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## ITRF local tie survey at Höfn - Iceland



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## ABSTRACT

The ITRF2014 realization (most recent frame of the International Terrestrial Reference System) computed by the ITRF product Centre (IGN Geodesy research team from IPGP) is the result of the reference frames combination from four space geodesy techniques (GNSS, DORIS, SLR and VLBI). One way to achieve one common frame consists in adding to the combination results from co-located sites local tie surveys. The geodetic observatory of Höfn in Iceland is equipped with a DORIS station and two permanent GNSS stations one of which is part of the IGS network. This report describes the local tie survey carried out in September 2020 during the DORIS station installation on site and provides the associated results.

## ACKNOWLEDGEMENTS

On behalf of CNES and IGN, we would like to acknowledge the staff from the geodetic department of LMI (LandMælingar Íslands, the Icelandic mapping agency) for all the essential logistics works, for their welcome and help.

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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 (GNSS, DORIS, SLR and VLBI). To perform this combination between independent reference frames, local tie surveys between co-located space geodetic instruments, precisely measured and expressed in three dimensions are necessary.

One way to improve the ITRS realization consists in adding to the combination tie vectors from new co-located sites or to improve the local tie accuracy on former sites.

To this end, missing or old local ties have to be surveyed. In charge of the DORIS network maintenance, IGN carries out local tie surveys as soon as a DORIS station is co-located.

This document presents the local tie survey performed at Höfn in Iceland, which took place on September 2020 during DORIS installation works on site.

The goals were the following:

- Assign coordinates to the reference point of new DORIS antenna ;
- Provide tie vectors between instruments reference points (i.e. DORIS, GNSS and VLBI marker) ;
- Produce a survey result file in SINEX format.

## 1.2 Glossary

ARP: Antenna Reference Point

BKG: Bundesamt für Kartographie und Geodäsie (Germany)

CNES: Centre National d'Études Spatiales (France)

DOMES: Directory of MERIT Sites

DORIS: Doppler Orbitography and Radiopositioning Integrated by Satellite

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

LMI: LandMælingar Íslands (Iceland)

SINEX: Solution INdependent Exchange

SLR: Satellite Laser Ranging

VLBI: Very Long Baseline Interferometry

## 2 Co-location site description

### 2.1 Site information

The site is located north of the city of Höfn on the South-East coast of Iceland. The site is a geodetic observatory owned by LMI (Icelandic mapping agency).



Iceland map (extract LMI)

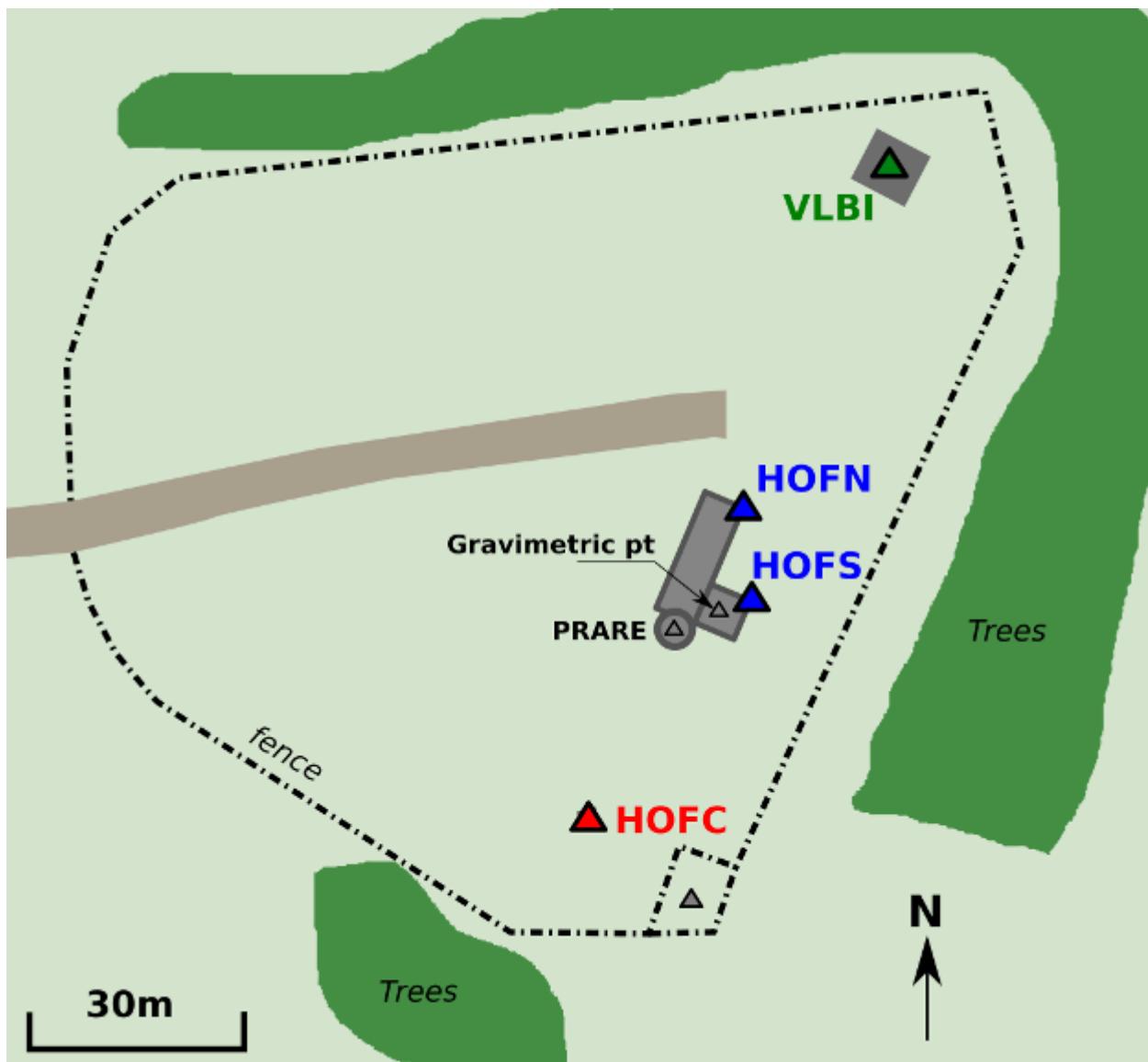
### 2.2 Co-located points

The observatory is equipped with a GNSS station (HOFN) part of IGS network operated by BKG, another GNSS station (HOFS) operated by Kartverket, the Norwegian mapping agency and a DORIS station (HOFC). The both GNSS antennas are fixed on two chimney pillars part of the observatory building. DORIS antenna is located about 26 m south of the building on an existing pillar. The pillar has a geodetic marker used by EUREF campaigns in the past. The marker is now the DORIS witness mark centred on the antenna vertical axis. North of the building, a marker embedded into concrete block was used for VLBI campaigns. For further information on these operating stations refer to the corresponding sitelogs in appendices. The following table sums up the geodetic techniques co-located on site.

Technique Name	DOMES n°	Description	Acronym / N°
GNSS	10204M002	Survey marker bolt / Chimney	HOFN
GNSS	10204M003	ARP - BAM / Chimney	HOFS
VLBI	10204M001	Survey marker bolt / Concrete block	7635
DORIS	10204M005	DORIS witness mark / Concrete pillar	-
DORIS	10204S001	DORIS antenna reference point	HOFC

Further details can be found at <http://itrf.ign.fr/>

The site is also equipped with a gravimetric point inside the building and former PRARE equipment in the observation tower of the observatory (DOMES number: 10204M004). They have not been included in the site survey.



Site map: Points location

## 3 Local tie survey description

### 3.1 Organization

The local tie was performed by Damien Pesce (IGN) on September 23<sup>rd</sup>, 2020.

### 3.2 Equipment – Instruments characteristics

The following section provides the characteristics of the surveying equipment that was used. The surveying instruments belong to IGN and are regularly checked and calibrated. GNSS equipment and the tripods are lent by LMI.

Equipment	Trademark, Serial ref. n°	Specifications, accuracy
Total station	Leica TM50 s/n 09856	EDM st. dev. 0.6 mm + 1 ppm Angular st. dev. 0.15 mgon (0.5")
Prism set	Leica GPF121	Dist. Corr. 0.0 mm
Reflector & tribraч		
Reflector mini pole	Leica GLS14 (n° 40911)	H = 0.200 m
Mini-reflector	Leica GMP101	Dist. Corr. 17.5 mm
Pocket weather tracker (meteorological station)	Kestrel 4500NV s/n 672710	Temp. st. dev. 0.5°C Pressure st. dev. 1 hPa
GNSS instrumentation	Receiver: Trimble NetR5 Antenna: NavXperinece 3G+C	Theoretical static post-processing accuracies: Horiz. 5 mm + 0.5 ppm Vert. 6 mm + 0.5 ppm

All these survey instruments allowed the observations to be recorded electronically on memory cards or storage devices and then downloaded to a laptop PC for on-site checking.

### 3.3 Co-located points

#### 3.3.1 DORIS station – HOFC

The DORIS station was installed on September 2020 right before the local tie survey.

Acronym : HOFC

DOMES number : 10204S001



Overview

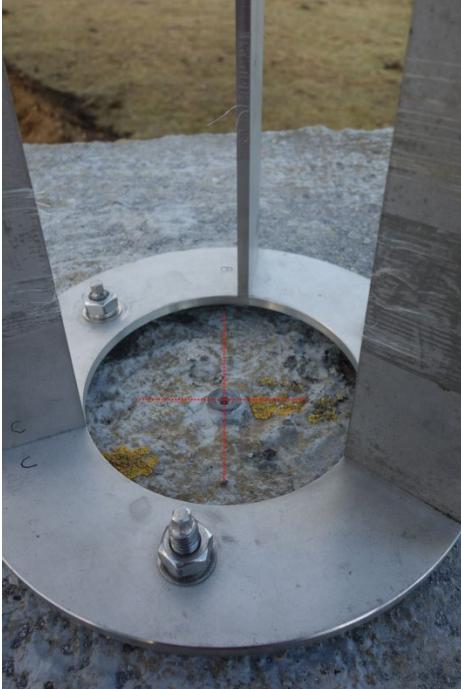


Close-up view

Description: The reference point is located 0.390 m above the antenna base-mounting surface on the antenna vertical axis.

#### 3.3.2 DORIS station – marker

A witness mark is embedded vertically down the DORIS reference point into the concrete pillar.

DORIS marker	DOMES number : 10204M005
 <p>Overview</p>	 <p>Close-up view</p>

Description : The marker is located 0.889 m underneath the antenna reference point

### 3.3.3 GNSS station – HOFN

HOFN that is managed by BKG is part of IGS network and was installed in 1997.

Acronym : HOFN	DOMES number : 10204M002
 <p>Overview</p>	 <p>Close-up view</p>

Description: The reference point is a marker located 0.0319 m under the ARP on the antenna vertical axis.

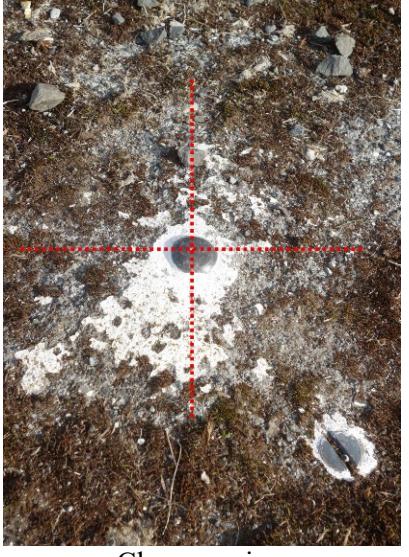
### 3.3.4 GNSS station – HOFS

HOFS is managed by Kartverket and was installed in 2007.

Acronym : HOFS	DOMES number : 10204M003
	
Overview	Close-up view
Description: The reference point is the antenna reference point.	

### 3.3.5 VLBI marker – 7635

The marker was set up in 1992 during a VLBI campaign.

Acronym : 7635	DOMES number : 10204M001
	
Overview	Close-up view
Description: The reference point is centre and top of the brass marker on concrete block.	

## 3.4 Observation polygon

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

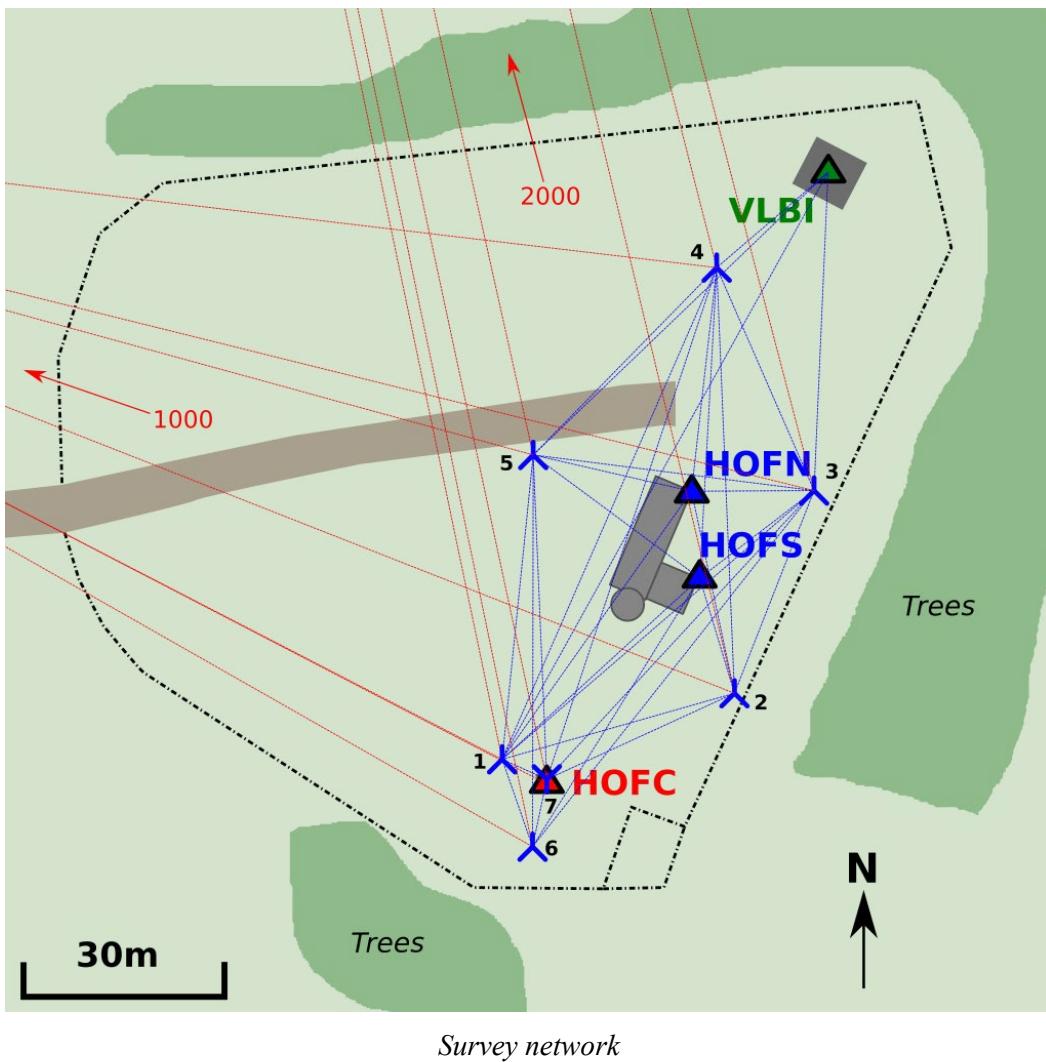
### 3.4.1 Total station figure

Observations were done by total station from 6 stations on tripod (number 1 to 6). In addition, a total station was installed on the DORIS antenna plate before the final DORIS installation (point number 7).



Point 7; total station on HOFN mast

Two references placed as far as possible from the site were used to constrain the polygon direction: 1000 was located 209 m away from HOFN and 2000 was installed 964 m from HOFN. The point 1000 was centred on a geodetic mark along the road in front of the observatory and 2000 was a temporary point on tripod.



