Check reference station coordinates NAM

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1 Procedure

Since 2006, 06-GPS processes GPS data of permanent monitor stations in a network with reference stations on a monthly basis (see Fig. 1 for the actual network). During processing with software package GNSMART, the coordinates of these reference stations are kept fixed (standard deviation of 0.0 mm), whereas the coordinates of the permanent monitor stations get some freedom to move. However, in reality the possibility exists that the positions of the reference stations change as well.

To deal with this problem, the coordinates of all reference station will be recalculated and eventually updated on a yearly basis. 06-GPS follows the advice of Geo++, the software company who developed GNSMART. The advice was formulated as follow:
"To detect the small moving of the gas field stations you should keep the reference station fixed. We suggest to check periodically the used reference station. In case of detected reference station movements, the coordinates of the reference station must be updated."

The following procedure is performed ones per year:
1. Recalculation of all reference station coordinates; i.e. giving them an a priori standard deviation of 1.0 mm for the horizontal position and 2.0 mm for the height.
2. Change the reference station coordinates for stations with a height deviation of more than 2 mm compared to the existing coordinates.
3. Process the network again with all reference stations fixed to be able to calculate the influence of the new reference station coordinates on the permanent monitor stations.
4. Evaluation of the results.

Fig. 1. Reference stations (yellow) and permanent monitoring stations (purple)

2 Reference checks

2.1 Check 2009

Time series: 17-05-2009 until 27-06-2009
Duration: 6 weeks
Reference: coordinates 2006 (see appendix A.1)

The difference between the reference station coordinates of 2006 and the recalculated coordinates is shown in Table 1. Notice that the stations 0687 (Borkum) and drac (Drachten) show a height deviation of more than 2 mm. Drachten has subsided even 6 mm in 3 years.

Station	dX (m)	dY (m)	dZ (m)
0687	0.0072	0.0076	0.0031
ball	-0.0001	-0.0006	-0.0003
drac	-0.0030	0.0027	-0.0061
schi	-0.0018	-0.0016	0.0006
ters	0.0005	-0.0061	0.0002
wsra	-0.0036	0.0021	-0.0011

Table 1. Difference between current coordinates and refcheck results.

New reference station coordinates are calculated for Borkum and Drachten, these can be found in appendix A.2 (Reference station coordinates 2009). All data since May 3th 2009 is processed with the new reference station coordinates for Borkum and Drachten.

Table 2 shows the influence of the new reference station coordinates for Borkum and Drachten on the permanent monitoring stations. Notice the extra subsidence of almost 1 mm at Moddergat and Anjum, while for ame1 the result did not change. An explanation for this effect is that Moddergat and Anjum are located somewhat closer to reference station Drachten (see Fig. 1), that subsided 6 mm relative to most other reference stations. Also the stable station of Westerbork may have contributed in the minor influences on Moddergat and Anjum.

Station	dx (m)	dy (m)	dH (m)
ame1	0.0002	0.0004	-0.0001
anjm	-0.0002	0.0019	-0.0009
modd	-0.0002	0.0013	-0.0006

Table 2. Influence of new coordinates for stations 0687 and drac on permanent monitor stations

2.2 Check 2010

Time series: 23-05-2010 until 03-07-2010
Duration: 6 weeks
Reference: coordinates 2009 (see appendix A.2)

The difference between the reference station coordinates of 2009 and the recalculated coordinates is shown in Table 1. Notice that all height differences are within the maximum tolerance of 2 mm. This makes it unnecessary to change the reference station coordinates. All stations will maintain the coordinates of 2009, see appendix A.3.

Station	dx (m)	dy (m)	dH (m)
0687	0.0004	0.0012	-0.0018
ball	0.0006	0.0019	-0.0011
drac	0.0006	0.0031	0.0012
schi	-0.0007	-0.0007	-0.0002
ters	0.0028	-0.0061	-0.0015
wsra	-0.0037	0.0052	0.0004

Table 1. Difference between coordinates 2006 and refcheck results.

