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Ascension ITRF co-location site survey



July 2015

DIFFUSION OUVERTE

RT/G 219
N° archive 28 564
Date de création 17/06/2016
N° de version 1

Mots-clé

Local survey ; ITRF ; DORIS ; GNSS ; REGINA ; Ascension; British Overseas Territory ; United Kingdom

Résumé

La réalisation ITRF2014 (dernière en date) de l'International Terrestrial Reference System calculée par le Laboratoire de Recherche en Géodésie (LAREG) de l'IGN est le résultat de la combinaison des référentiels terrestres issus des quatre techniques de géodésie spatiale (c'est à dire DORIS, GNSS, SLR et VLBI). Pour réaliser un repère unique, un moyen consiste à ajouter dans la combinaison les résultats de rattachements sur des sites co-localisés. La station de poursuite de l'ESA sur l'île de l'Ascension (Royaume-Uni) dispose d'une station DORIS et d'une station GNSS permanente, intégrée dans le réseau de l'IGS. Le présent rapport décrit le rattachement de précision réalisé sur ce site en juillet 2015 suite à l'installation d'une station GNSS REGINA.

The ITRF2014 (latest) realization of the International Terrestrial Reference System computed by the Laboratoire de Recherche en Géodésie (LAREG) at IGN is the result of the combination of reference frame from four space geodesy techniques (i.e. DORIS, GNSS, SLR and VLBI). One way to realize one common frame consists in adding results in the combination from local ties at co-location sites. A DORIS station and a permanent GNSS station, included in IGS network, are installed at the ESA tracking station at Ascension Island (United Kingdom). This report describes the local tie survey carried out in July 2015, following the installation of the GNSS station.

Matériel

Système d'exploitation	Logiciel
Windows 7 Professionnel	LibreOffice Writer 4.3.7.2

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1. Introduction

1.1. Context

The International Terrestrial Reference Frame (ITRF) is the result of a combination of different terrestrial reference frames provided by the four space geodetic techniques:

- Very Long Baseline Interferometry (VLBI)
- Satellite Laser Ranging (SLR)
- Global Navigation Satellite System (GNSS)
- Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS)

To perform this combination between independent reference frames, it is necessary to have some co-location sites where the various techniques are operating, from which tie vectors between their reference points have been surveyed in three dimensions.

According to GGOS objectives, a millimeter accuracy is required for the local ties.

In charge of the REGINA network deployment and the DORIS network maintenance, IGN carries out local tie surveys as far as a REGINA or DORIS station is co-located, with the following purposes:

- assign coordinates to new instruments reference points;
- provide tie vectors between instruments reference points (i.e. DORIS, GNSS, SLR, VLBI, tide gauge);

This document presents the local tie survey performed at Ascension Island (British Overseas Territories), which took place in July 2015 within the framework of the REGINA station installation.

1.2. Glossary

ARP : Antenna Reference Point
CNES : Centre National d'Études Spatiales (France)
DOMES : Directory of MERIT Sites
DORIS : Détermination d'Orbite et Radio positionnement Intégré par Satellite
ESA : European Space Agency
GGOS : Global Geodetic Observing System
GNSS : Global Navigation Satellite System
IDS : International DORIS Service
IERS : International Earth Rotation and Reference Systems Service
IGN : Institut National de l'Information Géographique et Forestière (France)
IGS : International GNSS Service
REGINA : REseau Gnss pour l'IGS et la NAvigation
SINEX : Solution INdependent Exchange
VLBI : Very Long Baseline Interferometry

Acknowledgements

On behalf of CNES and IGN, we would like to acknowledge Caroline Yon, manager of the ESA tracking station and her deputy, Nicholas John, for the welcome they have provided us, and the effective assistance to ensure the success of the mission. Thank you to them for their logistical support, efficiency, availability and good mood.



Thomas Donal (IGN), Nicholas John (ESA), Caroline Yon (ESA), Jean-Paul Cardaliaguet (CNES).

2. Co-location site description

2.1. Site description

The Ascension Island, British Overseas Territories, is located in the middle of Atlantic Ocean, close to the Earth's equator.



The site is located in the north-east part of the island, at the spacecraft tracking station managed by ESA. The tracking station is the subject of an agreement between ESA and the British government for the Ariane, Vega and Soyuz tracking activities.

▪Address of the site

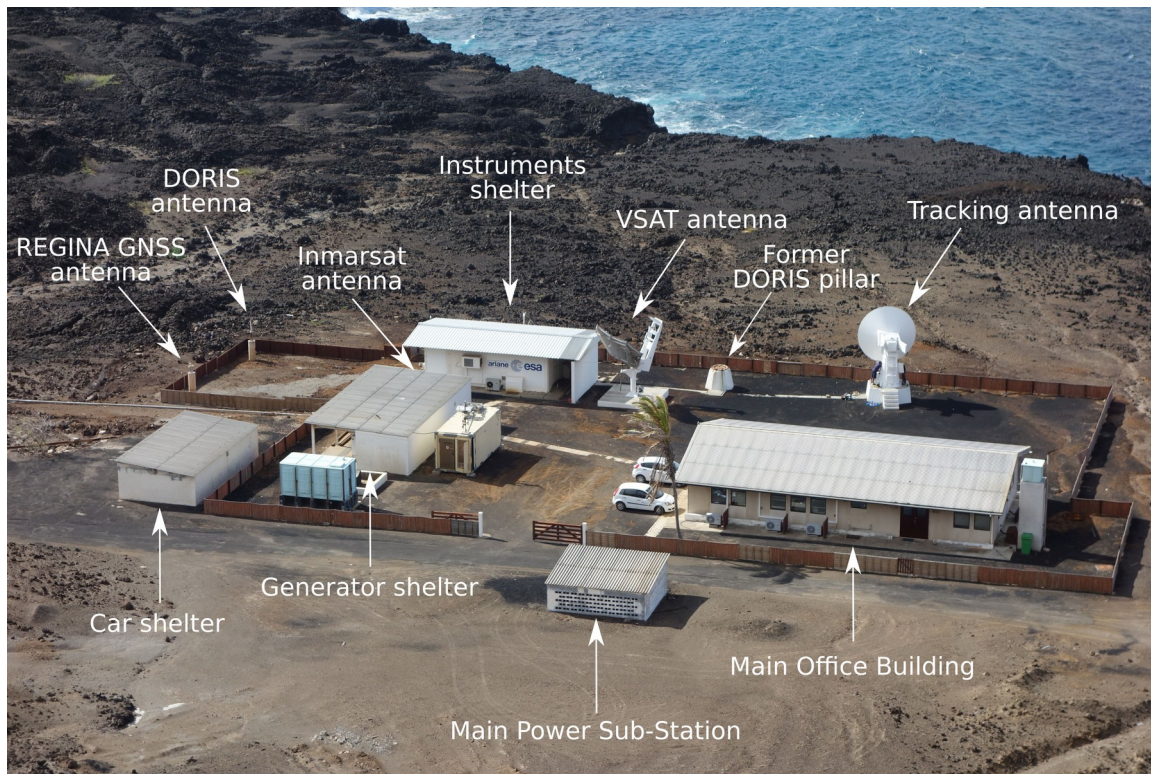


ESA Telemetry Tracking Station
Ascension Island
British Overseas Territory

▪Closer view

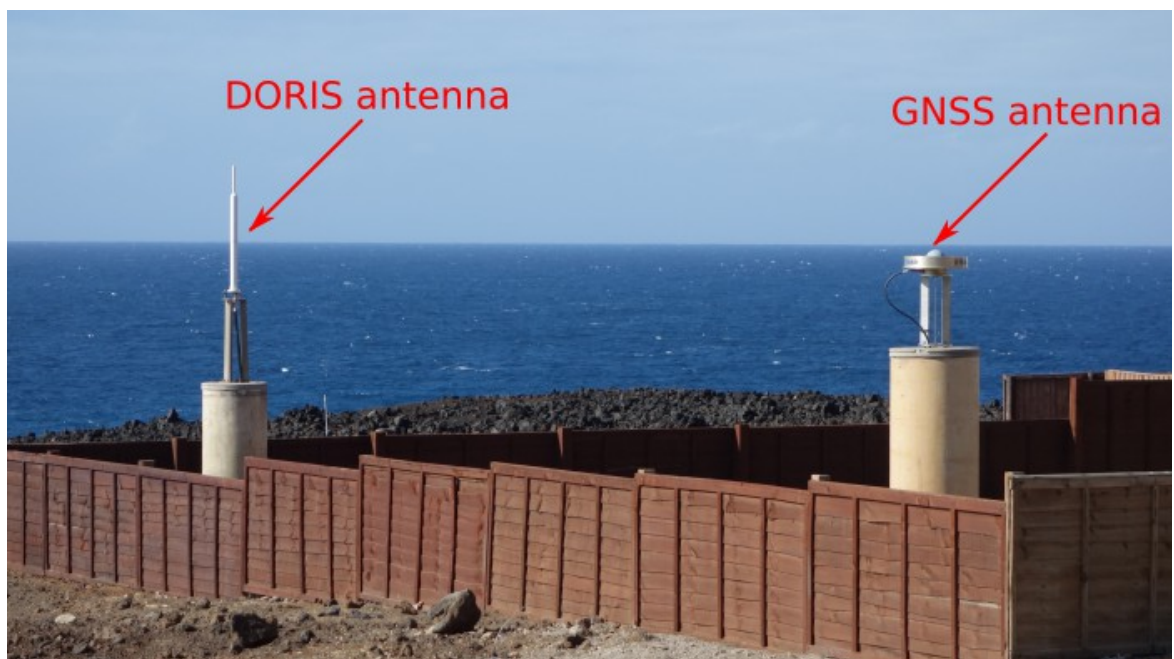


The tracking station and its environment



The tracking station and its equipments

The ESA Tracking Station hosts a DORIS and GNSS stations.



azimuth 70°

The topometric local tie survey was performed between REGINA GNSS antenna, DORIS antenna and former DORIS pillar.

In addition, GNSS observations have been carried out to tie the tide gauge located at English Bay.

2.2. Co-located points

2.2.1. GNSS station – ASCG

A permanent GNSS station named ASCG has been installed during the campaign. This station is dedicated to the GNSS real time Network for IGS and Navigation (REGINA) project. The antenna is a Trimble TRM 59800.00 type without radome. This antenna is mounted on top of a 40cm high stainless steel rigid structure. The reference point is defined as the top and centre of a brass mark embedded on top of the concrete pillar, vertically down from the antenna BPA (Bottom of the Pre-Amp).

Acronym : ASCG	DOMES number : 30602M004
 General view	 Close-up view (reference point)
Description : antenna monument and reference point. Antenna height is 0,408 m. See sitelog in appendix 6.2.	



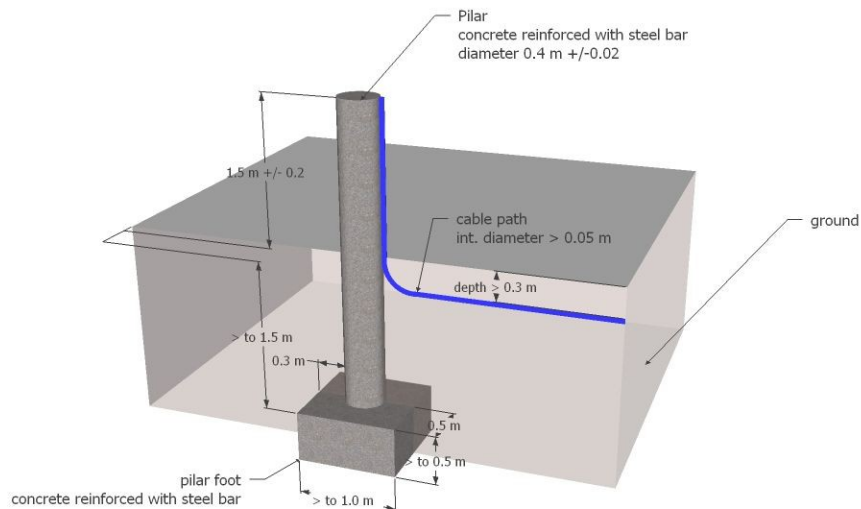
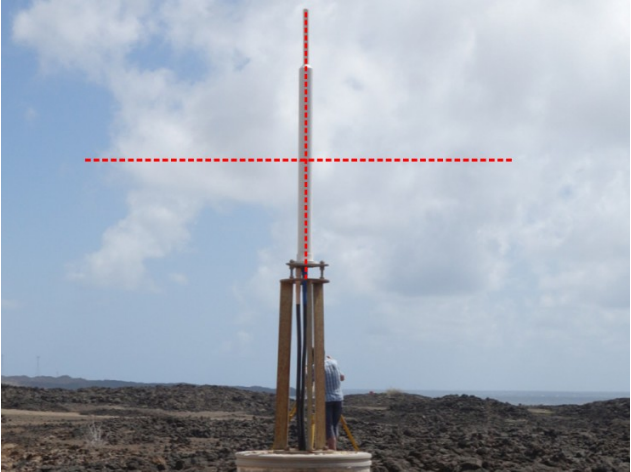


Diagram of the concrete reinforced pillar, GNSS monument.

2.2.2. DORIS station -ASEB

After a renovation on June 2010, the current antenna with the acronym « ASEB » is installed on top of a 40cm high stainless steel rigid structure. A domed brass marker is embedded into the concrete pillar vertically down the antenna. The antenna reference point is defined as the point located 0,390m above the antenna mounting surface. This point is roughly indicated with a red painting ring in the middle of the lower tube.

Acronym : ASEB	DOMES number : 30602S005
	
General view	Close-up view (reference point)
Description : DORIS antenna and reference point. See sitelog in appendix 6.1.	

Name: current DORIS marker	DOMES number : 30602M003
	
General view	Close-up view
Description : domed brass marker embedded on top of the concrete pillar in the vertical alignment with the DORIS antenna.	

For further details, refer to the IDS website : www.ids-doris.org.

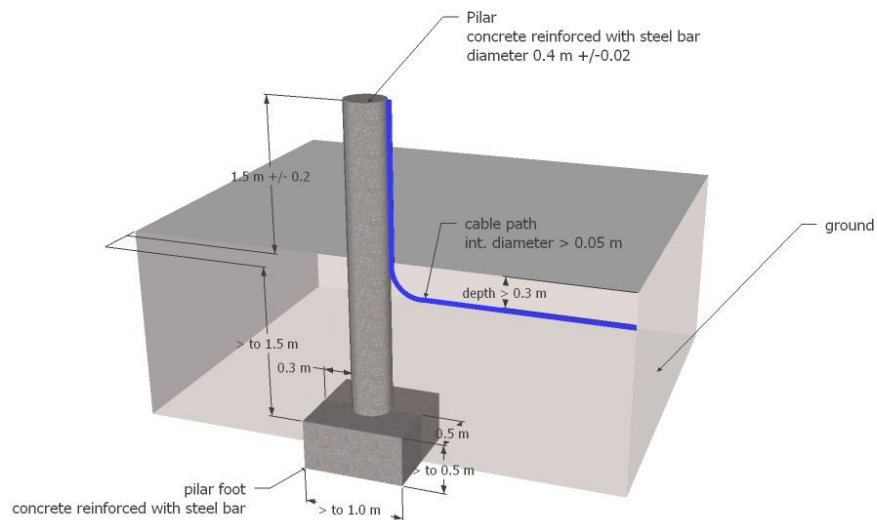


Diagram of the concrete reinforced pillar, DORIS monument.

2.2.3. Former DORIS station – ASDB

The DORIS station was initially set up in February 1997 on a concrete pillar, former STELLA antenna support. A domed brass marker is embedded into the concrete pillar

Name: DORIS marker	DOMES number : 30602M002
	
General view	Close-up view
Description : domed brass marker embedded on top of the former STELLA concrete block.	

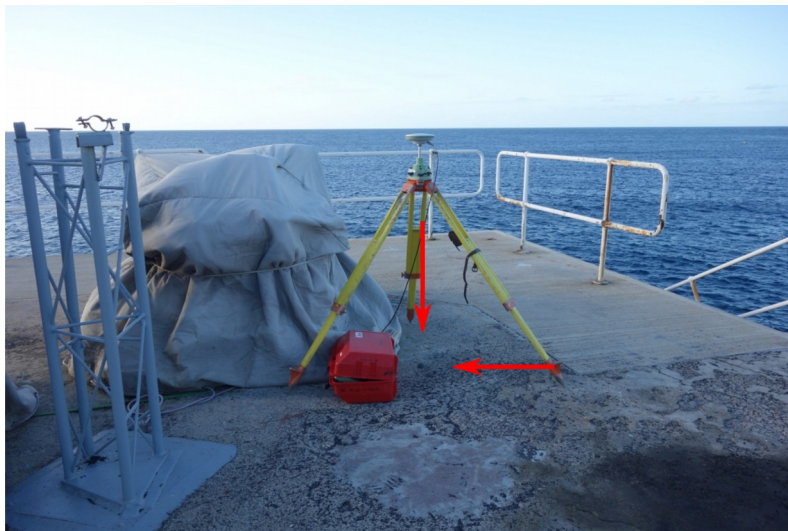
2.2.4. Tide gauge

6,5 km away from the tracking station, at English Bay in the North part of the island, is installed a permanent tide gauge, part of the ACCLAIM program (Antarctic Circumpolar Current Levels by Altimetry and Island Measurements), and contributing to the GLOSS network (Global Sea Level Observing System).



Tide gauge at English Bay, GLOSS ID:263

A benchmark from the Proudman Oceanographic Laboratory (POL18) close to the tide gauge has been tied to the GNSS station ASCG by GNSS baseline process.



Benchmark POL18

An unknown permanent GNSS station seems to be co-located with the tide gauge.

