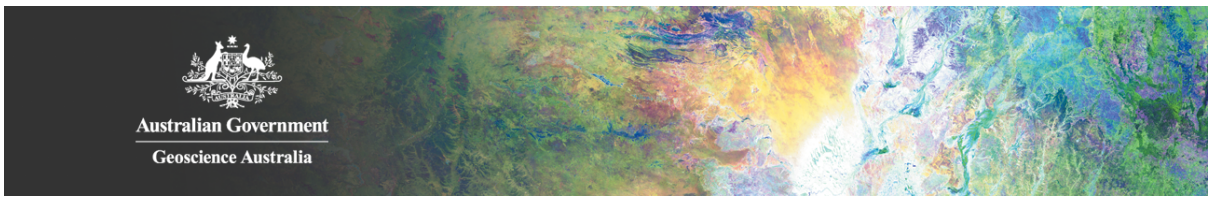

AUSPOS GPS Processing Report

August 17, 2012

This document is a report of the GPS data processing undertaken by the AUSPOS Online GPS Processing Service (version: AUSPOS 2.0) . The AUSPOS Online GPS Processing Service uses International GNSS Service (IGS) products (final, rapid, ultra-rapid depending on availability) to compute precise coordinates in ITRF anywhere on Earth and GDA94 within Australia. The Service is designed to process only dual frequency GPS phase data.

An overview of the GPS processing strategy is included in this report.

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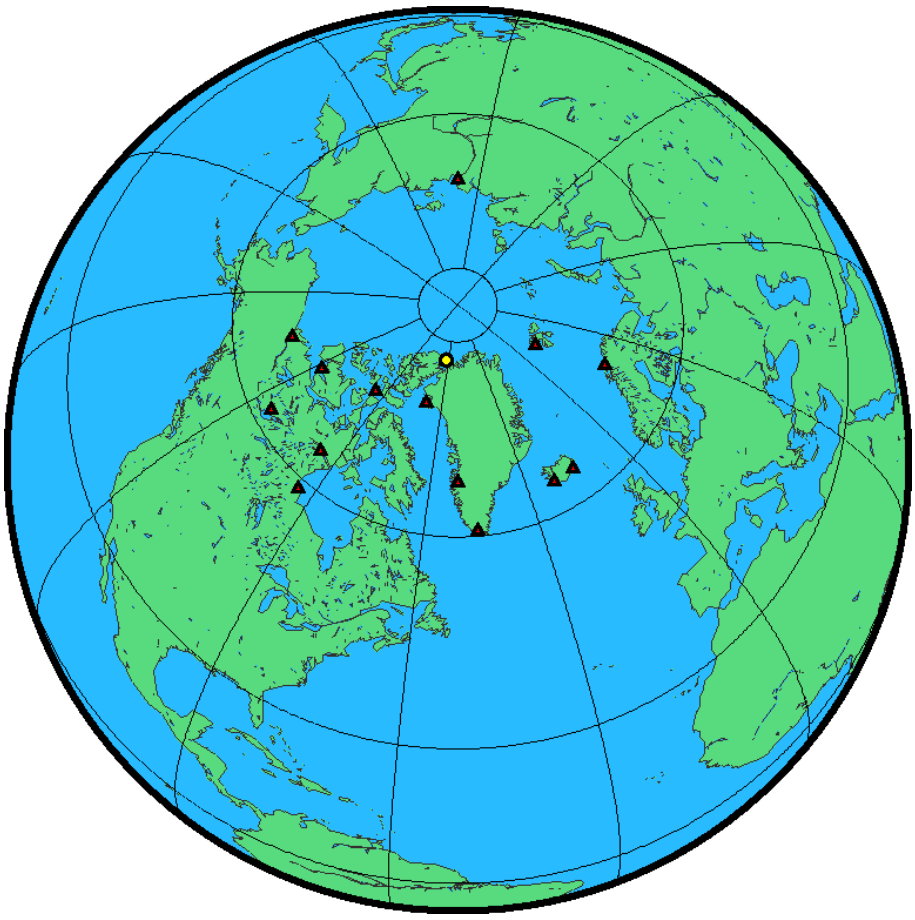
1 User Data

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

Station (s)	Submitted File	Antenna Type	Antenna Height (m)	Start Time	End Time
0439	ylt01450.04o	NONE NONE	0.000	2004/05/24 12:53:00	2004/05/24 16:06:00

2 Processing Summary



Date	User Stations	Reference Stations	Orbit Type
2004/05/24 12:53:00	0439	ALRT BAKE CHUR HOFN HOLM INVK KELY NYA1 QAQ1 RESO REYK THU3 TIXI TRO1 YELL	IGS final

3 Computed Coordinates, ITRF2008

All computed coordinates are based on the IGS realisation of the ITRF2008 reference frame. All the given ITRF2008 coordinates refer to a mean epoch of the site observation data. All coordinates refer to the Ground Mark.

