



CHERISH Survey Report No.
CH/RCAHMW 37

DINAS DINLLE HILLFORT, GWYNEDD

**CHERISH MONITORING NETWORK -
DD_E2 and DD_E6 Control Markers**
EVENT REPORT: 09/12/2021

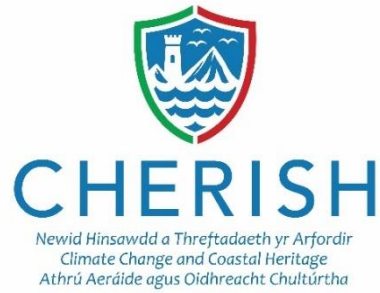


CHERISH

Newid Hinsawdd a Threftadaeth yr Arfordir
Climate Change and Coastal Heritage
Athrú Aeráide agus Oidhrecht Chultúrtha



**Comisiwn Brenhinol
Henebion Cymru**
**Royal Commission on the Ancient
and Historical Monuments of Wales**



Dinas Dinlle Hillfort – Monitoring Network Event Report

County: Gwynedd
Community: Llandwrog
NGR: SH 4370 5635
NPRN: 95309
Scheduled Monument No: CN048
Surveyed by: Louise Barker
Date of Survey: 09/12/2021
Report Number: CH/RCAHMW 37
Report Author: Louise Barker
Date of Report: 14/08/23
Data Archive Number: RCCS28

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OGL

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Tel: 01970 621200

World Wide Web: <http://www.rcahmw.gov.uk/> <http://www.cherishproject.eu/>



BACKGROUND

CHERISH Project

CHERISH – Climate Change and Coastal Heritage project was a six and a half year Ireland-Wales project bringing together four partners across two nations: the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW); the Discovery Programme, Ireland; Aberystwyth University: Department of Geography and Earth Sciences; and Geological Survey Ireland. The project began in January 2017 and ran until June 2023. It benefitted from €4.9 million of EU funds through the Ireland Wales Co-operation Programme 2014-2020.

CHERISH was a cross-disciplinary project aimed at raising awareness and understanding of the past, present and near-future impacts of climate change, storminess and extreme weather events on the cultural heritage of reefs, islands and headlands of Wales and Ireland. The project sought to fill gaps in data and knowledge, and develop a greater understanding of climate change impacts on fragile coastal heritage sites.

[Find out more about the project from the CHERISH website.](#)

This event report relates to **CHERISH INITIATIVE 2 -CHERISH permanent network of ‘local change’ fixed survey markers**. Seen as a key legacy of the project, CHERISH has established a series of fixed survey markers at ‘at-risk’ heritage sites. The markers and their associated location coordinates (Easting, Northing and Height) will enable accurate monitoring and change detection at these sites going forward. A list of all the fixed survey markers established in Wales, is noted at the end of this event report (Appendix 1). All data has been archived with the National Monuments Record of Wales and is available to the public online through *Coflein*. This can be searched both cartographically and by National Primary Record Number (NPRN), all of which are noted in Appendix 1.

[You can access Coflein here.](#)

Site Background: Dinas Dinlle Coastal Hillfort

Dinas Dinlle coastal hillfort (SH 4370 5635) is located immediately south of the small, low-lying coastal hamlet of Dinas Dinlle in the parish of Llandwrog, some 7 kilometres southwest of Caernarfon in Gwynedd. It is positioned overlooking Caernarfon Bay, close to the southern end of the Menai Strait, and is situated at the at the western edge of the reclaimed wetlands of the Caernarfonshire coastal plain with Foryd Bay to the northeast.

The hillfort is a substantial earthwork monument (SM: CNo48; SSI ID: 616; NPRN: 95309; PRN: 1570) enclosing the summit of a glacial deposit and encompassing an area some

32,000m² (3.2 hectares) in extent. It would originally have enclosed some 4 hectares, but severe erosion has removed the western defences and a small section of the interior.

Based on the morphology and excavation evidence, the hillfort dates from the Iron Age (800 BC – AD 43) and continued in use during the Roman period (AD 43- 410). It also features prominently in early medieval Welsh literature and folklore - it is mentioned in the fourth branch of the Mabinogi - and thus a longer history of use/reuse may be likely. This history stretches to the modern day with the hillfort incorporated into a golf course during the early decades of the twentieth century, and later during the Second World War, defences for the protection of the nearby RAF Llandwrog were constructed into the foot of the fort's northern slopes (SM: CN 396). Excavated features and finds of neolithic, medieval and post medieval date in the field directly to the south of the hillfort also provide a wider chronological and archaeological context (Lynes et al, 2021; Hopewell and McGuinness 2022).

[You can find out more about Dinas Dinlle Hillfort on Coflein here.](#)

METHODOLOGY

Two survey markers were installed by the CHERISH project at Dinas Dinlle Hillfort, the work undertaken on the 9 December 2021. The markers comprise Survey Point Nails, installed using a rock-drill and fixed with araldite into two prominent boulders on site.



Example of Survey Point Nail. Standard size is 50mm deep with a 20mm diameter head on which SURVEY_POINT is set in raised letters.

Permission for this work was obtained from the landowner (National Trust). Cadw were also notified of this work in advance, though Scheduled Monument Consent was not required as RCAHMW are permitted to install survey markers without Scheduled Monument Consent under **The Ancient Monuments (Class Consents) Order 1984**, specifically **Article 2 CLASS 10**. [WORKS UNDERTAKEN BY THE ROYAL COMMISSION ON THE HISTORICAL MONUMENTS OF ENGLAND OR THE ROYAL COMMISSION ON ANCIENT AND HISTORICAL MONUMENTS OF WALES](#) which can be viewed [here](#).

Coordinate data for each survey marker was collected using a Global Navigation Satellite System (GNSS) following discussion and advice from the **Wales Coast Monitoring Centre (WCMC)**. CHERISH has followed the WCMC survey specification as outlined in their

[Topographic Specification which can be downloaded here](#). The CHERISH survey control markers will also be incorporated in the WCMC coastal control network.

[The WCMC coastal control network can be viewed under the resources section of their website here](#).

Two grades of Environment Agency Control Stations (EACS) were installed at Dinas Dinlle following the specifications outlined by the WCMC (see WCMC Topographic Specification V4, pgs 7-12) as follows:

E2 Secondary Control Station:

This is designated as the Primary Survey Station marker over-which the base station or principal control station should be established during future monitoring surveys.

At Dinas Dinlle a Leica GS10 GNSS was set up over the E2 marker using a tripod, and a minimum of 4 hours of static GNSS observations were recorded and post-processed in Leica Infinity against five Ordnance Survey Net RINEX stations. This provides highly accurate location WGS84 coordinates, which were transformed to OSGB36 (British National Grid) coordinates using a OSGM15GB Geoid and OSTN15GB CSCS model transformation.



Example E2 GNSS tripod setup.

E6 Network RTK control station:

This is designated as a secondary control point and should be used as the check control for the E2 control station, when returning to undertake monitoring survey.

At Dinas Dinlle a Leica GS16 GNSS was set up over the E6 marker on a survey bipod and 3 x 5-minute static RTK GNSS observations were recorded, linked to the E2 base station. The observations were post-processed with the E2 station (as noted above) and an average of the three observations taken to provide the final OSGB36 coordinate.



Example E6 GNSS bipod setup.

This Event Report includes the resulting Witness documents for the E2 and E6 control stations which include location information and drawings together with the computed coordinates (Appendix 2).

The Leica GNSS processing report is also appended (Appendix 3).

REFERENCES



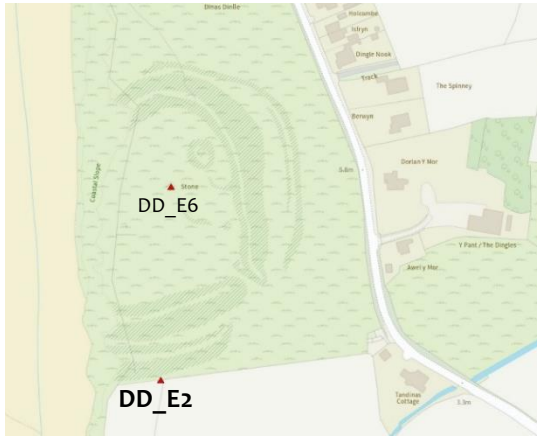

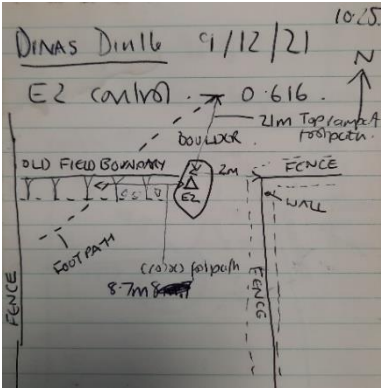
Wales Coast Monitoring Centre, 2023, Topographic Specification V4





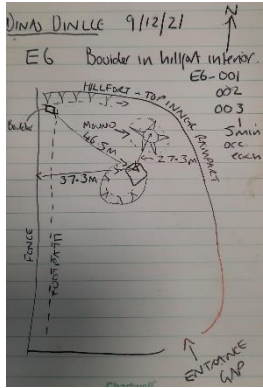
APPENDIX 1: LIST OF CHERISH MONITORING NETWORK CONTROL MARKERS IN WALES

Site Name	WCMC Survey Unit	Date of Capture	Type	Coordinates
Dinas Dinlle Hillfort, Gwynedd NPRN: 95309	10a16.2	9/12/21	E2 E6	DD_E2: E: 243688.2649 N: 356228.5588 H: 19.3042 DD_E6: 3 x 5min (Averaged) E: 243695.9868 N: 356373.3823 H: 27.7681
Castell Bach Promontory Fort, Ceredigion NPRN: 93914	9a6.7	13/01/22	E2 E6	CB_E2: E: 236033.8007 N: 258010.8374 H: 31.8252 CB_E6: 3 x 5min (Averaged) E: 236241.227 N: 257999.484 H: 72.3594
Caerfai Promontory Fort, Pembrokeshire NPRN: 305396	8d3.1	2/08/21	E2 E6	CF_E2: E: 176239.9611 N: 223928.981 H: 21.8663 CF_E6: 2 x 5mins (Averaged) E: 176287.2621 N: 224021.3485 H: 27.5102
Porth y Rhaw Promontory Fort, Pembrokeshire NPRN: 94210	8d3.1	3/02/22	E2 E6	PR_E2: E: 178742.369 N: 224229.8426 H: 24.8951 PR_E6: 3 x 5 min (Averaged) E: 178762.7489 N: 224199.5636 H: 29.1050
St Bride's Haven Limekiln, Pembrokeshire NPRN: 544131	8d1.2	4/08/21	E2 E6	SB_E2: E: 180158.305 N: 210907.9651 H: 4.8154 SB_E6: 2 x 3min (Averaged) E: 180194.0376 N: 210893.7264

