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Metsähovi ITRF co-location site survey



July 2012

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Résumé

La réalisation ITRF2008 (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. L'observatoire géodésique de Metsähovi (Finlande) dispose d'une station DORIS, d'une station VLBI 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 2012 suite à l'installation d'une station GNSS REGINA et de la rénovation de la station DORIS .

The ITRF2008 (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 VLBI station, a DORIS station and a permanent GNSS station, included in IGS network, are installed at the Metsähovi Research Station (Finland). This report describes the local tie survey carried out at Metsähovi in July 2012, following the installation of the stations.

Matériel

Système d'exploitation	Logiciel
Windows 7 Professionnel	LibreOffice Writer 4.3.7.2

Validation

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Commanditaire	Chef de département RSI	Bruno Garayt	14/10/2015 - signe
Rédacteur	Technicien d'études	Thomas Donal	25/01/2016 - signé
Lecteur	Expert DORIS	Jérôme Saunier	08/10/2015 - signé
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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 purpose:

- 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 Metsähovi (Finland), which took place in July 2012 within the framework of the REGINA station installation and the DORIS station renovation.

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
FGI : Finnish Geospatial Research Institute
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 Gns 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 Prof. Markku Poutanen, director of Geodesy and Geodynamics department from FGI for the welcome accorded to us. Our special thanks to Jyri Näränen, researcher from Geodesy and Geodynamics department, who has supplied a efficient assistance to ensure the success of the mission. FGI has been particularly hospitable. Thank you to them for their logistical support, efficiency, availability and good mood.



Jean-Claude Poyard (IGN), Jyri Näränen (FGI) , Thomas Donal (IGN).

2. Co-location site description

2.1. Site description

The local ties survey is performed in Finland at Metsähovi, about thirty kilometers west of Helsinki.



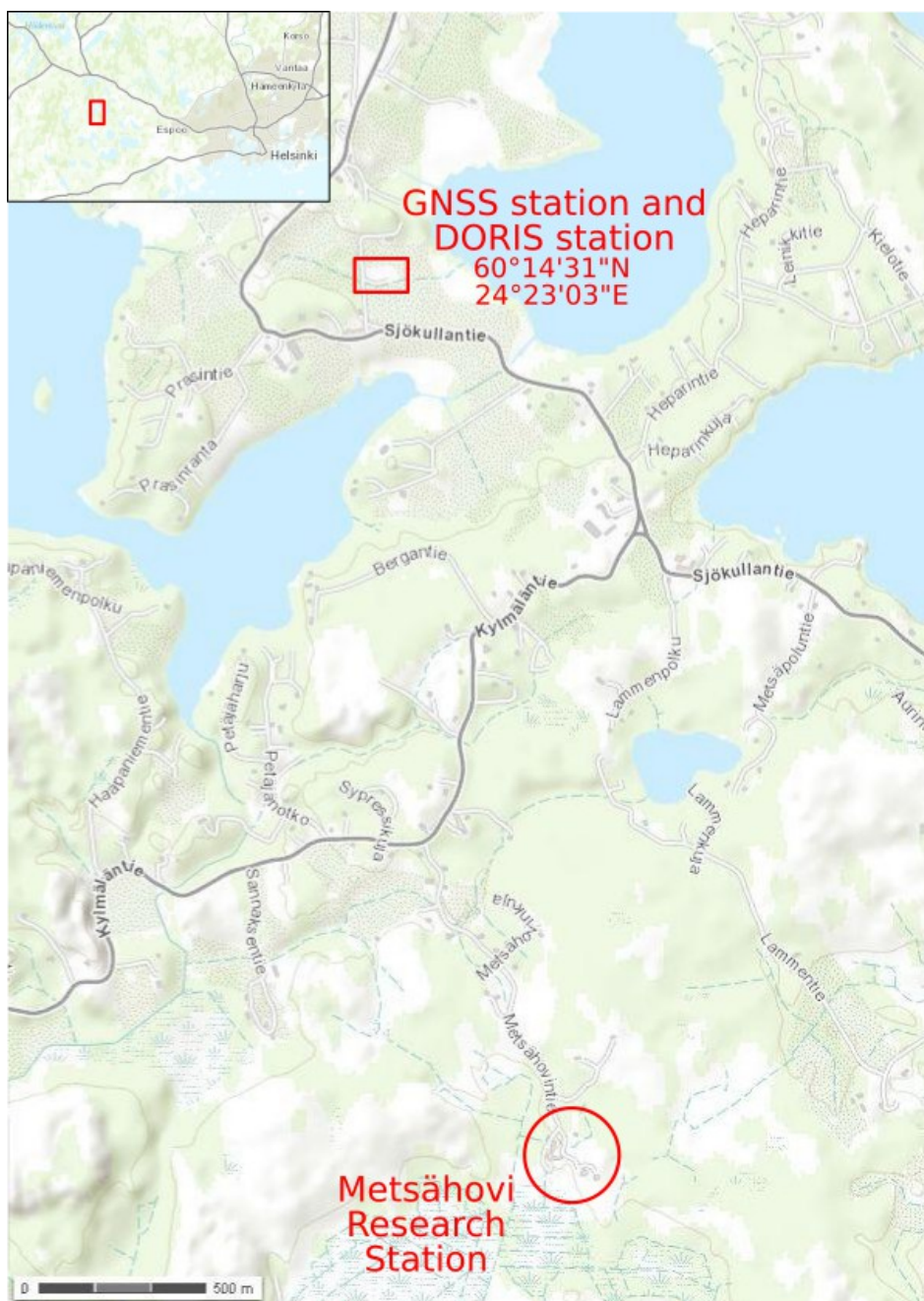
The site is located at the research station managed by the Finnish Geospatial Research Institute, the research and expert Finnish institute that performs research and development for spatial data infrastructures.

▪Address of FGI, headquarters



National Land Survey of Finland
Finnish Geospatial Research Institute FGI
Paikkatietokeskus MML
Geodeetinrinne 2
FI-02430 Masala
FINLAND

▪Closer view



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The Metsähovi Research Station is divided into two separate sites within 3 km of one another :

-the main site hosting all major space geodetic observing techniques : GNSS, SLR and VLBI, gravimeter and fundamental points for the national Finland reference system.

-the secondary site with DORIS and GNSS stations close to a photogrammetric test field in Sjäokulla.



Secondary site

azimuth 350°


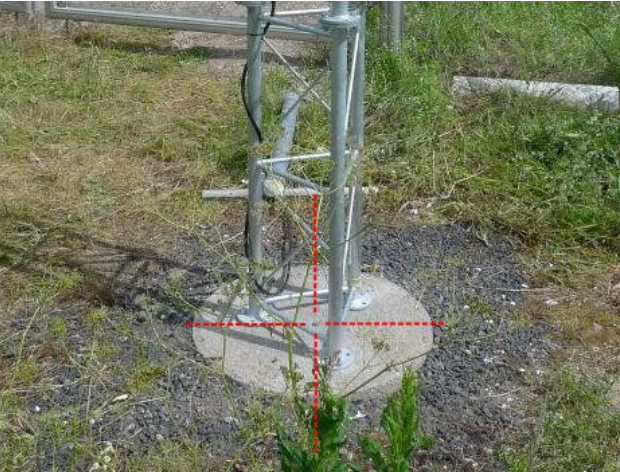
The topometric local tie survey was performed between REGINA GNSS station and DORIS station.

In addition, GNSS observations have been carried out to tie the permanent REGINA GNSS station to the permanent GNSS station located at Metsähovi Research Station, part of IGS network.

2.2. Co-located points

2.2.1. GNSS station – METG

A permanent GNSS station named METG 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 with SCIS radome. This antenna is mounted on top of a 2 m high stainless steel rigid structure and anchored into a concrete pad. The reference point is a brass mark embedded into the concrete and located vertically down from the BPA (Bottom of the Pre-Amp).

Acronym : METG	DOMES number : 10503M002
	
<p>General view</p> <p>Close-up view (reference point)</p>	
<p>Description : antenna monument and reference point. Antenna height is 2,0352 m. See sitelog in appendix 6.2.</p>	






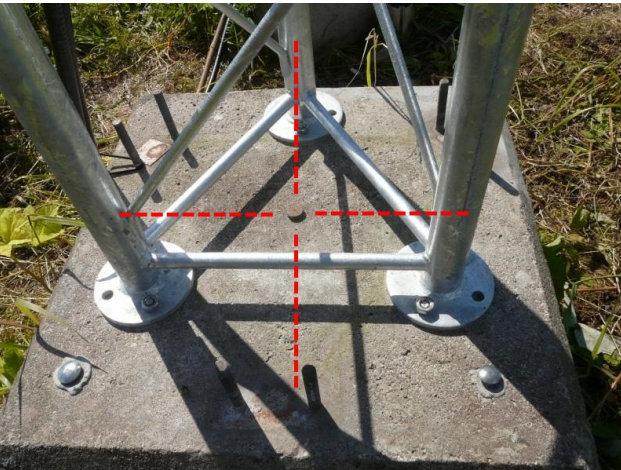
The reference mark is the former VLBI mark CDP 760.

For further information, refer to the IGS website : www.igs.org.

2.2.2. New DORIS station – MEUB

On the spot since June 1998, the DORIS station has been renovated during the campaign. The current antenna with the acronym « MEUB » is installed on a 2 m high stainless steel rigid structure fixed on a concrete block 1.6m deep. A domed brass marker is embedded into the concrete block at the antenna support base.


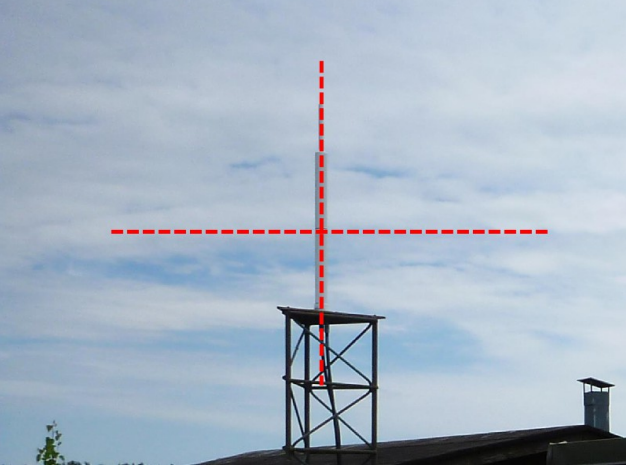
Acronym : MEUB	DOMES number : 10503S016
 <p data-bbox="386 1081 560 1111">General view</p>	 <p data-bbox="914 1081 1326 1115">Close-up view (reference point)</p>
<p data-bbox="159 1137 799 1205">Description : DORIS antenna and reference point. See sitelog in appendix 6.1.</p>	

Acronym : DORIS marker	DOMES number : 10503M006
 <p data-bbox="386 1821 560 1850">General view</p>	 <p data-bbox="1027 1821 1211 1854">Close-up view</p>
<p data-bbox="159 1877 1436 1944">Description : domed brass marker embedded on top of the concrete block in the alignment with the DORIS antenna.</p>	

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


2.2.3. Former DORIS station – METB

Initially set up on October 2000, DORIS station METB was removed during the campaign in order to install the new DORIS station MEUB on the same concrete block.

Acronym : METB	DOMES number : 10503S015
 <p data-bbox="387 974 560 1003">General view</p>	 <p data-bbox="914 974 1326 1003">Close-up view (reference point)</p>

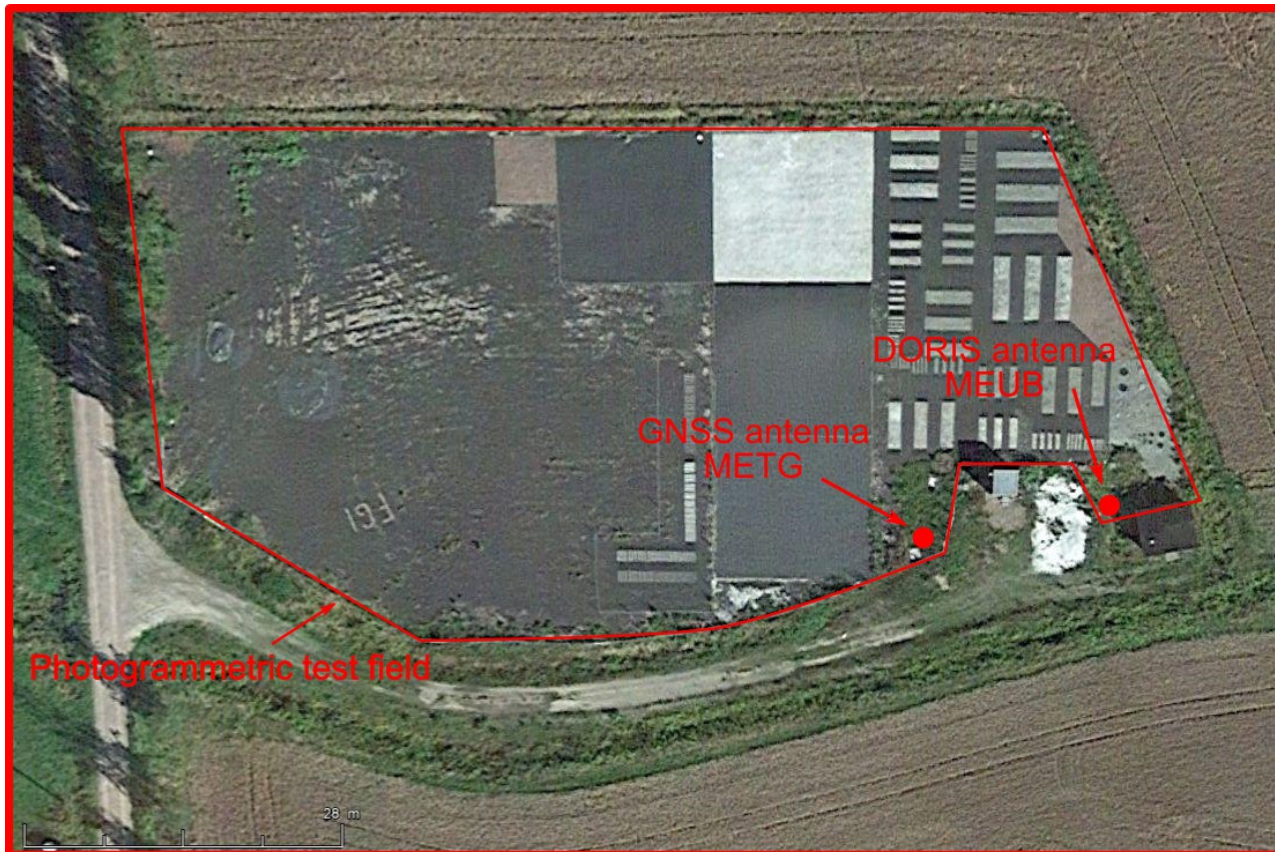
2.2.4. GNSS station – METS

The GNSS station « METS », part of IGS network, is located about 3 kilometres south from METG and MEUB, at Metsähovi Research Station.

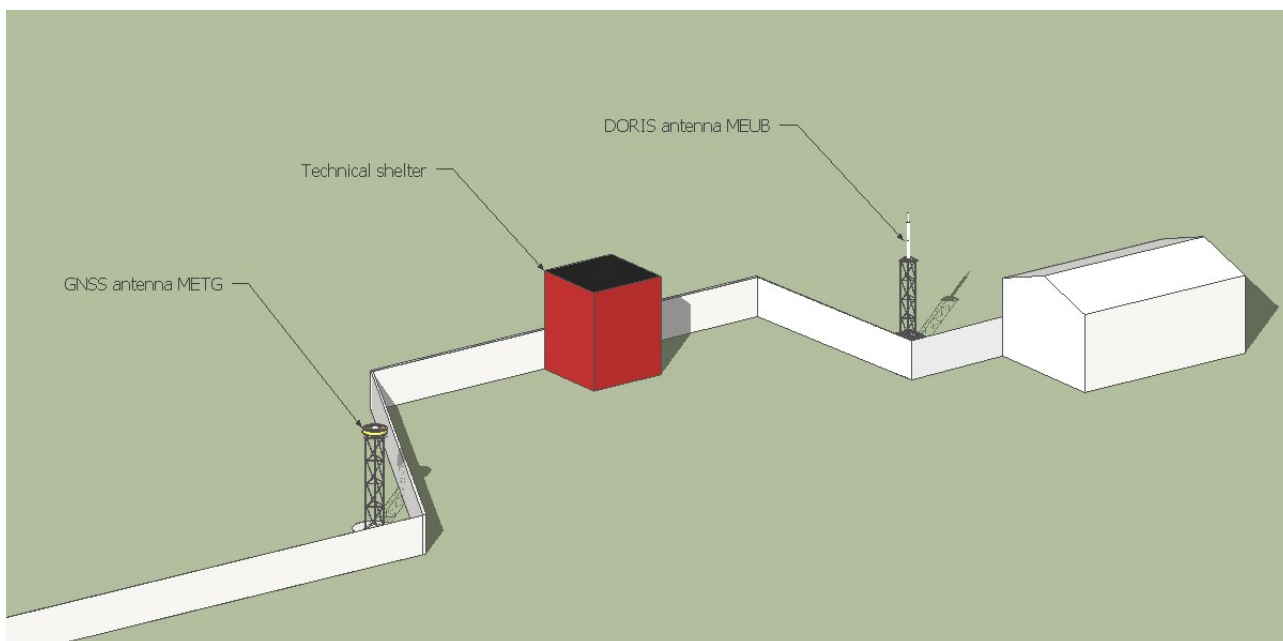
Acronym : METS DOMES number : 10503S011
 <p data-bbox="746 1892 919 1921">General view</p>
<p data-bbox="359 1944 1287 2056">Description : antenna is installed on top of a steel grid mast (21m high). Antenna height is 0,000 m. See sitelog in appendix 6.3.</p>

2.3. Global views

2.3.1. Site sketches



The photogrammetric test field : co-located points.



The antennas and the shelter hosting instrumentations. *Illustration azimuth : 30°*

2.3.2. Site pictures



From left to right : DORIS antenna, shelter, GNSS antenna.

Azimut 340°



From left to right : GNSS antenna, shelter, DORIS antenna.

Azimut 200°

3. Site Survey description

3.1. Organization

The site survey took place during the DORIS station renovation and REGINA station installation from June 27th to July 3rd, 2012 and performed by Thomas Donal (IGN) and Jean-Claude Poyard (IGN).

The topometric surveying operations were done on July 2nd, 2012.

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 0.3 mgon for angles and 1mm + 1.5 ppm for distances.

