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AUSPOS Online GPS Processing Report

Space Geodesy Analysis Centre
Minerals and 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.

The AUSPOS Online GPS Processing Service is a free service and you are encouraged to use it for your projects. However, you may not charge others for this service. Geoscience Australia does not warrant that this service a) is error free; b) meets the customer's requirements. Geoscience Australia shall not be liable to the customer in respect of any loss, damage or injury (including consequential loss, damage or injury) however caused, which may arise directly or indirectly in respect of this service.

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 Antenna Reference Point (ARP).

User File	Antenna Type	Antenna Height (m)	Start Time	End Time
APMP0580.040	DEFAULT (NONE)	0.0000	2004-02-27 10:11:00	2004-02-27 23:59:59
APMP0590.040	DEFAULT (NONE)	0.0000	2004-02-28 00:00:00	2004-02-28 23:59:59
APMP0600.040	DEFAULT (NONE)	0.0000	2004-02-29 00:00:00	2004-02-29 23:59:59
APMP0610.040	DEFAULT (NONE)	0.0000	2004-03-01 00:00:00	2004-03-01 23:59:59
APMP0620.040	DEFAULT (NONE)	0.0000	2004-03-02 00:00:00	2004-03-02 23:59:59
APMP0630.040	DEFAULT (NONE)	0.0000	2004-03-03 00:00:00	2004-03-03 23:59:59

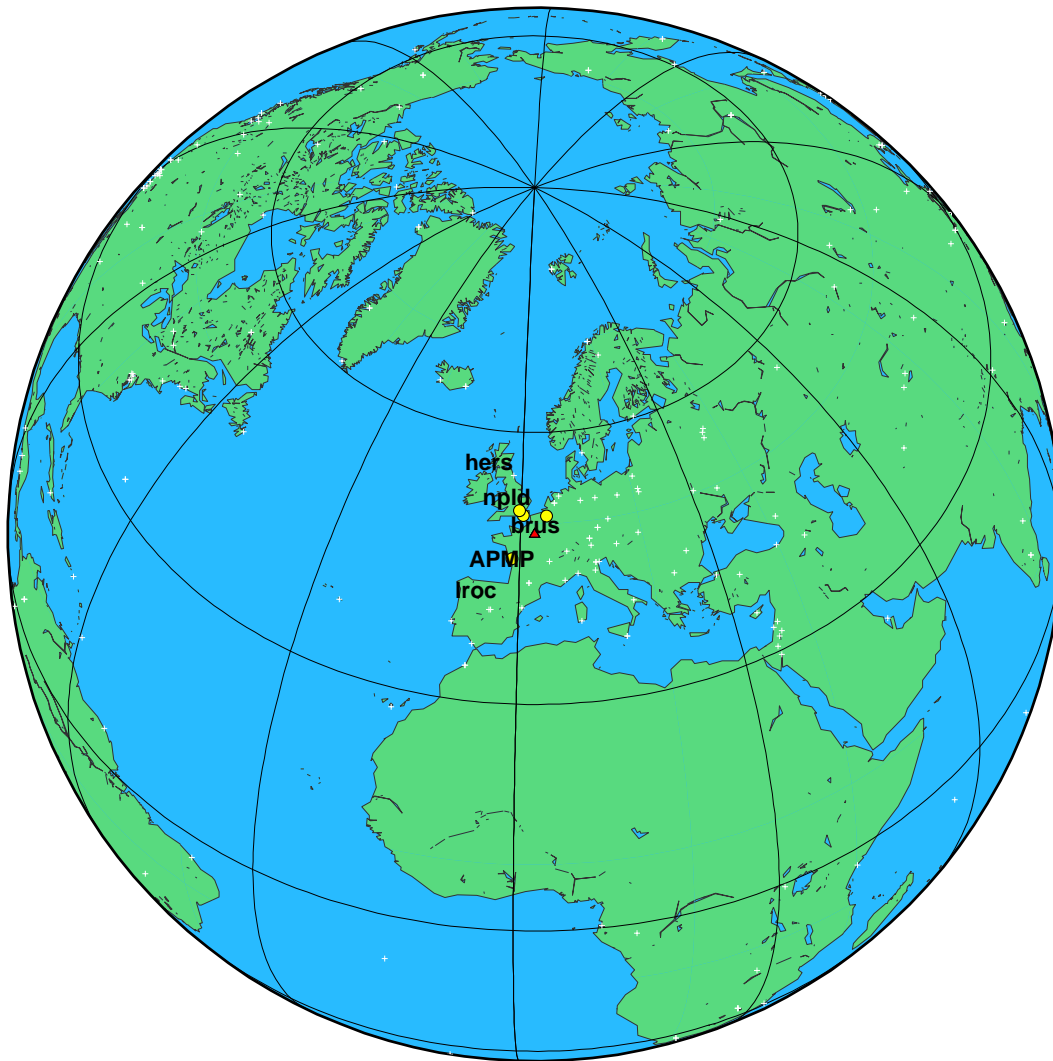


Figure 1: Global View – submitted GPS station(s) and nearby IGS GPS stations used in the processing; triangle(s) represent submitted user data; circle(s) represent the nearest available IGS stations.

2 Processing Summary

Date	IGS Data	User Data	Orbit Type
2004-02-27	brus hers npld	APMP	IGS Final
2004-02-28	brus hers npld	APMP	IGS Final
2004-02-29	brus hers npld	APMP	IGS Final
2004-03-01	brus hers npld	APMP	IGS Final
2004-03-02	brus npld lroc	APMP	IGS Final
2004-03-03	brus hers lroc	APMP	IGS Final

3 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.