3.1 Cartesian, ITRF2008

Station	X (m)	Y (m)	Z (m)	ITRF2008 @
0439	387260.796	-738540.261	6302237.086	24/05/2004
ALRT	388042.708	-740382.384	6302001.870	24/05/2004
BAKE	-289833.977	-2756501.050	5725162.239	24/05/2004
CHUR	-236438.847	-3307616.827	5430049.214	24/05/2004
HOFN	2679689.977	-727951.237	5722789.299	24/05/2004
HOLM	-983071.972	-1867623.644	5998639.553	24/05/2004
INVK	-1628432.100	-1714393.048	5903844.712	24/05/2004
KELY	1575559.122	-1941827.944	5848076.498	24/05/2004
NYA1	1202433.853	252632.281	6237772.578	24/05/2004
QAQ1	2170942.110	-2251829.958	5539988.337	24/05/2004
RESO	-144107.577	-1683119.782	6129763.274	24/05/2004
REYK	2587384.312	-1043033.521	5716564.022	24/05/2004
THU3	538093.559	-1389088.041	6180979.231	24/05/2004
TIXI	-1264873.175	1569455.782	6031003.427	24/05/2004
TRO1	2102928.482	721619.451	5958196.244	24/05/2004
YELL	-1224452.647	-2689216.129	5633638.274	24/05/2004

3.2 Geodetic, GRS80 Ellipsoid, ITRF2008

Geoid-ellipsoidal separations, in this section, are computed using a spherical harmonic synthesis of the global EGM2008 geoid. More information on the EGM2008 geoid can be found at http://earth-info.nga.mil/GandG/wgs84/gravitymod/egm2008/

Station	Latitude (DMS)	Longitude (DMS)	Ellipsoidal Height(m)	Derived Above Geoid Height(m)
0439	82 30 44.19475	-62 19 45.44966	51.097	32.213
ALRT	82 29 39.45785	-62 20 25.66492	78.122	59.226
BAKE	64 19 04.15243	-96 00 08.44036	4.424	46.351
CHUR	58 45 32.68021	-94 05 19.41941	-19.372	28.793
HOFN	64 16 02.25096	-15 11 52.51516	82.698	17.369
HOLM	70 44 10.69547	-117 45 40.44603	0.418	16.751
INVK	68 18 22.26825	-133 31 37.05683	46.365	49.524
KELY	66 59 14.70595	-50 56 41.41691	229.834	198.502
NYA1	78 55 46.39691	11 51 55.11224	84.226	48.632
QAQ1	60 42 54.94833	-46 02 51.94575	110.412	73.165
RESO	74 41 26.95378	-94 53 37.28812	19.946	27.984
REYK	64 08 19.62271	-21 57 19.74861	93.022	26.551
THU3	76 32 13.37118	-68 49 30.13053	36.107	19.758
TIXI	71 38 04.10516	128 51 59.11225	47.056	53.910
TRO1	69 39 45.78519	18 56 22.72712	138.075	106.629
YELL	62 28 51.21828	-114 28 50.52477	180.891	207.606

4 Solution Information

4.1 Coordinate Precision - Geodetic, One Sigma

Station	σ East (m)	σ North (m)	σ Up (m)
0439	0.001	0.001	0.006
ALRT	0.000	0.000	0.002
BAKE	0.000	0.001	0.001
CHUR	0.000	0.001	0.001
HOFN	0.000	0.001	0.001
HOLM	0.000	0.001	0.001
INVK	0.000	0.001	0.001
KELY	0.000	0.001	0.002
NYA1	0.000	0.000	0.002
QAQ1	0.000	0.001	0.001
RESO	0.000	0.000	0.001
REYK	0.000	0.001	0.001
THU3	0.000	0.000	0.002
TIXI	0.000	0.001	0.002
TRO1	0.000	0.001	0.001
YELL	0.000	0.001	0.001