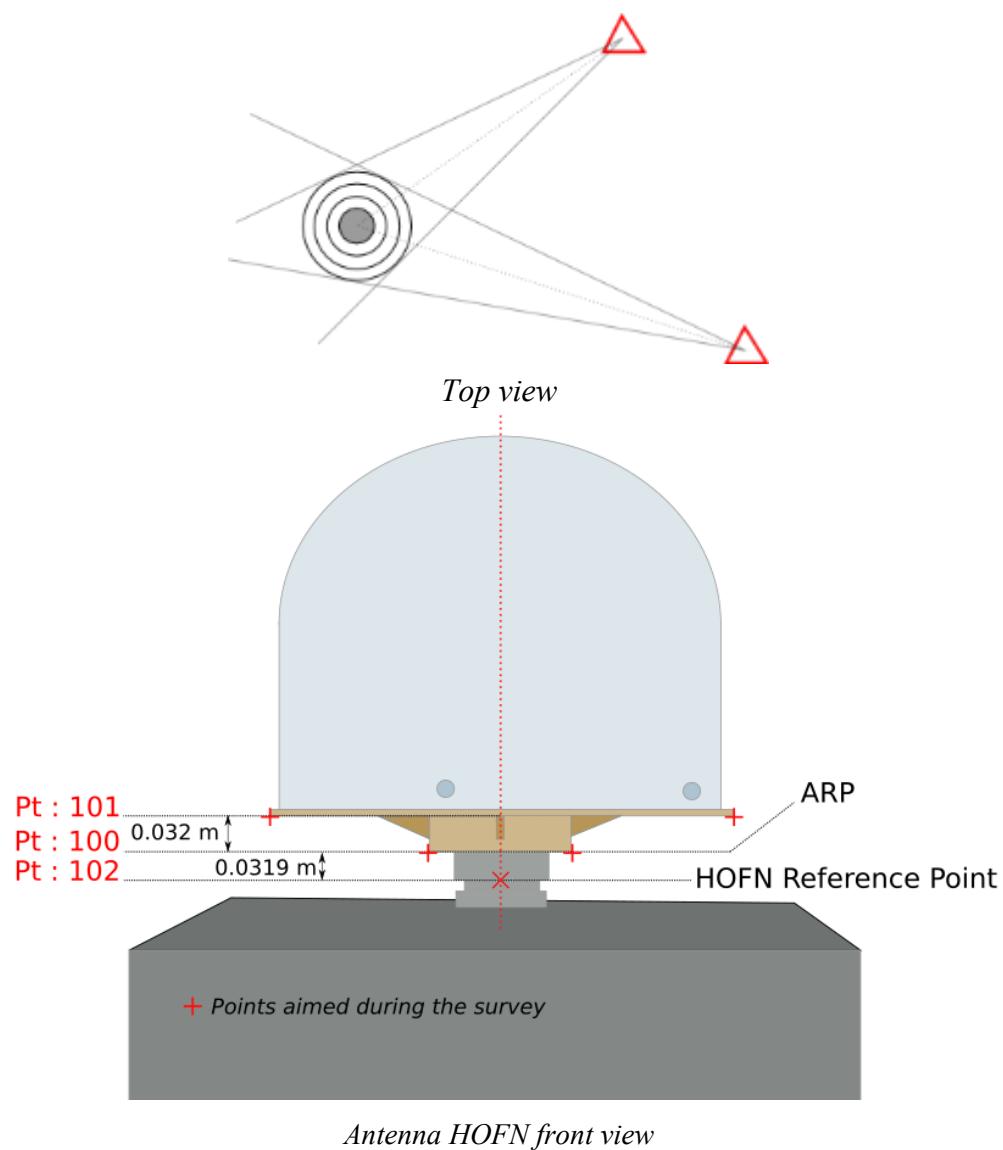
### 3.5 Survey method

All the visible lines of sight were observed with 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 once over each line. Meteorological data (atmospheric pressure and temperature) used to correct distances measurements, were recorded at each station.

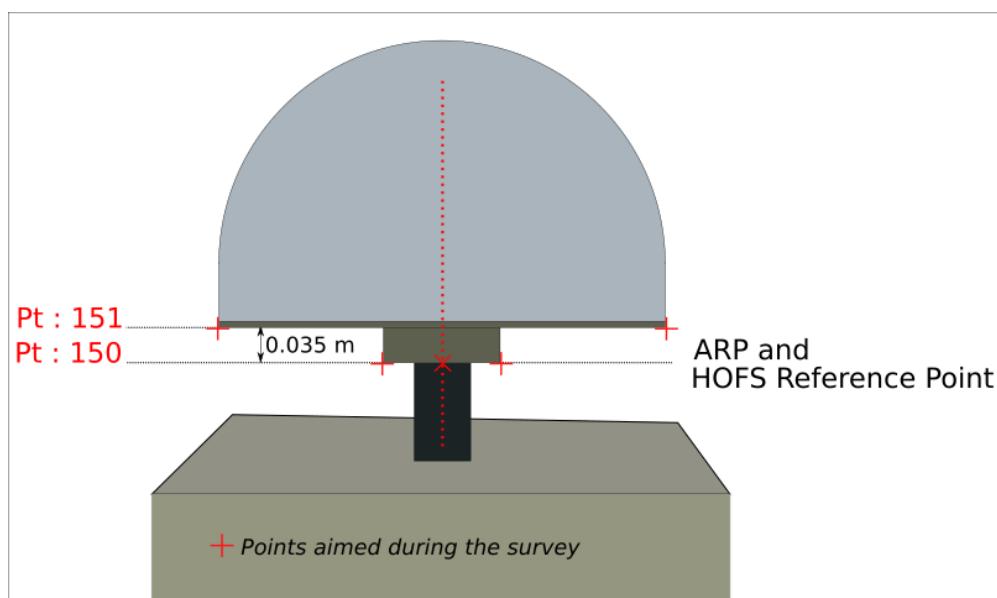
For a small network like this one, conventional terrestrial observations are more accurate than GNSS measurements. The GNSS observations are only used to get the polygon orientation.

#### 3.5.1 GNSS antenna reference points

The reference points have been determined indirectly for GNSS antennas. From each surveying station aiming at the antenna, right and left tangents on the bottom of the antenna and the bottom of chock ring (BCR) were observed. In the adjustment, horizontal and vertical angle observations were averaged.



*Antenna HOFN front view*



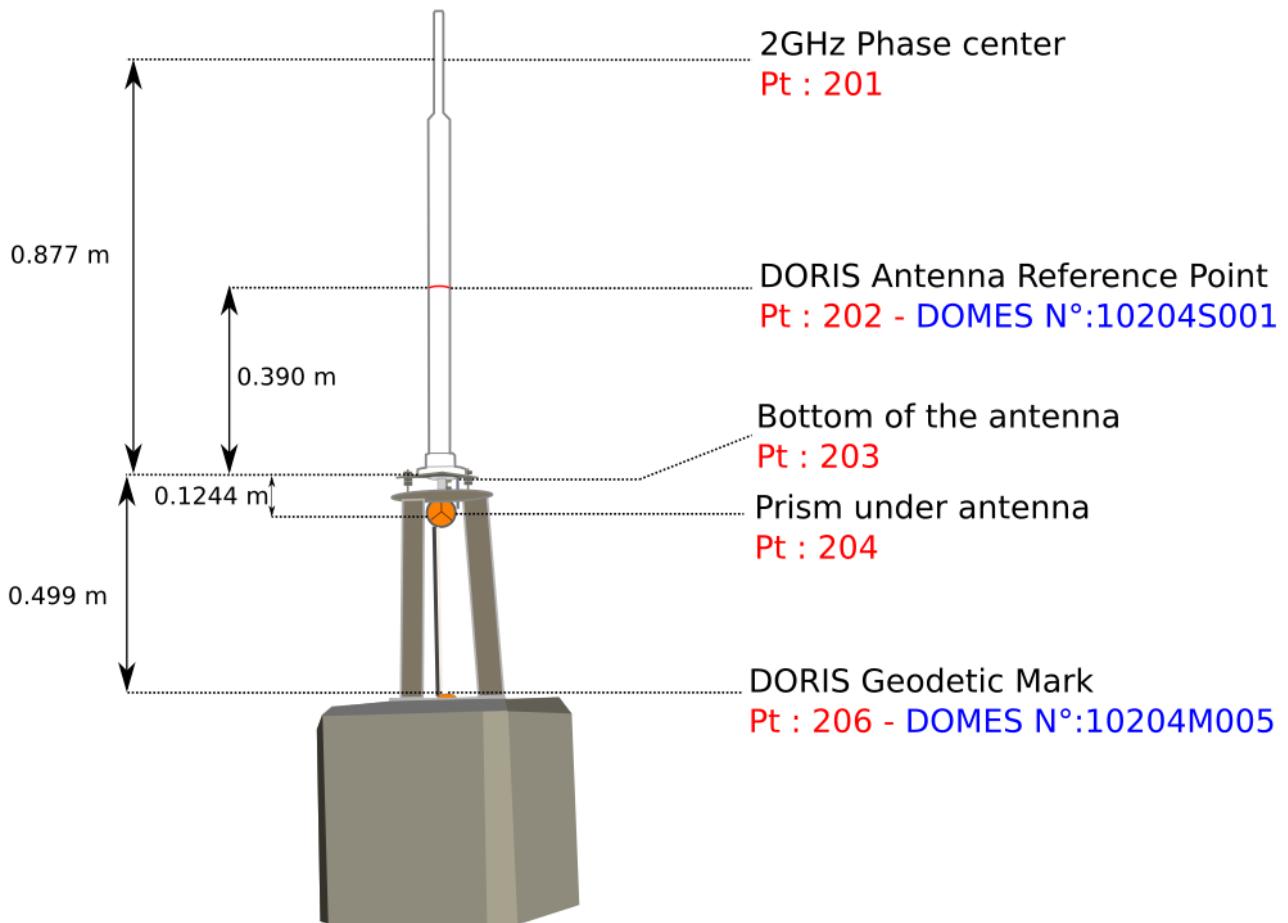
*Antenna HOFS front view*

### 3.5.2 DORIS antenna reference point

An indirect approach was used to determine the DORIS antenna reference point. From each surveying station aiming at the antenna, right and left tangents to the DORIS antenna close to the ARP (red circle n°202), close to 2 GHz phase centre (point 201) and close to antenna base (n°203) were observed. In the adjustment, horizontal and vertical angle observations were averaged to get the position for the ARP point. For the two other points, only horizontal angle observations were averaged because vertical positions of those points are not well defined.

A prism was placed under the bottom of the antenna, screwed on the 2GHz connexion on its antenna vertical axis, and 0.1244m under antenna bottom.

The height between DORIS mark (n°206) and the top of the support plate was measured, and the heights between antenna bottom and phase centres come from the antenna manufacturer.

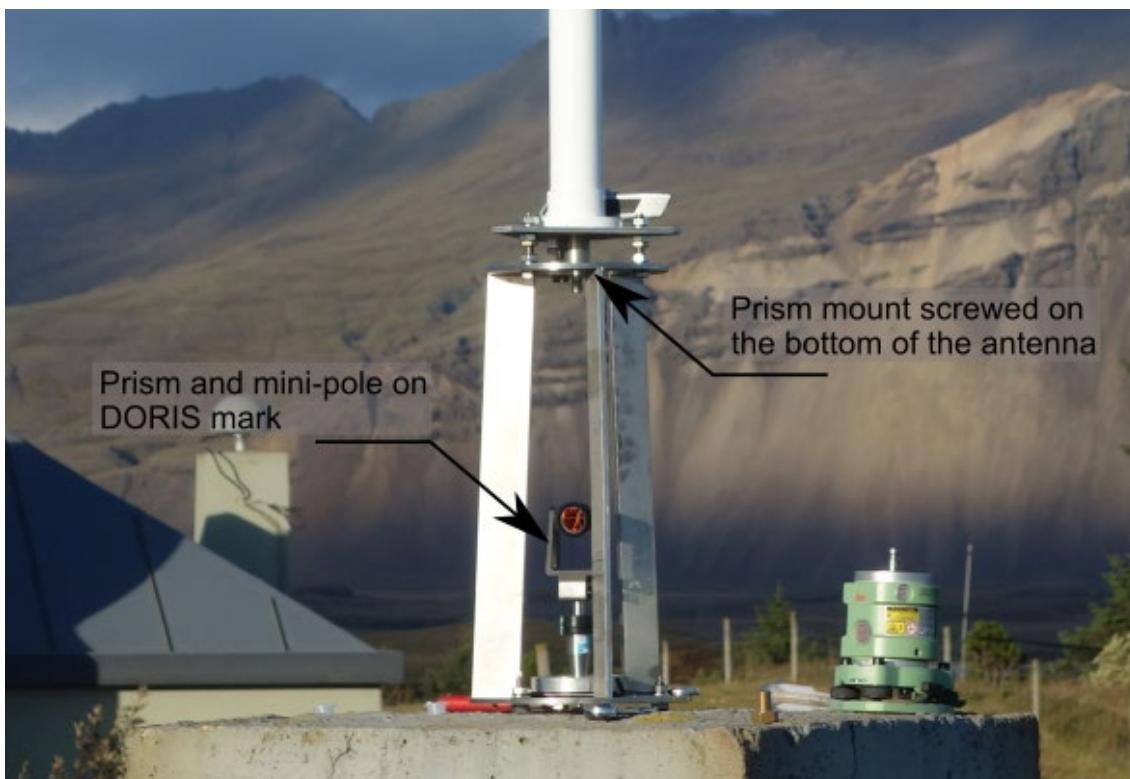


*HOF C antenna heights sketch*

The height from DORIS mark to the support plate is determined from the central recess of the marker, which is about 5mm deep.

### 3.5.3 Geodetic markers

Both VLBI mark and Doris witness mark were observed thank to prism on mini-pole (height 0.200 m).



*Prism and mini-pole*

### 3.5.4 GNSS observations

GNSS observations were carried out in order to align the terrestrial survey network to IGS14 reference frame. Orientations proceed from the baselines from HOFC to points 1000 and 2000.

At least 6 hours of GNSS observations were collected at 1000 and 2000 (September 23th, 2020) positions. GPS and Glonass constellations were recorded with a sampling rate of 30s.

## 4 Computation and data analysis

### 4.1 On site validation

Total station observations were checked on site and converted into the adjustment format. GNSS data were validated after a quick baselines calculation.

### 4.2 GNSS network

#### 4.2.1 Orientation points

The GNSS baselines from HOFN to points 1000 and 2000 were processed with Leica Infinity software version 3.3.1. The IGS14 precise ephemerides were used as well as the IGS antenna phase offset files. HOFN coordinates proceed from the igs20P2124.ssc file (i.e. IGS14 weekly combined solution for week 2124 (IGS14 epoch2020.73)).

The computation was done with GPS data, on L1 and L2 frequencies. The corresponding report files are shown in appendix 6.4.

### 4.3 Final adjustment

The data was processed using 3D least-square adjustment with IGN COMP3d version 5.19 software. The input file (see appendix 6.5) comes from:

- Total station observations : horizontal and zenith angles, distances ;
- Height differences between points of the same stations;
- Centring equations : relative position between points ;
- Orientation points coordinates constrain at 5 mm to its IGS14 epoch 2020.73 values;
- HOFN reference point coordinates, constrained at 0.1 mm to its IGS14 epoch 2020.73 values. As GNSS computation, these coordinates proceed from the igs20P2124.ssc file

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

- 0.7 mgon for horizontal angles
- 0.9 mgon for vertical angles,
- 0.5 mm for distances on prism.

The computations are done in UTM 28N projection.

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

The terrestrial adjustment was processed taking into account the mean vertical deflection from the geoid model EGM08.

Vertical deflection: east-west ( $\eta$ ) = 3.8 arcsec and north-south ( $\xi$ ) = -1.3 arcsec

## 5 Results

### 5.1 Adjusted coordinates and confidence intervals

The results of the adjustment are the coordinates of all points and their confidence ellipsoids in the IGS14 at epoch of the observations (i.e. epoch 2020.73).

The table below provides the 3D coordinates.

Cartesian Coordinates IGS14 epoch 2020.73			
Point – process nb	X (m)	Y (m)	Z (m)
HOFN - 102	2679689.926	-727950.974	5722789.575
HOFS - 150	2679698.000	-727952.811	5722785.645
HOFC mark - 206	2679718.045	-727977.842	5722771.769
HOFC - 202	2679718.417	-727977.945	5722772.570
VLBI mark - 500	2679650.114	-727916.122	5722807.563

The table below provide confidence ellipsoid (3D) at  $2.5\sigma$ . (That means the results have 90% of probability to be inside the ellipsoid)

3D confidence regions $2.5\sigma$ (90 percent)			
Point – process nb	$\frac{1}{2}$ axis (mm)	Azimuth (gr)	Tilt (gr)
HOFS - 150	1.5	163.21	100
	0.8	107.40	0
	0.8	7.40	0
HOFC mark - 206	1.8	122.96	99
	1.5	124.95	1
	1.3	24.94	0
HOFC - 202	2.0	117.69	100
	1.0	123.67	0
	0.5	23.67	0
VLBI mark - 500	1.8	124.12	0
	1.5	133.05	100
	1.5	24.12	0

The whole covariance matrix was computed. Covariance submatrix for the main points of interest was extracted from it for the next ITRF solution computation. Finally, this covariance submatrix was converted into SINEX format using the « geotosnx » tool provided by Z. Altamimi (LAREG, IGN). The resulting SINEX file (102004\_IGN\_2020-267\_v10.SNX) is provided in appendix 6.7.