Type	Model	Quantity
GNSS receiver	Leica GX1230GG	2
GNSS antenna	Leica AX1202GG	2
Total station	Leica TCRA 1201+	1

3.2.3. Surveying accessories

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

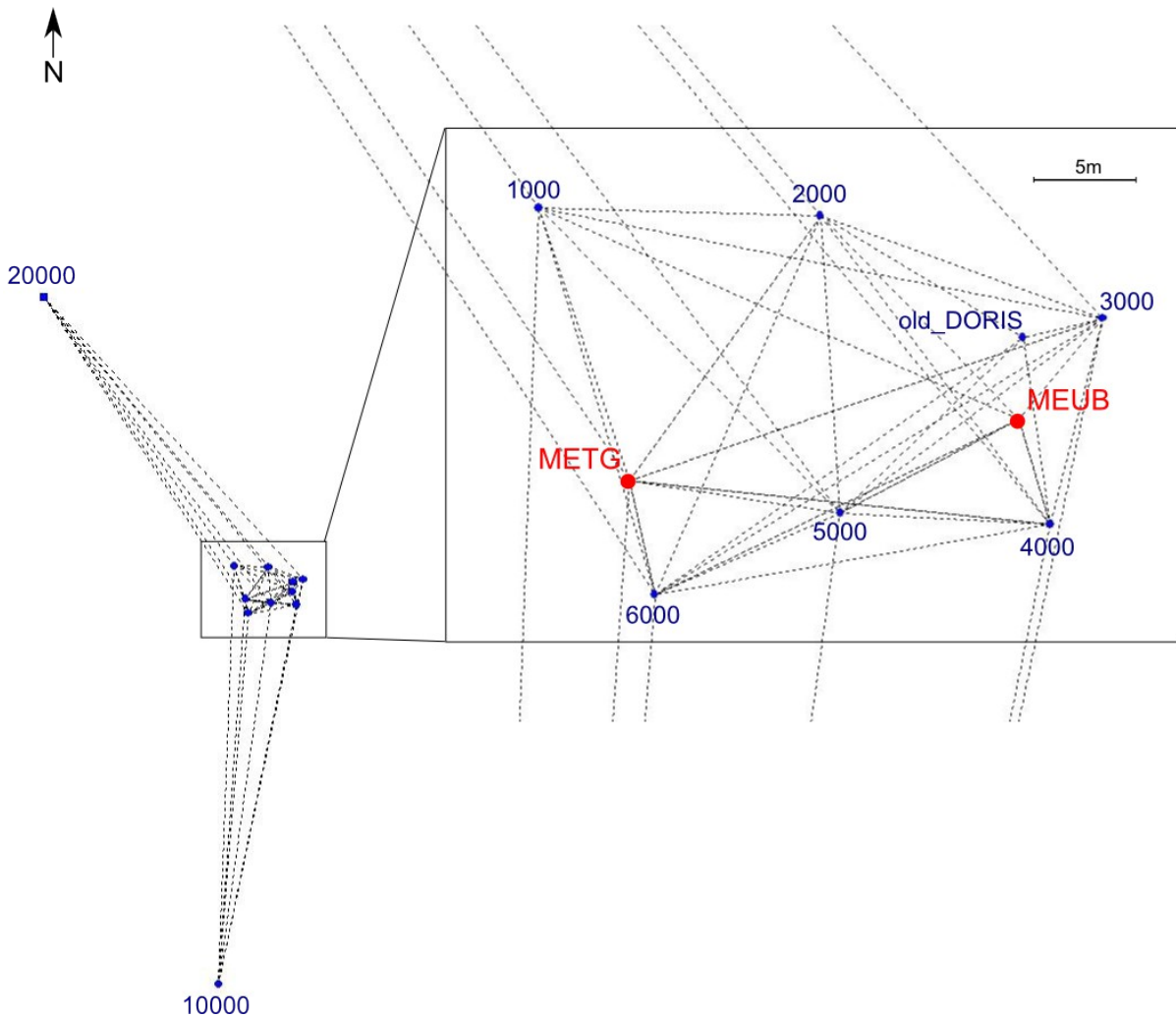
Type	Model	Quantity
Reflector	Leica GPH1P	4
Mini reflector	Leica GMP101	1
Carrier with optical plummet	Leica GZR3	2
Carrier with laser plummet	Leica SNLL121	2
Tripod	Leica wooden tripod	5
Meteo station	Kestrel 4500	1
Reflector pole	Leica GLS14	1



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 six temporary stations : 1000, 2000, 3000, 4000, 5000 and 6000.

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 distance measurements, were recorded during the operation.

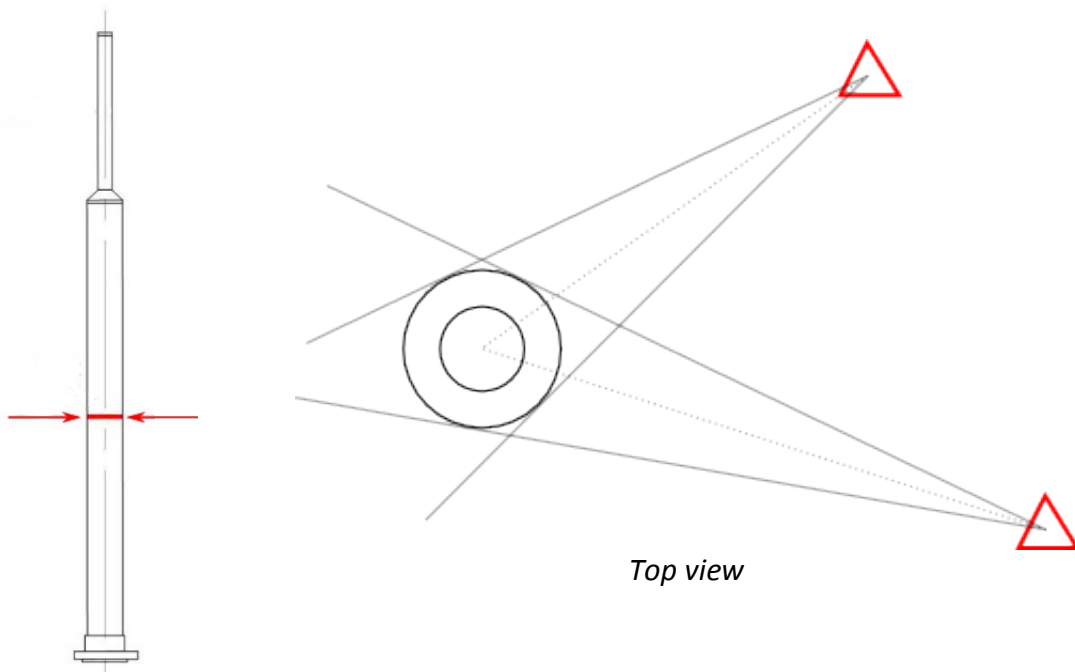
The set up strategy mixes GNSS and conventional observations. The GNSS observations are used to get the polygon bearing.

3.4.1. Permanent stations reference point

MEUB reference point :

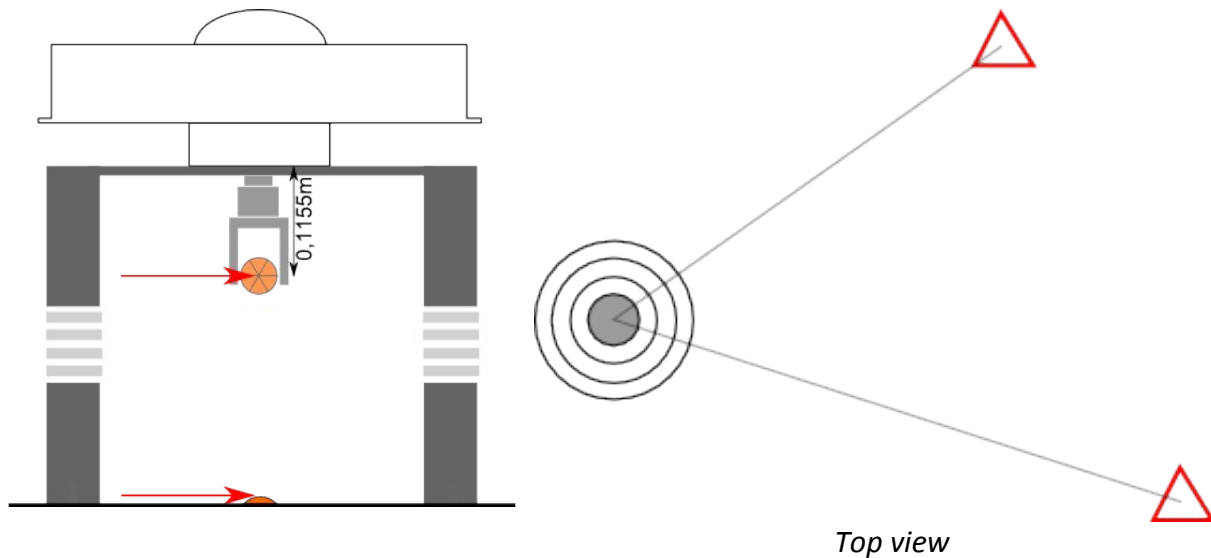
The reference point of DORIS antenna has been determined indirectly.

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.



METG reference point :

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

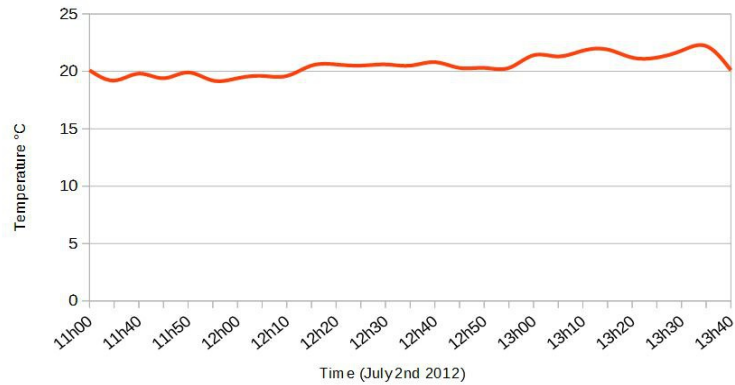


3.4.2. GNSS observations

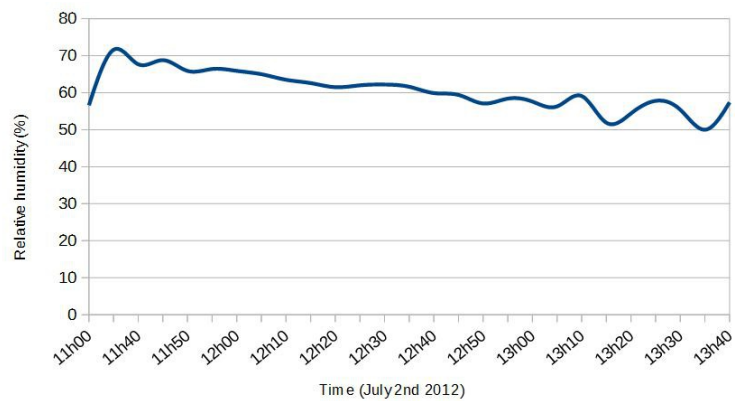
GNSS observations have been carried out in order to determine the orientation of the survey network. Orientations are known from the baselines between METG and stations 10000 and 20000. These two stations were temporary setup as far away as possible from the site. In addition, GNSS observations have been carried out to tie the permanent GNSS station METS to METG.

3.5. Weather data

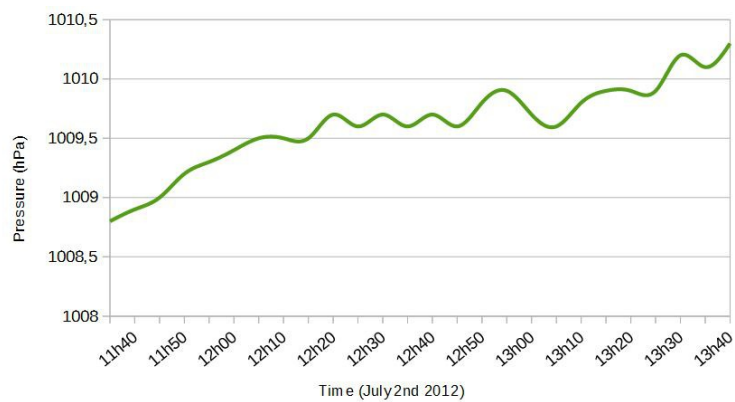
Metsähovi has a humid continental climate with warm summers and no dry season. Next graphics show weather conditions on site during the topometric survey measurements, i.e. July 2nd 2012, from 11 am to 2 pm.



Data record by weather tracker Kesterl 4500.



Data record by weather tracker Kesterl 4500.



Data record by weather tracker Kesterl 4500.

July 2nd 2012, the weather was sunny and temperate. These data have been taken into account to correct distance measurements.

4. Computation

4.1. Determination of METG 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 2012:193 (11/07/2012). 7 daily data sessions have been processed, from 09 July 2012 to 15 July 2012

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.

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 ITRF2008 via IGb08 reference frame.

The computation process is described in appendix 6.4.

- **Coordinates expressed in IGb8 at epoch 2012:193**

Station	DOMES number	X (m)	Y (m)	Z (m)
BOR1	12205M002	3738358.3234	1148173.8294	5021815.8357
JOZE	12204M001	3664940.0261	1409153.9823	5009571.4531
KIRO	10422M001	2248123.0689	865686.7661	5886425.8637
MAR6	10405M002	2998189.3140	931451.8850	5533398.7807
MDVJ	12309M005	2845455.9410	2160954.3537	5265993.3195
METG_ARP	-	2890653.4068	1310295.9723	5513960.6508
METS	10503S011	2892570.6569	1311843.5481	5512634.1969
ONSA	10402M004	3370658.4301	711877.2468	5349787.0192
POTS	14106M003	3800689.5132	882077.5017	5028791.3961
RIGA	12302M002	3183899.0652	1421478.5997	5322810.8726
SVTL	12350M001	2730155.2257	1562364.8428	5529989.3529
TRO1	10302M006	2102928.3502	721619.5311	5958196.3170
VISO	10423M001	3246470.1375	1077900.6230	5365278.1748

Cartesians coordinates, IGb08/ITRF08, epoch 2012:193 (11/07/2012)

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 6.5.

4.3. Global adjustment

The final computation has been carried out by a Least Squares 3D Adjustment with the Microsearch Geolab version 2001.9.20.0 software. The input file (see appendix 6.6) comes from :

- Total station observations : horizontal and zenith angles, distances,
- Centring equations : relative position between points,
- Azimuths issued from the GNSS baselines process,
- METG antenna reference point coordinates have been constrained at 1 mm to its IGS08 (epoch 2012:193, 11/07/2012) 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 our Microsearch Geolab computation input file.

This adjustment provided coordinates and a covariance matrix of our survey work (appendix 6.7).

Geoid slope is insignificant around Metsähovi. The EGM2008 geoid model undulations have not been taken into account in the process to correct the vertical / normal deflation.

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	10503S016	MEUB
→ DORIS pillar/domed mark	10503M006	MEUB_marker
→ Ex-DORIS antenna reference point	10503S015	METB
GNSS permanent station		
→ METS reference point	10503S011	METS
→ METG reference point	10503M002	METG
→ METG antenna reference point	-	METG_ARP

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/ITRF2008 at the mean epoch of the observations (i.e. epoch 2012 :193). The table below provides the 3D coordinates and confidence region at 95 % of the points of interest.

```

=====
METG (FINLAND) REGINA&DORIS TIES - JULY 2012 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		METB	2890643.9755 0.0024	1310311.9626 0.0024	5513963.0330 m 0.0025
XYZ		METG	2890652.4912 0.0010	1310295.5551 0.0010	5513958.8817 m 0.0011
XYZ		METG_ARP	2890653.4068 0.0010	1310295.9723 0.0010	5513960.6508 m 0.0011
XYZ		METS	2892570.6568 0.0010	1311843.5481 0.0010	5512634.1969 m 0.0012
XYZ		MEUB	2890643.7573 0.0010	1310311.8598 0.0010	5513962.6111 m 0.0011
XYZ		MEUB_marker	2890642.6624 0.0010	1310311.3643 0.0010	5513960.5083 m 0.0011

```

=====
                METG (FINLAND) REGINA&DORIS TIES - JULY 2012 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
-----
METB                    0.0060    21                0.0059                0.0048
METG                    0.0026    13                0.0025                0.0022
METG_ARP                0.0025    22                0.0024                0.0021
METS                    0.0026    23                0.0024                0.0023
MEUB                    0.0026    21                0.0025                0.0022
MEUB_marker            0.0026    21                0.0025                0.0022
=====

```