				H: 5.1429
Nab Head and Tower Point Promontory fort, Pembrokeshire NPRNs: 308819 and 276035	8d1.1	17/03/22	E2 E6	NH_E2: E: 179061.3296 N: 210904.9285 H: 36.3273 NH_E6: 3 x 5 min (Averaged) E: 179048.4878 N: 211091.3362 H: 20.4977
Albion shipwreck, Albion Sands, Pembrokeshire NPRN: 27284	8d1.1	2/02/22	E2 E6	ALB_E2: 4h23min E: 177202.7591 N: 207600.2769 H: 31.0316 ALB_E6: 3 x 5min (Averaged) E: 177147.1221 N: 207623.6880 H: 0.9467
Flimston Bay and Crocksydham Camp Promontory Forts, Pembrokeshire NPRNs: 94227 and 305417	8d18.1	4/08/22	E2 E6	FC_E2: 5h05min E: 193555.1547 N: 194447.1301 H: 48.7356 FC_E6: 3 x 5min (Averaged) E: 193465.171 N: 194510.5118 H: 48.8422
Buckspool Camp Promontory Fort, Pembrokeshire NPRN: 305429	8d18.1	3/08/22	E2 E6	BP_E2: 5h04min E: 195505.1586 N: 193538.1136 H: 37.7792 BP_E6: 3 x 5min (Averaged) E: 195730.5346 N: 193297.5313 H: 39.8089

APPENDIX 2: E2 AND E6 WITNESS FORMS

 CHERISH Newid Hinsawdd a Threfnadaeth yr Arfordir Climate Change and Coastal Heritage Athrú Aeráide agus Oidhreacht Chultúrtha				CHERISH Monitoring Network Marker Witness Diagram	
GNSS CONTROL POINT NAME:		DD_E2			
NPRN:		95309			
LOCATION:		Dinas Dinlle Hillfort, Llandwrog, Gwynedd			
TYPE:		E2			
WCMC SURVEY UNIT:		10a16.3			
Surveyed by:		Louise Barker (RCAHMW)			
Map:		Photograph:			
					
Date of Survey:		09/12/2021			
Session start time:		10:25:12		Session Duration: 4hrs 10min	
Marker processed against OS Net Stations:		Diagram:			
ABEP (Aberporth)					
ADAR (Aberdaron)					
ASAP (St Asaph)					
MACY (Machynlleth)					
HOLY (Holyhead)					
Marker type:		Survey Point Nail			
Description:		Nail set in top of large boulder adjacent to an old field boundary and opposite a fence corner.			
WGS84 Coordinates – Latitude:		53 04 49.278031 N			
WGS84 Coordinates – Longitude:		4 20 06.281194 W			
WGS84 Coordinates – Ellipsoidal Height (m):		73.8751			
Transformation:		OSTN15GB/OSGM15GB			
OSGB36 Coordinates – Easting:		243688.2649			
OSGB36 Coordinates – Northing:		356228.5588			
OSGB36 Coordinates – Height (m) ODN:		19.3042			

 		CHERISH Monitoring Network Marker Witness Diagram	
GNSS CONTROL POINT NAME:		DD_E6	
NPRN:		95309	
LOCATION:		Dinas Dinlle Hillfort, Llandwrog, Gwynedd	
TYPE:		E6	
WCMC SURVEY UNIT:		10a16.3	
Surveyed by:		Louise Barker (RCAHMW)	
Map:		Photograph:	
			
Date of Survey:		09/12/2021	
Session start time:	N/A	Session Duration:	3 x 5 mins
Marker processed against OS Net Stations:		Diagram:	
N/A			
Post-processed with DD_E2			
Average of 3 x 5 min readings taken.			
Marker type:			
Survey Point Nail			
Description:			
Nail set in top of exposed boulder near in centre of hillfort interior.			
WGS84 Coordinates – Latitude:		53 04 53.968876 N	
WGS84 Coordinates – Longitude:		4 20 06.120086 W	
WGS Coordinates – Ellipsoidal Height (m):		82.3396	
Transformation:		OSTN15/OSGM15	
OSGB36 Coordinates – Easting:		243695.9868	
OSGB36 Coordinates – Northing:		356373.3823	
OSGB36 Coordinates – Height (m) ODN:		27.7681	

APPENDIX 3: GNSS PROCESSING REPORT - SUMMARY

GNSS Processing Report - Summary

Report created: 24/08/2022 10:23:14

Project Details

General

Project Name: Dinas_Dinlle_Markers_091221
Owner: -
Lead Surveyor: Louise Barker
Date Created: 24/08/2022 10:17:12
Last Accessed: 24/08/2022 10:17:12
Application: Infinity 4.0.0
Software:

Customer Details

Customer Name: -
Contact Person: -
Number: -
Email: -
Skype: -
Website: -

Master Coordinate System

Coordinate System Name: OSGB36(15)
Transformation Type: -
Residual Distribution: None
Ellipsoid: GRS 1980
Projection Type: Transverse Mercator
Geoid Model: OSGM15GB
CSCS Model: OSTN15GB

Path: C:\Users\Louise1\Documents\Leica Geosystems\Infinity\Projects\Dinas_Dinlle_Markers_091221\Dinas_Dinlle_Markers_091221.ip rj...
Size: 13.7 MB
Comments: -

Baseline ABEP - DDE2

Processing Parameters (09/12/2021 10:25:33 - 09/12/2021 14:35:16)

Data	Selected	Used	Comments
Cut-Off Angle:	10°	10°	
Frequency:	Automatic	L1/L2	
Sampling Rate:	Use All	30.00 sec	
Satellite System:	GPS/GLONASS/Galileo/Beidou	GPS/GLONASS	
Ephemeris Type:	Broadcast	Broadcast	
Antenna Calibration Set:	NGS Absolute	NGS Absolute	

Processing Strategy

Solution Type:	Phase Fixed	Phase Fixed
Solution Optimisation:	Automatic	Iono Minimised
Frequency to use in Iono Minimised:	Automatic	L1/L2
Tropospheric Model:	Automatic	Computed
Ionospheric Model:	Automatic	Computed
Allow Widelane Fix:	Automatic	Automatic

General Settings

Min. Distance for Iono Minimised: 15 km
Possible Ambiguities Fix up to: 300 km
Min. Duration for Float Solution (static): 00:05:00

Time Settings

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

Results Baseline: ABEP - DDE2

Acquisition

Start Time - End Time: 09/12/2021 10:25:42 - 09/12/2021 14:35:12

Duration: 04:09:30

Antennas

	Reference - ABEP	Rover - DDE2
Receiver Name / SN:	TRIMBLE ALLOY / 5804R40034	LEICA GS10 / 1531204
Antenna Name / SN:	LEIAR25 LEIT / 08510004	LEIAS10 / -
Carrier Offset:	-	0.3600 m
Height Reading:	0.0000 m	0.6160 m
Antenna Height:	0.0000 m	0.9760 m

Phase Center Offset

GPS	Reference - LEIAR25 LEIT		Rover - LEIAS10	
	L1	L2	L1	L2
East	0.0012 m	0.0004 m	0.0014 m	-0.0024 m
North	0.0010 m	-0.0001 m	-0.0010 m	-0.0002 m
Up	0.1551 m	0.1631 m	0.0583 m	0.0555 m

GLONASS	L1		L2	
	L1	L2	L1	L2
East	0.0012 m	0.0004 m	0.0014 m	-0.0024 m
North	0.0010 m	-0.0001 m	-0.0010 m	-0.0002 m
Up	0.1551 m	0.1631 m	0.0583 m	0.0555 m

Coordinates

	Reference - ABEP	Rover - DDE2		Reference - ABEP	Rover - DDE2
Point Role:	Navigated RTK	Fixed PP			
WGS84 Latitude:	52° 08' 21.90" N	53° 04' 49.28" N	Easting:	224,134.5233 m	243,688.2634 m
WGS84 Longitude:	4° 34' 16.73" W	4° 20' 06.28" W	Northing:	252,130.7687 m	356,228.5643 m
WGS84 Ellip. Height:	188.4669 m	73.8119 m	Ortho. Height:	134.2377 m	19.2409 m
WGS84 Cartesian X:	3,910,361.3337 m	3,828,593.6465 m			
WGS84 Cartesian Y:	-312,649.7649 m	-290,230.7389 m			
WGS84 Cartesian Z:	5,012,487.9118 m	5,075,979.2206 m			

Baseline Vector and Quality - WGS84

ΔLatitude:	0° 56' 27.37"	SD ΔLatitude:	0.0013 m
ΔLongitude:	0° 14' 10.45"	SD ΔLongitude:	0.0009 m
ΔHeight:	-114.6550 m	SD ΔHeight:	0.0067 m
ΔX:	-81,767.6872 m	SD ΔX:	0.0041 m
ΔY:	22,419.0260 m	SD ΔY:	0.0010 m
ΔZ:	63,491.3088 m	SD ΔZ:	0.0055 m
Slope Dist.:	105,923.1499 m	SD Slope Dist.:	0.0013 m

M0:	0.8118 m	CQ 1D:	0.0067 m
Q11:	0.00002572	CQ 2D:	0.0016 m
Q12:	-0.00000173	CQ 3D:	0.0069 m
Q22:	0.00000142		
Q13:	0.00003160		
Q23:	-0.00000217		
Q33:	0.00004533		

Frequency:	L1/L2	GDOP:	1.4 - 2.9	GPS SVs:	9/10
Solution Optimisation:	Iono Minimised	PDOP:	1.1 - 2.2	GLONASS SVs:	9/9
Solution Type:	Phase Fixed	HDOP:	0.6 - 1.1	Beidou SVs:	-
		VDOP:	0.9 - 1.9	Galileo SVs:	-
				QZSS SVs:	-

