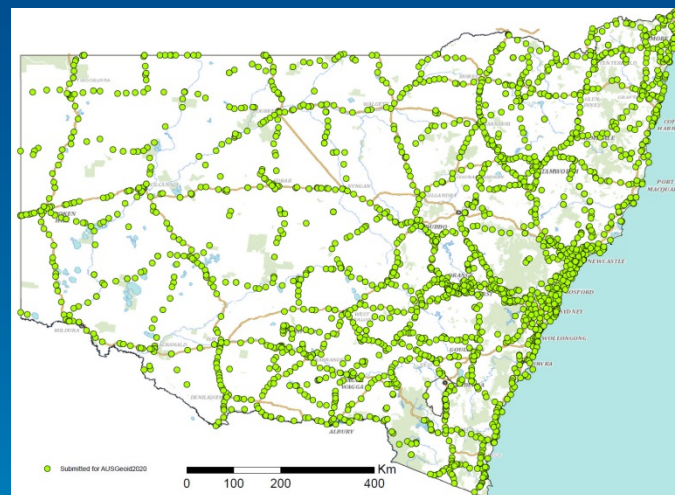
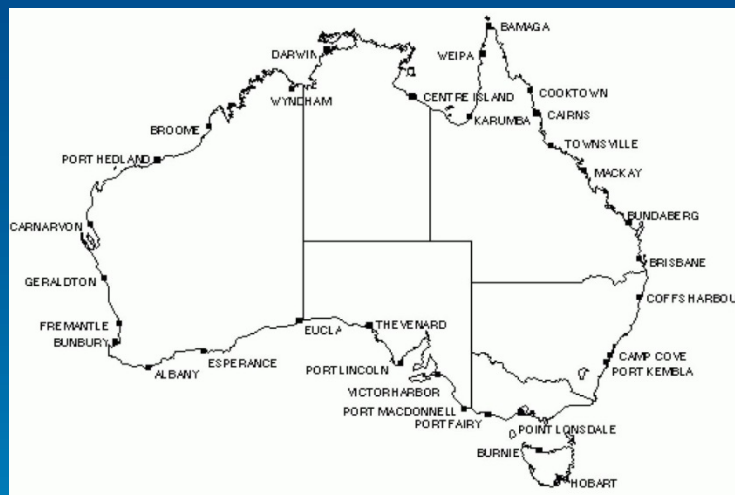




Spatial
Services

Performance Evaluation of AUSGeoid2020 in NSW



Volker Janssen & Tony Watson

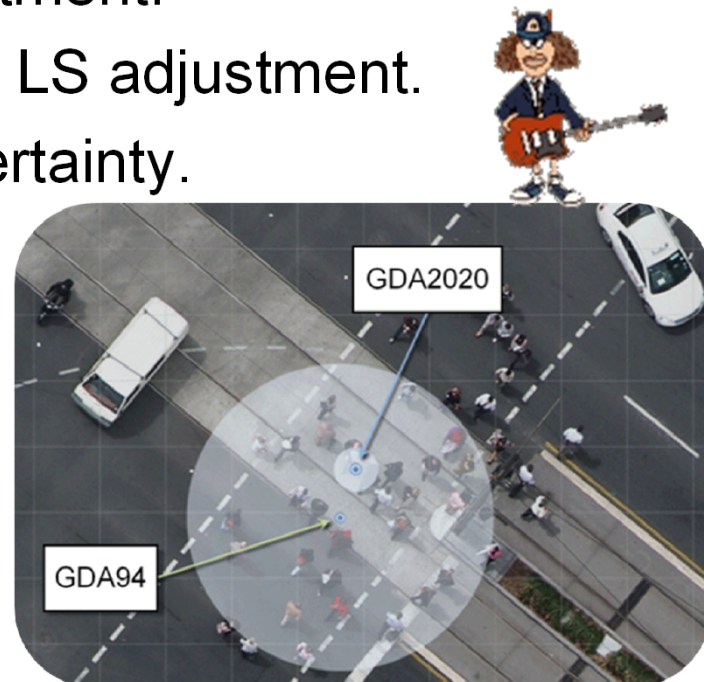
IGNSS2018

7-9 February 2018, Sydney, Australia

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Outline

- 1) GDA2020 implementation in NSW.
- 2) Geoid, AHD & ellipsoid-AHD separation.
- 3) AUSGeoid2020 product.
- 4) Test 1: CORSnet-NSW.
- 5) Test 2: Constrained LS adjustment.
- 6) Test 3: Minimally constrained LS adjustment.
- 7) Rigorous propagation of uncertainty.
- 8) Take-home messages.



