



Australian geoid models

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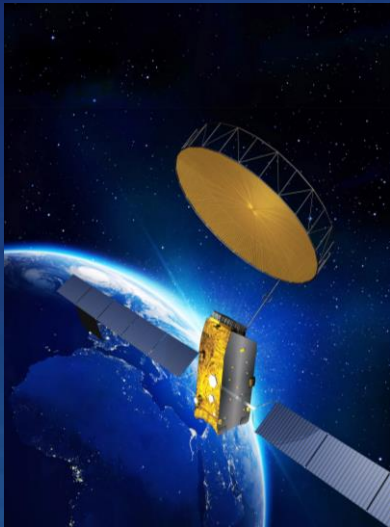
UN-GGCE International Workshop

JOINING LAND AND SEA

The Integration of Terrestrial, Maritime, Built, and Cadastral Domains

POSITIONING AUSTRALIA

- **The national authority** on geodesy and position verification
- **Australian Government lead** for position and navigation
- Operate **world-class geodetic infrastructure** and applied geoscience research
- Engagement with **international positioning and geodesy communities** on data and standards
- Provides **analytic capability** and **trusted platforms**
- Deliver precise positioning services that are reliable, accurate, nationally consistent, and **openly accessible**



Regional Navigation Satellite System Constellations

- 4** Global
- 2** Regional

Geostationary payloads (coming)

- 2** Satellites



2 SBAS uplink stations (1 coming)

2 Satellite Laser Ranging + 3 VLBI stations

235 GNSS reference stations

15 Absolute gravity ground stations



3000 direct users
3-5cm Services across **96% of mobile coverage**

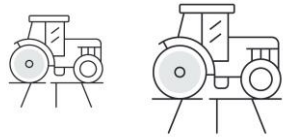
Early 10cm Services this year to **~3.4BN devices**





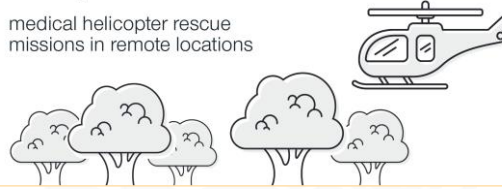
Precision agriculture

Improve the efficient spraying of nutrients, chemicals and water by 1-7%



Increase of 1866 successfully completed

medical helicopter rescue missions in remote locations



Avoidance of 45 road-related fatalities

and 2800 road-related serious injuries through SBAS enabled Cooperative Intelligent Transport System (C-ITS)



Accessible city navigation: enable assistive technologies

for the visually impaired, reducing the risks of incidents associated with trips, falls and collisions



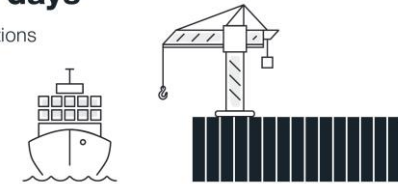
Decrease of network delays by 29% and \$36 million savings

through SBAS enabled C-ITS



Increased vessel capacity of 1375 days

for port operations



Save \$205 million through increased efficiency during blackouts



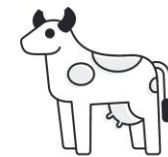
PRECISION MINING:

Increase the accuracy of autonomous vehicles
 Improving safety and efficiency



Livestock monitoring: save \$100 per dairy cow

every year with virtual fencing and 6 million sellable Australian sheep valued at \$80 million





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Gold Coast, Qld



Photo: pics4world.com

Woy Woy, NSW



Photo: Cathy Stubbs



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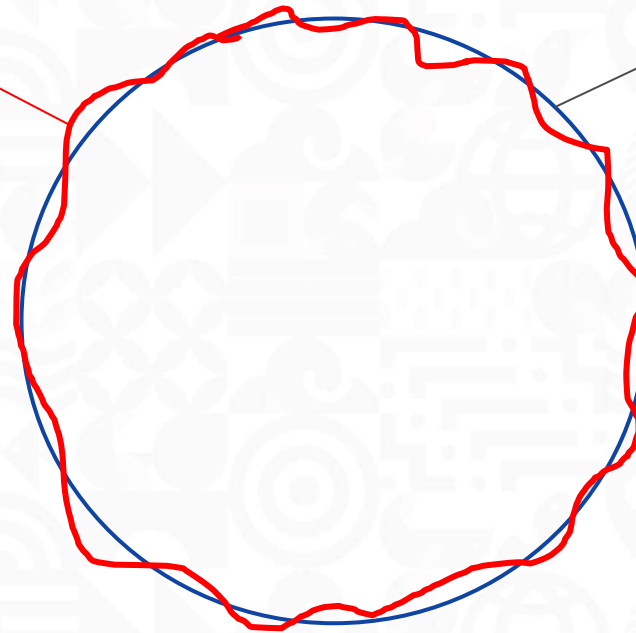
@infogeospasial