## 5.2 Vectors

The following table shows vectors in Cartesian coordinate system (IGS14 ep.2020.73):

	$\Delta X$ (m)	$\Delta Y$ (m)	$\Delta Z$ (m)
HOFN → HOFS	8.0736	-1.8366	-3.9295
HOFN → HOFC	28.4904	-26.9705	-17.0047
HOFC → DORIS marker	-0.3720	0.1026	-0.8007
HOFN → VLBI	-39.8120	34.8519	17.9881

*The tenth of a millimeter is provided as an indication.*

## 6 Annexes

### 6.1 HOFC station sitelog (extract)

HOFN DORIS site description form

0. Form

Prepared by : SIMB (DORIS installation and maintenance department)  
Date prepared : 03/11/2020  
Report type : NEW

1. Site location information

Site name : HOFN  
Site DOMES number : 10204  
Host agency : Landmælingar Íslands  
City : Höfn  
State or province : Austurland  
Country : Iceland  
Tectonic plate : Eurasia  
Geological information : Bedrock

Geographical coordinates (ITRF) :  
North Latitude : 64 deg 16' 01''  
East Longitude : -15 deg 11' 54''  
Ellipsoid height : 82 m  
Approximate altitude : m

2. DORIS antenna and reference point information

2.1

Four character ID : HOFC  
Antenna model : Starec C type  
Antenna serial number : 194  
IERS DOMES number : 10204S001  
CNES/IGN number : 102041  
DORIS SSALTO number : 348  
Date installed (dd/mm/yy) : 24/09/2020  
Date removed (dd/mm/yy) :  
Antenna support type : 45 cm high, 3-foot stainless steel support  
Installed on : 0.7 m square, 1.2 m high concrete pillar  
Height above ground mark : 0.889 m  
Ground mark type : Mark on top of the pillar  
Ground mark DOMES number : 10204M005  
Notes :

3. DORIS beacons information

3.1

Beacon serial number : 19104021  
Beacon model : 4.0  
USO serial number :  
4 Char. ID of the REF point : HOFC  
Date installed (dd/mm/yy) : 24/09/2020  
Date removed (dd/mm/yy) :

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

Solution : ITRF2014 (tie to HOFN)  
Epoch : 2000.0

X = 2679718.473 m Y = -727978.273 m Z = 5722772.163 m  
Sig X = 0.000 m Sig Y = 0.001 m Sig Z = 0.002 m

VX = -0.0027 m/y VY = 0.0158 m/y VZ = 0.0196 m/y  
Sig VX = 0.0000 m/y Sig VY = 0.0000 m/y Sig VZ = 0.0000 m/y

9. DORIS network contacts

Primary contact:  
Name : Jerome SAUNIER  
Agency : Institut Geographique National  
Mailing address : Service de Geodesie et de Metrologie  
: 73 avenue de Paris

Telephone : 94165 SAINT-MANDE Cedex FRANCE  
Fax : + 33 1 43 98 83 63  
E-mail : jerome (.) saunier (@) ign.fr

Secondary contact:  
Name : Vincent GARCIA  
Agency : Centre National des Etudes Spatiales  
Mailing address : CNES (DNO/SA/IS)  
: 18 Avenue Edouard Belin  
: 31401 TOULOUSE Cedex FRANCE  
Telephone : + 33 5 61 28 24 49  
Fax :  
E-mail : simb (.) doris (@) cnes.fr

## 6.2 HOFN station sitelog (extract)

HOFN00ISL Site Information Form (site log)  
International GNSS Service

0. Form

Prepared by (full name) : Mr. Uwe Hessels  
Date Prepared : 2020-06-02  
Report Type : UPDATE  
If Update:  
Previous Site Log : hofn\_20190613.log  
Modified/Added Sections : 12

1. Site Identification of the GNSS Monument

Site Name : Hoefn / Iceland  
Four Character ID : HOFN  
Monument Inscription : CHIMNEY PILLAR NO. 1  
IERS DOMES Number : 10204M002  
CDP Number :  
Monument Description : PILLAR  
Height of the Monument : 4.36 m  
Monument Foundation : CONCRETE BOLTED TO BEDROCK  
Foundation Depth :  
Marker Description : SURVEY MARKER BOLT  
Date Installed : 1997-05-27T00:00Z  
Geologic Characteristic : BEDROCK  
Additional Information : The survey marker bolt is anchored  
: on the top of the concrete chimney  
: pillar No.1 in the Maelingarhus in  
: Hofn. The height of the chimey pillar  
: No.1 is 4.36 m. It is bolted to the  
: bedrock. The antenna on the chimney  
: pillar is 4.47 m above the ground and  
: 1.4 m above the roof.

2. Site Location Information

City or Town : Hoefn  
State or Province :  
Country : Iceland  
Tectonic Plate : EURASIAN  
Approximate Position (ITRF)  
X coordinate (m) : 2679689.848  
Y coordinate (m) : -727951.343  
Z coordinate (m) : 5722788.898  
Latitude (N is +) : +641602.25  
Longitude (E is +) : -0151152.53  
Elevation (m, ellips.) : 82.3

3. GNSS Receiver Information

3.1 Receiver Type : TRIMBLE 4000SSI  
Satellite System : GPS  
Serial Number : 3503A09374  
Firmware Version : 7.12  
Elevation Cutoff Setting : 0 deg  
Date Installed : 1997-05-27T00:00Z  
Date Removed : 1999-07-31T14:00Z

3.19 Receiver Type : LEICA GR50  
Satellite System : GPS+GLO+GAL+BDS+IRNSS+SBAS  
Serial Number : 1870639  
Firmware Version : 4.31/7.403  
Elevation Cutoff Setting : 0 deg  
Date Installed : 2019-06-13T11:16Z  
Date Removed : CCYY-MM-DDThh:mmZ  
Temperature Stabiliz. : none  
Additional Information :

4. GNSS Antenna Information

4.1 Antenna Type : TRM22020.00+GP DOME  
Serial Number : 0220008914  
Antenna Reference Point : BPA  
Marker->ARP Up Ecc. (m) : 0.0550  
Marker->ARP North Ecc(m) : 0.0000  
Marker->ARP East Ecc(m) : 0.0000  
Alignment from True N : 0 deg  
Antenna Radome Type : DOME  
Radome Serial Number :  
Antenna Cable Type : RG214  
Antenna Cable Length : 30 m  
Date Installed : 1997-05-27T00:00Z  
Date Removed : 2000-03-13T00:00Z  
Additional Information : TRIMBLE 24490-00 Prod Ass Ext Dome

4.6 Antenna Type : LEIAR25.R4 LEIT  
Serial Number : 725283  
Antenna Reference Point : BPA  
Marker->ARP Up Ecc. (m) : 0.0319  
Marker->ARP North Ecc(m) : 0.0000  
Marker->ARP East Ecc(m) : 0.0000  
Alignment from True N : 0 deg  
Antenna Radome Type : LEIT  
Radome Serial Number :  
Antenna Cable Type : Ecoflex 10  
Antenna Cable Length : 30 m  
Date Installed : 2013-05-05T12:00Z  
Date Removed : CCYY-MM-DDThh:mmZ  
Additional Information :

5. Surveyed Local Ties

5.1 Tied Marker Name : VLBI PLATFORM  
Tied Marker Usage : VLBI  
Tied Marker CDP Number : 7635  
Tied Marker DOMES Number : 10204M001  
Differential Components from GNSS Marker to the tied monument (ITRS)  
dx (m) :  
dy (m) :  
dz (m) :  
Accuracy (mm) :  
Survey method : TRIANGULATION  
Date Measured : (CCYY-MM-DDThh:mmZ)  
Additional Information :

5.2 Tied Marker Name : CHIMNEY PILLAR NO. 2  
Tied Marker Usage : GPS  
Tied Marker CDP Number :  
Tied Marker DOMES Number : 10204M003  
Differential Components from GNSS Marker to the tied monument (ITRS)  
dx (m) :  
dy (m) :  
dz (m) :  
Accuracy (mm) :  
Survey method : TRIANGULATION  
Date Measured : (CCYY-MM-DDThh:mmZ)  
Additional Information :

5.3 Tied Marker Name : PRARE PILLAR  
Tied Marker Usage : PRARE  
Tied Marker CDP Number :  
Tied Marker DOMES Number : 10204M004

Differential Components from GNSS Marker to the tied monument (ITRS)

dx (m) :  
dy (m) :  
dz (m) :  
Accuracy (mm) :  
Survey method : TRIANGULATION  
Date Measured : (CCYY-MM-DDThh:mmZ)  
Additional Information :

5.4 Tied Marker Name : EUREF PILLAR

Tied Marker Usage : GPS

Tied Marker CDP Number :

Tied Marker DOMES Number : 10204M005

Differential Components from GNSS Marker to the tied monument (ITRS)

dx (m) :  
dy (m) :  
dz (m) :  
Accuracy (mm) :  
Survey method : TRIANGULATION  
Date Measured : (CCYY-MM-DDThh:mmZ)  
Additional Information :

## 6. Frequency Standard

6.1 Standard Type : INTERNAL

Input Frequency :

Effective Dates : 1997-05-27/CCYY-MM-DD

Notes :

## 7. Collocation Information

7.1 Instrumentation Type : VLBI  
Status : MOBILE  
Effective Dates : 1992-07-20/1992-07-28  
Notes : Mobile VLBI Observations.  
: Occupying system MV-2,  
: monument number 7635,  
: occupation designator  
: 76355201

7.2 Instrumentation Type : PRARE  
Status : PERMANENT  
Effective Dates : 1997-06-01/CCYY-MM-DD  
Notes : Statens Kartverk Norway

7.3 Instrumentation Type : GPS  
Status : MOBILE  
Effective Dates : 1990-07-23/1990-07-28  
Notes : EUREF PILLAR.  
: EUREFNW GPS camapign

7.4 Instrumentation Type : GPS  
Status : MOBILE  
Effective Dates : 1993-08-03/1993-08-14  
Notes : EUREF PILLAR.  
: ISNET93 GPS camapaign

7.5 Instrumentation Type : GPS  
Status : MOBILE  
Effective Dates : 1995-07-17/1995-07-28  
Notes : EUREF PILLAR.  
: ISLAND95 GPS Campaign

7.6 Instrumentation Type : GPS  
Status : MOBILE  
Effective Dates : 1997-05-27/1997-05-28  
Notes : EUREF PILLAR.  
: EUVN GPS Campaign  
: Also a GPS Campaign 1985,  
: dates not known yet

## 11. On-Site, Point of Contact Agency Information

Agency : Landmaelingar Islands

: National Land Survey of Iceland

Preferred Abbreviation : LMI  
Mailing Address : Stillholti 16 - 18  
: 300 Akranes  
: Iceland

Primary Contact  
Contact Name : Mr. Þórarinn Sigurðsson  
Telephone (primary) : +354 430 9000  
Telephone (secondary) : +354 430 9040  
Fax : +354 430 9090  
E-mail : thorarinn@lmi.is

12. Responsible Agency (if different from 11.)  
Agency : Bundesamt fuer Kartographie und Geodesie  
: Geodetic Observatory Wettzell

Preferred Abbreviation : FSW  
Mailing Address : Sackenrieder Strasse 25  
: D-93444 Bad Koetzing  
: Germany

Primary Contact  
Contact Name : Mr. Uwe Hessels  
Telephone (primary) : +49 9941 603208  
Telephone (secondary) : +49 9941 6030  
Fax : +49 9941 603222  
E-mail : uwe.hessels@bkg.bund.de

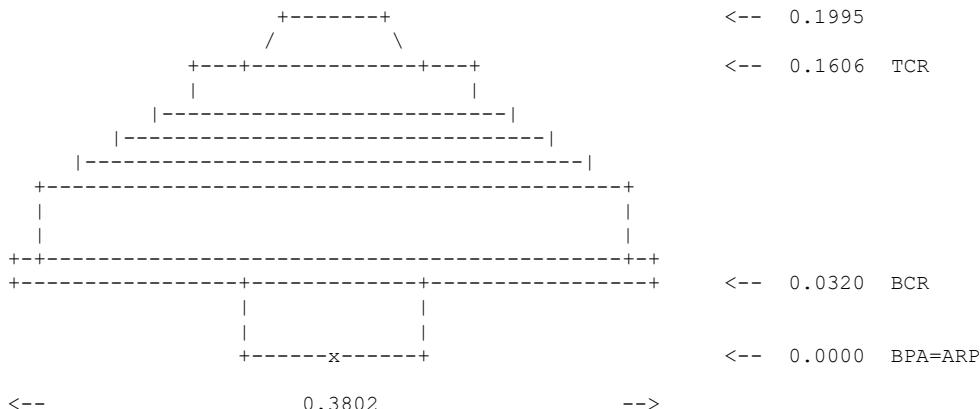
Secondary Contact  
Contact Name : Ms. Swetlana Maehler  
Telephone (primary) : +49 9941 603201  
Telephone (secondary) : +49 9941 6030  
Fax : +49 9941 603222  
E-mail : swetlana.maehler@bkg.bund.de

Additional Information :

13. More Information

Primary Data Center : BKG  
Secondary Data Center : BEV  
URL for More Information : <http://www.bkg.bund.de>,

LEIAR25.R4  
from 2013-05-05



ARP: Antenna Reference Point

L1 : L1 Phase Center

TCR: Top of Chokering

TGP: Top of Ground Plane

L2 : L2 Phase Center

BCR: Bottom of Chokering

BGP: Bottom of Ground Plane

## 6.3 HOFS station sitelog (extract)

HOFS Site Information Form (site log)  
International GPS Service

0. Form  
Prepared by (full name) : SOT  
Date prepared : 2007-10-29  
Report Type : Update  
If Update:  
Previous Site Log : N/A  
Modified/Added Sections : N/A

1. Site Identification of the GNSS Monument  
Site Name : Höfn  
Four Character ID : HOFS  
Monument Inscription :  
IERS DOMES Number :  
CDP Number : N/A  
Monument Description :  
Height of the Monument : 0.0  
Monument Foundation : BEDROCK  
Foundation Depth : null  
Marker Description : NB! ITRF-koordinater."Mellomstykke" på 10 cm mellom antennen og  
toppen av søyla.P  
Date Installed : PP-koordinater både på X, Y, Z og X\_PPP, Y\_PPP, Z\_PPP  
Date Installed : 2007-10-29

2. Site Location Information  
City or Town : Hofn  
State or Province :  
Country : Iceland  
Tectonic Plate : EURA  
Approximate Position (ITRF)  
X coordinate (m) : 2679698.046  
Y coordinate (m) : -727953.027  
Z coordinate (m) : -727953.027  
Latitude (N is +) :  
Longitude (E is +) :  
Elevation (m, ellips.) :

3. GNSS Receiver Information  
3.11 Receiver Type : TRIMBLE NETR9  
Satellite System : GPS+GLONASS  
Serial Number : 5218K84638  
Firmware Version : 5.44  
Elevation Cutoff Setting : 0  
Date Installed : 2020-01-30  
Date Removed :  
Temperature Stabiliz. : 22 grader C +/- 2  
Additional Information :

4. GNSS Antenna Information  
4.2 Antenna Type : TRM59900.00  
Serial Number : 5602362396  
Antenna Reference Point : BAM  
Marker->ARP Up Ecc. (m) : 0.0  
Marker->ARP North Ecc(m) : 0.0  
Marker->ARP East Ecc(m) : 0.0  
Alignment from True N :  
Antenna Radome Type : SCIS  
Radome Serial Number : 5602362396  
Antenna Cable Type : RG213  
Antenna Cable Length : 0.0  
Date Installed : 2019-09-19  
Date Removed :  
Additional Information :

...

## 6.4 GNSS process report

Report extract from Leica Infinity software

### 6.4.1 Project details

#### Système de coordonnées principal

Nom de système de coordonnées : UTM28N  
Type de transformation : Classique 3D  
Distribution des résidus : Aucun  
Ellipsoïde : WGS 1984  
Type de projection : UTM  
Modèle de géoïde : egm08\_0N-90N\_0W-180W\_5x5  
Modèle SCSP : -

### 6.4.2 HOFN – 1000 baseline settings

Filtres	Sélectionné	Utilisé
Angle de coupure:	5*	5*
Fréquence:	Automatique	L1/L2
Fréquence d'échantillonnage:	Utiliser tout	30,00 s
Système satellitaire:	GPS/GLONASS/Galileo/Beidou	GPS
Type d'éphéméride:	Précises	Précises
Jeu de calibration d'antennes:	NGS 14 Absolu	NGS 14 Absolu
Stratégie de Traitement		
Type de solution:	Fixé sur la phase	Fixé sur la phase
Optimisation de solution:	Automatique	Aucun
Fréquence à utiliser pour iono réduit:	Automatique	Automatique
Modèle troposphérique:	VMF avec modèle GPT2	VMF avec modèle GPT2
Modèle ionosphérique:	Automatique	Calculé
Autoriser la solution Widelan:	Automatique	Automatique

#### Paramètres

Distance min. pour iono réduit: 15 km  
Levée d'ambiguïtés possible jusqu'à: 300 km  
Durée min. pour solution flottante (statique): 00:05:00

#### Time Settings

Time Format: HH:mm:ss  
Time System: Local Time  
Leap Seconds: 18

### 6.4.3 HOFN – 1000 baseline results

#### Data acquisition

Heure de début - Heure de fin: 23/09/2020 11:20:12 - 23/09/2020 18:15:42

Durée: 06:55:30

#### Antenna

	<b>référence - HOFN</b>	<b>mobile - 1000</b>
Nom de récepteur / NS:	LEICA GR50 / 1870639	NetR5 / 4740K10724
Nom d'Antenne / NS:	LEIAR25.R4 LEIT / 725283	NAX3G+C / -
Décalage de porteuse:	-	-
Lecture altimétrique:	0,0319 m	0,1700 m
Hauteur d'antenne:	0,0319 m	0,1700 m

#### Phase center offsets

<b>référence - LEIAR25.R4 LEIT</b>			<b>mobile - NAX3G+C</b>		
<b>GPS</b>	<b>L1</b>	<b>L2</b>	<b>L1</b>	<b>L2</b>	
Est	0,0007 m	-0,0001 m	-0,0007 m	0,0005 m	
Nord	0,0008 m	0,0002 m	-0,0005 m	0,0006 m	
Haut	0,1591 m	0,1548 m	0,0605 m	0,0570 m	
<b>GLONASS</b>	<b>L1</b>	<b>L2</b>	<b>L1</b>	<b>L2</b>	
Est	0,0007 m	-0,0001 m	-0,0007 m	0,0005 m	
Nord	0,0008 m	0,0002 m	-0,0005 m	0,0006 m	
Haut	0,1591 m	0,1548 m	0,0605 m	0,0570 m	

#### Final coordinates

	<b>référence - HOFN</b>	<b>mobile - 1000</b>	<b>référence - HOFN</b>	<b>mobile - 1000</b>
Classe du point:	Contrôle	PT Fixé		
Latitude WGS84:	64° 16' 02,2583" N	64° 16' 04,0707" N	Est: 490 412,0956 m	490 210,9290 m
Longitude WGS84:	15° 11' 52,4973" O	15° 12' 07,4597" O	Nord: 7 126 814,9332 m	7 126 871,6691 m
Hauteur ellipsoïdale WGS84:	82,8952 m	70,6434 m	Altitude ortho: 17,5630 m	5,3068 m
X WGS84 Cartésien:	2 679 689,9265 m	2 679 583,1899 m		
Y WGS84 Cartésien:	-727 950,9741 m	-728 130,7032 m		
Z WGS84 Cartésien:	5 722 789,5745 m	5 722 802,9060 m		

#### Baseline results

ΔLatitude:	0° 00' 01,8124"	ET ΔLatitude:	0,0001 m
ΔLongitude:	-0° 00' 14,9624"	ET ΔLongitude:	0,0000 m
ΔAltitude:	-12,2517 m	ET ΔAltitude:	0,0001 m
ΔX:	-106,7366 m	ET ΔX:	0,0001 m
ΔY:	-179,7291 m	ET ΔY:	0,0001 m
ΔZ:	13,3315 m	ET ΔZ:	0,0001 m
Dist. pente:	209,4588 m	ET Dist. pente:	0,0000 m

