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NLS GNSS SOFAMESA

GNSS Position Solution Analysis Software of the National Land Survey of Finland

Beta Version 0.2
2019-09-03

NLS repository: <https://github.com/nlsfi/nls-gnss-sofamesa>
Updated repository: <https://github.com/dmm809/nls-gnss-sofamesa>

Combination of the Measurement Reports

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Combination of the Measurement Reports	3
Statistics Behind the Figures	4
Combination of the Figures	6
The Number of Satellites (No Outliers Removed)	7
The DOP Values (No Outliers Removed)	8
The Reported HRMS and VRMS Values of the Receiver (No Outliers Removed)	9
The Solutions (No Outliers Removed)	10
KDE Plot for Outlier Recognition (PRECISION, INNER ACCURACY)	11
KDE Plot for the Distribution of Errors (PRECISION, INNER ACCURACY)	12
The PRECISION of the point (INNER accuracy) (m) HORIZONTAL	13
The PRECISION of the point (INNER accuracy) (m) NORTH	14
The PRECISION of the point (INNER accuracy) (m) EAST	15
The PRECISION of the point (INNER accuracy) (m) VERTICAL	16
The ACCURACY of the point (OUTER accuracy) (m) HORIZONTAL	17
The ACCURACY of the point (OUTER accuracy) (m) NORTH	18
The ACCURACY of the point (OUTER accuracy) (m) EAST	19
The ACCURACY of the point (OUTER accuracy) (m) VERTICAL	20
The Horizontal PRECISION of the point (INNER accuracy) (m) with DOP values	21
The 3D PRECISION of the point (INNER accuracy) (m) with DOP values	22
Conclusions	23

Combination of the Measurement Reports

Please find the combined measurement results, which NLS GNSS SOFAMESA produces, on the upcoming pages.

Statistics Behind the Figures

Parameter	METHOD-1	METHOD-2	METHOD-3	METHOD-4	METHOD-5
Total Number of Measurements (No Outliers Removed)	2000	2000	2031	1984	2001
Timespan (No Outliers Removed)	09:34:03 - 10:11:00	09:46:06 - 10:19:25	09:36:26 - 10:11:03	09:34:04 - 10:07:22	09:33:44 - 10:12:30
Solution Percentages (No Outliers Removed), Fixed; Float; Code Diff; Standalone; Other	89.1%; 7.4%; 0.0%; 3.5%; 0.0%	100.0%; 0.0%; 0.0%; 0.0%; 0.0%	94.1%; 5.9%; 0.0%; 0.0%; 0.0%	98.8%; 1.2%; 0.0%; 0.1%; -0.1%	99.6%; 0.4%; 0.0%; 0.0%; 0.0%
Number of All Satellites Mean (No Outliers Removed)	20.2	18.1	29.9	21.4	26.8
Number of All Satellites (No Outliers Removed), Min; Max	17; 32	15; 20	25; 33	18; 32	22; 30
Number of GPS Satellites Mean (No Outliers Removed)	8.3	7.9	8.3	6.0	8.2
Number of GLONASS Satellites Mean (No Outliers Removed)	5.7	5.7	7.2	6.1	6.2
Number of GALILEO Satellites Mean (No Outliers Removed)	6.0	4.4	5.8	5.4	5.9
Number of BEIDOU Satellites Mean (No Outliers Removed)	0.3	0.0	8.5	4.0	6.4
Mean of HDOP Values (No Outliers Removed)	0.6	0.7	0.5	0.7	0.6
Mean of VDOP Values (No Outliers Removed)	1.1	1.3	1.0	1.2	1.1
Mean of PDOP Values (No Outliers Removed)	1.3	1.5	0.9	1.4	1.2
Mean of TDOP Values (No Outliers Removed)	nan	nan	nan	nan	nan
Mean of GDOP Values (No Outliers Removed)	1.5	1.7	1.2	1.6	1.4
User-Defined Tolerance Values, North (m) and East (m); Height (m)	0.1; 0.2	0.1; 0.2	0.1; 0.2	0.1; 0.2	0.1; 0.2
FIXED Measurements Above Tolerances	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	79 (3.97%)
Number of FIXED and inside tolerances / all measurements	1782 / 2000 (89%)	2000 / 2000 (100%)	1911 / 2031 (94%)	1960 / 1984 (99%)	1913 / 2001 (96%)
Timespan (Outliers Removed)	09:34:03 - 10:11:00	09:46:06 - 10:19:25	09:36:26 - 10:11:03	09:34:04 - 10:07:22	09:33:44 - 10:12:30
Number of All Satellites Mean (Outliers Removed)	19.8	18.1	30.0	21.4	26.8
Number of All Satellites (Outliers Removed), Min; Max	17.0; 22.0	15.0; 20.0	26.0; 33.0	18.0; 24.0	22.0; 30.0
Number of GPS Satellites Mean (Outliers Removed)	8.2	7.9	8.3	6.0	8.2
Number of GLONASS Satellites Mean (Outliers Removed)	5.6	5.7	7.3	6.1	6.2
Number of GALILEO Satellites Mean (Outliers Removed)	6.0	4.4	5.8	5.3	5.9
Number of BEIDOU Satellites Mean (Outliers Removed)	0.0	0.0	8.6	4.0	6.5
Mean of HDOP Values (Outliers Removed)	0.6	0.7	0.5	0.7	0.6
Mean of VDOP Values (Outliers Removed)	1.2	1.3	1.0	1.2	1.1
Mean of PDOP Values (Outliers Removed)	1.3	1.5	0.9	1.4	1.2
Mean of TDOP Values (Outliers Removed)	nan	nan	nan	nan	nan
Mean of GDOP Values (Outliers Removed)	1.5	1.7	1.2	1.6	1.4