Gravity

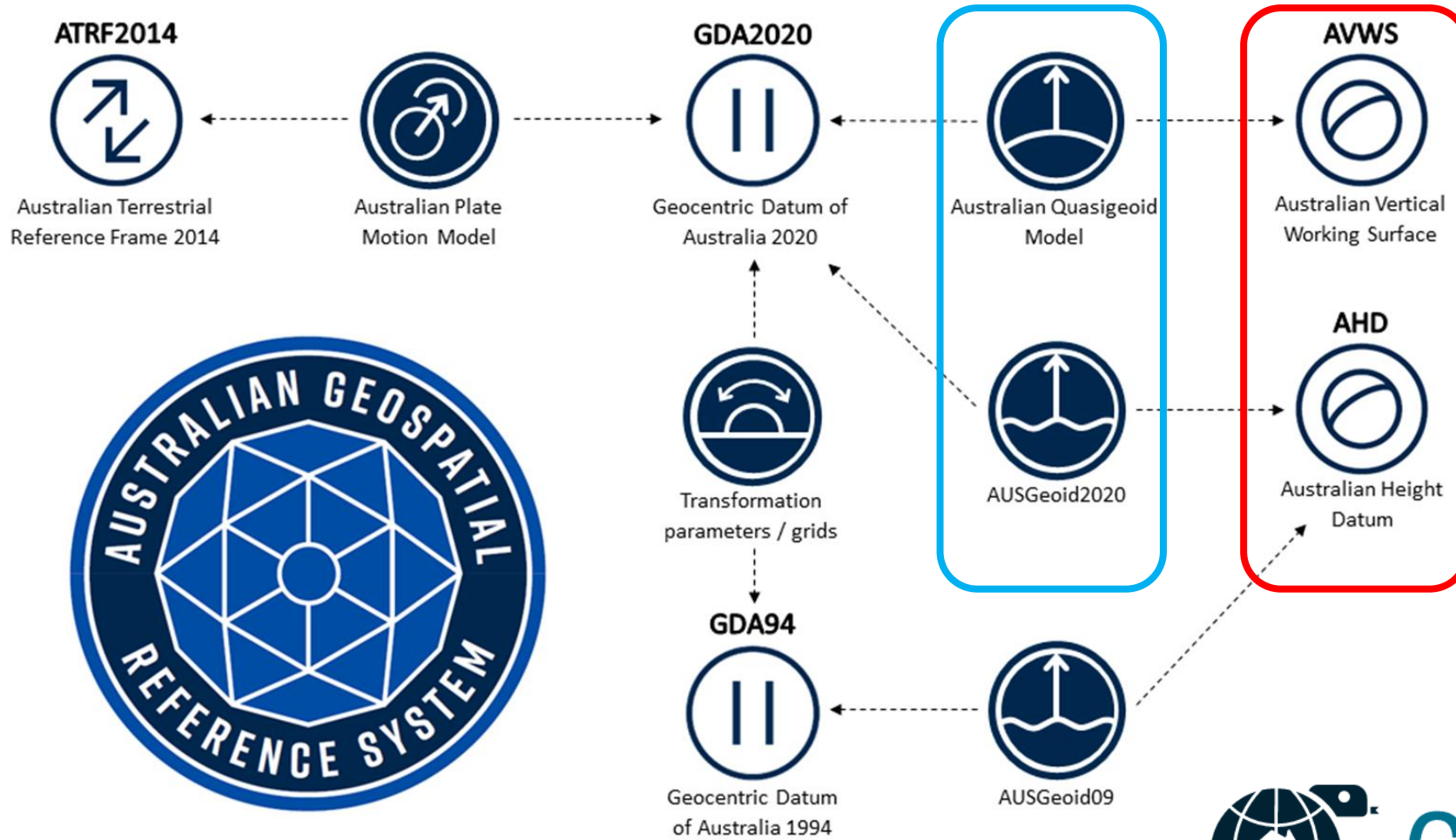
Geometric

- Complex
- Harder to define
- Precise
- Gravitational Potential
- Need a model to use with GNSS
- Water always flows downhill



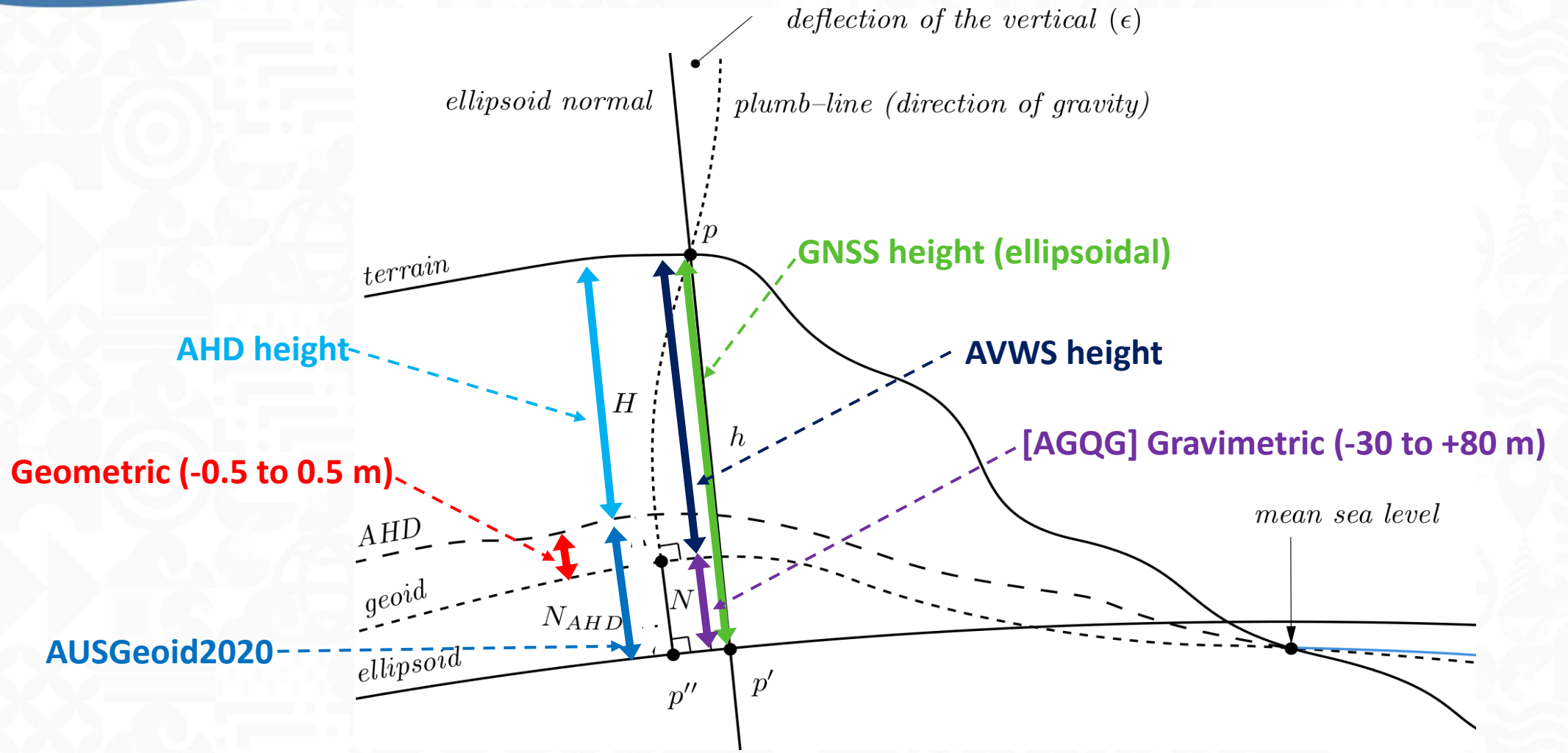
- Simple
- Precise
- Geometric
- Useful for GNSS
- Water doesn't always flow downhill