### Ambiguity resolution statistics

Nombre d'ambiguités	GPS
Fixés	63
Total	86
Fixé de façon indépendante	432
Fixation possible de façon indépendante	433
Temps moyen entre fixations indépendantes:	00:00:30

% d'époques	GPS	
	L1 [%]	L2 [%]
Fixés	99,68	99,65
Non fixé	0,32	0,35
Non fixé - contradiction	0,00	0,00
Non fixé - phase manquante	0,00	0,00

État	De l'époque	À l'époque	Durée
Fixés	23/09/2020 11:20:12	23/09/2020 18:15:42	06:55:30

### 6.4.4 HOFN – 2000 baseline settings

Filtres	Sélectionné	Utilisé
Angle de coupure:	5*	5*
Fréquence:	Automatique	L1/L2
Fréquence d'échantillonnage:	Utiliser tout	30,00 s
Système satellitaire:	GPS/GLONASS/Galileo/Beidou	GPS
Type d'éphéméride:	Précises	Précises
Jeu de calibration d'antennes:	NGS 14 Absolu	NGS 14 Absolu
Stratégie de Traitement		
Type de solution:	Fixé sur la phase	Fixé sur la phase
Optimisation de solution:	Automatique	Aucun
Fréquence à utiliser pour iono réduit:	Automatique	Automatique
Modèle troposphérique:	VMF avec modèle GPT2	VMF avec modèle GPT2
Modèle ionosphérique:	Automatique	Calculé
Autoriser la solution Widelane:	Automatique	Automatique
Time Settings		
Time Format:	HH:mm:ss	
Time System:	Local Time	
Leap Seconds:	18	

### 6.4.5 Résultats Ligne de base: HOFN - 2000

#### Data acquisition

Heure de début - Heure de fin: 23/09/2020 11:41:12 - 23/09/2020 18:07:12

Durée: 06:26:00

## Antenna

	<b>référence – HOFN</b>	<b>mobile - 2000</b>
Nom de récepteur / NS:	LEICA GR50 / 1870639	NetR5 / 4740K10717
Nom d'Antenne / NS:	LEIAR25.R4 LEIT / 725283	NAX3G+C / -
Décalage de porteuse:	-	-
Lecture altimétrique:	0,0319 m	0,0000 m
Hauteur d'antenne:	0,0319 m	0,0000 m

## Phase center offsets

	référence - LEIAR25.R4 LEIT		mobile - NAX3G+C	
GPS	L1	L2	L1	L2
Est	0,0007 m	-0,0001 m	-0,0007 m	0,0005 m
Nord	0,0008 m	0,0002 m	-0,0005 m	0,0006 m
Haut	0,1591 m	0,1548 m	0,0605 m	0,0570 m
GLONASS	L1	L2	L1	L2
Est	0,0007 m	-0,0001 m	-0,0007 m	0,0005 m
Nord	0,0008 m	0,0002 m	-0,0005 m	0,0006 m
Haut	0,1591 m	0,1548 m	0,0605 m	0,0570 m

## Estimated coordinates

	<b>référence - HOFN</b>	<b>mobile – 2000</b>		<b>référence – HOFN</b>	<b>mobile - 2000</b>
Classe du point:	Contrôle	PT Fixé			
Latitude WGS84:	64° 16' 02,2583" N	64° 16' 32,5122" N	Est:	490 412,0956 m	490 188,8782 m
Longitude WGS84:	15° 11' 52,4973" O	15° 12' 09,3068" O	Nord:	7 126 814,9332 m	7 127 752,1427 m
Hauteur ellipsoïdale WGS84:	82,8952 m	74,2747 m	Altitude ortho:	17,5630 m	8,8990 m
X WGS84 Cartésien:	2 679 689,9265 m	2 678 812,5131 m			
Y WGS84 Cartésien:	-727 950,9741 m	-727 947,0448 m			
Z WGS84 Cartésien:	5 722 789,5745 m	5 723 188,5182 m			

## Baseline results

$\Delta$ Latitude:	0° 00' 30,2539"	ET $\Delta$ Latitude:	0,0001 m
$\Delta$ Longitude:	-0° 00' 16,8095"	ET $\Delta$ Longitude:	0,0001 m
$\Delta$ Altitude:	-8,6205 m	ET $\Delta$ Altitude:	0,0002 m
$\Delta$ X:	-877,4134 m	ET $\Delta$ X:	0,0001 m
$\Delta$ Y:	3,9293 m	ET $\Delta$ Y:	0,0001 m
$\Delta$ Z:	398,9437 m	ET $\Delta$ Z:	0,0002 m
Dist. pente:	963,8599 m	ET Dist. pente:	0,0001 m

## Ambiguity resolution statistics

	<b>Nombre d'ambiguïtés</b>	<b>GPS</b>
Fixés		69
Total		86
Fixé de façon indépendante		407
Fixation possible de façon indépendante		407
Temps moyen entre fixations indépendantes:	00:00:30	

**GPS**

<b>% d'époques</b>	<b>L1 [%]</b>	<b>L2 [%]</b>
--------------------	---------------	---------------

Fixés	99,84	99,79
Non fixé	0,16	0,21
Non fixé - contradiction	0,00	0,00
Non fixé - phase manquante	0,00	0,00

<b>État</b>	<b>De l'époque</b>	<b>À l'époque</b>	<b>Durée</b>
Fixés	23/09/2020 11:41:12	23/09/2020 18:07:12	06:26:00

## 6.5 Adjustment input files

### 6.5.1 Approximate coordinates file

\*\*IGS station HOFN IGS14 epoch 2020.73 from igs20P2124.ssc DOMES:10204M002

1 102 490412.0956 7126814.9332 82.8952 0.0001 0.0001 0.0001 3.8 -1.3

\*\*ARP height antenna:0.0319m

0 100 490412.0956 7126814.9332 82.9271 0.0001 0.0001 0.0001 3.8 -1.3

\*\*BCR 0.032m up the ARP

0 101 490412.0956 7126814.9332 82.9600 0.0001 0.0001 0.0001 3.8 -1.3

\*\* orientations

9 1000 490210.929 7126871.669 70.643 0.005 0.005 0.005 3.8 -1.3

9 2000 490188.878 7127752.143 74.275 0.005 0.005 0.005 3.8 -1.3

\*\*stations

0 1 490380.89 7126775.76 78 0 0 0 3.8 -1.3

0 2 490418.91 7126792.98 79 0 0 0 3.8 -1.3

0 3 490430.00 7126821.00 79 0 0 0 3.8 -1.3

0 4 490405.00 7126851.00 78 0 0 0 3.8 -1.3

0 5 490373.98 7126810.77 77 0 0 0 3.8 -1.3

0 6 490395.70 7126769.94 78 0 0 0 3.8 -1.3

\*\*\*VLBI marker=500 DOMES:10204M001 ; prisme on mini-pole 0.2m up to the marker = 501

0 500 490434.23 7126862.25 78 0 0 0 3.8 -1.3

0 501 490434.23 7126862.25 78.2 0 0 0 3.8 -1.3

\*\*DORIS station

\*Reference point DOMES:10204S001 400Mhz phase centre

0 202 490393.4467 7126776.4907 82.5809 0 0 0 3.8 -1.3

\* 2Ghz phase centre

0 201 490393.4467 7126776.4907 83.0000 0 0 0 3.8 -1.3

\* bottom of antenna

0 203 490393.4467 7126776.4907 82.09 0 0 0 3.8 -1.3

\*prism under antenna 0.1244m under bottom of antenna

0 204 490393.4467 7126776.4907 81.9 0 0 0 3.8 -1.3

\*Doris Geodetic Mark DOMES:10204M005

0 206 490393.4467 7126776.4907 81.4 0 0 0 3.8 -1.3

\*Prism on minipole 0.2m up to the marker

0 205 490393.4467 7126776.4907 81.6 0 0 0 3.8 -1.3

\*Total station axis on DORIS support plate. height:0.252m

0 7 490393.4467 7126776.4907 82.15 0 0 0 3.8 -1.3

\*\*GNSS station HOFS DOMES:10204M003 (Kartverket)ARP

0 150 490412.0956 7126814.9332 82.9271 0.0001 0.0001 0.0001 3.8 -1.3

\*\*BCR 0.035m up the ARP

0 151 490412.0956 7126814.9332 82.9620 0.0001 0.0001 0.0001 3.8 -1.3

## 6.5.2 Observations file

\*\*\*Centering equations

\*\*station DORIS HOFC

\*Planimetric centering

9 202 201 0 0.0005 0 0 0

9 202 203 0 0.0005 0 0 0

9 202 204 0 0.0005 0 0 0

9 202 206 0 0.0009 0 0 0

9 203 7 0 0.0005 0 0 0

9 206 205 0 0.0005 0 0 0

\*height differences

4 203 202 0.390 0.0005 0 0 0

4 203 201 0.877 0.0005 0 0 0

4 203 204 -0.1244 0.0005 0 0 0

4 203 206 -0.499 0.0005 0 0 0

4 203 7 0.252 0.0010 0 0 0

4 206 205 0.200 0.0005 0 0 0

\*\*station GNSS HOFN

\*Planimetric centering

9 102 100 0 0.0001 0 0 0

9 102 101 0 0.0001 0 0 0

\*height differences

4 102 100 0.0319 0.0005 0 0 0

4 100 101 0.0320 0.0001 0 0 0

\*\*station GNSS HOFS

\*Planimetric centering

9 150 151 0 0.0001 0 0 0

\*height difference

4 150 151 0.0350 0.0001 0 0 0

\*\*VLBI marker

\*Planimetric centering

9 500 501 0 0.0005 0 0 0

\*height difference

4 500 501 0.20 0.0001 0 0 0

\* Station n°1

\* Temperature : 6.0 °C - Pression : 745.7 mmHg - Correction meteo : -0.6 ppm

7 1	2000	0.0000	0.0007	0.0000	0.0000	0.0000
5 1	1000	343.4329	0.0007	0.0000	0.0000	0.0000
5 1	2	96.3445	0.0007	0.0000	0.0000	0.0000
5 1	3	68.1344	0.0007	0.0000	0.0000	0.0000
5 1	4	39.5531	0.0007	0.0000	0.0000	0.0000
*5 1	2012	142.9708	0.0007	0.0000	0.0000	0.0000
*5 1	2011	142.7705	0.0007	0.0000	0.0000	0.0000
5 1	201	142.87065	0.0007	0.0000	0.0000	0.0000
*5 1	2021	142.6212	0.0007	0.0000	0.0000	0.0000
*5 1	2031	142.5871	0.0007	0.0000	0.0000	0.0000
5 1	203	142.86465	0.0007	0.0000	0.0000	0.0000
*5 1	2022	143.1147	0.0007	0.0000	0.0000	0.0000
*5 1	2032	143.1422	0.0007	0.0000	0.0000	0.0000
5 1	202	142.86795	0.0007	0.0000	0.0000	0.0000

5 1	205	142.8600	0.0007	0.0000	0.0000	0.0000
*5 1	1001	51.8382	0.0007	0.0000	0.0000	0.0000
*5 1	1002	51.9559	0.0007	0.0000	0.0000	0.0000
5 1	100	51.8971	0.0007	0.0000	0.0000	0.0000
*5 1	1501	61.5894	0.0007	0.0000	0.0000	0.0000
*5 1	1502	61.6965	0.0007	0.0000	0.0000	0.0000
5 1	150	61.6430	0.0007	0.0000	0.0000	0.0000
*6 1	2000	100.4562	0.0009	0.0000	0.0000	0.0000
*6 1	1000	103.3530	0.0009	0.0000	0.0000	0.0000
6 1	2	100.4456	0.0009	0.0000	0.0000	0.0000
6 1	3	99.9935	0.0009	0.0000	0.0000	0.0000
6 1	4	101.3176	0.0009	0.0000	0.0000	0.0000
*6 1	2012	84.2000	0.0009	0.0000	0.0000	0.0000
*6 1	2011	84.1996	0.0009	0.0000	0.0000	0.0000
**6 1	201	84.1998	0.0009	0.0020	0.0000	0.0000
*6 1	2021	88.4375	0.0009	0.0000	0.0000	0.0000
*6 1	2031	91.7081	0.0009	0.0000	0.0000	0.0000
**6 1	203	91.7137	0.0009	0.0000	0.0000	0.0000
*6 1	2022	88.4362	0.0009	0.0000	0.0000	0.0000
6 1	202	88.4369	0.0009	0.0020	0.0000	0.0000
*6 1	2032	91.7192	0.0009	0.0000	0.0000	0.0000
6 1	205	94.6410	0.0009	0.0000	0.0000	0.0000
*6 1	1001	97.6146	0.0009	0.0000	0.0000	0.0000
*6 1	1002	97.6138	0.0009	0.0000	0.0000	0.0000
6 1	100	97.6142	0.0009	0.0000	0.0000	0.0000
*6 1	1501	97.1283	0.0009	0.0000	0.0000	0.0000
*6 1	1502	97.1275	0.0009	0.0000	0.0000	0.0000
6 1	150	97.1279	0.0009	0.0000	0.0000	0.0000
3 1	2	33.0900	0.0005	0.0000	0.0000	0.0000
3 1	3	55.9555	0.0005	0.0000	0.0000	0.0000
3 1	4	72.7255	0.0005	0.0000	0.0000	0.0000
3 1	205	6.9895	0.0005	0.0000	0.0000	0.0000

\* Station n°2

\* Temperature : 7.4 °C - Pression : 745.5 mmHg - Correction meteo : 0.8 ppm

7 2	2000	0.0000	0.0007	0.0000	0.0000	0.0000
5 2	1000	339.2172	0.0007	0.0000	0.0000	0.0000
5 2	1	298.4659	0.0007	0.0000	0.0000	0.0000
5 2	3	38.5199	0.0007	0.0000	0.0000	0.0000
5 2	4	12.3685	0.0007	0.0000	0.0000	0.0000
*5 2	2011	287.9335	0.0007	0.0000	0.0000	0.0000
*5 2	2012	287.9830	0.0007	0.0000	0.0000	0.0000
5 2	201	287.95825	0.0007	0.0000	0.0000	0.0000
*5 2	2021	287.8962	0.0007	0.0000	0.0000	0.0000
*5 2	2022	288.0180	0.0007	0.0000	0.0000	0.0000
5 2	202	287.9571	0.0007	0.0000	0.0000	0.0000
*5 2	2031	287.8887	0.0007	0.0000	0.0000	0.0000
*5 2	2032	288.0256	0.0007	0.0000	0.0000	0.0000
5 2	203	287.95715	0.0007	0.0000	0.0000	0.0000
5 2	205	287.9543	0.0007	0.0000	0.0000	0.0000
*5 2	1001	398.3551	0.0007	0.0000	0.0000	0.0000
*5 2	1002	398.5356	0.0007	0.0000	0.0000	0.0000
5 2	100	398.4454	0.0007	0.0000	0.0000	0.0000

*5 2	1501	391.4692	0.0007	0.0000	0.0000	0.0000
*5 2	1502	391.6739	0.0007	0.0000	0.0000	0.0000
5 2	150	391.5716	0.0007	0.0000	0.0000	0.0000
*6 2	2000	100.4437	0.0009	0.0000	0.0000	0.0000
*6 2	1000	102.9057	0.0009	0.0000	0.0000	0.0000
6 2	1	99.5524	0.0009	0.0000	0.0000	0.0000
6 2	3	99.4867	0.0009	0.0000	0.0000	0.0000
6 2	4	101.3957	0.0009	0.0000	0.0000	0.0000
*6 2	2011	95.5180	0.0009	0.0000	0.0000	0.0000
*6 2	2012	95.5179	0.0009	0.0000	0.0000	0.0000
**6 2	201	95.5179	0.0009	0.0020	0.0000	0.0000
*6 2	2021	96.6060	0.0009	0.0000	0.0000	0.0000
*6 2	2022	96.6061	0.0009	0.0000	0.0000	0.0000
6 2	202	96.6061	0.0009	0.0020	0.0000	0.0000
*6 2	2031	97.4356	0.0009	0.0000	0.0000	0.0000
*6 2	2032	97.4355	0.0009	0.0000	0.0000	0.0000
**6 2	203	97.4355	0.0009	0.0000	0.0000	0.0000
6 2	205	98.1552	0.0009	0.0000	0.0000	0.0000
*6 2	1001	95.7609	0.0009	0.0000	0.0000	0.0000
*6 2	1002	95.7589	0.0009	0.0000	0.0000	0.0000
6 2	100	95.7599	0.0009	0.0000	0.0000	0.0000
*6 2	1501	93.7249	0.0009	0.0000	0.0000	0.0000
*6 2	1502	93.7265	0.0009	0.0000	0.0000	0.0000
6 2	150	93.7257	0.0009	0.0000	0.0000	0.0000
3 2	1	33.0895	0.0005	0.0000	0.0000	0.0000
3 2	3	29.6750	0.0005	0.0000	0.0000	0.0000
3 2	4	57.9860	0.0005	0.0000	0.0000	0.0000
3 2	205	28.2960	0.0005	0.0000	0.0000	0.0000