For more details, refer to SONEL, PSMSL and GLOSS websites :

- <http://www.psmsl.org/data/obtaining/stations/1831.php>
- <http://www.sonel.org/spip.php?page=maregraphe&idStation=1971>
- http://www.gloss-sealevel.org/station_handbook/stations/263/#.V2J5_EbSR6l

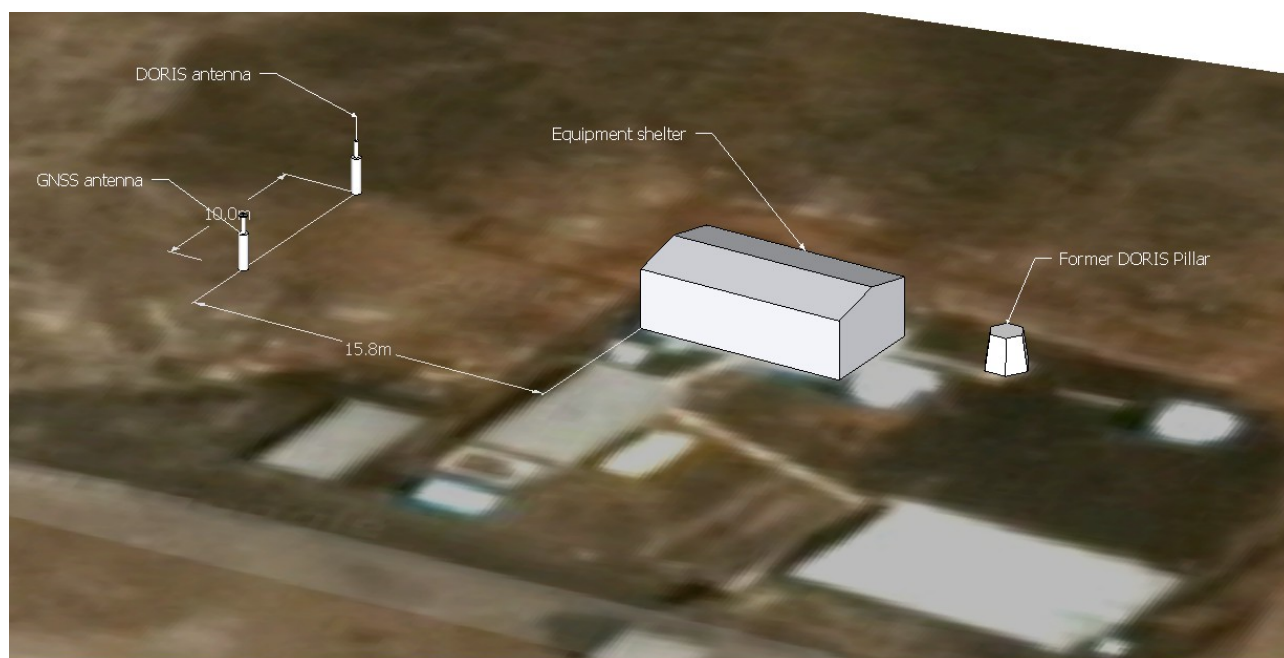
2.3. Global views

2.3.1. Tracking station site sketches



Co-located points

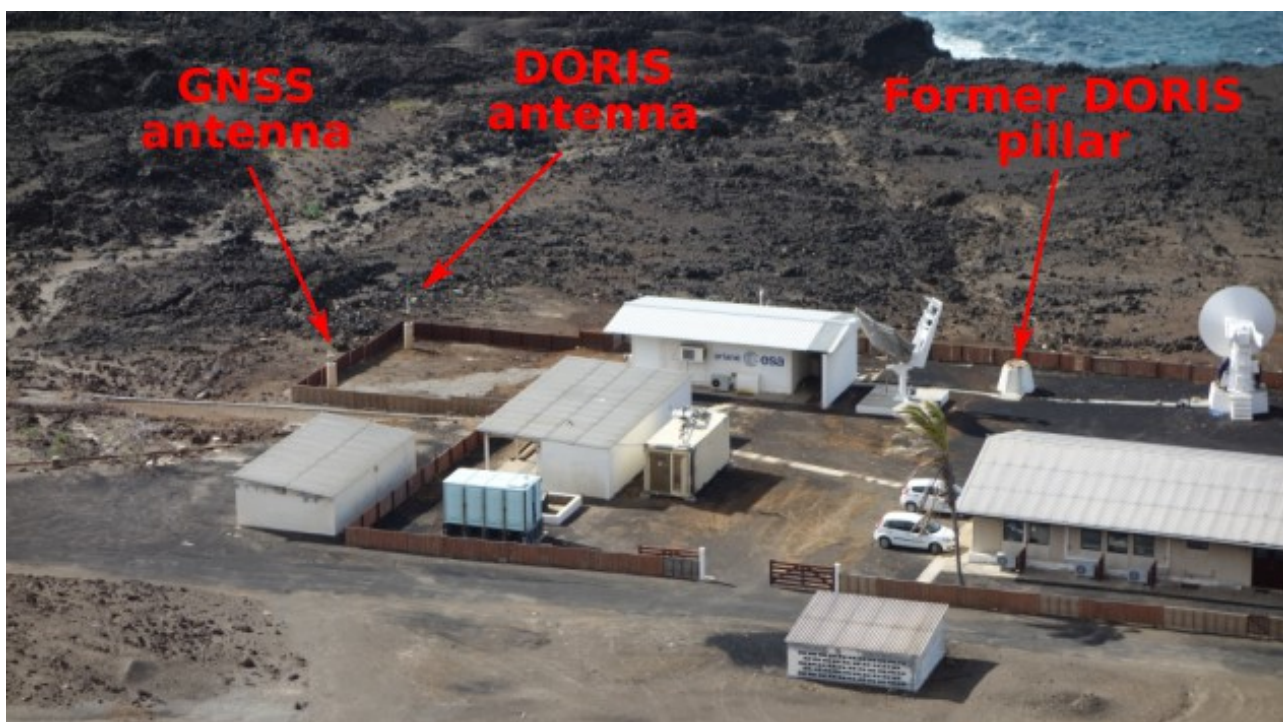
Top view.



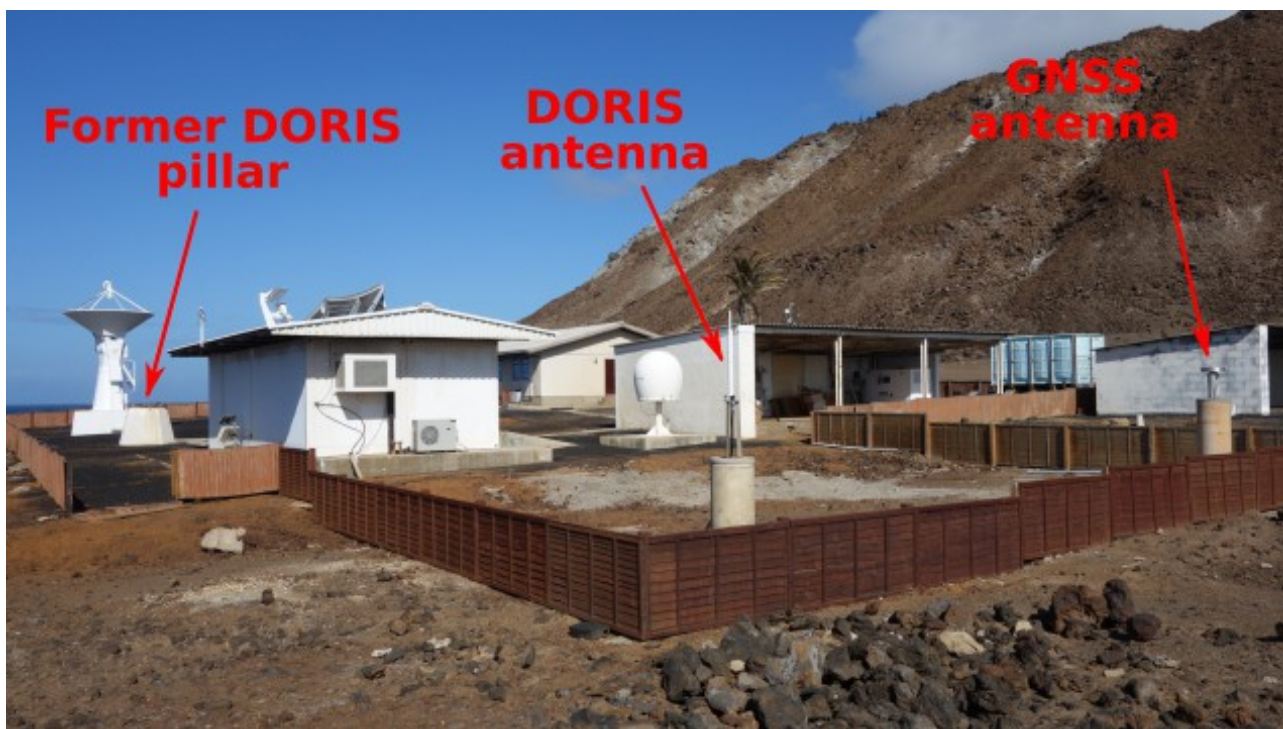
Co-located points.

Illustration azimuth : 330°

2.3.2. Tracking station site pictures



Azimut 340°



Azimut 120°

2.3.3. Co-located sites



3. Site survey description

3.1. Organization

The site survey took place during the REGINA station installation from July 20th to July 28th, 2015 and was conducted by Thomas Donal (IGN) with the help of Jean-Paul Cardaliaguet (CNES).

The topometric surveying operations was carried out on July 23th, 2015.

3.2. Equipment

All the surveying instruments used for this project belong to IGN, except GNSS REGINA instrumentations which belong to CNES.

3.2.1. GNSS REGINA permanent station

Type	Model	Quantity
GNSS antenna	Trimble Choke Ring TRM 59800.00	1
GNSS receiver	Trimble NetR9	1

3.2.2. Surveying instruments

The Leica total station used for the site survey, is yearly calibrated at IGN's calibration unit. It has a standard deviation of 0.15 mgon for angles and 1mm + 1 ppm for distances.

Type	Model	Quantity
GNSS receiver	Leica GX1230GG	2
GNSS antenna	Leica AX1202GG	2
Total station	Leica TCA2003	1

3.2.3. Surveying accessories

Two Leica accurate reflectors calibrated with the total station were used to determine distances.

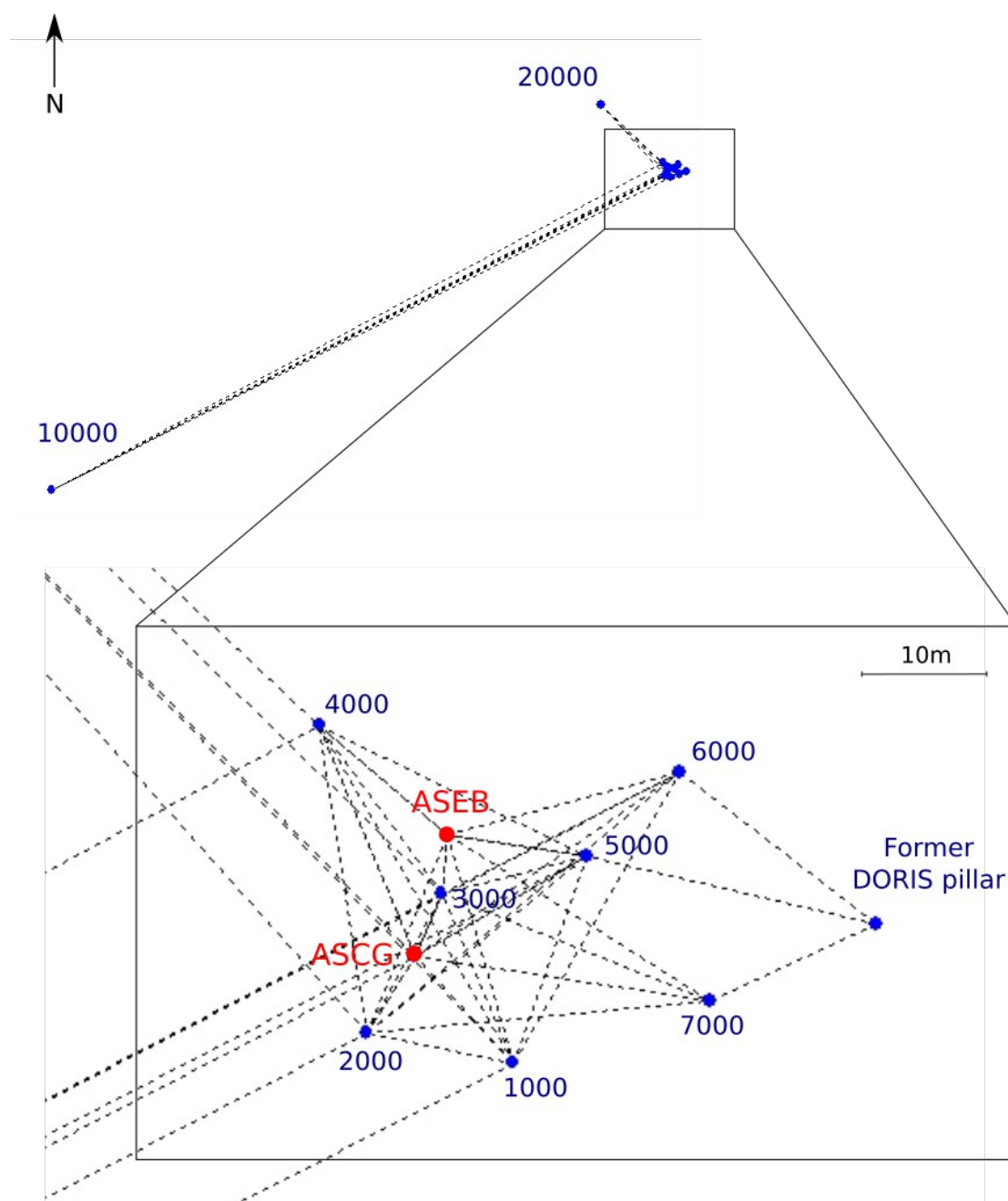
Type	Model	Quantity
Reflector	Leica GPH1P	2
Mini reflector	Leica GMP101	1
Carrier with optical plummet	Leica GZR3	1
Carrier with laser plummet	Leica SNLL121	1
Tripod	Leica wooden tripod	5
Meteo station	Kestrel 4500	1
Reflector pole	Leica GLS14	1



Surveying operations

3.3. Polygon network

All surveying operations have been carried out in such a way to provide the highest accuracy for the 3D vectors determination between the observing reference points.



General polygon network

Observations were done by total station from seven temporary stations : 1000, 2000, 3000, 4000, 5000, 6000 and 7000.

3.4. Surveying method

All the lines of sight have been observed with the total station. Horizontal directions and zenith angles were observed in data sets, each set consisting in one reading in both direct and reverse theodolite positions. Distance measurements were observed at least twice over each line. Meteorological data (atmospheric pressure and temperature) used to correct distances measurements, were recorded during the operation.

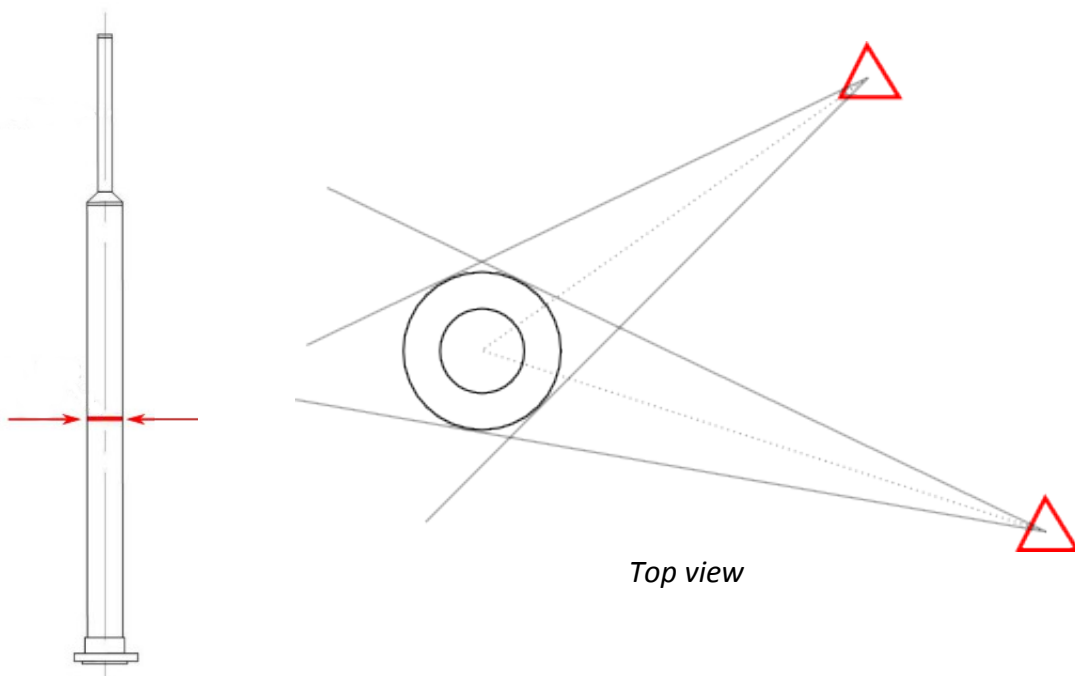
The set up strategy mixed GNSS and conventional observations. The GNSS observations were used to get the polygon bearing.

3.4.1. Permanent stations reference point

ASEB reference point :

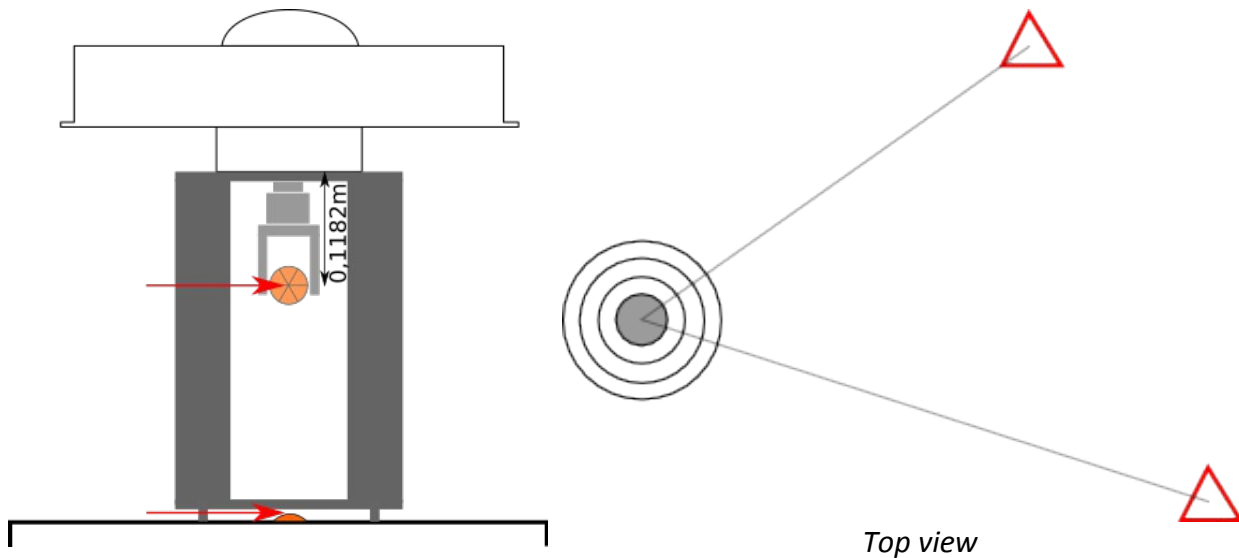
The reference point of DORIS antenna has been determined indirectly.

From each surveying station aiming at the antenna, right and left tangents to the DORIS antenna close to the ARP (red circle) were observed. In the adjustment, horizontal and zenithal angle observations were simply averaged to get its planimetric and altimetric positions.



ASCG reference point :

From each surveying station aiming at the antenna, the reference point was directly observed through a prism set up in the vertical alignment of the ARP. Vertical offset from prism to ARP is accurately known (see below).



3.4.2. GNSS observations

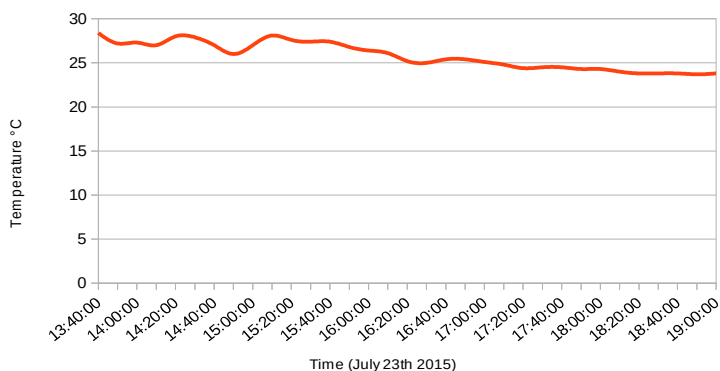
GNSS observations have been carried out in order to determine the orientation of the survey network. Orientations are known from the baselines between ASCG and stations 10000 and 20000. These two stations were temporary setup as far away as possible from the site (1300m for station 10000).

In addition, GNSS observations have been carried out to tie the permanent GNSS station ASCG to benchmark POL18 close to the tide gauge.

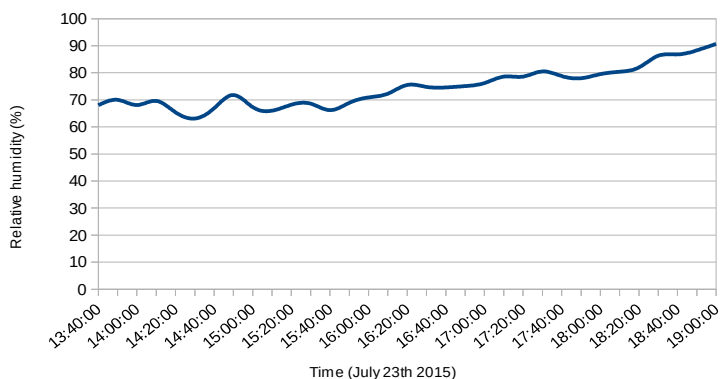
3.5. Weather data

Ascension Island has an oceanic climate. The site is very close from the seaboard and exposed to sea spray.

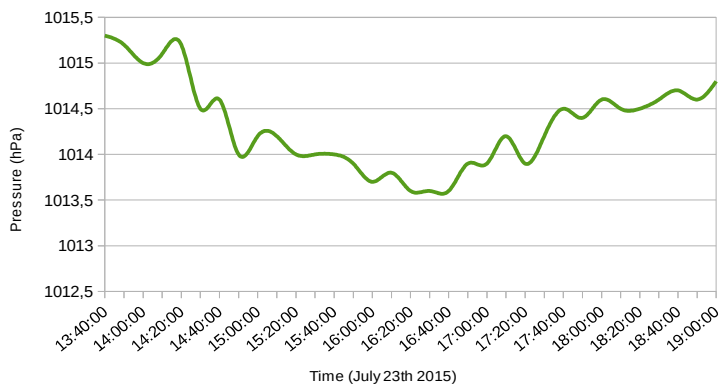
Next graphics show weather conditions on site during the topometric survey measurements, i.e. July 23th 2015, from 2 pm to 7 pm.