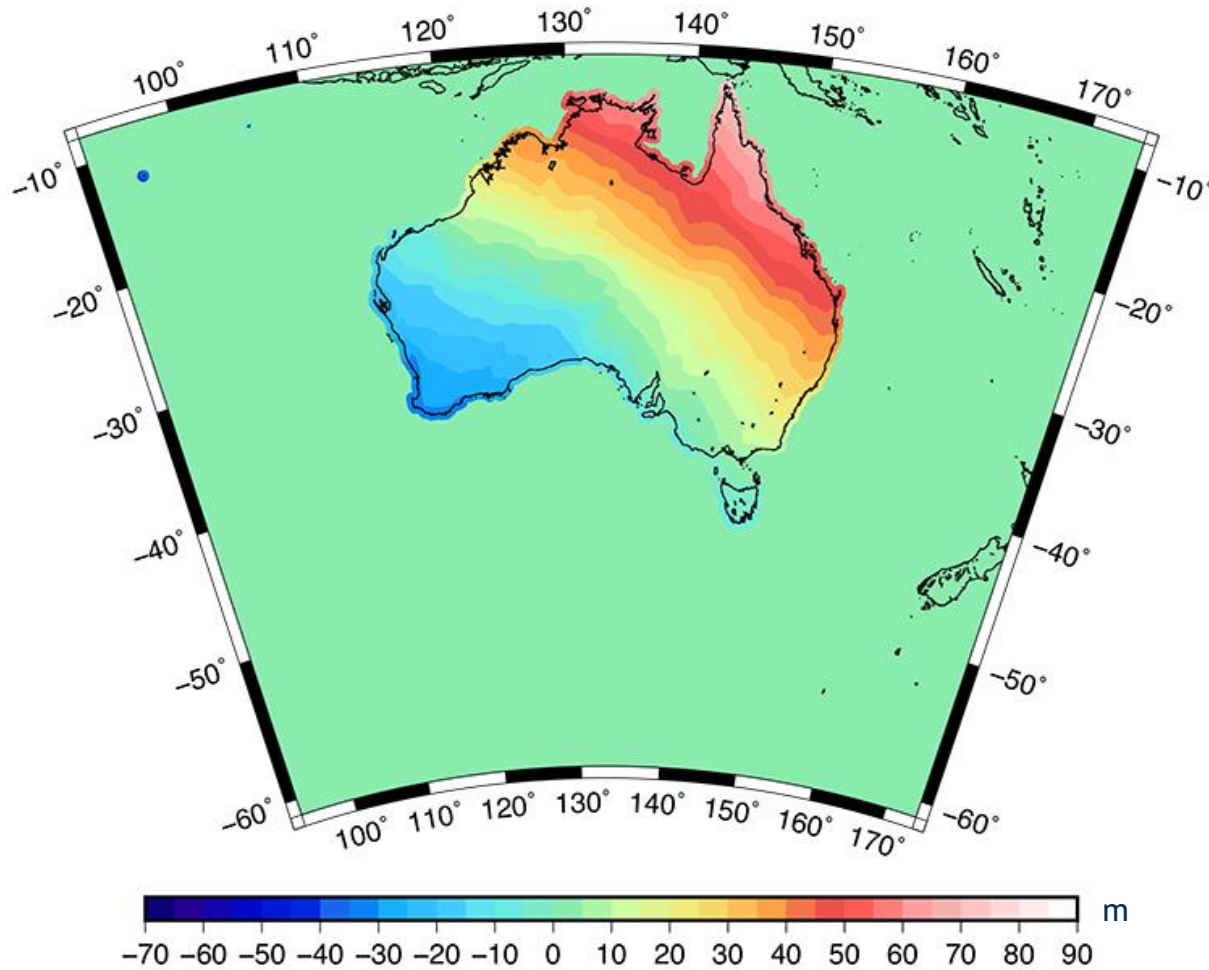




GeodePy



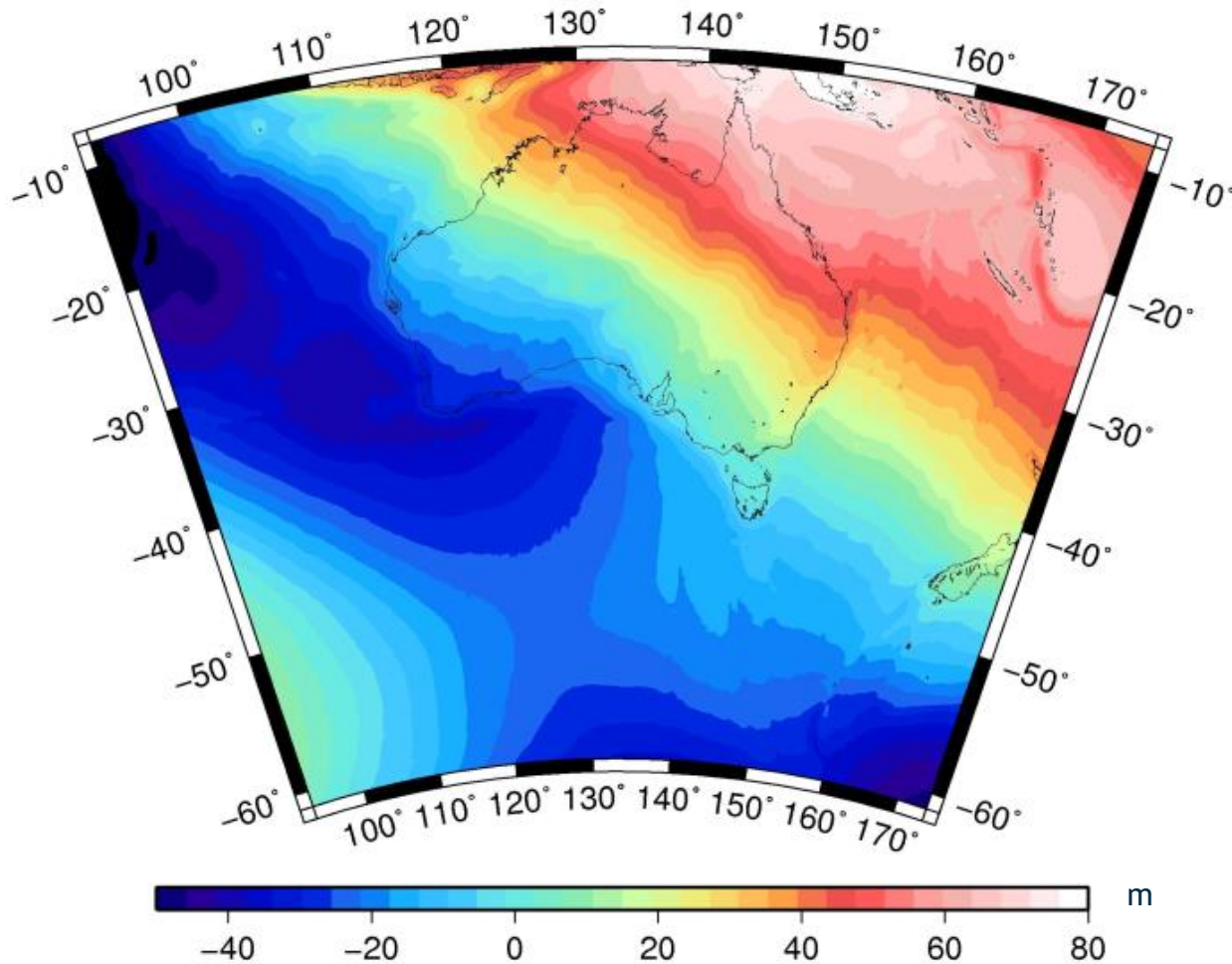




AUSGeoid2020

- combined gravimetric-geometric model
- Supports conversion of ellipsoidal (GNSS) heights to AHD
- Uncertainty of 8-13 cm
- Can only be used onshore (AHD extent)
- Constructed from levelling, and gravity data