2.3 Check 2011

Time series: 17-04-2011 until 28-05-2011
Duration: 6 weeks
Reference: coordinates 2010 (see appendix A.3)

The differences between the reference station coordinates of 2009 and the recalculated coordinates are shown in Table 1. Notice that the stations 0687 (Borkum) and ters (Terschelling) show a height deviation of more than 2 mm. The deviation of station Borkum is most likely related to an antenna replacement on October 20th 2010, in spite of the fact that a new individual antenna calibration file has been used for processing since that time.

Station	dx (m)	dy (m)	dH (m)
0687	0.0006	0.0006	-0.0037
ball	0.0013	0.0019	0.0012
drac	0.0000	0.0050	-0.0004
schi	-0.0009	-0.0013	0.0010
ters	0.0033	-0.0071	0.0024
wsra	-0.0039	0.0058	-0.0011

Table 1. Difference between coordinates 2010 and refcheck results.

The recalculated coordinates are applied for reference stations Borkum and Terschelling, these coordinates can be found in appendix A.4 (Reference station coordinates 2011).

The time series is processed again to calculate the influence of the new reference station coordinates for Borkum and Terschelling on the permanent monitoring stations. Table 2 shows the results. Notice that station Anjum (anjm), which is located closest to Borkum, gets the largest correction.

Station	dx (m)	dy (m)	dH (m)
ame1	0.0002	-0.0003	-0.0003
anjm	0.0000	0.0000	-0.0006
modd	0.0002	0.0000	-0.0004

Table 2. Influence of new coordinates for stations 0687 and ters on permanent monitor stations

All data since May 1th 2011 has been processed with the new reference station coordinates for Borkum and Terschelling.

2.4 Check 2012

Time series: 22-04-2012 until 02-06-2012
Duration: 6 weeks
Reference: coordinates 2011 (see appendix A.4)

06-GPS has been asked by NAM to expand the 'refcheck' with stations Veendam (veen) and Emden (0647). These stations, as well as station Drachten (drac), are likely to be within the influence zone of gas and/or salt abstraction. These stations will also be used for comparison with InSAR data. Therefore the coordinates of these three stations are calculated again within the network for an up-to-date accurate solution. During this calculation, coordinates of all other stations were kept fixed. Comparison with results of 2011 gives the following differences:

Station	dx (m)	dy (m)	dH (m)
0647	-0.0024	0.0012	-0.0003
drac	0.0008	0.0020	-0.0009
veen	-0.0037	0.0042	-0.0034

Table 1. Difference between 2011 and 2012.

The new coordinates of these three stations (see appendix A.5) are used for the actual 'refcheck'. In this calculation, all stations get some freedom to settle. The results should reveal if any other station have been moved over the last year. The results are shown in Table 2.

Station	dx (m)	dy (m)	dH (m)
0647	-0.0007	-0.0003	-0.0008
0687	0.0009	-0.0012	-0.0010
ball	0.0021	0.0015	0.0000
drac	0.0002	0.0013	-0.0003
schi	0.0006	-0.0025	-0.0016
ters	0.0015	-0.0018	0.0003
veen	-0.0011	0.0015	-0.0003
wsra	-0.0030	0.0053	0.0010

Table 2. Difference between coordinates 2011 and refcheck results.

The refcheck did not reveal deviations more than two millimeter in height, meaning that no other coordinate updates were necessary. The time series is processed again to calculate the influence of the new coordinates of station Drachten (Table 1) on the permanent monitor stations. This influence appears to be minimal, see Table 3. All data since May 6th 2012 has been processed with new coordinates for station Drachten.

Station	dx (m)	dy (m)	dH (m)
ame1	0.0000	0.0000	0.0000
anjm	0.0000	0.0003	-0.0003
modd	0.0002	0.0003	-0.0002

Table 3. Influence of new coordinates for station Drachten on permanent monitor stations

2.5 Check 2013

Time series: 21-04-2013 until 25-05-2013
Duration: 6 weeks
Reference: coordinates 2012 (see appendix A.5)

Since March 19th 2013, monitor station 'tenp' (Ten Post) has been added to the network. In addition, also station 'veen' (Veendam) has been considered to be a monitor station, because it subsides about 3 mm per year. Reference station '0647' (Emden) is permanently used within the network since March 19th 2013.

