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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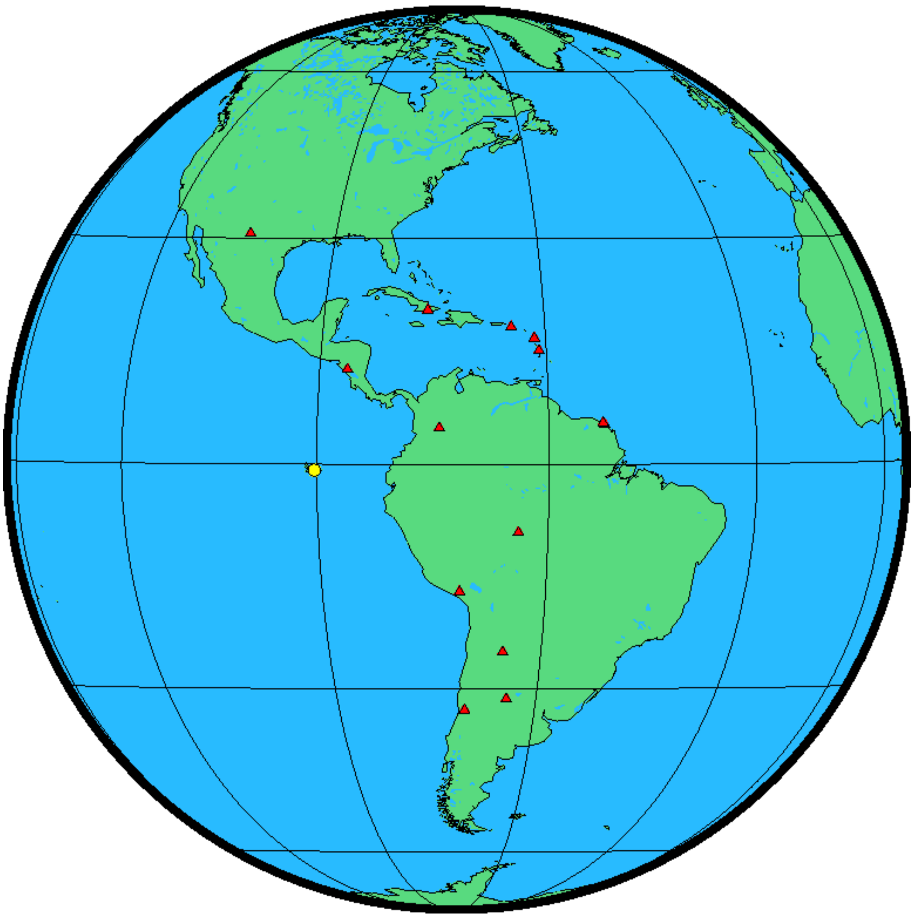
1 User Data

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
SNTC	santcruz2490.22o	SEPALTUS_NR3 NONE	2.000	2022/09/06 15:41:30	2022/09/06 20:22:30

2 Processing Summary



Date	User Stations	Reference Stations	Orbit Type
2022/09/06 15:41:30	SNTC	ABMF AREG BOGT CORD CRO1 GLPS KOUG KOUR LMMF MANA MDO1 POVE SANT SCUB 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 @
SNTC	-34813.849	-6377490.512	-83465.907	06/09/2022
ABMF	2919785.804	-5383744.958	1774604.903	06/09/2022
AREG	1942816.472	-5804077.157	-1796884.316	06/09/2022
BOGT	1744398.874	-6116036.957	512731.944	06/09/2022
CORD	2345503.882	-4910842.912	-3316365.181	06/09/2022
CRO1	2607771.355	-5488076.556	1932768.008	06/09/2022
GLPS	-33800.754	-6377516.502	-82154.193	06/09/2022
KOUG	3855263.296	-5049732.008	563040.566	06/09/2022
KOUR	3839591.317	-5059567.577	579957.264	06/09/2022
LMMF	2993387.426	-5399363.815	1596748.202	06/09/2022
MANA	407981.966	-6222925.632	1333529.125	06/09/2022
MDO1	-1329998.990	-5328393.359	3236504.070	06/09/2022
POVE	2774265.598	-5662060.182	-959415.710	06/09/2022
SANT	1769693.514	-5044574.286	-3468320.844	06/09/2022
SCUB	1474537.988	-5811243.267	2168958.893	06/09/2022
UNSA	2412830.518	-5271936.771	-2652208.834	06/09/2022

