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## AUSPOS Online GPS Processing Report

National Geospatial Reference Systems  
Geospatial and Earth Monitoring Division, Geoscience Australia

February 27, 2009

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.

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An overview of the GPS processing strategy is attached to this report. Please direct email correspondence to [geodesy@ga.gov.au](mailto: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
BAS1C09.09o	DEFAULT(NONE)	0.0000	2009-01-22 17:58:00	2009-01-23 05:37:00
BAS2B09.09o	DEFAULT(NONE)	0.0000	2009-01-22 18:15:59	2009-01-23 08:37:00

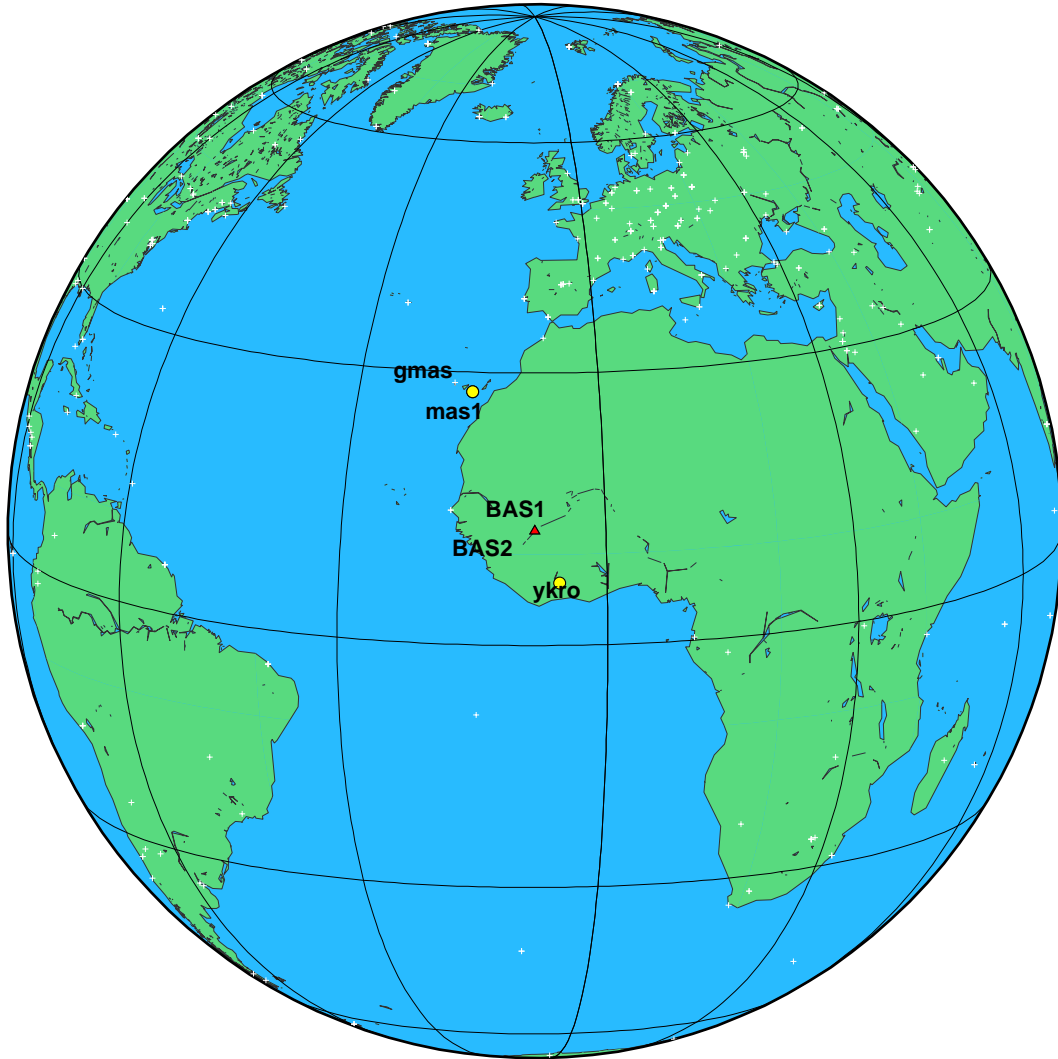


Figure 1: Global View – submitted GPS station(s) and nearby IGS GPS stations used in the processing; triangle(s) represent submitted user data; circle(s) represent the nearest available IGS stations.

## 2 Processing Summary

Date	IGS Data	User Data	Orbit Type
2009-01-22	ykro mas1 gmas	BAS1 BAS2	IGS Final
2009-01-23	ykro mas1 gmas	BAS1 BAS2	IGS Final

## 3 Computed Coordinates, ITRF2005

All computed coordinates are based on the IGS realisation of the ITRF2005 reference frame, provided by the IGS cumulative solution. All the given ITRF2005 coordinates refer to a mean epoch of the site observation data. All coordinates refer to the Ground Mark.