Data record by weather tracker Kesterl 4500.



Data record by weather tracker Kesterl 4500.



Data record by weather tracker Kesterl 4500.

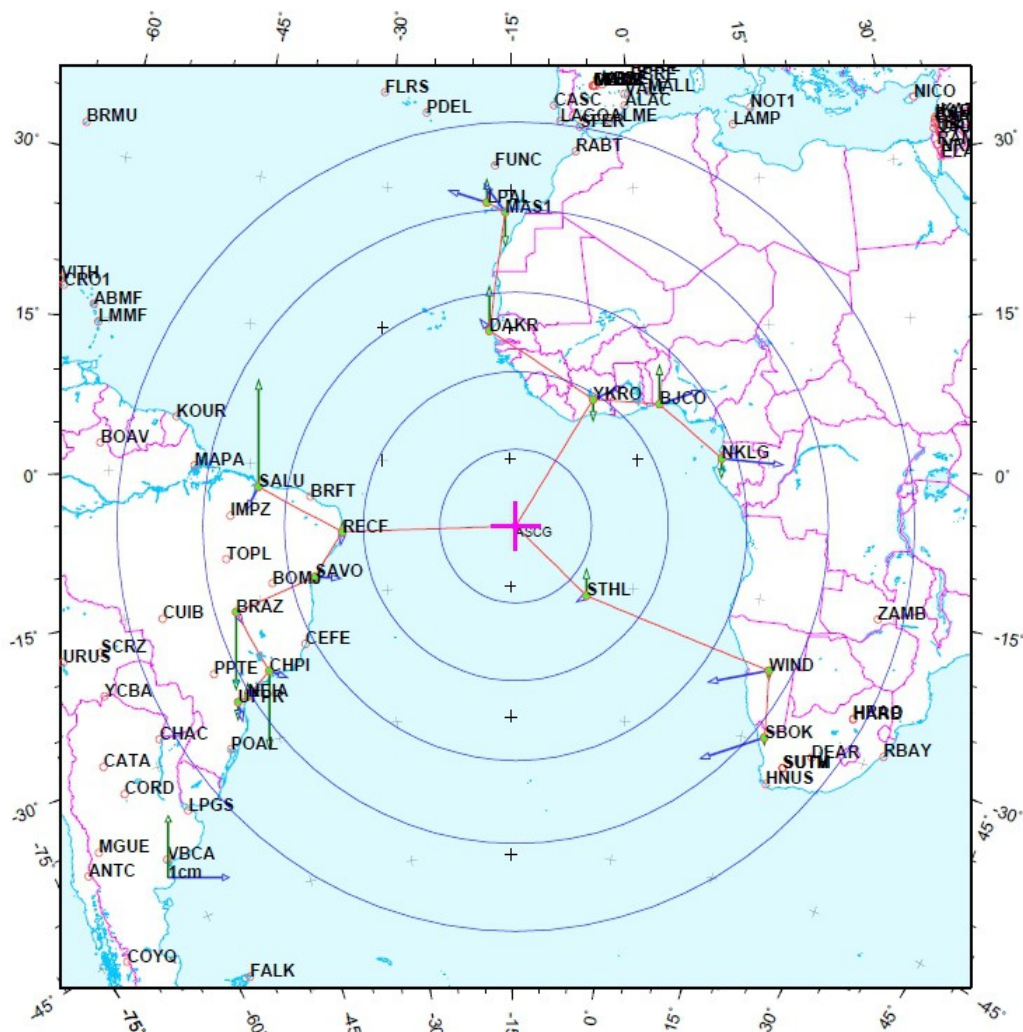
July 23th 2015, the weather was sunny and quiet. These data have been taken into account to correct the distance measurements.

4. Computation

4.1. Determination of ASCG antenna reference point coordinates in IGb08

The resulting coordinates are expressed in IGb08 at the mid-epoch of a GNSS data set, i.e. epoch 2015:217 (05/08/2015) close to the local tie survey operation date. 7 daily data sessions including 16 surrounding IGS station have been processed, from 2 August 2015 to 8 August 2015.

In summary, the computation process was the following: a first step to provide loosely constrained solutions, and a second step to combine these solutions in order to get final coordinates in the properly defined reference frame.



Baselines provided from session 05/08/2015 (Shortest strategy)

The use of a high level software *Bernese GNSS Software V5* is required with a thoroughly fixed parameterization.

The processing of a GNSS data set in ITRF is achieved by the use of IGS data and products expressed in IGB08 reference frame.

The computation process is described in appendix 6.3.

▪ Coordinates expressed in IGB8 at epoch 2015:217

Station	DOMES number	X (m)	Y (m)	Z (m)
ASCG_ARP	30602M004	6121151.94097	-1563979.02349	-872615.41109
BJCO	32701M001	6333076.45821	270973.67055	704552.18659
BRAZ	41606M001	4115014.06864	-4550641.61395	-1741443.83210
CHPI	41609M003	4164613.89961	-4162456.95174	-2445028.68903
DAKR	34108M001	5886533.47436	-1849181.51740	1610300.49829
FUNC	13911S001	5143339.23570	-1563412.57278	3421191.72519
LPAL	81701M001	5326646.23400	-1719826.06163	3052043.84810
MAS1	31303M002	5439192.16491	-1522055.28755	2953455.00375
NEIA	41620M002	3875254.97065	-4292588.77506	-2681108.58487
NKLG	32809M002	6287385.72389	1071574.75603	39133.10951
RECF	41617M001	5176588.58616	-3618162.19562	-887363.70736
SALU	41640M001	4566947.85661	-4443098.53355	-286674.60822
SAVO	41643M001	4870283.73308	-3864605.33943	-1418872.42724
SBOK	30320M001	5279492.04984	1703114.43187	-3139092.86881
STHL	30606M003	6104817.22073	-605827.90090	-1740738.76094
UFPR	41610M002	3763751.67578	-4365113.90410	-2724404.53356
WIND	31101M001	5633708.78717	1732017.94003	-2433985.58352
YKRO	32601M001	6306439.96918	-578380.64009	757956.61856

Cartesian coordinates, IGB08/ITRF08, epoch 2015:217 (05/08/2015)

4.2. Local GNSS network

The local GNSS baselines (see paragraph 3.4.2) were processed with Leica Geo Office V8.3 software using IGB08 precise ephemeris and the original set of « absolute » GNSS antenna calibrations (igs08.atx).

The corresponding LGO report file is given in appendix 6.4.

4.3. Global adjustment

The final computation has been carried out by an iterative least squares 3D adjustment with the Microsearch Geolab version 2001.9.20.0 software. The input file (see appendix 6.5) has been built from :

- Total station observations : horizontal and zenith angles, distances,
- Centring equations : relative position to markers,
- Azimuths issued from the GNSS baselines process,
- ASCG antenna reference point coordinates constrained at 1 mm to its IGB08 (epoch 2015:217, 05/08/2015) values.

The a priori standard deviations used for the different observations with total station are :

- 0.8 mgon for horizontal and vertical angles,
- 1 mm for distances on prism,

These values are used for most of the targets in the Microsearch Geolab computation input file.

This adjustment provided coordinates and a covariance matrix of our survey work (appendix 6.6).

Geoid slope is negligible around Ascension Island. The undulation of the geoid model EGM08 has not been taken into account in the process to correct the vertical normal heights.

5. Results

5.1. Station name translation table

The following list sums up the main points of the Microsearch Geolab input file.

Point description	Used name or code	Computation name
DORIS stations → DORIS antenna reference point → DORIS pillar/domed mark → Ex-DORIS mark	30602S005 30602M003 30602M002	ASEB ASEB_marker ASDB_marker
GNSS permanent station → ASCG reference point → ASCG antenna reference point	30602M004 -	ASCG ASCG_ARP
Benchmark → Tide Gauge benchmark POL18	-	POL18

In addition, observations from a local tie survey conducted by IGN in March 2003 have been added in the input file to recover the link between the ex-DORIS mark and the former DORIS antenna reference point, ASDB.

5.2. Adjusted coordinates and confidence regions

The results of the adjustment are the coordinates of all points and their confidence ellipsoids in the IGB08 reference frame at the mean epoch of the observations (i.e. epoch 2015 :217). The table below provides the 3D coordinates and confidence region at 95 % of the points of interest.

```
=====
                ASCG (ASCENSION) REGINA-DORIS TIES - JULY 2015 SURVEY
Microsearch GeoLab, V2001.9.20.0                GRS 80                UNITS: m,GRAD
=====
```

Adjusted XYZ Coordinates:

CODE	FFF	STATION	X-COORDINATE STD DEV	Y-COORDINATE STD DEV	Z-COORDINATE STD DEV
XYZ		ASCG	6121151.5493 0.0011	-1563978.9235 0.0011	-872615.3556 0.0011
XYZ		ASCG_ARP	6121151.9410 0.0011	-1563979.0235 0.0011	-872615.4111 0.0011
XYZ		ASDB_marker	6121160.9781 0.0016	-1563943.1600 0.0025	-872612.8054 0.0029
XYZ		ASEB	6121154.0333 0.0011	-1563976.7934 0.0011	-872605.9075 0.0011
XYZ		ASEB_marker	6121152.9870 0.0011	-1563976.5259 0.0011	-872605.7575 0.0011
XYZ		POL18	6120029.3034 0.0012	-1569737.0844 0.0011	-870050.3291 0.0011


```
=====
                ASCG (ASCENSION) REGINA-DORIS TIES - JULY 2015 SURVEY
Microsearch GeoLab, V2001.9.20.0                GRS 80                UNITS: m,GRAD
=====
2-D and 1-D Station Confidence Regions (95.000 and 95.000 percent):
STATION                MAJOR SEMI-AXIS  AZ                MINOR SEMI-AXIS                VERTICAL
-----
ASCG                0.0028  24                0.0027                0.0022
ASCG_ARP            0.0027  90                0.0027                0.0022
ASDB_marker         0.0072   5                0.0063                0.0028
ASEB                0.0028  10                0.0028                0.0022
ASEB_marker         0.0028  10                0.0028                0.0022
POL18               0.0028 106                0.0027                0.0024
=====
```

```
=====
                ASCG (ASCENSION) REGINA-DORIS TIES - JULY 2015 SURVEY
Microsearch GeoLab, V2001.9.20.0                GRS 80                UNITS: m,GRAD
=====
Adjusted PLH Coordinates:
                LATITUDE                LONGITUDE  ELIP-HEIGHT
CODE FFF STATION                STD DEV                STD DEV                STD DEV
-----
PLH  000 ASCG                S  7 54  58.61168 W 14 19  57.59211                37.9530 m                0
                0.0011                0.0011                0.0011
PLH  000 ASCG_ARP            S  7 54  58.61165 W 14 19  57.59211                38.3611 m                0
                0.0011                0.0011                0.0011
PLH  000 ASDB_marker         S  7 54  58.52819 W 14 19  56.38463                37.8812 m                0
                0.0029                0.0026                0.0014
PLH  000 ASEB                S  7 54  58.29864 W 14 19  57.50465                38.5132 m                0
                0.0011                0.0011                0.0011
PLH  000 ASEB_marker         S  7 54  58.29864 W 14 19  57.50465                37.4229 m                0
                0.0011                0.0011                0.0011
PLH  000 POL18               S  7 53  34.38514 W 14 23   8.79435                22.8021 m                0
                0.0011                0.0011                0.0012
=====
```

The whole covariance matrix was computed, then it was possible to extract from it the covariance submatrix for the 2 main points of interest i.e. ASCG and ASEB, plus ASDB, for the next ITRF computation. Finally, this covariance submatrix has been converted into the SINEX format using the « geotosnx » tool provided by Z. Altamimi. The resulting SINEX file (30602_IGN_2015-217_V10.SNX) is provided in appendix 6.7.

5.3. Vectors between points of interest

Differential components between points of interest in IGb08:

	dX (m)	dY (m)	dZ (m)	Accuracy (m)
ASCG → ASEB	2,484	2,130	9,448	0,001
ASCG → ASCG_ARP	0,392	-0,100	-0,055	0,001
ASEB → ASEB_marker	-1,046	0,267	0,150	0,001
ASEB → ASDB_marker	6,945	33,633	-6,898	0,001
ASCG → ASDB_marker	9,429	35,763	2,550	0,001
ASCG → POL18	-1122,246	-5758,161	2565,025	0,002

6. Annexes

6.1. «ASEB» DORIS station site log

ASCENSION DORIS site description form

0. Form

Prepared by : SIMB (DORIS installation and maintenance department)
Date prepared : 29/01/2013
Report type : NEW

1. Site location information

Site name : ASCENSION
Site DOMES number : 30602
Host agency : ARIANE Tracking Station
City : Ascension Island
State or province : South Atlantic Ocean
Country : UNITED KINGDOM (South Atlantic Ocean)
Tectonic plate : SOAM
Geological information :

Geographical coordinates (ITRF) :
North Latitude : -7 deg 54' 58''
East Longitude : -14 deg 19' 58''
Ellipsoid height : 38 m
Approximate altitude : 24 m

2. DORIS antenna and reference point information

2.1

Four character ID : ASDB
Antenna model : Starec 52291 type
Antenna serial number : 58
IERS DOMES number : 30602S004
CNES/IGN number : 306022
DORIS SSALTO number : 74
Date installed (dd/mm/yy) : 28/02/1997
Date removed (dd/mm/yy) : 16/03/2003
Antenna support type : Concrete pillar (old STELLA antenna support)
Installed on : Concrete pad
Height above ground mark : 0.548 m
Ground mark type : Domed brass mark 12 mm diameter
Ground mark DOMES number : 30602M002
Notes :

2.2

Four character ID : ASDB
Antenna model : Starec 52291 type
Antenna serial number : 89
IERS DOMES number : 30602S004
CNES/IGN number : 306022
DORIS SSALTO number : 74
Date installed (dd/mm/yy) : 16/03/2003
Date removed (dd/mm/yy) : 25/06/2009
Antenna support type : Concrete pillar (old STELLA antenna support)
Installed on : Concrete pad
Height above ground mark : 0.548 m
Ground mark type : Domed brass mark 12 mm diameter
Ground mark DOMES number : 30602M002
Notes :

2.3

Four character ID : ASEB
Antenna model : Starec 52291 type
Antenna serial number : 135
IERS DOMES number : 30602S005
CNES/IGN number : 306023
DORIS SSALTO number : 290
Date installed (dd/mm/yy) : 14/06/2010
Date removed (dd/mm/yy) :
Antenna support type : Stainless steel interface
Installed on : 1.5m high concrete reinforced pillar
Height above ground mark : 1.090 m
Ground mark type : Domed brass mark
Ground mark DOMES number : 30602M003
Notes :

3. DORIS beacons information

3.1

Beacon serial number : 9845107
Beacon model : 2.0
USO serial number : 2.866
4 Char. ID of the REF point : ASDB
Date installed (dd/mm/yy) : 09/04/1999
Date removed (dd/mm/yy) : 12/02/2002

3.2

Beacon serial number : 9904130
Beacon model : 2.0
USO serial number : 3.152
4 Char. ID of the REF point : ASDB
Date installed (dd/mm/yy) : 09/04/2002
Date removed (dd/mm/yy) : 18/05/2004

3.3

Beacon serial number : 9904121
Beacon model : 2.0
USO serial number : 3.130
4 Char. ID of the REF point : ASDB
Date installed (dd/mm/yy) : 19/05/2004
Date removed (dd/mm/yy) : 30/03/2005

3.4

Beacon serial number : 2819052
Beacon model : 3.0
USO serial number : 3.405
4 Char. ID of the REF point : ASDB
Date installed (dd/mm/yy) : 01/04/2005
Date removed (dd/mm/yy) : 07/04/2010

3.5

Beacon serial number : 2819017
Beacon model : 3.0
USO serial number : 3.280
4 Char. ID of the REF point : ASEB
Date installed (dd/mm/yy) : 14/06/2010
Date removed (dd/mm/yy) :

4. ITRF coordinates and velocities of the current DORIS ref. point (ASEB)

Solution : DPOD2008
Epoch : 2005.0

X = 6121154.081 m Y = -1563976.723 m Z = -872606.019 m
Sig X = 0.002 m Sig Y = 0.003 m Sig Z = 0.002 m

VX = -0.0032 m/y VY = -0.0090 m/y VZ = 0.0111 m/y
Sig VX = 0.0006 m/y Sig VY = 0.0007 m/y Sig VZ = 0.0004 m/y

5. IERS colocation information

6. Tide Gauge colocation information

6.1

Name : Ascension Is.
Location : Hook Jetty, English Bay
GLOSS number : 263
Distance : 6.4 km
Notes :

7. Local site ties

7.1

Point description : DORIS Starec antenna reference point ((ASDB)
DOMES number : 30602S004
Differential components from the current DORIS ref. point (ASEB)
to the above point (in the ITRS) :
dX (m) : 7.470
dY (m) : 33.499
dZ (m) : -6.973
Accuracy (m) : 0.001
Date measured : 14/06/2010
Additional information : Survey by IGN-F 2010

7.2

Point description : Mark under Doris antenna (ASDB)
DOMES number : 30602M002
Differential components from the current DORIS ref. point (ASEB)
to the above point (in the ITRS) :
dX (m) : 6.944
dY (m) : 33.633
dZ (m) : -6.870
Accuracy (m) : 0.001
Date measured : 14/06/2010
Additional information : Survey by IGN-F 2010

7.3

Point description : Mark under Doris antenna (ASEB)
DOMES number : 30602M003
Differential components from the current DORIS ref. point (ASEB)
to the above point (in the ITRS) :
dX (m) : -1.046
dY (m) : 0.267
dZ (m) : 0.150
Accuracy (m) : 0.001
Date measured : 14/06/2010
Additional information : Survey by IGN-F 2010

7.4

Point description : Tide gauge English Bay: POL18 mark
DOMES number :
Differential components from the current DORIS ref. point (ASEB)
to the above point (in the ITRS) :
dX (m) : -1124.734
dY (m) : -5760.272
dZ (m) : 2555.544
Accuracy (m) : 0.002
Date measured : 15/06/2010
Additional information : Survey by IGN-F 2003 & 2010

8. Meteorological Instrumentation

8.1 Humidity sensor

Model : HMP45D
Manufacturer : VAISALA
Accuracy : +/- 3 percents
Notes :

8.2 Pressure sensor

Model : PTU200 class B
Manufacturer : VAISALA
Accuracy : +/- 0.25 hPa
Height : 1.9 m above the current DORIS ref. point (ASEB)
Notes : long term stability = +/- 0.1 hPa/year

8.3 Temperature sensor

Model : HMP45D
Manufacturer : VAISALA
Accuracy : +/- 0.5 deg C
Notes :

9. DORIS network contacts

Primary contact:

Name : Jerome SAUNIER
Agency : Institut Geographique National
Mailing address : Service de Geodesie et Nivellement
: 73 avenue de Paris
: 94165 SAINT-MANDE Cedex FRANCE
Telephone : + 33 1 43 98 83 63
Fax : + 33 1 43 98 84 50
E-mail : jerome (.) saunier (@) ign.fr

Secondary contact:

Name : Francois BOLDO
Agency : Institut Geographique National
Mailing address : CNES (DCT/ME/OC)
: 18 Avenue Edouard Belin
: 31401 TOULOUSE Cedex FRANCE
Telephone : + 33 5 61 27 40 72
Fax : + 33 5 61 28 25 95
E-mail : simb (.) doris (@) cnes.fr

6.2. «ASCG» GNSS station site log

ASCG Site Information Form (site log)
International GNSS Service
See Instructions at:
ftp://igsb.jpl.nasa.gov/pub/station/general/sitelog_instr.txt

0. Form

Prepared by (full name) : Thomas DONAL
Date Prepared : 2015-10-16
Report Type : update
If Update:
Previous Site Log : ascg_20150916.log
Modified/Added Sections : 3.1,3.2

1. Site Identification of the GNSS Monument

Site Name : Ascension
Four Character ID : ASCG
Monument Inscription : None
IERS DOMES Number : 30602M004
CDP Number :
Monument Description : concrete pillar and 40 cm steel antenna mount
Height of the Monument : 2 m
Monument Foundation : concrete block
Foundation Depth : 1.4 m
Marker Description : brass hemispheric mark
Date Installed : 2015-07-24T00:00Z
Geologic Characteristic :
Bedrock Type :
Bedrock Condition :
Fracture Spacing :
Fault zones nearby :
Distance/activity :
Additional Information : GNSS station located at ARIANE Tracking Station
: site managed by European Space Agency