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)
SNTC	-0 45 17.50242	-90 18 45.96022	-1.635	1.981
ABMF	16 15 44.30567	-61 31 39.12722	-25.544	15.331
AREG	-16 27 55.51967	-71 29 34.45167	2489.351	2449.496
BOGT	4 38 24.27099	-74 04 51.38222	2576.173	2553.312
CORD	-31 31 42.35920	-64 28 12.17508	746.813	720.425
CRO1	17 45 24.84104	-64 35 03.54493	-31.949	11.730
GLPS	-0 44 34.79152	-90 18 13.19053	1.758	5.337
KOUG	5 05 54.49975	-52 38 23.10188	107.240	141.823
KOUR	5 15 07.85986	-52 48 21.45688	-25.774	8.487
LMMF	14 35 41.34525	-60 59 46.23099	-27.105	10.999
MANA	12 08 56.18378	-86 14 56.37380	71.005	66.397
MDO1	30 40 49.83718	-104 00 53.98290	2004.482	2026.561
POVE	-8 42 33.60267	-63 53 46.75258	119.584	107.606
SANT	-33 09 01.03313	-70 40 06.79648	723.100	695.197
SCUB	20 00 43.43049	-75 45 44.34214	20.910	44.492
UNSA	-24 43 38.83633	-65 24 27.51398	1257.781	1224.369

3.3 UTM Grid, GRS80 Ellipsoid, ITRF2020

Station	East (m)	North (m)	Zone	Ellipsoidal Height (m)	Derived Above Geoid Height(m)
SNTC	799106.385	9916472.584	15	-1.635	1.981
ABMF	657348.836	1798516.972	20	-25.544	15.331
AREG	233835.567	8177939.164	19	2489.351	2449.496
BOGT	601939.818	512945.123	18	2576.173	2553.312
CORD	360433.102	6510895.608	20	746.813	720.425
CRO1	332034.085	1963998.639	20	-31.949	11.730
GLPS	800121.133	9917784.765	15	1.758	5.337
KOUG	318229.357	563780.473	22	107.240	141.823
KOUR	299847.154	580829.188	22	-25.774	8.487
LMMF	715865.094	1614463.324	20	-27.105	10.999
MANA	581710.958	1343135.916	16	71.005	66.397
MDO1	594348.813	3394609.168	13	2004.482	2026.561
POVE	401400.633	9037165.998	20	119.584	107.606
SANT	344386.463	6330812.752	19	723.100	695.197
SCUB	420261.892	2212997.853	18	20.910	44.492
UNSA	256465.356	7263089.049	20	1257.781	1224.369

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

Station	Longitude(East) (m)	Latitude(North) (m)	Ellipsoidal Height(Up) (m)
SNTC	0.012	0.008	0.025
ABMF	0.010	0.006	0.021
AREG	0.011	0.007	0.022
BOGT	0.013	0.008	0.030
CORD	0.011	0.009	0.028
CRO1	0.010	0.006	0.017
GLPS	0.009	0.006	0.015
KOUG	0.009	0.006	0.015
KOUR	0.009	0.006	0.015
LMMF	0.009	0.006	0.015
MANA	0.011	0.008	0.025
MDO1	0.011	0.007	0.018
POVE	0.010	0.006	0.020
SANT	0.012	0.009	0.030
SCUB	0.011	0.007	0.019
UNSA	0.009	0.007	0.016

4 Ambiguity Resolution - Per Baseline

Baseline	Ambiguities Resolved	Baseline Length (km)
GLPS - MANA	66.7 %	1491.050
CORD - UNSA	60.9 %	758.963
CORD - SANT	77.3 %	610.354
GLPS - POVE	83.3 %	3027.656
ABMF - SCUB	56.2 %	1557.887
AREG - POVE	85.7 %	1188.625
KOUG - LMMF	80.0 %	1390.548
MANA - MDO1	72.2 %	2728.017
ABMF - LMMF	68.8 %	193.117
AREG - UNSA	73.7 %	1111.605
KOUG - KOUR	86.7 %	25.070
GLPS - SNTC	94.1 %	1.658
ABMF - CRO1	82.4 %	365.039
KOUG - POVE	100.0 %	1965.038
BOGT - POVE	78.9 %	1853.089
AVERAGE	77.8%	1217.848

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.