### 3.1 Cartesian, ITRF2005

	X(m)	Y(m)	Z(m)	ITRF2005 @	
gmas	5439112.551	-1522134.900	2953556.228	2009/01/23	
mas1	5439192.202	-1522055.410	2953454.912	2009/01/23	
ykro	6306439.981	-578380.784	757956.497	2009/01/23	
BAS1	6167515.359	-861600.619	1375642.694	2009/01/23	
BAS1	0.019 m	0.015 m	0.007 m		RMS
BAS2	6167516.713	-861666.974	1375589.783	2009/01/23	
BAS2	0.005 m	0.012 m	0.006 m		RMS

### 3.2 Geodetic, GRS80 Ellipsoid, ITRF2005

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](http://earth-info.nga.mil/GandG/wgsegm/egm96.html)

	Latitude(DMS)	Longitude(DMS)	Ellipsoidal Height(m)	Above-Geoid Height(m)	
gmas	27 45 53.2200	-15-38 -3.3694	195.426	153.610	
mas1	27 45 49.4710	-15-37 -59.7900	197.148	155.342	
ykro	6 52 14.0172	-5-14 -24.3345	270.268	241.651	
BAS1	12 32 16.6892	-7-57 -9.8631	401.008	370.351	
BAS1	0.004 m	0.017 m	0.018 m		RMS
BAS2	12 32 14.9342	-7-57 -12.0336	399.793	369.135	
BAS2	0.005 m	0.012 m	0.005 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)			yyyy/mm/dd
	Up	East	North	Up	
BAS1	0.0000	0.0000	0.0000	0.0000	2009/01/22
BAS2	0.0000	0.0000	0.0000	0.0000	2009/01/22
BAS1	0.0000	0.0000	0.0000	0.0000	2009/01/23
BAS2	0.0000	0.0000	0.0000	0.0000	2009/01/23

#### 4.2 Apriori Coordinate Updates - Cartesian, per day

	dX(m)	dY(m)	dZ(m)	yyyy/mm/dd
BAS1	0.010	0.010	0.005	2009/01/22
BAS1	0.047	-0.017	0.013	2009/01/23
BAS2	0.017	0.024	0.008	2009/01/22
BAS2	0.042	-0.015	0.012	2009/01/23

#### 4.3 Coordinate Precision - Cartesian, per day

1 Sigma	sX(m)	sY(m)	sZ(m)	yyyy/mm/dd
BAS1	0.007	0.007	0.002	2009/01/22
BAS1	0.016	0.005	0.003	2009/01/23
BAS2	0.010	0.007	0.002	2009/01/22
BAS2	0.013	0.005	0.003	2009/01/23

#### 4.4 Coordinate Value - Cartesian, ITRF2005, per day

	X(m)	Y(m)	Z(m)	ITRF2005 @
BAS1	6167515.353	-861600.638	1375642.688	2009/01/22
BAS1	6167515.385	-861600.609	1375642.701	2009/01/23
BAS2	6167516.709	-861666.988	1375589.778	2009/01/22
BAS2	6167516.719	-861666.966	1375589.789	2009/01/23

#### 4.5 Geodetic, GRS80 Ellipsoid, ITRF2005, per day

	Latitude(DMS)			Longitude(DMS)		Ellipsoidal Height(m)	
BAS1	12	32	16.6890	-7-57	-9.8638	401.003	2009/01/22
BAS1	12	32	16.6893	-7-57	-9.8627	401.033	2009/01/23
BAS2	12	32	14.9341	-7-57	-12.0341	399.790	2009/01/22
BAS2	12	32	14.9344	-7-57	-12.0333	399.799	2009/01/23

#### 4.6 RMS, Observations, Deletions per day

Data	RMS (m)	# Observations	% Obs. Deleted	Date
gmas	0.0047	31225	4 %	2009-01-22
mas1	0.0040	31599	3 %	2009-01-22
ykro	0.0056	18641	2 %	2009-01-22
BAS1	0.0053	8728	0 %	2009-01-22
BAS2	0.0052	5573	0 %	2009-01-22
gmas	0.0048	26078	4 %	2009-01-23
mas1	0.0044	29279	4 %	2009-01-23
ykro	0.0059	17538	4 %	2009-01-23
BAS1	0.0061	6032	2 %	2009-01-23
BAS2	0.0061	6907	2 %	2009-01-23

# A GPS Computation Standards

## A.1 Measurement Modelling

Observable	Ionosphere corrected L1 double difference carrier phase, Pseudo-range only used for receiver clock estimation, Elevation cut-off $15^\circ$ , 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	Jachhria 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 and Nutation	IERS 2003
Polar Motion	IGS Earth Orientation Parameters (Ultra-rapid, Rapid, Final) - apriori
Earth Rotation (UT1)	IGS Earth Orientation Parameters (Ultra-rapid, Rapid, Final) - apriori
Plate Motion	IGS Cumulative SSC (ITRF2005)
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 (ITRF2005)