```

=====
                METG (FINLAND) REGINA&DORIS TIES - JULY 2012 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 METB                    N 60 14    31.17433 E 24 23    4.22910    62.7904 m
                0.0024                0.0024                0.0025
PLH 000 METG                    N 60 14    31.08021 E 24 23    3.02939    59.6740 m
                0.0011                0.0010                0.0011
PLH 000 METG_ARP                N 60 14    31.08035 E 24 23    3.02952    61.7092 m
                0.0010                0.0010                0.0011
PLH 000 METS                    N 60 13    2.90291 E 24 23    43.16271    94.6291 m
                0.0010                0.0010                0.0012
PLH 000 MEUB                    N 60 14    31.17433 E 24 23    4.22887    62.3044 m
                0.0011                0.0010                0.0011
PLH 000 MEUB_marker            N 60 14    31.17432 E 24 23    4.22892    59.8824 m
                0.0011                0.0010                0.0011
=====

```

The whole covariance matrix was computed, then it was possible to extract from it the covariance submatrix for the 4 main points of interest i.e. MEUB, METB, METS and METG for the ITRF2014 computation. Finally, this covariance submatrix has been converted into the SINEX format using the « geotosnx » tool provided by Z. Altamimi. The resulting SINEX file (10503_IGN_2012-184_V12.SNX) is provided in appendix 6.8

5.3. Vectors between points of interest

Differential components between points of interest in IGB08:

	dX (m)	dY (m)	dZ (m)	Accuracy (m)
METG → MEUB	-8.734	16.305	3.729	0.001
METG → METB	-8.516	16.408	4.151	0.001
MEUB → METB	0.218	0.103	0.422	0.001
METG → METS	1918.165	1547.993	-1324.685	0.002

6. Appendixes

6.1. «MEUB» DORIS station site log

METSAHOVI DORIS site description form

0. Form

Prepared by : SIMB (DORIS installation and maintenance department)
Date prepared : 11/04/2013
Report type : UPDATE

1. Site location information

Site name : METSAHOVI
Site DOMES number : 10503
Host agency : Finnish Geodetic Institute
City : Masala
State or province :
Country : FINLAND
Tectonic plate : EURA
Geological information :

Geographical coordinates (ITRF) :
North Latitude : 60 deg 14' 31''
East Longitude : 24 deg 23' 4''
Ellipsoid height : 62 m
Approximate altitude : 42 m

2. DORIS antenna and reference point information

2.1

Four character ID : META
Antenna model : Alcatel
Antenna serial number : 53
IERS DOMES number : 10503S013
CNES/IGN number : 105031
DORIS SSALTO number : 6
Date installed (dd/mm/yy) : 21/06/1988
Date removed (dd/mm/yy) : 25/10/2000
Antenna support type : Guyed 3 metre tower
Installed on : Concrete block
Height above ground mark : 3.062 m
Ground mark type : FGI mark fixed on the base plate.
Ground mark DOMES number : 10503M004
Notes :

2.2

Four character ID : METB
Antenna model : Starec 52291 type
Antenna serial number : 68
IERS DOMES number : 10503S015
CNES/IGN number : 105032
DORIS SSALTO number : 97
Date installed (dd/mm/yy) : 26/10/2000
Date removed (dd/mm/yy) : 19/05/2005
Antenna support type : 2.5 m rigid tower
Installed on : 55cm sided concrete block (1.6 m deep)
Height above ground mark : 2.909 m
Ground mark type : FGI geodetic mark fixed on top concrete block
Ground mark DOMES number : 10503M006
Notes :

2.3

Four character ID : METB
Antenna model : Starec 52291 type
Antenna serial number : 104
IERS DOMES number : 10503S015
CNES/IGN number : 105032
DORIS SSALTO number : 97
Date installed (dd/mm/yy) : 19/05/2005
Date removed (dd/mm/yy) : 26/06/2012
Antenna support type : 2.5 m rigid tower
Installed on : 55cm sided concrete block (1.6 m deep)
Height above ground mark : 2.909 m
Ground mark type : FGI geodetic mark fixed on top concrete block
Ground mark DOMES number : 10503M006
Notes : Antenna change without centering control

2.4

Four character ID : MEUB
Antenna model : Starec 52291 type
Antenna serial number : 143
IERS DOMES number : 10503S016
CNES/IGN number : 105033
DORIS SSALTO number : 333
Date installed (dd/mm/yy) : 29/06/2012
Date removed (dd/mm/yy) :
Antenna support type : 2 m high very rigid metal tower
Installed on : 55 cm sided concrete block
Height above ground mark : 2.422 m
Ground mark type : FGI geodetic mark fixed on top concrete block
Ground mark DOMES number : 10503M006
Notes :

3. DORIS beacons information

3.1

Beacon serial number : 8633044
Beacon model : 1.0
USO serial number : 1.399
4 Char. ID of the REF point : META
Date installed (dd/mm/yy) : 01/07/1988
Date removed (dd/mm/yy) : 01/09/1988

3.2

Beacon serial number : 8627005
Beacon model : 1.0
USO serial number : 1.276
4 Char. ID of the REF point : META
Date installed (dd/mm/yy) : 01/10/1988
Date removed (dd/mm/yy) : 09/08/1994

3.3

Beacon serial number : 8633028
Beacon model : 1.0
USO serial number : 1.511
4 Char. ID of the REF point : META
Date installed (dd/mm/yy) : 15/08/1994
Date removed (dd/mm/yy) : 25/10/2000

3.4

Beacon serial number : 8633028
Beacon model : 1.0
USO serial number : 1.511
4 Char. ID of the REF point : METB
Date installed (dd/mm/yy) : 26/10/2000
Date removed (dd/mm/yy) : 15/08/2003

3.5

Beacon serial number : 2819036
Beacon model : 3.0
USO serial number : 3.298
4 Char. ID of the REF point : METB
Date installed (dd/mm/yy) : 18/08/2003
Date removed (dd/mm/yy) : 01/01/2004

3.6

Beacon serial number : 2819040
Beacon model : 3.0
USO serial number : 3.295
4 Char. ID of the REF point : METB
Date installed (dd/mm/yy) : 10/01/2004
Date removed (dd/mm/yy) : 28/01/2005

3.7

Beacon serial number : 2819048
Beacon model : 3.0
USO serial number : 3.400
4 Char. ID of the REF point : METB
Date installed (dd/mm/yy) : 17/02/2005
Date removed (dd/mm/yy) : 18/05/2005

3.8

Beacon serial number : 2819057
Beacon model : 3.0
USO serial number : 3.326
4 Char. ID of the REF point : METB
Date installed (dd/mm/yy) : 18/05/2005
Date removed (dd/mm/yy) : 26/06/2012

3.9

Beacon serial number : 2819018
Beacon model : 3.0
USO serial number : 3.569
4 Char. ID of the REF point : MEUB
Date installed (dd/mm/yy) : 29/06/2012
Date removed (dd/mm/yy) :

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

Solution : ITRF2008 (tie to METB)
Epoch : 2005.0

X = 2890643.876 m Y = 1310311.742 m Z = 5513962.524 m
Sig X = 0.001 m Sig Y = 0.001 m Sig Z = 0.001 m

VX = -0.0162 m/y VY = 0.0145 m/y VZ = 0.0103 m/y
Sig VX = 0.0001 m/y Sig VY = 0.0001 m/y Sig VZ = 0.0001 m/y

5. IERS colocation information

5.1

Instrument type : GNSS
Status : Permanent
DOMES number of the
instrument ref. point : 10503M002
Notes : Permanent GNSS station REGINA (METG ex VLBI mark)

5.2

Instrument type : GNSS
Status : Permanent
DOMES number of the
instrument ref. point : 10503S011
Notes : Permanent GNSS station IGS station (METS)

5.3

Instrument type : SLR
Status : Permanent
DOMES number of the
instrument ref. point : 10503S001
Notes :

5.4

Instrument type : SLR
Status : Mobile
DOMES number of the
instrument ref. point : 10503S014
Notes :

6. Tide Gauge colocation information

7. Local site ties

7.1

Point description : DORIS Starec antenna reference point (METB)
DOMES number : 10503S015
Differential components from the current DORIS ref. point (MEUB)
to the above point (in the ITRS) :
dX (m) : 0.218
dY (m) : 0.103
dZ (m) : 0.422
Accuracy (m) : 0.001
Date measured : 27/06/2012
Additional information : Survey by IGN-F 2012

7.2

Point description : DORIS Alcatel antenna reference point (META)
DOMES number : 10503S013
Differential components from the current DORIS ref. point (MEUB)
to the above point (in the ITRS) :
dX (m) : -4.284
dY (m) : -1.726
dZ (m) : -0.196
Accuracy (m) : 0.001
Date measured : 02/07/2012
Additional information : Survey by IGN-F 2012

7.3

Point description : Mark on top of concrete block
DOMES number : 10503M006
Differential components from the current DORIS ref. point (MEUB)
to the above point (in the ITRS) :
dX (m) : -1.095
dY (m) : -0.496
dZ (m) : -2.103
Accuracy (m) : 0.001
Date measured : 02/07/2012
Additional information : Survey by IGN-F 2012

7.4

Point description : Permanent GNSS station IGS (METS)
DOMES number : 10503S011
Differential components from the current DORIS ref. point (MEUB)
to the above point (in the ITRS) :
dX (m) : 1926.900
dY (m) : 1531.688
dZ (m) : -1328.414
Accuracy (m) : 0.01
Date measured : 02/07/2012
Additional information : Survey by IGN-F 2012

7.5

Point description : REGINA station (METG ex VLBI mark CDP 7601)
DOMES number : 10503M002
Differential components from the current DORIS ref. point (MEUB)
to the above point (in the ITRS) :
dX (m) : 8.734
dY (m) : -16.305
dZ (m) : -3.729
Accuracy (m) : 0.001
Date measured : 02/07/2012
Additional information : Survey by IGN-F 2012

7.6

Point description : SLR (CDP 7806)
DOMES number : 10503S014
Differential components from the current DORIS ref. point (MEUB)
to the above point (in the ITRS) :
dX (m) : 1963.116
dY (m) : 1501.430
dZ (m) : -1363.802
Accuracy (m) : 0.01

Date measured : 02/07/2012
Additional information : Survey by IGN-F 2012

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 : 1.8 m below the current DORIS ref. point (MEUB)
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. «METG» GNSS station site log

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

0. Form

Prepared by (full name) : Jean-Paul CARDALIAGUET
Date Prepared : 2015-06-23
Report Type : update
If Update:
Previous Site Log : metg_20150303.log
Modified/Added Sections : 2, 3.2, 3.3

1. Site Identification of the GNSS Monument

Site Name : METSAHOVI
Four Character ID : METG
Monument Inscription : None
IERS DOMES Number : 10503M002
CDP Number :
Monument Description : STEEL MAST
Height of the Monument : 2 m
Monument Foundation : CONCRETE BLOCK (1M diameter)
Foundation Depth :
Marker Description : DOMED BRASS NAIL
Date Installed : 2012-07-03T00:00Z
Geologic Characteristic :
Bedrock Type :
Bedrock Condition :
Fracture Spacing :
Fault zones nearby :
Distance/activity :
Additional Information : (multiple lines)
: VERY RIGID STEEL MAST, 2M HIGH

2. Site Location Information

City or Town : METSAHOVI
State or Province : MASALA
Country : Finland
Tectonic Plate : EURASIAN
Approximate Position (ITRF)
X coordinate (m) : 2890652.4997
Y coordinate (m) : 1310295.5475
Z coordinate (m) : 5513958.8762
Latitude (N is +) : +601431.07999
Longitude (E is +) : +0242303.02871
Elevation (m,ellips.) : 59.672
Additional Information : ITRF2008 epoch 2012.0

3. GNSS Receiver Information

- 3.1 Receiver Type : TRIMBLE NETR9
Satellite System : GPS+GLO+GAL+SBAS
Serial Number : 77913
Firmware Version : 4.60
Elevation Cutoff Setting : 03 deg
Date Installed : 2012-07-03T00:00Z
Date Removed : 2014-06-04T16:03Z
Temperature Stabiliz. :
Additional Information :
- 3.2 Receiver Type : TRIMBLE NETR9
Satellite System : GPS+GLO+GAL+BDS+SBAS
Serial Number : 5134K77913
Firmware Version : 4.85

```
Elevation Cutoff Setting : 03 deg
Date Installed           : 2014-06-04T16:03Z
Date Removed            : 2015-06-23T07:55Z
Temperature Stabiliz.   :
Additional Information   :

3.3 Receiver Type       : TRIMBLE NETR9
Satellite System        : GPS+GLO+GAL+BDS+SBAS
Serial Number           : 5134K77913
Firmware Version        : 5.01
Elevation Cutoff Setting : 03 deg
Date Installed           : 2015-06-23T08:10Z
Date Removed            : CCYY-MM-DDThh:mmZ
Temperature Stabiliz.   :
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        : (All)
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      SCIS
Serial Number           : 5116354159
Antenna Reference Point : BPA
Marker->ARP Up Ecc. (m) : 002.0352
Marker->ARP North Ecc(m) : 000.0046
Marker->ARP East Ecc(m) : 000.0020
Alignment from True N   : 0 deg
Antenna Radome Type     : SCIS
Radome Serial Number    : 0879
Antenna Cable Type      : TRIMBLE
Antenna Cable Length    : 30 m
Date Installed           : 2012-07-03T00:00Z
Date Removed            : CCYY-MM-DDThh:mmZ
Additional Information   :

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. (MEUB)
Tied Marker Usage       :
Tied Marker CDP Number  :
Tied Marker DOMES Number : 10503S016
Differential Components from GNSS Marker to the tied monument (ITRS)
  dx (m)                : -8.7339
  dy (m)                : 16.3047
  dz (m)                : 3.7294
Accuracy (mm)           : 1 mm
Survey method           : TRIANGULATION
Date Measured           : 2012-07-02T00:00Z
Additional Information   : high geodetic surveying
```

5.2 Tied Marker Name : Marker DORIS
Tied Marker Usage :
Tied Marker CDP Number :
Tied Marker DOMES Number : 10503M006
Differential Components from GNSS Marker to the tied monument (ITRS)
dx (m) : -9.8289
dy (m) : 15.8092
dz (m) : 1.6266
Accuracy (mm) : 1 mm
Survey method : TRIANGULATION
Date Measured : 2012-07-02T00:00Z
Additional Information : high geodetic surveying

5.3 Tied Marker Name : DORIS Starec antenna reference point (METB)
Tied Marker Usage :
Tied Marker CDP Number :
Tied Marker DOMES Number : 10503S015
Differential Components from GNSS Marker to the tied monument (ITRS)
dx (m) : -8.5159
dy (m) : 16.4077
dz (m) : 4.1514
Accuracy (mm) : 1 mm
Survey method : TRIANGULATION
Date Measured : 2012-07-02T00:00Z
Additional Information : high geodetic surveying

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-DDTh:mmZ)
Additional Information : (multiple lines)

6. Frequency Standard

6.1 Standard Type : INTERNAL
Input Frequency :
Effective Dates : 2012-07-03/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 : 2005-05-19/CCYY-MM-DD
Notes :

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 : NATIONAL LAND SURVEY OF FINLAND
Preferred Abbreviation : FGI
Mailing Address : PAIKKATIE TOKESKUS MML
: GEODEETINRINNE 2
: FI-02430 MASALA, FINLAND

Primary Contact
Contact Name : JYRI NARANEN
Telephone (primary) : +358-50-435 7258
Telephone (secondary) :
Fax :
E-mail : JYRI.NARANEN@NLS.FI

Secondary Contact
Contact Name :
Telephone (primary) :
Telephone (secondary) :

Fax :
E-mail :
Additional Information :

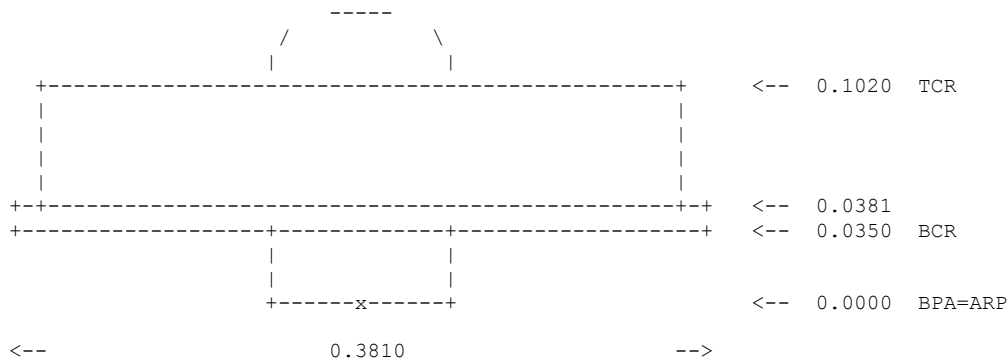
12. Responsible Agency (if different from 11.)

Agency : Centre National d'Etudes Spatiales
Preferred Abbreviation : CNES
Mailing Address : CNES DCT/OP/EM - 18, avenue Edouard Belin
: 31401 Toulouse cedex 09 - France
Primary Contact
Contact Name : Jean-Paul Cardaliaguet
Telephone (primary) : (33) 5.61.27.31.98
Telephone (secondary) :
Fax : (33) 5 61 28 15 36
E-mail : jean-paul.cardaliaguet@cnes.fr
Secondary Contact
Contact Name :
Telephone (primary) :
Telephone (secondary) :
Fax :
E-mail :
Additional Information :

13. More Information

Primary Data Center : IGN
Secondary Data Center : CDDIS
URL for More Information :
Hardcopy on File
Site Map :
Site Diagram : X
Horizon Mask : X
Monument Description : (Y)
Site Pictures : (Y)
Additional Information :
Antenna Graphics with Dimensions

TRM59800.00



6.3. «METS» GNSS station site log

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

0. Form

Prepared by (full name) : Sonja Nyberg
Date Prepared : 2015-03-18
Report Type : UPDATE
If Update:
Previous Site Log : mets_20150203.log
Modified/Added Sections : 7.5, 7.6, 7.7, 7.8, 7.9, 7.10, 7.11

1. Site Identification of the GNSS Monument

Site Name : METSAHOVI
Four Character ID : METS
Monument Inscription :
IERS DOMES Number : 10503S011
CDP Number :
Monument Description : STEEL GRID MAST
Height of the Monument : 21 m
Monument Foundation :
Foundation Depth :
Marker Description : BRASS BOLT ON BEDROCK
Date Installed : 1992-05-01T12:00Z
Geologic Characteristic : BEDROCK
Bedrock Type : METAMORPHIC
Bedrock Condition : FRESH
Fracture Spacing : over 200 cm
Fault zones nearby : NO
Distance/activity :
Additional Information : Antenna height stabilised by an invar bar.

2. Site Location Information

City or Town : Kirkkonummi
State or Province :
Country : Finland
Tectonic Plate : EURASIAN
Approximate Position (ITRF)
X coordinate (m) : 2892570.999
Y coordinate (m) : 1311843.280
Z coordinate (m) : 5512634.011
Latitude (N is +) : +601303.00
Longitude (E is +) : +0242343.08
Elevation (m,ellips.) : 94.6
Additional Information : 40 km west from Helsinki

3. GNSS Receiver Information

- 3.1 Receiver Type : ROGUE SNR-8C
Satellite System : GPS
Serial Number : #302
Firmware Version : 7.3
Elevation Cutoff Setting : 10 deg
Date Installed : 1992-04-30T12:00Z
Date Removed : 1993-12-06T10:30Z
Temperature Stabiliz. : 18.0 +/-
Additional Information :

3.2 Receiver Type : ROGUE SNR-8C
Satellite System : GPS
Serial Number : #302
Firmware Version : 7.5

Elevation Cutoff Setting : 5 deg
Date Installed : 1993-12-06T11:11Z
Date Removed : 1994-08-12T06:00Z
Temperature Stabiliz. : 18.0 +/-
Additional Information :

3.3 Receiver Type : ROGUE SNR-8C
Satellite System : GPS
Serial Number : #302
Firmware Version : 5
Elevation Cutoff Setting : 5 deg
Date Installed : 1994-08-12T06:20Z
Date Removed : 1995-04-29T23:50Z
Temperature Stabiliz. : 18.0 +/-
Additional Information :

3.4 Receiver Type : ROGUE SNR-8100
Satellite System : GPS
Serial Number : #131
Firmware Version : 2.8.32.1
Elevation Cutoff Setting : 5 deg
Date Installed : 1995-04-30T00:02Z
Date Removed : 1996-02-27T00:00Z
Temperature Stabiliz. : 18.0 +/-
Additional Information :

3.5 Receiver Type : ROGUE SNR-8100
Satellite System : GPS
Serial Number : #131
Firmware Version : 3.2.32.1
Elevation Cutoff Setting : 5 deg
Date Installed : 1996-02-27T00:10Z
Date Removed : 1999-08-20T23:55Z
Temperature Stabiliz. : 18.0 +/-
Additional Information :

3.6 Receiver Type : ROGUE SNR-8100
Satellite System : GPS
Serial Number : #131
Firmware Version : 3.2.32.8
Elevation Cutoff Setting : 5 deg
Date Installed : 1999-08-21T00:03Z
Date Removed : 2000-05-23T23:55Z
Temperature Stabiliz. : 18.0 +/-
Additional Information :

3.7 Receiver Type : ASHTECH Z-XII3
Satellite System : GPS
Serial Number : 160
Firmware Version : CC00
Elevation Cutoff Setting : 5 deg
Date Installed : 2000-05-24T00:00Z
Date Removed : 2008-04-25T07:00Z
Temperature Stabiliz. : 18.0 +/-
Additional Information : 22-MAY-2001 : Changes made to be consistent
with RINEX header (Full s/n: LP00160U).

3.8 Receiver Type : ASHTECH Z-XII3
Satellite System : GPS
Serial Number : 108
Firmware Version : CD00
Elevation Cutoff Setting : 5 deg
Date Installed : 2008-04-25T07:00Z
Date Removed : 2008-09-22T08:20Z
Temperature Stabiliz. : 18.0 +/-
Additional Information :

3.9 Receiver Type : ASHTECH Z-XII3
Satellite System : GPS
Serial Number : 160
Firmware Version : CD00
Elevation Cutoff Setting : 5 deg
Date Installed : 2008-09-22T08:20Z
Date Removed : 2009-08-24T12:45Z
Temperature Stabiliz. : 18.0 +/-

```

Additional Information      : Full s/n: LP00160U

3.10 Receiver Type        : ASHTECH Z-XII3
Satellite System          : GPS
Serial Number             : 108
Firmware Version          : CD00
Elevation Cutoff Setting  : 5 deg
Date Installed            : 2009-08-24T12:45Z
Date Removed              : 2010-09-09T09:00Z
Temperature Stabiliz.    : 18.0 +/-
Additional Information     :

3.11 Receiver Type        : ASHTECH Z-XII3
Satellite System          : GPS
Serial Number             : 298
Firmware Version          : CD00
Elevation Cutoff Setting  : 5 deg
Date Installed            : 2010-09-09T09:00Z
Date Removed              : 2011-10-11T11:55Z
Temperature Stabiliz.    : 18.0 +/-
Additional Information     :

3.12 Receiver Type        : ASHTECH Z-XII3
Satellite System          : GPS
Serial Number             : 832
Firmware Version          : CD00
Elevation Cutoff Setting  : 5 deg
Date Installed            : 2011-10-11T11:56Z
Date Removed              : CCYY-MM-DDThh:mmZ
Temperature Stabiliz.    : 18.0 +/-
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          : AOAD/M_B          NONE
Serial Number             : 125
Antenna Reference Point   : BCR
Marker->ARP Up Ecc. (m)   : 0.0000
Marker->ARP North Ecc(m)  : 0.0000
Marker->ARP East Ecc(m)   : 0.0000
Alignment from True N     : +/- 4 deg
Antenna Radome Type       : NONE
Radome Serial Number      :
Antenna Cable Type        :
Antenna Cable Length      :
Date Installed            : 1992-04-30T12:00Z
Date Removed              : 2010-08-19T14:31Z
Additional Information     :

4.2 Antenna Type          : AOAD/M_T          NONE
Serial Number             : 519
Antenna Reference Point   : BPA
Marker->ARP Up Ecc. (m)   : 0.0000
Marker->ARP North Ecc(m)  : 0.0000
Marker->ARP East Ecc(m)   : 0.0000
Alignment from True N     : 0 deg
Antenna Radome Type       : NONE
Radome Serial Number      :
Antenna Cable Type        :
Antenna Cable Length      :
Date Installed            : 2010-08-19T14:31Z
Date Removed              : 2013-06-28T11:45Z
Additional Information     : Due to reinstallation of the invar
                          : stabilization, the ARP of the new antenna is

```

```

: 22mm lower than the ARP of the old antenna. New
: antenna is absolute calibrated by Geo++ GmbH in
: Feb 24 2009.