Parameter	METHOD-1: P*	METHOD-1: A**	METHOD-2: P*	METHOD-2: A**	METHOD-3: P*	METHOD-3: A**	METHOD-4: P*	METHOD-4: A**	METHOD-5: P*	METHOD-5: A**
Horizontal RMSE*** (m)	0.024	0.036	0.025	0.025	0.022	0.041	0.023	0.028	0.029	0.068
Vertical RMSE**** (m)	0.056	0.069	0.038	0.093	0.045	0.093	0.047	0.064	0.067	0.111
Horizontal 2dRMSE*** (m)	0.047	0.071	0.05	0.051	0.044	0.081	0.046	0.056	0.057	0.136
Vertical 2dRMSE**** (m)	0.111	0.137	0.076	0.187	0.09	0.186	0.094	0.127	0.134	0.222
North Coordinate Std (m)	0.0174		0.0168		0.0113		0.0187		0.0206	
East Coordinate Std (m)	0.0161		0.0182		0.0187		0.0134		0.0199	
Height Std (m)	0.0557		0.0379		0.0451		0.0469		0.0669	
North Coordinate Mean (m)	7581216.7139		7581216.6976		7581216.6747		7581216.7009		7581216.6536	
East Coordinate Mean (m)	454139.458		454139.4414		454139.4601		454139.4523		454139.3942	
Height Mean (m)	264.7613		264.8064		264.8025		264.7642		264.8094	
North Coordinate Median (m)	7581216.712		7581216.696		7581216.676		7581216.703		7581216.653	
East Coordinate Median (m)	454139.458		454139.444		454139.458		454139.453		454139.396	
Height Median (m)	264.766		264.811		264.8001		264.752		264.819	
Sample size	1782.0	1782	2000.0	2000	1911.0	1911	1960.0	1960	1913.0	1913

* The precision of the measurements = inner accuracy.

** The accuracy of the measurements = outer accuracy.

*** Horizontal RMSE is 63-68% of the measurements and it depends on the shape of the distribution. Horizontal 2dRMSE is 95-98% of the measurements and it also depends on the shape of the distribution.

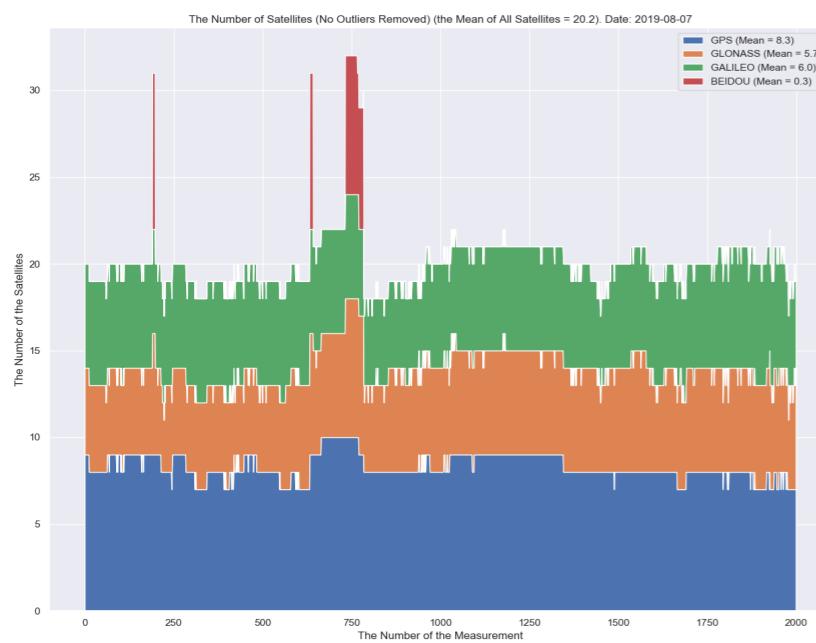
**** Vertical RMSE is 63-68% of the measurements and it depends on the shape of the distribution. Vertical 2dRMSE is 95-98% of the measurements and it also depends on the shape of the distribution.

Combination of the Figures

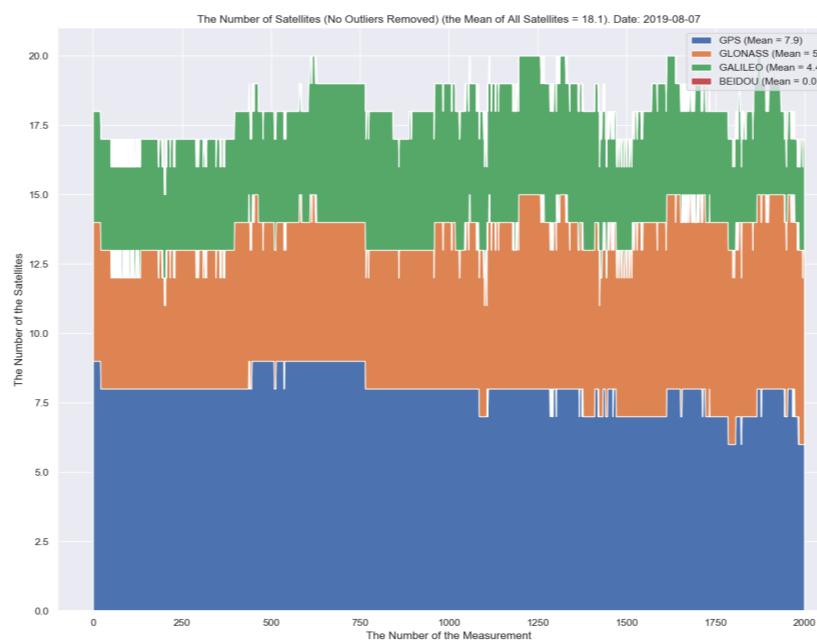
Please find the combined figures of the measurement results, which NLS GNSS SOFAMESA produces, on the upcoming pages.