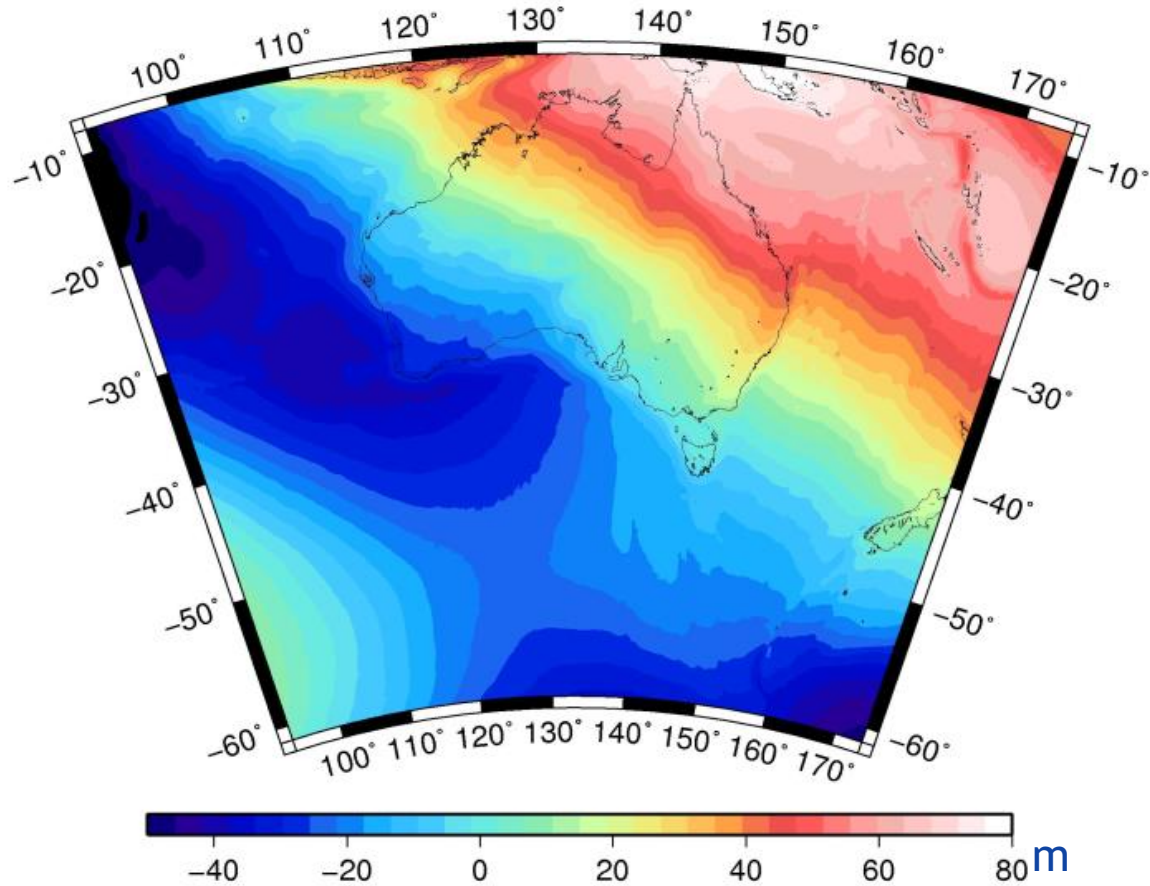
Australian Gravimetric Quasi-Geoid [AGQG]

- Updated version of gravimetric model (gravimetric only)
- Supports direct heighting with GNSS to AVWS
- Uncertainty of 1-8 cm
- Can be used onshore and offshore
- Constructed from airborne, terrestrial and satellite gravity

