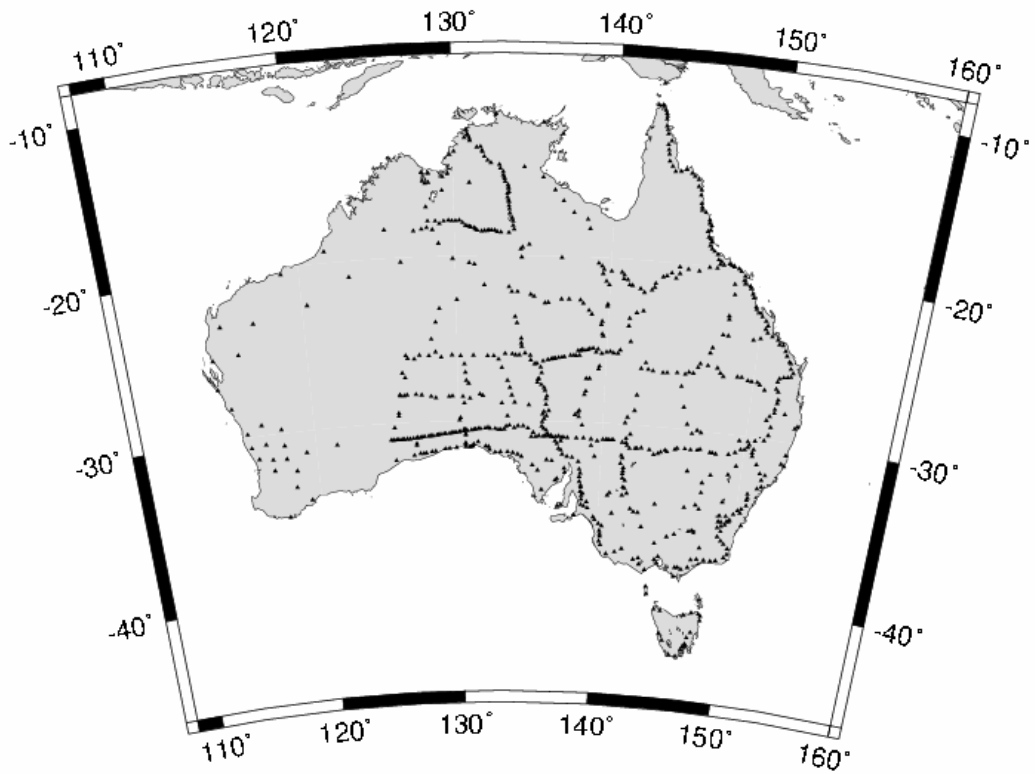
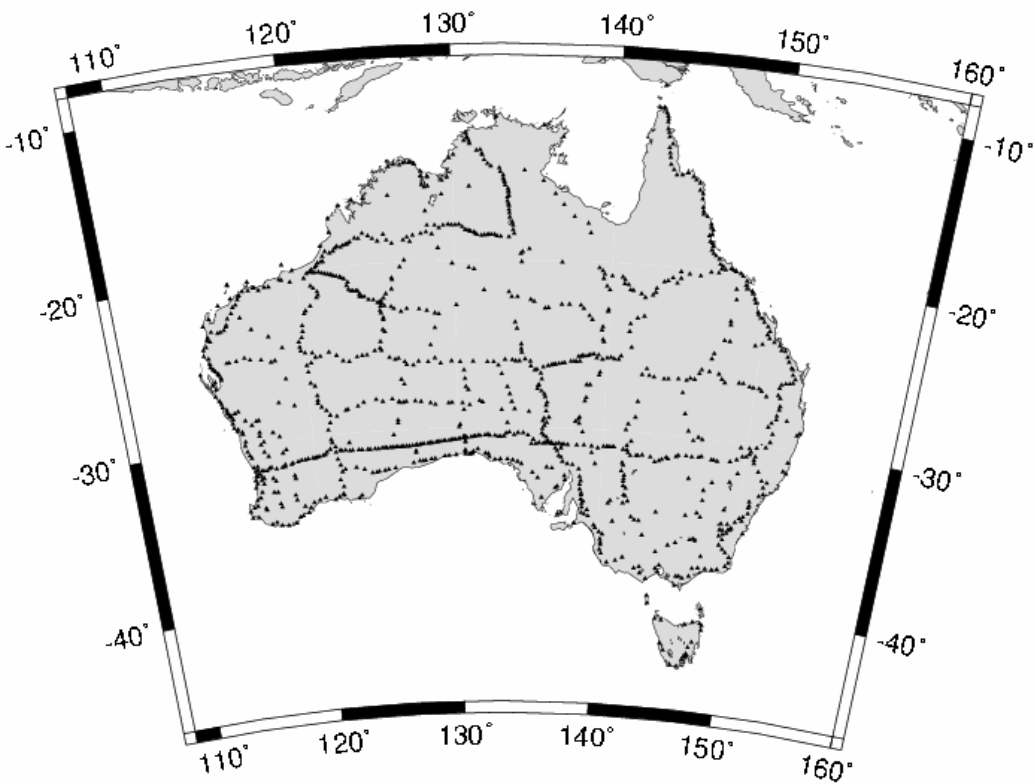Figure 1. Coverage of the 741 Laplace stations used in Featherstone (2006) [Lambert projection]

Figure 2. Coverage of the 1080 Laplace stations used here [Lambert projection]

The analyses in Featherstone (2006) are now repeated using all 1080 astrogeodetic vertical deflections. Table 1 here shows the equivalent of Table 1 in Featherstone (2006) for all 1080 stations. The descriptive statistics change only slightly on the addition of these new data, but more outliers were identified by the Z score of three. As concluded in Featherstone (2006), the precision of AUSGeoid98-derived vertical deviations is around one arc-second.