2. Site Location Information

City or Town : Ascension Island
State or Province : British Overseas Territory
Country : Saint Helena, Ascension and Tristan Da Cunha
Tectonic Plate : SOUTH AMERICAN
Approximate Position (ITRF)
X coordinate (m) : 6121151.5493
Y coordinate (m) : -1563978.9235
Z coordinate (m) : -872615.3556
Latitude (N is +) : -075458.61168
Longitude (E is +) : -0141957.59211
Elevation (m,ellips.) : 37.953
Additional Information : coordinates in IGS08
: EPOCH 2015:217 (05/08/2015)

3. GNSS Receiver Information

- 3.1 Receiver Type : TRIMBLE NETR9
Satellite System : GPS+GLO+GAL+BDS+SBAS
Serial Number : 5340K46069
Firmware Version : 5.01
Elevation Cutoff Setting : 3 deg
Date Installed : 2015-07-24T00:00Z
Date Removed : 2015-10-16T15:05Z
Temperature Stabiliz. : 25 C +/- 5 C
Additional Information :

3.2 Receiver Type : TRIMBLE NETR9
Satellite System : GPS+GLO+GAL+BDS+SBAS

```

Serial Number      : 5340K46069
Firmware Version   : 5.01
Elevation Cutoff Setting : 0 deg
Date Installed     : 2015-10-16T15:10Z
Date Removed      : CCYY-MM-DDThh:mmZ
Temperature Stabiliz. : 25 C +/- 5 C
Additional Information :

3.x Receiver Type      : (A20, from rcvr_ant.tab; see instructions)
Satellite System      : (GPS+GLO+GAL+BDS+QZSS+SBAS)
Serial Number         : (A20, but note the first A5 is used in SINEX)
Firmware Version      : (A11)
Elevation Cutoff Setting : (deg)
Date Installed        : (CCYY-MM-DDThh:mmZ)
Date Removed          : (CCYY-MM-DDThh:mmZ)
Temperature Stabiliz. : (none or tolerance in degrees C)
Additional Information : (multiple lines)

4. GNSS Antenna Information

4.1 Antenna Type      : TRM59800.00      NONE
Serial Number        : 5406354931
Antenna Reference Point : BPA
Marker->ARP Up Ecc. (m) : 000.4080
Marker->ARP North Ecc(m) : -000.0007
Marker->ARP East Ecc(m) : 000.0001
Alignment from True N : 0 deg
Antenna Radome Type   : NONE
Radome Serial Number  :
Antenna Cable Type    : TRIMBLE LMR-400
Antenna Cable Length  : 30 m
Date Installed        : 2015-07-24T00:00Z
Date Removed          : CCYY-MM-DDThh:mmZ
Additional Information : multiple lines)

4.x Antenna Type      : (A20, from rcvr_ant.tab; see instructions)
Serial Number         : (A*, but note the first A5 is used in SINEX)
Antenna Reference Point : (BPA/BCR/XXX from "antenna.gra"; see instr.)
Marker->ARP Up Ecc. (m) : (F8.4)
Marker->ARP North Ecc(m) : (F8.4)
Marker->ARP East Ecc(m) : (F8.4)
Alignment from True N : (deg; + is clockwise/east)
Antenna Radome Type   : (A4 from rcvr_ant.tab; see instructions)
Radome Serial Number  :
Antenna Cable Type    : (vendor & type number)
Antenna Cable Length  : (m)
Date Installed        : (CCYY-MM-DDThh:mmZ)
Date Removed          : (CCYY-MM-DDThh:mmZ)
Additional Information : (multiple lines)

5. Surveyed Local Ties

5.1 Tied Marker Name      : DORIS antenna ref. pt.(ASEB)
Tied Marker Usage       :
Tied Marker CDP Number  :
Tied Marker DOMES Number : 30602S005
Differential Components from GNSS Marker to the tied monument (ITRS)
  dx (m)                : 2.4840
  dy (m)                : 2.1301
  dz (m)                : 9.4481
Accuracy (mm)           : 1 mm
Survey method           : TRIANGULATION
Date Measured           : 2015-07-23T00:00Z
Additional Information   : high geodetic surveying proceed by IGN-F

5.2 Tied Marker Name      : Mark under DORIS antenna(ASEB)
Tied Marker Usage       :
Tied Marker CDP Number  :
Tied Marker DOMES Number : 30602M003
Differential Components from GNSS Marker to the tied monument (ITRS)
  dx (m)                : 1.4377
  dy (m)                : 2.3976
  dz (m)                : 9.5981

```

```

Accuracy (mm)           : 1 mm
Survey method           : TRIANGULATION
Date Measured           : 2015-07-23T00:00Z
Additional Information    : high geodetic surveying proceed by IGN-F

5.3 Tied Marker Name      : Mark under former Doris antenna (ASDB)
    Tied Marker Usage     :
    Tied Marker CDP Number :
    Tied Marker DOMES Number : 30602M002
    Differential Components from GNSS Marker to the tied monument (ITRS)
        dx (m)             : 9.42881
        dy (m)             : 35.7635
        dz (m)             : 2.5502
    Accuracy (mm)         : 1 mm
    Survey method         : TRIANGULATION
    Date Measured         : 2015-07-23T00:00Z
    Additional Information : high geodetic surveying proceed by IGN-F

5.4 Tied Marker Name      : Tide gauge English Bay: POL18 mark
    Tied Marker Usage     :
    Tied Marker CDP Number :
    Tied Marker DOMES Number :
    Differential Components from GNSS Marker to the tied monument (ITRS)
        dx (m)             : -1122.246
        dy (m)             : -5758.161
        dz (m)             : 2565.025
    Accuracy (mm)         : 3 mm
    Survey method         : TRIANGULATION
    Date Measured         : 2015-07-23T00:00Z
    Additional Information : surveying proceed by IGN-F

5.x Tied Marker Name      :
    Tied Marker Usage     : (SLR/VLBI/LOCAL CONTROL/FOOTPRINT/etc)
    Tied Marker CDP Number : (A4)
    Tied Marker DOMES Number : (A9)
    Differential Components from GNSS Marker to the tied monument (ITRS)
        dx (m)             : (m)
        dy (m)             : (m)
        dz (m)             : (m)
    Accuracy (mm)         : (mm)
    Survey method         : (GPS CAMPAIGN/TRILATERATION/TRIANGULATION/etc)
    Date Measured         : (CCYY-MM-DDThh:mmZ)
    Additional Information : (multiple lines)

6. Frequency Standard

6.1 Standard Type         : INTERNAL
    Input Frequency        :
    Effective Dates        : 2015-07-24/CCYY-MM-DD
    Notes                  :

6.x Standard Type         : (INTERNAL or EXTERNAL H-MASER/CESIUM/etc)
    Input Frequency        : (if external)
    Effective Dates        : (CCYY-MM-DD/CCYY-MM-DD)
    Notes                  : (multiple lines)

7. Collocation Information

7.1 Instrumentation Type   : DORIS
    Status                 : PERMANENT
    Effective Dates        : 1997-02-28/CCYY-MM-DD
    Notes                  :

7.2 Instrumentation Type   : TIDE GAUGE
    Status                 : PERMANENT
    Effective Dates        : 1993-01-01/CCYY-MM-DD
    Notes                  : GLOSS ID: 263
                        : located at English Bay,
                        : 6 km far away from ASCG
                        : Agency: National Oceanography Centre

7.x Instrumentation Type   : (GPS/GLONASS/DORIS/PRARE/SLR/VLBI/TIME/etc)
    Status                 : (PERMANENT/MOBILE)

```


Effective Dates : (CCYY-MM-DD/CCYY-MM-DD)
Notes : (multiple lines)

8. Meteorological Instrumentation

8.1.x Humidity Sensor Model :
Manufacturer :
Serial Number :
Data Sampling Interval : (sec)
Accuracy (% rel h) : (% rel h)
Aspiration : (UNASPIRATED/NATURAL/FAN/etc)
Height Diff to Ant : (m)
Calibration date : (CCYY-MM-DD)
Effective Dates : (CCYY-MM-DD/CCYY-MM-DD)
Notes : (multiple lines)

8.2.x Pressure Sensor Model :
Manufacturer :
Serial Number :
Data Sampling Interval : (sec)
Accuracy : (hPa)
Height Diff to Ant : (m)
Calibration date : (CCYY-MM-DD)
Effective Dates : (CCYY-MM-DD/CCYY-MM-DD)
Notes : (multiple lines)

8.3.x Temp. Sensor Model :
Manufacturer :
Serial Number :
Data Sampling Interval : (sec)
Accuracy : (deg C)
Aspiration : (UNASPIRATED/NATURAL/FAN/etc)
Height Diff to Ant : (m)
Calibration date : (CCYY-MM-DD)
Effective Dates : (CCYY-MM-DD/CCYY-MM-DD)
Notes : (multiple lines)

8.4.x Water Vapor Radiometer :
Manufacturer :
Serial Number :
Distance to Antenna : (m)
Height Diff to Ant : (m)
Calibration date : (CCYY-MM-DD)
Effective Dates : (CCYY-MM-DD/CCYY-MM-DD)
Notes : (multiple lines)

8.5.x Other Instrumentation : (multiple lines)

9. Local Ongoing Conditions Possibly Affecting Computed Position

9.1.x Radio Interferences : (TV/CELL PHONE ANTENNA/RADAR/etc)
Observed Degradations : (SN RATIO/DATA GAPS/etc)
Effective Dates : (CCYY-MM-DD/CCYY-MM-DD)
Additional Information : (multiple lines)

9.2.x Multipath Sources : (METAL ROOF/DOME/VLBI ANTENNA/etc)
Effective Dates : (CCYY-MM-DD/CCYY-MM-DD)
Additional Information : (multiple lines)

9.3.x Signal Obstructions : (TREES/BUILDINGS/etc)
Effective Dates : (CCYY-MM-DD/CCYY-MM-DD)
Additional Information : (multiple lines)

10. Local Episodic Effects Possibly Affecting Data Quality

10.x Date : (CCYY-MM-DD/CCYY-MM-DD)
Event : (TREE CLEARING/CONSTRUCTION/etc)

11. On-Site, Point of Contact Agency Information

Agency : European Space Agency
Preferred Abbreviation : ESA

BPA: bottom of preamplifier
TCR: top of chokering

Dimensions

All dimensions are in meters.

6.3. Bernese GNSS process

The processing of a GNSS data set in ITRF is achieved by the use of IGS data and products expressed in IGB08 reference frame:

- Ephemeris and Earth Orientation Parameters.
- GNSS observations, coordinates and velocities of IGS reference stations. Basically the observation data of about 16 IGS stations in a 5000 km radius from Ascension Island are available daily.
- Antenna calibration stemming from igs08.atx.

The computation is validated with respect to the following points:

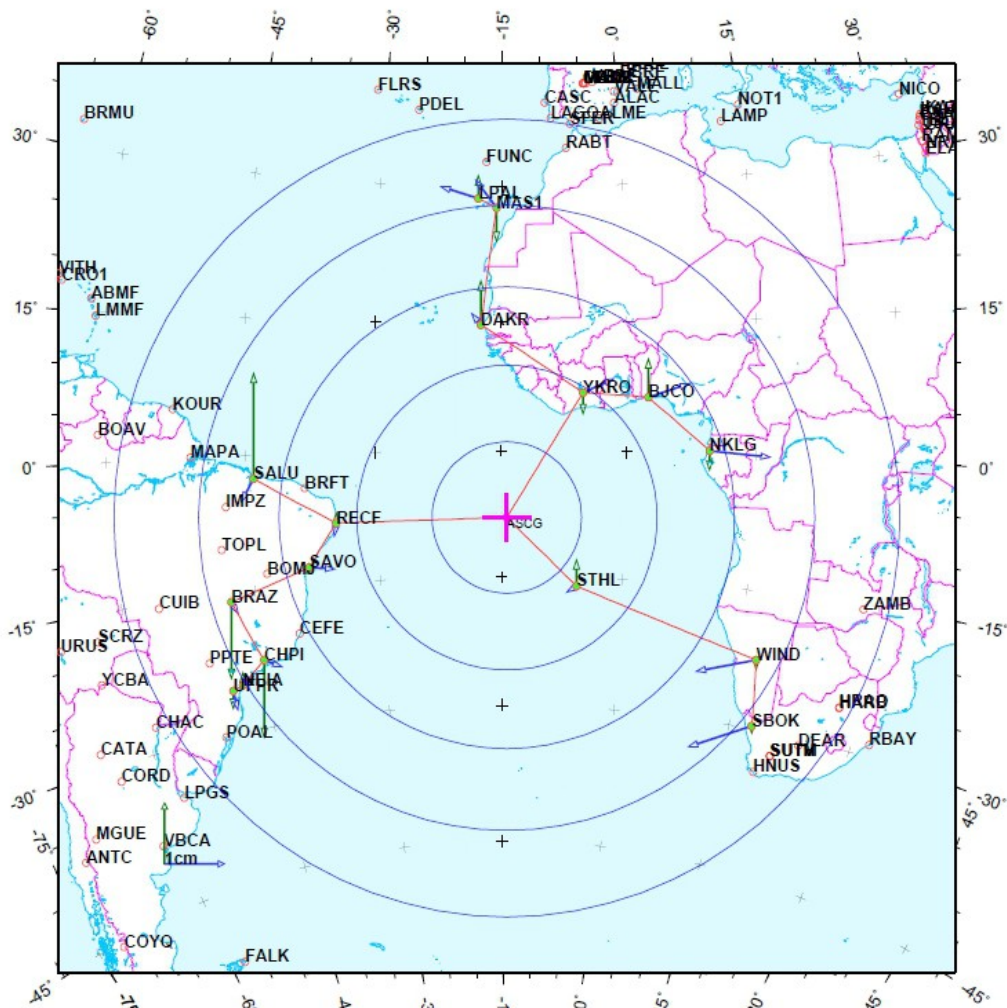
- Assessment of the Root Mean Square errors of the combined solution.
- Assessment of consistency between the daily solutions (repeatability).
- Assessment of alignment of the combined solution to the IGS08 reference frame.

▪ Daily processing steps

7 daily data sessions have been processed, from 02 August 2015 to 08 August 2015 based on a network integer ambiguity fixed solution from ionosphere free double difference processing using IGS precise ephemeris and earth orientation parameters.

Each daily solution has been validated according to :

- Ambiguity integer fixed results
- Variance factor range
- Helmert adaptation from IGS stations computed coordinates to actual ones



Baselines provided from session 05/08/2015 (Shortest strategy)

■ Session Combination

Daily normal equations were merged using a least squares adjustment process in order to provide a final reference free combined solution. The residuals of the individual solutions with respect to the combined one have been computed and checked. The Root Mean Square errors and the consistency between the daily solutions (repeatability) were assessed.

◦ Root Mean Square errors

Next table shows the Root Mean Square errors of the combined solution (**mm** in East, North and Up component).

Station	DOMES number	E RMS	N RMS	U RMS
ASCG_ARP	-	1.0	0.8	1.7
BJCO	32701M001	1.2	0.9	1.6
BRAZ	41606M001	1.3	0.9	1.5
CHPI	41609M003	1.3	0.9	1.5
DAKR	34108M001	0.9	1.1	1.6
FUNC	13911S001	1.0	1.5	1.9
LPAL	81701M001	0.9	1.4	1.4
MAS1	31303M002	0.9	1.3	1.4
NEIA	41620M002	1.3	1.0	1.5
NKLG	32809M002	1.3	0.9	1.6
RECF	41617M001	1.1	0.8	1.7
SALU	41640M001	1.2	0.8	1.6
SAVO	41643M001	1.2	0.9	1.7
SBOK	30320M001	1.5	1.0	1.4
STHL	30606M003	1.1	0.9	1.7
UFPR	41610M002	1.3	1.0	1.5
WIND	31101M001	1.5	0.9	1.4
YKRO	32601M001	1.1	0.9	1.7

◦ Repeatability

Next table shows statistics about shifts between the daily solutions and the adjusted solution (**mm** in North, East and Up component).

Station	DOMES number	RMS N	Min N	Max N	RMS E	Min E	Max E	RMS U	Min U	Max U
ASCG_ARP	-	1.7	-3.1	2.0	2.5	-4.1	3.7	2.4	-3.7	3.1
BJCO	32701M001	2.1	-2.5	2.6	1.5	-1.9	2.1	5.7	-7.5	9.5
BRAZ	41606M001	1.3	-2.0	1.9	2.1	-3.5	2.5	1.6	-2.2	2.6
CHPI	41609M003	1.3	-1.7	1.7	2.3	-4.6	1.6	2.1	-2.8	2.2
DAKR	34108M001	2.3	-3.6	3.4	2.7	-5.0	3.1	2.6	-3.5	3.5
FUNC	13911S001	3.3	-3.3	-3.3	0.2	-0.2	-0.2	1.0	1.0	1.0
LPAL	81701M001	2.7	-3.2	3.5	2.6	-5.2	3.1	5.2	-8.9	8.7
MAS1	31303M002	2.7	-3.4	4.0	2.4	-2.7	3.4	3.1	-4.0	3.2
NEIA	41620M002	1.2	-1.8	1.4	2.0	-3.6	2.3	2.0	-3.8	2.5
NKLG	32809M002	2.1	-2.5	2.7	1.8	-2.0	2.9	4.3	-3.5	7.1
RECF	41617M001	1.0	-1.4	1.4	2.1	-3.7	2.8	3.9	-4.5	5.7
SALU	41640M001	1.0	-1.1	2.0	2.2	-2.6	2.4	5.3	-7.6	6.5
SAVO	41643M001	1.3	-1.9	1.7	2.1	-3.2	2.4	3.4	-3.1	6.0
SBOK	30320M001	3.7	-5.6	6.4	4.6	-6.4	6.4	5.3	-5.8	6.8
STHL	30606M003	1.5	-1.6	2.4	2.2	-3.9	2.4	2.6	-3.7	2.7
UFPR	41610M002	1.5	-1.7	2.3	1.9	-3.2	1.9	3.5	-4.8	5.7
WIND	31101M001	3.5	-4.8	5.9	3.5	-3.9	4.9	2.3	-5.1	1.2
YKRO	32601M001	1.7	-2.9	2.1	1.2	-2.2	1.5	1.2	-1.3	1.4

◦ **IGb08 epoch alignment**

The combined solution has been Helmert-aligned to IGb08 at mid-epoch of data set, i.e. 2015:217. Residuals have been checked to assess consistency of this solution. Due to their significant residuals, stations in italic were not taken into account to establish Helmert parameters.