The Number of Satellites (No Outliers Removed)

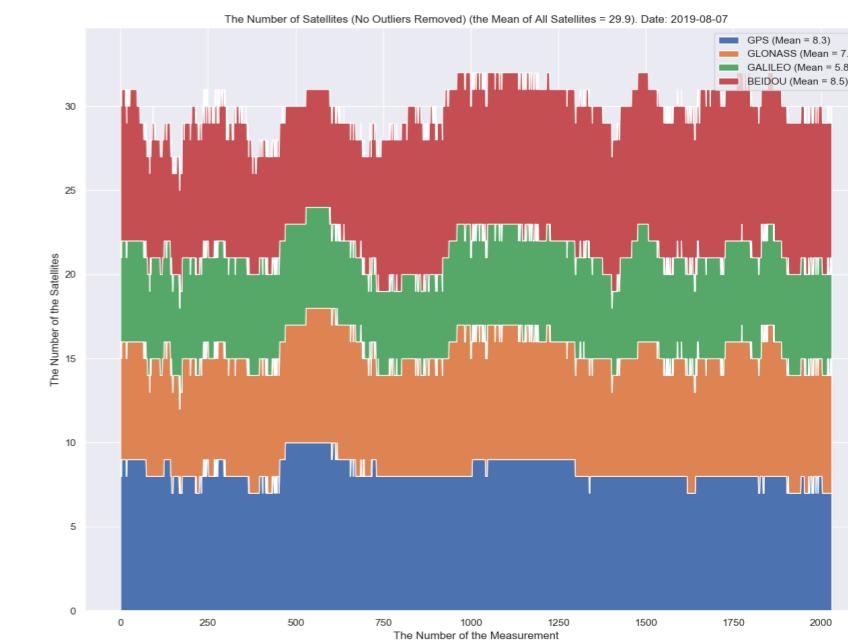
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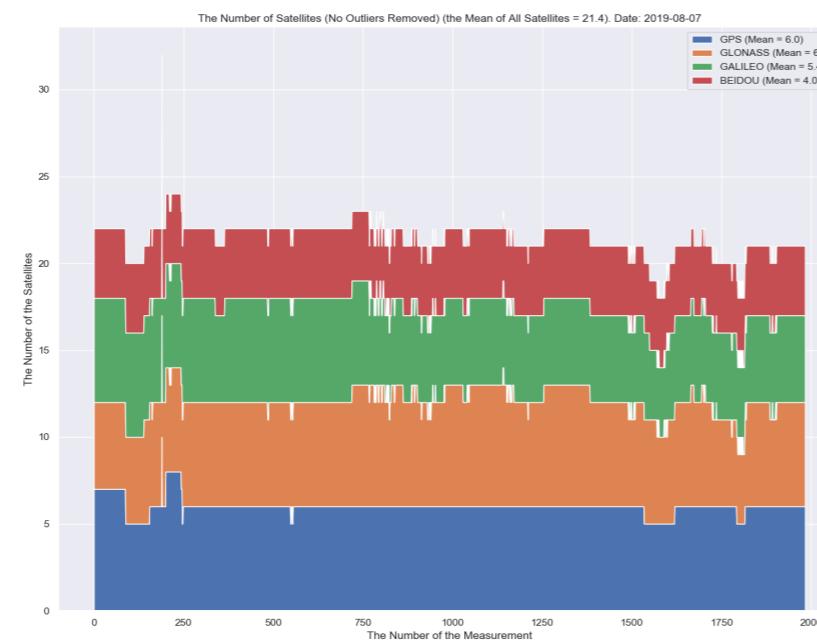
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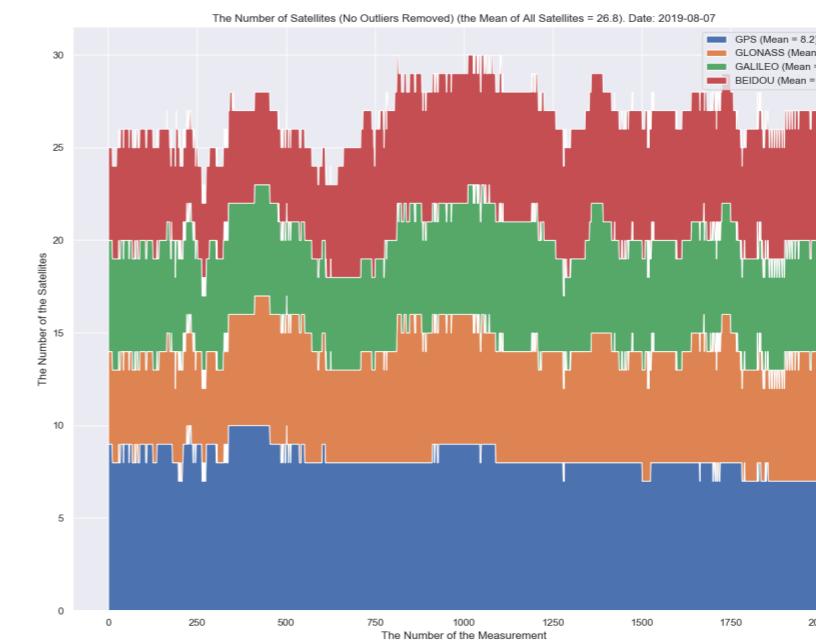
METHOD-3



