Australian Government
Geoscience Australia

AUSPOS GPS Processing Report

March 13, 2025

This document is a report of the GPS data processing undertaken by the AUSPOS Online GPS Processing Service (version: AUSPOS 3.0). The AUSPOS Online GPS Processing Service uses International GNSS Service (IGS) products (final, rapid, ultra-rapid depending on availability) to compute precise coordinates in International Terrestrial Reference Frame (ITRF) anywhere on Earth and Geocentric Datum of Australia (GDA) within Australia. The Service is designed to process only dual frequency GPS phase data.

An overview of the GPS processing strategy is included in this report.

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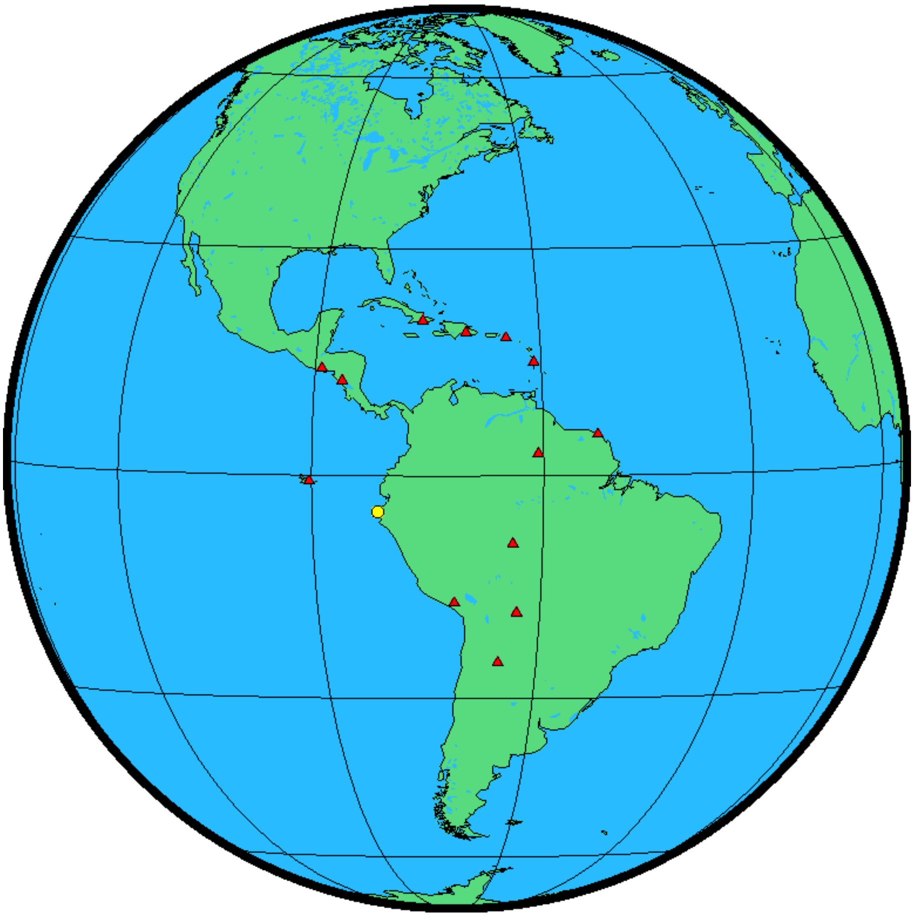
1 User Data

All antenna heights refer to the vertical distance from the Ground Mark to the Antenna Reference Point (ARP).

Station (s)	Submitted File	Antenna Type	Antenna Height (m)	Start Time	End Time
TALA	talaBMA1750.19o	SEPALTUS_NR3 NONE	2.000	2019/06/24 15:33:00	2019/06/24 20:42:30

2 Processing Summary



Date	User Stations	Reference Stations	Orbit Type
2019/06/24 15:33:00	TALA	AREQ BOAV CRO1 GLPS KOUR LMMF MANA POVE RDSD SCRZ SCUB SSIA UNSA	IGS final

3 Computed Coordinates, ITRF2020

All coordinates are based on the IGS realisation of the ITRF2020 reference frame. All the given ITRF2020 coordinates refer to a mean epoch of the site observation data. All coordinates refer to the Ground Mark.

