Australian Government

Geoscience Australia

AUSPOS Online GPS Processing Report

Space Geodesy Analysis Centre
Geohazards Division, Geoscience Australia

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This document is a report of the GPS data processing undertaken by the AUSPOS Online GPS Processing Service. The AUSPOS Online GPS Processing Service uses International GPS Service (IGS) products (final, rapid, ultra-rapid depending on availability) including Precise Orbits, Earth Orientation, Coordinate Solutions (IGS-SSC) to compute precise coordinates in ITRF anywhere on Earth. The Service is designed to process only dual frequency GPS phase data.

An overview of the GPS processing strategy is attached to this report. Please direct email correspondence to geodesy@ga.gov.au

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1 User and IGS GPS Data

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

User File	Antenna Type	Antenna Height (m)	Start Time	End Time
8005015A.08O	SOKGSR2700IS NONE	1.6570	2008-01-14 20:33:00	2008-01-15 06:21:59

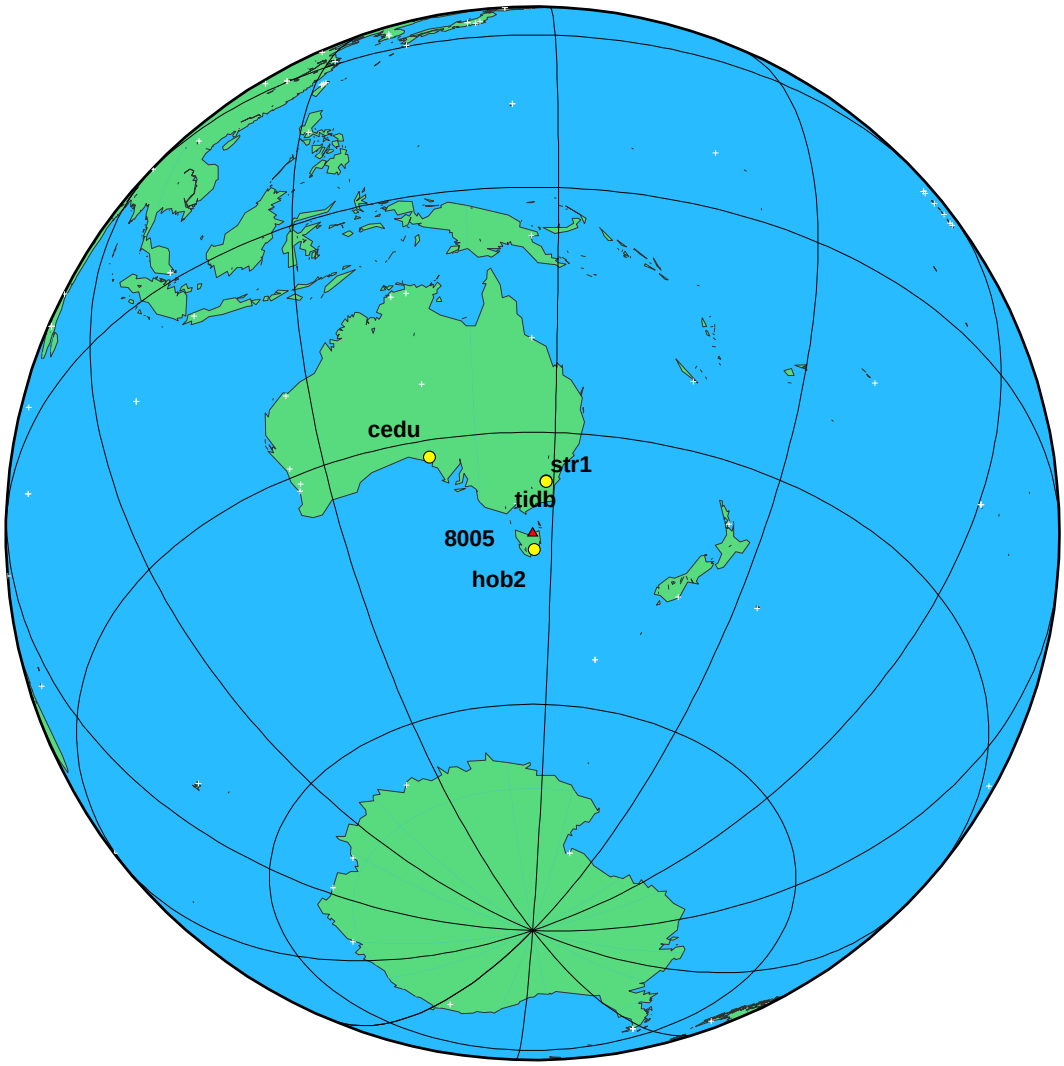

Figure 1: Global View – submitted GPS station(s) and nearby IGS GPS stations used in the processing; triangle(s) represent submitted user data; circle(s) represent the nearest available IGS stations.