4.3 Antenna Type : ASH700936C_M NONE
Serial Number : 11761
Antenna Reference Point : BPA
Marker->ARP Up Ecc. (m) : 0.0000
Marker->ARP North Ecc(m) : 0.0000
Marker->ARP East Ecc(m) : 0.0000
Alignment from True N : 0 deg
Antenna Radome Type : NONE
Radome Serial Number :
Antenna Cable Type :
Antenna Cable Length :
Date Installed : 2013-06-28T11:55Z
Date Removed : 2013-08-27T06:54Z
Additional Information : New antenna is absolute calibrated by Geo++
: GmbH. Calibration values have been submitted to
: EPN CB.

4.4 Antenna Type : ASH700936C_M NONE
Serial Number : 11761
Antenna Reference Point : BPA
Marker->ARP Up Ecc. (m) : 0.0000
Marker->ARP North Ecc(m) : 0.0000
Marker->ARP East Ecc(m) : 0.0000
Alignment from True N : 0 deg
Antenna Radome Type : NONE
Radome Serial Number :
Antenna Cable Type : AIRCOM+ and Aircell15
Antenna Cable Length : 72 m
Date Installed : 2013-08-27T09:45Z
Date Removed : CCYY-MM-DDThh:mmZ
Additional Information : Only antenna cable setup was changed.
: : Cable setup from antenna to receiver is
: : (1) 45m AIRCOM+;
: : (2)Lightning Protection
: : (PolyPhaser DGXZ + 15NFNF-A);
: : (3) 25m AIRCOM+;
: : (4) GPS Networking HIALDCBS1X2-N High Isolated
: : 1X2
: : splitter;
: : (5) 2m Aircell15

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 : Mobile VLBI
Tied Marker Usage : Mobile VLBI
Tied Marker CDP Number : 7601
Tied Marker DOMES Number : 10503M002
Differential Components from GNSS Marker to the tied monument (ITRS)
dx (m) : -1918.178
dy (m) : -1548.001
dz (m) : 1324.664
Accuracy (mm) : 5 mm
Survey method : GPS
Date Measured : 1993-12-29T12:00Z
Additional Information :

```

- 5.2 Tied Marker Name : DORIS
Tied Marker Usage : DORIS
Tied Marker CDP Number :
Tied Marker DOMES Number : 10503S013
Differential Components from GNSS Marker to the tied monument (ITRS)
dx (m) : -1929.787
dy (m) : -1532.781
dz (m) : 1330.896
Accuracy (mm) : 5 mm
Survey method : Precision tacheometry
Date Measured : 1993-12-29T12:00Z
Additional Information :
- 5.3 Tied Marker Name : SLR
Tied Marker Usage : SLR
Tied Marker CDP Number : 7806
Tied Marker DOMES Number : 10503S014
Differential Components from GNSS Marker to the tied monument (ITRS)
dx (m) : 36.216
dy (m) : -30.258
dz (m) : -35.388
Accuracy (mm) : 2 mm
Survey method : Precision tacheometry
Date Measured : 1996-10-15T12:00Z
Additional Information :
- 5.4 Tied Marker Name : GPS/GLONASS
Tied Marker Usage : GLONASS
Tied Marker CDP Number :
Tied Marker DOMES Number : 10503M005
Differential Components from GNSS Marker to the tied monument (ITRS)
dx (m) : -0.951
dy (m) : 0.205
dz (m) : 0.398
Accuracy (mm) : 1 mm
Survey method : GPS
Date Measured : 1998-10-12T12:00Z
Additional Information :
- 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 : EXTERNAL H-MASER
Input Frequency : 5 MHz
Effective Dates : 1992-05-01/1999-06-29
Notes : often unreliable, from Metsahovi Radio
: Research Station
- 6.2 Standard Type : EXTERNAL QUARTZ (OSCILLOQUARTZ BVA 8600-B)
Input Frequency : 5 MHz
Effective Dates : 1999-06-29/1999-10-04
Notes :
- 6.3 Standard Type : EXTERNAL H-MASER
Input Frequency : 5 MHz
Effective Dates : 1999-10-04/2014-11-05
Notes : repaired, frequency availability not fully
: secured.
: External H-MASER disconnected due to bad signal
: quality.

6.4 Standard Type : INTERNAL
Input Frequency :
Effective Dates : 2014-11-05/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 : SLR
Status : PERMANENT
Effective Dates : 1978-08-01/1998-10-03
Notes : 7805, upgraded in 1993

7.2 Instrumentation Type : VLBI
Status : MOBILE
Effective Dates : 1989-07-01/1989-07-10
Notes : MV-3, 5 days

7.3 Instrumentation Type : DORIS
Status : PERMANENT
Effective Dates : 1988-06-21/CCYY-MM-DD
Notes :

7.4 Instrumentation Type : SUPERCONDUCTING GRAVIMETER
Status : PERMANENT
Effective Dates : 1994-08-10/CCYY-MM-DD
Notes : GWR TT70, S/N 20

7.5 Instrumentation Type : SLR
Status : PERMANENT
Effective Dates : 1996-10-15/2007-01-01
Notes : 7806

7.6 Instrumentation Type : GPS/GLONASS RECEIVER
Status : PERMANENT
Effective Dates : 1998-10-12/2012-03-14
Notes : METZ 10503M005

7.7 Instrumentation Type : ABSOLUTE GRAVIMETER
Status : MOBILE
Effective Dates : 2003-01-01/CCYY-MM-DD
Notes : FG5-221, updated to FG5x in 2013

7.8 Instrumentation Type : VLBI
Status : PERMANENT
Effective Dates : 2005-01-01/CCYY-MM-DD
Notes : IVS station METSAHOV
: Observations during GeoVLBI campaigns

7.9 Instrumentation Type : GNSS
Status : PERMANENT
Effective Dates : 2012-07-03/CCYY-MM-DD
Notes : IGS station METG 10503M002

7.10 Instrumentation Type : GNSS
Status : PERMANENT
Effective Dates : 2013-08-27/CCYY-MM-DD
Notes : MET3 10503M010

7.11 Instrumentation Type : SUPERCONDUCTING GRAVIMETER
Status : PERMANENT
Effective Dates : 2014-02-15/CCYY-MM-DD
Notes : OSG-073

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)

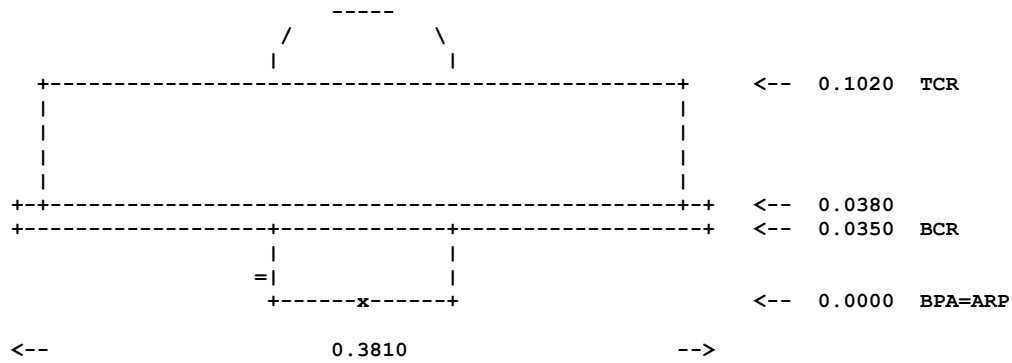
8. Meteorological Instrumentation
- 8.1.1 Humidity Sensor Model : HMP35D
Manufacturer : Vaisala
Serial Number :
Data Sampling Interval : 600 sec
Accuracy (% rel h) : 3
Aspiration : +/-0.2
Height Diff to Ant : -5.3 m
Calibration date : (CCYY-MM-DD)
Effective Dates : 1997-05-21/CCYY-MM-DD
Notes :
- 8.1.x 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)
- 8.2.1 Pressure Sensor Model : PTB200A
Manufacturer : Vaisala
Serial Number :
Data Sampling Interval : 600 sec
Accuracy : 0.2 hPa
Height Diff to Ant : -5.3 m
Calibration date : (CCYY-MM-DD)
Effective Dates : 1997-05-21/CCYY-MM-DD
Notes :
- 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)
- 8.3.1 Temp. Sensor Model : HMP35D (Pt-100)
Manufacturer : Vaisala
Serial Number :
Data Sampling Interval : 600 sec
Accuracy : 0.2 deg C
Aspiration :
Height Diff to Ant : -5.3 m
Calibration date :
Effective Dates : 1997-05-21/CCYY-MM-DD
Notes :
- 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 : Finnish Geospatial Research Institute
: National Land Survey of Finland
- Preferred Abbreviation : FGI
- Mailing Address : PL 84 FIN-00521 Helsinki FINLAND
- Primary Contact
- Contact Name : Finnref GNSS team
- Telephone (primary) :
- Telephone (secondary) :
- Fax :
- E-mail : finnref_team@maanmittauslaitos.fi
- Secondary Contact
- Contact Name : Sonja Nyberg
- Telephone (primary) : +358 29 531 4855
- Telephone (secondary) :
- Fax :
- E-mail : sonja.nyberg@nls.fi
- Additional Information :
12. Responsible Agency (if different from 11.)
- Agency :
- Preferred Abbreviation :
- Mailing Address :
- Primary Contact
- Contact Name :
- Telephone (primary) :
- Telephone (secondary) :
- Fax :
- E-mail :
- Secondary Contact
- Contact Name :
- Telephone (primary) :
- Telephone (secondary) :
- Fax :
- E-mail :
- Additional Information :
13. More Information
- Primary Data Center : BKG
- Secondary Data Center : OLG
- URL for More Information :
- Hardcopy on File
- Site Map :
- Site Diagram : X
- Horizon Mask : X
- Monument Description : X

Site Pictures : X
Additional Information :
Antenna Graphics with Dimensions

AOAD/M T

Dorne Margolin with chokerings (Rogue, AOA design)



ARP: Antenna Reference Point
L1 : L1 Phase Center

L2 : L2 Phase Center

6.4. Bernese GNSS process

The processing of a GNSS data set in ITRF is achieved by the use of IGS data and products expressed in ITRF2008 via IGB08 reference frame:

- Ephemeris and Earth Orientation Parameters.
- GNSS observations, coordinates and velocities of IGS reference stations. Basically the observation data of about 12 IGS stations in a 1000 km radius from Metsähovi are available daily.
- Antenna calibration stemming from igs08.atx.

The computation is validated with respect to the following points:

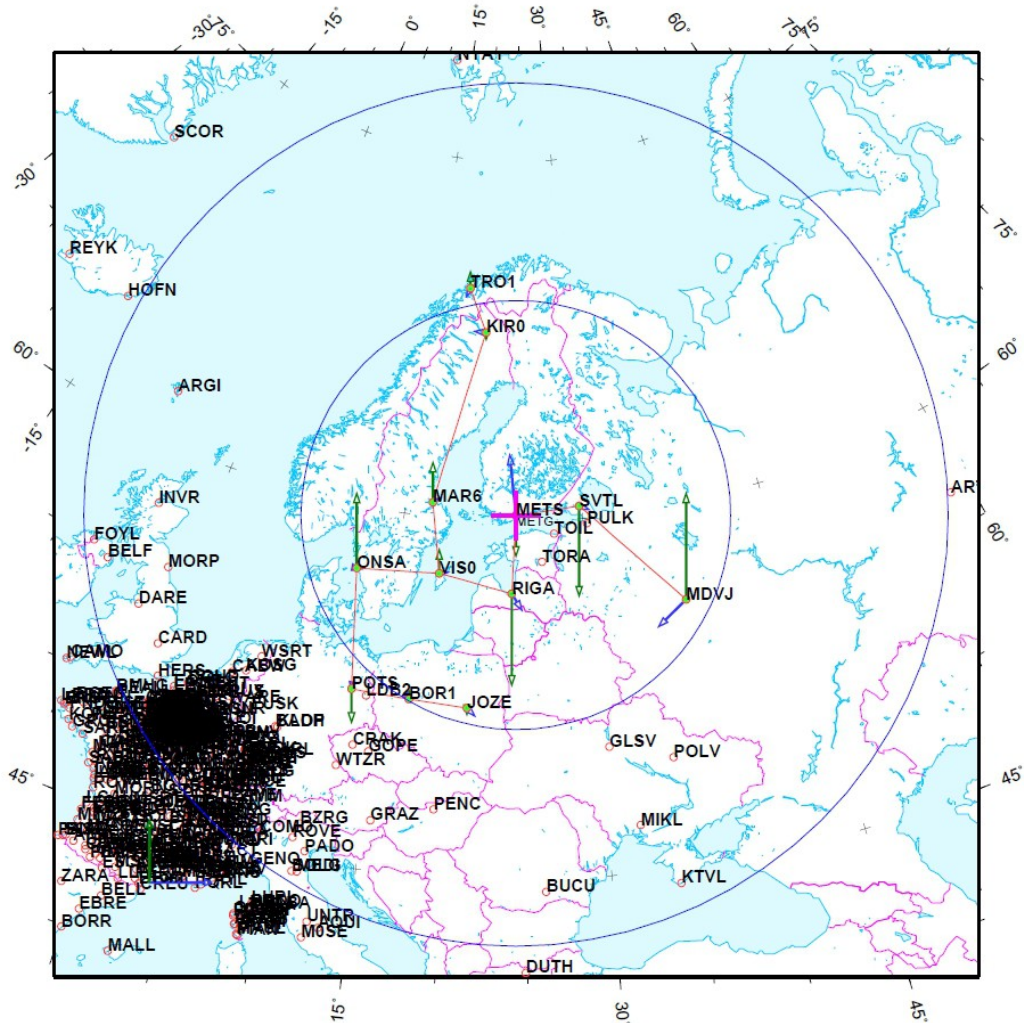
- Assessment of the Root Mean Square errors of the combined solution.
- Assessment of consistency between the daily solutions (repeatability).
- Assessment of alignment of the combined solution to the IGS08 reference frame.

▪ Daily processing steps

7 daily data sessions have been processed, from 09 July 2012 to 15 July 2012 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 11/07/2012 (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 North, East and Up component).

Station	DOMES number	E RMS	N RMS	U RMS
BOR1	12205M002	2.1	2.5	5.4
JOZE	12204M001	2.0	2.5	5.4
KIRO	10422M001	2.1	2.4	5.6
MAR6	10405M002	2.1	2.3	5.6
MDVJ	12309M005	2.2	2.4	5.4
METG_ARP	-	2.1	2.3	5.5
METS	10503S011	2.1	2.3	5.5
ONSA	10402M004	2.1	2.3	5.5
POTS	14106M003	2.1	2.5	5.4
RIGA	12302M002	2.1	2.4	5.5
SVTL	12350M001	2.1	2.3	5.5
TRO1	10302M006	2.1	2.4	5.5
VISO	10423M001	2.1	2.3	5.5

○ **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
BOR1	12205M002	0.8	-1.0	1.2	1.3	-1.4	2.6	2.6	-3.7	4.2
JOZE	12204M001	1.2	-1.7	1.2	1.5	-1.1	2.3	4.3	-5.1	5.7
KIRO	10422M001	0.7	-0.8	1.1	0.8	-1.4	1.0	2.4	-1.8	5.3
MAR6	10405M002	0.8	-1.0	1.2	0.7	-0.9	1.0	1.9	-2.8	3.3
MDVJ	12309M005	0.8	-1.5	0.7	2.1	-4.4	1.8	2.5	-3.4	3.2
METG_ARP	-	1.4	-1.9	2.8	0.7	-1.3	0.6	2.7	-3.9	4.5
METS	10503S011	0.6	-1.1	0.8	0.5	-1.0	0.7	1.6	-2.5	2.7
ONSA	10402M004	0.6	-0.9	0.8	0.5	-0.7	0.5	2.0	-2.8	2.4
POTS	14106M003	2.1	-3.9	2.7	2.7	-4.5	3.0	2.7	-3.9	2.7
RIGA	12302M002	0.4	-0.6	0.4	0.5	-0.7	0.7	1.9	-2.8	3.3
SVTL	12350M001	1.2	-2.1	1.4	0.9	-1.3	1.7	3.4	-4.0	6.0
TRO1	10302M006	0.9	-1.8	1.4	0.7	-0.8	1.3	3.7	-5.6	4.4
VISO	10302M006	0.9	-1.8	1.2	0.7	-0.8	0.8	3.9	-3.2	7.3

○ **IGb08 epoch alignment**

The combined solution has been Helmert-aligned to IGb08 at mid-epoch of data set, i.e. 2012:193. Residuals have been checked to assess consistency of this solution.

Station	DOMES number	Residuals (mm)		
		North	East	Vertical
BOR1	12205M002	0.2	-1.2	1.7
JOZE	12204M001	-0.3	0.0	-1.2
KIRO	10422M001	-0.5	-1.1	-1.1
MAR6	10405M002	0.9	1.1	5.1
MDVJ	12309M005	-3.1	-5.1	19.5
METS	10503S011	10.0	-1.0	-6.8
ONSA	10402M004	0.9	0.7	14.4
POTS	14106M003	-4.3	3.0	-4.8
RIGA	12302M002	-2.4	1.2	-14.2
SVTL	12350M001	0.7	0.8	-18.0
TRO1	10302M006	-1.3	0.7	4.3
VISO	10423M001	0.7	0.8	1.1
RMS	COMPONENT	3.6	2.0	10.6

▪ **Coordinates expressed in IGb08 at epoch 2012:193**

Station	DOMES number	X (m)	Y (m)	Z (m)
BOR1	12205M002	3738358.3234	1148173.8294	5021815.8357
JOZE	12204M001	3664940.0261	1409153.9823	5009571.4531
KIRO	10422M001	2248123.0689	865686.7661	5886425.8637
MAR6	10405M002	2998189.3140	931451.8850	5533398.7807
MDVJ	12309M005	2845455.9410	2160954.3537	5265993.3195
METG_ARP	-	2890653.4068	1310295.9723	5513960.6508
METS	10503S011	2892570.6569	1311843.5481	5512634.1969
ONSA	10402M004	3370658.4301	711877.2468	5349787.0192
POTS	14106M003	3800689.5132	882077.5017	5028791.3961
RIGA	12302M002	3183899.0652	1421478.5997	5322810.8726
SVTL	12350M001	2730155.2257	1562364.8428	5529989.3529
TRO1	10302M006	2102928.3502	721619.5311	5958196.3170
VISO	10423M001	3246470.1375	1077900.6230	5365278.1748

Cartesians coordinates, IGb08/ITRF08, epoch 2012:193 (11/07/2012)

6.5. Leica Geo Office report file

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



Récapitulatif du Traitement METG

Informations sur le Projet

Nom du Projet:	METG
Date de création:	07/07/2015 10:34:13
Fuseau Horaire:	0h 00'
Nom Syst. Coordonnées:	WGS 1984
Logiciel d'application:	LEICA Geo Office 8.1
Date et heure de début:	07/02/2012 11:36:44
Date et heure de fin:	07/03/2012 10:05:44
Points occupés manuellement:	4
Noyau de Post-Traitement:	PSI-Pro 3.0
Traité:	09/19/2014 11:46:27

Paramètres de Traitement

Paramètres	Sélectionnés
Angle de Coupure:	5°
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

METG_ARP - 20000

Référence: METG_ARP

Mobile: 20000

Coordonnées:

Latitude:	60° 14' 31.08035" N	60° 14' 34.87410" N
Longitude:	24° 23' 03.02952" E	24° 22' 57.91616" E
Hteur Ellip.:	61.7092 m	66.2216 m

Type de solution: GPS fixe, GLONASS flottante
Type GNSS: GPS / GLONASS
Fréquence: L1/E1 et L2
Ambiguïté: Oui

METG_ARP - 10000

Référence: METG_ARP

Mobile: 10000

Coordonnées:

Latitude:	60° 14' 31.08035" N	60° 14' 26.23927" N
Longitude:	24° 23' 03.02952" E	24° 23' 02.34988" E
Hteur Ellip.:	61.7092 m	66.4547 m

Type de solution: GPS fixe, GLONASS flottante
Type GNSS: GPS / GLONASS
Fréquence: L1/E1 et L2
Ambiguïté: Oui

METG_ARP - 20000

Référence: METG_ARP

Mobile: 20000

Coordonnées:

Latitude:	60° 14' 31.08035" N	60° 14' 34.87394" N
Longitude:	24° 23' 03.02952" E	24° 22' 57.91620" E
Hteur Ellip.:	61.7092 m	66.3560 m

Type de solution: Phase: toutes fixes
Type GNSS: GPS / GLONASS
Fréquence: L1/E1 et L2
Ambiguïté: Oui

METG_ARP - 10000

Référence: METG_ARP

Mobile: 10000

Coordonnées:

Latitude:	60° 14' 31.08035" N	60° 14' 26.23924" N
Longitude:	24° 23' 03.02952" E	24° 23' 02.35001" E
Hteur Ellip.:	61.7092 m	66.4870 m

Type de solution: Phase: toutes fixes
Type GNSS: GPS / GLONASS
Fréquence: L1/E1 et L2
Ambiguïté: Oui

Metsähovi ITRF co-location site survey – July 2012

6.6. Adjustment input file