Station	DOMES number	Residuals (mm)		
		North	East	Vertical
<i>BRAZ</i>	<i>41606M001</i>	6.14	-15.04	-1.10
CHPI	41609M003	-1.98	-0.18	-11.55
<i>DAKR</i>	<i>34108M001</i>	3.22	5.25	-23.25
FUNC	13911S001	4.83	-6.23	2.12
MAS1	31303M002	3.03	-2.37	1.87
NKLG	32809M002	-1.59	6.33	-3.38
STHL	30606M003	-3.21	-7.15	3.92
WIND	31101M001	-3.18	-3.93	1.41
<i>YKRO</i>	<i>32601M001</i>	-0.31	14.77	7.92
SALU	41640M001	1.21	9.32	-2.45
SAVO	41643M001	-1.69	2.45	8.12
RMS	COMPONENT	3.02	5.90	5.88

6.4. Leica Geo Office report file

Local GNSS observations were processed with Leica Geo Office V8.3

- when it has to be **right**



Récapitulatif du Traitement

ASCG

Informations sur le Projet

Nom du Projet:	ASCG
Date de création:	07/24/2015 13:21:21
Fuseau Horaire:	1h 00'
Nom Syst. Coordonnées:	WGS 1984
Logiciel d'application:	LEICA Geo Office 8.3
Date et heure de début:	07/23/2015 14:00:43
Date et heure de fin:	07/25/2015 18:57:43
Points occupés manuellement:	3
Noyau de Post-Traitement:	PSI-Pro 3.0
Traité:	06/16/2016 15:51:19

Paramètres de Traitement

Paramètres	Sélectionnés
Angle de Coupure:	3°
Type d'Ephémérides:	Précises
Type de solution:	Automatique
Type GNSS:	Automatique
Fréquence:	Automatique
Fixer les ambiguïtés jusqu'à:	80 km
Durée mini pour solution flottante (statique):	5' 00"
Taux d'échantillonnage:	Tout Utiliser
Modèle Troposphérique:	Hopfield
Modèle Ionosphérique:	Automatique
Utiliser modélisation statistique:	Oui
Distance mini.:	8 km
Activité ionosphérique:	Automatique

Ligne de Base - Aperçu

ASCG_ARP - 10000	Référence: ASCG_ARP	Mobile: 10000
Coordonnées:		
Latitude:	7° 54' 58.61165" S	7° 55' 18.28249" S
Longitude:	14° 19' 57.59211" O	14° 20' 36.09126" O
Hteur Ellip.:	38.3611 m	138.1817 m
Type de solution:	Phase: toutes fixes	
Type GNSS:	GPS / GLONASS	
Fréquence:	L1/E1 et L2	
Ambiguïté:	Oui	
ASCG_ARP - 20000	Référence: ASCG_ARP	Mobile: 20000
Coordonnées:		
Latitude:	7° 54' 58.61165" S	7° 54' 54.40192" S
Longitude:	14° 19' 57.59211" O	14° 20' 01.69863" O
Hteur Ellip.:	38.3611 m	36.8114 m
Type de solution:	Phase: toutes fixes	
Type GNSS:	GPS / GLONASS	
Fréquence:	L1/E1 et L2	
Ambiguïté:	Oui	
ASCG_ARP - POL18	Référence: ASCG_ARP	Mobile: POL18
Coordonnées:		
Latitude:	7° 54' 58.61165" S	7° 53' 34.38515" S
Longitude:	14° 19' 57.59211" O	14° 23' 08.79437" O
Hteur Ellip.:	38.3611 m	22.8016 m
Type de solution:	Phase: toutes fixes	
Type GNSS:	GPS / GLONASS	
Fréquence:	L1/E1 et L2	
Ambiguïté:	Oui	

6.5. Adjustment input file

```
TITL ASCG (ASCENSION) REGINA-DORIS TIES - JULY 2015 SURVEY
COMP ADJ
ELIP GRS 80          6378137.000  6356752.3142  0.0000  0.0000  0.0000 m
MAXI          15
CONF YES YES YES YES NO
PSOL NO YES
PMIS NO NO
PRES YES NO
PADJ NO NO YES YES YES NO
VARF YES YES NO
RTST TAU MAX
LUNT m  1.000000000000
CONV  0.00010
CLEV  95.000
ANGT GRD
LDEC 4
FCOV YES
PGEO YES

*****
*                               ITRF ACRONYMS, n°DOMES and POINTS DESCRIPTION                               *
*****
*DORIS:
*ASEB: DORIS Ant. Ref. Pt. (Starec type) (DOMES 30602S005)
*ASEB_marker : DORIS concrete pillar / domed brass mark (DOMES 30602M003)
*ASDB_marker : former DORIS concrete pillar / domed brass mark (DOMES 30602M002)

*GNSS permanent station:
*ASCG: domed brass mark vertically down the BPA of antenna (DOMES 30602M004)

*****
*                               LIST OF POINTS for the SURVEY ADJUSTMENT                               *
*****
*10000: station to orient the survey polygon network
*20000: station to orient the survey polygon network
*ASEB_2GHz: DORIS antenna, upper part
*ASCG_BCR: bottom of chokering of ASCG
*ASCG_ARP: antenna reference point of ASCG
*101: mini reflector pole on ASCG
*102: mini-prism udder ASCG antenna ARP
*201: mini reflector pole on ASEB_marker
*301: mini reflector pole on ASDB_marker

*Temporary points
*1000: survey station
*2000: survey station
*3000: survey station
*4000: survey station
*5000: survey station
*6000: survey station
*7000: survey station

*****POINT COORDINATES*****

*LOCAL GEODETIC DATUM: IGS08/ITRF08 EPOCH 2015:217 COORDINATES (05/08/2015 12:00:00)
*Results from computation, Bernese GNSS software V5
3DC
XYZ 000 ASCG_ARP          6121151.9410      -1563979.0235      -872615.4111
COV CT DIAG          1
ELEM          0.000001          0.000001          0.000001

*****AZIMUT DEDUCTED FROM THE GNSS DETERMINATION*****

*IGS08/ITRF2008 EPOCH 2015:217 COORDINATES (05/08/2015) - LGO process

3DD
PLH 000 ASCG_ARP      S 7 54 58.61165 W 14 19 57.59211      38.3611 m 0
PLH 000 10000      S 7 55 18.28249 W 14 20 36.09126      138.1817 m 0
COV LG DIAG
ELEM          0.000001          0.000001          0.1

3DD
PLH 000 ASCG_ARP      S 7 54 58.61165 W 14 19 57.59211      38.3611 m 0
PLH 000 20000      S 7 54 54.40192 W 14 20 01.69865      36.8114 m 0
COV LG DIAG
ELEM          0.000004          0.000004          0.1
```

*****APPROXIMATE COORDINATES*****

PLH 000 1000	S 7 54	58.88711	W 14 19	57.33439	38.8016 m	0
PLH 000 2000	S 7 54	58.81069	W 14 19	57.71827	38.0278 m	0
PLH 000 3000	S 7 54	58.44848	W 14 19	57.52135	37.8014 m	0
PLH 000 4000	S 7 54	58.01225	W 14 19	57.84031	38.0975 m	0
PLH 000 5000	S 7 54	58.35269	W 14 19	57.14089	37.9747 m	0
PLH 000 6000	S 7 54	58.13457	W 14 19	56.89831	37.5912 m	0
PLH 000 7000	S 7 54	58.72719	W 14 19	56.81978	38.3192 m	0
PLH 000 10000	S 7 55	18.28250	W 14 20	36.09125	138.1817 m	0
PLH 000 20000	S 7 54	54.40184	W 14 20	1.69855	36.8114 m	0
PLH 000 ASCG	S 7 54	58.61168	W 14 19	57.59211	37.9530 m	0
PLH 000 101	S 7 54	58.61169	W 14 19	57.59211	38.1529 m	0
PLH 000 102	S 7 54	58.61165	W 14 19	57.59213	38.2425 m	0
PLH 000 ASCG_BCR	S 7 54	58.61166	W 14 19	57.59210	38.3964 m	0
PLH 000 ASEB_marker	S 7 54	58.29864	W 14 19	57.50465	37.4229 m	0
PLH 000 201	S 7 54	58.29865	W 14 19	57.50464	37.6222 m	0
PLH 000 ASEB	S 7 54	58.29864	W 14 19	57.50465	38.5132 m	0
PLH 000 ASEB_2GHz	S 7 54	58.29865	W 14 19	57.50470	38.9881 m	0
PLH 000 ASDB_marker	S 7 54	58.52819	W 14 19	56.38463	37.8812 m	0
PLH 000 301	S 7 54	58.52819	W 14 19	56.38463	38.0802 m	0

*****CENTRING EQUATIONS*****

*vertical offset ARP->BCR = +0.035m

3DD						
PLH 000 ASCG_BCR	S 7 54	58.61165	W 14 19	57.59211	38.3961 m	0
PLH 000 ASCG_ARP	S 7 54	58.61165	W 14 19	57.59211	38.3611 m	0
COV LG DIAG						
ELEM	0.00000004	0.00000004	0.00000009			

*vertical offset prism 102->ARP = +0.1182m (prism+adaptator+plaque)

3DD						
PLH 000 ASCG_ARP	S 7 54	58.61165	W 14 19	57.59211	38.3611 m	0
PLH 000 102	S 7 54	58.61165	W 14 19	57.59211	38.2429 m	0
COV LG DIAG						
ELEM	0.0000001	0.0000001	0.0000001			

*mini reflector pole, prism height over ASCG = 0.20m

3DD						
PLH 000 101	S 7 54	58.61165	W 14 19	57.59211	38.1531 m	0
PLH 000 ASCG	S 7 54	58.61165	W 14 19	57.59211	37.9531 m	0
COV LG DIAG						
ELEM	0.000004	0.000004	0.0000006			

*mini reflector pole, prism height over ASEB_marker = 0.199m

3DD						
PLH 000 201	S 7 54	58.29865	W 14 19	57.50464	37.6219 m	0
PLH 000 ASEB_marker	S 7 54	58.29865	W 14 19	57.50464	37.4229 m	0
COV LG DIAG						
ELEM	0.000004	0.000004	0.0000006			

*mini reflector pole, prism height over ASDB_marker = 0.199m

3DD						
PLH 000 301	S 7 54	58.52819	W 14 19	56.38463	38.0802 m	0
PLH 000 ASDB_marker	S 7 54	58.52819	W 14 19	56.38463	37.8812 m	0
COV LG DIAG						
ELEM	0.000004	0.000004	0.0000006			

*results from local tie survey - IGN France - March 2003 - ASDB_marker <-> ASDB

3DD						
PLH 000 ASDB_marker	S 7 54	58.535930	W 14 19	56.380800	38.0000	0
PLH 000 ASDB	S 7 54	58.535990	W 14 19	56.380900	38.5480	0
COV LG DIAG	0.00000	1.00000	0.00000	1.00000	0.00000	
ELEM	0.000001	0.000001	0.000001	0.000001	0.000001	
ELEM	0.000001					

*****BASELINE*****

*ASCG_ARP->POL18 - LGO process

GRP Obs #00001 tide_gauge.asc						
3DD						
DXYZ ASCG_ARP POL18		-1122.6376	-5758.0609	2565.0820 m		
COV CT UPFR						
ELEM 2.0878612160000000e-07	-6.7109824800000001e-08	-7.4566472000000000e-09	m			
ELEM 6.3381501200000000e-08	3.7283236000000000e-09		m			
ELEM 3.3554912400000000e-08			m			

```

*****
*                               Total station observations 2015 T.DONAL                               *
*****

*Tours d'horizon
SIGM AH      8.0
SIGM BH      30.0
HIST NEW
DSET AH

DIR 1000      10000      0 0      0.0
DIR 1000      2000      42 16     42.5
DIR 1000      3000     104 3      46.2
DIR 1000      4000      96 32      6.2
DIR 1000      5000     151 67     16.9
DIR 1000     20000      80 58     29.6
DIR 1000      ASCG      81 82     63.5
DIR 1000      101      81 82     39.3
DIR 1000      102      81 82     59.4
* DIR 1000      103      80 78     11.6
* DIR 1000      104      82 87     76.2
DIR 1000     ASCG_BCR      81 82     93.9
DIR 1000     ASEB_marker  111 73     77.5
DIR 1000      201      111 73     77.3
* DIR 1000      202      111 64     41.8
* DIR 1000      203      111 82     92.1
DIR 1000      ASEB      111 73     66.9
* DIR 1000      204      111 69     31.5
* DIR 1000      205      111 76     89.7
DIR 1000     ASEB_2GHz    111 73     10.6
DSET AH

DIR 2000      10000      0 0      0.0
DIR 2000      1000     242 51     91.8
DIR 2000      4000     120 34     50.3
DIR 2000      3000     161 59     63.3
DIR 2000     20000      83 31     69.3
DIR 2000      5000     187 18     78.7
DIR 2000      102     165 84     76.0
* DIR 2000      103     164 17     86.5
* DIR 2000      104     167 53      2.1
DIR 2000     ASCG_BCR    165 85     44.3
DIR 2000     ASCG      165 85     59.0
DIR 2000      101     165 85     63.2
* DIR 2000      202     154 96     48.4
* DIR 2000      203     155 16     75.3
DIR 2000      ASEB      155 6      61.8
* DIR 2000      204     155 1      94.1
* DIR 2000      205     155 10      2.3
DIR 2000     ASEB_2GHz    155 5      98.2
DIR 2000     ASEB_marker  155 6      69.1
DIR 2000      201     155 6      70.9
DSET AH

DIR 3000      10000      0 0      0.0
DIR 3000     20000      79 39     99.3
DIR 3000      4000      90 21     43.2
DIR 3000      5000     214 56     91.7
DIR 3000      1000     304 73     43.8
DIR 3000      2000     361 93     98.8
DIR 3000      102     356 30     45.7
* DIR 3000      103     354 7      10.1
* DIR 3000      104     358 51     39.2
DIR 3000     ASCG_BCR    356 29     24.6
DIR 3000     ASCG      356 29     37.9
DIR 3000      101     356 29     24.2
* DIR 3000      202     136 98     12.3
* DIR 3000      203     137 73     45.6
DIR 3000      ASEB      137 35     78.9
* DIR 3000      204     137 18     33.2
* DIR 3000      205     137 49     35.3
DIR 3000     ASEB_2GHz    137 33     84.2
DIR 3000     ASEB_marker  137 36     14.8
DIR 3000      201     137 36     49.6
DSET AH

DIR 5000      10000      0 0      0.0
DIR 5000      1000     352 24     21.0
DIR 5000      2000     387 40     39.9
DIR 5000      102     396 93     72.6
* DIR 5000      103     396 17     37.7
* DIR 5000      104     397 69     43.4
DIR 5000     ASCG_BCR    396 93     40.5
DIR 5000      3000      14 43     90.0
DIR 5000      4000      59 10      7.1
DIR 5000     ASCG      396 93     17.3
DIR 5000      101     396 93     17.0
*DIR 5000     20000      75 74     96.1
DIR 5000     ASEB_marker  39 60     43.1
DIR 5000      201      39 60     52.2

```

* DIR	5000	202	39 45	9.2
* DIR	5000	203	39 75	78.8
DIR	5000	ASEB	39 60	44.0
* DIR	5000	204	39 53	77.2
* DIR	5000	205	39 66	41.3
DIR	5000	ASEB_2GHz	39 60	9.2
DSET AH				
DIR	4000	10000	0 0	0.0
DIR	4000	20000	79 8	71.1
DIR	4000	5000	260 1	58.1
DIR	4000	3000	291 0	1.5
DIR	4000	1000	297 80	68.8
DIR	4000	2000	321 47	58.3
DIR	4000	102	306 17	92.0
* DIR	4000	103	305 56	83.0
* DIR	4000	104	306 78	36.9
DIR	4000	ASCG_BCR	306 17	59.9
DIR	4000	ASCG	306 17	76.7
DIR	4000	101	306 17	76.7
* DIR	4000	202	276 3	56.1
* DIR	4000	203	276 29	15.3
DIR	4000	ASEB	276 16	35.7
* DIR	4000	204	276 11	73.4
* DIR	4000	205	276 22	37.5
DIR	4000	ASEB_2GHz	276 17	5.4
DIR	4000	ASEB_marker	276 16	40.0
DIR	4000	201	276 16	49.8
*very windy				
*DSET BH				
*DIR	5000	10000	0 0	0.0
*DIR	5000	2000	387 49	42.0
*DIR	5000	301	244 83	54.9
DSET BH				
DIR	6000	10000	0 0	0.0
DIR	6000	3000	0 52	9.0
DIR	6000	2000	386 31	68.3
DIR	6000	1000	363 66	33.6
DIR	6000	102	391 87	28.9
DIR	6000	301	272 2	52.7
DIR	6000	201	13 43	28.9
DSET BH				
DIR	7000	2000	0 0	0.0
DIR	7000	3000	30 6	72.1
DIR	7000	102	15 40	89.4
DIR	7000	201	41 60	92.5
DIR	7000	301	178 54	70.1

12

HIST GEN Tours d'horizon

Zenithales

SIGM ZA 8.0
SIGM ZC 15.0
SIGM ZB 20.0
HIST NEW

* ZANG ZA	1000	10000	95 27	99.8
ZANG ZA	1000	2000	104 10	12.3
ZANG ZA	1000	3000	104 34	7.4
ZANG ZA	1000	4000	101 44	51.0
ZANG ZA	1000	5000	103 1	35.5
* ZANG ZA	1000	20000	100 74	64.1
ZANG ZA	1000	ASCG	104 66	3.7
ZANG ZA	1000	101	103 56	51.1
ZANG ZA	1000	102	103 7	27.0
* ZANG ZA	1000	103	102 22	82.0
* ZANG ZA	1000	104	102 23	50.3
ZANG ZC	1000	ASCG_BCR	102 23	16.1
ZANG ZA	1000	ASEB_marker	104 65	62.3
ZANG ZA	1000	201	103 98	50.9
* ZANG ZA	1000	202	100 97	69.2
* ZANG ZA	1000	203	100 97	53.7
ZANG ZA	1000	ASEB	100 97	61.4
* ZANG ZA	1000	204	99 37	16.9
* ZANG ZA	1000	205	99 37	17.6
ZANG ZB	1000	ASEB_2GHz	99 37	17.2
* ZANG ZA	2000	10000	95 21	65.3
ZANG ZA	2000	1000	95 89	73.1
ZANG ZA	2000	4000	99 82	8.8
ZANG ZA	2000	3000	101 13	66.9
* ZANG ZA	2000	20000	100 48	53.3
ZANG ZA	2000	5000	100 15	4.1
ZANG ZA	2000	102	98 11	6.6
* ZANG ZA	2000	103	96 75	2.7
* ZANG ZA	2000	104	96 76	56.1
ZANG ZA	2000	ASCG_BCR	96 75	79.4

Ascension ITRF co-location site survey – July 2015

ZANG ZA 2000	ASCG	100 65	77.3
ZANG ZA 2000	101	98 89	92.2
* ZANG ZA 2000	202	98 18	74.5
* ZANG ZA 2000	203	98 18	52.6
ZANG ZA 2000	ASEB	98 18	63.5
* ZANG ZA 2000	204	96 41	67.9
* ZANG ZA 2000	205	96 41	64.0
ZANG ZB 2000	ASEB_2GHz	96 41	66.0
ZANG ZA 2000	ASEB_marker	102 25	80.2
ZANG ZA 2000	201	101 51	44.7
* ZANG ZA 3000	10000	95 23	87.2
* ZANG ZA 3000	20000	100 42	69.7
ZANG ZA 3000	4000	98 86	35.7
ZANG ZA 3000	5000	99 8	5.5
ZANG ZA 3000	1000	95 65	71.0
ZANG ZA 3000	2000	98 86	12.1
ZANG ZA 3000	102	94 86	88.9
* ZANG ZA 3000	103	93 10	0.7
* ZANG ZA 3000	104	93 8	19.1
ZANG ZA 3000	ASCG_BCR	93 9	9.9
ZANG ZA 3000	ASCG	98 23	49.2
ZANG ZA 3000	101	95 90	91.6
* ZANG ZA 3000	202	90 28	85.9
* ZANG ZA 3000	203	90 28	70.5
ZANG ZB 3000	ASEB	90 28	78.2
* ZANG ZA 3000	204	84 46	48.9
* ZANG ZA 3000	205	84 46	45.8
*ZANG ZB 3000	ASEB_2GHz	84 46	47.3
ZANG ZA 3000	ASEB_marker	105 19	23.4
ZANG ZA 3000	201	102 46	20.1
* ZANG ZA 5000	10000	95 31	10.8
ZANG ZA 5000	1000	96 98	61.4
ZANG ZA 5000	2000	99 84	96.5
ZANG ZA 5000	102	98 93	16.9
* ZANG ZA 5000	103	98 32	5.9
* ZANG ZA 5000	104	98 31	47.9
ZANG ZA 5000	ASCG_BCR	98 31	76.9
ZANG ZA 5000	3000	100 91	68.4
ZANG ZA 5000	4000	99 67	17.1
ZANG ZA 5000	ASCG	100 8	55.1
ZANG ZA 5000	101	99 28	80.8
* ZANG ZA 5000	20000	100 43	69.9
ZANG ZA 5000	ASEB_marker	103 11	45.9
ZANG ZC 5000	201	101 99	40.3
* ZANG ZA 5000	202	96 95	81.5
* ZANG ZA 5000	203	96 96	4.6
ZANG ZA 5000	ASEB	96 95	93.0
* ZANG ZA 5000	204	94 28	2.1
* ZANG ZA 5000	205	94 28	13.9
*ZANG ZA 5000	ASEB_2GHz	94 28	8.0
* ZANG ZA 4000	10000	95 23	31.4
* ZANG ZA 4000	20000	100 56	21.6
ZANG ZA 4000	5000	100 32	93.4
ZANG ZC 4000	3000	101 13	33.8
ZANG ZA 4000	1000	98 55	38.3
ZANG ZA 4000	2000	100 17	96.0
ZANG ZA 4000	102	99 53	75.5
* ZANG ZA 4000	103	99 4	70.3
* ZANG ZA 4000	104	99 4	45.6
ZANG ZA 4000	ASCG_BCR	99 4	57.9
ZANG ZA 4000	ASCG	100 46	5.9
ZANG ZA 4000	101	99 82	20.8
* ZANG ZA 4000	202	98 4	61.8
* ZANG ZA 4000	203	98 4	61.4
ZANG ZA 4000	ASEB	98 4	61.6
* ZANG ZA 4000	204	95 81	27.9
* ZANG ZA 4000	205	95 81	24.7
ZANG ZB 4000	ASEB_2GHz	95 81	26.3
ZANG ZA 4000	ASEB_marker	103 17	6.8
ZANG ZA 4000	201	102 23	41.7
* ZANG ZA 5000	10000	95 34	9.4
ZANG ZB 5000	2000	99 85	22.6
ZANG ZB 5000	301	99 71	70.0
*ZANG ZA 6000	10000	95 37	44.7
ZANG ZA 6000	3000	99 37	35.2
ZANG ZA 6000	2000	99 14	80.7
ZANG ZA 6000	1000	97 11	43.4
ZANG ZA 6000	102	98 39	63.7
ZANG ZA 6000	301	98 43	17.6
ZANG ZA 6000	201	99 89	69.6
ZANG ZA 7000	2000	100 67	0.1
ZANG ZA 7000	3000	101 42	62.3
ZANG ZA 7000	102	100 20	35.4
ZANG ZB 7000	201	101 79	58.9
ZANG ZA 7000	301	101 3	74.1