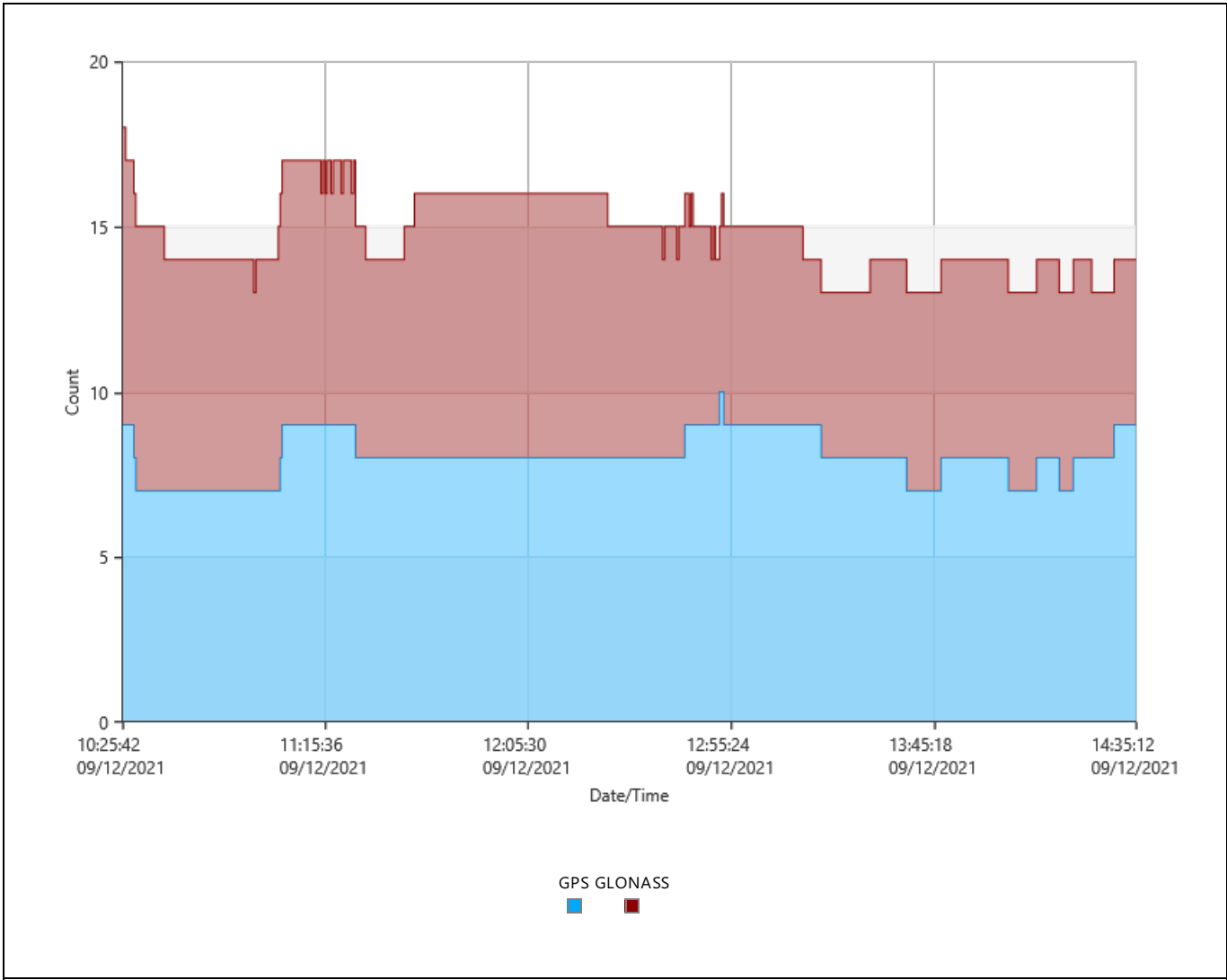
Ephemeris Type:

GPS	Broadcast
GLONASS	Broadcast

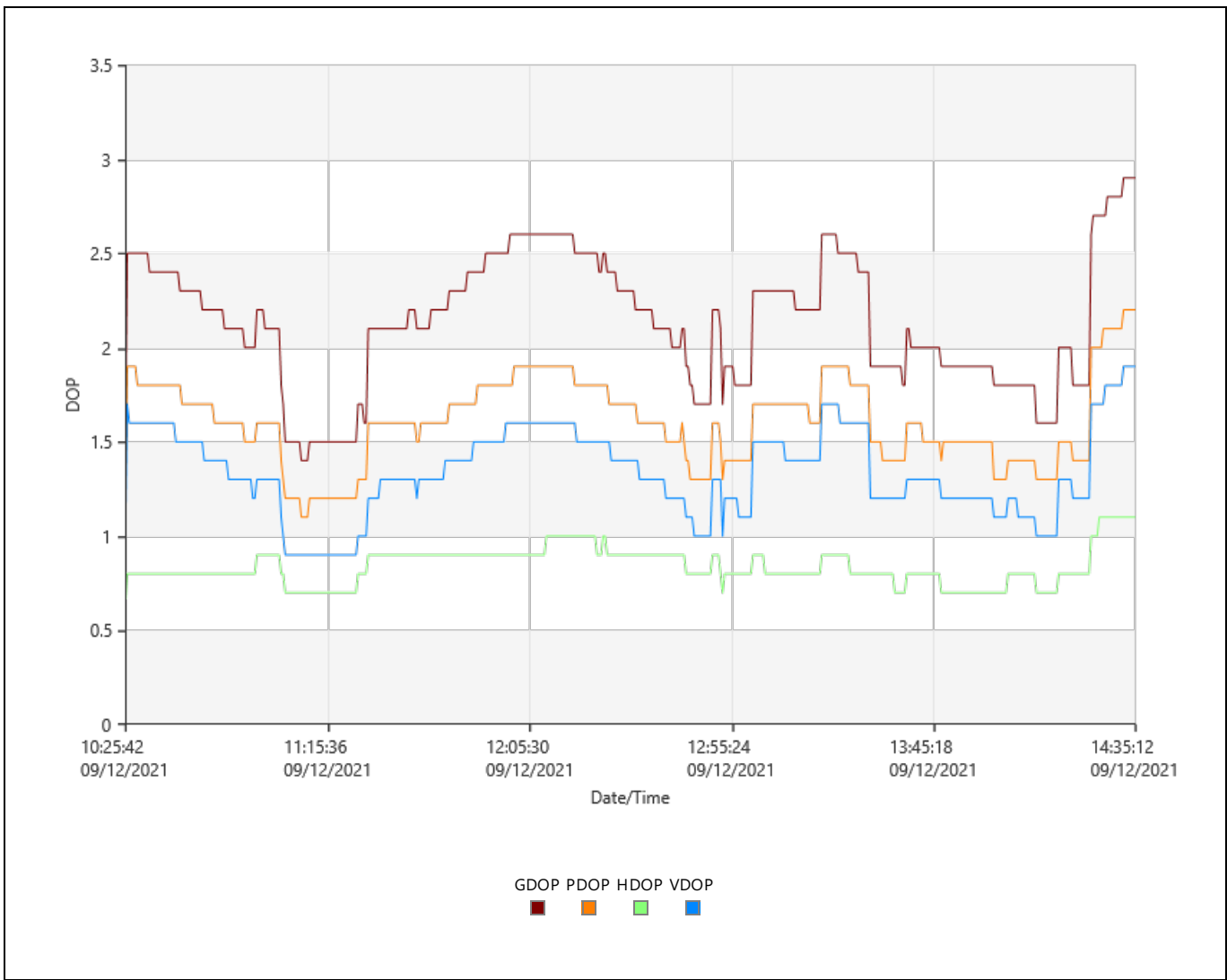
Processing Info (09/12/2021 10:25:33 - 09/12/2021 14:35:16)

Processed Date/Time: 24/08/2022 10:22:40

SVs Tracked



DOP



Ambiguity Statistics

Number of Ambiguities	GPS	GLONASS
Fixed	34	27
Total	257	48
Independently fixed	346	343
Possible independently fixed	372	372

Average time between independent fixes: 00:01:00

% of Epochs	GPS		GLONASS	
	L1 [%]	L2 [%]	L1 [%]	L2 [%]
Fixed	96.74	96.81	73.35	98.64
Not fixed	2.98	2.90	26.65	1.36
Not fixed - contradiction	0.28	0.28	0.00	0.00
Not fixed - missing phase	0.00	0.00	0.00	0.00

Status	From Epoch	To Epoch	Duration
Not fixed	09/12/2021 10:25:42	09/12/2021 10:26:12	00:00:30
Fixed	09/12/2021 10:26:12	09/12/2021 14:35:12	04:09:00

Baseline ADAR - DDE2

Processing Parameters (09/12/2021 10:25:33 - 09/12/2021 14:35:16)

Data	Selected	Used	Comments
Cut-Off Angle:	10°	10°	
Frequency:	Automatic	L1/L2	
Sampling Rate:	Use All	30.00 sec	

Satellite System: GPS/GLONASS/Galileo/Beidou GPS/GLONASS
 Ephemeris Type: Broadcast Broadcast
 Antenna Calibration Set: NGS Absolute NGS Absolute

Processing Strategy

Solution Type: Phase Fixed Phase Fixed
 Solution Optimisation: Automatic Iono Minimised
 Frequency to use in Iono Minimised: Automatic L1/L2
 Tropospheric Model: Automatic Computed
 Ionospheric Model: Automatic Computed
 Allow Widelane Fix: Automatic Automatic

General Settings

Min. Distance for Iono Minimised: 15 km
 Possible Ambiguities Fix up to: 300 km
 Min. Duration for Float Solution (static): 00:05:00

Time Settings

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

Results Baseline: ADAR - DDE2

Acquisition

Start Time - End Time: 09/12/2021 10:25:42 - 09/12/2021 14:35:12
 Duration: 04:09:30

Antennas

	Reference - ADAR	Rover - DDE2
Receiver Name / SN:	SEPT POLARX5 / 3022763	LEICA GS10 / 1531204
Antenna Name / SN:	LEIAR25 LEIT / 08420006	LEIAS10 / -
Carrier Offset:	-	0.3600 m
Height Reading:	0.1888 m	0.6160 m
Antenna Height:	0.1888 m	0.9760 m