Reference stations '0647' (Emden) and 'drac' (Drachten) are located at the edge of a gas field. Therefore the coordinates of these two stations are calculated again within the network for an up-to-date accurate solution. During this calculation, coordinates of all other reference stations were kept fixed. Comparison with results of 2012 gives the following differences:

Station	dx (m)	dy (m)	dH (m)
0647	-0.0043	0.0009	0.0005
drac	-0.0010	0.0034	0.0004

Table 1. Difference between 2012 and 2013.

Notice that the horizontal position has been changed a few millimeters, whereas the height didn't change significantly. Therefore only new xy-coordinates for these two stations (see appendix A.6) are applied in the actual 'refcheck'. In this calculation, all stations get some freedom to settle. The results should reveal if any other station has been moved over the last year. The results are shown in Table 2.

Station	dx (m)	dy (m)	dH (m)
0647	-0.0009	-0.0010	0.0000
0687	-0.0009	0.0000	-0.0013
ball	0.0019	0.0031	0.0020
drac	0.0004	0.0009	0.0004
schi	-0.0017	-0.0022	-0.0011
ters	0.0023	-0.0006	0.0003
wsra	-0.0009	0.0009	-0.0004

Table 2. Differences between coordinates 2012 and refcheck results.

The refcheck did not reveal deviations more than two millimeters in height, meaning that all stations maintain the height of 2012.

2.6 Check 2014

Time series: 04-05-2014 until 17-05-2014
Duration: 2 weeks
Reference: coordinates 2013 (see appendix A.6)

Since October 2013, two monitor stations near 'De Wijk' have been added to the network. In February and March 2014, twelve more monitor stations are added in Groningen. In addition, also five extra reference stations are added to the network since October 2013. These stations are Makkum, Urk, Beilen, Nieuwleusen and Meppen.

Reference stations '0647' (Emden) and 'drac' (Drachten) are located at the edge of a gas field. Therefore the coordinates of these two stations are calculated again within the network for an up-to-date accurate solution. During this calculation, coordinates of all other reference stations were kept fixed. Comparison with results of 2013 gives the following differences:

Station	dx (m)	dy (m)	dH (m)
0647	-0.0013	-0.0013	-0.0039
drac	-0.0002	0.0006	0.0011

Table 1. Difference between 2013 and 2014.

Notice that station 0647 (Emden) has been subsided 3.9 mm. Because of this result, station 0647 will be treated as a 'monitor station' in all future calculations.
In the actual 'refcheck', all reference stations get some freedom to settle. The results should reveal if any other station has been moved over the last year. The results are shown in Table 2.

Station	dx (m)	dy (m)	dH (m)
0683	-0.0029	0.0018	0.0003
0687	-0.0007	-0.0013	-0.0020
ball	0.0030	0.0019	-0.0016
beil	-0.0021	0.0012	-0.0004
drac	0.0002	0.0006	-0.0001
makk	0.0014	0.0012	-0.0001
nieu	-0.0015	0.0018	0.0015
schi	-0.0002	-0.0040	-0.0020
ters	0.0032	-0.0025	-0.0015
urk2	0.0004	0.0012	0.0048
wsra	-0.0013	0.0003	-0.0008

Table 2. Differences between coordinates 2013 and refcheck results.

Station 'urk2' has a height deviation of more than 2 mm. Stations '0683', 'ball', 'schi' and 'ters' have deviations in horizontal position of more than 2 mm. New coordinates will be applied for these stations for all future calculations. However, the height of 'ball' and 'schi' will be maintained. See appendix A.7 for the actual coordinates.

The time series of May is processed again to calculate the influence of the new reference station coordinates on the permanent monitor stations. This influence appears to be minimal, see Table 3.