METHOD-4

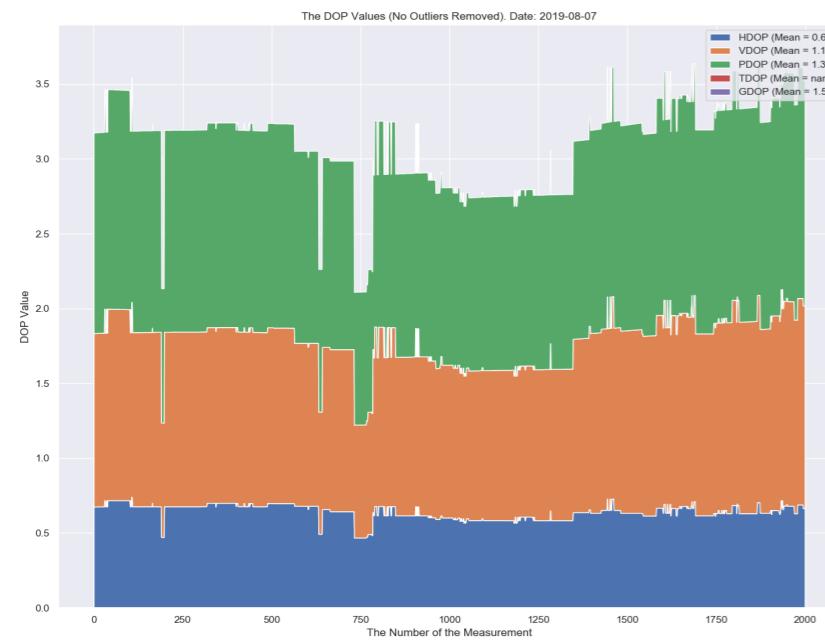


METHOD-5

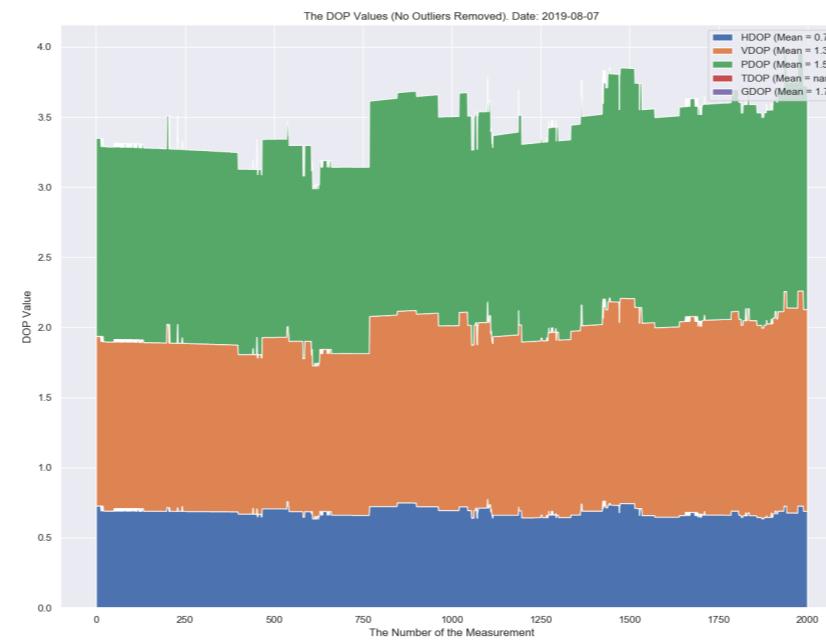


The DOP Values (No Outliers Removed)

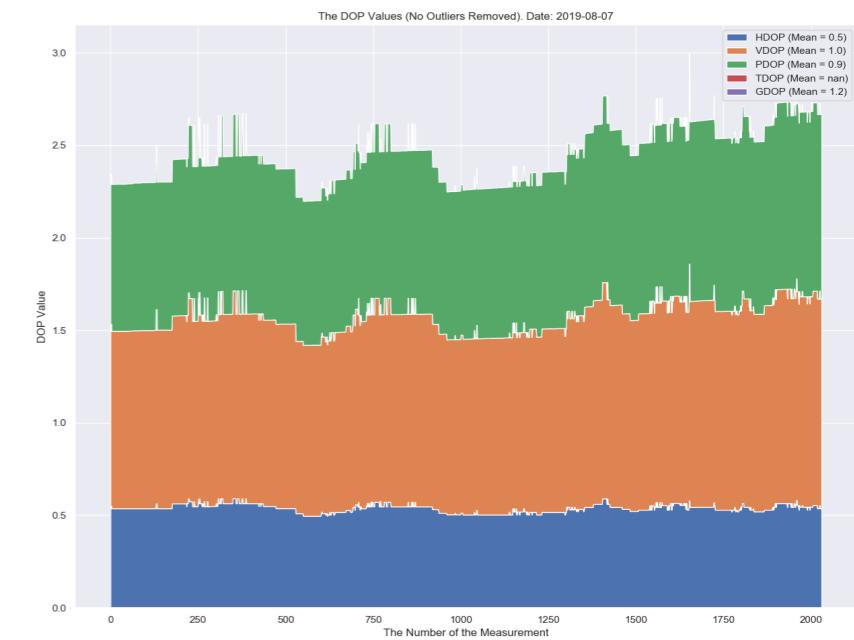
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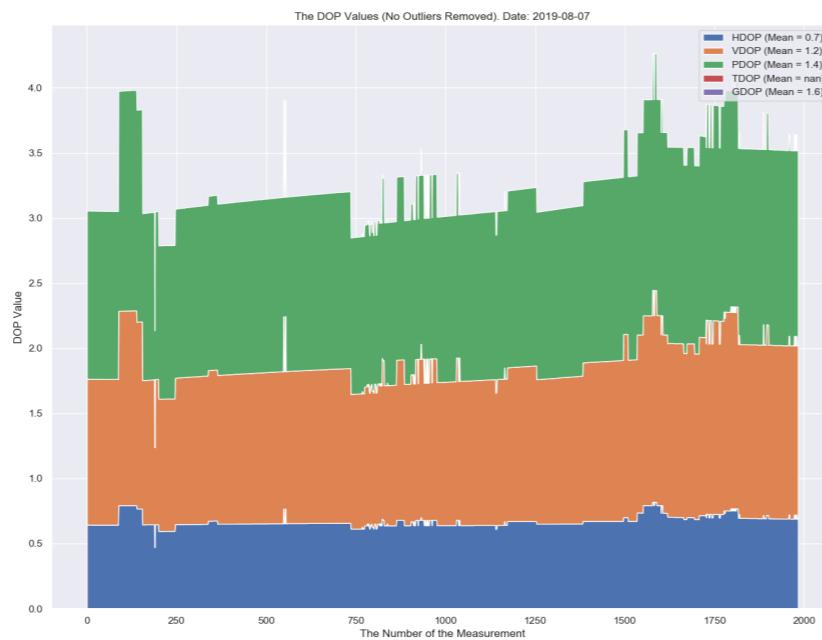
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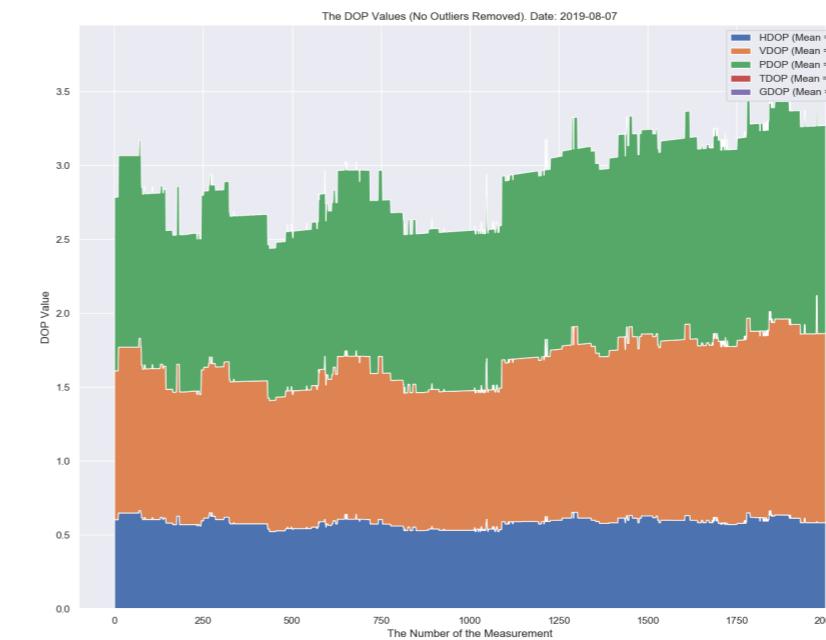
METHOD-3