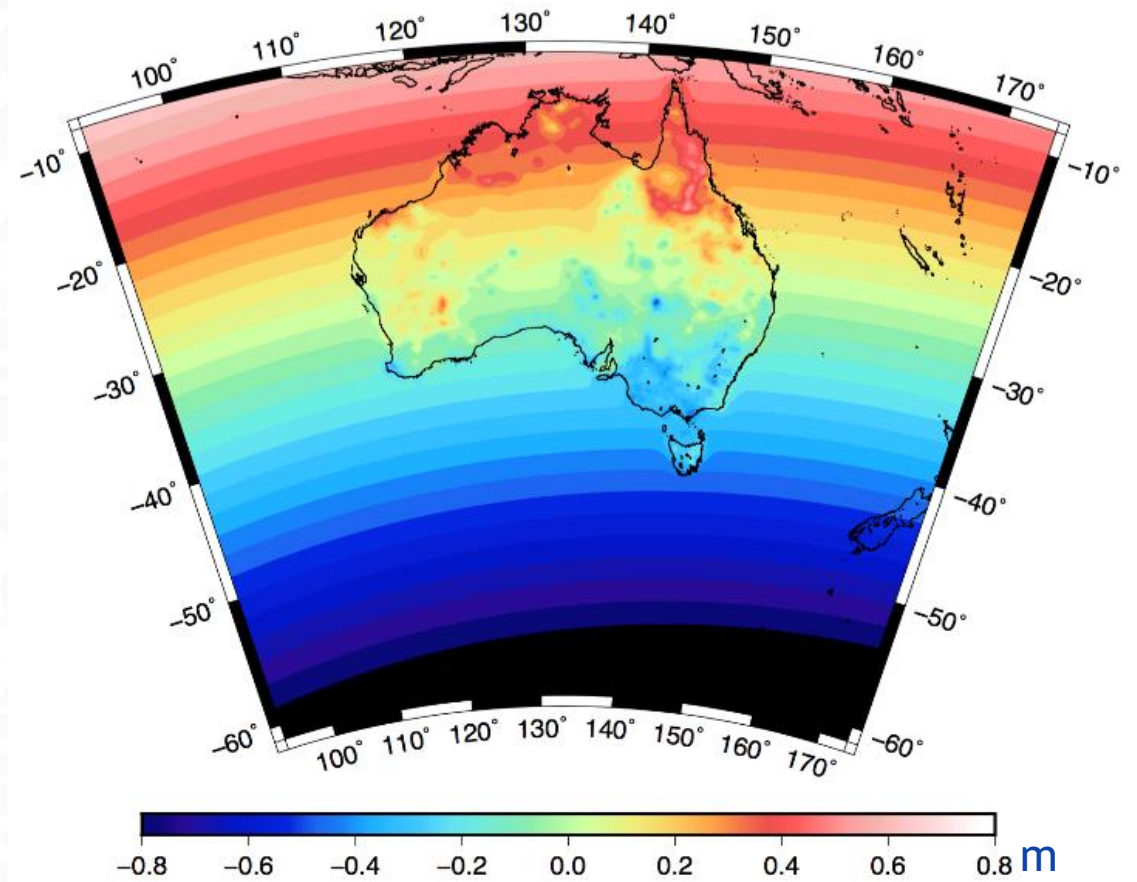




Australian Gravimetric Quasigeoid 2017 (AGQG2017)