```

TITL METG (FINLAND) REGINA&DORIS TIES - JULY 2012 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 NO YES NO
VARF YES YES NO
RTST TAU MAX
LUNT m  1.000000000000
CONV  0.00010
CLEV  95.000
ANGT GRD
LDEC 4

*****
*                ITRF ACRONYMS, n° DOMES and POINTS DESCRIPTION                *
*****

*DORIS:
*MEUB : DORIS Ant. Ref. Pt. (Starec type) (DOMES 10503S016), after renovation
*METB : DORIS Ant. Ref. Pt. (Starec type) (DOMES 10503S015), before renovation
*MEUB marker : DORIS concrete pillar / domed brass mark (DOMES 10503M006)
*old_DORIS -> base of the pillar META (DOMES 10503S013)

*GNSS permanent stations:
*METS (DOMES 10503S011)
*METG (DOMES 10503M002), ex VLBI mark CDP 7601

*****
*                LIST OF POINTS for the SURVEY ADJUSTMENT                *
*****
*10000: station to orient the survey polygon network
*20000: station to orient the survey polygon network
*MEUB 2GHz: DORIS antenna, upper part
*101: mini reflector pole on marker METG
*102: mini-prism under METG antenna ARP
*201: mini reflector pole on marker MEUB

*Temporary points
*1002: survey station
*2002: survey station
*3002: survey station
*4002: survey station
*6002: survey station
*4002: survey station

*****AZIMUT DEDUCTED FROM THE GNSS DETERMINATION*****
3DD
PLH 000 METG_ ARP      n 60 14 31.080350 e 24 23 03.029520      61.7092
PLH 000 10000         n 60 14 26.239250 e 24 23 02.349940      66.4705 m      0
COV LG DIAG
ELEM                0.00000009                0.00000009                1 m

3DD
PLH 000 METG_ ARP      n 60 14 31.080350 e 24 23 03.029520      61.7092
PLH 000 20000         n 60 14 34.873940 e 24 22 57.916200      66.3560 m      0
COV LG DIAG
ELEM                0.00000009                0.00000009                1 m

*****POINTS COORDINATES*****

*LOCAL GEODETIC DATUM: IGS08/ITRF2008                EPOCH: 2012-07-11 12:00:00
*Results from computation, BERNESE GNSS software V5
3DC
XYZ 000 METG_ ARP      2890653.4068      1310295.9723      5513960.6508
COV CT DIAG          1
ELEM                0.000001                0.000001                0.000001

```

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

PLH 000 1002	N 60 14	31.49890	E 24 23	2.74856	61.1485 m	0
PLH 000 2002	N 60 14	31.48680	E 24 23	3.61680	61.2688 m	0
PLH 000 3002	N 60 14	31.33015	E 24 23	4.48744	61.0423 m	0
PLH 000 4002	N 60 14	31.01382	E 24 23	4.32597	60.8110 m	0
PLH 000 5002	N 60 14	31.03104	E 24 23	3.67787	61.0252 m	0
PLH 000 6002	N 60 14	30.90622	E 24 23	3.10639	61.0975 m	0
PLH 000 10000	n 60 14	26.239270	e 24 23	02.350010	66.4536 m	0
PLH 000 20000	n 60 14	34.873960	e 24 22	57.916260	66.3391 m	0
PLH 000 old_DORIS	N 60 14	31.30063	E 24 23	4.24174	59.8273 m	0
PLH 000 MEUB	N 60 14	31.17435	E 24 23	4.22894	62.2875 m	0
PLH 000 MEUB_2Ghz	N 60 14	31.17436	E 24 23	4.22900	62.7798 m	0
PLH 000 METG	N 60 14	31.08022	E 24 23	3.02946	59.6572 m	0
PLH 000 101	N 60 14	31.08022	E 24 23	3.02946	59.8545 m	0
PLH 000 102	N 60 14	31.08036	E 24 23	3.02958	61.5764 m	0
PLH 000 MEUB_marker	N 60 14	31.17433	E 24 23	4.22898	59.8654 m	0
PLH 000 201	N 60 14	31.17434	E 24 23	4.22898	60.0632 m	0

* SINEX imported from METS.SNX *

*PLH 000 METG	60 14	31.00000	24 23	3.00000	61.800 m	0
PLH 000 METS	60 13	2.90000	24 23	43.10000	94.700 m	0
* 3DC						
XYZ METG_ARP		2890653.4068		1310295.9723	5513960.6508	
XYZ METS		2892570.6568		1311843.5481	5512634.1969	0
COV LG UPPR	0.00000	1.00000	0.00000	1.00000	0.00000	0.00000 1.00000 m
ELEM 9.759922345259399e-06		1.964299438780700e-06		9.704229180305800e-06		m
ELEM 9.725266937125599e-06		1.948944493891800e-06		9.664315615699800e-06		m
ELEM 4.964313192366300e-06		3.267190642784300e-06		1.952017032670400e-06		m
ELEM 4.951210882120900e-06		3.246686990514700e-06		0.000000000000000e+00		m
ELEM 2.546603068213800e-05		9.661409837527300e-06		3.242961674868600e-06		m
ELEM 2.536496500834100e-05		0.000000000000000e+00		0.000000000000000e+00		m
ELEM 9.754702029020699e-06		1.961045713435000e-06		9.700279414418200e-06		m
ELEM 4.962923487006400e-06		3.261562491133700e-06		0.000000000000000e+00		m
ELEM 2.546293667368300e-05		0.000000000000000e+00		0.000000000000000e+00		m

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

*prism under ARP, vertical offset: 0.1155m

3DD						
PLH 000 METG_BCR	n 60 14	31.080350	e 24 23	03.029520	61.7442 m	
PLH 000 METG_ARP	n 60 14	31.080350	e 24 23	03.029520	61.7092 m	
PLH 000 102	n 60 14	31.080350	e 24 23	03.029520	61.5937 m	
COV LG DIAG						
ELEM		0.00000004		0.00000004		0.00000009
ELEM		0.00000004		0.00000004		0.00000009

*mini reflector pole, prism height over survey mark of 0.20m

3DD						
PLH 000 201	N 60 14	31.17434	E 24 23	4.22898	61.0612 m	
PLH 000 MEUB_marker	N 60 14	31.17434	E 24 23	4.22898	60.8632 m	
COV LG DIAG						
ELEM		0.000001		0.000001		0.0000006

*mini reflector pole, prism height over survey mark of 0.20m

3DD						
PLH 000 101	N 60 14	31.08022	E 24 23	3.02946	59.8562 m	
PLH 000 METG	N 60 14	31.08022	E 24 23	3.02946	59.6582 m	
COV LG DIAG						
ELEM		0.000001		0.000001		0.0000006

*Data provided by J-C POYARD, result from DORIS station renovation

3DD						
PLH 000 METB	n 60 14	31.171000	e 24 23	4.219000	62.4860 m	
PLH 000 MEUB	n 60 14	31.170997	e 24 23	4.218773	62.0000 m	
COV LG DIAG						
ELEM		0.000004		0.000004		0.000004

* Total Station Observations 2012 T.DONAL *

*Tours d'horizon
SIGM AH 8.0
HIST NEW
DSET AH
DIR 1002 10000 0 0 0.0
DIR 1002 20000 158 22 6.1
DIR 1002 2002 299 38 73.9
DIR 1002 3002 309 87 51.5

DIR	1002	6002	379	3	82.7
DIR	1002	102	377	8	99.4
DIR	1002	5002	348	0	26.9
DIR	1002	METG	377	10	64.5
*DIR	1002	103	376	78	67.4
*DIR	1002	104	377	39	42.3
DIR	1002	METG_BCR	377	09	04.8
DIR	1002	MEUB_marker	324	4	24.2
*DIR	1002	202	323	97	35.1
*DIR	1002	203	324	11	24.3
DIR	1002	MEUB	324	04	29.7
*DIR	1002	204	324	1	14.7
*DIR	1002	205	324	6	77.5
DIR	1002	MEUB_2Ghz	324	3	96.1
DSET AH					
DIR	1002	10000	0	0	0.0
DIR	1002	101	377	10	61.1
DIR	1002	201	324	4	29.1
DSET AH					
DIR	2002	20000	0	0	0.0
DIR	2002	1002	346	13	79.7
DIR	2002	3002	166	46	8.5
DIR	2002	MEUB_marker	195	18	98.2
*DIR	2002	202	195	6	37.5
*DIR	2002	203	195	31	97.6
DIR	2002	MEUB	195	19	17.5
*DIR	2002	204	195	13	54.5
*DIR	2002	205	195	24	6.0
DIR	2002	MEUB_2Ghz	195	18	80.2
DIR	2002	4002	203	57	41.9
DIR	2002	5002	240	11	96.4
DIR	2002	6002	270	58	73.7
DIR	2002	METG	284	0	32.7
DIR	2002	102	284	0	89.1
*DIR	2002	103	283	74	25.5
*DIR	2002	104	284	27	74.0
DIR	2002	METG_BCR	284	00	99.7
*DIR	2002	301	178	60	41.1
*DIR	2002	302	178	83	37.4
DIR	2002	old_DORIS	178	71	89.2
DSET AH					
DIR	2002	20000	0	0	0.0
DIR	2002	201	195	19	19.7
DIR	2002	101	284	0	39.4
DSET AH					
DIR	3002	10000	0	0	0.0
DIR	3002	20000	139	48	69.4
DIR	3002	1002	99	17	13.1
DIR	3002	2002	109	0	46.9
DIR	3002	5002	46	21	41.4
DIR	3002	4002	2	72	12.7
*DIR	3002	301	71	47	49.0
*DIR	3002	302	72	13	33.6
DIR	3002	old_DORIS	71	80	41.3
DIR	3002	6002	51	68	52.0
DIR	3002	102	65	77	17.1
*DIR	3002	103	65	59	70.0
*DIR	3002	104	65	94	71.7
DIR	3002	METG_BCR	65	77	20.8
DIR	3002	MEUB_marker	30	79	90.8
*DIR	3002	202	30	52	96.3
*DIR	3002	203	31	8	44.7
DIR	3002	MEUB	30	80	70.5
*DIR	3002	204	30	68	75.1
*DIR	3002	205	30	91	67.6
DIR	3002	MEUB_2Ghz	30	80	21.3
DSET AH					
DIR	3002	10000	0	0	0.0
DIR	3002	101	65	76	33.3
DSET AH					
DIR	4002	10000	0	0	0.0
DIR	4002	20000	143	14	84.2
DIR	4002	3002	202	90	45.7
DIR	4002	5002	90	48	36.4
DIR	4002	2002	146	30	16.1
*DIR	4002	301	177	70	90.8
*DIR	4002	302	177	99	42.9
DIR	4002	old_DORIS	177	85	16.8
DIR	4002	MEUB_marker	168	50	34.6
*DIR	4002	202	168	16	18.3
*DIR	4002	203	168	83	8.4
DIR	4002	MEUB	168	49	63.3
*DIR	4002	204	168	36	76.1
*DIR	4002	205	168	65	31.7
DIR	4002	MEUB_2Ghz	168	51	03.9
DIR	4002	6002	75	90	14.4

DIR	4002	METG	93 61	73.9
DIR	4002	102	93 63	19.5
*DIR	4002	103	93 42	71.5
*DIR	4002	104	93 83	90.6
DIR	4002	METG_BCR	93 63	31.0
DSET AH				
DIR	4002	10000	0 0	0.0
DIR	4002	201	168 50	42.6
DIR	4002	101	93 61	73.9
DSET AH				
DIR	5002	10000	0 0	0.0
DIR	5002	20000	150 50	62.6
*DIR	5002	301	242 42	7.6
*DIR	5002	302	242 63	33.9
DIR	5002	old_DORIS	242 52	70.7
DIR	5002	2002	187 4	81.0
DIR	5002	3002	250 59	74.0
DIR	5002	6002	64 93	6.2
DIR	5002	1002	141 68	28.3
DIR	5002	4002	294 68	49.1
DIR	5002	MEUB_marker	260 60	69.9
*DIR	5002	202	260 42	11.1
*DIR	5002	203	260 78	31.7
DIR	5002	MEUB	260 60	21.4
*DIR	5002	204	260 52	66.7
*DIR	5002	205	260 67	90.2
DIR	5002	MEUB_2Ghz	260 60	28.4
DIR	5002	METG	100 92	21.5
DIR	5002	102	100 94	91.9
*DIR	5002	103	100 53	92.3
*DIR	5002	104	101 36	25.3
DIR	5002	METG_BCR	100 95	08.8
DSET AH				
DIR	5002	10000	0 0	0.0
DIR	5002	201	260 60	60.2
DIR	5002	101	100 92	14.3
DSET AH				
DIR	6002	10000	0 0	0.0
DIR	6002	20000	158 17	48.7
DIR	6002	1002	176 31	77.8
DIR	6002	2002	221 11	54.2
DIR	6002	3002	259 66	67.5
DIR	6002	4002	283 69	95.2
DIR	6002	5002	268 52	89.3
*DIR	6002	301	255 99	48.1
*DIR	6002	302	256 11	11.8
DIR	6002	old_DORIS	256 05	29.9
DIR	6002	MEUB_marker	266 37	2.4
*DIR	6002	202	266 27	72.2
*DIR	6002	203	266 45	92.9
DIR	6002	MEUB	266 36	82.5
*DIR	6002	204	266 32	94.1
*DIR	6002	205	266 40	60.4
DIR	6002	MEUB_2Ghz	266 36	77.2
DIR	6002	METG	181 10	58.0
DIR	6002	102	181 13	74.7
*DIR	6002	103	180 38	90.4
*DIR	6002	104	181 89	22.7
DIR	6002	METG_BCR	181 14	06.5
DSET AH				
DIR	6002	10000	0 0	0.0
DIR	6002	201	266 37	13.4
DIR	6002	101	181 10	77.0

HIST GEN Tours d'horizon

Zenithales

SIGM ZA 10.0
SIGM ZB 16.0
HIST NEW

*ZANG ZA	1002	10000	98 35	92.6
*ZANG ZA	1002	20000	97 98	64.8
ZANG ZA	1002	2002	99 42	50.1
ZANG ZA	1002	3002	100 24	69.8
ZANG ZA	1002	6002	100 16	79.7
ZANG ZA	1002	102	98 0	50.2
ZANG ZA	1002	5002	100 38	37.1
ZANG ZA	1002	METG	106 92	20.0
*ZANG ZA	1002	103	97 30	15.6
*ZANG ZA	1002	104	97 30	15.1
ZANG ZA	1002	METG_BCR	97 30	15.4
ZANG ZA	1002	MEUB_marker	103 27	73.9
*ZANG ZA	1002	202	97 8	91.7
*ZANG ZA	1002	203	97 8	89.9

ZANG ZA 1002	MEUB	97 8	90.8
*ZANG ZA 1002	204	95 83	54.6
*ZANG ZA 1002	205	95 83	46.4
ZANG ZA 1002	MEUB_2Ghz	95 83	50.5
*ZANG ZA 1002	10000	98 27	45.8
ZANG ZA 1002	101	106 1	47.7
*ZANG ZB 1002	201	102 78	21.5
*ZANG ZA 2002	20000	98 15	61.0
ZANG ZA 2002	1002	100 57	16.1
ZANG ZB 2002	3002	101 0	81.6
ZANG ZA 2002	MEUB_marker	106 59	48.3
*ZANG ZA 2002	202	95 20	63.3
*ZANG ZA 2002	203	95 20	60.9
ZANG ZA 2002	MEUB	95 20	62.1
*ZANG ZA 2002	204	92 90	41.7
*ZANG ZA 2002	205	92 90	40.1
ZANG ZA 2002	MEUB_2Ghz	92 90	40.9
ZANG ZA 2002	4002	101 59	45.7
ZANG ZA 2002	5002	101 9	48.5
ZANG ZA 2002	6002	100 55	50.2
ZANG ZA 2002	METG	106 59	88.6
ZANG ZA 2002	102	98 73	53.2
*ZANG ZA 2002	103	98 11	46.9
*ZANG ZA 2002	104	98 11	47.8
ZANG ZA 2002	METG_BCR	98 11	47.4
*ZANG ZA 2002	301	108 14	8.2
*ZANG ZA 2002	302	108 14	6.6
ZANG ZA 2002	old_DORIS	108 14	7.4
*ZANG ZA 2002	20000	98 9	78.4
ZANG ZB 2002	201	105 67	52.8
ZANG ZA 2002	101	105 79	83.4
*ZANG ZA 3002	10000	98 29	52.3
*ZANG ZA 3002	20000	98 22	57.0
ZANG ZA 3002	1002	99 75	30.5
ZANG ZA 3002	2002	98 98	74.1
ZANG ZA 3002	5002	100 6	96.7
ZANG ZA 3002	4002	101 45	51.1
*ZANG ZA 3002	301	119 27	76.6
*ZANG ZA 3002	302	119 27	73.6
ZANG ZA 3002	old_DORIS	119 27	75.1
ZANG ZA 3002	6002	99 85	84.6
ZANG ZA 3002	102	98 56	77.0
*ZANG ZA 3002	103	98 16	30.6
*ZANG ZA 3002	104	98 16	39.3
ZANG ZA 3002	METG_BCR	98 16	34.9
ZANG ZA 3002	MEUB_marker	111 84	49.6
*ZANG ZA 3002	202	87 48	24.1
*ZANG ZA 3002	203	87 48	15.1
ZANG ZA 3002	MEUB	87 48	19.6
*ZANG ZA 3002	204	82 73	91.1
*ZANG ZA 3002	205	82 73	91.8
ZANG ZA 3002	MEUB_2Ghz	82 73	91.5
ZANG ZA 3002	10000	98 22	18.6
ZANG ZB 3002	101	103 19	7.2
*ZANG ZA 4002	10000	98 6	63.5
*ZANG ZA 4002	20000	98 17	70.9
ZANG ZA 4002	3002	98 54	18.1
ZANG ZA 4002	5002	98 63	45.1
ZANG ZA 4002	2002	98 40	37.0
*ZANG ZA 4002	301	106 95	39.9
*ZANG ZA 4002	302	106 95	37.8
ZANG ZA 4002	old_DORIS	106 95	38.8
ZANG ZA 4002	MEUB_marker	111 47	82.9
*ZANG ZA 4002	202	82 34	49.0
*ZANG ZA 4002	203	82 34	88.7
ZANG ZA 4002	MEUB	82 34	68.8
*ZANG ZA 4002	204	76 90	50.1
*ZANG ZA 4002	205	76 90	48.8
*ZANG ZB 4002	MEUB_2Ghz	76 90	49.5
ZANG ZA 4002	6002	99 4	25.9
ZANG ZA 4002	METG	103 65	84.3
ZANG ZA 4002	102	97 57	20.0
*ZANG ZA 4002	103	97 9	48.5
*ZANG ZA 4002	104	97 9	45.1
ZANG ZA 4002	METG_BCR	97 9	46.8
*ZANG ZA 4002	10000	98 1	84.3
ZANG ZB 4002	201	109 11	26.0
ZANG ZB 4002	101	103 4	10.4
*ZANG ZA 5002	10000	98 15	8.0
*ZANG ZA 5002	20000	98 21	28.4
*ZANG ZA 5002	301	106 31	44.5
*ZANG ZA 5002	302	106 31	43.6
ZANG ZA 5002	old_DORIS	106 31	44.0
ZANG ZA 5002	2002	98 90	20.8
ZANG ZA 5002	3002	99 92	85.0
ZANG ZA 5002	6002	99 51	93.4

ZANG ZA 5002	1002	99 61	31.3
ZANG ZB 5002	4002	101 36	17.4
ZANG ZA 5002	MEUB_marker	107 67	75.4
*ZANG ZA 5002	202	91 65	4.5
*ZANG ZA 5002	203	91 65	4.5
ZANG ZA 5002	MEUB	91 65	4.5
*ZANG ZA 5002	204	88 46	6.9
*ZANG ZA 5002	205	88 46	5.6
ZANG ZA 5002	MEUB_2Ghz	88 46	6.3
ZANG ZA 5002	METG	108 57	66.8
ZANG ZA 5002	102	96 52	75.6
*ZANG ZA 5002	103	95 57	86.4
*ZANG ZA 5002	104	95 57	84.1
ZANG ZA 5002	METG_BCR	95 57	85.2
*ZANG ZA 5002	10000	98 8	64.6
ZANG ZA 5002	201	106 37	91.6
ZANG ZB 5002	101	107 35	23.5
*ZANG ZA 6002	10000	98 10	70.9
*ZANG ZA 6002	20000	98 22	59.0
ZANG ZA 6002	1002	99 83	0.2
ZANG ZA 6002	2002	99 44	41.5
ZANG ZA 6002	3002	100 14	5.5
ZANG ZA 6002	4002	100 95	64.2
ZANG ZA 6002	5002	100 47	71.0
*ZANG ZA 6002	301	103 79	13.5
*ZANG ZA 6002	302	103 78	99.0
ZANG ZA 6002	old_DORIS	103 79	06.2
ZANG ZA 6002	MEUB_marker	104 8	77.7
*ZANG ZA 6002	202	96 5	20.6
*ZANG ZA 6002	203	96 5	18.6
ZANG ZA 6002	MEUB	96 5	19.6
*ZANG ZA 6002	204	94 42	89.2
*ZANG ZA 6002	205	94 42	86.3
ZANG ZA 6002	MEUB_2Ghz	94 42	87.8
ZANG ZA 6002	METG	116 26	71.3
ZANG ZA 6002	102	94 48	87.3
*ZANG ZA 6002	103	92 76	24.8
*ZANG ZA 6002	104	92 76	52.6
ZANG ZA 6002	METG_BCR	92 76	38.7
*ZANG ZA 6002	10000	98 4	77.9
*ZANG ZA 6002	101	114 10	81.0
*ZANG ZA 6002	201	103 44	5.5

HIST GEN Zénithales

Distances

SIGM DP 0.0010
HIST NEW

DIST DP 1002	2002	13.36552
DIST DP 1002	3002	27.26035
DIST DP 1002	6002	19.15182
DIST DP 1002	102	13.66263
DIST DP 1002	5002	20.35039
DIST DP 1002	101	13.72062
DIST DP 1002	201	24.91933
DIST DP 2002	1002	13.36513
DIST DP 2002	3002	14.24824
DIST DP 2002	4002	18.26373
DIST DP 2002	5002	14.13859
DIST DP 2002	6002	19.61084
DIST DP 2002	102	15.49060
DIST DP 2002	201	13.55353
DIST DP 2002	101	15.55655
DIST DP 3002	1002	27.26043
DIST DP 3002	2002	14.24850
DIST DP 3002	5002	15.51981
DIST DP 3002	4002	10.10320
DIST DP 3002	6002	24.97446
DIST DP 3002	102	23.73255
DIST DP 3002	101	23.76045
DIST DP 4002	3002	10.10360
DIST DP 4002	5002	9.98885
DIST DP 4002	2002	18.26358
DIST DP 4002	6002	19.06114
DIST DP 4002	102	20.06805
DIST DP 4002	201	5.24025
DIST DP 4002	101	20.07810
DIST DP 5002	2002	14.13908
DIST DP 5002	3002	15.51979
DIST DP 5002	6002	9.60479
DIST DP 5002	1002	20.35034
DIST DP 5002	4002	9.98874
DIST DP 5002	102	10.10649
DIST DP 5002	201	9.61719

DIST DP	5002	101	10.15979
DIST DP	6002	1002	19.15151
DIST DP	6002	2002	19.61092
DIST DP	6002	3002	24.97448
DIST DP	6002	4002	19.06141
DIST DP	6002	5002	9.60496
DIST DP	6002	102	5.53891
DIST DP	6002	201	19.19111
DIST DP	6002	101	5.65236

HIST GEN Distances
HIST ALL Toutes les observations
END

6.7. Adjustment output file