METHOD-4

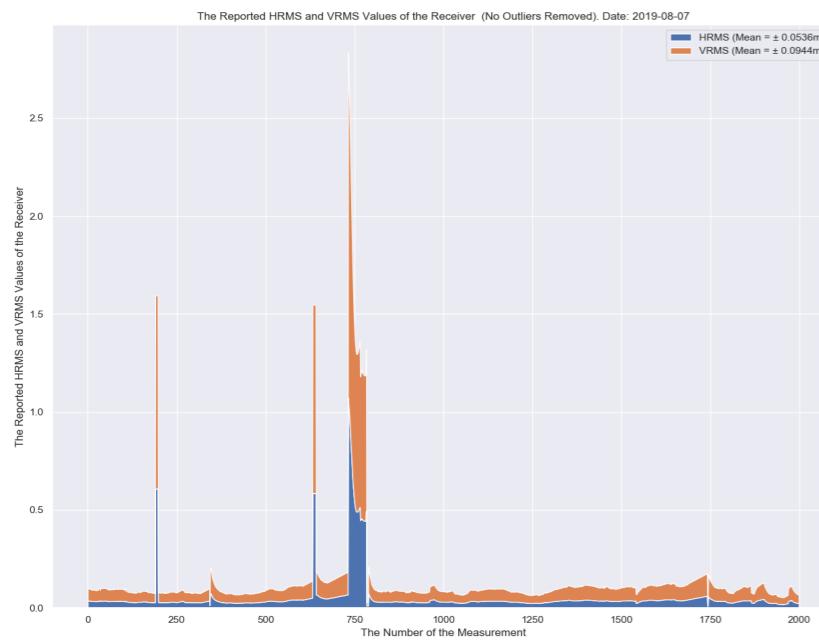


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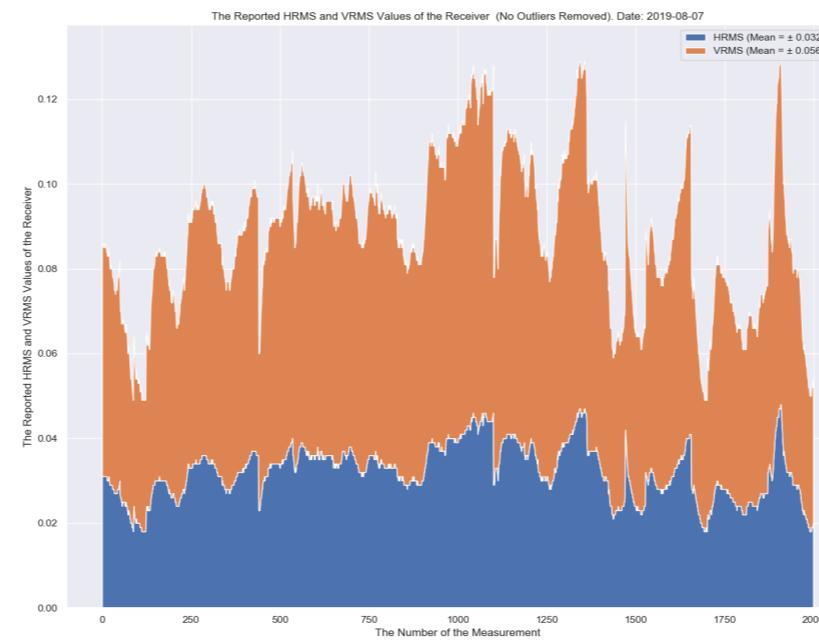


The Reported HRMS and VRMS Values of the Receiver (No Outliers Removed)

