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AUSPOS Online GPS Processing Report

Space Geodesy Analysis Centre
Minerals and Geohazards Division, Geoscience Australia

June 28, 2004

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
TLTW1140.040	DEFAULT (NONE)	0.0000	2004-04-23 00:00:00	2004-04-23 23:59:59
TLTW1150.040	DEFAULT (NONE)	0.0000	2004-04-24 00:00:00	2004-04-24 23:59:59

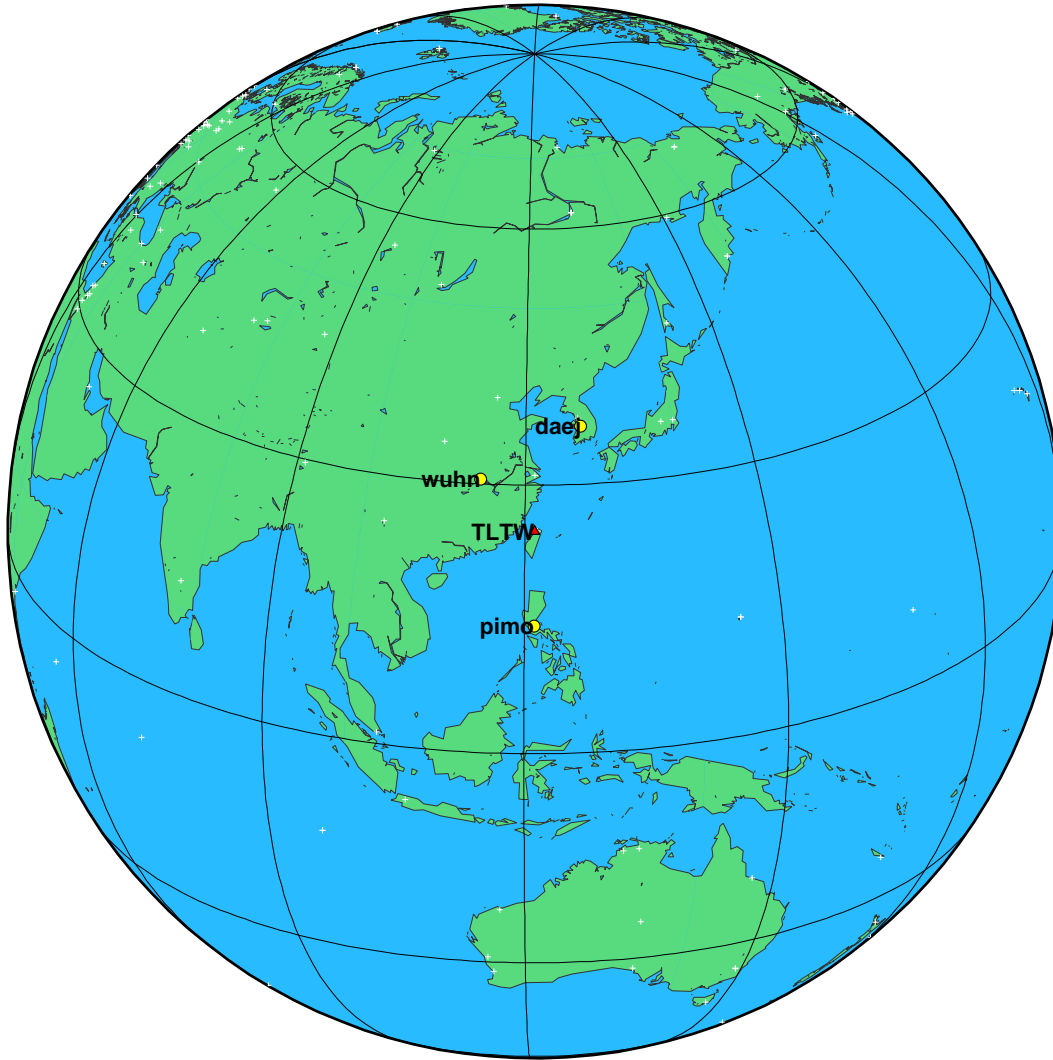


Figure 1: Global View – submitted GPS station(s) and nearby IGS GPS stations used in the processing; triangle(s) represent submitted user data; circle(s) represent the nearest available IGS stations.

2 Processing Summary

Date	IGS Data	User Data	Orbit Type
2004-04-23	wuhn pimo daej	TLTW	IGS Final
2004-04-24	wuhn pimo daej	TLTW	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 @	
wuhn	-2267749.410	5009154.323	3221290.696	2004/04/24	
daej	-3120041.959	4084614.889	3764026.906	2004/04/24	
pimo	-3186293.921	5286624.204	1601158.260	2004/04/24	
TLTW	-2994425.895	4951311.783	2674496.617	2004/04/24	
TLTW	0.010 m	0.017 m	0.018 m		RMS

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)
wuhn	30	31	53.9494	114	21	26.1426	25.879	40.305
daej	36	23	57.9433	127	22	28.1244	116.829	91.811
pimo	14	38	8.5901	121	4	39.8347	95.517	51.989
TLTW	24	57	12.8151	121	9	52.0875	202.329	183.269
TLTW			0.009 m			0.004 m	0.025 m	RMS

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
TLTW	0.0000	0.0000	0.0000	0.0000	2004/04/23
TLTW	0.0000	0.0000	0.0000	0.0000	2004/04/24

4.2 Apriori Coordinate Updates - Cartesian, per day

	dX(m)	dY(m)	dZ(m)	yyyy/mm/dd
TLTW	-0.032	-0.009	0.011	2004/04/23
TLTW	0.022	-0.001	0.000	2004/04/24

4.3 Coordinate Precision - Cartesian, per day

1 Sigma	sX(m)	sY(m)	sZ(m)	yyyy/mm/dd
TLTW	0.007	0.015	0.007	2004/04/23
TLTW	0.007	0.007	0.007	2004/04/24

4.4 Coordinate Value - Cartesian, ITRF2000, per day

	X(m)	Y(m)	Z(m)	ITRF2000 @
TLTW	-2994425.885	4951311.759	2674496.599	2004/04/23
TLTW	-2994425.905	4951311.788	2674496.634	2004/04/24

4.5 Geodetic, GRS80 Ellipsoid, ITRF2000, per day

	Latitude(DMS)			Longitude(DMS)			Ellipsoidal Height(m)	
TLTW	24	57	12.8149	121	9	52.0876	202.298	2004/04/23
TLTW	24	57	12.8154	121	9	52.0877	202.344	2004/04/24

4.6 RMS, Observations, Deletions per day

Data	RMS (m)	# Observations	% Obs. Deleted	Date
wuhn	0.0151	11828	16 %	2004-04-23
daej	0.0136	11007	12 %	2004-04-23
pimo	0.0151	9337	17 %	2004-04-23
TLTW	0.0146	32172	15 %	2004-04-23
wuhn	0.0149	19575	13 %	2004-04-24
daej	0.0132	17709	12 %	2004-04-24
pimo	0.0140	14687	27 %	2004-04-24
TLTW	0.0141	51971	17 %	2004-04-24

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