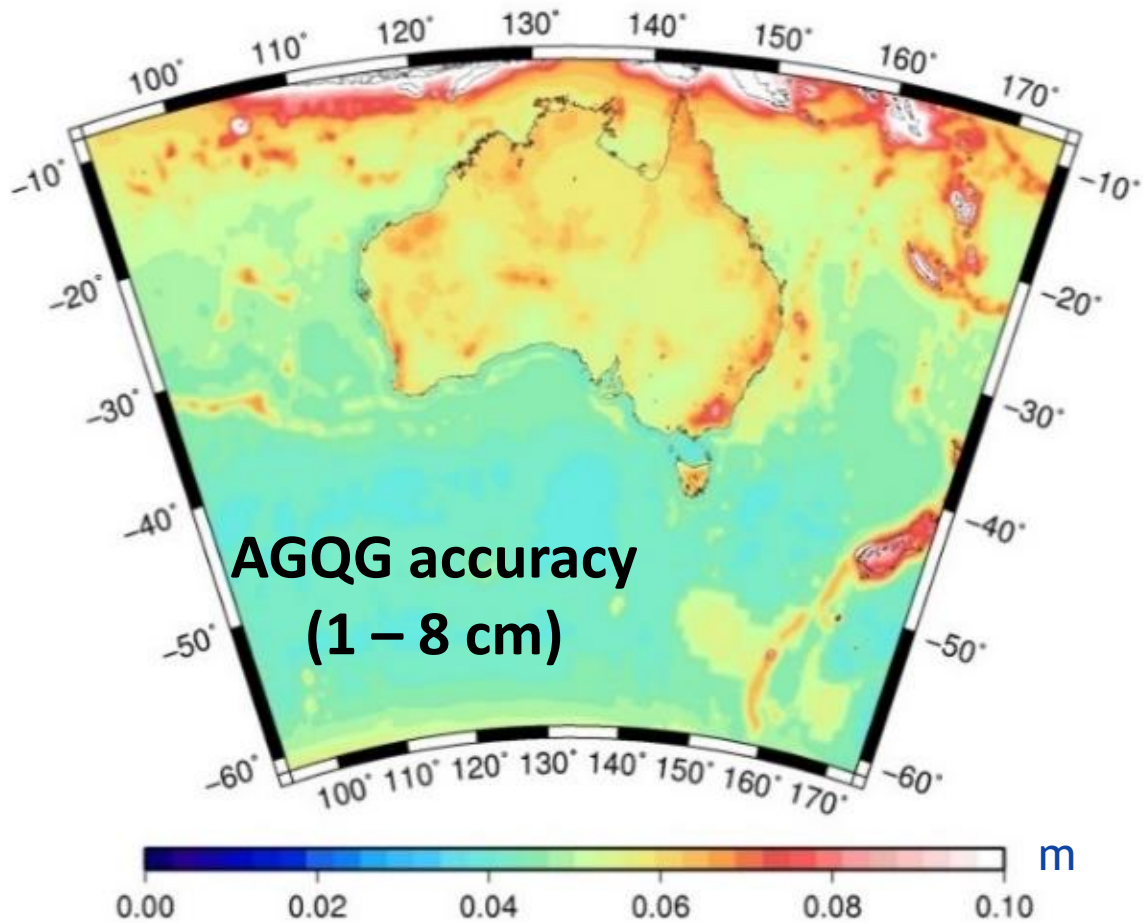


Imperfections in the 1971 realisation of AHD not in AGQG2017



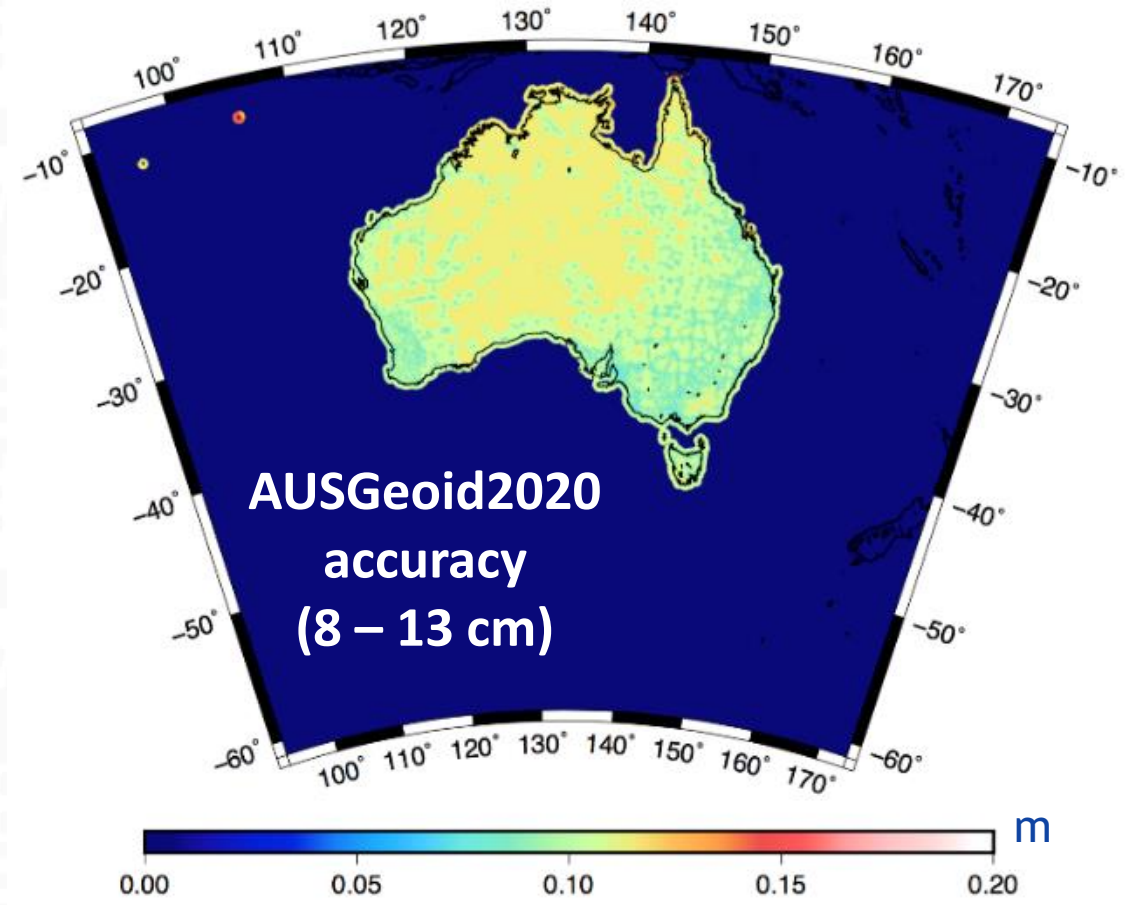


AGQG2017 - Error



Featherstone et al. (2017), Journal of Geodesy

AUSGeoid2020 - Error

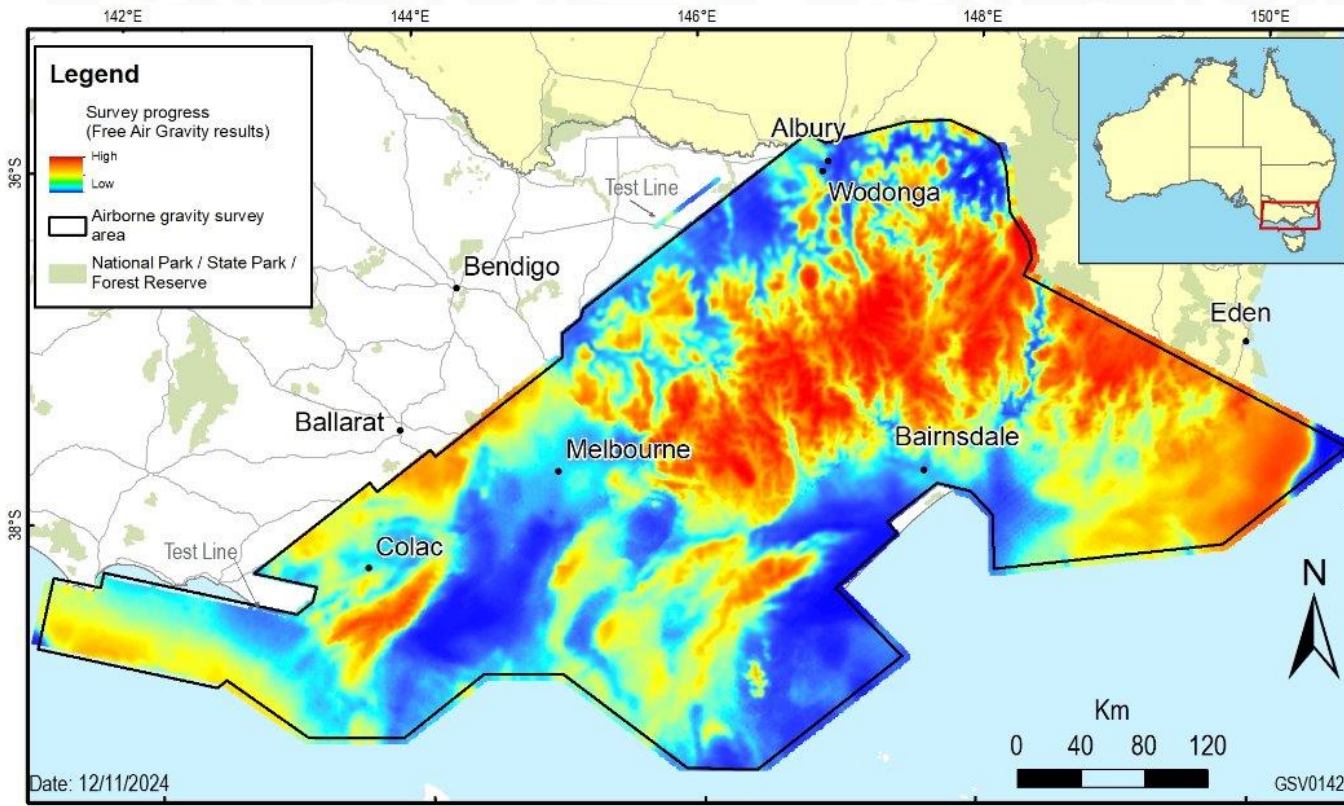


Brown et al. (2018), Journal of Geodesy





Improving AGQG with airborne gravity data



Map credit: Suzanne Haydon (Geological Survey of Victoria)



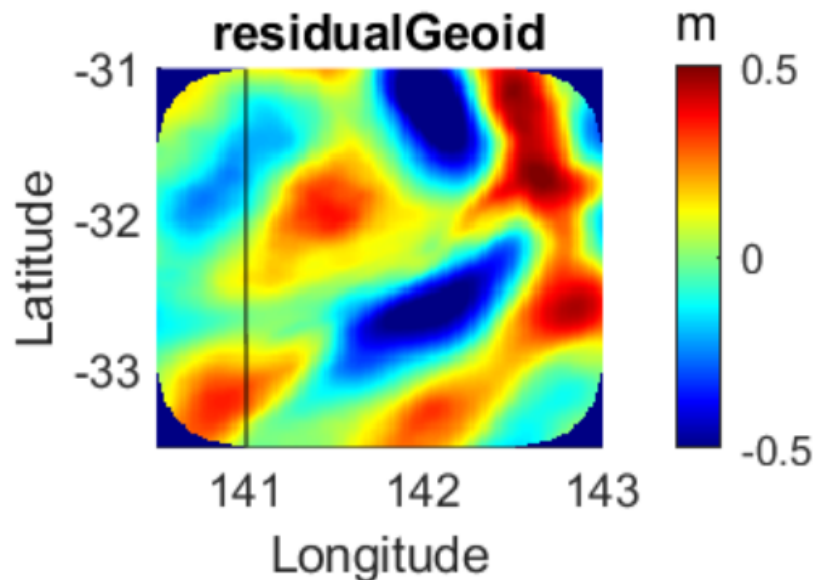
Photo credit : Surveyor-General Victoria





🔗 Analysis Ready Gravity Data Workflow

This repository introduces an open-source tool for computing regional gravimetric geoids using gravity observations. Our primary goal is to create a platform for analysis-ready gravity data, where algorithms and code for working with gravity data are openly shared and improved. The initial release features a tile-wise least-squares collocation (LSC) method based on gravity anomaly observations.