HIST GEN Zénithales

Distances

SIGM DP 0.0010

HIST NEW

DIST DP	1000	2000	12.01546
DIST DP	1000	3000	14.67570
DIST DP	1000	4000	31.03253
DIST DP	1000	5000	17.47489
DIST DP	1000	101	11.58866
DIST DP	1000	102	11.58511
DIST DP	1000	201	18.85370
DIST DP	2000	1000	12.01557
DIST DP	2000	4000	24.81270
DIST DP	2000	3000	12.65943
DIST DP	2000	5000	22.59977
DIST DP	2000	102	7.23550
DIST DP	2000	101	7.23325
DIST DP	2000	201	17.04219
DIST DP	3000	4000	16.58735
DIST DP	3000	5000	12.02048
DIST DP	3000	1000	14.67562
DIST DP	3000	2000	12.65934
DIST DP	3000	102	5.47793
DIST DP	3000	101	5.47193
DIST DP	3000	201	4.63467
DIST DP	5000	1000	17.47476
DIST DP	5000	2000	22.59974
DIST DP	5000	102	15.94964
DIST DP	5000	3000	12.02058
DIST DP	5000	4000	23.84026
DIST DP	5000	101	15.94849
DIST DP	5000	201	11.26982
DIST DP	4000	5000	23.84013
DIST DP	4000	3000	16.58731
DIST DP	4000	1000	31.03249
DIST DP	4000	2000	24.81254
DIST DP	4000	102	19.92087
DIST DP	4000	101	19.92167
DIST DP	4000	201	13.54041
DIST DP	5000	2000	22.59975
DIST DP	5000	301	23.78347
DIST DP	6000	3000	21.38293
DIST DP	6000	2000	32.59489
DIST DP	6000	1000	26.72761
DIST DP	6000	102	25.82269
DIST DP	6000	301	19.85000
DIST DP	6000	201	19.24419
DIST DP	7000	2000	27.64242
DIST DP	7000	3000	23.13725
DIST DP	7000	102	23.92127
DIST DP	7000	201	24.77568
DIST DP	7000	301	14.66512

HIST GEN Distances

HIST ALL Toutes les observations

END

6.6. Adjustment output file

```
=====
                ASCG (ASCENSION) REGINA-DORIS TIES - JULY 2015 SURVEY
Microsearch GeoLab, V2001.9.20.0                GRS 80                UNITS: m,GRAD
=====
Thu Jun 16 16:41:31 2016

Input file:  ..\ASCG.iob
Output file: ..\ASCG.lst
Options file: ..\default.gpj

Geoid File:  ..\Geoids\egm08.gsp
=====
```

PARAMETERS		OBSERVATIONS	
Description	Number	Description	Number
No. of Stations	22	Directions	81
Coord Parameters	66	Distances	48
Free Latitudes	22	Azimuths	0
Free Longitudes	22	Vertical Angles	0
Free Heights	22	Zenithal Angles	71
Fixed Coordinates	0	Angles	0
Astro. Latitudes	0	Heights	0
Astro. Longitudes	0	Height Differences	0
Geoid Records	0	Auxiliary Params.	0
All Aux. Pars.	7	2-D Coords.	0
Direction Pars.	7	2-D Coord. Diffs.	0
Scale Parameters	0	3-D Coords.	3
Constant Pars.	0	3-D Coord. Diffs.	27
Rotation Pars.	0		
Translation Pars.	0		
	-----		-----
Total Parameters	73	Total Observations	230
Degrees of Freedom =		157	

```
=====
                SUMMARY OF SELECTED OPTIONS
=====
```

OPTION	SELECTION
Computation Mode	Adjustment
Maximum Iterations	15
Convergence Criterion	0.00010
Residual Rejection Criterion	Tau Max
Confidence Region Types	1D 2D 3D Station
Variance Factor (VF) Known	Yes
Scale Covariance Matrix With VF	Yes
Scale Residual Variances With VF	No
Force Convergence in Max Iters	No
Distances Contribute To Heights	No
Compute Full Inverse	Yes
Optimize Band Width	Yes
Generate Initial Coordinates	Yes
Re-Transform Obs After 1st Pass	Yes
Geoid Interpolation Method	Bi-Quadratic

```
=====
```

Ascension ITRF co-location site survey – July 2015

=====										
ASCG (ASCENSION) REGINA-DORIS TIES - JULY 2015 SURVEY										
Microsearch GeoLab, V2001.9.20.0 GRS 80 UNITS: m,GRAD										
=====										
Adjusted PLH Coordinates:										
CODE	FFF	STATION			LATITUDE STD DEV			LONGITUDE STD DEV	ELIP-HEIGHT STD DEV	
----	---	-----			-----			-----	-----	
PLH	000	1000	S	7 54	58.88711	W 14 19	57.33439	38.8016 m	0	
					0.0011		0.0011	0.0011		
PLH	000	10000	S	7 55	18.28250	W 14 20	36.09125	138.1817 m	0	
					0.0016		0.0016	0.3489		
PLH	000	101	S	7 54	58.61169	W 14 19	57.59211	38.1529 m	0	
					0.0011		0.0011	0.0011		
PLH	000	102	S	7 54	58.61165	W 14 19	57.59213	38.2425 m	0	
					0.0011		0.0011	0.0011		
PLH	000	2000	S	7 54	58.81069	W 14 19	57.71827	38.0278 m	0	
					0.0011		0.0011	0.0011		
PLH	000	20000	S	7 54	54.40184	W 14 20	1.69855	36.8114 m	0	
					0.0021		0.0021	0.3489		
PLH	000	201	S	7 54	58.29865	W 14 19	57.50464	37.6222 m	0	
					0.0011		0.0011	0.0011		
PLH	000	3000	S	7 54	58.44848	W 14 19	57.52135	37.8014 m	0	
					0.0011		0.0011	0.0011		
PLH	000	301	S	7 54	58.52819	W 14 19	56.38463	38.0802 m	0	
					0.0019		0.0013	0.0011		
PLH	000	4000	S	7 54	58.01225	W 14 19	57.84031	38.0975 m	0	
					0.0011		0.0011	0.0011		
PLH	000	5000	S	7 54	58.35269	W 14 19	57.14089	37.9747 m	0	
					0.0011		0.0011	0.0011		
PLH	000	6000	S	7 54	58.13457	W 14 19	56.89831	37.5912 m	0	
					0.0014		0.0013	0.0011		
PLH	000	7000	S	7 54	58.72719	W 14 19	56.81978	38.3192 m	0	
					0.0016		0.0013	0.0011		
PLH	000	ASCG	S	7 54	58.61168	W 14 19	57.59211	37.9530 m	0	
					0.0011		0.0011	0.0011		
PLH	000	ASCG_ARP	S	7 54	58.61165	W 14 19	57.59211	38.3611 m	0	
					0.0011		0.0011	0.0011		
PLH	000	ASCG_BCR	S	7 54	58.61166	W 14 19	57.59210	38.3964 m	0	
					0.0011		0.0011	0.0011		
PLH	000	ASDB	S	7 54	58.52825	W 14 19	56.38473	38.4292 m	0	
					0.0031		0.0028	0.0018		
PLH	000	ASDB_marker	S	7 54	58.52819	W 14 19	56.38463	37.8812 m	0	
					0.0029		0.0026	0.0014		
PLH	000	ASEB	S	7 54	58.29864	W 14 19	57.50465	38.5132 m	0	
					0.0011		0.0011	0.0011		
PLH	000	ASEB_2GHz	S	7 54	58.29865	W 14 19	57.50470	38.9881 m	0	
					0.0011		0.0011	0.0012		
PLH	000	ASEB_marker	S	7 54	58.29864	W 14 19	57.50465	37.4229 m	0	
					0.0011		0.0011	0.0011		
PLH	000	POL18	S	7 53	34.38514	W 14 23	8.79435	22.8021 m	0	
					0.0011		0.0011	0.0012		

=====										
ASCG (ASCENSION) REGINA-DORIS TIES - JULY 2015 SURVEY										
Microsearch GeoLab, V2001.9.20.0 GRS 80 UNITS: m,GRAD										
=====										
Adjusted PLO Coordinates:										
CODE	FFF	STATION			LATITUDE STD DEV			LONGITUDE STD DEV	O-HEIGHT STD DEV	
----	---	-----			-----			-----	-----	
PLO	000	1000	S	7 54	58.88711	W 14 19	57.33439	23.8531 m	0	
					0.0011		0.0011	0.0011		
PLO	000	10000	S	7 55	18.28250	W 14 20	36.09125	123.1983 m	0	
					0.0016		0.0016	0.3489		
PLO	000	101	S	7 54	58.61169	W 14 19	57.59211	23.2044 m	0	
					0.0011		0.0011	0.0011		
PLO	000	102	S	7 54	58.61165	W 14 19	57.59213	23.2940 m	0	
					0.0011		0.0011	0.0011		
PLO	000	2000	S	7 54	58.81069	W 14 19	57.71827	23.0793 m	0	
					0.0011		0.0011	0.0011		
PLO	000	20000	S	7 54	54.40184	W 14 20	1.69855	21.8629 m	0	
					0.0021		0.0021	0.3489		
PLO	000	201	S	7 54	58.29865	W 14 19	57.50464	22.6737 m	0	
					0.0011		0.0011	0.0011		
PLO	000	3000	S	7 54	58.44848	W 14 19	57.52135	22.8529 m	0	
					0.0011		0.0011	0.0011		
PLO	000	301	S	7 54	58.52819	W 14 19	56.38463	23.1324 m	0	
					0.0019		0.0013	0.0011		
PLO	000	4000	S	7 54	58.01225	W 14 19	57.84031	23.1490 m	0	
					0.0011		0.0011	0.0011		

Ascension ITRF co-location site survey – July 2015

Adjusted PLO Coordinates:									
CODE	FFF	STATION			LATITUDE STD DEV			LONGITUDE STD DEV	O-HEIGHT STD DEV
PLO	000	5000	S	7 54	58.35269	W 14 19	57.14089	23.0262 m	0
					0.0011		0.0011	0.0011	
PLO	000	6000	S	7 54	58.13457	W 14 19	56.89831	22.6434 m	0
					0.0014		0.0013	0.0011	
PLO	000	7000	S	7 54	58.72719	W 14 19	56.81978	23.3714 m	0
					0.0016		0.0013	0.0011	
PLO	000	ASCG	S	7 54	58.61168	W 14 19	57.59211	23.0045 m	0
					0.0011		0.0011	0.0011	
PLO	000	ASCG_ARP	S	7 54	58.61165	W 14 19	57.59211	23.4126 m	0
					0.0011		0.0011	0.0011	
PLO	000	ASCG_BCR	S	7 54	58.61166	W 14 19	57.59210	23.4479 m	0
					0.0011		0.0011	0.0011	
PLO	000	ASDB	S	7 54	58.52825	W 14 19	56.38473	23.4814 m	0
					0.0031		0.0028	0.0018	
PLO	000	ASDB_marker	S	7 54	58.52819	W 14 19	56.38463	22.9334 m	0
					0.0029		0.0026	0.0014	
PLO	000	ASEB	S	7 54	58.29864	W 14 19	57.50465	23.5647 m	0
					0.0011		0.0011	0.0011	
PLO	000	ASEB_2GHz	S	7 54	58.29865	W 14 19	57.50470	24.0396 m	0
					0.0011		0.0011	0.0012	
PLO	000	ASEB_marker	S	7 54	58.29864	W 14 19	57.50465	22.4744 m	0
					0.0011		0.0011	0.0011	
PLO	000	POL18	S	7 53	34.38514	W 14 23	8.79435	7.8948 m	0
					0.0011		0.0011	0.0012	

ASCG (ASCENSION) REGINA-DORIS TIES - JULY 2015 SURVEY									
Microsearch GeoLab, V2001.9.20.0					GRS 80		UNITS: m,GRAD		
=====									
Adjusted XYZ Coordinates:									
CODE	FFF	STATION	X-COORDINATE		Y-COORDINATE		Z-COORDINATE		
----	----	-----	STD DEV		STD DEV		STD DEV		
XYZ		1000	6121153.1887		-1563971.1948		-872623.8535	m	
			0.0011		0.0011		0.0011		
XYZ		10000	6120875.0427		-1565125.3711		-873227.7159	m	
			0.3348		0.0856		0.0481		
XYZ		101	6121151.7411		-1563978.9725		-872615.3834	m	
			0.0011		0.0011		0.0011		
XYZ		102	6121151.8271		-1563978.9951		-872615.3947	m	
			0.0011		0.0011		0.0011		
XYZ		2000	6121149.8486		-1563982.4774		-872621.4215	m	
			0.0011		0.0011		0.0011		
XYZ		20000	6121136.5723		-1564104.9163		-872487.0996	m	
			0.3348		0.0856		0.0481		
XYZ		201	6121153.1783		-1563976.5745		-872605.7850	m	
			0.0011		0.0011		0.0011		
XYZ		3000	6121152.6094		-1563976.9573		-872610.3690	m	
			0.0011		0.0011		0.0011		
XYZ		301	6121161.1690		-1563943.2088		-872612.8328	m	
			0.0012		0.0013		0.0019		
XYZ		4000	6121152.2632		-1563986.9525		-872597.1360	m	
			0.0011		0.0011		0.0011		
XYZ		5000	6121156.0531		-1563965.8095		-872607.4780	m	
			0.0011		0.0011		0.0011		
XYZ		6000	6121158.4186		-1563958.7450		-872600.7881	m	
			0.0011		0.0013		0.0014		
XYZ		7000	6121157.2832		-1563955.9726		-872618.9209	m	
			0.0012		0.0013		0.0016		
XYZ		ASCG	6121151.5493		-1563978.9235		-872615.3556	m	
			0.0011		0.0011		0.0011		
XYZ		ASCG_ARP	6121151.9410		-1563979.0235		-872615.4111	m	
			0.0011		0.0011		0.0011		
XYZ		ASCG_BCR	6121151.9749		-1563979.0319		-872615.4160	m	
			0.0011		0.0011		0.0011		
XYZ		ASDB	6121161.5030		-1563943.2973		-872612.8827	m	
			0.0019		0.0027		0.0031		
XYZ		ASDB_marker	6121160.9781		-1563943.1600		-872612.8054	m	
			0.0016		0.0025		0.0029		
XYZ		ASEB	6121154.0333		-1563976.7934		-872605.9075	m	
			0.0011		0.0011		0.0011		
XYZ		ASEB_2GHz	6121154.4886		-1563976.9113		-872605.9733	m	
			0.0012		0.0011		0.0011		
XYZ		ASEB_marker	6121152.9870		-1563976.5259		-872605.7575	m	
			0.0011		0.0011		0.0011		
XYZ		POL18	6120029.3034		-1569737.0844		-870050.3291	m	
			0.0012		0.0011		0.0011		

Ascension ITRF co-location site survey – July 2015

=====						
ASCG (ASCENSION) REGINA-DORIS TIES - JULY 2015 SURVEY						
Microsearch GeoLab, V2001.9.20.0 GRS 80 UNITS: m,GRAD						
=====						
Geoid Values:						
CODE	STATION	N/S DEFLECTION		E/W DEFLECTION		UNDULATION
----	-----	-----	-----	-----	-----	-----
GEOI	1000	0 0	4.62	0 0	4.84	14.9485 m
GEOI	10000	0 0	2.67	0 0	3.59	14.9834 m
GEOI	101	0 0	4.62	0 0	4.84	14.9485 m
GEOI	102	0 0	4.62	0 0	4.84	14.9485 m
GEOI	2000	0 0	4.62	0 0	4.84	14.9485 m
GEOI	20000	0 0	4.84	0 0	4.96	14.9485 m
GEOI	201	0 0	4.62	0 0	4.84	14.9485 m
GEOI	3000	0 0	4.62	0 0	4.84	14.9485 m
GEOI	301	0 0	4.63	0 0	4.87	14.9478 m
GEOI	4000	0 0	4.62	0 0	4.84	14.9485 m
GEOI	5000	0 0	4.62	0 0	4.84	14.9485 m
GEOI	6000	0 0	4.63	0 0	4.87	14.9478 m
GEOI	7000	0 0	4.63	0 0	4.87	14.9478 m
GEOI	ASCG	0 0	4.62	0 0	4.84	14.9485 m
GEOI	ASCG_ARP	0 0	4.62	0 0	4.84	14.9485 m
GEOI	ASCG_BCR	0 0	4.62	0 0	4.84	14.9485 m
GEOI	ASDB	0 0	4.63	0 0	4.87	14.9478 m
GEOI	ASDB_marker	0 0	4.63	0 0	4.87	14.9478 m
GEOI	ASEB	0 0	4.62	0 0	4.84	14.9485 m
GEOI	ASEB_2GHz	0 0	4.62	0 0	4.84	14.9485 m
GEOI	ASEB_marker	0 0	4.62	0 0	4.84	14.9485 m
GEOI	POL18	0 0	9.27	- 0 0	2.02	14.9073 m

=====						
ASCG (ASCENSION) REGINA-DORIS TIES - JULY 2015 SURVEY						
Microsearch GeoLab, V2001.9.20.0 GRS 80 UNITS: m,GRAD						
=====						
Residuals (critical value = 3.794):						
NOTE: Observation values shown are reduced to mark-to-mark.						
TYPE AT	FROM	TO	OBSERVATION	RESIDUAL	STD RES	
----	-----	-----	STD DEV	STD DEV	PPM	
XCT	ASCG_ARP		6121151.94100	-0.0000	-0.0000	
			0.0010	0.0000		*
YCT	ASCG_ARP		-1563979.02350	-0.0000	-0.0000	
			0.0010	0.0000		*
ZCT	ASCG_ARP		-872615.41110	-0.0000	-0.0000	
			0.0010	0.0000		*
ELAT	ASCG_ARP	10000	0 00 19.67084	-0.0001	-0.0001	
			0.0010	0.0000	0.09*	
ELON	ASCG_ARP	10000	0 00 38.49915	0.0001	0.0001	
			0.0010	0.0000	0.05*	
EHGT	ASCG_ARP	10000	99.82060	0.0000	0.0000	
			0.3162	0.0000	0.00*	
ELAT	ASCG_ARP	20000	0 00 4.20973	0.0027	2.4924	
			0.0020	0.0011	15.21	
ELON	ASCG_ARP	20000	0 00 4.10654	0.0028	2.7417	
			0.0020	0.0010	15.60	
EHGT	ASCG_ARP	20000	-1.54970	-0.0000	-0.0243	
			0.3162	0.0005	0.07	
ELAT	ASCG_BCR	ASCG_ARP	0 00 0.00000	0.0001	0.7163	
			0.0002	0.0001	1988.10	
ELON	ASCG_BCR	ASCG_ARP	0 00 0.00000	-0.0002	-2.3822	
			0.0002	0.0001	7001.14	
EHGT	ASCG_BCR	ASCG_ARP	-0.03500	-0.0003	-1.5650	
			0.0003	0.0002	9032.21	
ELAT	ASCG_ARP	102	0 00 0.00000	0.0001	0.4856	
			0.0003	0.0002	1002.45	
ELON	ASCG_ARP	102	0 00 0.00000	-0.0007	-2.6840	
			0.0003	0.0003	5859.78	
EHGT	ASCG_ARP	102	-0.11820	-0.0004	-1.5650	
			0.0003	0.0002	2989.83	
ELAT	101	ASCG	0 00 0.00000	0.0003	0.1478	
			0.0020	0.0020	1472.97	
ELON	101	ASCG	0 00 0.00000	0.0001	0.0301	
			0.0020	0.0020	300.77	
EHGT	101	ASCG	-0.20000	0.0001	0.1078	
			0.0008	0.0008	416.22	
ELAT	201	ASEB_marker	0 00 0.00000	0.0000	0.0230	
			0.0020	0.0020	230.18	
ELON	201	ASEB_marker	0 00 0.00000	-0.0002	-0.1069	
			0.0020	0.0020	1071.39	
EHGT	201	ASEB_marker	-0.19900	-0.0003	-0.4195	
			0.0008	0.0008	1623.50	
ELAT	301	ASDB_marker	0 00 0.00000	-0.0000	-0.0000	
			0.0020	0.0000	0.00*	
ELON	301	ASDB_marker	0 00 0.00000	-0.0000	-0.0000	
			0.0020	0.0000	0.00*	