Station	dx (m)	dy (m)	dH (m)
ame1	0.0011	-0.0009	-0.0001
anjm	0.0002	-0.0016	0.0000
dw16	-0.0002	0.0003	0.0000
dw26	0.0000	0.0003	0.0004
dzyl	-0.0008	-0.0018	-0.0011
eems	-0.0006	-0.0009	0.0000
froo	-0.0007	-0.0006	0.0000
grij	0.0000	-0.0009	0.0000
modd	0.0002	-0.0015	-0.0001
norg	-0.0001	-0.0006	0.0000
over	-0.0007	-0.0010	-0.0003
sted	-0.0003	-0.0013	-0.0001
tenp	-0.0007	-0.0013	-0.0003
tjuc	-0.0008	-0.0013	-0.0006
usqu	-0.0003	-0.0012	-0.0001
veen	-0.0008	-0.0007	-0.0002
zand	-0.0006	-0.0012	-0.0003
zdvn	-0.0007	-0.0009	-0.0003
zeer	-0.0006	-0.0010	-0.0001

Table 3. Influence of new reference station coordinates on permanent monitor stations

A.1 Reference station coordinates 2006

Transformation to RD/NAP based on RDNAPTRANS2004
Date: 2006

Station	owner	status	Date	N ETRS89 (° ' ")			E ETRS89 (° ' ")			ell.h. (m)	ant.h. (m)	ARP (m)	X-RD (m)	Y-RD (m)	NAP(m)	ant.h.(m)	ARP(m)	ser.no.ant.	ant. Type
0687	SAPOS	fixed	2006	53	33	49.15550	6	44	50.78800	54.4070	0.0540	54.4610	245130.1140	620587.9950	14.2226	0.0540	14.2766	200110	LEIAT504GG
ball	06-GPS	fixed	2006	53	26	29.58829	5	41	15.67011	54.5499	0.1010	54.6509	174967.3850	606186.3570	13.7208	0.1010	13.8218	2170556	TPSCR3_GGD CONE
drac	06-GPS	fixed	2006	53	6	31.75441	6	4	58.04678	56.3542	0.1470	56.5012	201580.5900	569339.0570	15.0405	0.1470	15.1875	2170593	TPSCR3_GGD CONE
schi	NAM	fixed	2006	53	28	38.43917	6	9	44.16452	50.8109	0.1480	50.9589	206461.0960	610405.7140	10.3550	0.1480	10.5030	2170643	TPSCR3_GGD CONE
ters	AGRS	fixed	2006	53	21	45.84903	5	13	9.78826	56.1008	0.0000	56.1008	143827.2360	597385.4980	14.6893	0.0000	14.6893	220193243	trm29659.00
wsra	AGRS	fixed	2006	52	54	52.58929	6	36	16.20650	82.2751	0.3890	82.6641	236880.5080	548192.3070	40.7251	0.3890	41.1141	273	AOAD/M_T

A.2 Reference station coordinates 2009

Transformation to RD/NAP based on RDNAPTRANS2004
Date: 27-6-2009

Station	owner	status	Date	N ETRS89 (° ' ")			E ETRS89 (° ' ")			ell.h. (m)	ant.h. (m)	ARP (m)	X-RD (m)	Y-RD (m)	NAP(m)	ant.h.(m)	ARP(m)	ser.no.ant.	ant. Type
0687	SAPOS	fixed	27-6-2009	53	33	49.15574	6	44	50.78840	54.4101	0.0540	54.4641	245130.1210	620588.0030	14.2257	0.0540	14.2797	200110	LEIAT504GG
ball	06-GPS	fixed	2006	53	26	29.58829	5	41	15.67011	54.5499	0.1010	54.6509	174967.3850	606186.3570	13.7208	0.1010	13.8218	2170556	TPSCR3_GGD CONE
drac	06-GPS	fixed	27-6-2009	53	6	31.75455	6	4	58.04662	56.3480	0.1470	56.4950	201580.5870	569339.0610	15.0343	0.1470	15.1813	2170593	TPSCR3_GGD CONE
schi	NAM	fixed	2006	53	28	38.43917	6	9	44.16452	50.8109	0.1480	50.9589	206461.0960	610405.7140	10.3550	0.1480	10.5030	2170643	TPSCR3_GGD CONE
ters	AGRS	fixed	2006	53	21	45.84903	5	13	9.78826	56.1008	0.0000	56.1008	143827.2360	597385.4980	14.6893	0.0000	14.6893	220193243	trm29659.00
wsra	AGRS	fixed	2006	52	54	52.58929	6	36	16.20650	82.2751	0.3890	82.6641	236880.5080	548192.3070	40.7251	0.3890	41.1141	273	AOAD/M_T