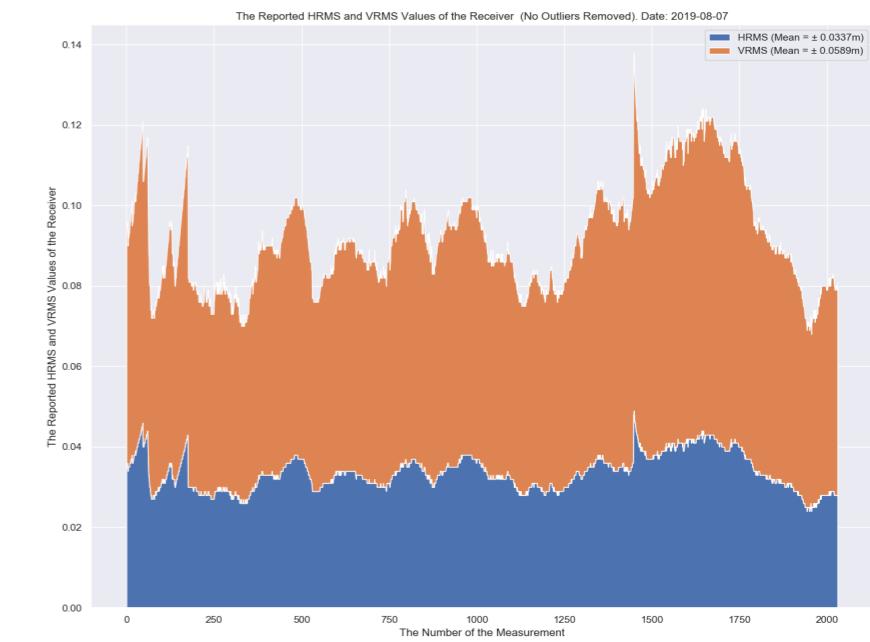
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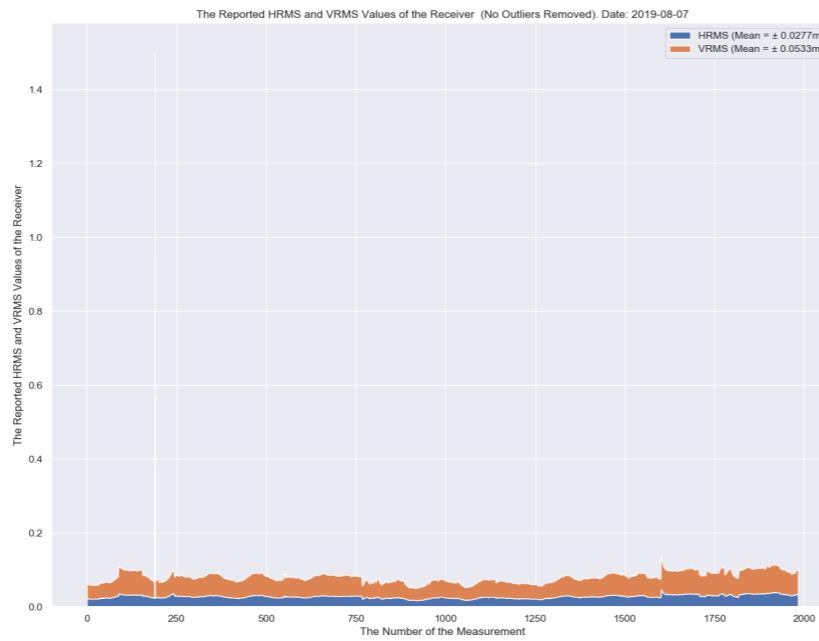
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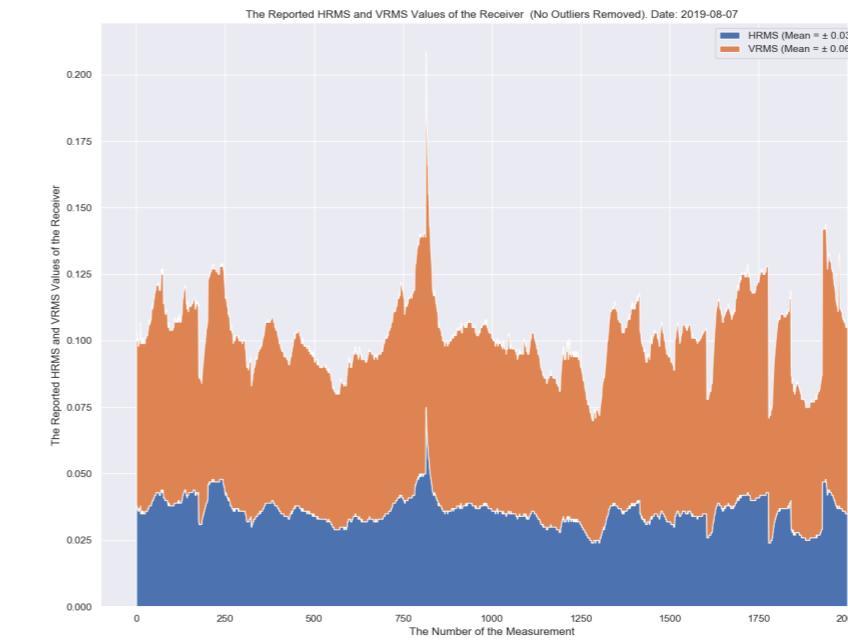
METHOD-3