GDA2020: Timeline for Implementation

Prepare

Work out what is required to enable GDA2020 in government systems.

Enable

- GDA94 remains the legal datum.
- Cadastral and Geodetic environment is enabled.
- Department assesses when a reasonable number of stakeholders are ready to adopt.
- Stakeholders are able to access real data and tools to start testing.

Adopt

Officially adopt GDA2020 when a sufficient number of stakeholders are ready.

Transition

Support both GDA94 and GDA2020 with a sunset period.

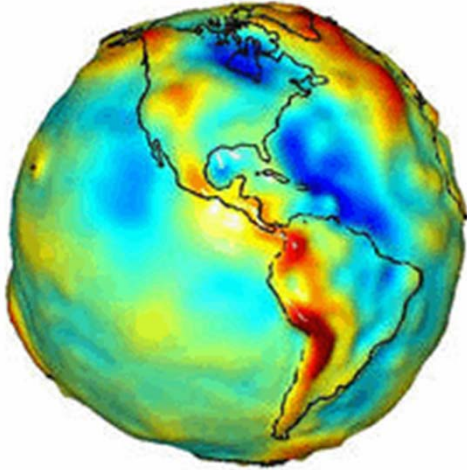


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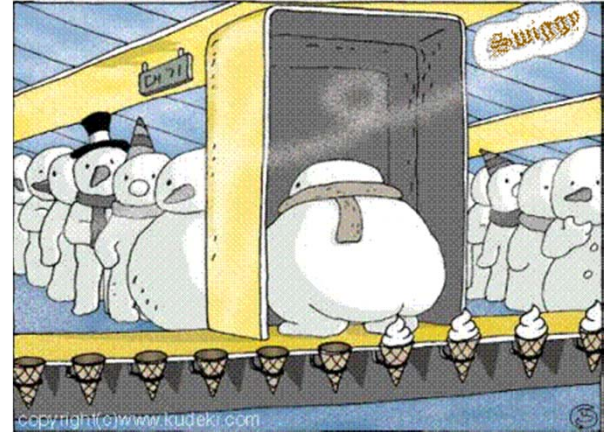


Geoid, AHD & Ellipsoid-AHD Separation

Geoid:

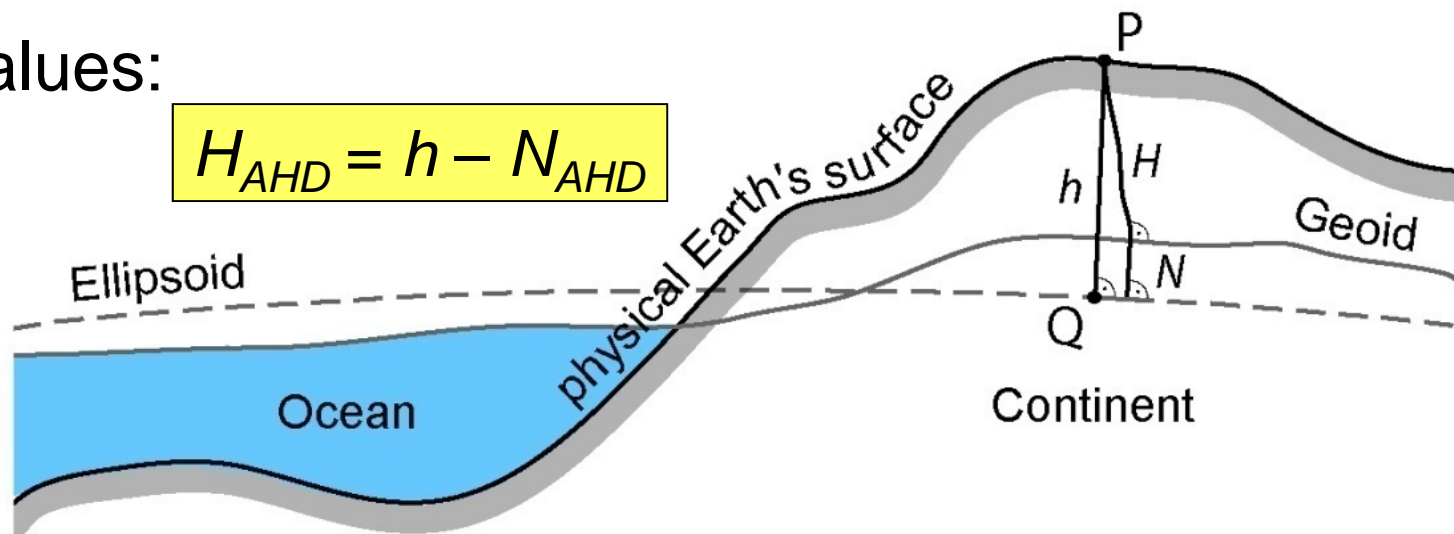


AHD:



N values:

$$H_{AHD} = h - N_{AHD}$$



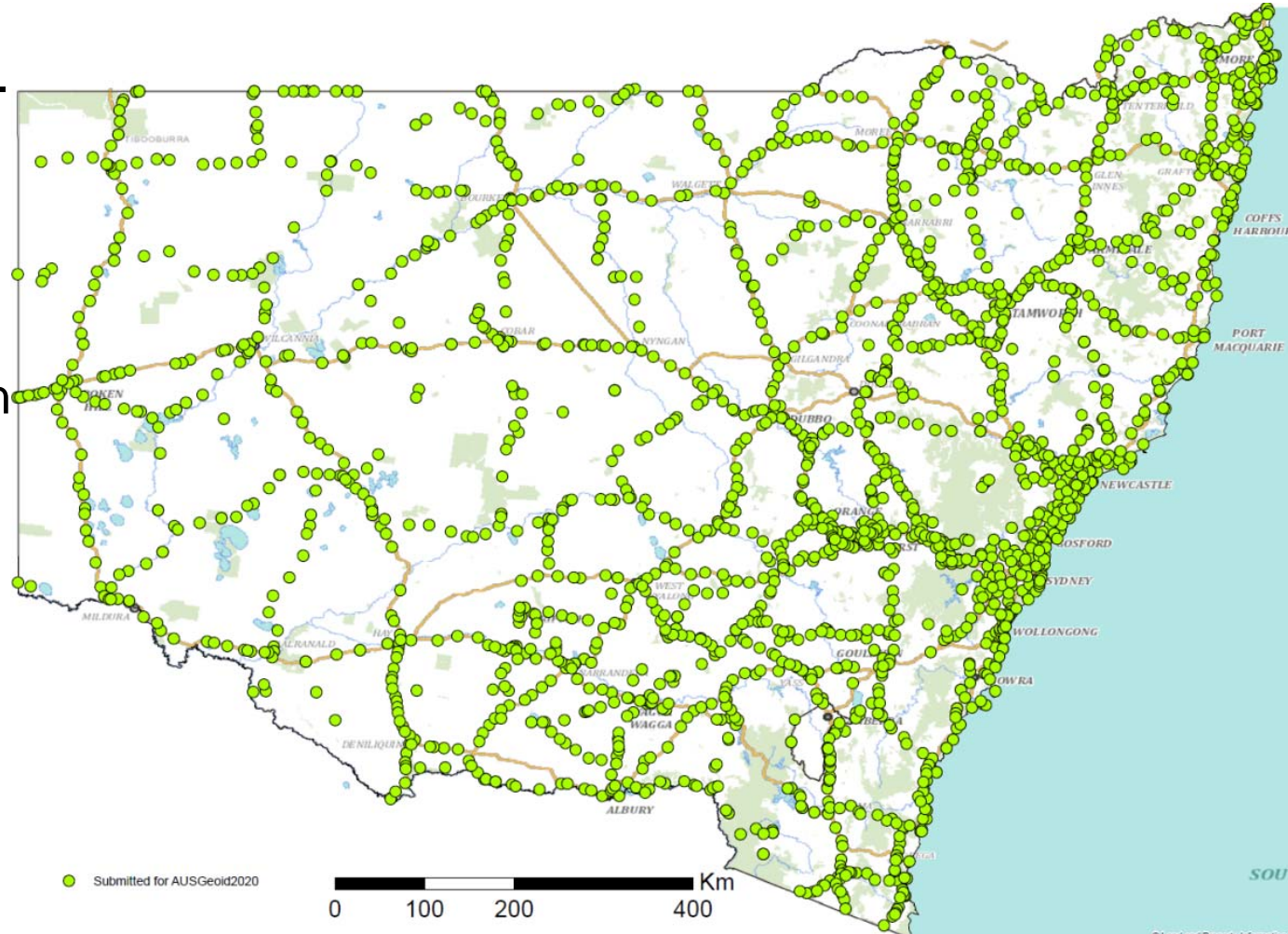
GDA2020 Product: AUSGeoid2020

AUSGeoid2020

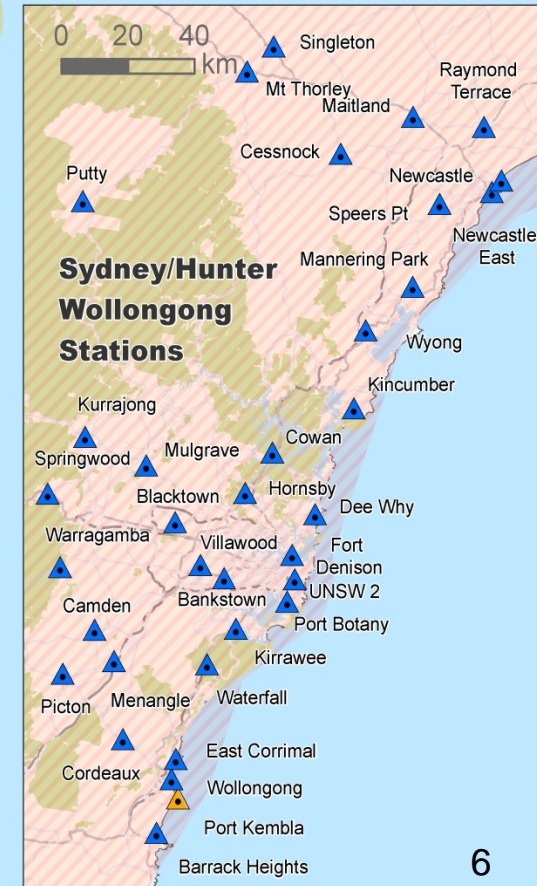