Phase Center Offset

GPS	Reference - LEIAR25 LEIT		Rover - LEIAS10	
	L1	L2	L1	L2
East	0.0012 m	0.0004 m	0.0014 m	-0.0024 m
North	0.0010 m	-0.0001 m	-0.0010 m	-0.0002 m
Up	0.1551 m	0.1631 m	0.0583 m	0.0555 m

GLONASS	L1	L2	L1	L2
East	0.0012 m	0.0004 m	0.0014 m	-0.0024 m
North	0.0010 m	-0.0001 m	-0.0010 m	-0.0002 m
Up	0.1551 m	0.1631 m	0.0583 m	0.0555 m

Coordinates

	Reference - ADAR	Rover - DDE2		Reference - ADAR	Rover - DDE2
Point Role:	Navigated RTK	Fixed PP			
WGS84 Latitude:	52° 47' 21.17" N	53° 04' 49.28" N	Easting:	215,244.0784 m	243,688.2620 m
WGS84 Longitude:	4° 44' 28.82" W	4° 20' 06.28" W	Northing:	324,815.1305 m	356,228.5603 m
WGS84 Ellip. Height:	148.3845 m	73.8590 m	Ortho. Height:	94.0208 m	19.2881 m
WGS84 Cartesian X:	3,852,249.6709 m	3,828,593.6779 m			
WGS84 Cartesian Y:	-319,510.9644 m	-290,230.7425 m			
WGS84 Cartesian Z:	5,056,510.2833 m	5,075,979.2559 m			

Baseline Vector and Quality - WGS84

ΔLatitude: 0° 17' 28.11" SD ΔLatitude: 0.0004 m

ΔLongitude:	0° 24' 22.54"	SD ΔLongitude:	0.0003 m
ΔHeight:	-74.5255 m	SD ΔHeight:	0.0019 m
ΔX:	-23,655.9930 m	SD ΔX:	0.0012 m
ΔY:	29,280.2219 m	SD ΔY:	0.0003 m
ΔZ:	19,468.9726 m	SD ΔZ:	0.0015 m
Slope Dist.:	42,378.9841 m	SD Slope Dist.:	0.0003 m

M0:	0.2251 m	CQ 1D:	0.0019 m
Q11:	0.00002653	CQ 2D:	0.0004 m
Q12:	-0.00000167	CQ 3D:	0.0020 m
Q22:	0.00000143		
Q13:	0.00003286		
Q23:	-0.00000213		
Q33:	0.00004742		

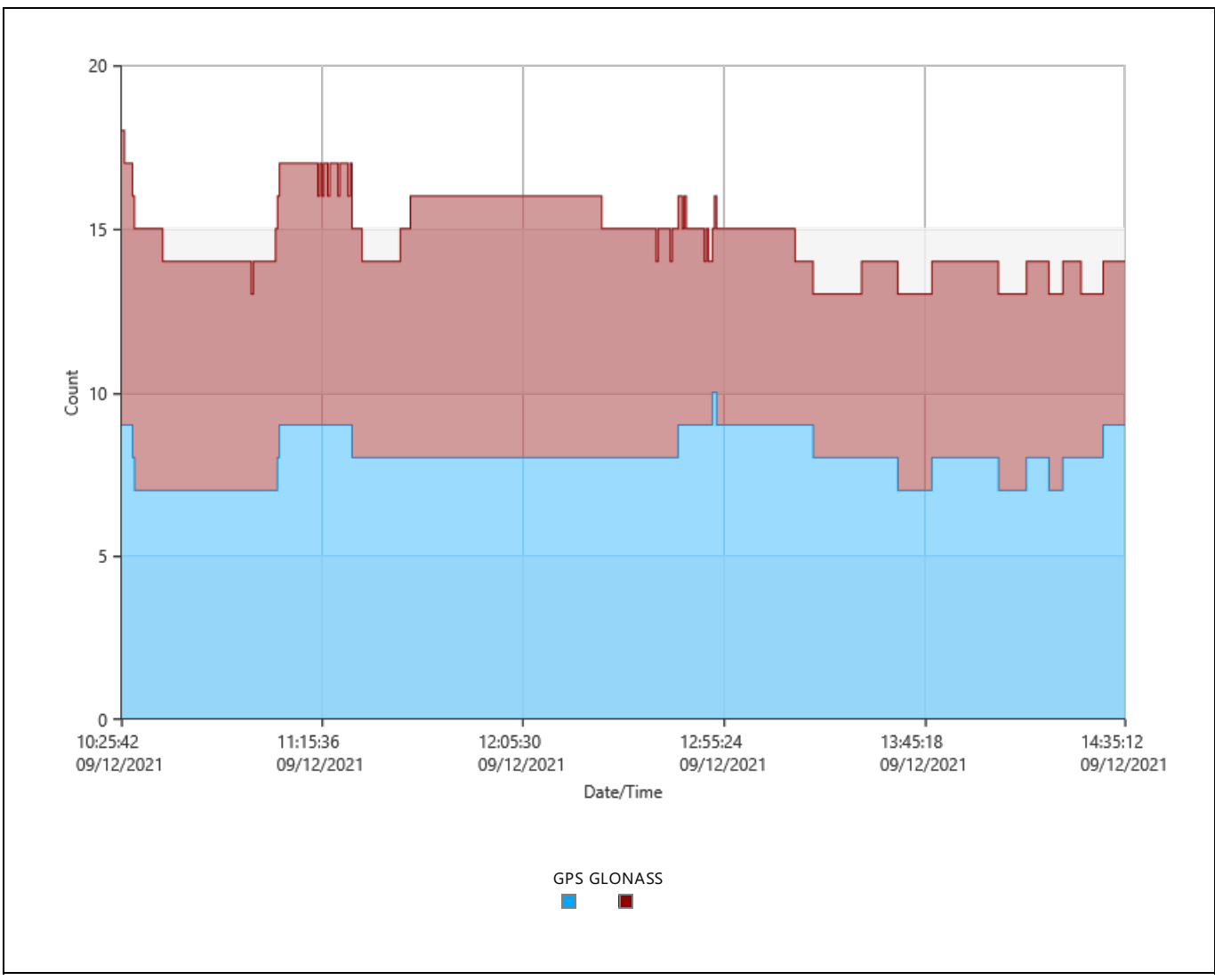
Frequency:	L1/L2	GDOP:	1.4 - 2.9	GPS SVs:	9/10
Solution Optimisation:	Iono Minimised	PDOP:	1.1 - 2.2	GLONASS SVs:	9/9
Solution Type:	Phase Fixed	HDOP:	0.6 - 1.1	Beidou SVs:	-
		VDOP:	0.9 - 1.9	Galileo SVs:	-
				QZSS SVs:	-

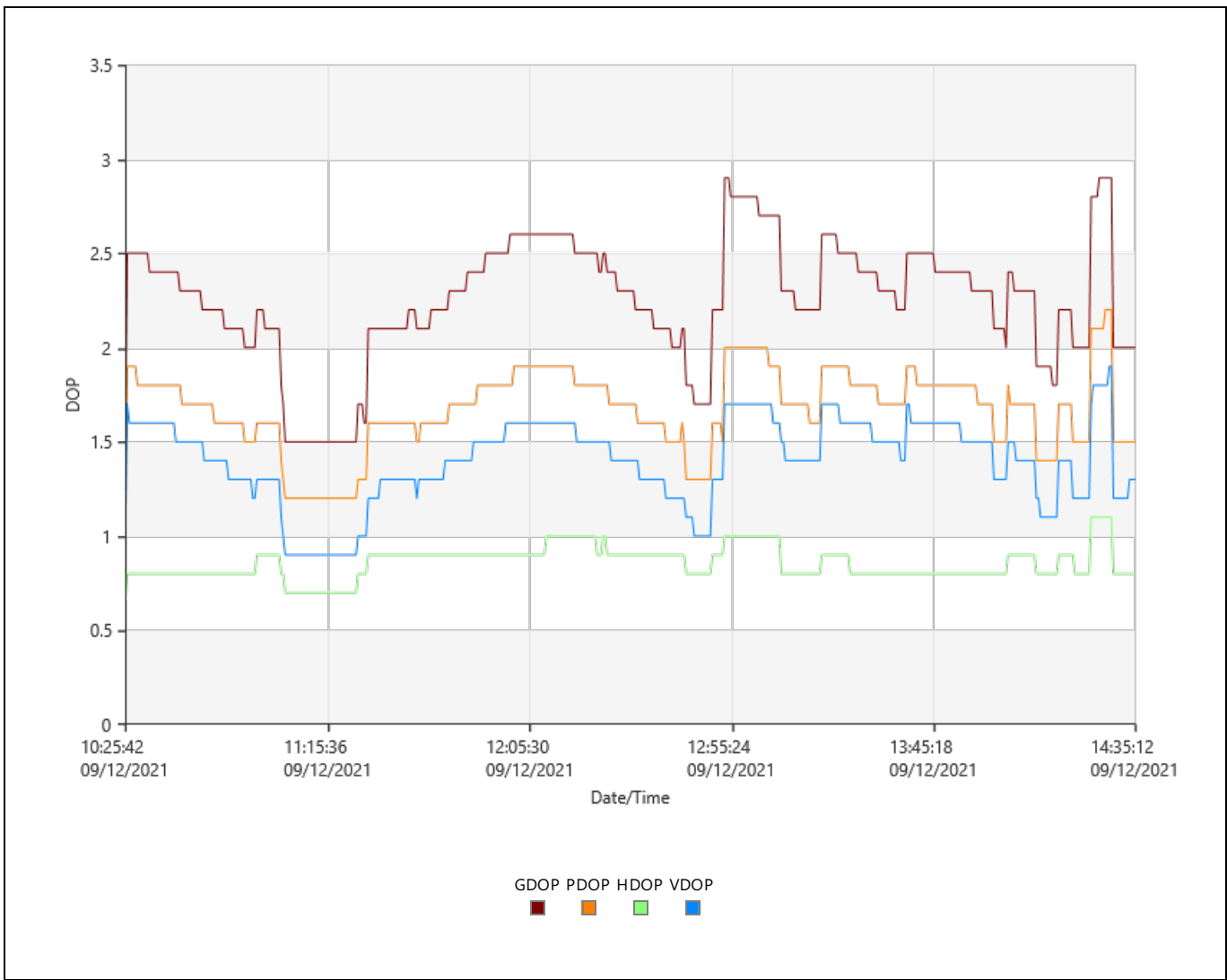
Ephemeris Type:
GPS Broadcast
GLONASS Broadcast