```

=====
METG (FINLAND) REGINA&DORIS TIES - JULY 2012 SURVEY
Microsearch GeoLab, V2001.9.20.0          GRS 80          UNITS: m,GRAD
=====
Wed Jul 8 13:28:18 2015

Input file:  ..\METG.iob
Output file: ..\METG.lst
Options file: ..\default.gpj
=====

```

PARAMETERS		OBSERVATIONS	
Description	Number	Description	Number
No. of Stations	20	Directions	96
Coord Parameters	60	Distances	45
Free Latitudes	20	Azimuths	0
Free Longitudes	20	Vertical Angles	0
Free Heights	20	Zenithal Angles	76
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.	12	2-D Coords.	0
Direction Pars.	12	2-D Coord. Diffs.	0
Scale Parameters	0	3-D Coords.	9
Constant Pars.	0	3-D Coord. Diffs.	21
Rotation Pars.	0		
Translation Pars.	0		
	-----		-----
Total Parameters	72	Total Observations	247
Degrees of Freedom =		175	

```

=====
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	No
Geoid Interpolation Method	Bi-Quadratic

```

=====
METG (FINLAND) REGINA&DORIS TIES - JULY 2012 SURVEY
Microsearch GeoLab, V2001.9.20.0          GRS 80          UNITS: m,GRAD
=====
Adjusted PLH Coordinates:
=====

```

CODE	FFF	STATION	LATITUDE	LONGITUDE	ELIP-HEIGHT	
			STD DEV	STD DEV	STD DEV	
PLH	000	10000	N 60 14 26.23925	E 24 23 2.34994	65.5580 m	0
			0.0011	0.0010	0.0030	
PLH	000	1002	N 60 14 31.49889	E 24 23 2.74849	61.1652 m	0
			0.0011	0.0010	0.0011	
PLH	000	101	N 60 14 31.08021	E 24 23 3.02940	59.8707 m	0
			0.0011	0.0010	0.0011	
PLH	000	102	N 60 14 31.08035	E 24 23 3.02951	61.5933 m	0
			0.0010	0.0010	0.0011	
PLH	000	20000	N 60 14 34.87394	E 24 22 57.91620	66.3564 m	0
			0.0011	0.0010	1.0966	

Adjusted PLH Coordinates:

CODE	FFF	STATION	LATITUDE STD DEV	LONGITUDE STD DEV	ELIP-HEIGHT STD DEV
PLH	000	2002	N 60 14 31.48678 E 24 23 0.0011	3.61673 0.0010	61.2856 m 0.0011
PLH	000	201	N 60 14 31.17432 E 24 23 0.0011	4.22891 0.0010	60.0801 m 0.0011
PLH	000	3002	N 60 14 31.33014 E 24 23 0.0011	4.48737 0.0010	61.0592 m 0.0011
PLH	000	4002	N 60 14 31.01380 E 24 23 0.0011	4.32591 0.0010	60.8279 m 0.0011
PLH	000	5002	N 60 14 31.03103 E 24 23 0.0010	3.67781 0.0010	61.0421 m 0.0011
PLH	000	6002	N 60 14 30.90620 E 24 23 0.0010	3.10633 0.0010	61.1144 m 0.0011
PLH	000	METB	N 60 14 31.17433 E 24 23 0.0024	4.22910 0.0024	62.7904 m 0.0025
PLH	000	METG	N 60 14 31.08021 E 24 23 0.0011	3.02939 0.0010	59.6740 m 0.0011
PLH	000	METG_ARP	N 60 14 31.08035 E 24 23 0.0010	3.02952 0.0010	61.7092 m 0.0011
PLH	000	METG_BCR	N 60 14 31.08035 E 24 23 0.0010	3.02952 0.0010	61.7442 m 0.0011
PLH	000	METS	N 60 13 2.90291 E 24 23 0.0010	43.16271 0.0010	94.6291 m 0.0012
PLH	000	MEUB	N 60 14 31.17433 E 24 23 0.0011	4.22887 0.0010	62.3044 m 0.0011
PLH	000	MEUB_2Ghz	N 60 14 31.17435 E 24 23 0.0011	4.22894 0.0010	62.7963 m 0.0011
PLH	000	MEUB_marker	N 60 14 31.17432 E 24 23 0.0011	4.22892 0.0010	59.8824 m 0.0011
PLH	000	old_DORIS	N 60 14 31.30062 E 24 23 0.0011	4.24167 0.0010	59.8441 m 0.0011

METG (FINLAND) REGINA&DORIS TIES - JULY 2012 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		10000	2890777.9312 0.0016	1310340.9364 0.0012	5513889.6248 m 0.0027
XYZ		1002	2890644.7041 0.0010	1310287.2798 0.0010	5513966.6077 m 0.0011
XYZ		101	2890652.5801 0.0010	1310295.5955 0.0010	5513959.0525 m 0.0011
XYZ		102	2890653.3547 0.0010	1310295.9485 0.0010	5513960.5500 m 0.0011
XYZ		20000	2890595.1534 0.4957	1310183.1862 0.2247	5514022.9588 m 0.9520
XYZ		2002	2890639.5392 0.0010	1310299.6065 0.0010	5513966.5263 m 0.0011
XYZ		201	2890642.7516 0.0010	1310311.4047 0.0010	5513960.6800 m 0.0011
XYZ		3002	2890637.7394 0.0011	1310313.4990 0.0010	5513963.9235 m 0.0011
XYZ		4002	2890646.4017 0.0010	1310314.6979 0.0010	5513958.8634 m 0.0011
XYZ		5002	2890650.1940 0.0010	1310305.4680 0.0010	5513959.3139 m 0.0011
XYZ		6002	2890656.9117 0.0010	1310298.8585 0.0010	5513957.4592 m 0.0011
XYZ		METB	2890643.9755 0.0024	1310311.9626 0.0024	5513963.0330 m 0.0025
XYZ		METG	2890652.4912 0.0010	1310295.5551 0.0010	5513958.8817 m 0.0011
XYZ		METG_ARP	2890653.4068 0.0010	1310295.9723 0.0010	5513960.6508 m 0.0011
XYZ		METG_BCR	2890653.4226 0.0010	1310295.9795 0.0010	5513960.6812 m 0.0011
XYZ		METS	2892570.6568 0.0010	1311843.5481 0.0010	5512634.1969 m 0.0012
XYZ		MEUB	2890643.7573 0.0010	1310311.8598 0.0010	5513962.6111 m 0.0011
XYZ		MEUB_2Ghz	2890643.9788 0.0010	1310311.9614 0.0010	5513963.0384 m 0.0011
XYZ		MEUB_marker	2890642.6623 0.0010	1310311.3643 0.0010	5513960.5083 m 0.0011
XYZ		old_DORIS	2890639.4733 0.0011	1310310.1342 0.0010	5513962.4152 m 0.0011

Metsähovi ITRF co-location site survey – July 2012

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=====
METG (FINLAND) REGINA&DORIS TIES - JULY 2012 SURVEY
Microsearch GeoLab, V2001.9.20.0          GRS 80          UNITS: m,GRAD
=====
Residuals (critical value = 3.816):
NOTE: Observation values shown are reduced to mark-to-mark.

```

TYPE AT	FROM	TO	OBSERVATION	RESIDUAL		STD RES
				STD DEV	STD DEV	
						PPM
ELAT	METG_ARP	10000	0 00 4.84110	-0.0000	-0.0000	
			0.0003	0.6094	0.06	
ELON	METG_ARP	10000	0 00 0.67958	-0.0000	-0.0482	
			0.0003	0.0001	0.02	
EHGT	METG_ARP	10000	4.76130	-0.9125	-1.1509	
			1.0000	0.7929	6073.67	
ELAT	METG_ARP	20000	0 00 3.79359	-0.0000	-0.0025	
			0.0003	0.0012	0.02	
ELON	METG_ARP	20000	0 00 5.11332	-0.0000	-0.0253	
			0.0003	0.0001	0.01	
EHGT	METG_ARP	20000	4.64680	0.0004	0.2674	
			1.0000	0.0016	2.99	
XCT METG_ARP			2890653.40680	-0.0000	-0.0000	
			0.0010	0.0004		
YCT METG_ARP			1310295.97230	-0.0000	-0.0000	
			0.0010	0.0004		
ZCT METG_ARP			5513960.65080	-0.0000	-0.0000	
			0.0010	0.0002		
XCT METG_ARP			2890653.40680	-0.0000	-0.0000	
			0.0023	0.0021		
YCT METG_ARP			1310295.97230	-0.0000	-0.0000	
			0.0022	0.0020		
ZCT METG_ARP			5513960.65080	-0.0000	-0.0000	
			0.0055	0.0054		
XCT METS			2892570.65680	-0.0000	-0.0000	
			0.0023	0.0021		
YCT METS			1311843.54810	-0.0000	-0.0000	
			0.0022	0.0020		
ZCT METS			5512634.19690	-0.0000	-0.0000	
			0.0055	0.0054		
ELAT	METG_BCR	METG_ARP	0 00 0.00000	-0.0000	-0.0000	
			0.0002	0.0000	153.14*	
ELON	METG_BCR	METG_ARP	0 00 0.00000	-0.0000	-0.0000	
			0.0002	0.0000	63.50*	
EHGT	METG_BCR	METG_ARP	-0.03500	-0.0000	-0.0000	
			0.0003	0.0000	2.34*	
ELAT	METG_BCR	102	0 00 0.00000	-0.0002	-1.2040	
			0.0002	0.0002	1306.11	
ELON	METG_BCR	102	0 00 0.00000	-0.0001	-0.7309	
			0.0002	0.0002	879.86	
EHGT	METG_BCR	102	-0.15050	-0.0005	-1.6220	
			0.0003	0.0003	3075.45	
ELAT	201	MEUB_marker	0 00 0.00000	-0.0001	-0.0903	
			0.0010	0.0010	451.07	
ELON	201	MEUB_marker	0 00 0.00000	0.0000	0.0430	
			0.0010	0.0010	216.44	
EHGT	201	MEUB_marker	-0.19800	0.0003	0.4501	
			0.0008	0.0008	1745.59	
ELAT	101	METG	0 00 0.00000	-0.0000	-0.0061	
			0.0010	0.0010	30.54	
ELON	101	METG	0 00 0.00000	-0.0001	-0.0884	
			0.0010	0.0010	446.81	
EHGT	101	METG	-0.19800	0.0013	1.7186	
			0.0008	0.0008	6642.88	
ELAT	METB	MEUB	0 00 0.00000	-0.0000	-0.0000	
			0.0020	0.0000	0.00*	
ELON	METB	MEUB	0 00 0.00023	0.0000	0.0000	
			0.0020	0.0000	0.00*	
EHGT	METB	MEUB	-0.48600	0.0000	0.0000	
			0.0020	0.0000	0.00*	
DIR	1002	10000	0 0 0.0	-4.8	-0.7	
			8.0	7.1		
DIR	1002	20000	158 22 6.1	5.9	0.9	
			8.0	6.8		
DIR	1002	2002	299 38 73.9	-7.3	-1.1	
			8.0	6.5		
DIR	1002	3002	309 87 51.5	-6.7	-0.9	
			8.0	7.2		
DIR	1002	6002	379 3 82.7	-2.8	-0.4	
			8.0	7.4		
DIR	1002	102	377 8 99.4	15.3	2.3	
			8.0	6.8		
DIR	1002	5002	348 0 26.9	-9.2	-1.3	
			8.0	7.2		
DIR	1002	METG	377 10 64.5	-2.7	-0.4	
			8.0	6.7		

Metsähovi ITRF co-location site survey – July 2012

```

=====
Residuals (critical value = 3.816):
NOTE: Observation values shown are reduced to mark-to-mark.
=====

```

TYPE AT	FROM	TO	OBSERVATION		RESIDUAL		STD RES PPM
			STD	DEV	STD	DEV	
DIR	1002	METG_BCR	377	9	4.8	1.1	0.2
					8.0	6.8	
DIR	1002	MEUB_marker	324	4	24.2	3.8	0.5
					8.0	7.3	
DIR	1002	MEUB	324	4	29.7	-2.2	-0.3
					8.0	7.3	
DIR	1002	MEUB_2Ghz	324	3	96.1	9.7	1.3
					8.0	7.3	
DIR	1002	10000	0	0	0.0	-1.2	-0.2
					8.0	6.0	
DIR	1002	101	377	10	61.1	0.3	0.1
					8.0	5.4	
DIR	1002	201	324	4	29.1	0.9	0.1
					8.0	5.9	
DIR	2002	20000	0	0	0.0	-3.3	-0.5
					8.0	6.8	
DIR	2002	1002	346	13	79.7	3.2	0.6
					8.0	5.7	
DIR	2002	3002	166	46	8.5	-14.6	-2.2
					8.0	6.5	
DIR	2002	MEUB_marker	195	18	98.2	10.7	1.6
					8.0	6.8	
DIR	2002	MEUB	195	19	17.5	4.9	0.7
					8.0	6.8	
DIR	2002	MEUB_2Ghz	195	18	80.2	-8.1	-1.2
					8.0	6.8	
DIR	2002	4002	203	57	41.9	0.0	0.0
					8.0	7.3	
DIR	2002	5002	240	11	96.4	-7.4	-1.2
					8.0	6.3	
DIR	2002	6002	270	58	73.7	-12.6	-1.7
					8.0	7.3	
DIR	2002	METG	284	0	32.7	18.8	3.0
					8.0	6.3	
DIR	2002	102	284	0	89.1	4.4	0.7
					8.0	6.6	
DIR	2002	METG_BCR	284	0	99.7	-5.9	-0.9
					8.0	6.6	
DIR	2002	old_DORIS	178	71	89.2	10.0	1.6
					8.0	6.1	
DIR	2002	20000	0	0	0.0	-1.2	-0.2
					8.0	5.6	
DIR	2002	201	195	19	19.7	-10.2	-1.9
					8.0	5.4	
DIR	2002	101	284	0	39.4	11.4	2.2
					8.0	5.2	
DIR	3002	10000	0	0	0.0	0.3	0.0
					8.0	7.0	
DIR	3002	20000	139	48	69.4	0.9	0.1
					8.0	7.0	
DIR	3002	1002	99	17	13.1	4.5	0.6
					8.0	7.1	
DIR	3002	2002	109	0	46.9	3.5	0.5
					8.0	6.6	
DIR	3002	5002	46	21	41.4	-14.7	-2.0
					8.0	7.3	
DIR	3002	4002	2	72	12.7	-7.1	-1.1
					8.0	6.4	
DIR	3002	old_DORIS	71	80	41.3	4.2	1.6
					8.0	2.6	
DIR	3002	6002	51	68	52.0	3.3	0.4
					8.0	7.3	
DIR	3002	102	65	77	17.1	-8.6	-1.2
					8.0	7.2	
DIR	3002	METG_BCR	65	77	20.8	-8.5	-1.2
					8.0	7.1	
DIR	3002	MEUB_marker	30	79	90.8	7.2	1.5
					8.0	4.7	
DIR	3002	MEUB	30	80	70.5	7.9	1.7
					8.0	4.7	
DIR	3002	MEUB_2Ghz	30	80	21.3	7.0	1.5
					8.0	4.7	
DIR	3002	10000	0	0	0.0	10.0	1.9
					8.0	5.2	
DIR	3002	101	65	76	33.3	-10.0	-1.9
					8.0	5.2	
DIR	4002	10000	0	0	0.0	3.5	0.5
					8.0	6.9	
DIR	4002	20000	143	14	84.2	3.7	0.5
					8.0	7.1	

Metsähovi ITRF co-location site survey – July 2012