\* Station n°3

\* Temperature : 7.6 °C - Pression : 745.6 mmHg - Correction meteo : 1.0 ppm

7 3	2000	0.0000	0.0007	0.0000	0.0000	0.0000
5 3	1000	331.9519	0.0007	0.0000	0.0000	0.0000
5 3	1	271.3674	0.0007	0.0000	0.0000	0.0000
5 3	2	239.6313	0.0007	0.0000	0.0000	0.0000
5 3	4	390.0757	0.0007	0.0000	0.0000	0.0000
*5 3	2011	263.7134	0.0007	0.0000	0.0000	0.0000
*5 3	2012	263.7395	0.0007	0.0000	0.0000	0.0000
5 3	201	263.7265	0.0007	0.0000	0.0000	0.0000
*5 3	2021	263.6957	0.0007	0.0000	0.0000	0.0000
*5 3	2022	263.7598	0.0007	0.0000	0.0000	0.0000
5 3	202	263.7278	0.0007	0.0000	0.0000	0.0000
*5 3	2031	263.6901	0.0007	0.0000	0.0000	0.0000
*5 3	2032	263.7631	0.0007	0.0000	0.0000	0.0000
5 3	203	263.7266	0.0007	0.0000	0.0000	0.0000
5 3	205	263.7244	0.0007	0.0000	0.0000	0.0000
*5 3	1011	312.4160	0.0007	0.0000	0.0000	0.0000
*5 3	1012	313.7699	0.0007	0.0000	0.0000	0.0000
5 3	101	313.0930	0.0007	0.0000	0.0000	0.0000
*5 3	1501	282.9902	0.0007	0.0000	0.0000	0.0000
*5 3	1502	283.1824	0.0007	0.0000	0.0000	0.0000
5 3	150	283.0863	0.0007	0.0000	0.0000	0.0000

*6 3	2000	100.4701	0.0009	0.0000	0.0000	0.0000
*6 3	1000	102.9508	0.0009	0.0000	0.0000	0.0000
6 3	1	100.0078	0.0009	0.0000	0.0000	0.0000
6 3	2	100.5119	0.0009	0.0000	0.0000	0.0000
6 3	4	102.9150	0.0009	0.0000	0.0000	0.0000
*6 3	2011	97.9170	0.0009	0.0000	0.0000	0.0000
*6 3	2012	97.9167	0.0009	0.0000	0.0000	0.0000
**6 3	201	97.9169	0.0009	0.0020	0.0000	0.0000
*6 3	2021	98.4927	0.0009	0.0000	0.0000	0.0000
*6 3	2022	98.4928	0.0009	0.0000	0.0000	0.0000
6 3	202	98.4928	0.0009	0.0020	0.0000	0.0000
*6 3	2031	98.9283	0.0009	0.0000	0.0000	0.0000
*6 3	2032	98.9281	0.0009	0.0000	0.0000	0.0000
**6 3	203	98.9282	0.0009	0.0000	0.0000	0.0000
6 3	205	99.3111	0.0009	0.0000	0.0000	0.0000
*6 3	1011	94.1546	0.0009	0.0000	0.0000	0.0000
*6 3	1012	94.1617	0.0009	0.0000	0.0000	0.0000
6 3	101	94.1582	0.0009	0.0000	0.0000	0.0000
*6 3	1501	94.8611	0.0009	0.0000	0.0000	0.0000
*6 3	1502	94.8619	0.0009	0.0000	0.0000	0.0000
6 3	150	94.8615	0.0009	0.0000	0.0000	0.0000
3 3	1	55.9551	0.0005	0.0000	0.0000	0.0000
3 3	2	29.6750	0.0005	0.0000	0.0000	0.0000
3 3	4	33.0040	0.0005	0.0000	0.0000	0.0000
3 3	205	53.6501	0.0005	0.0000	0.0000	0.0000

\* Station n°4

\* Temperature : 8.9 °C - Pression : 745.8 mmHg - Correction meteo : 2.2 ppm

7 4	2000	0.0000	0.0007	0.0000	0.0000	0.0000
5 4	1000	323.5805	0.0007	0.0000	0.0000	0.0000
5 4	1	242.4387	0.0007	0.0000	0.0000	0.0000
5 4	2	213.1305	0.0007	0.0000	0.0000	0.0000
5 4	3	189.7266	0.0007	0.0000	0.0000	0.0000
*5 4	2011	236.3890	0.0007	0.0000	0.0000	0.0000
*5 4	2012	236.4079	0.0007	0.0000	0.0000	0.0000
5 4	201	236.3985	0.0007	0.0000	0.0000	0.0000
*5 4	2021	236.3756	0.0007	0.0000	0.0000	0.0000
*5 4	2022	236.4207	0.0007	0.0000	0.0000	0.0000
5 4	202	236.3982	0.0007	0.0000	0.0000	0.0000
*5 4	2031	236.3727	0.0007	0.0000	0.0000	0.0000
*5 4	2032	236.4235	0.0007	0.0000	0.0000	0.0000
5 4	203	236.3981	0.0007	0.0000	0.0000	0.0000
5 4	205	236.3968	0.0007	0.0000	0.0000	0.0000
*5 4	1001	225.3157	0.0007	0.0000	0.0000	0.0000
*5 4	1002	225.4748	0.0007	0.0000	0.0000	0.0000
5 4	100	225.3953	0.0007	0.0000	0.0000	0.0000
*5 4	1011	225.0109	0.0007	0.0000	0.0000	0.0000
*5 4	1012	225.7806	0.0007	0.0000	0.0000	0.0000
5 4	101	225.3958	0.0007	0.0000	0.0000	0.0000
*5 4	1501	222.6157	0.0007	0.0000	0.0000	0.0000
*5 4	1502	222.8198	0.0007	0.0000	0.0000	0.0000
5 4	150	222.71.78	0.0007	0.0000	0.0000	0.0000
*6 4	2000	100.3849	0.0009	0.0000	0.0000	0.0000

*6 4	1000	102.7526	0.0009	0.0000	0.0000	0.0000
6 4	1	98.6841	0.0009	0.0000	0.0000	0.0000
6 4	2	98.6034	0.0009	0.0000	0.0000	0.0000
6 4	3	97.0862	0.0009	0.0000	0.0000	0.0000
*6 4	2011	97.1701	0.0009	0.0000	0.0000	0.0000
*6 4	2012	97.1698	0.0009	0.0000	0.0000	0.0000
**6 4	201	97.1699	0.0009	0.0020	0.0000	0.0000
*6 4	2021	97.5903	0.0009	0.0000	0.0000	0.0000
*6 4	2022	97.5909	0.0009	0.0000	0.0000	0.0000
6 4	202	97.5906	0.0009	0.0020	0.0000	0.0000
*6 4	2031	97.9079	0.0009	0.0000	0.0000	0.0000
*6 4	2032	97.9088	0.0009	0.0000	0.0000	0.0000
**6 4	203	97.9084	0.0009	0.0000	0.0000	0.0000
6 4	205	98.1875	0.0009	0.0000	0.0000	0.0000
*6 4	1001	93.6994	0.0009	0.0000	0.0000	0.0000
*6 4	1002	93.7016	0.0009	0.0000	0.0000	0.0000
6 4	100	93.7005	0.0009	0.0000	0.0000	0.0000
*6 4	1011	93.6322	0.0009	0.0000	0.0000	0.0000
*6 4	1012	93.6384	0.0009	0.0000	0.0000	0.0000
6 4	101	93.6353	0.0009	0.0000	0.0000	0.0000
*6 4	1501	95.0701	0.0009	0.0000	0.0000	0.0000
*6 4	1502	95.0692	0.0009	0.0000	0.0000	0.0000
6 4	150	95.0697	0.0009	0.0000	0.0000	0.0000
3 4	1	72.7252	0.0005	0.0000	0.0000	0.0000
3 4	2	57.9861	0.0005	0.0000	0.0000	0.0000
3 4	3	33.0041	0.0005	0.0000	0.0000	0.0000
3 4	205	73.4312	0.0005	0.0000	0.0000	0.0000

\* Station n°4-2

\* Temperature : 7.4 °C - Pression : 746.0 mmHg - Correction meteo : 0.7 ppm

7 4	2000	0.0000	0.0007	0.0000	0.0000	0.0000
5 4	1000	323.5833	0.0007	0.0000	0.0000	0.0000
5 4	1	242.4377	0.0007	0.0000	0.0000	0.0000
5 4	3	189.7267	0.0007	0.0000	0.0000	0.0000
5 4	5	265.4697	0.0007	0.0000	0.0000	0.0000
5 4	501	64.1748	0.0007	0.0000	0.0000	0.0000
5 4	204	236.3954	0.0007	0.0000	0.0000	0.0000
*6 4	2000	100.3837	0.0009	0.0000	0.0000	0.0000
*6 4	1000	102.7525	0.0009	0.0000	0.0000	0.0000
6 4	1	98.6838	0.0009	0.0000	0.0000	0.0000
6 4	3	97.0853	0.0009	0.0000	0.0000	0.0000
6 4	5	102.4575	0.0009	0.0000	0.0000	0.0000
6 4	501	102.7219	0.0009	0.0000	0.0000	0.0000
6 4	204	98.0364	0.0009	0.0000	0.0000	0.0000
3 4	1	72.7260	0.0005	0.0000	0.0000	0.0000
3 4	3	33.0040	0.0005	0.0000	0.0000	0.0000
3 4	5	35.6615	0.0005	0.0000	0.0000	0.0000
3 4	501	26.9460	0.0005	0.0000	0.0000	0.0000
3 4	204	73.4370	0.0005	0.0000	0.0000	0.0000

\* Station n°3

\* Temperature : 7.6 °C - Pression : 745.9 mmHg - Correction meteo : 0.9 ppm

7 3	2000	0.0000	0.0007	0.0000	0.0000	0.0000
5 3	1000	331.9513	0.0007	0.0000	0.0000	0.0000
5 3	1	271.3654	0.0007	0.0000	0.0000	0.0000
5 3	4	390.0754	0.0007	0.0000	0.0000	0.0000
5 3	5	324.2967	0.0007	0.0000	0.0000	0.0000
5 3	501	23.0494	0.0007	0.0000	0.0000	0.0000
5 3	204	263.7248	0.0007	0.0000	0.0000	0.0000
*6 3	2000	100.4711	0.0009	0.0000	0.0000	0.0000
*6 3	1000	102.9523	0.0009	0.0000	0.0000	0.0000
6 3	1	100.0075	0.0009	0.0000	0.0000	0.0000
6 3	4	102.9142	0.0009	0.0000	0.0000	0.0000
6 3	5	104.7623	0.0009	0.0000	0.0000	0.0000
6 3	501	103.3832	0.0009	0.0000	0.0000	0.0000
6 3	204	99.1052	0.0009	0.0000	0.0000	0.0000
3 3	1	55.9551	0.0005	0.0000	0.0000	0.0000
3 3	4	33.0040	0.0005	0.0000	0.0000	0.0000
3 3	5	38.6180	0.0005	0.0000	0.0000	0.0000
3 3	501	50.1240	0.0005	0.0000	0.0000	0.0000
3 3	204	53.6530	0.0005	0.0000	0.0000	0.0000

\* Station n°1-2

\* Temperature : 7.3 °C - Pression : 746.1 mmHg - Correction meteo : 0.5 ppm

7 1	2000	0.0000	0.0007	0.0000	0.0000	0.0000
5 1	1000	343.4339	0.0007	0.0000	0.0000	0.0000
5 1	204	142.8644	0.0007	0.0000	0.0000	0.0000
5 1	3	68.1352	0.0007	0.0000	0.0000	0.0000
5 1	4	39.5555	0.0007	0.0000	0.0000	0.0000
5 1	5	19.8231	0.0007	0.0000	0.0000	0.0000
5 1	501	45.3892	0.0007	0.0000	0.0000	0.0000
*5 1	1011	51.6193	0.0007	0.0000	0.0000	0.0000
*5 1	1012	52.1801	0.0007	0.0000	0.0000	0.0000
5 1	101	51.8997	0.0007	0.0000	0.0000	0.0000
*6 1	2000	100.4574	0.0009	0.0000	0.0000	0.0000
*6 1	1000	103.3515	0.0009	0.0000	0.0000	0.0000
6 1	204	93.0718	0.0009	0.0000	0.0000	0.0000
6 1	3	99.9929	0.0009	0.0000	0.0000	0.0000
6 1	4	101.3170	0.0009	0.0000	0.0000	0.0000
6 1	5	104.4269	0.0009	0.0000	0.0000	0.0000
6 1	501	101.7180	0.0009	0.0000	0.0000	0.0000
*6 1	1011	97.5706	0.0009	0.0000	0.0000	0.0000
*6 1	1012	97.5649	0.0009	0.0000	0.0000	0.0000
6 1	101	97.5678	0.0009	0.0000	0.0000	0.0000
3 1	204	7.0060	0.0005	0.0000	0.0000	0.0000
3 1	3	55.9550	0.0005	0.0000	0.0000	0.0000
3 1	4	72.7250	0.0005	0.0000	0.0000	0.0000
3 1	5	41.4530	0.0005	0.0000	0.0000	0.0000
3 1	501	98.5271	0.0005	0.0000	0.0000	0.0000

\* Station n°5

\* Temperature : 6.6 °C - Pression : 746.5 mmHg - Correction meteo : -0.3 ppm

7 5	2000	0.0000	0.0007	0.0000	0.0000	0.0000
5 5	1000	331.1321	0.0007	0.0000	0.0000	0.0000
*5 5	2011	211.2608	0.0007	0.0000	0.0000	0.0000
*5 5	2012	211.2916	0.0007	0.0000	0.0000	0.0000
5 5	201	211.2762	0.0007	0.0000	0.0000	0.0000
*5 5	2021	211.2377	0.0007	0.0000	0.0000	0.0000
*5 5	2022	211.3140	0.0007	0.0000	0.0000	0.0000
5 5	202	211.2759	0.0007	0.0000	0.0000	0.0000
*5 5	2031	211.2326	0.0007	0.0000	0.0000	0.0000
*5 5	2032	211.3178	0.0007	0.0000	0.0000	0.0000
5 5	203	211.2752	0.0007	0.0000	0.0000	0.0000
5 5	204	211.2750	0.0007	0.0000	0.0000	0.0000
5 5	1	220.6689	0.0007	0.0000	0.0000	0.0000
5 5	3	121.9108	0.0007	0.0000	0.0000	0.0000
5 5	4	63.4346	0.0007	0.0000	0.0000	0.0000
5 5	501	62.8771	0.0007	0.0000	0.0000	0.0000
*5 5	1011	130.7950	0.0007	0.0000	0.0000	0.0000
*5 5	1012	131.9395	0.0007	0.0000	0.0000	0.0000
5 5	101	131.3673	0.0007	0.0000	0.0000	0.0000
*5 5	1001	131.2488	0.0007	0.0000	0.0000	0.0000
*5 5	1002	131.4877	0.0007	0.0000	0.0000	0.0000
5 5	100	131.3683	0.0007	0.0000	0.0000	0.0000
5 5	150	153.5843	0.0007	0.0000	0.0000	0.0000
*6 5	2000	100.2839	0.0009	0.0000	0.0000	0.0000
*6 5	1000	102.5741	0.0009	0.0000	0.0000	0.0000
*6 5	2011	93.3498	0.0009	0.0000	0.0000	0.0000
*6 5	2012	93.3503	0.0009	0.0000	0.0000	0.0000
**6 5	201	93.3500	0.0009	0.0020	0.0000	0.0000
*6 5	2021	94.0423	0.0009	0.0000	0.0000	0.0000
*6 5	2022	94.0432	0.0009	0.0000	0.0000	0.0000
6 5	202	94.0428	0.0009	0.0020	0.0000	0.0000
*6 5	2031	94.5582	0.0009	0.0000	0.0000	0.0000
*6 5	2032	94.5595	0.0009	0.0000	0.0000	0.0000
**6 5	203	94.5589	0.0009	0.0000	0.0000	0.0000
6 5	204	94.7818	0.0009	0.0000	0.0000	0.0000
6 5	1	95.5746	0.0009	0.0000	0.0000	0.0000
6 5	3	95.2373	0.0009	0.0000	0.0000	0.0000
6 5	4	97.5432	0.0009	0.0000	0.0000	0.0000
6 5	501	99.7724	0.0009	0.0000	0.0000	0.0000
*6 5	1011	86.5587	0.0009	0.0000	0.0000	0.0000
*6 5	1012	86.5562	0.0009	0.0000	0.0000	0.0000
6 5	101	86.5560	-0.0009	0.0000	0.0000	0.0000
*6 5	1001	86.6554	0.0009	0.0000	0.0000	0.0000
*6 5	1002	86.6547	0.0009	0.0000	0.0000	0.0000
6 5	100	86.6550	0.0009	0.0000	0.0000	0.0000
6 5	150	88.8337	0.0009	0.0000	0.0000	0.0000
3 5	204	44.4490	0.0005	0.0000	0.0000	0.0000
3 5	1	41.4530	0.0005	0.0000	0.0000	0.0000
3 5	3	38.6180	0.0005	0.0000	0.0000	0.0000
3 5	4	35.6610	0.0005	0.0000	0.0000	0.0000
3 5	501	62.5540	0.0005	0.0000	0.0000	0.0000