3.1 Cartesian, ITRF2000

	X(m)	Y(m)	Z(m)	ITRF2000 @	
hers	4033470.129	23672.880	4924301.301	2004/02/29	
brus	4027893.769	307045.812	4919475.107	2004/03/01	
npld	3985500.312	-23625.461	4962941.685	2004/02/29	
APMP	4202783.525	171367.812	4778657.541	2004/03/01	
APMP	0.002 m	0.004 m	0.004 m		RMS
lroc	4424632.586	-94175.244	4577544.067	2004/03/03	

3.2 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)
hers	50	52	2.3289	0	20	10.5769	76.492	31.471
brus	50	47	52.1441	4	21	33.1883	149.680	104.159
npld	51	25	15.5300	0-20	-22	6.932	72.646	26.553
APMP	48	50	9.1056	2	20	5.7574	124.628	80.086
APMP			0.002 m			0.005 m	0.004 m	RMS
lroc	46	9	32.1913	-1-13	-9	5.410	57.862	9.814

4 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) %;

4.1 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.

Station	Height(m)		Antenna Offsets(m)			
	Up		East	North	Up	yyyy/mm/dd
APMP	0.0000		0.0000	0.0000	0.0000	2004/02/27
APMP	0.0000		0.0000	0.0000	0.0000	2004/02/28

APMP	0.0000	0.0000	0.0000	0.0000	2004/02/29
APMP	0.0000	0.0000	0.0000	0.0000	2004/03/01
APMP	0.0000	0.0000	0.0000	0.0000	2004/03/02
APMP	0.0000	0.0000	0.0000	0.0000	2004/03/03

4.2 Apriori Coordinate Updates - Cartesian, per day

	dX(m)	dY(m)	dZ(m)	yyyy/mm/dd
APMP	0.008	0.009	0.009	2004/02/27
APMP	0.030	0.006	0.033	2004/02/28
APMP	0.030	0.012	0.029	2004/02/29
APMP	0.015	0.004	0.012	2004/03/01
APMP	0.020	0.002	0.023	2004/03/02
APMP	0.023	0.004	0.022	2004/03/03

4.3 Coordinate Precision - Cartesian, per day

1 Sigma	sX(m)	sY(m)	sZ(m)	yyyy/mm/dd
APMP	0.004	0.004	0.004	2004/02/27
APMP	0.003	0.003	0.003	2004/02/28
APMP	0.003	0.003	0.003	2004/02/29
APMP	0.003	0.003	0.003	2004/03/01
APMP	0.003	0.003	0.003	2004/03/02
APMP	0.003	0.003	0.003	2004/03/03

4.4 Coordinate Value - Cartesian, ITRF2000, per day

	X(m)	Y(m)	Z(m)	ITRF2000	@
APMP	4202783.521	171367.821	4778657.537	2004/02/27	
APMP	4202783.523	171367.809	4778657.545	2004/02/28	
APMP	4202783.528	171367.813	4778657.545	2004/02/29	
APMP	4202783.525	171367.812	4778657.543	2004/03/01	
APMP	4202783.527	171367.807	4778657.541	2004/03/02	
APMP	4202783.524	171367.810	4778657.536	2004/03/03	

4.5 Geodetic, GRS80 Ellipsoid, ITRF2000, per day

	Latitude(DMS)		Longitude(DMS)		Ellipsoidal Height(m)	
APMP	48 50	9.1056	2 20	5.7579	124.622	2004/02/27
APMP	48 50	9.1057	2 20	5.7573	124.629	2004/02/28
APMP	48 50	9.1056	2 20	5.7575	124.633	2004/02/29
APMP	48 50	9.1056	2 20	5.7574	124.629	2004/03/01
APMP	48 50	9.1056	2 20	5.7572	124.629	2004/03/02
APMP	48 50	9.1055	2 20	5.7573	124.623	2004/03/03

4.6 RMS, Observations, Deletions per day

Data	RMS (m)	# Observations	% Obs. Deleted	Date
hers	0.0073	8108	7 %	2004-02-27
brus	0.0076	8106	9 %	2004-02-27
np1d	0.0071	8290	6 %	2004-02-27
APMP	0.0073	24504	7 %	2004-02-27
hers	0.0066	14430	4 %	2004-02-28
brus	0.0066	14162	8 %	2004-02-28
np1d	0.0069	14850	3 %	2004-02-28
APMP	0.0067	43442	5 %	2004-02-28
hers	0.0062	13873	5 %	2004-02-29
brus	0.0065	14428	6 %	2004-02-29
np1d	0.0063	15102	2 %	2004-02-29
APMP	0.0063	43403	4 %	2004-02-29
hers	0.0062	14406	4 %	2004-03-01
brus	0.0064	15065	3 %	2004-03-01
np1d	0.0062	14465	6 %	2004-03-01
APMP	0.0063	43936	4 %	2004-03-01
brus	0.0066	16245	5 %	2004-03-02
np1d	0.0061	16592	2 %	2004-03-02
APMP	0.0064	49192	3 %	2004-03-02
hers	0.0062	16100	3 %	2004-03-03
brus	0.0065	16431	3 %	2004-03-03
APMP	0.0063	48931	3 %	2004-03-03

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°, 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