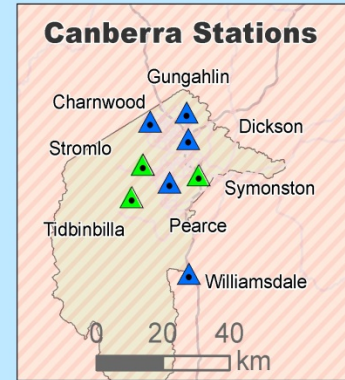
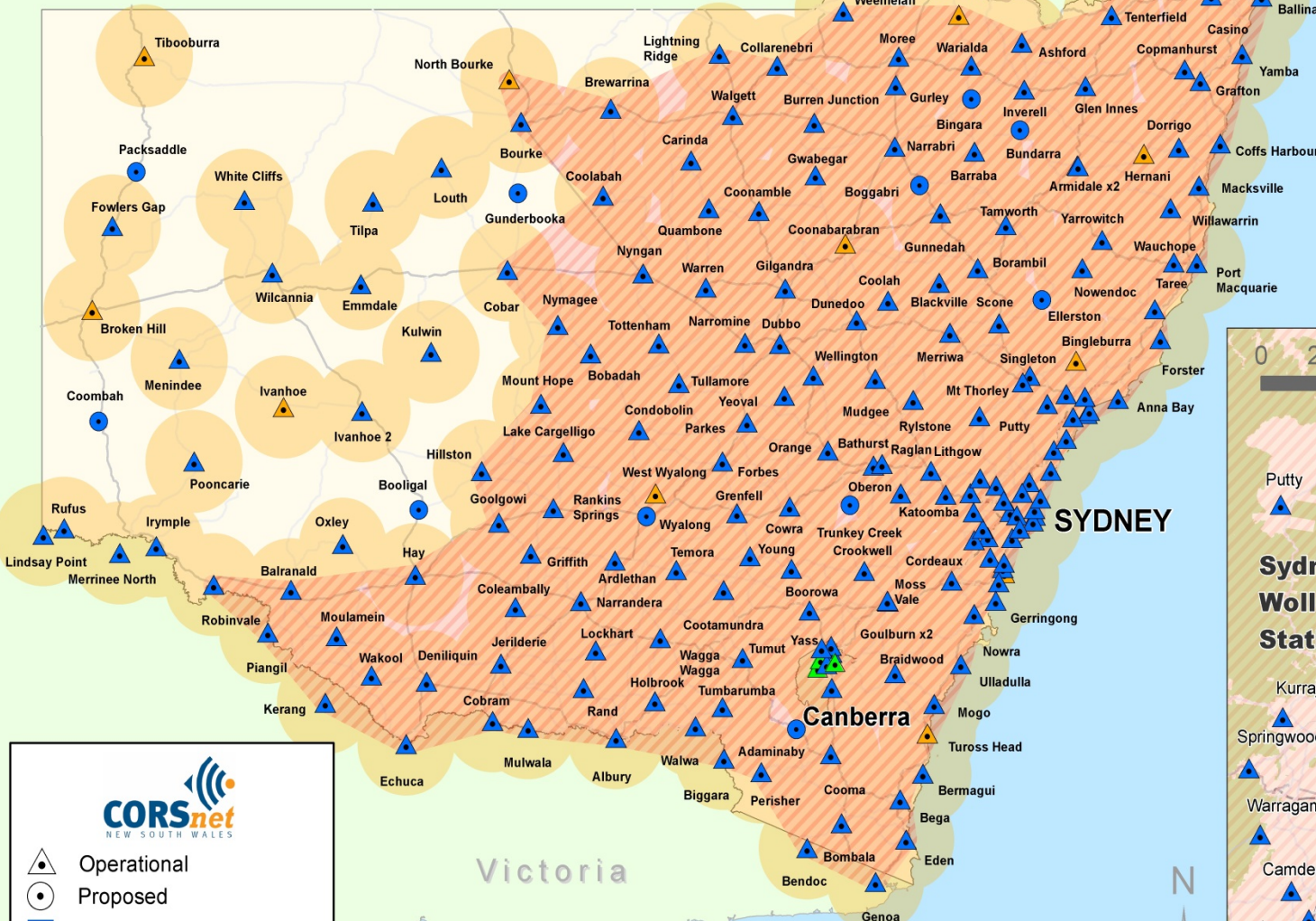
- Links GNSS ellips. heights & AHD.
- Gravimetric + geometric.
- Uncertainty is a function of location