Processing Info (09/12/2021 10:25:33 - 09/12/2021 14:35:16)

Processed Date/Time: 24/08/2022 10:22:40

SVs Tracked





Ambiguity Statistics

Number of Ambiguities	GPS	GLONASS
Fixed	32	23
Total	213	41
Independently fixed	255	251
Possible independently fixed	261	261

Average time between independent fixes: 00:00:30

% of Epochs	GPS		GLONASS	
	L1 [%]	L2 [%]	L1 [%]	L2 [%]
Fixed	93.94	94.01	94.68	92.86
Not fixed	3.61	3.53	1.40	1.76
Not fixed - contradiction	2.45	2.46	3.91	5.37
Not fixed - missing phase	0.00	0.00	0.00	0.00

Status	From Epoch	To Epoch	Duration
Not fixed	09/12/2021 10:25:42	09/12/2021 10:26:12	00:00:30
Fixed	09/12/2021 10:26:12	09/12/2021 14:35:12	04:09:00

Baseline ASAP - DDE2

Processing Parameters (09/12/2021 10:25:33 - 09/12/2021 14:35:16)

Data	Selected	Used	Comments
Cut-Off Angle:	10°	10°	
Frequency:	Automatic	L1/L2	
Sampling Rate:	Use All	30.00 sec	

Satellite System: GPS/GLONASS/Galileo/Beidou GPS/GLONASS
 Ephemeris Type: Broadcast Broadcast
 Antenna Calibration Set: NGS Absolute NGS Absolute

Processing Strategy

Solution Type: Phase Fixed Phase Fixed
 Solution Optimisation: Automatic Iono Minimised
 Frequency to use in Iono Minimised: Automatic L1/L2
 Tropospheric Model: Automatic Computed
 Ionospheric Model: Automatic Computed
 Allow Widelane Fix: Automatic Automatic

General Settings

Min. Distance for Iono Minimised: 15 km
 Possible Ambiguities Fix up to: 300 km
 Min. Duration for Float Solution (static): 00:05:00

Time Settings

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

Results Baseline: ASAP - DDE2

Acquisition

Start Time - End Time: 09/12/2021 10:25:42 - 09/12/2021 14:35:12
 Duration: 04:09:30

Antennas

	Reference - ASAP	Rover - DDE2
Receiver Name / SN:	SEPT POLARX5 / 3022940	LEICA GS10 / 1531204
Antenna Name / SN:	LEIAR25 LEIT / 08420007	LEIAS10 / -
Carrier Offset:	-	0.3600 m
Height Reading:	0.0000 m	0.6160 m
Antenna Height:	0.0000 m	0.9760 m

Phase Center Offset

GPS	Reference - LEIAR25 LEIT		Rover - LEIAS10	
	L1	L2	L1	L2
East	0.0012 m	0.0004 m	0.0014 m	-0.0024 m
North	0.0010 m	-0.0001 m	-0.0010 m	-0.0002 m
Up	0.1551 m	0.1631 m	0.0583 m	0.0555 m

GLONASS	L1	L2	L1	L2
East	0.0012 m	0.0004 m	0.0014 m	-0.0024 m
North	0.0010 m	-0.0001 m	-0.0010 m	-0.0002 m
Up	0.1551 m	0.1631 m	0.0583 m	0.0555 m

Coordinates

	Reference - ASAP	Rover - DDE2		Reference - ASAP	Rover - DDE2
Point Role:	Navigated RTK	Fixed PP			
WGS84 Latitude:	53° 15' 04.84" N	53° 04' 49.28" N	Easting:	301,344.5059 m	243,688.2594 m
WGS84 Longitude:	3° 28' 48.41" W	4° 20' 06.28" W	Northing:	373,724.0425 m	356,228.5542 m
WGS84 Ellip. Height:	103.3446 m	73.8829 m	Ortho. Height:	49.6474 m	19.3119 m
WGS84 Cartesian X:	3,817,313.1385 m	3,828,593.6969 m			
WGS84 Cartesian Y:	-232,146.9777 m	-290,230.7463 m			
WGS84 Cartesian Z:	5,087,411.0255 m	5,075,979.2712 m			

Baseline Vector and Quality - WGS84

ΔLatitude: -0° 10' 15.56" SD ΔLatitude: 0.0005 m

ΔLongitude:	-0° 51' 17.87"	SD ΔLongitude:	0.0004 m
ΔHeight:	-29.4617 m	SD ΔHeight:	0.0027 m
ΔX:	11,280.5584 m	SD ΔX:	0.0017 m
ΔY:	-58,083.7686 m	SD ΔY:	0.0004 m
ΔZ:	-11,431.7543 m	SD ΔZ:	0.0022 m
Slope Dist.:	60,263.2573 m	SD Slope Dist.:	0.0004 m

M0:	0.3272 m	CQ 1D:	0.0027 m
Q11:	0.00002620	CQ 2D:	0.0006 m
Q12:	-0.00000178	CQ 3D:	0.0028 m
Q22:	0.00000144		
Q13:	0.00003214		
Q23:	-0.00000224		
Q33:	0.00004594		

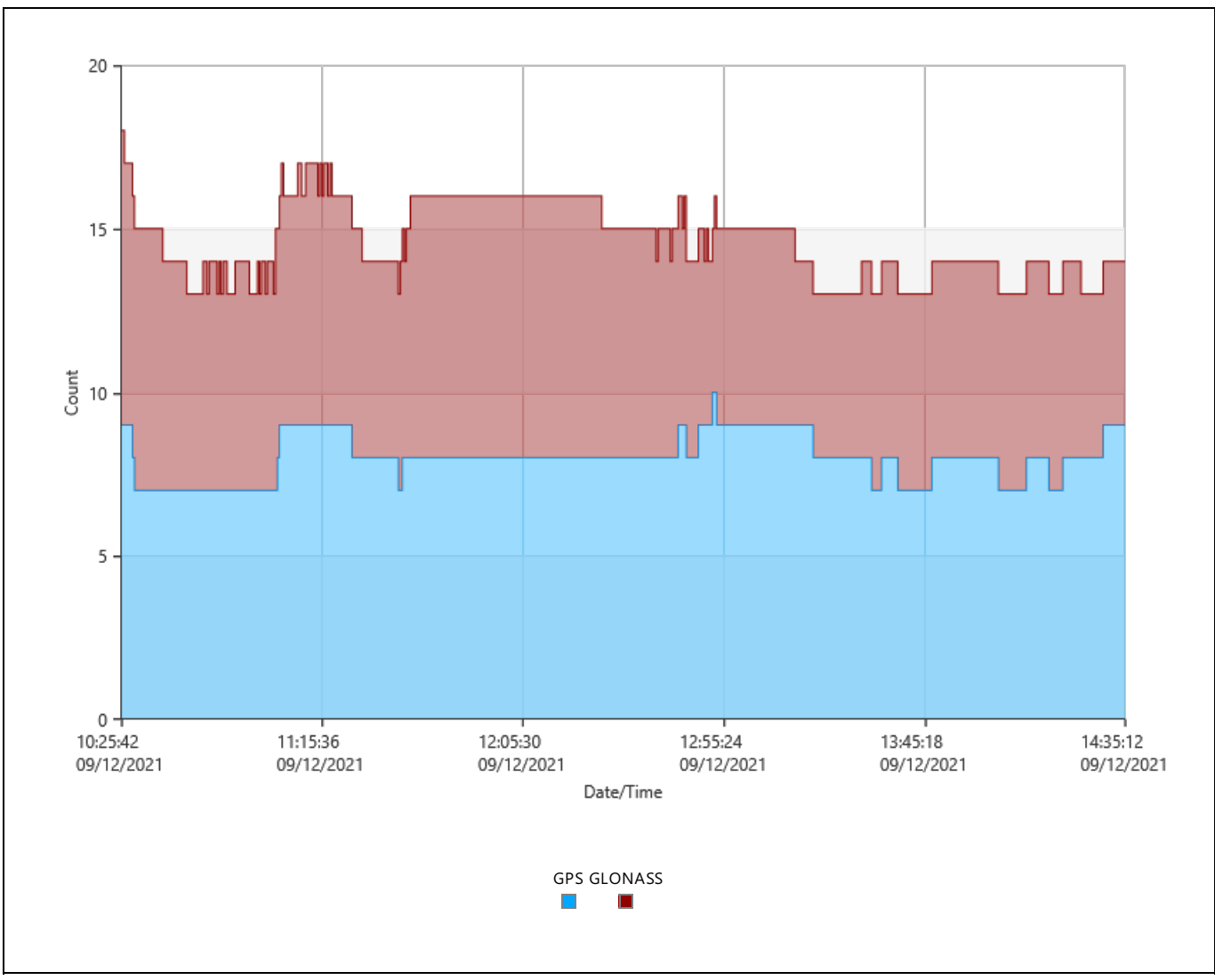
Frequency:	L1/L2	GDOP:	1.4 - 3.9	GPS SVs:	9/10
Solution Optimisation:	Iono Minimised	PDOP:	1.1 - 2.9	GLONASS SVs:	9/9
Solution Type:	Phase Fixed	HDOP:	0.6 - 1.4	Beidou SVs:	-
		VDOP:	0.9 - 2.5	Galileo SVs:	-
				QZSS SVs:	-