```

=====
Residuals (critical value = 3.816):
NOTE: Observation values shown are reduced to mark-to-mark.

```

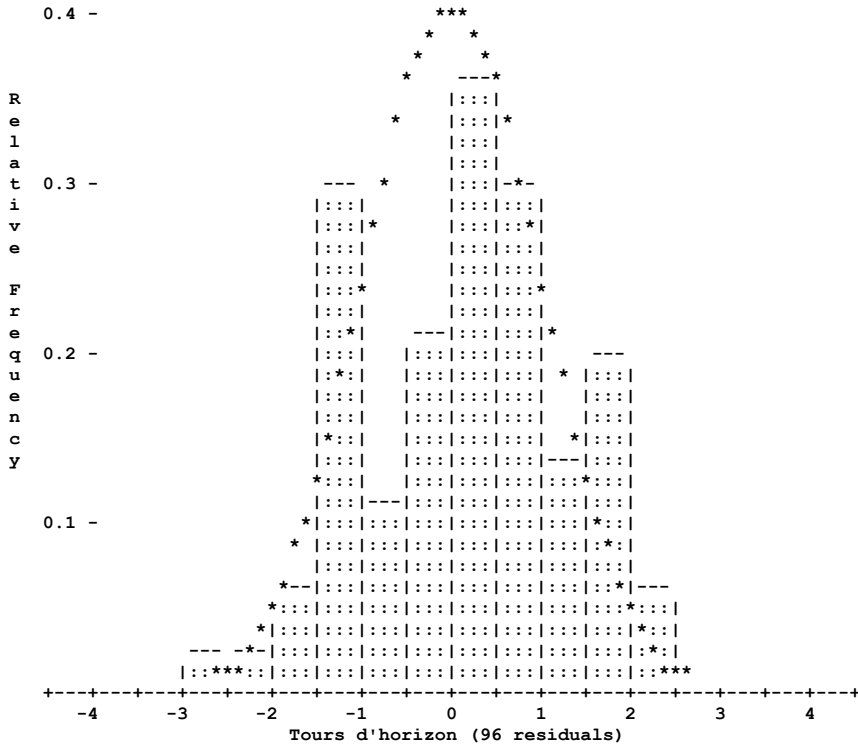
TYPE AT	FROM	TO	OBSERVATION		RESIDUAL		STD RES PPM
			STD DEV	STD DEV	STD DEV	STD DEV	
DIR	4002	3002	202 90	45.7	-16.0	-2.6	
				8.0	6.2		
DIR	4002	5002	90 48	36.4	-9.8	-1.5	
				8.0	6.7		
DIR	4002	2002	146 30	16.1	6.4	0.9	
				8.0	7.1		
DIR	4002	old_DORIS	177 85	16.8	4.5	1.1	
				8.0	4.2		
DIR	4002	MEUB_marker	168 50	34.6	7.0	2.1	
				8.0	3.3		
DIR	4002	MEUB	168 49	63.3	4.1	1.2	
				8.0	3.3		
DIR	4002	MEUB_2Ghz	168 51	3.9	0.9	0.3	
				8.0	3.3		
DIR	4002	6002	75 90	14.4	-1.7	-0.2	
				8.0	7.0		
DIR	4002	METG	93 61	73.9	2.0	0.3	
				8.0	6.8		
DIR	4002	102	93 63	19.5	0.1	0.0	
				8.0	7.0		
DIR	4002	METG_BCR	93 63	31.0	-4.7	-0.7	
				8.0	7.0		
DIR	4002	10000	0 0	0.0	2.5	0.5	
				8.0	5.2		
DIR	4002	201	168 50	42.6	-3.9	-1.8	
				8.0	2.2		
DIR	4002	101	93 61	73.9	1.4	0.3	
				8.0	5.2		
DIR	5002	10000	0 0	0.0	-6.0	-0.8	
				8.0	7.1		
DIR	5002	20000	150 50	62.6	0.6	0.1	
				8.0	7.2		
DIR	5002	old_DORIS	242 52	70.7	-2.2	-0.3	
				8.0	6.5		
DIR	5002	2002	187 4	81.0	3.6	0.6	
				8.0	6.2		
DIR	5002	3002	250 59	74.0	-8.1	-1.1	
				8.0	7.3		
DIR	5002	6002	64 93	6.2	-0.1	-0.0	
				8.0	5.7		
DIR	5002	1002	141 68	28.3	1.3	0.2	
				8.0	6.9		
DIR	5002	4002	294 68	49.1	-7.5	-1.3	
				8.0	5.8		
DIR	5002	MEUB_marker	260 60	69.9	3.0	0.5	
				8.0	6.1		
DIR	5002	MEUB	260 60	21.4	8.3	1.4	
				8.0	6.0		
DIR	5002	MEUB_2Ghz	260 60	28.4	5.1	0.8	
				8.0	6.0		
DIR	5002	METG	100 92	21.5	-11.0	-2.5	
				8.0	4.4		
DIR	5002	102	100 94	91.9	8.2	1.5	
				8.0	5.4		
DIR	5002	METG_BCR	100 95	8.8	4.8	0.9	
				8.0	5.4		
DIR	5002	10000	0 0	0.0	-5.1	-1.2	
				8.0	4.4		
DIR	5002	201	260 60	60.2	7.0	2.0	
				8.0	3.5		
DIR	5002	101	100 92	14.3	-1.8	-0.5	
				8.0	4.0		
DIR	6002	10000	0 0	0.0	-2.5	-0.4	
				8.0	7.0		
DIR	6002	20000	158 17	48.7	-6.4	-0.9	
				8.0	7.1		
DIR	6002	1002	176 31	77.8	-9.7	-1.4	
				8.0	6.9		
DIR	6002	2002	221 11	54.2	-21.2	-3.0	
				8.0	7.1		
DIR	6002	3002	259 66	67.5	3.2	0.4	
				8.0	7.5		
DIR	6002	4002	283 69	95.2	8.9	1.3	
				8.0	7.1		
DIR	6002	5002	268 52	89.3	-6.9	-1.0	
				8.0	6.8		
DIR	6002	old_DORIS	256 5	29.9	12.8	1.7	
				8.0	7.3		
DIR	6002	MEUB_marker	266 37	2.4	3.0	0.4	
				8.0	7.2		

Metsähovi ITRF co-location site survey – July 2012

```
=====
Residuals (critical value = 3.816):
NOTE: Observation values shown are reduced to mark-to-mark.
=====
```

TYPE AT	FROM	TO	OBSERVATION		RESIDUAL		STD RES PPM
			STD DEV	STD DEV	STD DEV	STD DEV	
DIR	6002	MEUB	266 36	82.5	1.9	0.3	
				8.0	7.2		
DIR	6002	MEUB_2Ghz	266 36	77.2	7.8	1.1	
				8.0	7.2		
DIR	6002	METG	181 10	58.0	5.4	1.7	
				8.0	3.2		
DIR	6002	102	181 13	74.7	7.8	2.0	
				8.0	3.9		
DIR	6002	METG_BCR	181 14	6.5	-4.2	-1.1	
				8.0	3.9		
DIR	6002	10000	0 0	0.0	3.3	0.6	
				8.0	5.3		
DIR	6002	201	266 37	13.4	-5.5	-1.1	
				8.0	5.2		
DIR	6002	101	181 10	77.0	2.3	0.8	
				8.0	2.7		

```
=====
METG (FINLAND) REGINA&DORIS TIES - JULY 2012 SURVEY
Microsearch GeoLab, V2001.9.20.0 GRS 80 UNITS: m,GRAD
=====
```



```
=====
METG (FINLAND) REGINA&DORIS TIES - JULY 2012 SURVEY
Microsearch GeoLab, V2001.9.20.0 GRS 80 UNITS: m,GRAD
=====
```

```
Residuals (critical value = 3.821):
NOTE: Observation values shown are reduced to mark-to-mark.
=====
```

TYPE AT	FROM	TO	OBSERVATION		RESIDUAL		STD RES PPM
			STD DEV	STD DEV	STD DEV	STD DEV	
ZANG	1002	2002	99 42	50.1	-13.7	-1.5	
				10.0	9.2		
ZANG	1002	3002	100 24	69.8	-7.3	-0.7	
				10.0	9.8		
ZANG	1002	6002	100 16	79.7	-8.9	-0.9	
				10.0	9.6		
ZANG	1002	102	98 0	50.2	-0.5	-0.1	
				10.0	9.0		
ZANG	1002	5002	100 38	37.1	-13.6	-1.4	
				10.0	9.7		

Metsähovi ITRF co-location site survey – July 2012

```

=====
Residuals (critical value = 3.821):
NOTE: Observation values shown are reduced to mark-to-mark.
=====

```

TYPE AT	FROM	TO	OBSERVATION		RESIDUAL	STD RES
			STD DEV	STD DEV	STD DEV	PPM
ZANG	1002	METG	106 92	20.0	-2.1	-0.2
				10.0	8.9	
ZANG	1002	METG_BCR	97 30	15.4	-7.0	-0.8
				10.0	9.0	
ZANG	1002	MEUB_marker	103 27	73.9	-0.3	-0.0
				10.0	9.7	
ZANG	1002	MEUB	97 8	90.8	2.4	0.2
				10.0	9.7	
ZANG	1002	MEUB_2Ghz	95 83	50.5	1.4	0.1
				10.0	9.6	
ZANG	1002	101	106 1	47.7	-1.7	-0.2
				10.0	7.8	
ZANG	2002	1002	100 57	16.1	-21.4	-2.3
				10.0	9.2	
ZANG	2002	3002	101 0	81.6	-37.4	-2.4
				16.0	15.7	
ZANG	2002	MEUB_marker	106 59	48.3	13.7	1.5
				10.0	9.3	
ZANG	2002	MEUB	95 20	62.1	17.3	1.9
				10.0	9.3	
ZANG	2002	MEUB_2Ghz	92 90	40.9	-11.0	-1.2
				10.0	9.0	
ZANG	2002	4002	101 59	45.7	-10.3	-1.1
				10.0	9.7	
ZANG	2002	5002	101 9	48.5	-16.7	-1.8
				10.0	9.5	
ZANG	2002	6002	100 55	50.2	-8.8	-0.9
				10.0	9.7	
ZANG	2002	METG	106 59	88.6	1.6	0.2
				10.0	9.3	
ZANG	2002	102	98 73	53.2	-3.4	-0.4
				10.0	9.3	
ZANG	2002	old_DORIS	98 11	47.4	-7.4	-0.8
				10.0	9.3	
ZANG	2002	old_DORIS	108 14	7.4	-11.0	-1.2
				10.0	9.0	
ZANG	2002	201	105 67	52.8	52.4	3.5
				16.0	15.1	
ZANG	2002	101	105 79	83.4	2.3	0.3
				10.0	8.3	
ZANG	3002	1002	99 75	30.5	4.8	0.5
				10.0	9.8	
ZANG	3002	2002	98 98	74.1	-8.3	-0.9
				10.0	9.5	
ZANG	3002	5002	100 6	96.7	-3.3	-0.3
				10.0	9.7	
ZANG	3002	4002	101 45	51.1	-20.7	-2.2
				10.0	9.3	
ZANG	3002	old_DORIS	119 27	75.1	6.6	1.2
				10.0	5.3	
ZANG	3002	6002	99 85	84.6	-8.4	-0.9
				10.0	9.8	
ZANG	3002	102	98 56	77.0	4.1	0.4
				10.0	9.7	
ZANG	3002	METG_BCR	98 16	34.9	10.0	1.0
				10.0	9.7	
ZANG	3002	MEUB_marker	111 84	49.6	-12.4	-1.6
				10.0	7.7	
ZANG	3002	MEUB	87 48	19.6	3.0	0.4
				10.0	7.6	
ZANG	3002	MEUB_2Ghz	82 73	91.5	-14.3	-2.2
				10.0	6.4	
ZANG	3002	10000	98 22	18.6	0.0	0.9
				10.0	0.0	
ZANG	3002	101	103 19	7.2	49.6	3.2
				16.0	15.6	
ZANG	4002	3002	98 54	18.1	-11.1	-1.2
				10.0	9.3	
ZANG	4002	5002	98 63	45.1	-3.5	-0.4
				10.0	9.3	
ZANG	4002	2002	98 40	37.0	-8.8	-0.9
				10.0	9.7	
ZANG	4002	old_DORIS	106 95	38.8	-0.1	-0.0
				10.0	8.7	
ZANG	4002	MEUB_marker	111 47	82.9	3.3	0.5
				10.0	6.8	
ZANG	4002	MEUB	82 34	68.8	-12.4	-1.8
				10.0	6.9	
ZANG	4002	6002	99 4	25.9	-6.6	-0.7
				10.0	9.7	

Metsähovi ITRF co-location site survey – July 2012

```

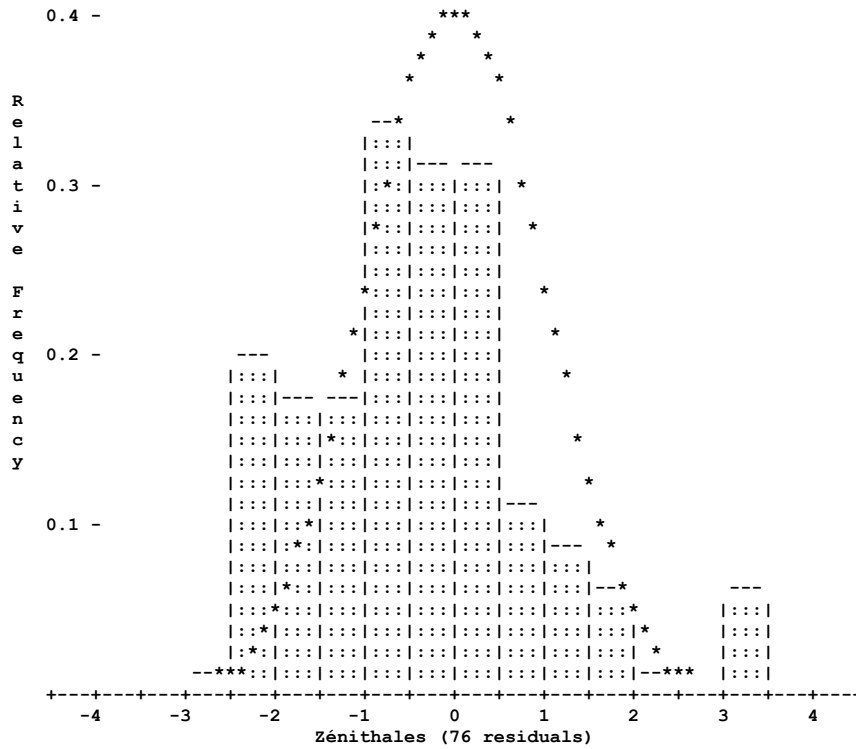
=====
Residuals (critical value = 3.821):
NOTE: Observation values shown are reduced to mark-to-mark.

```

TYPE AT	FROM	TO	OBSERVATION		RESIDUAL		STD RES PPM
			STD DEV	STD DEV	STD DEV	STD DEV	
ZANG	4002	METG	103 65	84.3	-5.3	-0.5	
				10.0	9.6		
ZANG	4002	102	97 57	20.0	3.6	0.4	
				10.0	9.6		
ZANG	4002	METG_BCR	97 9	46.8	14.6	1.5	
				10.0	9.6		
ZANG	4002	201	109 11	26.0	-26.1	-2.4	
				16.0	10.7		
ZANG	4002	101	103 4	10.4	47.2	3.1	
				16.0	15.4		
ZANG	5002	old_DORIS	106 31	44.0	-9.1	-1.0	
				10.0	9.2		
ZANG	5002	2002	98 90	20.8	-15.4	-1.6	
				10.0	9.5		
ZANG	5002	3002	99 92	85.0	-16.5	-1.7	
				10.0	9.7		
ZANG	5002	6002	99 51	93.4	-15.5	-1.7	
				10.0	9.2		
ZANG	5002	1002	99 61	31.3	-20.1	-2.1	
				10.0	9.7		
ZANG	5002	4002	101 36	17.4	-35.0	-2.2	
				16.0	15.5		
ZANG	5002	MEUB_marker	107 67	75.4	-0.4	-0.1	
				10.0	8.9		
ZANG	5002	MEUB	91 65	4.5	2.4	0.3	
				10.0	8.8		
ZANG	5002	MEUB_2Ghz	88 46	6.3	18.9	2.3	
				10.0	8.3		
ZANG	5002	METG	108 57	66.8	-6.7	-0.8	
				10.0	8.6		
ZANG	5002	102	96 52	75.6	10.2	1.2	
				10.0	8.7		
ZANG	5002	METG_BCR	95 57	85.2	7.2	0.8	
				10.0	8.7		
ZANG	5002	201	106 37	91.6	5.0	0.7	
				10.0	7.5		
ZANG	5002	101	107 35	23.5	-37.2	-2.7	
				16.0	13.6		
ZANG	6002	1002	99 83	0.2	-13.1	-1.4	
				10.0	9.6		
ZANG	6002	2002	99 44	41.5	-1.5	-0.2	
				10.0	9.7		
ZANG	6002	3002	100 14	5.5	-4.0	-0.4	
				10.0	9.8		
ZANG	6002	4002	100 95	64.2	-5.2	-0.5	
				10.0	9.7		
ZANG	6002	5002	100 47	71.0	-21.1	-2.3	
				10.0	9.2		
ZANG	6002	old_DORIS	103 79	6.2	3.8	0.4	
				10.0	9.7		
ZANG	6002	MEUB_marker	104 8	77.7	4.9	0.5	
				10.0	9.7		
ZANG	6002	MEUB	96 5	19.6	2.8	0.3	
				10.0	9.6		
ZANG	6002	MEUB_2Ghz	94 42	87.8	18.5	1.9	
				10.0	9.5		
ZANG	6002	METG	116 26	71.3	3.7	0.6	
				10.0	6.1		
ZANG	6002	102	94 48	87.3	-1.6	-0.3	
				10.0	6.2		
ZANG	6002	METG_BCR	92 76	38.7	-9.4	-1.5	
				10.0	6.2		

Metsähovi ITRF co-location site survey – July 2012

```
=====
METG (FINLAND) REGINA&DORIS TIES - JULY 2012 SURVEY
Microsearch GeoLab, V2001.9.20.0          GRS 80          UNITS: m,GRAD
=====
```



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=====
METG (FINLAND) REGINA&DORIS TIES - JULY 2012 SURVEY
Microsearch GeoLab, V2001.9.20.0          GRS 80          UNITS: m,GRAD
=====
```

Residuals (critical value = 3.821):

NOTE: Observation values shown are reduced to mark-to-mark.