\* Station n°6

\* Temperature : 6.2 °C - Pression : 746.2 mmHg - Correction meteo : -0.6 ppm

7 6	2000	0.0000	0.0007	0.0000	0.0000	0.0000
5 6	1000	346.1219	0.0007	0.0000	0.0000	0.0000
*5 6	2011	25.9189	0.0007	0.0000	0.0000	0.0000
*5 6	2012	26.0782	0.0007	0.0000	0.0000	0.0000
5 6	201	25.9986	0.0007	0.0000	0.0000	0.0000
*5 6	2021	25.8054	0.0007	0.0000	0.0000	0.0000
*5 6	2022	26.1979	0.0007	0.0000	0.0000	0.0000
5 6	202	26.0017	0.0007	0.0000	0.0000	0.0000
*5 6	2031	25.7829	0.0007	0.0000	0.0000	0.0000
*5 6	2032	26.2213	0.0007	0.0000	0.0000	0.0000
5 6	203	26.0021	0.0007	0.0000	0.0000	0.0000
5 6	204	26.0050	0.0007	0.0000	0.0000	0.0000
*5 6	1501	44.8176	0.0007	0.0000	0.0000	0.0000
*5 6	1502	44.9068	0.0007	0.0000	0.0000	0.0000
5 6	150	44.8622	0.0007	0.0000	0.0000	0.0000
5 6	1	390.1187	0.0007	0.0000	0.0000	0.0000
5 6	3	55.8939	0.0007	0.0000	0.0000	0.0000
5 6	5	13.0976	0.0007	0.0000	0.0000	0.0000
*6 6	2000	100.4642	0.0009	0.0000	0.0000	0.0000
*6 6	1000	103.2541	0.0009	0.0000	0.0000	0.0000
*6 6	2011	88.6641	0.0009	0.0000	0.0000	0.0000
*6 6	2012	88.6638	0.0009	0.0000	0.0000	0.0000
**6 6	201	88.6639	0.0009	0.0020	0.0000	0.0000
*6 6	2021	92.1132	0.0009	0.0000	0.0000	0.0000
*6 6	2022	92.1109	0.0009	0.0000	0.0000	0.0000
6 6	202	92.1120	0.0009	0.0020	0.0000	0.0000
*6 6	2031	94.7239	0.0009	0.0000	0.0000	0.0000
*6 6	2032	94.7238	0.0009	0.0000	0.0000	0.0000
**6 6	203	94.7238	0.0009	0.0000	0.0000	0.0000
6 6	204	95.8154	0.0009	0.0000	0.0000	0.0000
*6 6	1501	97.8565	0.0009	0.0000	0.0000	0.0000
*6 6	1502	97.8554	0.0009	0.0000	0.0000	0.0000
6 6	150	97.8560	0.0009	0.0000	0.0000	0.0000
6 6	1	100.9216	0.0009	0.0000	0.0000	0.0000
6 6	3	100.1832	0.0009	0.0000	0.0000	0.0000
6 6	5	103.6835	0.0009	0.0000	0.0000	0.0000
3 6	204	8.8100	0.0005	0.0000	0.0000	0.0000
3 6	1	12.5745	0.0005	0.0000	0.0000	0.0000
3 6	3	61.3410	0.0005	0.0000	0.0000	0.0000
3 6	5	52.9650	0.0005	0.0000	0.0000	0.0000

\* Station n°7

\* Temperature : 5.9 °C - Pression : 746.1 mmHg - Correction meteo : -0.9 ppm

7 7	2000	0.0000	0.0007	0.0000	0.0000	0.0000
5 7	1000	343.7632	0.0007	0.0000	0.0000	0.0000
5 7	1	343.2149	0.0007	0.0000	0.0000	0.0000
5 7	3	60.8403	0.0007	0.0000	0.0000	0.0000
5 7	5	10.7751	0.0007	0.0000	0.0000	0.0000
5 7	6	226.2353	0.0007	0.0000	0.0000	0.0000
*6 7	2000	100.5284	0.0009	0.0000	0.0000	0.0000

---

*6 7	1000	103.5884	0.0009	0.0000	0.0000	0.0000
6 7	1	110.2885	0.0009	0.0000	0.0000	0.0000
6 7	3	101.3413	0.0009	0.0000	0.0000	0.0000
6 7	5	105.7520	0.0009	0.0000	0.0000	0.0000
6 7	6	106.8779	0.0009	0.0000	0.0000	0.0000
3 7	1	7.0570	0.0005	0.0000	0.0000	0.0000
3 7	3	53.6600	0.0005	0.0000	0.0000	0.0000
3 7	5	44.4820	0.0005	0.0000	0.0000	0.0000
3 7	6	8.8430	0.0005	0.0000	0.0000	0.0000

## 6.6 Adjustment output file: COMP3D computation report



### Comp3D HOFN

Version: COMP3D v5.19  
Commit: v5.19  
Options: QT GUI SIM RES AUTO  
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#### Project configuration

Name:HOFN

Root COR file:HOFN.cor

Root OBS file:HOFN.obs

Unit:Grad

Decimal places number:4

Computation nature:Compensation

Normal matrix inversion:Yes

Internal constraints:No

Refraction coefficient:0.1200

Georeferencing:Yes

Projection definition: +proj=utm +zone=28 +datum=WGS84 +units=m +no\_defs

Projection center:E=490412 N=7126815

Convergence criterion:0.001000

Maximum iterations:100

Ellipsoidal heights:Yes

Additional iterations:0

Initialization with CAP:Yes

Gauss-Jordan elimination:No

Kernel computation:Yes

#### Computation information

Compensation done:Yes

Initial  $\sigma_0$ :22105.1837

Final  $\sigma_0$ :1.0129

Iterations:6

Computation interruption:No

Computation start:2020-Nov-04 11:41:09.390627

Sphere radius: 6391473.65 m

Total observations number: 241

Active observations number: 240

Parameters: 74

Normal matrix inversion: Yes

Internal constraints: No

Using vertical deflection: Yes

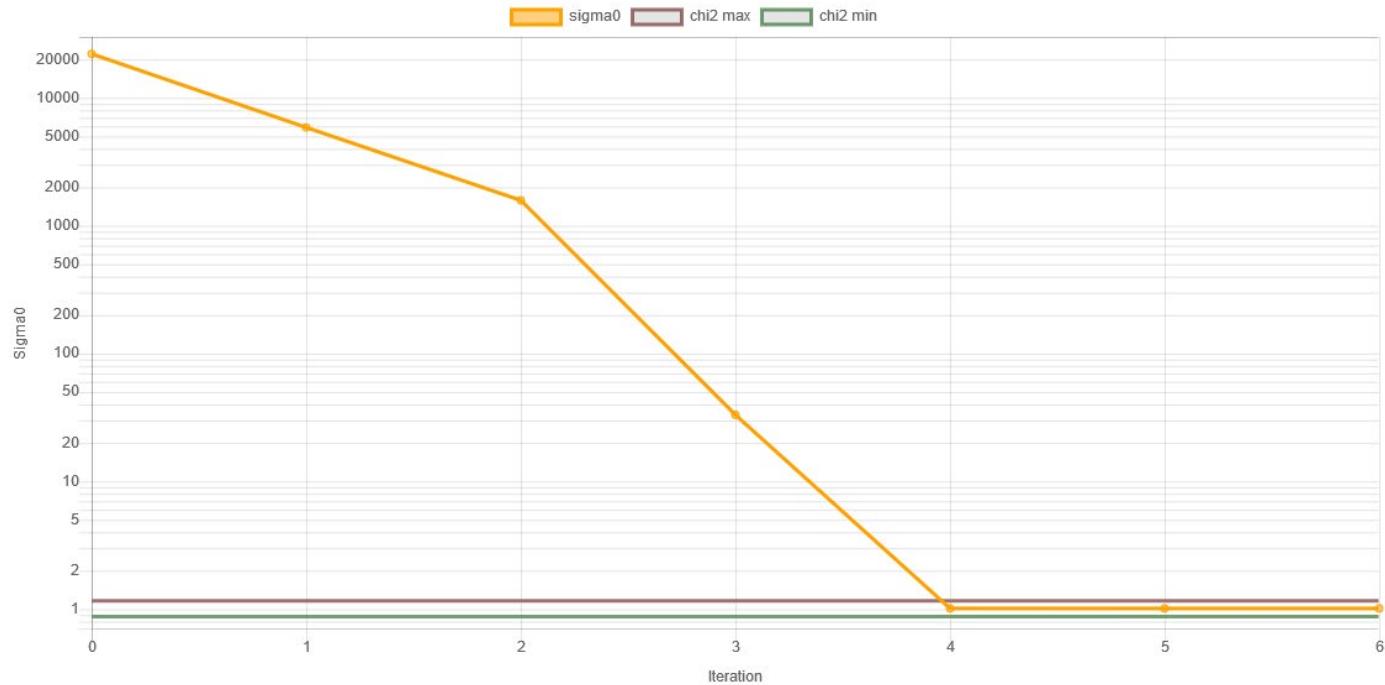
#### Cartesian Global to Geocentric:

0.2621541102267223 -0.8693237486422951 0.41898859475854855 2679655.1113664294

Geocentr = 0.9650260216653411 0.23615611258958505 -0.1138203320823643 \* Global + -727941.6157322718

0 0.43417336460575623 0.9008293342619994 5722714.928990906

#### $\sigma_0$ evolution



$\chi^2$  test: 😊

Confidence: 99%

Degrees of freedom: 166

Test:  $0.8753 < 1.0129 < 1.1626$  ?

Test passed: Yes !

### Initial coordinates

Name	E init	N init	Eh	$\sigma X$	$\sigma Y$	$\sigma Z$ init	$\eta$	$\xi$	Active
<b>102</b>	490412.0956	7126814.933	82.89	0.0001	0.0001	0.0001	3.8	-	8
<b>100</b>	490412.0956	7126814.933	82.92				3.8	-	12
<b>101</b>	490412.0956	7126814.933	82.96				3.8	-	10
<b>1000</b>	490210.9290	7126871.669	70.64	0.0050	0.0050	-	3.8	-	12
<b>2000</b>	490188.8780	7127752.143	74.27	0.0050	0.0050	-	3.8	-	12
<b>1</b>	490380.8900	7126775.760	78.00				3.8	-	65
<b>2</b>	490418.9100	7126792.980	79.00				3.8	-	31
<b>3</b>	490430.0000	7126821.000	79.00				3.8	-	63
<b>4</b>	490405.0000	7126851.000	78.00				3.8	-	59
<b>5</b>	490373.9800	7126810.770	77.00				3.8	-	41
<b>6</b>	490395.7000	7126769.940	78.00				3.8	-	23
<b>500</b>	490434.2300	7126862.250	78.00				3.8	-	3
<b>501</b>	490434.2300	7126862.250	78.20				3.8	-	15
<b>202</b>	490393.4467	7126776.490	82.58				3.8	-	21
<b>201</b>	490393.4467	7126776.490	83.00				3.8	-	9
<b>203</b>	490393.4467	7126776.490	82.09				3.8	-	15
<b>204</b>	490393.4467	7126776.490	81.90				3.8	-	18
<b>206</b>	490393.4467	7126776.490	81.40				3.8	-	6
<b>205</b>	490393.4467	7126776.490	81.60				3.8	-	15
<b>7</b>	490393.4467	7126776.490	82.15				3.8	-	17
<b>150</b>	490412.0956	7126814.933	82.92				3.8	-	15
<b>151</b>	490412.0956	7126814.933	82.96				3.8	-	3

## Observations

Code	From	To	Measure	Distance	Total σ	Normalized	Residual	Residual mm	A posteriori	Standard	Redondancy	Bigr
<b>HOFN.cor</b>												
coord x	102	102	0.0958	0.0000	0.0001	-0.0	-0.0000	-0.0	0.0001	-0.0	0	
coord y	102	102	-0.0665	0.0000	0.0001	0.0	0.0000	0.0	0.0001	0.0	0	
coord z	102	102	82.8952	0.0000	0.0001	0.0	0.0000	0.0	0.0001	0.0	0	
coord x	1000	1000	-201.3267	0.0000	0.0050	0.9	0.0043	4.3	0.0036	1.2	50	
coord y	1000	1000	56.0654	0.0000	0.0050	-0.4	-0.0018	-1.8	0.0018	-1.0	86	
coord x	2000	2000	-226.1274	0.0000	0.0050	0.0	0.0001	0.1	0.0049	0.0	4	
coord v	2000	2000	936.8178	0.0000	0.0050	0.0	0.0001	0.1	0.0050	0.0	0	
<b>HOFN.obs</b>												
dE	202	201	0.0000	0.4866	0.0005	-0.9	-0.0004	-0.4	0.0001	-3.9	95	
dN	202	201	0.0000	0.4866	0.0005	-0.2	-0.0001	-0.1	0.0001	-0.9	95	
dE	202	203	0.0000	0.3904	0.0005	0.4	0.0002	0.2	0.0001	1.6	95	
dN	202	203	0.0000	0.3904	0.0005	0.5	0.0003	0.3	0.0001	2.3	95	
dE	202	204	0.0000	0.5151	0.0005	1.1	0.0006	0.6	0.0001	4.9	95	
dN	202	204	0.0000	0.5151	0.0005	0.5	0.0003	0.3	0.0001	2.1	94	
dE	202	206	0.0000	0.8888	0.0009	1.6	0.0015	1.5	0.0005	3.1	72	
dN	202	206	0.0000	0.8888	0.0009	-0.0	-0.0000	-0.0	0.0005	-0.0	75	
dE	203	7	0.0000	0.2499	0.0005	2.2	0.0011	1.1	0.0001	8.7	94	
dN	203	7	0.0000	0.2499	0.0005	-1.4	-0.0007	-0.7	0.0001	-5.3	93	
dE	206	205	0.0000	0.2005	0.0005	0.9	0.0005	0.5	0.0004	1.0	22	
dN	206	205	0.0000	0.2005	0.0005	-0.0	-0.0000	-0.0	0.0004	-0.0	23	
den	203	202	0.3900	0.3904	0.0005	0.7	0.0004	0.4	0.0005	0.8	18	
den	203	201	0.8770	0.8770	0.0005	0.0	0.0000	0.0	0.0005	0.0	0	
den	203	204	-0.1244	0.1248	0.0005	-0.7	-0.0004	-0.4	0.0004	-1.0	48	
den	203	206	-0.4990	0.4985	0.0005	1.0	0.0005	0.5	0.0004	1.3	36	
den	203	7	0.2520	0.2499	0.0010	-2.1	-0.0021	-2.1	0.0004	-5.6	86	
den	206	205	0.2000	0.2005	0.0005	1.0	0.0005	0.5	0.0004	1.3	36	
dE	102	100	0.0000	0.0319	0.0001	-0.0	-0.0000	-0.0	0.0001	-0.0	6	
dN	102	100	0.0000	0.0319	0.0001	-0.3	-0.0000	-0.0	0.0001	-0.3	10	
dE	102	101	0.0000	0.0639	0.0001	-0.0	-0.0000	-0.0	0.0001	-0.0	6	
dN	102	101	0.0000	0.0639	0.0001	0.3	0.0000	0.0	0.0001	0.3	10	
den	102	100	0.0319	0.0319	0.0005	-0.0	-0.0000	-0.0	0.0005	-0.0	0	
den	100	101	0.0320	0.0320	0.0001	0.1	0.0000	0.0	0.0001	0.1	9	
dE	150	151	0.0000	0.0350	0.0001	0.0	0.0000	0.0	0.0001	0.0	0	

dN	150	151	0.0000	0.0350	0.0001	-0.0	-0.0000	-0.0	0.0001	-0.0	0
den	150	151	0.0350	0.0350	0.0001	-0.0	-0.0000	-0.0	0.0001	-0.0	0
dE	500	501	0.0000	0.2000	0.0005	-0.0	-0.0000	-0.0	0.0005	-0.0	0
dN	500	501	0.0000	0.2000	0.0005	0.0	0.0000	0.0	0.0005	0.0	0
den	500	501	0.2000	0.2000	0.0001	0.0	0.0000	0.0	0.0001	0.0	0
tour	1	2000	0.0000	992.9440	0.0007	-0.9	-0.0006	-9.5	0.0004	-1.7	75
hz	1	1000	343.4329	199.2280	0.0007	-0.9	-0.0006	-1.9	0.0004	-1.5	70
hz	1	2	96.3445	33.0888	0.0007	-0.1	-0.0001	-0.0	0.0004	-0.1	74
hz	1	3	68.1344	55.9548	0.0007	-1.3	-0.0009	-0.8	0.0003	-3.0	82
hz	1	4	39.5531	72.7254	0.0007	1.1	0.0008	0.9	0.0003	2.6	82
hz	1	201	142.8707	7.1833	0.0007	-0.3	-0.0002	-0.0	0.0007	-0.3	6
hz	1	203	142.8647	7.0201	0.0007	0.3	0.0002	0.0	0.0007	0.3	8
hz	1	202	142.8680	7.0799	0.0007	-0.3	-0.0002	-0.0	0.0007	-0.3	10
hz	1	205	142.8600	6.9905	0.0007	-0.2	-0.0001	-0.0	0.0007	-0.2	7
hz	1	100	51.8971	43.2126	0.0007	1.9	0.0013	0.9	0.0004	3.6	72
hz	1	150	61.6430	36.3393	0.0007	0.6	0.0004	0.2	0.0004	1.0	67
zen	1	2	100.4456	33.0888	0.0009	1.8	0.0017	0.9	0.0003	5.0	86
zen	1	3	99.9935	55.9548	0.0009	-0.8	-0.0007	-0.6	0.0002	-3.8	96
zen	1	4	101.3176	72.7254	0.0009	-0.8	-0.0007	-0.8	0.0002	-4.5	97
zen	1	202	88.4369	7.0799	0.0189	1.4	0.0262	2.9	0.0047	5.5	94
zen	1	205	94.6410	6.9905	0.0009	0.5	0.0005	0.1	0.0009	0.5	8
zen	1	100	97.6142	43.2126	0.0009	-0.1	-0.0001	-0.0	0.0003	-0.2	90
zen	1	150	97.1279	36.3393	0.0009	-0.8	-0.0008	-0.4	0.0003	-2.2	86
dist	1	2	33.0900	33.0888	0.0005	-2.4	-0.0012	-1.2	0.0002	-6.4	86
dist	1	3	55.9555	55.9548	0.0005	-1.4	-0.0007	-0.7	0.0001	-5.1	93
dist	1	4	72.7255	72.7254	0.0005	-0.2	-0.0001	-0.1	0.0001	-0.7	92
dist	1	205	6.9895	6.9905	0.0005	1.9	0.0010	1.0	0.0003	3.6	71
tour	2	2000	0.0000	991.5942	0.0007	-0.7	-0.0005	-7.6	0.0003	-1.4	76
hz	2	1000	339.2172	224.7373	0.0007	2.2	0.0015	5.4	0.0003	4.7	78
hz	2	1	298.4659	33.0888	0.0007	-0.1	-0.0001	-0.0	0.0003	-0.3	80
hz	2	3	38.5199	29.6750	0.0007	-0.4	-0.0003	-0.1	0.0004	-0.7	64
hz	2	4	12.3685	57.9860	0.0007	0.1	0.0000	0.0	0.0003	0.1	80
hz	2	201	287.9583	28.3575	0.0007	-1.4	-0.0010	-0.4	0.0004	-2.7	74
hz	2	202	287.9571	28.3270	0.0007	-0.1	-0.0000	-0.0	0.0004	-0.1	75
hz	2	203	287.9572	28.3086	0.0007	0.4	0.0003	0.1	0.0004	0.7	74
hz	2	205	287.9543	28.2969	0.0007	1.4	0.0010	0.4	0.0005	2.0	54
hz	2	100	398.4454	27.8195	0.0007	-0.9	-0.0006	-0.3	0.0005	-1.3	53
hz	2	150	391.5716	19.0256	0.0007	-0.4	-0.0003	-0.1	0.0006	-0.5	26