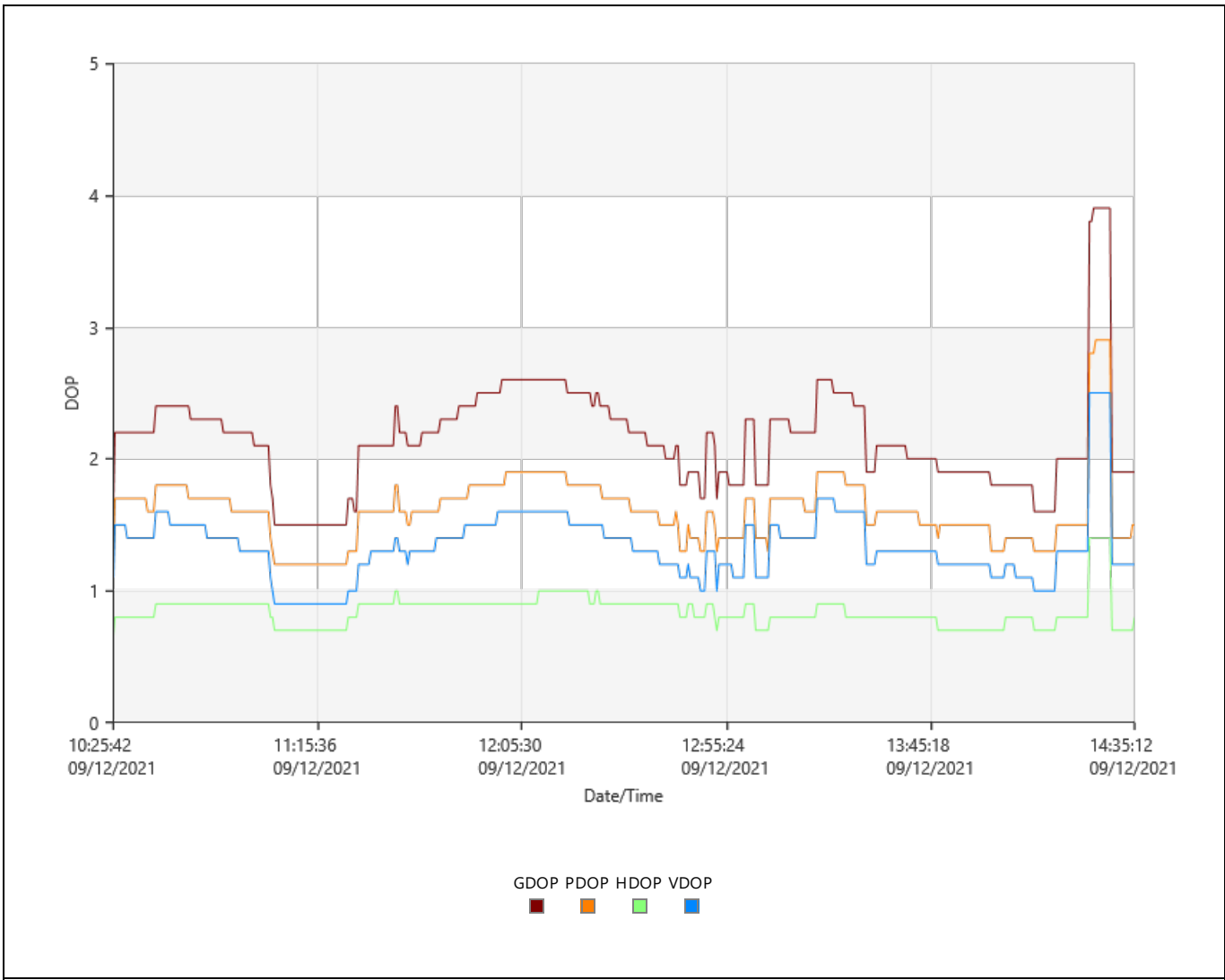
Ephemeris Type:
GPS Broadcast
GLONASS Broadcast

Processing Info (09/12/2021 10:25:33 - 09/12/2021 14:35:16)

Processed Date/Time: 24/08/2022 10:22:40

SVs Tracked





Ambiguity Statistics

Number of Ambiguities	GPS	GLONASS
Fixed	34	28
Total	261	53
Independently fixed	304	300
Possible independently fixed	304	304

Average time between independent fixes: 00:00:30

% of Epochs	GPS		GLONASS	
	L1 [%]	L2 [%]	L1 [%]	L2 [%]
Fixed	95.83	95.90	98.40	99.70
Not fixed	3.38	3.30	1.60	0.30
Not fixed - contradiction	0.80	0.80	0.00	0.00
Not fixed - missing phase	0.00	0.00	0.00	0.00

Status	From Epoch	To Epoch	Duration
Not fixed	09/12/2021 10:25:42	09/12/2021 10:26:12	00:00:30
Fixed	09/12/2021 10:26:12	09/12/2021 14:35:12	04:09:00

Baseline HOLY - DDE2

Processing Parameters (09/12/2021 10:25:33 - 09/12/2021 14:35:16)

Data	Selected	Used	Comments
Cut-Off Angle:	10°	10°	
Frequency:	Automatic	L1/L2	
Sampling Rate:	Use All	30.00 sec	

Satellite System: GPS/GLONASS/Galileo/Beidou GPS/GLONASS
 Ephemeris Type: Broadcast Broadcast
 Antenna Calibration Set: NGS Absolute NGS Absolute

Processing Strategy

Solution Type: Phase Fixed Phase Fixed
 Solution Optimisation: Automatic Iono Minimised
 Frequency to use in Iono Minimised: Automatic L1/L2
 Tropospheric Model: Automatic Computed
 Ionospheric Model: Automatic Computed
 Allow Widelane Fix: Automatic Automatic

General Settings

Min. Distance for Iono Minimised: 15 km
 Possible Ambiguities Fix up to: 300 km
 Min. Duration for Float Solution (static): 00:05:00

Time Settings

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

Results Baseline: HOLY - DDE2

Acquisition

Start Time - End Time: 09/12/2021 10:25:42 - 09/12/2021 14:35:12
 Duration: 04:09:30

Antennas

	Reference - HOLY	Rover - DDE2
Receiver Name / SN:	TRIMBLE ALLOY / 5804R40053	LEICA GS10 / 1531204
Antenna Name / SN:	LEIAR25 LEIT / 08510032	LEIAS10 / -
Carrier Offset:	-	0.3600 m
Height Reading:	0.0000 m	0.6160 m
Antenna Height:	0.0000 m	0.9760 m

Phase Center Offset

GPS	Reference - LEIAR25 LEIT		Rover - LEIAS10	
	L1	L2	L1	L2
East	0.0012 m	0.0004 m	0.0014 m	-0.0024 m
North	0.0010 m	-0.0001 m	-0.0010 m	-0.0002 m
Up	0.1551 m	0.1631 m	0.0583 m	0.0555 m

GLONASS	Reference - LEIAR25 LEIT		Rover - LEIAS10	
	L1	L2	L1	L2
East	0.0012 m	0.0004 m	0.0014 m	-0.0024 m
North	0.0010 m	-0.0001 m	-0.0010 m	-0.0002 m
Up	0.1551 m	0.1631 m	0.0583 m	0.0555 m

Coordinates

	Reference - HOLY	Rover - DDE2		Reference - HOLY	Rover - DDE2
Point Role:	Navigated RTK	Fixed PP			
WGS84 Latitude:	53° 19' 03.82" N	53° 04' 49.28" N	Easting:	224,104.3098 m	243,688.2766 m
WGS84 Longitude:	4° 38' 31.46" W	4° 20' 06.28" W	Northing:	383,342.5130 m	356,228.5595 m
WGS84 Ellip. Height:	67.8924 m	73.8972 m	Ortho. Height:	13.2814 m	19.3263 m
WGS84 Cartesian X:	3,805,896.4535 m	3,828,593.7021 m			
WGS84 Cartesian Y:	-309,028.0090 m	-290,230.7297 m			
WGS84 Cartesian Z:	5,091,799.5204 m	5,075,979.2862 m			

Baseline Vector and Quality - WGS84

ΔLatitude:	-0° 14' 14.54"	SD ΔLatitude:	0.0004 m
ΔLongitude:	0° 18' 25.18"	SD ΔLongitude:	0.0003 m
ΔHeight:	6.0048 m	SD ΔHeight:	0.0020 m
ΔX:	22,697.2486 m	SD ΔX:	0.0013 m
ΔY:	18,797.2793 m	SD ΔY:	0.0003 m
ΔZ:	-15,820.2342 m	SD ΔZ:	0.0017 m
Slope Dist.:	33,448.2079 m	SD Slope Dist.:	0.0003 m

M0:	0.2478 m	CQ 1D:	0.0020 m
Q11:	0.00002547	CQ 2D:	0.0005 m
Q12:	-0.00000169	CQ 3D:	0.0021 m
Q22:	0.00000142		
Q13:	0.00003135		
Q23:	-0.00000213		
Q33:	0.00004509		