4.2 Ambiguity Resolution - per baseline

Baseline	Ambiguities Resolved	Baseline Length (km)
HOFN - REYK	84.0 %	328.4
KELY - QAQ1	64.8 %	738.6
HOLM - INVK	89.7 %	670.0
HOFN - QAQ1	89.1 %	1616.9
0439 - THU3	86.7 %	678.7
NYA1 - TRO1	82.7 %	1053.1
BAKE - CHUR	88.9 %	627.4
ALRT - NYA1	89.6 %	1285.9
ALRT - TIXI	89.4 %	2853.2
HOFN - TRO1	86.3 %	1577.8
ALRT - THU3	95.5 %	676.7
BAKE - YELL	87.7 %	941.5
HOLM - YELL	89.3 %	930.9
HOLM - RESO	91.5 %	869.0
RESO - THU3	93.2 %	744.6
AVERAGE	87.0%	1039.5

Please note for a regional solution, such as used by AUSPOS, an average ambiguity resolution of 50% or better for the network indicates a reliable solution.

5 Computation Standards

5.1 Computation System

Software	Bernese GPS Software Version 5.0.
GNSS system(s)	GPS only.

5.2 Data Preprocessing and Measurement Modelling

Data preprocessing	Phase preprocessing is undertaken in a baseline by baseline mode using triple-differences. In most cases, cycle slips are fixed by the simultaneous analysis of different linear combinations of L1 and L2. If a cycle slip cannot be fixed reliably, bad data points are removed or new ambiguities are set up A data screening step on the basis of weighted postfit residuals is also performed, and outliers are removed.
Basic observable	Carrier phase with an elevation angle cutoff of 10° and a sampling rate of 3 minutes. However, data cleaning is performed a sampling rate of 30 seconds. Elevation dependent weighting is applied according to $1/\sin(e)^2$ where e is the satellite elevation. The code observable is only used for the receiver clock synchronisation.
Modelled observable	Double differences of the ionosphere-free linear combination.
Ground antenna phase centre calibrations	IGS08 absolute phase-centre variation model is applied.
Tropospheric Model	A priori model is the Saastamoinen-based hydrostatic mapped with the dry-Niell.
Tropospheric Estimation	Zenith delay corrections are estimated relying on the wet-Niell mapping function in intervals of 2 hour. N-S and E-W horizontal delay parameters are solved for every 24 hours.
Tropospheric Mapping Function	Niell
Ionosphere	First-order effect eliminated by forming the ionosphere-free linear combination of L1 and L2.
Tidal displacements	Solid earth tidal displacements are derived from the complete model from the IERS Conventions 2003, but ocean tide loading is not applied.
Atmospheric loading	Not applied
Satellite centre of mass correction	IGS08 phase-centre variation model applied
Satellite phase centre calibration	IGS08 phase-centre variation model applied
Satellite trajectories	Best available IGS products.
Earth Orientation	Best available IGS products.

5.3 Estimation Process

Adjustment	Weighted least-squares algorithm.
Station coordinates	Coordinate constraints are applied at the Reference sites with standard deviation of 1mm and 2mm for horizontal and vertical components respectively.
Troposphere	Zenith delay parameters and pairs of horizontal delay gradient parameters are estimated for each station in intervals of 2 hour and 24 hours.
Ionospheric correction	An ionospheric map derived from the contributing reference stations is used to aid ambiguity resolution using the QIF strategy
Ambiguity	Ambiguities are resolved in a baseline-by-baseline mode using Quasi-Ionosphere-Free (QIF) approach.

5.4 Reference Frame

Terrestrial reference frame	IGS08 station coordinates and velocities mapped to the mean epoch of observation.
Australian datum	GDA94 coordinates determined via Helmert transformation from ITRF using the Dawson and Woods (2010) parameters.
Derived AHD	For stations within Australia, AUSGeoid09 is used to compute AHD. AUSGeoid09 is the Australia-wide gravimetric quasigeoid model that has been a posteriori fitted to the Australian Height Datum
Above-geoid heights	Earth Gravitational Model EGM2008 released by the National Geospatial-Intelligence Agency (NGA) EGM Development Team is used to compute above-geoid heights. This gravitational model is complete to spherical harmonic degree and order 2159, and contains additional coefficients extending to degree 2190 and order 2159.