A.3 Reference station coordinates 2010

Transformation to RD/NAP based on RDNAPTRANS2004
Date: 3-7-2010

Station	owner	status	Date	N ETRS89 (° ' ")			E ETRS89 (° ' ")			ell.h. (m)	ant.h. (m)	ARP (m)	X-RD (m)	Y-RD (m)	NAP(m)	ant.h.(m)	ARP(m)	ser.no.ant.	ant. Type
0647	SAPOS	fixed	3-7-2010	53	20	14.76816	7	1	38.98468	56.9653	0.0540	57.0193	264259.0517	595802.0454	16.4691	0.0540	16.5231	200082	LEIAT504GG
0687	SAPOS	fixed	27-6-2009	53	33	49.15574	6	44	50.78840	54.4101	0.0540	54.4641	245130.1210	620588.0030	14.2257	0.0540	14.2797	200110	LEIAT504GG
ball	06-GPS	fixed	2006	53	26	29.58829	5	41	15.67011	54.5499	0.1010	54.6509	174967.3850	606186.3570	13.7208	0.1010	13.8218	2170556	TPSCR3_GGD CONE
drac	06-GPS	fixed	27-6-2009	53	6	31.75455	6	4	58.04662	56.3480	0.1470	56.4950	201580.5870	569339.0610	15.0343	0.1470	15.1813	2170593	TPSCR3_GGD CONE
schi	NAM	fixed	2006	53	28	38.43917	6	9	44.16452	50.8109	0.1480	50.9589	206461.0960	610405.7140	10.3550	0.1480	10.5030	2170643	TPSCR3_GGD CONE
ters	AGRS	fixed	2006	53	21	45.84903	5	13	9.78826	56.1008	0.0000	56.1008	143827.2360	597385.4980	14.6893	0.0000	14.6893	220193243	trm29659.00
veen	06-GPS	fixed	3-7-2010	53	6	15.38181	6	51	54.03593	65.9273	0.1470	66.0743	253969.3935	569622.6727	24.9513	0.1470	25.0983	3830189	TPSCR.G3 TPSH
wsra	AGRS	fixed	2006	52	54	52.58929	6	36	16.20650	82.2751	0.3890	82.6641	236880.5080	548192.3070	40.7251	0.3890	41.1141	273	AOAD/M_T

A.4 Reference station coordinates 2011

Transformation to RD/NAP based on RDNAPTRANS2004
Date: 28-05-2011

Station	owner	status	Date	N ETRS89 (° ' ")			E ETRS89 (° ' ")			ell.h. (m)	ant.h. (m)	ARP (m)	X-RD (m)	Y-RD (m)	NAP(m)	ant.h.(m)	ARP(m)	ser.no.ant.	ant. Type
0647	SAPOS	fixed	28-5-2011	53	20	14.76805	7	1	38.98444	56.9575	0.0550	57.0125	264259.0473	595802.0419	16.4613	0.0550	16.5163	10211016	LEIAR25.R4 LEIT
0687	SAPOS	fixed	28-5-2011	53	33	49.15576	6	44	50.78843	54.4054	0.0550	54.4604	245130.1219	620588.0031	14.2210	0.0550	14.2760	10211024	LEIAR25.R4 LEIT
ball	06-GPS	fixed	2006	53	26	29.58829	5	41	15.67011	54.5499	0.1010	54.6509	174967.3850	606186.3570	13.7208	0.1010	13.8218	2170556	TPSCR3_GGD CONE
drac	06-GPS	fixed	27-6-2009	53	6	31.75455	6	4	58.04662	56.3480	0.1470	56.4950	201580.5870	569339.0610	15.0343	0.1470	15.1813	2170593	TPSCR3_GGD CONE
schi	NAM	fixed	2006	53	28	38.43917	6	9	44.16452	50.8109	0.1480	50.9589	206461.0960	610405.7140	10.3550	0.1480	10.5030	2170643	TPSCR3_GGD CONE
ters	AGRS	fixed	28-5-2011	53	21	45.84880	5	13	9.78844	56.1032	0.0000	56.1032	143827.2394	597385.4907	14.6917	0.0000	14.6917	220193243	trm29659.00
veen	06-GPS	fixed	28-5-2011	53	6	15.38193	6	51	54.03564	65.9204	0.1470	66.0674	253969.3881	569622.6763	24.9444	0.1470	25.0914	3830189	TPSCR.G3 TPSH
wsra	AGRS	fixed	2006	52	54	52.58929	6	36	16.20650	82.2751	0.3890	82.6641	236880.5080	548192.3070	40.7251	0.3890	41.1141	273	AOAD/M_T