In NSW:

- AG09: 100 LCL3+GNSS
- AG2020: **2,500** LCL3+GNSS
- **EHGT decreases by ≈ 0.09 m.**



CORSnet-NSW (Jan 2018)

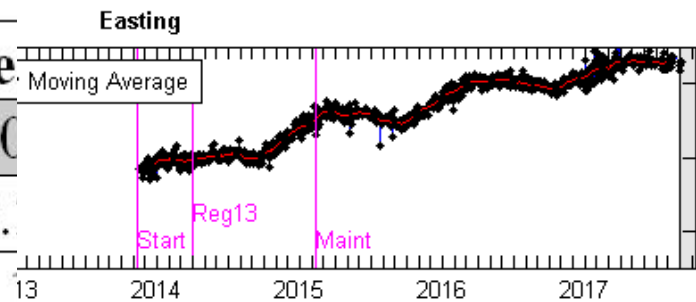


RTK: 79% area, 99.8% population
 NRTK: 62% area, 98.7% population
 >62% population is <10 km from nearest CORS

Test 1: 138 CORSnet-NSW Sites

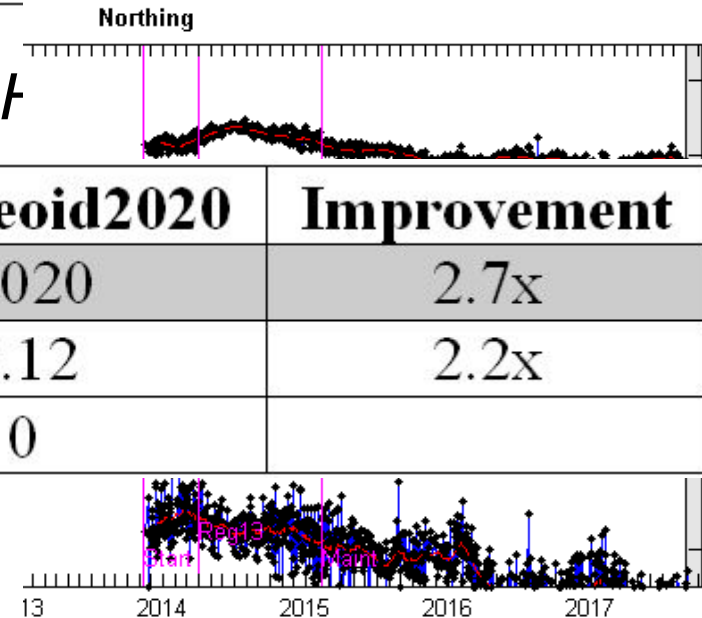
- GDA94 Reg 13 + **AG09** and GDA2020 nat. adj. + **AG2020** vs. **SCIMS AHD**.

Parameter	AUSGeoid09	AUSGeoid2020
RMS (m)	0.056	0.020
Range (m)	0.33	0.12
#Diff > 0.1m	12	0