2 Processing Summary

Date	IGS Data	User Data	Orbit Type
2008-01-14	hob2 tidb str1	8005	IGS Rapid
2008-01-15	hob2 tidb cedu	8005	IGS Rapid

Warning: An IGS Rapid orbit product has been used in this computation. For the highest quality coordinates please resubmit approximately 2 weeks after the observation session end to ensure the use of the IGS Final orbit product.

3 Computed Coordinates, GDA94

For Australian users Geocentric Datum of Australia (GDA94, ITRF92@1994.0) coordinates are provided. GDA94 coordinates are determined from ITRF coordinates by an Geoscience Australia (GA) derived coordinate transformation process. GA transformation parameters between ITRF and GDA94 are re-computed weekly, incorporating the latest available tectonic motions (determined from the GA GPS network). GA recommends that users within Australia use GDA94 coordinates. All coordinates refer to the Ground Mark. For general/technical information on GDA94 see www.ga.gov.au/nmd/geodesy/datums/gda.jsp and www.icsm.gov.au/icsm/gda/gdatm/

3.1 Cartesian, GDA94

	X(m)	Y(m)	Z(m)	
hob2	-3950071.286	2522415.223	-4311638.529	GDA94
str1	-4467102.302	2683039.531	-3666949.979	GDA94
8005	-4047615.782	2610545.486	-4167351.315	GDA94
tidb	-4460996.066	2682557.136	-3674443.861	GDA94
cedu	-3753472.147	3912741.047	-3347961.037	GDA94

3.2 Geodetic, GRS80 Ellipsoid, GDA94

The height above the Geoid is computed using the GPS Ellipsoidal height and subtracting a Geoid-Ellipsoid separation. Geoid-Ellipsoidal separations are computed using a bilinear interpolation of the AUSGeoid98 grid. The height above the Geoid is only provided for sites within the AUSGeoid98 extents. For information on AUSGeoid98 see www.ga.gov.au/nmd/geodesy/ausgeoid/

	Latitude(DMS)	Longitude(DMS)	Ellipsoidal Height(m)	Above-Geoid Height(m)	
hob2	-42-48 -16.9852	147 26 19.4356	41.148	44.454	GDA94
str1	-35-18 -55.9395	149 0 36.1797	800.028	780.691	GDA94
8005	-41 -3 -28.7397	147 10 46.7411	107.262	107.640	GDA94
tidb	-35-23 -57.1560	148 58 47.9845	665.426	646.141	GDA94
cedu	-31-52 -0.0165	133 48 35.3757	144.822	153.381	GDA94

3.3 MGA Grid, GRS80 Ellipsoid, GDA94

	East(M)	North(M)	Zone	Ellipsoidal Height(m)	Above-Geoid Height(m)	
hob2	535873.398	5260777.226	55	41.148	44.454	GDA94
str1	682726.018	6090110.672	55	800.028	780.691	GDA94
8005	515095.622	5454790.670	55	107.262	107.640	GDA94
tidb	679807.859	6080884.476	55	665.426	646.141	GDA94
cedu	387415.775	6473725.245	53	144.822	153.381	GDA94

4 Computed Coordinates, ITRF2000

All computed coordinates are based on the IGS realisation of the ITRF2000 reference frame, provided by the IGS cumulative solution. All the given ITRF2000 coordinates refer to a mean epoch of the site observation data. All coordinates refer to the Ground Mark.

4.1 Cartesian, ITRF2000

	X(m)	Y(m)	Z(m)	ITRF2000 @	
hob2	-3950071.811	2522415.294	-4311637.940	2008/01/15	
str1	-4467102.782	2683039.492	-3666949.336	2008/01/14	
8005	-4047616.301	2610545.534	-4167350.711	2008/01/15	
8005	0.111 m	0.089 m	0.016 m		RMS
tidb	-4460996.547	2682557.098	-3674443.219	2008/01/15	
cedu	-3753472.711	3912741.027	-3347960.335	2008/01/15	

4.2 Geodetic, GRS80 Ellipsoid, ITRF2000

The height above the Geoid is computed using the GPS Ellipsoidal height and subtracting a Geoid-Ellipsoid separation. Geoid-Ellipsoidal separations, in this section, are computed using a spherical harmonic synthesis of the global EGM96 geoid. More information on the EGM96 geoid can be found at earth-info.nga.mil/GandG/wgsegm/egm96.html

	Latitude(DMS)	Longitude(DMS)	Ellipsoidal Height(m)	Above-Geoid Height(m)	
hob2	-42-48 -16.9606	147 26 19.4454	41.100	44.610	
str1	-35-18 -55.9151	149 0 36.1908	799.976	780.731	
8005	-41 -3 -28.7151	147 10 46.7515	107.214	108.098	
8005	0.081 m	0.016 m	0.117 m		RMS
tidb	-35-23 -57.1317	148 58 47.9956	665.375	646.212	
cedu	-31-51 -59.9907	133 48 35.3917	144.770	154.034	

5 Solution Information

To validate your solution you should check the :-

i. Antenna Reference Point (ARP) to Ground Mark records;

ii. Apriori Coordinate Updates (valid range is 0.000 - 15.000 m);

iii. Coordinate Precision (valid range is 0.001 - 0.025 m);

iv. Root Mean Square (RMS) (valid range is 0.0005 - 0.0250 m); and

v. % Observations Deleted (valid range is 0 - 25) %;

5.1 ARP to Ground Mark, per day

All heights refer to the vertical distance from the Ground Mark to the Antenna Reference Point (ARP). The Antenna Offsets refer to the vertical distance from the ARP to the L1 phase centre.