A.5 Reference station coordinates 2012

Transformation to RD/NAP based on RDNAPTRANS2004
Date: 2-6-2012

Station	owner	status	Date	N ETRS89 (° ' ")			E ETRS89 (° ' ")			ell.h. (m)	ant.h. (m)	ARP (m)	X-RD (m)	Y-RD (m)	NAP(m)	ant.h.(m)	ARP(m)	ser.no.ant.	ant. Type
0647	SAPOS	fixed	2-6-2012	53	20	14.76809	7	1	38.98431	56.9572	0.0550	57.0122	264259.0449	595802.0431	16.4610	0.0550	16.5160	10211016	LEIAR25.R4 LEIT
0687	SAPOS	fixed	28-5-2011	53	33	49.15576	6	44	50.78843	54.4054	0.0550	54.4604	245130.1219	620588.0031	14.2210	0.0550	14.2760	10211024	LEIAR25.R4 LEIT
ball	06-GPS	fixed	2006	53	26	29.58829	5	41	15.67011	54.5499	0.1010	54.6509	174967.3850	606186.3570	13.7208	0.1010	13.8218	2170556	TPSCR3_GGD CONE
drac	06-GPS	fixed	2-6-2012	53	6	31.75461	6	4	58.04664	56.3471	0.1470	56.4941	201580.5878	569339.0630	15.0334	0.1470	15.1804	2170593	TPSCR3_GGD CONE
schi	NAM	fixed	2006	53	28	38.43917	6	9	44.16452	50.8109	0.1480	50.9589	206461.0960	610405.7140	10.3550	0.1480	10.5030	2170643	TPSCR3_GGD CONE
ters	AGRS	fixed	28-5-2011	53	21	45.84880	5	13	9.78844	56.1032	0.0000	56.1032	143827.2394	597385.4907	14.6917	0.0000	14.6917	220193243	trm29659.00
veen	06-GPS	fixed	2-6-2012	53	6	15.38207	6	51	54.03545	65.9170	0.1470	66.064	253969.3844	569622.6805	24.9410	0.1470	25.0880	3830189	TPSCR.G3 TPSH
wsra	AGRS	fixed	2006	52	54	52.58929	6	36	16.20650	82.2751	0.3890	82.6641	236880.5080	548192.3070	40.7251	0.3890	41.1141	273	AOAD/M_T