<https://github.com/GeoscienceAustralia/analysis-ready-gravity-data-workflow>

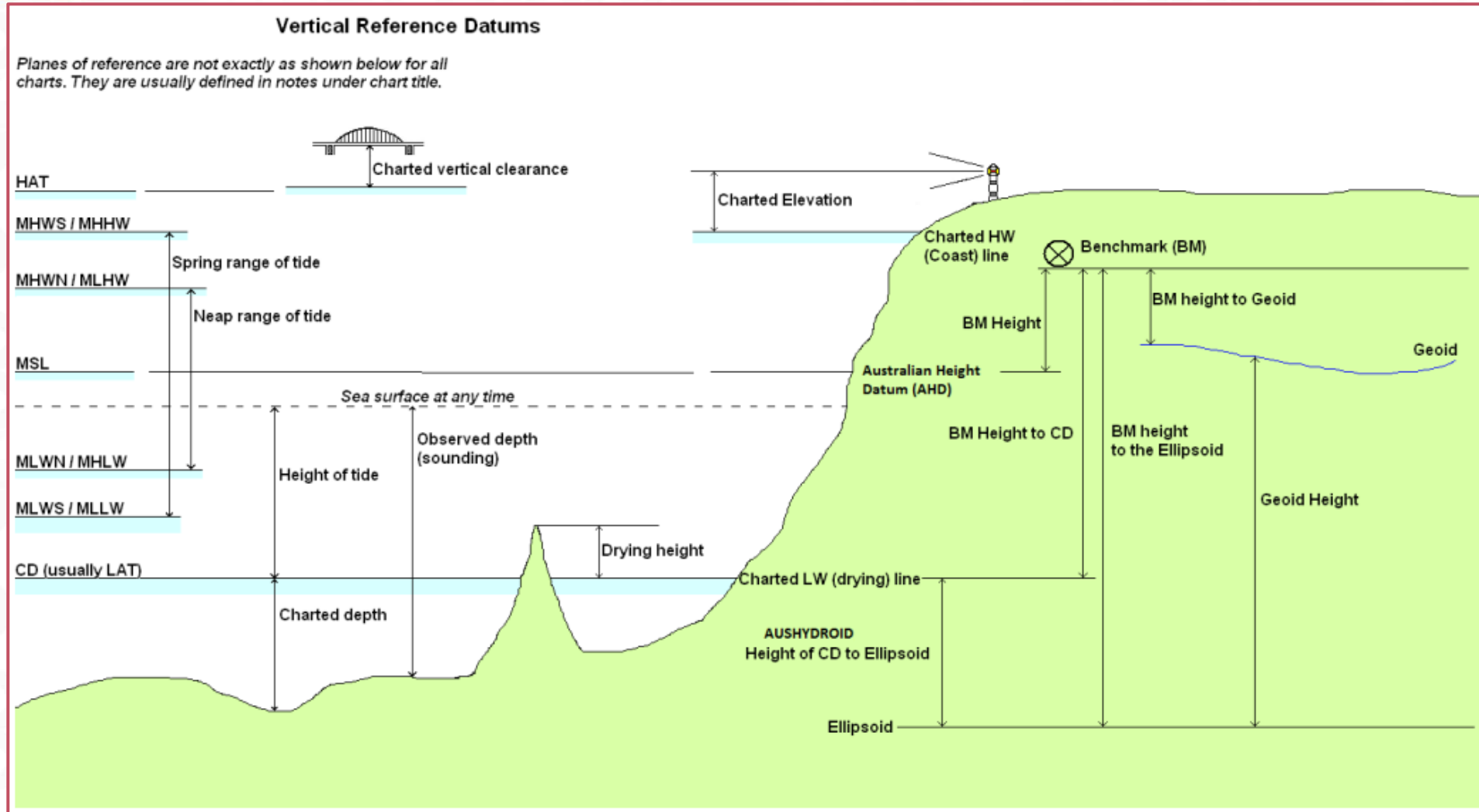


Inter-tidal zone survey in Northern Territory

- Across multiple jurisdictions and challenging inter-tidal zone area
- AGQG and AVWS provided an on-shore/off-shore consistent height surface and datum for the project with better accuracy and reduced uncertainty
- Height transfer from tidal buoys (off-shore) to survey control marks (on-shore)

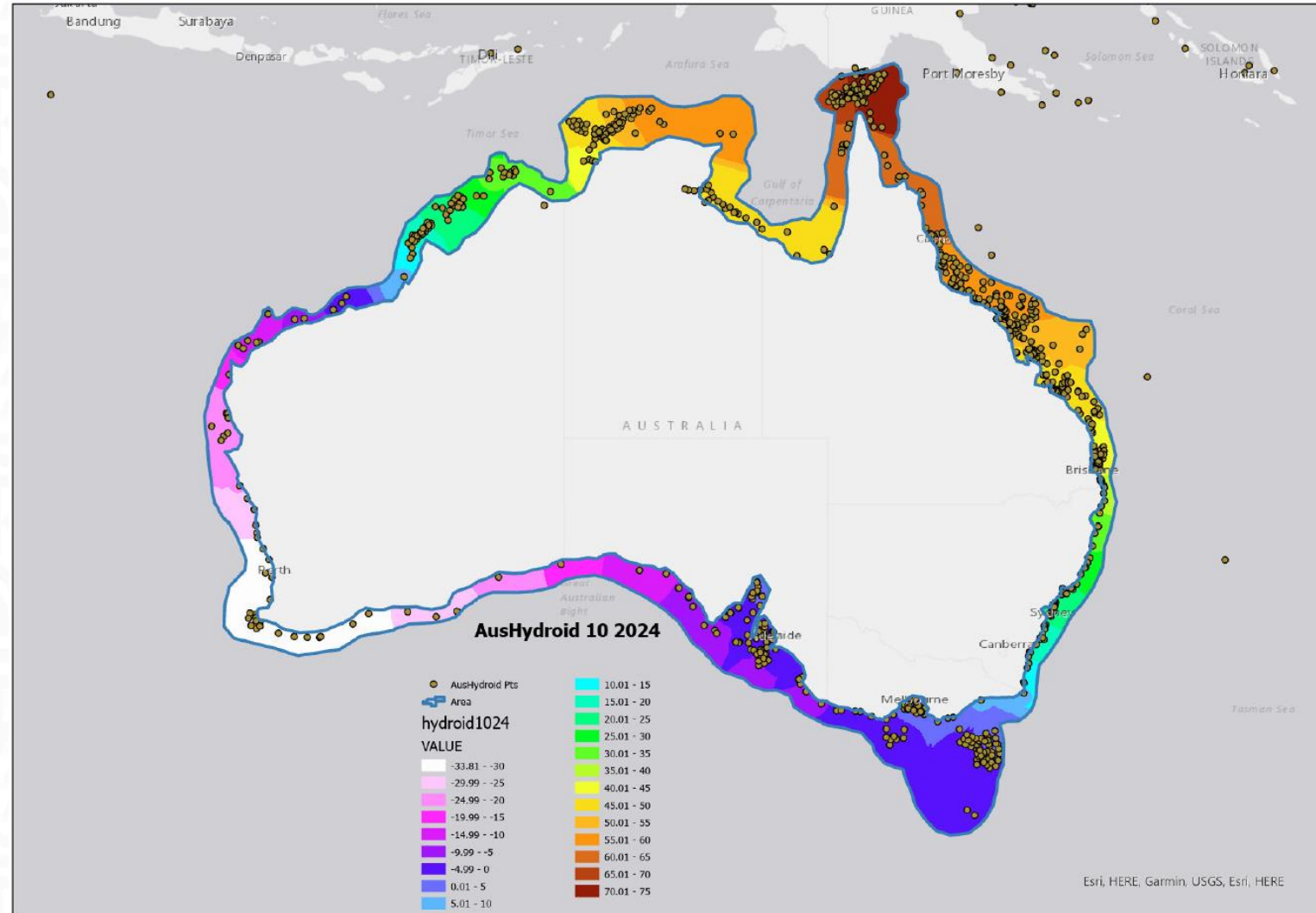


Vertical reference datum, from ICSM SP9 Australian Tides Manual



AusHydroid

- Facilitates GNSS surveying to chart datum and solves coastal vertical datum issues
- Defines the surface separation between the national ellipsoid (GRS80) and chart datum (LAT)
- Modelling methods:
 - **Terrestrial and Ocean surface:** GNSS and where needed TG obs [high accuracy but low resolution; high cost], <25 km from shore
 - **Space:** analysis of space sensor data, e.g. altimetry, gravity, astronomical obs [low spatial resolution and accuracy; cost effective]





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Coastal Research Infrastructure (CoastalRI) is an initiative of the National Collaborative Research Infrastructure Strategy



CoastRI

Research Infrastructure Connecting Land and Sea



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*Terima
Kasih!*



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