	All 1080 stations		After removal of 26 outliers	
	East-west deflection (η)	North-south deflection (ξ)	East-west deflection (η)	North-south deflection (ξ)
Max	17.83	9.11	3.28	3.76
Min	−7.76	−12.65	−3.91	−3.62
Mean	−0.25	−0.17	−0.25	−0.14
STD	±1.28	±1.36	±0.84	±1.09

Table 1. Descriptive statistics (in arc-seconds) of the fit of AUSGeoid98-derived vertical deflections to astrogeodetically derived vertical deflections.

The trend between the astrogeodetic and AUSGeoid98 north-south vertical deflections with latitude (Figure 3) is now not as close to zero as was in Featherstone's (2006) Figure 2. The trend has increased from -0.0017 arc-seconds per degree to -0.0186 arc-seconds per degree, though the R-squared statistic has increased from 0.0002 to 0.0125 showing a larger scatter. The fact that the slope has increased in magnitude, though with a lower R-squared statistic, lessens the strength of the conclusion reached in Featherstone (2006) that there is no north-south slope in AUSGeoid98; there is a small one, but not enough to completely discount the major conclusion that there is a north south-slope in the Australian Height Datum (AHD). The compulsion of the conclusion in Featherstone (2006) is just lessened.

In retrospect, this is a sensible result in that the Australian gravity anomalies used in AUSGeoid98 were computed with heights on or tied to the AHD. Therefore, an error will be introduced because these gravity anomalies do not refer to the geoid, as is demanded by Stokes's theory. A height error of 1 m corresponds to an error in the free-air gravity anomaly of ~0.3 mGal. However, this will not propagate fully into AUSGeoid98 because of the high-pass filtering properties of the modified kernel used over a one-degree integration cap (cf. Vaníček and Featherstone, 1998). Current work on the new Australian quasigeoid model is looking at these filtering issues, as well as a model of the errors in the AHD that can be used to correct the gravity anomalies.
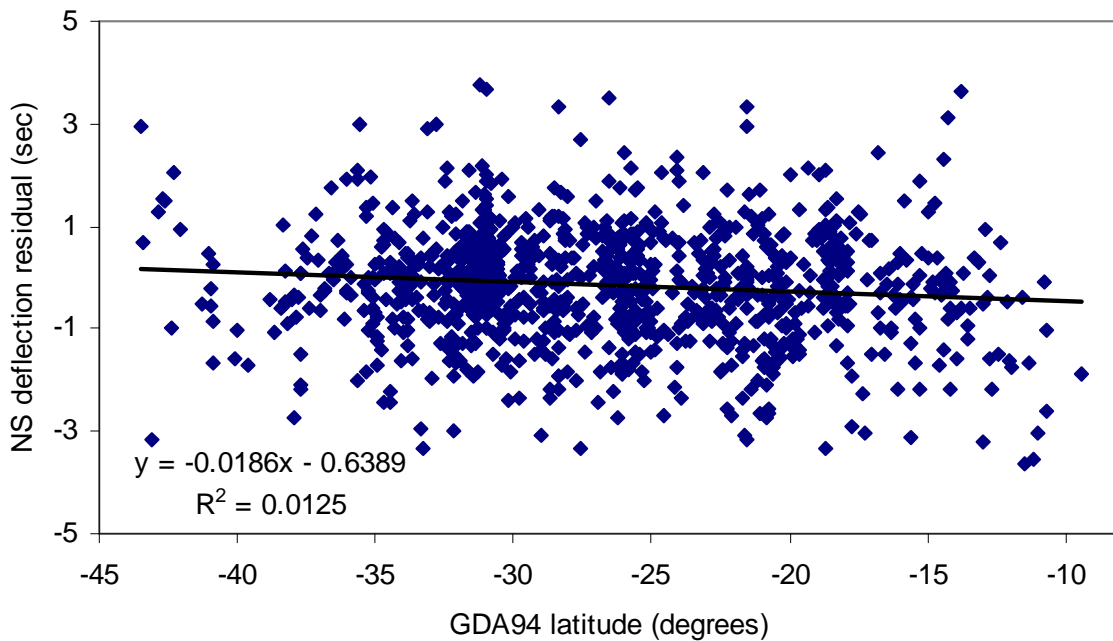
Figure 3. Differences between astrogeodetic and AUSGeoid98-derived north-south vertical deflections (arc seconds) as a function of GDA94 latitude (degrees); 1054 points

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