Ascension ITRF co-location site survey – July 2015

=====						
Residuals (critical value = 3.794):						
NOTE: Observation values shown are reduced to mark-to-mark.						
TYPE AT	FROM	TO	OBSERVATION STD DEV	RESIDUAL STD DEV	STD RES PPM	
-----	-----	-----	-----	-----	-----	-----
			0.0020	0.0000	0.00*	
EHGT	301	ASDB_marker	-0.19900	-0.0000	-0.0000	
			0.0008	0.0000	0.00*	
ELAT	ASDB_marker	ASDB	0 00 0.00006	0.0000	0.0000	
			0.0010	0.0000	0.00*	
ELON	ASDB_marker	ASDB	0 00 0.00010	-0.0000	-0.0000	
			0.0010	0.0000	0.00*	
EHGT	ASDB_marker	ASDB	0.54800	0.0000	0.0000	
			0.0010	0.0000	0.00*	
GROUP: Obs #00001 tide_gauge.asc						
DXCT	ASCG_ARP	POL18	-1122.63760	0.0000	0.0000	
			0.0005	0.0000	0.00*	
DYCT	ASCG_ARP	POL18	-5758.06090	0.0000	0.0000	
			0.0003	0.0000	0.00*	
DZCT	ASCG_ARP	POL18	2565.08200	0.0000	0.0000	
			0.0002	0.0000	0.00*	
DIR	1000	10000	0 0 0.0	3.0	0.5	
			8.0	6.6		
DIR	1000	2000	42 16 42.5	-7.3	-1.3	
			8.0	5.7		
DIR	1000	3000	104 3 46.2	-1.8	-0.2	
			8.0	7.2		
DIR	1000	4000	96 32 6.2	-1.0	-0.1	
			8.0	7.3		
DIR	1000	5000	151 67 16.9	-4.8	-0.8	
			8.0	6.1		
DIR	1000	20000	80 58 29.6	-4.1	-0.6	
			8.0	6.7		
DIR	1000	ASCG	81 82 63.5	-5.2	-1.3	
			8.0	4.2		
DIR	1000	101	81 82 39.3	5.2	1.2	
			8.0	4.4		
DIR	1000	102	81 82 59.4	3.4	0.7	
			8.0	4.9		
DIR	1000	ASCG_BCR	81 82 93.9	-0.6	-0.1	
			8.0	4.6		
DIR	1000	ASEB_marker	111 73 77.5	-0.9	-0.1	
			8.0	7.3		
DIR	1000	201	111 73 77.3	5.6	0.8	
			8.0	7.3		
DIR	1000	ASEB	111 73 66.9	3.0	0.4	
			8.0	7.3		
DIR	1000	ASEB_2GHz	111 73 10.6	5.7	0.8	
			8.0	7.3		
DIR	2000	10000	0 0 0.0	1.0	0.2	
			8.0	6.7		
DIR	2000	1000	242 51 91.8	0.6	0.1	
			8.0	5.4		
DIR	2000	4000	120 34 50.3	-4.4	-0.7	
			8.0	6.6		
DIR	2000	3000	161 59 63.3	-14.1	-1.9	
			8.0	7.5		
DIR	2000	20000	83 31 69.3	-9.1	-1.4	
			8.0	6.6		
DIR	2000	5000	187 18 78.7	1.0	0.1	
			8.0	7.0		
DIR	2000	102	165 84 76.0	-2.2	-0.4	
			8.0	5.9		
DIR	2000	ASCG_BCR	165 85 44.3	8.4	1.4	
			8.0	5.9		
DIR	2000	ASCG	165 85 59.0	1.6	0.3	
			8.0	5.8		
DIR	2000	101	165 85 63.2	6.7	1.1	
			8.0	5.8		
DIR	2000	ASEB	155 6 61.8	-4.6	-0.6	
			8.0	7.2		
DIR	2000	ASEB_2GHz	155 5 98.2	12.8	1.8	
			8.0	7.2		
DIR	2000	ASEB_marker	155 6 69.1	-1.9	-0.3	
			8.0	7.2		
DIR	2000	201	155 6 70.9	4.2	0.6	
			8.0	7.2		
DIR	3000	10000	0 0 0.0	5.0	0.7	
			8.0	6.9		
DIR	3000	20000	79 39 99.3	8.4	1.3	
			8.0	6.7		
DIR	3000	4000	90 21 43.2	-2.2	-0.4	
			8.0	6.2		
DIR	3000	5000	214 56 91.7	-5.3	-1.0	
			8.0	5.4		

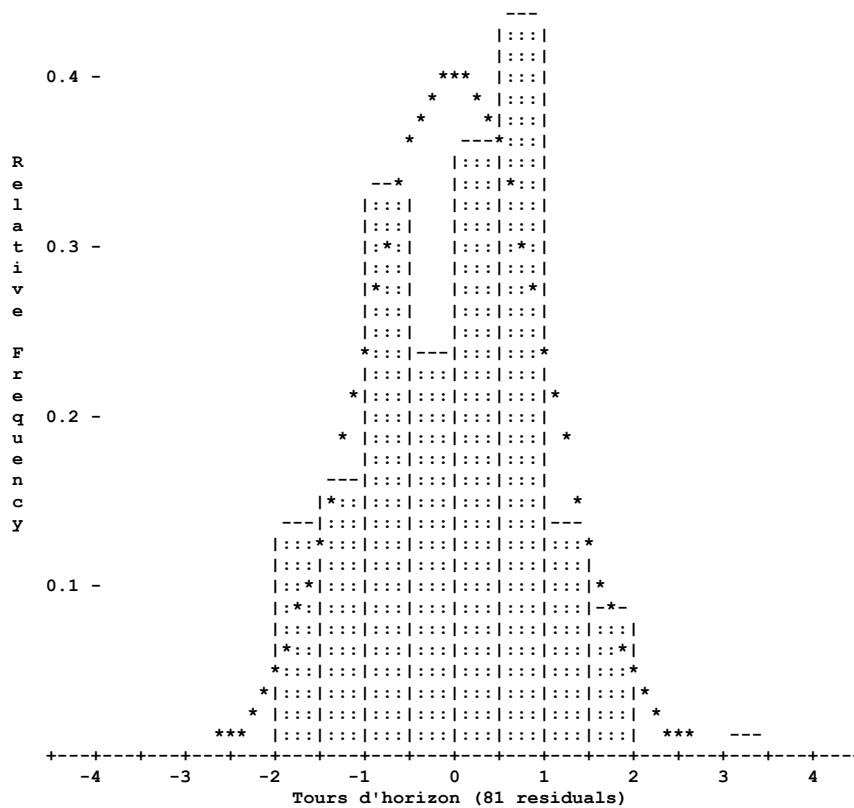
Ascension ITRF co-location site survey – July 2015

Residuals (critical value = 3.794):						
NOTE: Observation values shown are reduced to mark-to-mark.						
TYPE AT	FROM	TO	OBSERVATION STD DEV	RESIDUAL STD DEV	STD RES	PPM
DIR	3000	1000	304 73	43.8	1.0	0.2
				8.0	6.1	
DIR	3000	2000	361 93	98.8	-6.5	-0.9
				8.0	7.1	
DIR	3000	102	356 30	45.7	-4.0	-0.8
				8.0	4.8	
DIR	3000	ASCG_BCR	356 29	24.6	7.8	1.6
				8.0	4.8	
DIR	3000	ASCG	356 29	37.9	-3.6	-0.8
				8.0	4.7	
DIR	3000	101	356 29	24.2	3.2	0.7
				8.0	4.7	
DIR	3000	ASEB	137 35	78.9	2.6	1.0
				8.0	2.6	
DIR	3000	ASEB_2GHz	137 33	84.2	-3.9	-1.5
				8.0	2.6	
DIR	3000	ASEB_marker	137 36	14.8	1.4	0.5
				8.0	2.7	
DIR	3000	201	137 36	49.6	-4.1	-1.5
				8.0	2.8	
DIR	5000	10000	0 0	0.0	3.5	0.5
				8.0	6.4	
DIR	5000	1000	352 24	21.0	-4.4	-0.7
				8.0	6.0	
DIR	5000	2000	387 40	39.9	-13.0	-1.8
				8.0	7.3	
DIR	5000	102	396 93	72.6	-1.2	-0.2
				8.0	6.9	
DIR	5000	ASCG_BCR	396 93	40.5	5.6	0.8
				8.0	6.8	
DIR	5000	3000	14 43	90.0	0.4	0.1
				8.0	6.6	
DIR	5000	4000	59 10	7.1	-12.9	-1.9
				8.0	6.7	
DIR	5000	ASCG	396 93	17.3	12.9	1.9
				8.0	6.7	
DIR	5000	101	396 93	17.0	4.2	0.6
				8.0	6.8	
DIR	5000	ASEB_marker	39 60	43.1	2.5	0.6
				8.0	4.4	
DIR	5000	201	39 60	52.2	-7.6	-1.6
				8.0	4.7	
DIR	5000	ASEB	39 60	44.0	6.3	1.4
				8.0	4.4	
DIR	5000	ASEB_2GHz	39 60	9.2	3.8	0.9
				8.0	4.4	
DIR	4000	10000	0 0	0.0	4.9	0.7
				8.0	6.6	
DIR	4000	20000	79 8	71.1	-12.1	-1.9
				8.0	6.2	
DIR	4000	5000	260 1	58.1	-4.3	-0.6
				8.0	6.9	
DIR	4000	3000	291 0	1.5	3.1	0.4
				8.0	7.2	
DIR	4000	1000	297 80	68.8	0.4	0.1
				8.0	7.4	
DIR	4000	2000	321 47	58.3	-5.6	-0.8
				8.0	7.0	
DIR	4000	102	306 17	92.0	-4.9	-0.7
				8.0	7.0	
DIR	4000	ASCG_BCR	306 17	59.9	1.9	0.3
				8.0	6.9	
DIR	4000	ASCG	306 17	76.7	1.2	0.2
				8.0	6.9	
DIR	4000	101	306 17	76.7	6.8	1.0
				8.0	6.9	
DIR	4000	ASEB	276 16	35.7	11.3	1.9
				8.0	6.1	
DIR	4000	ASEB_2GHz	276 17	5.4	3.9	0.6
				8.0	6.1	
DIR	4000	ASEB_marker	276 16	40.0	3.9	0.6
				8.0	6.1	
DIR	4000	201	276 16	49.8	-10.5	-1.7
				8.0	6.2	
DIR	6000	10000	0 0	0.0	7.3	0.4
				30.0	20.4	
DIR	6000	3000	0 52	9.0	-11.6	-0.4
				30.0	26.3	
DIR	6000	2000	386 31	68.3	4.6	0.2
				30.0	27.4	

Ascension ITRF co-location site survey – July 2015

Residuals (critical value = 3.794):
NOTE: Observation values shown are reduced to mark-to-mark.

TYPE AT	FROM	TO	OBSERVATION STD DEV	RESIDUAL STD DEV	STD RES PPM
DIR	6000	1000	363 66	33.6 30.0	-26.6 27.0
DIR	6000	102	391 87	28.9 30.0	-10.1 27.2
DIR	6000	301	272 2	52.7 30.0	3.6 13.3
DIR	6000	201	13 43	28.9 30.0	32.9 25.2
DIR	7000	2000	0 0	0.0 32.3	85.7 28.1
DIR	7000	3000	30 6	72.1 30.0	-30.2 25.5
DIR	7000	102	15 40	89.4 30.0	-22.7 25.5
DIR	7000	201	41 60	92.5 30.0	-27.2 25.7
DIR	7000	301	178 54	70.1 30.0	6.3 8.8



ASCG (ASCENSION) REGINA-DORIS TIES - JULY 2015 SURVEY
Microsearch GeoLab, V2001.9.20.0 GRS 80 UNITS: m,GRAD

Residuals (critical value = 3.794):
NOTE: Observation values shown are reduced to mark-to-mark.

TYPE AT	FROM	TO	OBSERVATION STD DEV	RESIDUAL STD DEV	STD RES PPM
ZANG	1000	2000	104 10	12.3 8.0	-18.1 7.4
ZANG	1000	3000	104 34	7.4 8.0	-13.9 7.6
ZANG	1000	4000	101 44	51.0 8.0	2.9 7.8
ZANG	1000	5000	103 1	35.5 8.0	-2.9 7.6
ZANG	1000	ASCG	104 66	3.7 8.0	1.5 7.1
ZANG	1000	101	103 56	51.1 8.0	0.3 7.1

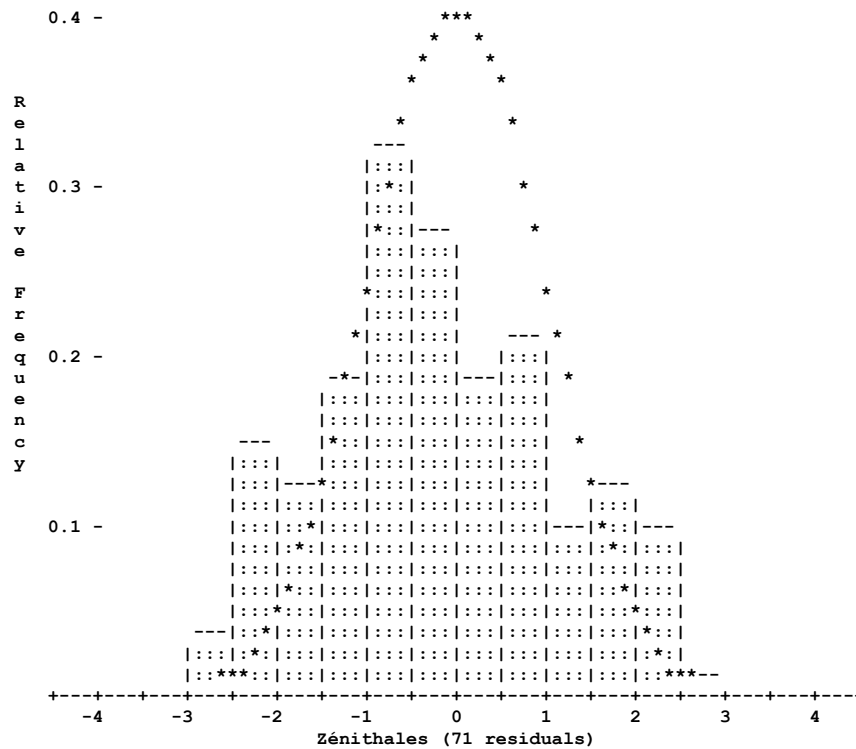
Ascension ITRF co-location site survey – July 2015

Residuals (critical value = 3.794):						
NOTE: Observation values shown are reduced to mark-to-mark.						
TYPE	AT	FROM	TO	OBSERVATION STD DEV	RESIDUAL STD DEV	STD RES PPM
ZANG		1000	102	103 7	27.0 8.0	-4.0 7.1
ZANG		1000	ASCG_BCR	102 23	16.1 15.0	33.1 14.5
ZANG		1000	ASEB_marker	104 65	62.3 8.0	-3.1 7.6
ZANG		1000	201	103 98	50.9 8.0	-1.8 7.6
ZANG		1000	ASEB	100 97	61.4 8.0	4.0 7.4
ZANG		1000	ASEB_2GHz	99 37	17.2 20.0	26.4 17.3
ZANG		2000	1000	95 89	73.1 8.0	2.3 7.4
ZANG		2000	4000	99 82	8.8 8.0	-4.0 7.8
ZANG		2000	3000	101 13	66.9 8.0	-16.6 7.7
ZANG		2000	5000	100 15	4.1 8.0	7.1 7.8
ZANG		2000	102	98 11	6.6 8.0	2.5 6.3
ZANG		2000	ASCG_BCR	96 75	79.4 8.0	-5.4 6.2
ZANG		2000	ASCG	100 65	77.3 8.0	-4.4 6.3
ZANG		2000	101	98 89	92.2 8.0	6.2 6.3
ZANG		2000	ASEB	98 18	63.5 8.0	-2.4 7.3
ZANG		2000	ASEB_2GHz	96 41	66.0 20.0	14.1 16.7
ZANG		2000	ASEB_marker	102 25	80.2 8.0	-12.6 7.7
ZANG		2000	201	101 51	44.7 8.0	-6.6 7.6
ZANG		3000	4000	98 86	35.7 8.0	-2.5 7.6
ZANG		3000	5000	99 8	5.5 8.0	-20.3 7.5
ZANG		3000	1000	95 65	71.0 8.0	-9.1 7.6
ZANG		3000	2000	98 86	12.1 8.0	-5.6 7.7
ZANG		3000	102	94 86	88.9 8.0	-6.5 5.4
ZANG		3000	ASCG_BCR	93 9	9.9 8.0	-7.6 5.1
ZANG		3000	ASCG	98 23	49.2 8.0	9.5 5.3
ZANG		3000	101	95 90	91.6 8.0	-0.7 5.3
ZANG		3000	ASEB	90 28	78.2 20.0	-46.9 16.7
ZANG		3000	ASEB_marker	105 19	23.4 8.0	10.2 4.1
ZANG		3000	201	102 46	20.1 8.0	0.8 3.9
ZANG		5000	1000	96 98	61.4 8.0	-1.9 7.6
ZANG		5000	2000	99 84	96.5 8.0	-8.7 7.8
ZANG		5000	102	98 93	16.9 8.0	8.0 7.5
ZANG		5000	ASCG_BCR	98 31	76.9 8.0	8.4 7.5
ZANG		5000	3000	100 91	68.4 8.0	-7.0 7.5
ZANG		5000	4000	99 67	17.1 8.0	-4.6 7.7
ZANG		5000	ASCG	100 8	55.1 8.0	-10.8 7.5
ZANG		5000	101	99 28	80.8 8.0	-4.8 7.5
ZANG		5000	ASEB_marker	103 11	45.9 8.0	-11.4 7.0
ZANG		5000	201	101 99	40.3 15.0	28.7 14.4
ZANG		5000	ASEB	96 95	93.0 8.0	4.8 6.4

Ascension ITRF co-location site survey – July 2015

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Residuals (critical value = 3.794):						
NOTE: Observation values shown are reduced to mark-to-mark.						
TYPE	AT	FROM	TO	OBSERVATION STD DEV	RESIDUAL STD DEV	STD RES PPM