3.1 Cartesian, ITRF2020

Station	X (m)	Y (m)	Z (m)	ITRF2020 @
TALA	963606.240	-6284515.930	-505356.828	24/06/2019
AREQ	1942826.284	-5804070.356	-1796894.121	24/06/2019
BOAV	3117452.164	-5555487.871	314480.978	24/06/2019
CRO1	2607771.341	-5488076.599	1932767.973	24/06/2019
GLPS	-33800.925	-6377516.515	-82154.231	24/06/2019
KOUR	3839591.322	-5059567.594	579957.225	24/06/2019
LMMF	2993387.391	-5399363.836	1596748.154	24/06/2019
MANA	407981.945	-6222925.657	1333529.099	24/06/2019
POVE	2774265.568	-5662060.145	-959415.748	24/06/2019
RDSD	2078678.913	-5683737.249	2006886.965	24/06/2019
SCRZ	2743005.927	-5420745.283	-1937117.000	24/06/2019
SCUB	1474537.997	-5811243.260	2168958.891	24/06/2019
SSIA	95567.107	-6197785.560	1500590.606	24/06/2019
UNSA	2412830.500	-5271936.763	-2652208.880	24/06/2019

3.2 Geodetic, GRS80 Ellipsoid, ITRF2020

Geoid-ellipsoidal separations, in this section, are computed using a spherical harmonic synthesis of the global EGM2008 geoid. More information on the EGM2008 geoid can be found at http://earth-info.nga.mil/GandG/wgs84/gravitymod/egm2008/.

Station	Latitude (DMS)	Longitude (DMS)	Ellipsoidal Height(m)	Derived Above Geoid Height(m)
TALA	-4 34 30.16962	-81 16 57.78139	11.960	4.368
AREQ	-16 27 55.85618	-71 29 34.06533	2488.932	2449.077
BOAV	2 50 42.66418	-60 42 04.01606	69.510	84.808
CRO1	17 45 24.83960	-64 35 03.54596	-31.929	11.750
GLPS	-0 44 34.79275	-90 18 13.19606	1.773	5.352
KOUR	5 15 07.85854	-52 48 21.45707	-25.761	8.500
LMMF	14 35 41.34373	-60 59 46.23238	-27.115	10.989
MANA	12 08 56.18278	-86 14 56.37453	71.022	66.414
POVE	-8 42 33.60411	-63 53 46.75293	119.545	107.567
RDSD	18 27 41.03366	-69 54 40.76230	-9.184	26.192
SCRZ	-17 47 48.44489	-63 09 34.82629	442.064	419.601
SCUB	20 00 43.43048	-75 45 44.34176	20.906	44.488
SSIA	13 41 49.50798	-89 06 59.74011	626.626	625.198
UNSA	-24 43 38.83790	-65 24 27.51442	1257.786	1224.374

3.3 UTM Grid, GRS80 Ellipsoid, ITRF2020

Station	East (m)	North (m)	Zone	Ellipsoidal Height (m)	Derived Above Geoid Height(m)
TALA	468640.115	9494302.881	17	11.960	4.368
AREQ	233847.159	8177928.957	19	2488.932	2449.077
BOAV	755563.754	314735.563	20	69.510	84.808
CRO1	332034.054	1963998.595	20	-31.929	11.750
GLPS	800120.962	9917784.727	15	1.773	5.352
KOUR	299847.147	580829.148	22	-25.761	8.500
LMMF	715865.052	1614463.277	20	-27.115	10.989
MANA	581710.936	1343135.885	16	71.022	66.414
POVE	401400.622	9037165.954	20	119.545	107.567
RDSD	403775.723	2041476.418	19	-9.184	26.192
SCRZ	483077.222	8032289.354	20	442.064	419.601
SCUB	420261.903	2212997.852	18	20.906	44.488
SSIA	271084.555	1515227.421	16	626.626	625.198
UNSA	256465.344	7263089.001	20	1257.786	1224.374

3.4 Positional Uncertainty (95% C.L.) - Geodetic, ITRF2020

Station	Longitude(East) (m)	Latitude(North) (m)	Ellipsoidal Height(Up) (m)
TALA	0.010	0.006	0.021
AREQ	0.008	0.006	0.014
BOAV	0.007	0.005	0.013
CRO1	0.008	0.006	0.015
GLPS	0.010	0.006	0.016
KOUR	0.008	0.006	0.015
LMMF	0.007	0.005	0.014
MANA	0.011	0.006	0.027
POVE	0.008	0.006	0.018
RDSD	0.007	0.005	0.015
SCRZ	0.008	0.006	0.015
SCUB	0.008	0.005	0.015
SSIA	0.011	0.006	0.027
UNSA	0.010	0.008	0.017