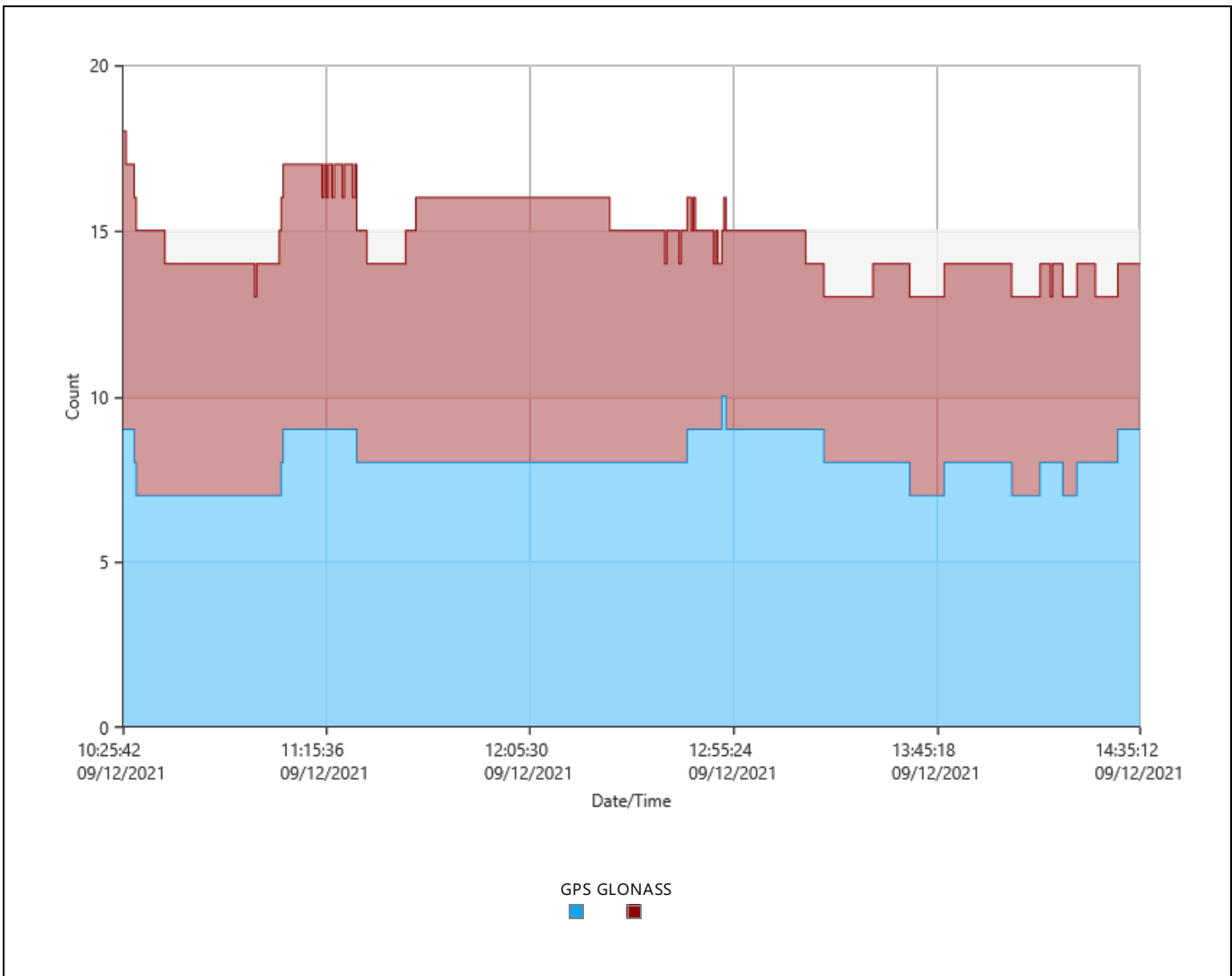
Frequency:	L1/L2	GDOP:	1.4 - 2.8	GPS SVs:	9/10
Solution Optimisation:	Iono Minimised	PDOP:	1.1 - 2.1	GLONASS SVs:	9/9
Solution Type:	Phase Fixed	HDOP:	0.6 - 1.1	Beidou SVs:	-
		VDOP:	0.9 - 1.8	Galileo SVs:	-
				QZSS SVs:	-

Ephemeris Type:
GPS Broadcast
GLONASS Broadcast

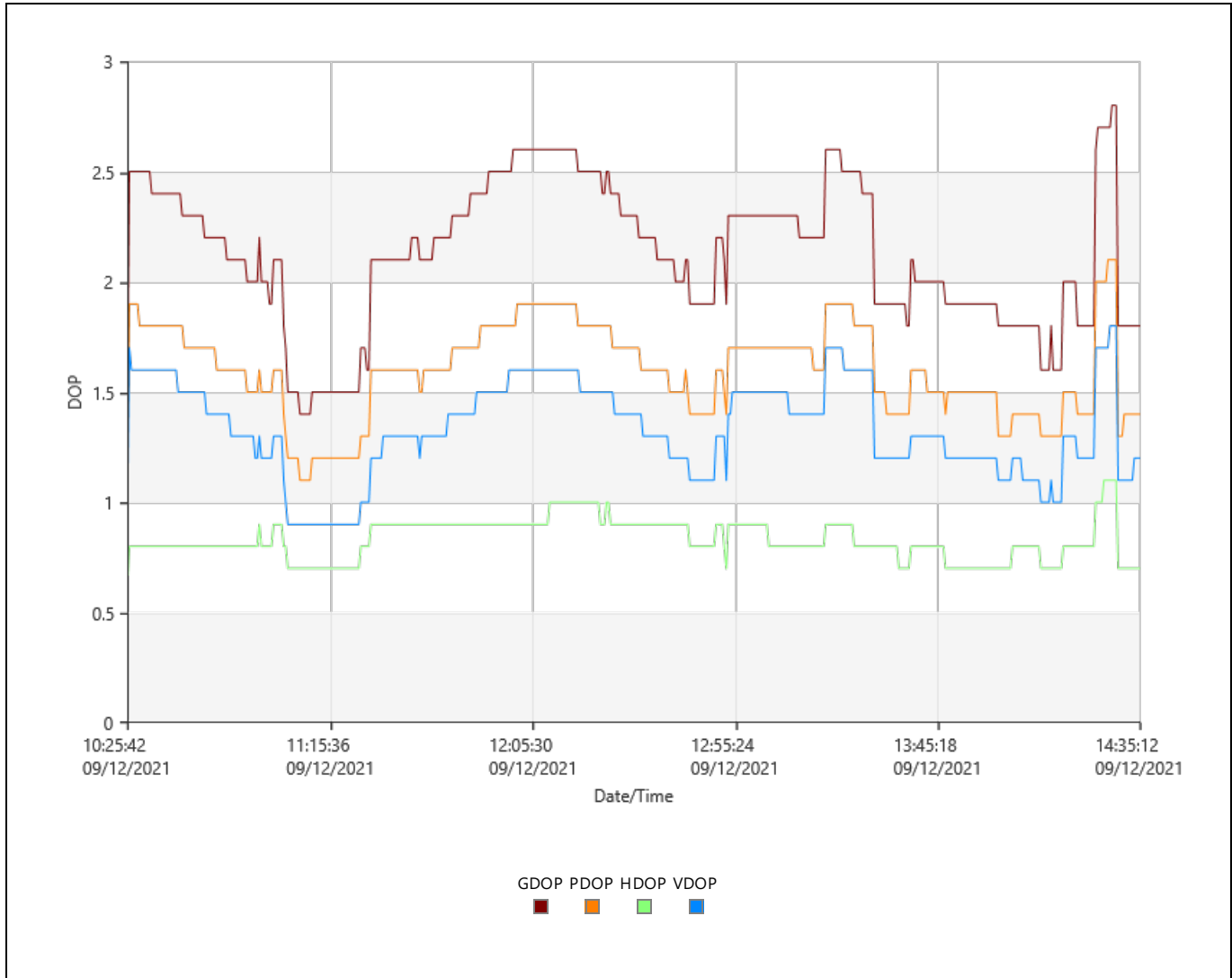
Processing Info (09/12/2021 10:25:33 - 09/12/2021 14:35:16)

Processed Date/Time: 24/08/2022 10:22:40

SVs Tracked



DOP



Ambiguity Statistics

Number of Ambiguities	GPS	GLONASS
Fixed	34	31
Total	259	49
Independently fixed	293	286
Possible independently fixed	293	293

Average time between independent fixes: 00:00:30

% of Epochs	GPS		GLONASS	
	L1 [%]	L2 [%]	L1 [%]	L2 [%]
Fixed	96.84	96.92	98.56	98.68
Not fixed	3.16	3.08	1.44	1.32
Not fixed - contradiction	0.00	0.00	0.00	0.00
Not fixed - missing phase	0.00	0.00	0.00	0.00

Status	From Epoch	To Epoch	Duration
Not fixed	09/12/2021 10:25:42	09/12/2021 10:26:12	00:00:30
Fixed	09/12/2021 10:26:12	09/12/2021 14:35:12	04:09:00

Baseline MACY - DDE2

Processing Parameters (09/12/2021 10:25:33 - 09/12/2021 14:35:16)

Data	Selected	Used	Comments
Cut-Off Angle:	10°	10°	
Frequency:	Automatic	L1/L2	

Sampling Rate: Use All 30.00 sec
 Satellite System: GPS/GLONASS/Galileo/Beidou GPS/GLONASS
 Ephemeris Type: Broadcast Broadcast
 Antenna Calibration Set: NGS Absolute NGS Absolute

Processing Strategy

Solution Type: Phase Fixed Phase Fixed
 Solution Optimisation: Automatic Iono Minimised
 Frequency to use in Iono Minimised: Automatic L1/L2
 Tropospheric Model: Automatic Computed
 Ionospheric Model: Automatic Computed
 Allow Widelane Fix: Automatic Automatic

General Settings

Min. Distance for Iono Minimised: 15 km
 Possible Ambiguities Fix up to: 300 km
 Min. Duration for Float Solution (static): 00:05:00

Time Settings

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

Results Baseline: MACY - DDE2

Acquisition

Start Time - End Time: 09/12/2021 10:25:42 - 09/12/2021 14:35:12
 Duration: 04:09:30

Antennas

	Reference - MACY	Rover - DDE2
Receiver Name / SN:	TRIMBLE ALLOY / 5804R40023	LEICA GS10 / 1531204
Antenna Name / SN:	LEIAR25 LEIT / 08360007	LEIAS10 / -
Carrier Offset:	-	0.3600 m
Height Reading:	0.0000 m	0.6160 m
Antenna Height:	0.0000 m	0.9760 m

Phase Center Offset

GPS	Reference - LEIAR25 LEIT		Rover - LEIAS10	
	L1	L2	L1	L2
East	0.0012 m	0.0004 m	0.0014 m	-0.0024 m
North	0.0010 m	-0.0001 m	-0.0010 m	-0.0002 m
Up	0.1551 m	0.1631 m	0.0583 m	0.0555 m

GLONASS	Reference - LEIAR25 LEIT		Rover - LEIAS10	
	L1	L2	L1	L2
East	0.0012 m	0.0004 m	0.0014 m	-0.0024 m
North	0.0010 m	-0.0001 m	-0.0010 m	-0.0002 m
Up	0.1551 m	0.1631 m	0.0583 m	0.0555 m

Coordinates

	Reference - MACY	Rover - DDE2		Reference - MACY	Rover - DDE2
Point Role:	Navigated RTK	Fixed PP			
WGS84 Latitude:	52° 35' 20.04" N	53° 04' 49.28" N	Easting:	274,647.7441 m	243,688.2562 m
WGS84 Longitude:	3° 51' 06.47" W	4° 20' 06.28" W	Northing:	300,620.2083 m	356,228.5581 m
WGS84 Ellip. Height:	76.6641 m	73.8719 m	Ortho. Height:	22.4250 m	19.3010 m
WGS84 Cartesian X:	3,874,391.7849 m	3,828,593.6871 m			
WGS84 Cartesian Y:	-260,854.9659 m	-290,230.7489 m			
WGS84 Cartesian Z:	5,042,941.6715 m	5,075,979.2648 m			