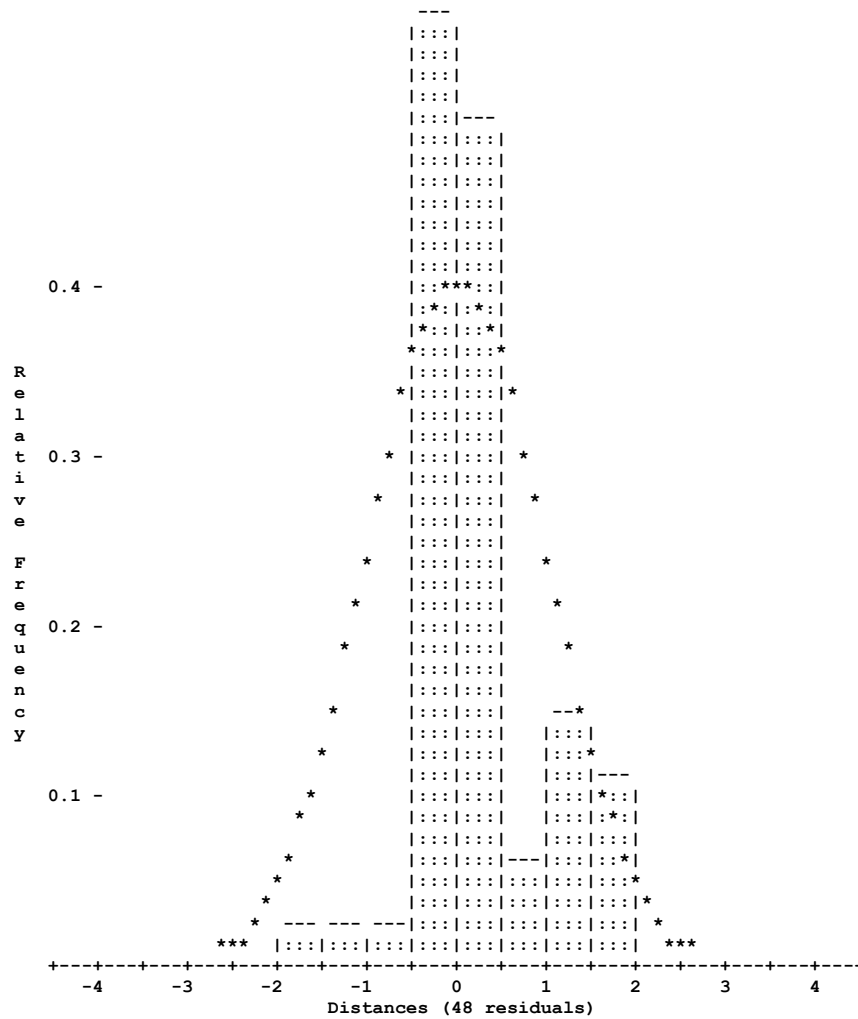
ZANG		4000	5000	100 32	93.4 8.0	12.7 7.7
ZANG		4000	3000	101 13	33.8 15.0	-29.6 14.8
ZANG		4000	1000	98 55	38.3 8.0	-16.7 7.8
ZANG		4000	2000	100 17	96.0 8.0	6.3 7.8
ZANG		4000	102	99 53	75.5 8.0	9.7 7.6
ZANG		4000	ASCG_BCR	99 4	57.9 8.0	8.5 7.6
ZANG		4000	ASCG	100 46	5.9 8.0	-11.8 7.6
ZANG		4000	101	99 82	20.8 8.0	-8.7 7.6
ZANG		4000	ASEB	98 4	61.6 8.0	14.7 6.7
ZANG		4000	ASEB_2GHz	95 81	26.3 20.0	-30.2 14.5
ZANG		4000	ASEB_marker	103 17	6.8 8.0	-2.9 7.1
ZANG		4000	201	102 23	41.7 8.0	-7.4 7.1
ZANG		5000	2000	99 85	22.6 20.0	17.4 19.9
ZANG		5000	301	99 71	70.0 20.0	-5.6 19.3
ZANG		6000	3000	99 37	35.2 8.0	-6.2 7.0
ZANG		6000	2000	99 14	80.7 8.0	6.4 7.6
ZANG		6000	1000	97 11	43.4 8.0	-17.2 7.3
ZANG		6000	102	98 39	63.7 8.0	21.2 7.3
ZANG		6000	301	98 43	17.6 8.0	2.6 5.4
ZANG		6000	201	99 89	69.6 8.0	-4.2 6.7
ZANG		7000	2000	100 67	0.1 8.0	-13.9 7.1
ZANG		7000	3000	101 42	62.3 8.0	13.4 6.8
ZANG		7000	102	100 20	35.4 8.0	-6.7 6.8
ZANG		7000	201	101 79	58.9 20.0	46.3 19.6
ZANG		7000	301	101 3	74.1 8.0	-1.4 4.0

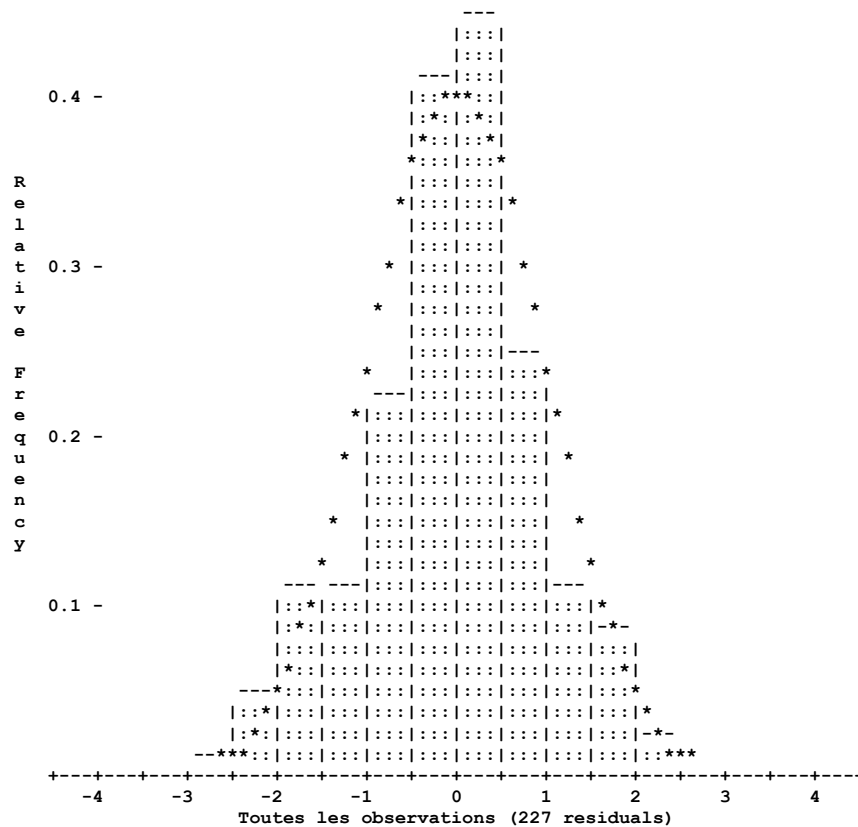


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ASCG (ASCENSION) REGINA-DORIS TIES - JULY 2015 SURVEY						
Microsearch GeoLab, V2001.9.20.0 GRS 80 UNITS: m,GRAD						
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Residuals (critical value = 3.794):						
NOTE: Observation values shown are reduced to mark-to-mark.						
TYPE AT	FROM	TO	OBSERVATION	RESIDUAL	STD RES	
			STD DEV	STD DEV	PPM	
DIST	1000	2000	12.01540	-0.0001	-0.1111	
			0.0010	0.0010	9.11	
DIST	1000	3000	14.67570	-0.0001	-0.0660	
			0.0010	0.0010	4.42	
DIST	1000	4000	31.03250	-0.0005	-0.4835	
			0.0010	0.0010	14.84	
DIST	1000	5000	17.47480	-0.0001	-0.0801	
			0.0010	0.0010	4.49	
DIST	1000	101	11.58860	0.0015	1.5383	
			0.0010	0.0010	130.83	
DIST	1000	102	11.58510	0.0016	1.5827	
			0.0010	0.0010	134.67	
DIST	1000	201	18.85370	-0.0013	-1.2846	
			0.0010	0.0010	66.42	
DIST	2000	1000	12.01550	-0.0002	-0.2127	
			0.0010	0.0010	17.43	
DIST	2000	4000	24.81270	-0.0006	-0.5929	
			0.0010	0.0010	23.10	
DIST	2000	3000	12.65940	-0.0004	-0.4209	
			0.0010	0.0010	32.74	
DIST	2000	5000	22.59970	-0.0002	-0.2393	
			0.0010	0.0010	10.28	
DIST	2000	102	7.23550	0.0007	0.7510	
			0.0010	0.0010	102.30	
DIST	2000	101	7.23320	0.0003	0.3065	
			0.0010	0.0010	41.73	
DIST	2000	201	17.04210	-0.0001	-0.0588	
			0.0010	0.0010	3.38	
DIST	3000	4000	16.58730	-0.0001	-0.0781	
			0.0010	0.0010	4.59	
DIST	3000	5000	12.02040	0.0001	0.0627	
			0.0010	0.0010	5.15	
DIST	3000	1000	14.67560	0.0000	0.0358	
			0.0010	0.0010	2.39	
DIST	3000	2000	12.65930	-0.0003	-0.3193	
			0.0010	0.0010	24.84	
DIST	3000	102	5.47790	0.0013	1.3220	
			0.0010	0.0010	238.25	
DIST	3000	101	5.47190	0.0016	1.6355	
			0.0010	0.0010	294.77	

Ascension ITRF co-location site survey – July 2015

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Residuals (critical value = 3.794):						
NOTE: Observation values shown are reduced to mark-to-mark.						
TYPE AT	FROM	TO	OBSERVATION STD DEV	RESIDUAL STD DEV	STD RES PPM	
-----	-----	-----	-----	-----	-----	-----
DIST	3000	201	4.63460	0.0005	0.4624	
			0.0010	0.0010	98.64	
DIST	5000	1000	17.47470	0.0000	0.0221	
			0.0010	0.0010	1.24	
DIST	5000	2000	22.59970	-0.0002	-0.2393	
			0.0010	0.0010	10.28	
DIST	5000	102	15.94960	0.0001	0.1220	
			0.0010	0.0010	7.49	
DIST	5000	3000	12.02050	-0.0000	-0.0387	
			0.0010	0.0010	3.17	
DIST	5000	4000	23.84020	-0.0002	-0.2017	
			0.0010	0.0010	8.15	
DIST	5000	101	15.94840	0.0001	0.1212	
			0.0010	0.0010	7.43	
DIST	5000	201	11.26980	0.0004	0.3840	
			0.0010	0.0010	33.60	
DIST	4000	5000	23.84010	-0.0001	-0.0979	
			0.0010	0.0010	3.96	
DIST	4000	3000	16.58730	-0.0001	-0.0781	
			0.0010	0.0010	4.59	
DIST	4000	1000	31.03240	-0.0004	-0.3785	
			0.0010	0.0010	11.61	
DIST	4000	2000	24.81250	-0.0004	-0.3860	
			0.0010	0.0010	15.04	
DIST	4000	102	19.92080	0.0013	1.3215	
			0.0010	0.0010	64.35	
DIST	4000	101	19.92160	0.0013	1.3271	
			0.0010	0.0010	64.59	
DIST	4000	201	13.54040	0.0000	0.0506	
			0.0010	0.0010	3.65	
DIST	5000	2000	22.59970	-0.0002	-0.2393	
			0.0010	0.0010	10.28	
DIST	5000	301	23.78340	-0.0003	-0.3738	
			0.0010	0.0008	12.00	
DIST	6000	3000	21.38290	-0.0000	-0.0190	
			0.0010	0.0009	0.79	
DIST	6000	2000	32.59480	-0.0002	-0.2737	
			0.0010	0.0009	7.51	
DIST	6000	1000	26.72760	-0.0000	-0.0162	
			0.0010	0.0008	0.51	
DIST	6000	102	25.82260	0.0011	1.2449	
			0.0010	0.0009	43.24	
DIST	6000	301	19.85000	-0.0002	-0.3277	
			0.0010	0.0007	10.77	
DIST	6000	201	19.24410	-0.0004	-0.4798	
			0.0010	0.0009	21.33	
DIST	7000	2000	27.64240	-0.0013	-1.5824	
			0.0010	0.0008	46.25	
DIST	7000	3000	23.13720	0.0002	0.2267	
			0.0010	0.0009	8.64	
DIST	7000	102	23.92120	0.0003	0.4000	
			0.0010	0.0009	14.58	
DIST	7000	201	24.77560	0.0003	0.3280	
			0.0010	0.0009	11.28	
DIST	7000	301	14.66510	0.0004	0.6364	
			0.0010	0.0007	29.91	





STATISTICS SUMMARY

Residual Critical Value Type	Tau Max
Residual Critical Value	3.7941
Number of Flagged Residuals	0
Convergence Criterion	0.0001
Final Iteration Counter Value	2
Confidence Level Used	95.0000
Estimated Variance Factor	1.2171
Number of Degrees of Freedom	157

Chi-Square Test on the Variance Factor:

9.8707e-01 < 1.0000 < 1.5385e+00 ?

THE TEST PASSES

NOTE: All confidence regions were computed using the following factors:

Variance factor used	=	1.2171
1-D expansion factor	=	1.9600
2-D expansion factor	=	2.4477
3-D expansion factor	=	2.7955

Note that, for relative confidence regions, precisions are computed from the ratio of the major semi-axis and the spatial distance between the two stations.

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ASCG (ASCENSION) REGINA-DORIS TIES - JULY 2015 SURVEY				
Microsearch GeoLab, V2001.9.20.0 GRS 80 UNITS: m,GRAD				
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2-D and 1-D Station Confidence Regions (95.000 and 95.000 percent):				
STATION	MAJOR SEMI-AXIS	AZ	MINOR SEMI-AXIS	VERTICAL

1000	0.0028	146	0.0028	0.0022
10000	0.0038	63	0.0038	0.6838
101	0.0028	24	0.0027	0.0022
102	0.0028	24	0.0027	0.0022
2000	0.0028	31	0.0027	0.0022
20000	0.0060	135	0.0043	0.6838
201	0.0028	11	0.0028	0.0022
3000	0.0028	22	0.0027	0.0022
301	0.0047	5	0.0032	0.0022
4000	0.0028	153	0.0028	0.0022
5000	0.0028	49	0.0028	0.0022
6000	0.0037	144	0.0030	0.0022
7000	0.0039	17	0.0030	0.0022
ASCG	0.0028	24	0.0027	0.0022
ASCG_ARP	0.0027	90	0.0027	0.0022
ASCG_BCR	0.0027	23	0.0027	0.0022
ASDB	0.0077	5	0.0068	0.0035
ASDB_marker	0.0072	5	0.0063	0.0028
ASEB	0.0028	10	0.0028	0.0022
ASEB_2GHz	0.0028	10	0.0028	0.0023
ASEB_marker	0.0028	10	0.0028	0.0022
POL18	0.0028	106	0.0027	0.0024

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ASCG (ASCENSION) REGINA-DORIS TIES - JULY 2015 SURVEY				
Microsearch GeoLab, V2001.9.20.0 GRS 80 UNITS: m,GRAD				
=====				
3D Station Confidence Regions (95.000 percent):				
STATION	MAJ-SEMI (AZ,VANG)	MED-SEMI (AZ,VANG)	MIN-SEMI (AZ,VANG)	

1000	0.0032 (326, 0)	0.0032 (214, 90)	0.0032 (56, 0)	
10000	0.9753 (63, 90)	0.0044 (243, 0)	0.0044 (153, 0)	
101	0.0032 (204, 0)	0.0032 (23, 90)	0.0031 (114, 0)	
102	0.0032 (208, 90)	0.0031 (24, 0)	0.0031 (114, 0)	
2000	0.0032 (211, 0)	0.0032 (330, 90)	0.0031 (121, 0)	
20000	0.9753 (135, 90)	0.0069 (315, 0)	0.0049 (45, 0)	
201	0.0032 (191, 0)	0.0032 (350, 90)	0.0031 (101, 0)	
3000	0.0032 (202, 0)	0.0032 (21, 90)	0.0031 (112, 0)	
301	0.0054 (185, 0)	0.0037 (275, 0)	0.0032 (82, 90)	
4000	0.0032 (153, 0)	0.0032 (243, 0)	0.0032 (62, 90)	
5000	0.0032 (229, 0)	0.0032 (18, 90)	0.0032 (139, 0)	
6000	0.0042 (144, 0)	0.0034 (234, 0)	0.0032 (51, 90)	
7000	0.0045 (197, 0)	0.0034 (287, 0)	0.0032 (89, 90)	
ASCG	0.0032 (204, 0)	0.0032 (22, 90)	0.0031 (114, 0)	
ASCG_ARP	0.0031 (46, 0)	0.0031 (316, 1)	0.0031 (158, 89)	
ASCG_BCR	0.0032 (217, 90)	0.0031 (23, 0)	0.0031 (113, 0)	
ASDB	0.0088 (185, 0)	0.0078 (275, 0)	0.0051 (52, 90)	
ASDB_marker	0.0082 (185, 0)	0.0072 (275, 0)	0.0040 (51, 90)	
ASEB	0.0032 (190, 0)	0.0032 (357, 90)	0.0031 (100, 0)	
ASEB_2GHz	0.0033 (216, 90)	0.0032 (10, 0)	0.0031 (100, 0)	
ASEB_marker	0.0032 (190, 0)	0.0032 (345, 90)	0.0031 (100, 0)	
POL18	0.0034 (308, 81)	0.0031 (79, 6)	0.0031 (169, 7)	

6.7. Ascension SINEX file

```
%=SNX 1.00 IGN 16:298:00000 IGN 15:217:00000 15:217:00000 C 00009
*-----
+FILE/COMMENT
* File created by geotosnx software (Z.Altamimi)
* Original input file: ASCG_SINEX.cov
* Matrix Scalling Factor used: 1.0000000000
-FILE/COMMENT
*-----
+SITE/ID
*CODE PT DOME T STATION DESCRIPTION APPROX_LON APPROX_LAT APP_H
ASCG A 30602S005 30602S005 345 40 02.4 -7 54 58.6 38.0
ASEB A 30602M004 30602M004 345 40 02.4 -7 54 58.2 38.5
ASDB A 30602S004 30602S004 345 40 03.6 -7 54 58.5 38.4
-SITE/ID
*-----
+SOLUTION/EPOCHS
*Code PT SOLN T Data_start Data_end Mean_epoch
-SOLUTION/EPOCHS
*-----
+SOLUTION/ESTIMATE
*INDEX TYPE CODE PT SOLN REF EPOCH UNIT S ESTIMATED VALUE STD DEV
1 STAX ASCG A 1 15:217:00000 m 2 0.612115154930000E+07 0.11309E-02
2 STAX ASCG A 1 15:217:00000 m 2 -.156397892350000E+07 0.11258E-02
3 STAZ ASCG A 1 15:217:00000 m 2 -.872615355600000E+06 0.11285E-02
4 STAX ASEB A 1 15:217:00000 m 2 0.612115403330000E+07 0.11331E-02
5 STAX ASEB A 1 15:217:00000 m 2 -.156397679340000E+07 0.11261E-02
6 STAZ ASEB A 1 15:217:00000 m 2 -.872605907500000E+06 0.11343E-02
7 STAX ASDB A 1 15:217:00000 m 2 0.612116150300000E+07 0.18397E-02
8 STAX ASDB A 1 15:217:00000 m 2 -.156394329730000E+07 0.28316E-02
9 STAZ ASDB A 1 15:217:00000 m 2 -.872612882700000E+06 0.30817E-02
-SOLUTION/ESTIMATE
*-----
+SOLUTION/MATRIX_ESTIMATE L COVA
*PARA1 PARA2 PARA2+0 PARA2+1 PARA2+2
1 1 0.127902474441325E-05
2 1 0.177147894162523E-08 0.126739035524722E-05
3 1 -.792184067345896E-09 0.127398439967917E-07 0.127343781345726E-05
4 1 0.127594263053875E-05 0.639514565215940E-09 -.225142108128083E-08
4 4 0.128390840843959E-05
5 1 0.560062061435044E-09 0.125703976997599E-05 0.402783445798463E-08
5 4 0.147220471215480E-08 0.126801049928399E-05
6 1 -.225142587178420E-08 0.459917027853846E-08 0.126006430900886E-05
6 4 0.377271713036242E-09 0.105876307382146E-07 0.128656919742920E-05
7 1 0.127563027389584E-05 0.647123325155509E-09 -.208063864426570E-08
7 4 0.127564415868932E-05 0.116719045354172E-08 -.204606021070255E-08
7 7 0.338458434360806E-05
8 1 0.596629562621580E-09 0.125683599408037E-05 0.429080958543579E-08
8 4 -.682070681275695E-09 0.125805755719756E-05 -.490512494579538E-08
8 7 0.864331237755710E-07 0.801790450825703E-05
9 1 -.208064349410577E-08 0.465389460837410E-08 0.126095641133458E-05
9 4 -.204606015363540E-08 0.839407480080647E-08 0.126121419829835E-05
9 7 0.866639686050402E-06 0.621595501717473E-06 0.949663336711952E-05
-SOLUTION/MATRIX_ESTIMATE L COVA
%ENDSNX
```