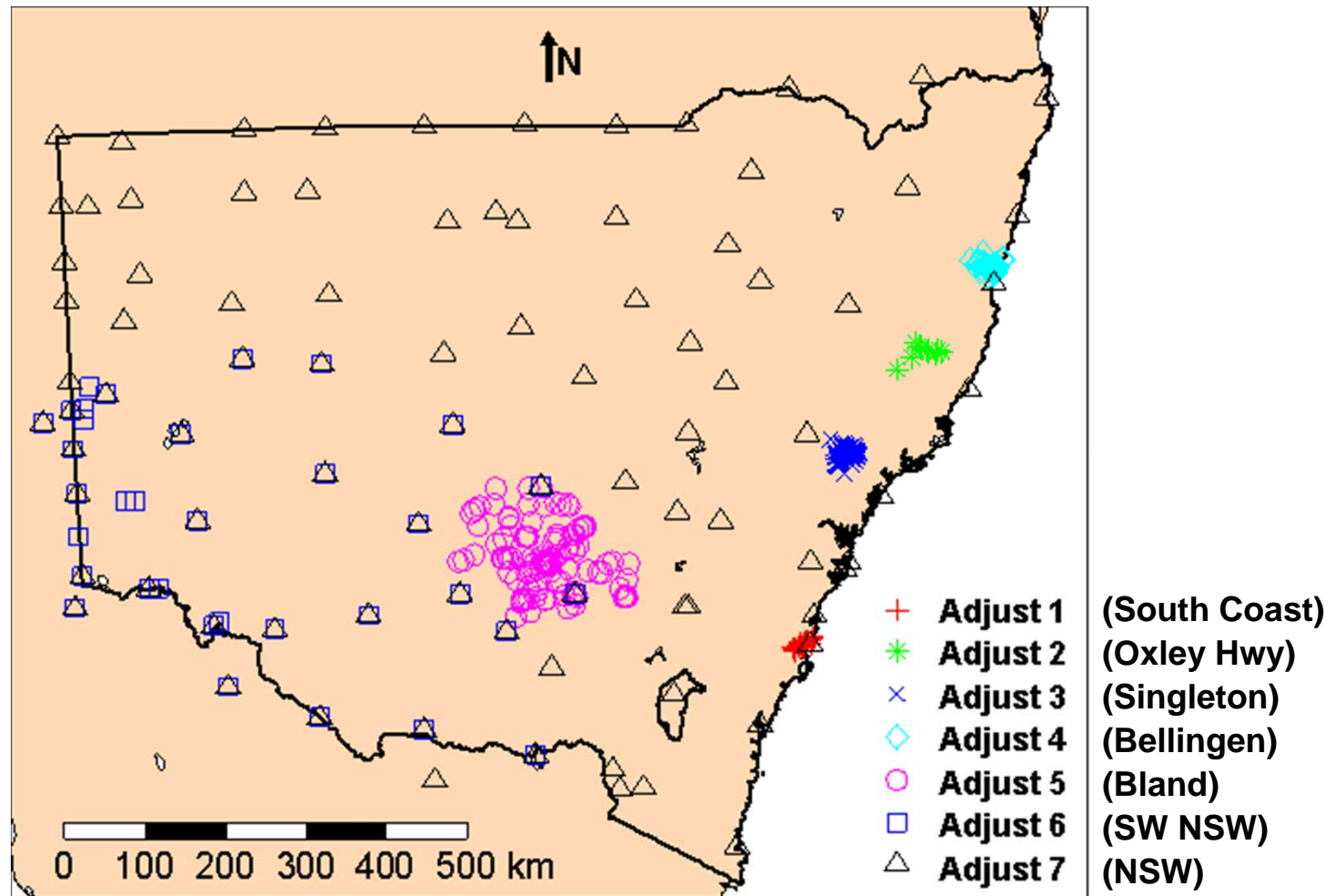
- Excl. GURL (*black soil, E5 SCIMS AHD*)

Parameter	AUSGeoid09	AUSGeoid2020	Improvement
RMS (m)	0.054	0.020	2.7x
Range (m)	0.25	0.12	2.2x
#Diff > 0.1m	11	0	



Test 2: Constrained LS Network Adj.

- Location of GNSS adjustments analysed:



Test 2: Constrained LS Network Adj.

- 7 GNSS-based GEOLAB adjustments:

Adjustment	Extent (km)	Height Range (m)	# Sites	# Obs	Baseline Length (km)	Average Bsl Length (km)
1: South Coast	21 x 18	7 – 296	18	159	0.4 – 12	5
2: Oxley Hwy	53 x 35	116 – 1,208	13	108	0.03 – 53	16
3: Singleton	33 x 42	30 – 442	87	631	0.6 – 30	5
4: Bellingen	40 x 27	2 – 1,041	107	565	0.3 – 23	2
5: Bland	212 x 162	167 – 544	155	1,075	0.1 – 67	12
6: SW NSW	633 x 553	20 – 645	34	752	8 – 270	128
7: NSW	1,000 x 800	2 – 2,229	89	1,721	3 – 393	130

- Varying adjustment size, extent, height range & baseline lengths.

Test 2: Constrained LS Network Adj.