	Height(m)	Antenna Offsets(m)			
Station	Up	East	North	Up	yyyy/mm/dd
8005	1.6570	0.0000	-0.0011	0.1257	2008/01/14
8005	1.6570	0.0000	-0.0011	0.1257	2008/01/15

5.2 Apriori Coordinate Updates - Cartesian, per day

	dX(m)	dY(m)	dZ(m)	yyyy/mm/dd
8005	-0.198	0.052	-0.015	2008/01/14
8005	-0.030	0.006	-0.013	2008/01/15

5.3 Coordinate Precision - Cartesian, per day

1 Sigma	sX(m)	sY(m)	sZ(m)	yyyy/mm/dd
8005	0.080	0.034	0.046	2008/01/14
8005	0.008	0.012	0.008	2008/01/15

5.4 Coordinate Value - Cartesian, ITRF2000, per day

	X(m)	Y(m)	Z(m)	ITRF2000 @
8005	-4047616.459	2610545.659	-4167350.733	2008/01/14
8005	-4047616.300	2610545.519	-4167350.710	2008/01/15

5.5 Geodetic, GRS80 Ellipsoid, ITRF2000, per day

	Latitude(DMS)	Longitude(DMS)	Ellipsoidal Height(m)	
8005	-41 -3 -28.7114	147 10 46.7507	107.379	2008/01/14
8005	-41 -3 -28.7153	147 10 46.7520	107.206	2008/01/15

5.6 RMS, Observations, Deletions per day

Data	RMS (m)	# Observations	% Obs. Deleted	Date
hob2	0.0396	629	18 %	2008-01-14
str1	0.0113	1958	0 %	2008-01-14
8005	0.0218	2587	5 %	2008-01-14
tidb	0.0081	3429	0 %	2008-01-15
hob2	0.0080	4600	3 %	2008-01-15
cedu	0.0072	3931	3 %	2008-01-15
8005	0.0078	11960	2 %	2008-01-15

WARNING: This solution has modelling problems associated with the submitted GPS data. Please consider this solution with CAUTION.

A GPS Computation Standards

A.1 Measurement Modelling

Observable	Ionosphere corrected L1 double difference carrier phase, Psuedo-range only used for receiver clock estimation, Elevation cut-off 15^o, Sampling rate 30 seconds, Weighting 1.0cm for double difference, elevation dependent 1/sin(E).
Troposphere	Hopfield, Niell mapping function
Preprocessing	Receiver clocks estimated using pseudo-range information
Satellite center of mass correction	Block II x,y,z: 0.2794, 0.0000, 1.0259 m Block IIA x,y,z: 0.2794, 0.0000, 1.2053 m
Satellite Antenna Phase centre calibration	Not applied
Ground Antenna phase centre calibrations	Elevation-dependent phase centre corrections are applied according to the model IGS01, the NGS antenna calibrations are used when the antenna used is not a recognised IGS type. The corrections are given relative to the Dorne Margolin T antenna.
Atmospheric Drag	Jachhia Model
Centre of Mass Correction / Attitude	Nil

A.2 Orbit Modelling

Earth's Gravitational (Static) Potential Model	EGM96 - degree and order 12
Solid Earth Tides (Dynamic) Potential	Love Model
Ocean Tide (Dynamic) Potential	Christodoulidis
Third Body Perturbations	Sun, Moon and Planets Values for physical constants - AU, Moon/Earth mass ratio, GM(moon, sun and planets) from JPL DE403 Planetary Ephemeris.
Direct Solar Radiation Pressure	Rock

A.3 Station Position Modelling and Reference Frame

Precession	IAU76/IERS96
Nutation	IAU80/IERS96 (including epsilon and psi corrections)
Sine terms added to accumulated precession and nutation in Right Ascension	As in IERS TN 21, p. 21
Geodesic Nutation	As in IERS TN 21, P. 37
Polar Motion	IGS Earth Orientation Parameters (Ultra-rapid, Rapid, Final) - apriori
Earth Rotation (UT1)	IGS Earth Orientation Parameters (Ultra-rapid, Rapid, Final) - apriori
Daily and Sub-daily tidal corrections to X, Y and UT1	Applied (IERS2000)
Plate Motion	IGS Cumulative SSC
Planetary and Lunar Ephemeris	JPL DE403
Station Displacement - Solid Earth Tide Loading	Williamson and Diamante (1972) + Wahr (1980) for the frequency dependent elastic response of the Earth's fluid interior.
Station Displacement - Ocean Tide Loading	not applied
Station Displacement - Pole Tide	applied
Station Displacement - Atmosphere Loading	not applied
Reference Frame	IGS Cumulative SSC