METHOD-4

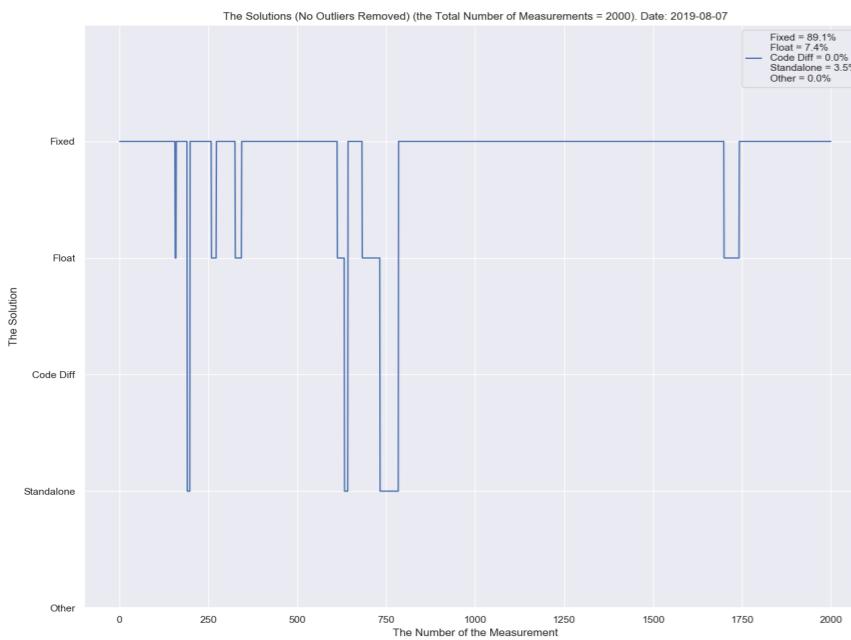


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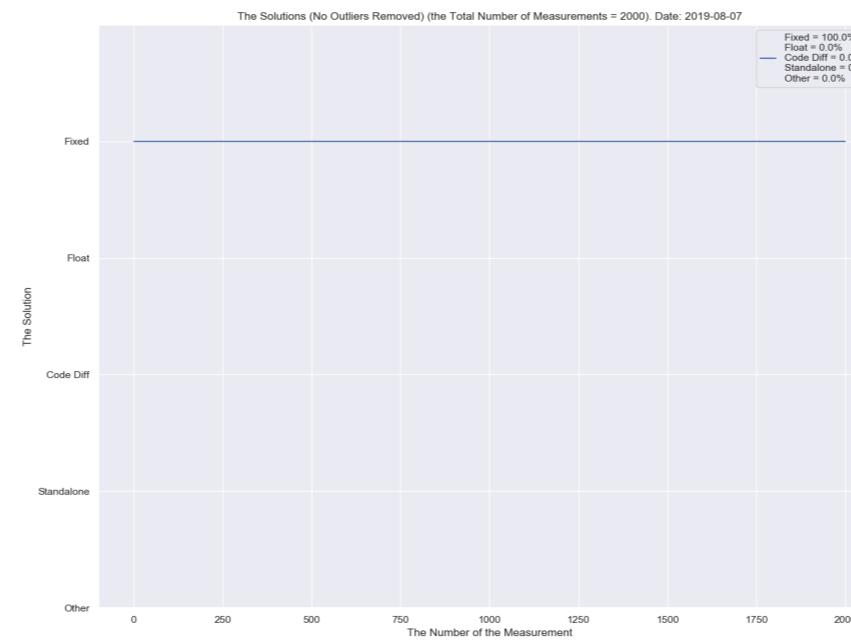


The Solutions (No Outliers Removed)

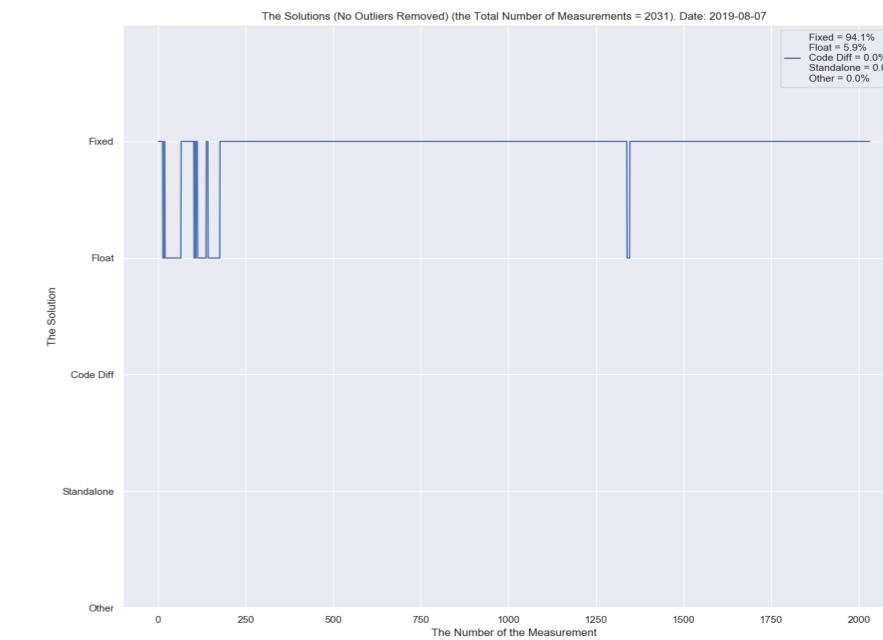
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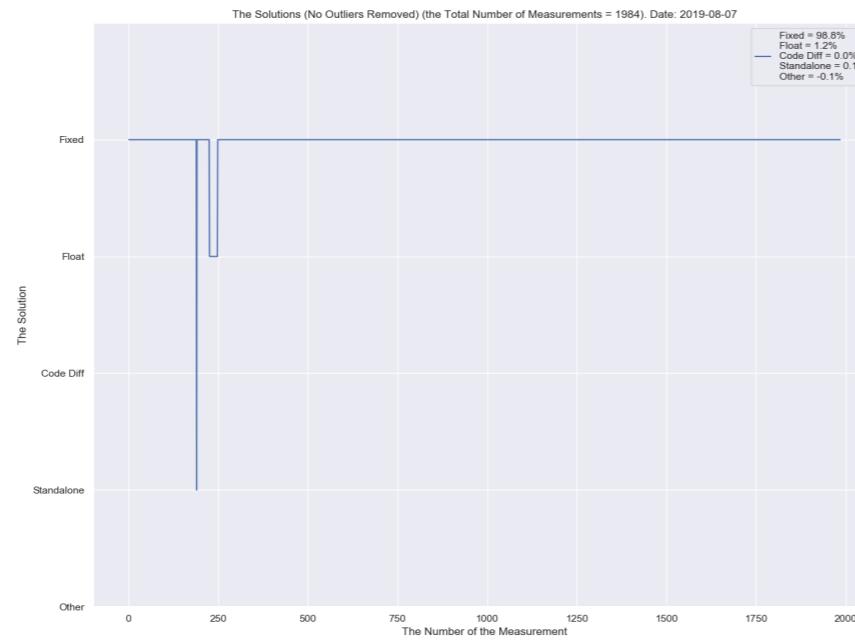
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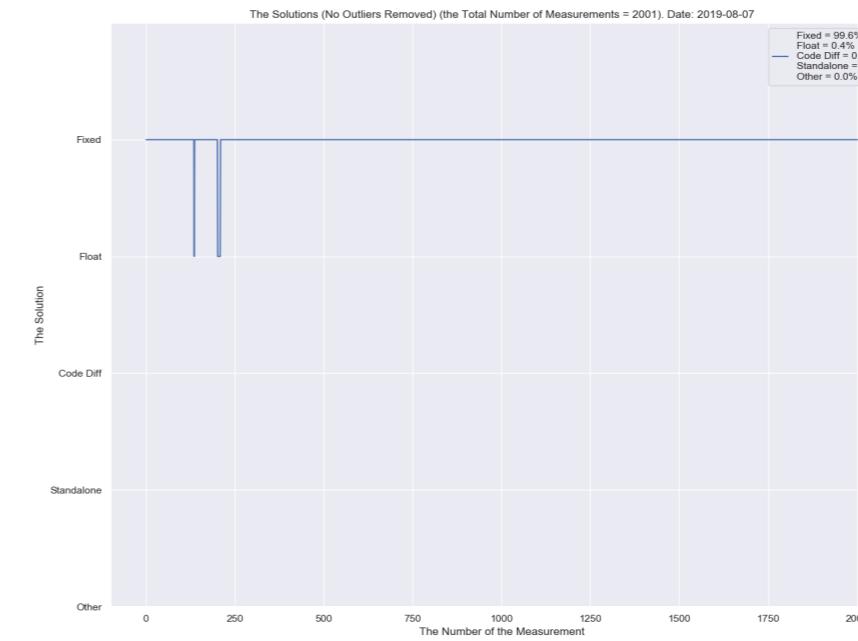
METHOD-3



