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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 Antennna Reference Point (ARP).

User File	Antenna Type	Antenna Height (m)	Start Time	End Time
NICT1420.04O	DEFAULT(NONE)	0.0000	2004-05-21 00:00:00	2004-05-21 23:59:59
NICT1430.04O	DEFAULT(NONE)	0.0000	2004-05-22 00:00:00	2004-05-22 23:59:59

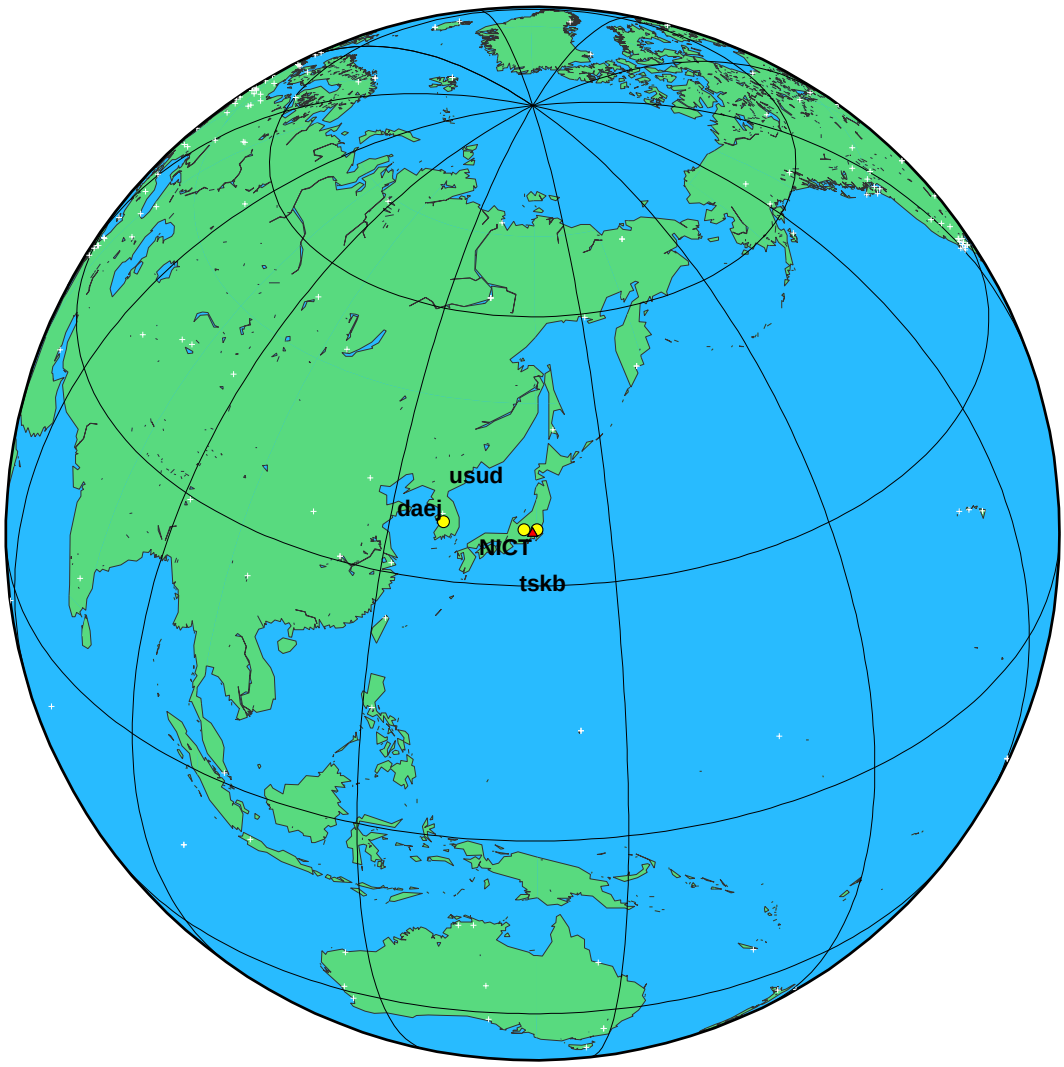

Figure 1: Global View – submitted GPS station(s) and nearby IGS GPS stations used in the processing; triangle(s) represent submitted user data; circle(s) represent the nearest available IGS stations.

2 Processing Summary

Date	IGS Data	User Data	Orbit Type
2004-05-21	tskb usud daej	NICT	IGS Final
2004-05-22	tskb usud daej	NICT	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 @	
usud	-3855263.022	3427432.544	3741020.314	2004/05/22	
tskb	-3957199.245	3310199.711	3737711.650	2004/05/22	
daej	-3120041.961	4084614.888	3764026.906	2004/05/22	
NICT	-3942161.308	3368285.880	3701886.725	2004/05/22	
NICT	0.001 m	0.001 m	0.002 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)	
usud	36 7 59.1978	138 21 43.3570	1508.616	1465.997	
tskb	36 6 20.4469	140 5 14.9875	67.248	28.298	
daej	36 23 57.9433	127 22 28.1245	116.830	91.812	
NICT	35 42 23.9392	139 29 18.7997	131.323	93.579	
NICT	0.001 m	0.000 m	0.002 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.

	Height(m)	Antenna Offsets(m)			
Station	Up	East	North	Up	yyyy/mm/dd
NICT	0.0000	0.0000	0.0000	0.0000	2004/05/21
NICT	0.0000	0.0000	0.0000	0.0000	2004/05/22

4.2 Apriori Coordinate Updates - Cartesian, per day

	dX(m)	dY(m)	dZ(m)	yyyy/mm/dd
NICT	-0.005	-0.001	0.004	2004/05/21
NICT	-0.014	0.011	0.012	2004/05/22

4.3 Coordinate Precision - Cartesian, per day

1 Sigma	sX(m)	sY(m)	sZ(m)	yyyy/mm/dd
NICT	0.004	0.004	0.004	2004/05/21
NICT	0.005	0.005	0.005	2004/05/22

4.4 Coordinate Value - Cartesian, ITRF2000, per day

	X(m)	Y(m)	Z(m)	ITRF2000 @
NICT	-3942161.308	3368285.880	3701886.723	2004/05/21
NICT	-3942161.309	3368285.881	3701886.727	2004/05/22

4.5 Geodetic, GRS80 Ellipsoid, ITRF2000, per day

	Latitude(DMS)	Longitude(DMS)	Ellipsoidal Height(m)	
NICT	35 42 23.9392	139 29 18.7997	131.321	2004/05/21
NICT	35 42 23.9393	139 29 18.7997	131.324	2004/05/22

4.6 RMS, Observations, Deletions per day

Data	RMS (m)	# Observations	% Obs. Deleted	Date
usud	0.0085	21105	1 %	2004-05-21
tskb	0.0082	22466	1 %	2004-05-21
daej	0.0087	17443	3 %	2004-05-21
NICT	0.0085	61014	1 %	2004-05-21
usud	0.0101	20746	4 %	2004-05-22
tskb	0.0081	22409	3 %	2004-05-22
daej	0.0090	18517	8 %	2004-05-22
NICT	0.0091	61672	5 %	2004-05-22

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