zen	2	1	99.5524	33.0888	0.0009	0.7	0.0006	0.3	0.0003	1.9	86
zen	2	3	99.4867	29.6750	0.0009	0.9	0.0008	0.4	0.0004	2.3	83
zen	2	4	101.3957	57.9860	0.0009	0.7	0.0006	0.6	0.0002	2.8	94
zen	2	202	96.6061	28.3270	0.0054	0.4	0.0024	1.1	0.0012	1.9	95
zen	2	205	98.1552	28.2969	0.0009	-0.4	-0.0004	-0.2	0.0004	-0.9	78
zen	2	100	95.7599	27.8195	0.0009	-0.2	-0.0001	-0.1	0.0005	-0.3	73
zen	2	150	93.7257	19.0256	0.0009	1.1	0.0010	0.3	0.0006	1.6	53
dist	2	1	33.0895	33.0888	0.0005	-1.4	-0.0007	-0.7	0.0002	-3.7	86
dist	2	3	29.6750	29.6750	0.0005	-0.1	-0.0000	-0.0	0.0002	-0.2	85
dist	2	4	57.9860	57.9860	0.0005	-0.1	-0.0000	-0.0	0.0002	-0.3	85
dist	2	205	28.2960	28.2969	0.0005	1.8	0.0009	0.9	0.0002	4.0	79
tour	3	2000	0.0000	967.3381	0.0007	0.3	0.0002	3.2	0.0003	0.6	78
hz	3	1000	331.9519	226.3761	0.0007	0.8	0.0005	1.9	0.0003	1.7	79
hz	3	1	271.3674	55.9548	0.0007	-1.3	-0.0009	-0.8	0.0003	-3.4	86
hz	3	2	239.6313	29.6750	0.0007	-0.1	-0.0001	-0.0	0.0004	-0.1	74
hz	3	4	390.0757	33.0042	0.0007	0.2	0.0002	0.1	0.0004	0.4	72
hz	3	201	263.7265	53.6779	0.0007	0.8	0.0005	0.5	0.0003	2.0	86
hz	3	202	263.7278	53.6638	0.0007	-1.5	-0.0011	-0.9	0.0003	-4.1	86
hz	3	203	263.7266	53.6557	0.0007	0.2	0.0002	0.1	0.0003	0.6	86
hz	3	205	263.7244	53.6507	0.0007	0.9	0.0006	0.5	0.0003	1.9	76
hz	3	101	313.0930	17.9482	0.0007	-0.6	-0.0004	-0.1	0.0005	-0.7	39
hz	3	150	283.0863	20.2480	0.0007	0.2	0.0001	0.0	0.0006	0.2	31
zen	3	1	100.0078	55.9548	0.0009	-0.1	-0.0001	-0.1	0.0002	-0.6	96
zen	3	2	100.5119	29.6750	0.0009	0.9	0.0008	0.4	0.0004	2.2	83
zen	3	4	102.9150	33.0042	0.0009	-0.4	-0.0004	-0.2	0.0003	-1.3	88
zen	3	202	98.4928	53.6638	0.0033	0.4	0.0013	1.1	0.0007	2.0	96
zen	3	205	99.3111	53.6507	0.0009	-0.5	-0.0005	-0.4	0.0002	-2.3	94
zen	3	101	94.1582	17.9482	0.0009	-0.0	-0.0000	-0.0	0.0006	-0.1	54
zen	3	150	94.8615	20.2480	0.0009	-1.0	-0.0009	-0.3	0.0006	-1.6	61
dist	3	1	55.9551	55.9548	0.0005	-0.6	-0.0003	-0.3	0.0001	-2.1	93
dist	3	2	29.6750	29.6750	0.0005	-0.1	-0.0000	-0.0	0.0002	-0.2	85
dist	3	4	33.0040	33.0042	0.0005	0.4	0.0002	0.2	0.0002	1.2	90
dist	3	205	53.6501	53.6507	0.0005	1.2	0.0006	0.6	0.0002	3.6	90
tour	4	2000	0.0000	934.7729	0.0007	0.2	0.0001	1.8	0.0003	0.4	77
hz	4	1000	323.5805	207.8155	0.0007	2.6	0.0018	5.8	0.0004	4.7	70
hz	4	1	242.4387	72.7254	0.0007	-0.8	-0.0005	-0.6	0.0002	-2.1	87
hz	4	2	213.1305	57.9860	0.0007	1.4	0.0010	0.9	0.0003	3.7	86
hz	4	3	189.7266	33.0042	0.0007	0.8	0.0006	0.3	0.0003	1.8	80

hz	4	201	236.3985	73.4753	0.0007	-1.1	-0.0007	-0.9	0.0002	-3.0	87
hz	4	202	236.3982	73.4550	0.0007	-1.1	-0.0008	-0.9	0.0002	-3.2	87
hz	4	203	236.3981	73.4410	0.0007	-1.1	-0.0008	-0.9	0.0002	-3.1	87
hz	4	205	236.3968	73.4316	0.0007	-1.4	-0.0010	-1.1	0.0003	-3.3	82
hz	4	100	225.3953	31.6120	0.0007	0.6	0.0004	0.2	0.0004	1.1	67
hz	4	101	225.3958	31.6152	0.0007	-0.1	-0.0001	-0.0	0.0004	-0.1	65
hz	4	150	222.7100	40.6202	0.7811	0.0	0.0085	5.4	0.0004	22.4	100
zen	4	1	98.6841	72.7254	0.0009	-0.4	-0.0003	-0.4	0.0002	-2.0	97
zen	4	2	98.6034	57.9860	0.0009	0.9	0.0008	0.7	0.0002	3.6	94
zen	4	3	97.0862	33.0042	0.0009	-0.6	-0.0005	-0.3	0.0003	-1.7	88
zen	4	202	97.5906	73.4550	0.0026	-0.1	-0.0001	-0.2	0.0005	-0.3	97
zen	4	205	98.1875	73.4316	0.0009	-0.8	-0.0007	-0.8	0.0002	-4.2	96
zen	4	100	93.7005	31.6120	0.0009	-0.1	-0.0001	-0.1	0.0004	-0.3	82
zen	4	101	93.6353	31.6152	0.0009	1.1	0.0010	0.5	0.0004	2.5	82
zen	4	150	95.0697	40.6202	0.0009	-0.8	-0.0008	-0.5	0.0003	-2.3	87
dist	4	1	72.7252	72.7254	0.0005	0.4	0.0002	0.2	0.0001	1.4	92
dist	4	2	57.9861	57.9860	0.0005	-0.3	-0.0001	-0.1	0.0002	-0.8	85
dist	4	3	33.0041	33.0042	0.0005	0.2	0.0001	0.1	0.0002	0.6	90
dist	4	205	73.4312	73.4316	0.0005	0.8	0.0004	0.4	0.0002	2.4	90
tour	4	2000	0.0000	934.7729	0.0007	-0.5	-0.0003	-4.9	0.0004	-0.9	74
hz	4	1000	323.5833	207.8155	0.0007	-2.1	-0.0015	-4.8	0.0004	-3.7	68
hz	4	1	242.4377	72.7254	0.0007	0.0	0.0000	0.0	0.0003	0.0	81
hz	4	3	189.7267	33.0042	0.0007	-0.0	-0.0000	-0.0	0.0004	-0.0	73
hz	4	5	265.4697	35.6611	0.0007	1.3	0.0009	0.5	0.0004	2.4	70
hz	4	501	64.1748	26.9465	0.0007	-0.4	-0.0002	-0.1	0.0006	-0.4	28
hz	4	204	236.3954	73.4369	0.0007	1.6	0.0012	1.3	0.0003	3.8	81
zen	4	1	98.6838	72.7254	0.0009	-0.0	-0.0000	-0.0	0.0002	-0.2	97
zen	4	3	97.0853	33.0042	0.0009	0.4	0.0004	0.2	0.0003	1.2	88
zen	4	5	102.4575	35.6611	0.0009	-0.6	-0.0006	-0.3	0.0003	-1.7	86
zen	4	501	102.7219	26.9465	0.0009	0.5	0.0004	0.2	0.0007	0.6	34
zen	4	204	98.0364	73.4369	0.0009	0.3	0.0003	0.3	0.0002	1.7	96
dist	4	1	72.7260	72.7254	0.0005	-1.2	-0.0006	-0.6	0.0001	-4.2	92
dist	4	3	33.0040	33.0042	0.0005	0.4	0.0002	0.2	0.0002	1.2	90
dist	4	5	35.6615	35.6611	0.0005	-0.8	-0.0004	-0.4	0.0002	-2.2	87
dist	4	501	26.9460	26.9465	0.0005	0.9	0.0005	0.5	0.0003	1.7	70
dist	4	204	73.4370	73.4369	0.0005	-0.2	-0.0001	-0.1	0.0002	-0.6	90
tour	3	2000	0.0000	967.3381	0.0007	-1.0	-0.0007	-11.1	0.0003	-2.1	76
hz	3	1000	331.9513	226.3761	0.0007	0.3	0.0002	0.7	0.0003	0.6	77

hz	3	1	271.3654	55.9548	0.0007	0.2	0.0002	0.2	0.0003	0.5	79
hz	3	4	390.0754	33.0042	0.0007	-0.7	-0.0005	-0.2	0.0004	-1.3	74
hz	3	5	324.2967	38.6184	0.0007	-0.6	-0.0005	-0.3	0.0003	-1.3	76
hz	3	501	23.0494	50.1239	0.0007	0.8	0.0006	0.5	0.0004	1.4	65
hz	3	204	263.7248	53.6536	0.0007	1.0	0.0007	0.6	0.0003	2.1	78
zen	3	1	100.0075	55.9548	0.0009	0.2	0.0002	0.2	0.0002	1.0	96
zen	3	4	102.9142	33.0042	0.0009	0.5	0.0004	0.2	0.0003	1.3	88
zen	3	5	104.7623	38.6184	0.0009	0.3	0.0003	0.2	0.0003	0.9	89
zen	3	501	103.3832	50.1239	0.0009	-0.0	-0.0000	-0.0	0.0004	-0.1	79
zen	3	204	99.1052	53.6536	0.0009	-0.1	-0.0001	-0.1	0.0002	-0.3	95
dist	3	1	55.9551	55.9548	0.0005	-0.6	-0.0003	-0.3	0.0001	-2.1	93
dist	3	4	33.0040	33.0042	0.0005	0.4	0.0002	0.2	0.0002	1.2	90
dist	3	5	38.6180	38.6184	0.0005	0.8	0.0004	0.4	0.0002	2.2	88
dist	3	501	50.1240	50.1239	0.0005	-0.1	-0.0001	-0.1	0.0003	-0.2	72
dist	3	204	53.6530	53.6536	0.0005	1.1	0.0006	0.6	0.0001	3.8	91
tour	1	2000	0.0000	992.9440	0.0007	0.9	0.0006	9.3	0.0003	1.8	76
hz	1	1000	343.4339	199.2280	0.0007	-0.6	-0.0004	-1.2	0.0004	-1.0	71
hz	1	204	142.8644	7.0058	0.0007	0.2	0.0001	0.0	0.0007	0.2	10
hz	1	3	68.1352	55.9548	0.0007	-0.7	-0.0005	-0.4	0.0003	-1.6	82
hz	1	4	39.5555	72.7254	0.0007	-0.6	-0.0004	-0.5	0.0003	-1.4	83
hz	1	5	19.8231	41.4529	0.0007	-0.3	-0.0002	-0.1	0.0003	-0.6	77
hz	1	501	45.3892	98.5268	0.0007	1.3	0.0009	1.4	0.0003	2.9	81
hz	1	101	51.8997	43.2138	0.0007	-0.2	-0.0001	-0.1	0.0004	-0.3	72
zen	1	204	93.0718	7.0058	0.0009	0.3	0.0003	0.0	0.0008	0.4	28
zen	1	3	99.9929	55.9548	0.0009	-0.1	-0.0001	-0.1	0.0002	-0.5	96
zen	1	4	101.3170	72.7254	0.0009	-0.2	-0.0001	-0.2	0.0002	-0.8	97
zen	1	5	104.4269	41.4529	0.0009	-0.6	-0.0006	-0.4	0.0003	-2.1	90
zen	1	501	101.7180	98.5268	0.0009	-1.5	-0.0014	-2.1	0.0002	-6.2	94
zen	1	101	97.5678	43.2138	0.0009	-0.9	-0.0008	-0.5	0.0003	-2.7	90
dist	1	204	7.0060	7.0058	0.0005	-0.3	-0.0002	-0.2	0.0002	-1.0	89
dist	1	3	55.9550	55.9548	0.0005	-0.4	-0.0002	-0.2	0.0001	-1.3	93
dist	1	4	72.7250	72.7254	0.0005	0.8	0.0004	0.4	0.0001	2.8	92
dist	1	5	41.4530	41.4529	0.0005	-0.2	-0.0001	-0.1	0.0002	-0.6	89
dist	1	501	98.5271	98.5268	0.0005	-0.7	-0.0003	-0.3	0.0003	-1.2	72
tour	5	2000	0.0000	953.6477	0.0007	1.4	0.0009	14.2	0.0003	2.9	79
hz	5	1000	331.1321	188.1100	0.0007	-0.6	-0.0004	-1.2	0.0004	-1.2	75
hz	5	201	211.2762	44.5431	0.0007	0.6	0.0004	0.3	0.0003	1.4	84
hz	5	202	211.2759	44.4949	0.0007	0.1	0.0001	0.0	0.0003	0.2	84

hz	5	203	211.2752	44.4599	0.0007	0.7	0.0005	0.3	0.0003	1.7	84
hz	5	204	211.2750	44.4495	0.0007	0.2	0.0001	0.1	0.0003	0.5	84
hz	5	1	220.6689	41.4529	0.0007	0.2	0.0001	0.1	0.0003	0.4	81
hz	5	3	121.9108	38.6184	0.0007	1.0	0.0007	0.4	0.0003	2.4	83
hz	5	4	63.4346	35.6611	0.0007	-0.7	-0.0005	-0.3	0.0004	-1.3	69
hz	5	501	62.8771	62.5536	0.0007	-1.1	-0.0008	-0.8	0.0004	-2.1	73
hz	5	101	131.3673	21.6266	0.0007	-0.1	-0.0000	-0.0	0.0004	-0.1	60
hz	5	100	131.3683	21.6200	0.0007	-1.3	-0.0009	-0.3	0.0005	-1.9	54
hz	5	150	153.5843	25.9003	0.0007	-0.3	-0.0002	-0.1	0.0005	-0.4	47
zen	5	202	94.0428	44.4949	0.0038	0.7	0.0028	2.0	0.0008	3.5	96
zen	5	204	94.7818	44.4495	0.0009	-1.8	-0.0017	-1.2	0.0003	-6.0	91
zen	5	1	95.5746	41.4529	0.0009	-0.6	-0.0006	-0.4	0.0003	-2.0	90
zen	5	3	95.2373	38.6184	0.0009	0.5	0.0005	0.3	0.0003	1.6	89
zen	5	4	97.5432	35.6611	0.0009	0.2	0.0002	0.1	0.0003	0.6	86
zen	5	501	99.7724	62.5536	0.0009	-0.1	-0.0001	-0.1	0.0003	-0.2	85
zen	5	101	86.5560	21.6266	0.0009	7.6	0.0068	2.3	-	0.0	-
zen	5	100	86.6550	21.6200	0.0009	0.0	0.0000	0.0	0.0006	0.0	60
zen	5	150	88.8337	25.9003	0.0009	1.6	0.0014	0.6	0.0005	2.8	69
dist	5	204	44.4490	44.4495	0.0005	1.0	0.0005	0.5	0.0002	3.0	88
dist	5	1	41.4530	41.4529	0.0005	-0.2	-0.0001	-0.1	0.0002	-0.6	89
dist	5	3	38.6180	38.6184	0.0005	0.8	0.0004	0.4	0.0002	2.2	88
dist	5	4	35.6610	35.6611	0.0005	0.2	0.0001	0.1	0.0002	0.6	87
dist	5	501	62.5540	62.5536	0.0005	-0.8	-0.0004	-0.4	0.0003	-1.4	69
tour	6	2000	0.0000	1005.364	0.0007	-0.5	-0.0003	-5.1	0.0004	-0.8	69
hz	6	1000	346.1219	208.7510	0.0007	0.6	0.0004	1.3	0.0004	1.0	64
hz	6	201	25.9986	8.9321	0.0007	-0.1	-0.0001	-0.0	0.0007	-0.1	12
hz	6	202	26.0017	8.8591	0.0007	-0.2	-0.0001	-0.0	0.0006	-0.2	18
hz	6	203	26.0021	8.8197	0.0007	0.6	0.0004	0.1	0.0006	0.7	15
hz	6	204	26.0050	8.8107	0.0007	0.3	0.0002	0.0	0.0007	0.3	12
hz	6	150	44.8622	43.2582	0.0007	-0.1	-0.0001	-0.0	0.0004	-0.1	69
hz	6	1	390.1187	12.5742	0.0007	-0.5	-0.0004	-0.1	0.0006	-0.7	35
hz	6	3	55.8939	61.3413	0.0007	0.0	0.0000	0.0	0.0003	0.0	76
hz	6	5	13.0976	52.9650	0.0007	-0.1	-0.0001	-0.1	0.0003	-0.3	78
zen	6	202	92.1120	8.8591	0.0153	0.5	0.0072	1.0	0.0038	1.9	94
zen	6	204	95.8154	8.8107	0.0009	-0.2	-0.0002	-0.0	0.0007	-0.3	41
zen	6	150	97.8560	43.2582	0.0009	-0.9	-0.0009	-0.6	0.0003	-2.8	89
zen	6	1	100.9216	12.5742	0.0009	0.7	0.0006	0.1	0.0005	1.3	72
zen	6	3	100.1832	61.3413	0.0009	-0.8	-0.0007	-0.7	0.0002	-3.7	96