Baseline Vector and Quality - WGS84

ΔLatitude:	0° 29' 29.23"	SD ΔLatitude:	0.0005 m
ΔLongitude:	-0° 28' 59.82"	SD ΔLongitude:	0.0004 m
ΔHeight:	-2.7922 m	SD ΔHeight:	0.0027 m
ΔX:	-45,798.0978 m	SD ΔX:	0.0016 m
ΔY:	-29,375.7830 m	SD ΔY:	0.0004 m
ΔZ:	33,037.5933 m	SD ΔZ:	0.0022 m
Slope Dist.:	63,654.4182 m	SD Slope Dist.:	0.0005 m

M0:	0.3227 m	CQ 1D:	0.0027 m
Q11:	0.00002536	CQ 2D:	0.0006 m
Q12:	-0.00000167	CQ 3D:	0.0027 m
Q22:	0.00000143		
Q13:	0.00003121		
Q23:	-0.00000213		
Q33:	0.00004492		

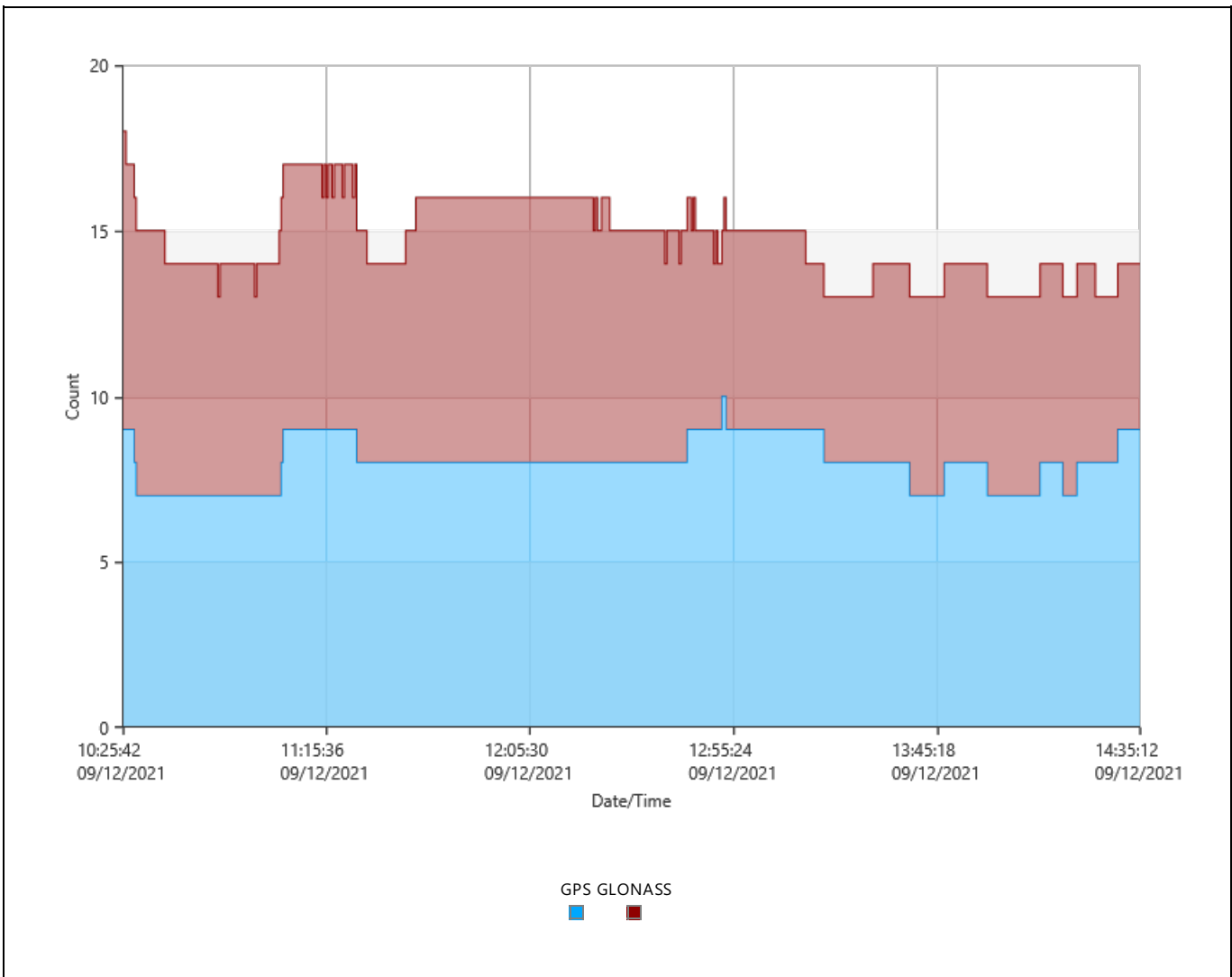
Frequency:	L1/L2	GDOP:	1.4 - 2.8	GPS SVs:	9/10
Solution Optimisation:	Iono Minimised	PDOP:	1.1 - 2.1	GLONASS SVs:	9/9
Solution Type:	Phase Fixed	HDOP:	0.6 - 1.1	Beidou SVs:	-
		VDOP:	0.9 - 1.8	Galileo SVs:	-
				QZSS SVs:	-

Ephemeris Type:
GPS Broadcast
GLONASS Broadcast

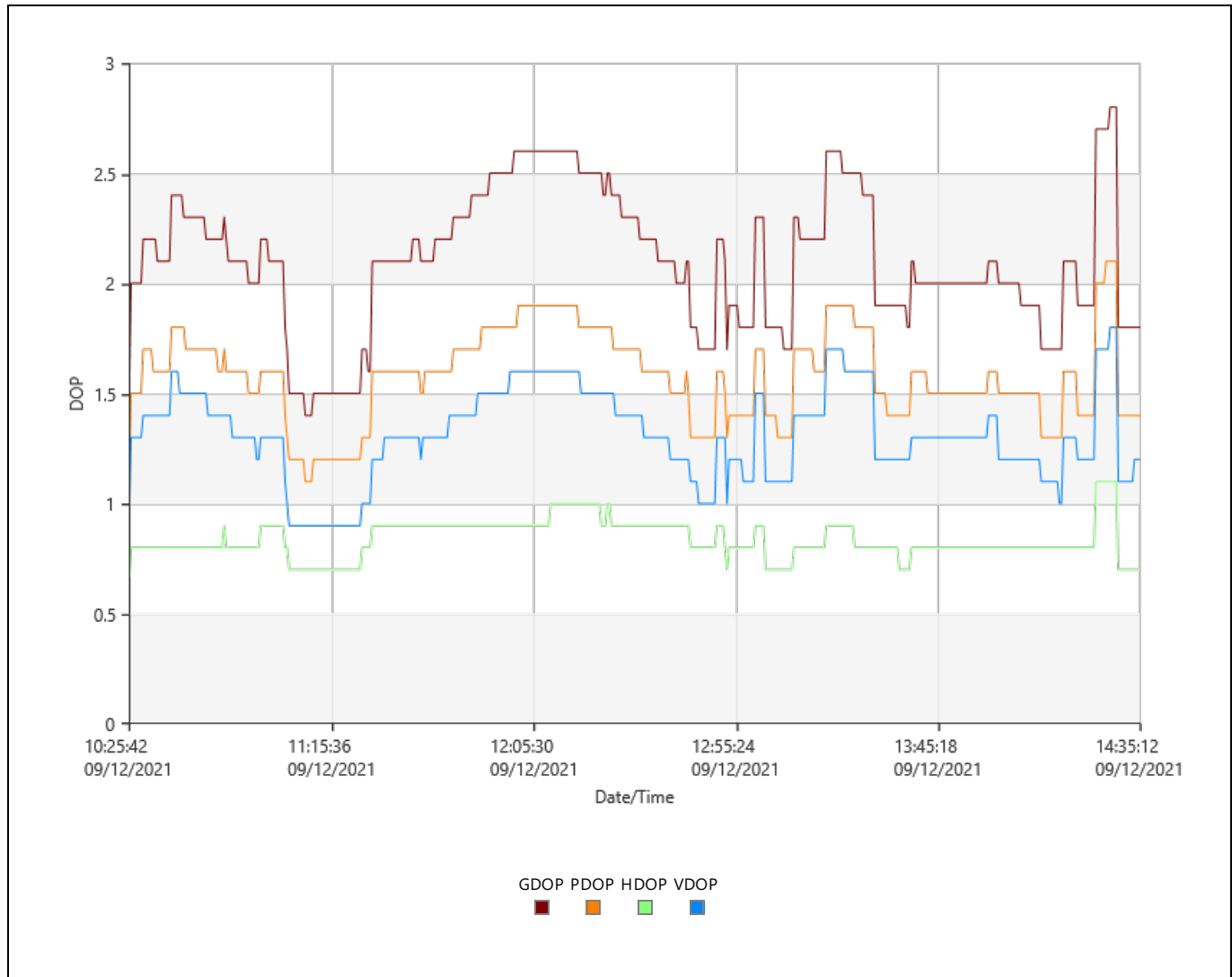
Processing Info (09/12/2021 10:25:33 - 09/12/2021 14:35:16)

Processed Date/Time: 24/08/2022 10:22:40

SVs Tracked



DOP



Ambiguity Statistics

Number of Ambiguities	GPS	GLONASS
Fixed	34	32
Total	257	52
Independently fixed	327	326
Possible independently fixed	329	329

Average time between independent fixes: 00:01:00

% of Epochs	GPS		GLONASS	
	L1 [%]	L2 [%]	L1 [%]	L2 [%]
Fixed	94.54	94.61	98.23	99.22
Not fixed	2.99	2.91	1.77	0.78
Not fixed - contradiction	2.47	2.47	0.00	0.00
Not fixed - missing phase	0.00	0.00	0.00	0.00

Status	From Epoch	To Epoch	Duration
Not fixed	09/12/2021 10:25:42	09/12/2021 10:26:12	00:00:30
Fixed	09/12/2021 10:26:12	09/12/2021 14:35:12	04:09:00