A.6 Reference station coordinates 2013

Transformation to RD/NAP based on RDNAPTRANS2004
Date: 1-6-2013

Station	owner	status	Date	N ETRS89 (° ' ")			E ETRS89 (° ' ")			ell.h. (m)	ant.h. (m)	ARP (m)	X-RD (m)	Y-RD (m)	NAP(m)	ant.h.(m)	ARP(m)	ser.no.ant.	ant. Type	
0647	SAPOS	fixed	1-6-2013	53	20	14.76812	7	1	38.98408	56.9572	0.0550	57.0122	264259.041	595802.044	16.461	0.055	16.516	10211016	LEIAR25.R4	LEIT
0687	SAPOS	fixed	28-5-2011	53	33	49.15576	6	44	50.78843	54.4054	0.0550	54.4604	245130.122	620588.003	14.221	0.055	14.276	10211024	LEIAR25.R4	LEIT
ball	06-GPS	fixed	2006	53	26	29.58829	5	41	15.67011	54.5499	0.1010	54.6509	174967.385	606186.357	13.721	0.101	13.822	2170556	TPSCR3_GGD	CONE
drac	06-GPS	fixed	1-6-2013	53	6	31.75472	6	4	58.04659	56.3471	0.1470	56.4941	201580.587	569339.066	15.033	0.147	15.180	2170593	TPSCR3_GGD	CONE
schi	NAM	fixed	2006	53	28	38.43917	6	9	44.16452	50.8109	0.1480	50.9589	206461.096	610405.714	10.355	0.148	10.503	2170643	TPSCR3_GGD	CONE
ters	AGRS	fixed	28-5-2011	53	21	45.84880	5	13	9.78844	56.1032	0.0000	56.1032	143827.239	597385.490	14.692	0.000	14.692	220193243	trm29659.00	
wsra	AGRS	fixed	2006	52	54	52.58952	6	36	16.20634	82.2751	0.3890	82.6641	236880.505	548192.313	40.725	0.389	41.114	273	AOAD/M_T	

A.7 Reference station coordinates 2014

Transformation to RD/NAP based on RDNAPTRANS2004
Date: 17-05-2014

Station	owner	status	Date	N ETRS89 (° ' ")	E ETRS89 (° ' ")	ell.h. (m)	ant.h. (m)	ARP (m)	X-RD (m)	Y-RD (m)	NAP(m)	ant.h.(m)	ARP(m)	ser.no.ant.	ant. Type
0683	SAPOS	fixed	17-5-2014	52 42 57.21135	7 18 55.66291	89.2457	0.0520	89.2977	285286.470	527127.602	47.091	0.052	47.143	10231023	LEIAR25.R4 LEIT
0687	SAPOS	fixed	28-5-2011	53 33 49.15576	6 44 50.78843	54.4054	0.0550	54.4604	245130.122	620588.003	14.221	0.055	14.276	10211024	LEIAR25.R4 LEIT
ball	06-GPS	fixed	17-5-2014	53 26 29.58835	5 41 15.67027	54.5499	0.1010	54.6509	174967.388	606186.359	13.721	0.101	13.822	2170556	TPSCR3_GGD CONE
beil	06-GPS	fixed	26-10-2013	52 51 37.49852	6 30 54.37391	71.3793	0.0990	71.4783	230961.813	542064.730	29.649	0.099	29.748	2170563	TPSCR3_GGD CONE
drac	06-GPS	fixed	1-6-2013	53 6 31.75472	6 4 58.04659	56.3471	0.1470	56.4941	201580.587	569339.066	15.033	0.147	15.180	2170593	TPSCR3_GGD CONE
makk	06-GPS	fixed	26-10-2013	53 3 36.43453	5 23 50.91281	59.4181	0.1470	59.5651	155688.445	563694.695	17.679	0.147	17.826	3830141	TPSCR.G3 TPSH
nieu	06-GPS	fixed	26-10-2013	52 35 14.08076	6 16 57.49715	61.3727	0.1480	61.5207	215682.954	511450.194	18.841	0.148	18.989	3830174	TPSCR.G3 TPSH
schi	NAM	fixed	17-5-2014	53 28 38.43904	6 9 44.16451	50.8109	0.1480	50.9589	206461.096	610405.710	10.355	0.148	10.503	2170643	TPSCR3_GGD CONE
ters	AGRS	fixed	17-5-2014	53 21 45.84872	5 13 9.78861	56.1017	0.0000	56.1017	143827.243	597385.488	14.690	0.000	14.690	220193243	trm29659.00
urk2	06-GPS	fixed	17-5-2014	52 39 49.41047	5 36 8.55299	54.4050	0.1480	54.5530	169556.792	519606.278	11.976	0.148	12.124	3830190	TPSCR.G3 TPSH
wsra	AGRS	fixed	2006	52 54 52.58952	6 36 16.20634	82.2751	0.3890	82.6641	236880.505	548192.313	40.725	0.389	41.114	273	AOAD/M_T