- Overall adjustment results:

Table 2: Variance factors obtained for the adjustments investigated.

Adjustment	AUSGeoid09	AUSGeoid2020	Improvement Factor
1: South Coast	1.19	1.16	1.0
2: Oxley Hwy	0.54	0.71	0.8
3: Singleton	1.05	0.59	1.8
4: Bellingen	1.12	0.93	1.2
5: Bland	1.00	0.43	2.3
6: SW NSW	0.24	0.22	1.1
7: NSW	0.63	0.60	1.1

Table 3: Number of flagged residuals obtained for the adjustments investigated.

Adjustment	AUSGeoid09	AUSGeoid2020	Change
1: South Coast	2	2	0
2: Oxley Hwy	0	2	+2
3: Singleton	0	0	0
4: Bellingen	1	1	0
5: Bland	1	0	-1
6: SW NSW	0	0	0
7: NSW	1	2	+1

- Improved VF & comparable #flagged residuals.
- Highest improvement in areas of moderate height variation.¹⁰

Test 3: Min. Constrained Adjustment

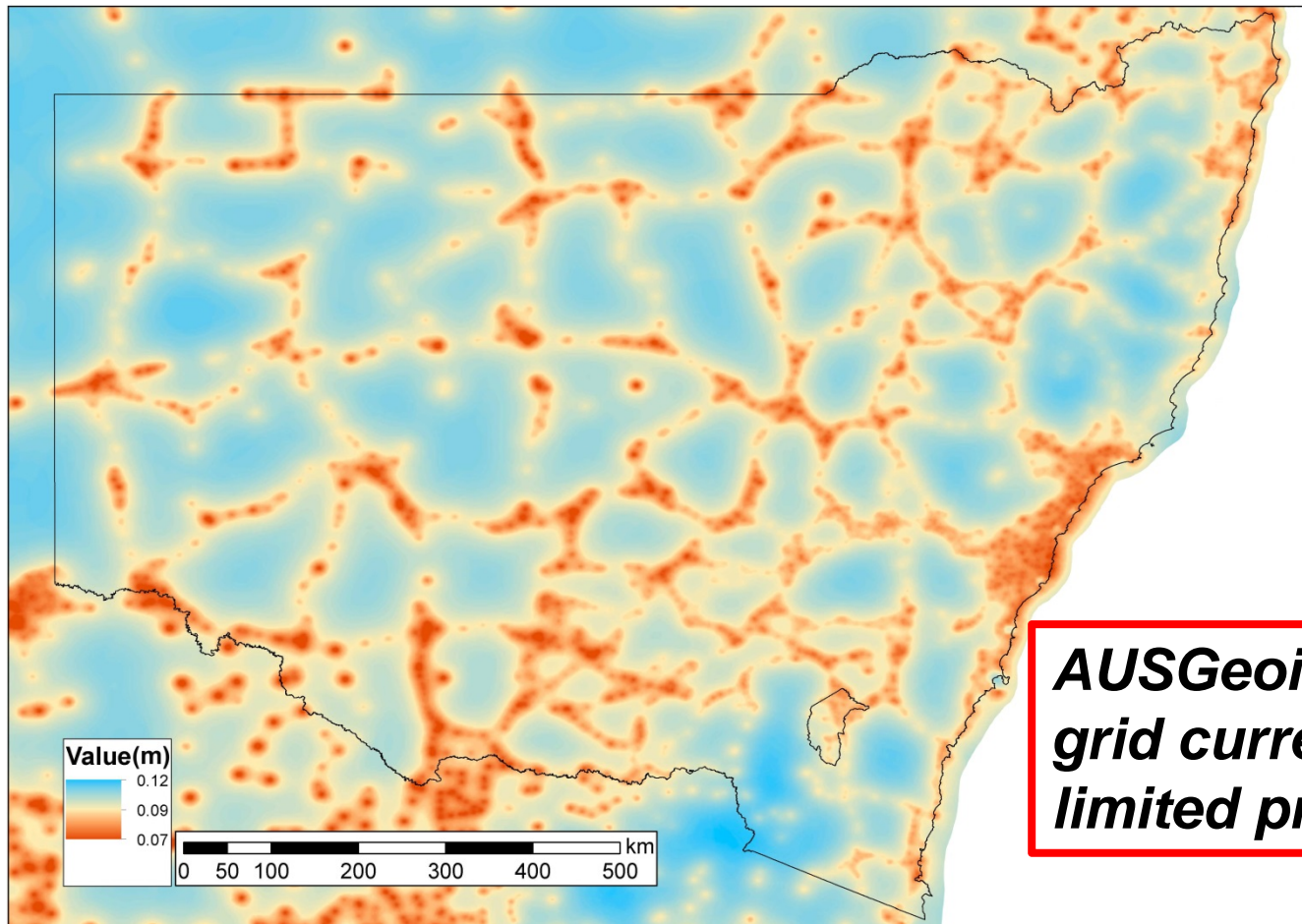
- Compared adjusted heights to SCIMS AHD:

Adjustment	Parameter	AUSGeoid09	AUSGeoid2020	Improvement Factor
1: South Coast (11 marks)	RMS (m)	0.024	0.022	1.1
	Range (m)	0.070	0.059	1.2
2: Oxley Hwy (5 marks)	RMS (m)	0.034	0.038	0.9
	Range (m)	0.050	0.076	0.7
3: Singleton (53 marks)	RMS (m)	0.029	0.021	1.4
	Range (m)	0.104	0.076	1.4
4: Bellingen (60 marks)	RMS (m)	0.053	0.044	1.2
	Range (m)	0.340	0.246	1.4
5: Bland (68 marks)	RMS (m)	0.049	0.027	1.8
	Range (m)	0.281	0.115	2.4
6: SW NSW (24 marks)	RMS (m)	0.087	0.061	1.4
	Range (m)	0.408	0.234	1.7
7: NSW (9 marks)	RMS (m)	0.144	0.071	2.0
	Range (m)	0.411	0.231	1.8

- RMS within ± 0.05 m, except adj. 6&7 (long baselines).

Rigorous Propagation of Uncertainty

- AUSGeoid2020 uncertainty **overly pessimistic** (610 marks)
→ <0.05 m vs. 0.07 m – 0.11 m AG2020 uncertainty grid:



AUSGeoid2020 uncertainty grid currently has only limited practical value.

Take-Home Messages

- Only use **AG2020 with GDA2020** (or AG09 with GDA94).
- AG2020 provides substantially **better** fit to AHD.
 - Larger, denser & higher-quality input dataset.
 - Improved modelling.
- In most cases AG2020 provides AHD heights **well within ± 0.05 m** of SCIMS.
- Rigorous, location-based AG2020 **uncertainty appears overly pessimistic** (0.07 m – 0.11 m) → *limited practical use*.

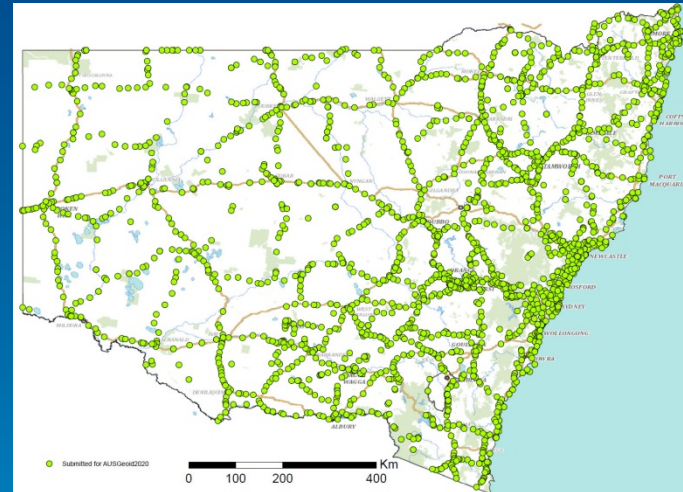
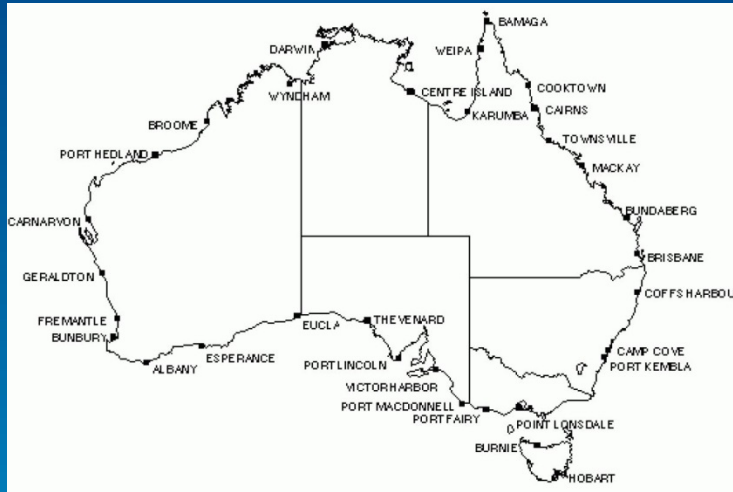
AUSGeoid2020 rocks!





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