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AUSPOS Online GPS Processing Report

Space Geodesy Analysis Centre
Geohazards Division, Geoscience Australia

September 4, 2005

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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Job number: #164397; User: `ttaka@yk.rim.or.jp` AUSPOS version 1.01.24

1 User and IGS GPS Data

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

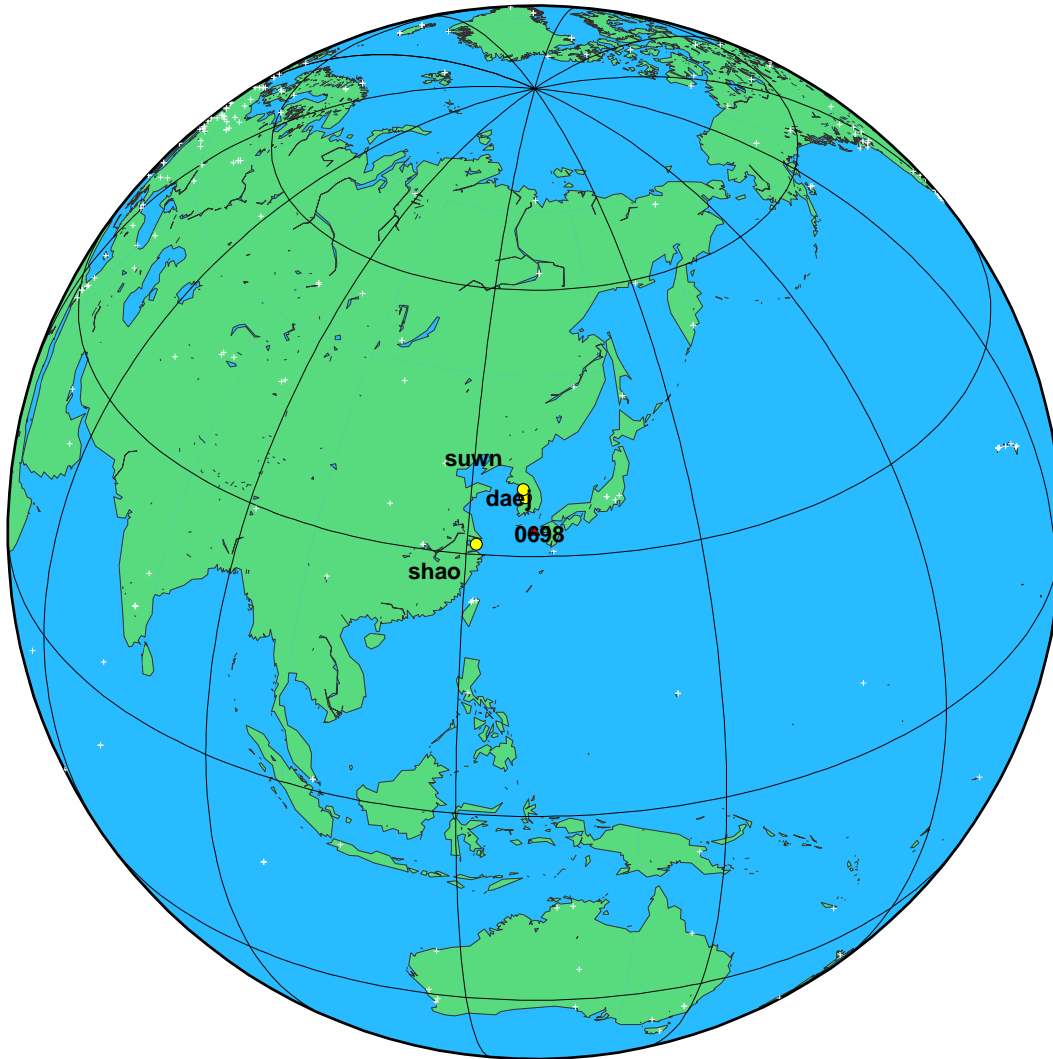| User File	Antenna Type	Antenna Height (m)	Start Time	End Time
06982770.04o	AOAD/M_T	0.0000	2004-10-03 00:00:00	2004-10-03 23:59:59

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
2004-10-03	daej suwn shao	0698	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 @
shao     -2831733.500     4675665.959     3275369.417 2004/10/03
suwn     -3062022.860     4055448.021     3841818.256 2004/10/03
daej     -3120041.973     4084614.886     3764026.903 2004/10/03
0698     -3355701.783     4200702.963     3419893.740 2004/10/03
```

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

```
                                       Ellipsoidal  Above-Geoid
          Latitude(DMS)   Longitude(DMS)  Height(m)    Height(m)
shao   31  5  58.7127  121 12   1.5990     22.058       11.905
suwn   37 16  31.8524  127  3  15.2667     82.260       59.049
daej   36 23  57.9431  127 22  28.1250    116.832       91.814
0698   32 38   3.3898  128 37   9.6991     39.502        9.214
```

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
0698      0.0000      0.0000    0.0000   0.1100  2004/10/03
```

4.2   Apriori Coordinate Updates - Cartesian, per day

```
              dX(m)           dY(m)           dZ(m) yyyy/mm/dd
0698          0.015          -0.006          -0.007 2004/10/03
```

4.3   Coordinate Precision - Cartesian, per day

```
1 Sigma       sX(m)           sY(m)           sZ(m) yyyy/mm/dd
0698          0.003           0.003           0.003 2004/10/03
```

4.4 RMS, Observations, Deletions per day

Data	RMS (m)	# Observations	% Obs. Deleted	Date
shao	0.0071	11548	26 %	2004-10-03
suwn	0.0064	13303	25 %	2004-10-03
daej	0.0064	13756	25 %	2004-10-03
0698	0.0066	38607	25 %	2004-10-03

shao	0.0071	11548	26 %	2004-10-03
suwn	0.0064	13303	25 %	2004-10-03
daej	0.0064	13756	25 %	2004-10-03
0698	0.0066	38607	25 %	2004-10-03

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