TYPE	AT	FROM	TO	OBSERVATION STD DEV	RESIDUAL STD DEV	STD RES PPM
DIST		1002	2002	13.36550	-0.0002	-0.1962
				0.0010	0.0010	14.46
DIST		1002	3002	27.26030	0.0007	0.7018
				0.0010	0.0010	24.94
DIST		1002	6002	19.15180	-0.0002	-0.1758
				0.0010	0.0010	8.99
DIST		1002	102	13.66260	0.0002	0.1960
				0.0010	0.0010	14.11
DIST		1002	5002	20.35030	0.0003	0.3492
				0.0010	0.0010	16.80
DIST		1002	101	13.72060	0.0002	0.2469
				0.0010	0.0010	17.62
DIST		1002	201	24.91930	-0.0002	-0.1978
				0.0010	0.0010	7.68
DIST		2002	1002	13.36510	0.0002	0.2099
				0.0010	0.0010	15.47
DIST		2002	3002	14.24820	0.0002	0.1732
				0.0010	0.0010	11.98
DIST		2002	4002	18.26370	0.0000	0.0229
				0.0010	0.0010	1.23
DIST		2002	5002	14.13850	0.0001	0.1440
				0.0010	0.0010	10.09
DIST		2002	6002	19.61080	-0.0002	-0.2237
				0.0010	0.0010	11.21
DIST		2002	102	15.49060	0.0001	0.1318
				0.0010	0.0010	8.40
DIST		2002	201	13.55350	-0.0000	-0.0005
				0.0010	0.0010	0.04

Metsähovi ITRF co-location site survey – July 2012

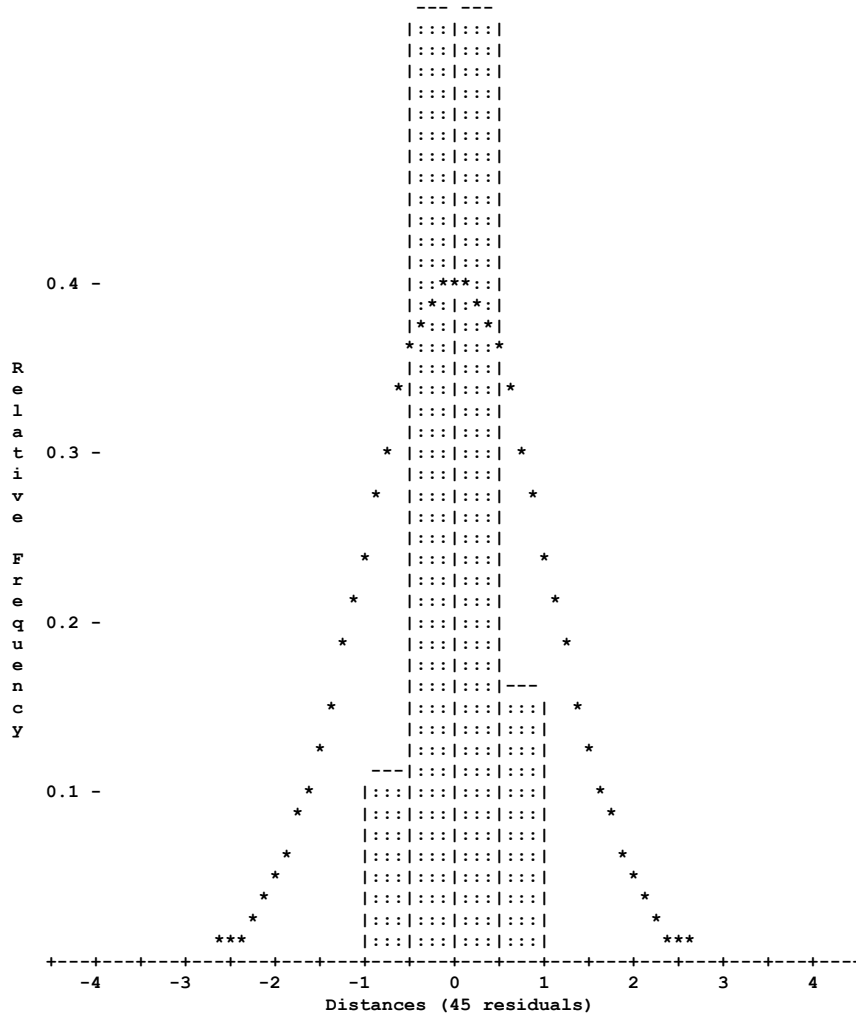
```

=====
Residuals (critical value = 3.821):
NOTE: Observation values shown are reduced to mark-to-mark.

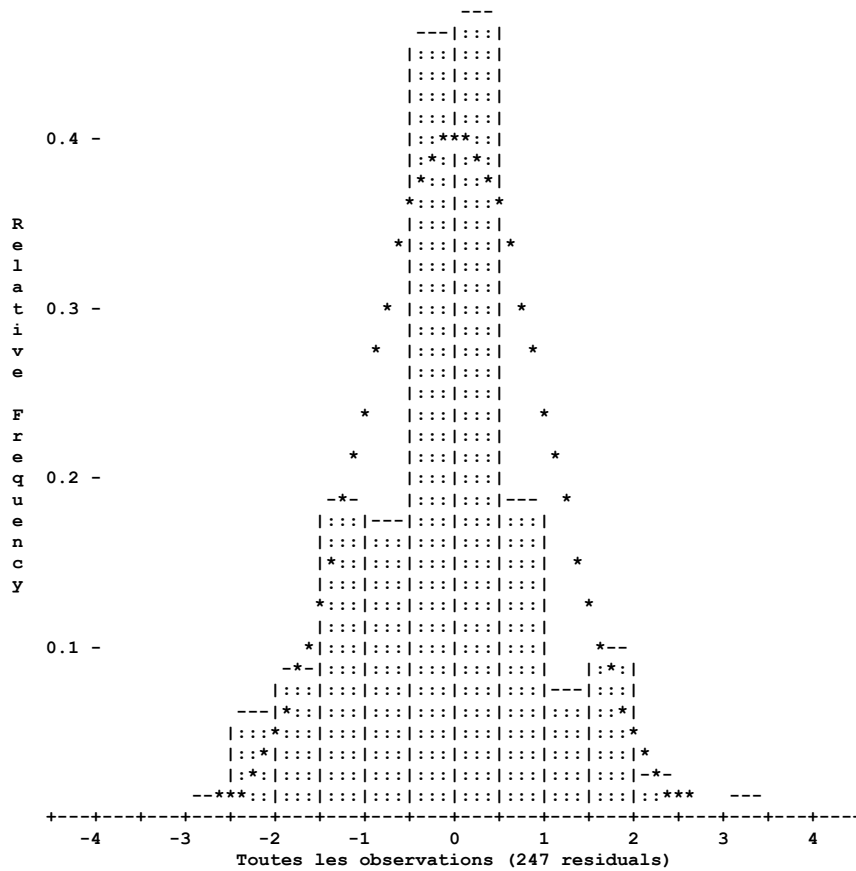
```

TYPE AT	FROM	TO	OBSERVATION	RESIDUAL	STD RES
			STD DEV	STD DEV	PPM
DIST	2002	101	15.55650	0.0002	0.2273
			0.0010	0.0010	14.38
DIST	3002	1002	27.26040	0.0006	0.5986
			0.0010	0.0010	21.27
DIST	3002	2002	14.24850	-0.0001	-0.1312
			0.0010	0.0010	9.08
DIST	3002	5002	15.51980	-0.0000	-0.0360
			0.0010	0.0010	2.28
DIST	3002	4002	10.10320	0.0002	0.1770
			0.0010	0.0010	17.32
DIST	3002	6002	24.97440	-0.0003	-0.2764
			0.0010	0.0010	10.78
DIST	3002	102	23.73250	0.0001	0.0962
			0.0010	0.0010	3.95
DIST	3002	101	23.76040	-0.0010	-0.9987
			0.0010	0.0010	40.96
DIST	4002	3002	10.10360	-0.0002	-0.2276
			0.0010	0.0010	22.27
DIST	4002	5002	9.98880	-0.0001	-0.1003
			0.0010	0.0010	9.94
DIST	4002	2002	18.26350	0.0002	0.2267
			0.0010	0.0010	12.18
DIST	4002	6002	19.06110	-0.0003	-0.3080
			0.0010	0.0010	15.90
DIST	4002	102	20.06800	0.0000	0.0018
			0.0010	0.0010	0.09
DIST	4002	201	5.24020	0.0008	0.7965
			0.0010	0.0010	149.85
DIST	4002	101	20.07810	-0.0005	-0.5516
			0.0010	0.0010	26.93
DIST	5002	2002	14.13900	-0.0004	-0.3609
			0.0010	0.0010	25.28
DIST	5002	3002	15.51970	0.0001	0.0658
			0.0010	0.0010	4.17
DIST	5002	6002	9.60470	0.0001	0.0899
			0.0010	0.0010	9.27
DIST	5002	1002	20.35030	0.0003	0.3492
			0.0010	0.0010	16.80
DIST	5002	4002	9.98870	0.0000	0.0008
			0.0010	0.0010	0.07
DIST	5002	102	10.10640	-0.0001	-0.0562
			0.0010	0.0010	5.50
DIST	5002	201	9.61710	0.0006	0.5869
			0.0010	0.0010	60.29
DIST	5002	101	10.15970	0.0005	0.4677
			0.0010	0.0010	45.44
DIST	6002	1002	19.15150	0.0001	0.1304
			0.0010	0.0010	6.67
DIST	6002	2002	19.61090	-0.0003	-0.3254
			0.0010	0.0010	16.31
DIST	6002	3002	24.97440	-0.0003	-0.2764
			0.0010	0.0010	10.78
DIST	6002	4002	19.06140	-0.0006	-0.6130
			0.0010	0.0010	31.63
DIST	6002	5002	9.60490	-0.0001	-0.1121
			0.0010	0.0010	11.55
DIST	6002	102	5.53890	-0.0005	-0.4883
			0.0010	0.0010	87.41
DIST	6002	201	19.19110	-0.0003	-0.3074
			0.0010	0.0010	15.72
DIST	6002	101	5.65230	0.0000	0.0253
			0.0010	0.0010	4.42

```
=====
METG (FINLAND) REGINA&DORIS TIES - JULY 2012 SURVEY
Microsearch GeoLab, V2001.9.20.0          GRS 80          UNITS: m,GRAD
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```
=====
METG (FINLAND) REGINA&DORIS TIES - JULY 2012 SURVEY
Microsearch GeoLab, V2001.9.20.0          GRS 80          UNITS: m,GRAD
=====
```



STATISTICS SUMMARY

Residual Critical Value Type	Tau Max
Residual Critical Value	3.8209
Number of Flagged Residuals	0
Convergence Criterion	0.0001
Final Iteration Counter Value	3
Confidence Level Used	95.0000
Estimated Variance Factor	1.2025
Number of Degrees of Freedom	175

Chi-Square Test on the Variance Factor:

9.8555e-01 < 1.0000 < 1.5003e+00 ?

THE TEST PASSES

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

Variance factor used	=	1.2025
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.

2-D and 1-D Station Confidence Regions (95.000 and 95.000 percent):				
STATION	MAJOR SEMI-AXIS	AZ	MINOR SEMI-AXIS	VERTICAL
10000	0.0026	20	0.0025	0.0059
1002	0.0026	10	0.0025	0.0022
101	0.0026	13	0.0025	0.0022
102	0.0026	16	0.0025	0.0022
20000	0.0026	19	0.0025	2.1493
2002	0.0026	17	0.0025	0.0022
201	0.0026	18	0.0025	0.0022
3002	0.0026	27	0.0025	0.0022
4002	0.0026	19	0.0025	0.0022
5002	0.0026	20	0.0025	0.0022
6002	0.0026	14	0.0025	0.0022
METB	0.0060	21	0.0059	0.0048
METG	0.0026	13	0.0025	0.0022
METG_ARP	0.0025	22	0.0024	0.0021
METG_BCR	0.0026	20	0.0025	0.0022
METS	0.0026	23	0.0024	0.0023
MEUB	0.0026	21	0.0025	0.0022
MEUB_2Ghz	0.0026	21	0.0025	0.0022
MEUB_marker	0.0026	21	0.0025	0.0022
old_DORIS	0.0026	26	0.0025	0.0022

3D Station Confidence Regions (95.000 percent):			
STATION	MAJ-SEMI (AZ, VANG)	MED-SEMI (AZ, VANG)	MIN-SEMI (AZ, VANG)
10000	0.0084 (17, 90)	0.0030 (200, 0)	0.0029 (110, 0)
1002	0.0032 (15, 69)	0.0029 (186, 21)	0.0029 (277, 3)
101	0.0032 (16, 70)	0.0029 (192, 20)	0.0028 (282, 1)
102	0.0032 (17, 70)	0.0029 (195, 20)	0.0028 (286, 0)
20000	3.0655 (146, 90)	0.0030 (19, 0)	0.0029 (289, 0)
2002	0.0032 (17, 68)	0.0029 (197, 22)	0.0029 (107, 0)
201	0.0032 (18, 69)	0.0029 (199, 21)	0.0029 (109, 0)
3002	0.0032 (21, 66)	0.0029 (212, 23)	0.0029 (120, 4)
4002	0.0032 (18, 68)	0.0029 (200, 22)	0.0029 (109, 1)
5002	0.0032 (18, 70)	0.0029 (202, 20)	0.0029 (111, 1)
6002	0.0032 (16, 69)	0.0029 (193, 21)	0.0028 (283, 1)
METB	0.0069 (19, 68)	0.0068 (204, 22)	0.0068 (113, 2)
METG	0.0032 (16, 70)	0.0029 (192, 20)	0.0028 (282, 1)
METG_ARP	0.0030 (19, 63)	0.0028 (205, 27)	0.0028 (114, 2)
METG_BCR	0.0031 (18, 70)	0.0029 (201, 20)	0.0028 (111, 1)
METS	0.0034 (23, 63)	0.0029 (205, 27)	0.0028 (114, 1)
MEUB	0.0032 (19, 68)	0.0029 (204, 22)	0.0029 (113, 2)
MEUB_2Ghz	0.0032 (19, 68)	0.0029 (204, 21)	0.0029 (113, 2)
MEUB_marker	0.0032 (19, 68)	0.0029 (204, 22)	0.0029 (113, 2)
old_DORIS	0.0032 (20, 68)	0.0029 (211, 22)	0.0029 (119, 4)

6.8. Metsähovi SINEX file

```

%=SNX 1.00 IGN 15:160:00000 IGN 12:184:00000 12:184:00000 C 00012
*-----
+FILE/COMMENT
* File created by geotosnx software (Z.Altamimi)
* Original input file: METG_v2.cov
* Matrix Scaling Factor used: 1.0000000000
-FILE/COMMENT
*-----
+SITE/ID
*CODE PT DOMES T STATION DESCRIPTION APPROX LON APPROX LAT APP H
MEUB A 10503S016 10503S016 24 23 04.2 60 14 31.1 62.3
METG A 10503M002 10503M002 24 23 03.0 60 14 31.0 59.7
METS A 10503S011 10503S011 24 23 43.1 60 13 02.9 94.6
METB A 10503S015 10503S015 24 23 04.2 60 14 31.1 62.8
-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 MEUB A 1 12:184:00000 m 2 0.289064375730000E+07 0.10496E-02
2 STAX MEUB A 1 12:184:00000 m 2 0.131031185980000E+07 0.10293E-02
3 STAX MEUB A 1 12:184:00000 m 2 0.551396261110000E+07 0.11266E-02
4 STAX METG A 1 12:184:00000 m 2 0.289065249120000E+07 0.10415E-02
5 STAX METG A 1 12:184:00000 m 2 0.13102955510000E+07 0.10158E-02
6 STAX METG A 1 12:184:00000 m 2 0.551395888170000E+07 0.11243E-02
7 STAX METS A 1 12:184:00000 m 2 0.289257065680000E+07 0.10185E-02
8 STAX METS A 1 12:184:00000 m 2 0.131184354810000E+07 0.99121E-03
9 STAX METS A 1 12:184:00000 m 2 0.551263419690000E+07 0.12004E-02
10 STAX METB A 1 12:184:00000 m 2 0.289064397540000E+07 0.24270E-02
11 STAX METB A 1 12:184:00000 m 2 0.131031196260000E+07 0.24183E-02
12 STAX METB A 1 12:184:00000 m 2 0.551396303300000E+07 0.24613E-02
-SOLUTION/ESTIMATE
*-----
+SOLUTION/MATRIX_ESTIMATE L COVA
*PARA1 PARA2 PARA2+0 PARA2+1 PARA2+2
1 1 0.110158872973707E-05
2 1 -.101885721225899E-09 0.105948946076036E-05
3 1 0.215649806242037E-07 -.864576555016524E-08 0.126931821348550E-05
4 1 0.107636108761762E-05 0.523455613049803E-08 0.327335535593400E-07
4 4 0.108475425161744E-05
5 1 0.368547155891751E-08 0.102405095325029E-05 -.108116554919148E-07
5 4 0.770147788126574E-08 0.103182358595109E-05
6 1 0.327335668358250E-07 -.116978984410431E-07 0.125723323956224E-05
6 4 0.312998806923309E-07 -.131086648096114E-07 0.126393923229974E-05
7 1 0.100396154661169E-05 -.103818686551532E-08 0.850900737720741E-08
7 4 0.100396144382795E-05 -.894189263645914E-09 0.763300173649513E-08
7 7 0.103727309464986E-05
8 1 -.898573598366990E-09 0.968227449335230E-06 -.952365459310285E-08
8 4 -.104243842555214E-08 0.968227482540225E-06 -.866450517724316E-08
8 7 -.660798628355896E-09 0.982492187881463E-06
9 1 0.763318239462755E-08 -.866694034774651E-08 0.115374677208120E-05
9 4 0.850884603318201E-08 -.952651138453158E-08 0.115374638750518E-05
9 7 0.183844751193709E-07 -.604225236307121E-08 0.144087198524515E-05
10 1 0.110158872974211E-05 -.101886902586483E-09 0.215649803611662E-07
10 4 0.107636108762939E-05 0.368547040516716E-08 0.327335665786309E-07
10 7 0.100396154661255E-05 -.898574675603256E-09 0.763318215493981E-08
10 10 0.589043424742566E-05
11 1 -.101884586089700E-09 0.105948946076006E-05 -.864576560061265E-08
11 4 0.523455722686774E-08 0.102405095324411E-05 -.116978984910767E-07
11 7 -.103818582834003E-08 0.968227449335931E-06 -.866694039362282E-08
11 10 -.101885767450036E-09 0.584833497843827E-05
12 1 0.215649809180173E-07 -.864576551284447E-08 0.126931821348077E-05
12 4 0.327335538479430E-07 -.108116554671575E-07 0.125723323955494E-05
12 7 0.850900764248189E-08 -.952365454727407E-08 0.115374677207962E-05
12 10 0.215649806549792E-07 -.864576556329207E-08 0.605816373115454E-05
-SOLUTION/MATRIX_ESTIMATE L COVA
%ENDSNX

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