zen	6	5	103.6835	52.9650	0.0009	-1.1	-0.0010	-0.8	0.0002	-4.1	93
dist	6	204	8.8100	8.8107	0.0005	1.5	0.0007	0.7	0.0002	3.7	84
dist	6	1	12.5745	12.5742	0.0005	-0.5	-0.0003	-0.3	0.0002	-1.2	80
dist	6	3	61.3410	61.3413	0.0005	0.5	0.0003	0.3	0.0002	1.4	84
dist	6	5	52.9650	52.9650	0.0005	-0.1	-0.0000	-0.0	0.0002	-0.2	79
tour	7	2000	0.0000	997.3111	0.0007	0.8	0.0005	8.6	0.0004	1.5	71
hz	7	1000	343.7632	206.2453	0.0007	-1.9	-0.0013	-4.2	0.0004	-3.3	69
hz	7	1	343.2149	7.0573	0.0007	-0.3	-0.0002	-0.0	0.0007	-0.3	8
hz	7	3	60.8403	53.6602	0.0007	1.0	0.0007	0.6	0.0004	1.8	66
hz	7	5	10.7751	44.4825	0.0007	0.7	0.0005	0.3	0.0004	1.2	67
hz	7	6	226.2353	8.8427	0.0007	-0.4	-0.0003	-0.0	0.0007	-0.4	8
zen	7	1	110.2885	7.0573	0.0009	0.1	0.0001	0.0	0.0008	0.2	28
zen	7	3	101.3413	53.6602	0.0009	-1.6	-0.0015	-1.2	0.0002	-7.0	94
zen	7	5	105.7520	44.4825	0.0009	2.9	0.0026	1.8	0.0003	9.4	90
zen	7	6	106.8779	8.8427	0.0009	-0.2	-0.0002	-0.0	0.0007	-0.3	40
dist	7	1	7.0570	7.0573	0.0005	0.6	0.0003	0.3	0.0002	1.6	87
dist	7	3	53.6600	53.6602	0.0005	0.3	0.0002	0.2	0.0002	1.0	91
dist	7	5	44.4820	44.4825	0.0005	0.9	0.0005	0.5	0.0002	2.7	87
dist	7	6	8.8430	8.8427	0.0005	-0.5	-0.0003	-0.3	0.0002	-1.3	83

## Residual repartition



## Pseudo random propositions

**System redundancy: 156**

Observations sigmas may be multiplied by:

Horizontal angles: 1.0597

Zenith angles: 0.9530

Distances: 0.9720

Coordinates: Not enough observations

## Biggest residuals

Code	From	To	Measure	Distance	Total σ	Normalized	Residual	Residual mm	A posteriori	Standard	Redondanc
<b>zen</b>	7	5	105.7520	44.4825	0.0009	2.9	0.0026	1.8	0.0003	9.4	90
<b>hz</b>	4	1000	323.5805	207.8155	0.0007	2.6	0.0018	5.8	0.0004	4.7	70
<b>dist</b>	1	2	33.0900	33.0888	0.0005	-2.4	-0.0012	-1.2	0.0002	-6.4	86
<b>hz</b>	2	1000	339.2172	224.7373	0.0007	2.2	0.0015	5.4	0.0003	4.7	78
<b>dE</b>	203	7	0.0000	0.2499	0.0005	2.2	0.0011	1.1	0.0001	8.7	94
<b>hz</b>	4	1000	323.5833	207.8155	0.0007	-2.1	-0.0015	-4.8	0.0004	-3.7	68
<b>den</b>	203	7	0.2520	0.2499	0.0010	-2.1	-0.0021	-2.1	0.0004	-5.6	86
<b>dist</b>	1	205	6.9895	6.9905	0.0005	1.9	0.0010	1.0	0.0003	3.6	71
<b>hz</b>	1	100	51.8971	43.2126	0.0007	1.9	0.0013	0.9	0.0004	3.6	72
<b>hz</b>	7	1000	343.7632	206.2453	0.0007	-1.9	-0.0013	-4.2	0.0004	-3.3	69
<b>zen</b>	1	2	100.4456	33.0888	0.0009	1.8	0.0017	0.9	0.0003	5.0	86
<b>zen</b>	5	204	94.7818	44.4495	0.0009	-1.8	-0.0017	-1.2	0.0003	-6.0	91
<b>dist</b>	2	205	28.2960	28.2969	0.0005	1.8	0.0009	0.9	0.0002	4.0	79
<b>hz</b>	4	204	236.3954	73.4369	0.0007	1.6	0.0012	1.3	0.0003	3.8	81
<b>zen</b>	7	3	101.3413	53.6602	0.0009	-1.6	-0.0015	-1.2	0.0002	-7.0	94
<b>dE</b>	202	206	0.0000	0.8888	0.0009	1.6	0.0015	1.5	0.0005	3.1	72
<b>zen</b>	5	150	88.8337	25.9003	0.0009	1.6	0.0014	0.6	0.0005	2.8	69
<b>hz</b>	3	202	263.7278	53.6638	0.0007	-1.5	-0.0011	-0.9	0.0003	-4.1	86
<b>zen</b>	1	501	101.7180	98.5268	0.0009	-1.5	-0.0014	-2.1	0.0002	-6.2	94
<b>dist</b>	6	204	8.8100	8.8107	0.0005	1.5	0.0007	0.7	0.0002	3.7	84

### Compensated coordinates

Name	E comp	N comp	Eh comp	ΔE	ΔN	ΔZ	σX init	σY init	σZ init	η	ξ	Active obs
<b>102</b>	490412.0956	7126814.9332	82.8952	-0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	3.8	-1.3	8
<b>100</b>	490412.0956	7126814.9332	82.9271	-0.0000	-	-				3.8	-1.3	12
<b>101</b>	490412.0956	7126814.9332	82.9591	-0.0000	0.0000	-				3.8	-1.3	10
<b>1000</b>	490210.9333	7126871.6672	70.6430	0.0043	-	-	0.0050	0.0050	-	3.8	-1.3	12
<b>2000</b>	490188.8781	7127752.1431	74.2750	0.0001	0.0001	-	0.0050	0.0050	-	3.8	-1.3	12
<b>1</b>	490387.2257	7126779.6534	81.3081	6.3357	3.8934	3.3081				3.8	-1.3	65
<b>2</b>	490419.2002	7126788.1118	81.0752	0.2902	-	2.0752				3.8	-1.3	31
<b>3</b>	490429.9417	7126815.7604	81.3141	-0.0583	-	2.3141				3.8	-1.3	63
<b>4</b>	490416.8698	7126846.0131	79.8041	11.8698	-	1.8041				3.8	-1.3	59
<b>5</b>	490391.7704	7126820.7386	78.4286	17.7904	9.9686	1.4286				3.8	-1.3	41
<b>6</b>	490391.6339	7126767.8841	81.4901	-4.0661	-	3.4901				3.8	-1.3	23
<b>500</b>	490435.4396	7126865.4900	78.4520	1.2096	3.2400	0.4520				3.8	-1.3	3
<b>501</b>	490435.4396	7126865.4900	78.6520	1.2096	3.2400	0.4520				3.8	-1.3	15
<b>202</b>	490393.4252	7126776.4873	82.5840	-0.0215	-	0.0031				3.8	-1.3	21
<b>201</b>	490393.4247	7126776.4872	83.0706	-0.0220	-	0.0706				3.8	-1.3	9
<b>203</b>	490393.4254	7126776.4876	82.1936	-0.0213	-	0.1036				3.8	-1.3	15
<b>204</b>	490393.4257	7126776.4876	82.0689	-0.0210	-	0.1689				3.8	-1.3	18
<b>206</b>	490393.4266	7126776.4873	81.6952	-0.0201	-	0.2952				3.8	-1.3	6
<b>205</b>	490393.4271	7126776.4873	81.8957	-0.0196	-	0.2957				3.8	-1.3	15
<b>7</b>	490393.4264	7126776.4869	82.4436	-0.0203	-	0.2936				3.8	-1.3	17
<b>150</b>	490412.4111	7126805.7776	82.9472	0.3155	-	0.0201				3.8	-1.3	15
<b>151</b>	490412.4111	7126805.7776	82.9822	0.3155	-	0.0202				3.8	-1.3	3

### Confidence ellipsoids

Name	1/2 Axis	Azimuth (gr)	Tilt (gr)
<b>102</b>	0.1	104.6304	99.9979
	0.1	93.6235	0.0020
	0.1	193.6235	0.0004
<b>100</b>	0.5	114.0146	100.0000
	0.1	114.5771	200.0000
	0.1	14.5771	0.0000
<b>101</b>	0.5	24.0039	99.9935
	0.1	114.3863	199.9990
	0.1	14.3863	0.0064
<b>1000</b>	3.8	121.6161	0.0000
	1.5	21.6161	0.0000
<b>2000</b>	5.1	185.3533	0.0000
	5.0	85.3533	0.0000
<b>1</b>	0.6	119.8386	99.5443
	0.4	133.0911	0.4458
	0.2	33.0905	199.9058
<b>2</b>	0.6	22.5910	99.7586
	0.3	75.7920	199.8381
	0.2	175.7915	0.1791
<b>3</b>	0.5	62.0175	100.1853
	0.2	109.7339	199.8643
	0.2	9.7337	199.8737
<b>4</b>	0.6	177.8383	99.6411
	0.3	110.5737	0.1765
	0.2	10.5745	0.3125
<b>5</b>	0.6	117.8099	101.1762
	0.3	109.8282	1.1670
	0.2	9.8309	199.8530
<b>6</b>	0.6	88.3131	99.2986
	0.4	127.8271	0.5706
	0.3	27.8234	199.5921
<b>500</b>	0.7	124.1203	0.3994
	0.6	133.0482	99.5966
	0.6	24.1206	0.0564
<b>501</b>	0.6	121.7920	99.7712
	0.5	124.1205	199.7713
	0.3	24.1204	0.0084
<b>202</b>	0.8	117.6936	99.7900
	0.4	123.6674	0.2090
	0.2	23.6674	199.9803
<b>201</b>	0.8	112.9412	99.8357
	0.4	123.7953	0.1619
	0.2	23.7952	199.9721
<b>203</b>	0.7	114.1726	99.6922

	0.4	123.7373	0.3043
	0.2	23.7371	199.9539
<b>204</b>	0.6	118.9360	99.1764
	0.4	123.9832	0.8210
	0.2	23.9823	199.9348
<b>206</b>	0.7	122.9550	98.5579
	0.6	124.9453	1.4414
	0.5	24.9443	199.9549
<b>205</b>	0.6	125.4763	97.6995
	0.4	125.7152	2.3005
	0.2	25.7148	199.9914
7	0.6	119.0936	98.8107
	0.4	124.8384	1.1844
	0.2	24.8364	199.8929
<b>150</b>	0.6	163.2126	100.1917
	0.3	107.3963	0.1226
	0.3	7.3966	0.1474
<b>151</b>	0.6	163.2126	99.8083
	0.3	107.3963	0.1226
	0.3	7.3966	199.8526

### Confidence intervals

Name	$\sigma X$ (mm)	$\sigma Y$ (mm)	$\sigma Z$ (mm)
<b>102</b>	0.1	0.1	0.1
<b>100</b>	0.1	0.1	0.5
<b>101</b>	0.1	0.1	0.5
<b>1000</b>	3.6	1.9	-
<b>2000</b>	5.0	5.1	-
<b>1</b>	0.3	0.3	0.6
<b>2</b>	0.3	0.3	0.6
<b>3</b>	0.2	0.2	0.5
<b>4</b>	0.3	0.2	0.6
<b>5</b>	0.3	0.2	0.6
<b>6</b>	0.4	0.3	0.6
<b>500</b>	0.7	0.6	0.6
<b>501</b>	0.5	0.3	0.6
<b>202</b>	0.4	0.3	0.8
<b>201</b>	0.4	0.3	0.8
<b>203</b>	0.4	0.3	0.7
<b>204</b>	0.4	0.3	0.6
<b>206</b>	0.6	0.5	0.7
<b>205</b>	0.4	0.3	0.6
7	0.4	0.3	0.6
<b>150</b>	0.3	0.3	0.6
<b>151</b>	0.3	0.3	0.6

## 6.7 Sinex file: 102004 IGN 2020-267\_v10.SNX

```
%=SNX 1.00 IGN 20:310:00000 IGN 20:267:00000 20:267:00000 C 00012
*-----
+FILE/COMMENT
* File created by geotosnx software (Z.Altamimi)
* Original input file: D:\DORIS_Doc\geotosnx\HOFN-matrice-comp.csv
* Matrix Scalling Factor used: 1.0000000000
-FILE/COMMENT
*-----
+SITE/ID
*CODE PT __DOMES__ T _STATION DESCRIPTION_ APPROX_LON_ APPROX_LAT_ APP_H_
HOFN A 10204M002 10204M002 344 48 07.5 64 16 02.2 82.9
7635 A 10204M001 10204M001 344 48 09.2 64 16 03.8 78.5
HOFC A 10204S001 10204S001 344 48 06.1 64 16 01.0 82.6
HOFS A 10204M003 10204M003 344 48 07.5 64 16 01.9 82.9
-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 HOFN A 1 20:267:00000 m 2 0.267968992650000E+07 0.99987E-04
 2 STAY HOFN A 1 20:267:00000 m 2 -.727950974110000E+06 0.99992E-04
 3 STAZ HOFN A 1 20:267:00000 m 2 0.572278957450000E+07 0.99997E-04
 4 STAX 7635 A 1 20:267:00000 m 2 0.267965011440000E+07 0.63109E-03
 5 STAY 7635 A 1 20:267:00000 m 2 -.727916122210000E+06 0.65916E-03
 6 STAZ 7635 A 1 20:267:00000 m 2 0.572280756260000E+07 0.62176E-03
 7 STAX HOFC A 1 20:267:00000 m 2 0.267971841690000E+07 0.41440E-03
 8 STAY HOFC A 1 20:267:00000 m 2 -.727977944590000E+06 0.34007E-03
 9 STAZ HOFC A 1 20:267:00000 m 2 0.572277256990000E+07 0.69253E-03
10 STAX HOFS A 1 20:267:00000 m 2 0.267969800010000E+07 0.33423E-03
11 STAY HOFS A 1 20:267:00000 m 2 -.727952810740000E+06 0.28978E-03
12 STAZ HOFS A 1 20:267:00000 m 2 0.572278564510000E+07 0.51195E-03
-SOLUTION/ESTIMATE
*-----
+SOLUTION/MATRIX_ESTIMATE L COVA
*PARA1 PARA2 _ PARA2+0_ _ PARA2+1_ _ PARA2+2_
 1 1 0.999746323862000E-08
 2 1 0.102860018899000E-12 0.999833622630000E-08
 3 1 0.119285284890000E-11 -.258115680361000E-12 0.999941257986000E-08
 4 1 0.100643224232000E-07 -.349110545076000E-09 -.739609614579000E-10
 4 4 0.398279051449000E-06
 5 1 0.929242950937000E-10 0.953603490324000E-08 -.101901718711000E-09
 5 4 0.572556588192000E-07 0.434485508342000E-06
 6 1 -.183062776422000E-10 0.103906517920000E-09 0.100216047110000E-07
 6 4 0.428670303045000E-08 -.206533214126000E-07 0.386580622177000E-06
 7 1 0.994994661714000E-08 0.300583143336000E-09 0.612103105271000E-10
 7 4 0.488941894008000E-07 -.481042138808000E-07 0.102974218341000E-06
 7 7 0.171723331470000E-06
 8 1 -.505906441786000E-10 0.103670390657000E-07 0.699535872362000E-10
 8 4 -.505122883952000E-07 -.618740289131000E-09 -.116868565426000E-07
 8 7 0.148615194100000E-07 0.115645001237000E-06
 9 1 0.165541770811000E-10 -.937950534038000E-10 0.998047817379000E-08
```

---

```
9      4 0.102457235704000E-06 -.124769814898000E-07 0.231923395704000E-06
9      7 0.190987582246000E-06 -.637605701149000E-07 0.479598188178000E-06
10     1 0.998625181124000E-08 0.209732198779000E-10 0.903025951394000E-11
10     4 0.746275357157000E-07 -.102042963386000E-07 0.954081712064000E-07
10     7 0.824235027458000E-07 -.275410780146000E-08 0.942506618976000E-07
10    10 0.111712394742000E-06
11     1 -.171172215100000E-10 0.100910483660000E-07 0.194684404774000E-10
11     4 -.214364627846000E-07 0.286210634677000E-07 -.215896637977000E-07
11     7 0.346458613322000E-08 0.610038238610000E-07 -.293016740543000E-07
11    10 -.598129505942000E-08 0.839706870052000E-07
12     1 0.408269768667000E-11 0.176562125810000E-11 0.999833114229000E-08
12     4 0.942427209619000E-07 -.268097993379000E-07 0.234330863299000E-06
12     7 0.951563796456000E-07 -.265046055607000E-07 0.236757726620000E-06
12    10 0.912404821359000E-07 -.252937848720000E-07 0.262095884094000E-06
-SOLUTION/MATRIX_ESTIMATE L COVA
%ENDSNX
```