4 Ambiguity Resolution - Per Baseline

Baseline	Ambiguities Resolved	Baseline Length (km)
BOAV - KOUR	73.7 %	915.369
POVE - SCRZ	86.7 %	1007.527
MANA - SSIA	87.5 %	355.168
CRO1 - RDSD	76.4 %	568.960
BOAV - LMMF	75.0 %	1297.681
AREQ - POVE	86.7 %	1188.625
TALA - SSIA	62.5 %	2187.428
AREQ - UNSA	56.2 %	1111.591
POVE - TALA	86.7 %	1967.767
GLPS - TALA	57.7 %	1087.461
RDSD - SCUB	81.2 %	638.366
BOAV - POVE	81.2 %	1323.612
LMMF - RDSD	77.8 %	1042.005
AVERAGE	76.1%	1130.120

Please note for a regional solution, such as used by AUSPOS, ambiguity resolution success rate of 50% or better for a baseline formed by a user site indicates a reliable solution.

5 Computation Standards

5.1 Computation System

Software	Bernese GNSS Software Version 5.2.
GNSS system(s)	GPS only.

5.2 Data Preprocessing and Measurement Modelling

Data preprocessing	Phase preprocessing is undertaken in a baseline by baseline mode using triple-difference. In most cases, cycle slips are fixed by the simultaneous analysis of different linear combinations of L1 and L2. If a cycle slip cannot be fixed reliably, bad data points are removed or new ambiguities are set up A data screening step on the basis of weighted postfit residuals is also performed, and outliers are removed.
Basic observable	Carrier phase with an elevation angle cutoff of 7° and a sampling rate of 3 minutes. However, data cleaning is performed a sampling rate of 30 seconds. Elevation dependent weighting is applied according to $1/\sin(e)^2$ where e is the satellite elevation.
Modelled observable	Double differences of the ionosphere-free linear combination.
Ground antenna phase centre calibrations	IGS20 absolute phase-centre variation model is applied.
Tropospheric Model	A priori model is the GMF mapped with the DRY-GMF.
Tropospheric Estimation	Zenith delay corrections are estimated relying on the WET-GMF mapping function in intervals of 2 hour. N-S and E-W horizontal delay parameters are solved for every 24 hours.
Tropospheric Mapping Function	GMF
Ionosphere	First-order effect eliminated by forming the ionosphere-free linear combination of L1 and L2. Second and third effect applied.
Tidal displacements	Solid earth tidal displacements are derived from the complete model from the IERS Conventions 2010, but ocean tide loading is not applied.
Atmospheric loading	Applied
Satellite centre of mass correction	IGS20 phase-centre variation model applied
Satellite phase centre calibration	IGS20 phase-centre variation model applied
Satellite trajectories	Best available IGS products.
Earth Orientation	Best available IGS products.

5.3 Estimation Process

Adjustment	Weighted least-squares algorithm.
Station coordinates	Coordinate constraints are applied at the Reference sites with standard deviation of 1mm and 2mm for horizontal and vertical components respectively.
Troposphere	Zenith delay parameters and pairs of horizontal delay gradient parameters are estimated for each station in intervals of 2 hours and 24 hours.
Ionospheric correction	An ionospheric map derived from the contributing reference stations is used to aid ambiguity resolution.
Ambiguity	Ambiguities are resolved in a baseline-by-baseline mode using the Code-Based strategy for 200-6000km baselines, the Phase-Based L5/L3 strategy for 20-200km baselines, the Quasi-Ionosphere-Free (QIF) strategy for 20-2000km baselines and the Direct L1/L2 strategy for 0-20km baselines.

5.4 Reference Frame and Coordinate Uncertainty

Terrestrial reference frame	IGS20 station coordinates and velocities mapped to the mean epoch of observation.
Australian datums	GDA2020 and GDA94.
Derived AHD	For stations within Australia, AUSGeoid2020 (V20180201) is used to compute AHD. AUSGeoid2020 is the Australia-wide gravimetric quasigeoid model that has been a posteriori fitted to the AHD. For reference, derived AHD is always determined from the GDA2020 coordinates. In the GDA94 section of the report, AHD values are assumed to be identical to those derived from GDA2020.
Above-geoid heights	Earth Gravitational Model EGM2008 released by the National Geospatial-Intelligence Agency (NGA) EGM Development Team is used to compute above-geoid heights. This gravitational model is complete to spherical harmonic degree and order 2159, and contains additional coefficients extending to degree 2190 and order 2159.
Coordinate uncertainty	Coordinate uncertainty is expressed in terms of the 95% confidence level for GDA94, GDA2020 and ITRF2020. Uncertainties are scaled using an empirically derived model which is a function of data span, quality and geographical location.