METHOD-4

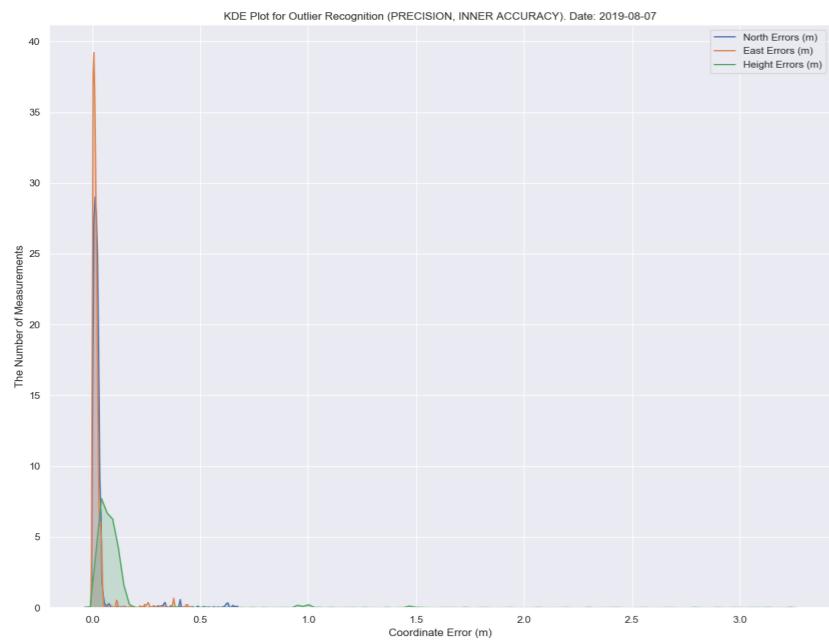


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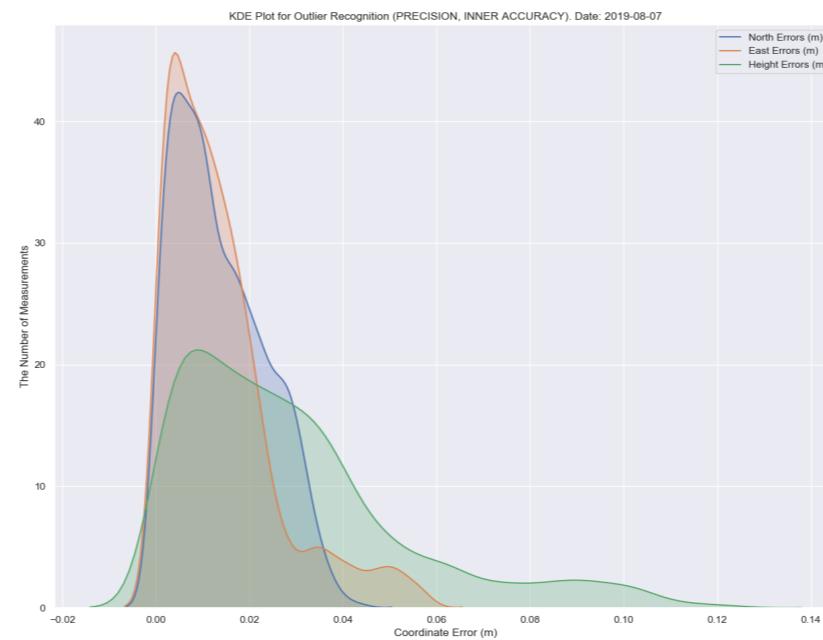


KDE Plot for Outlier Recognition (PRECISION, INNER ACCURACY)

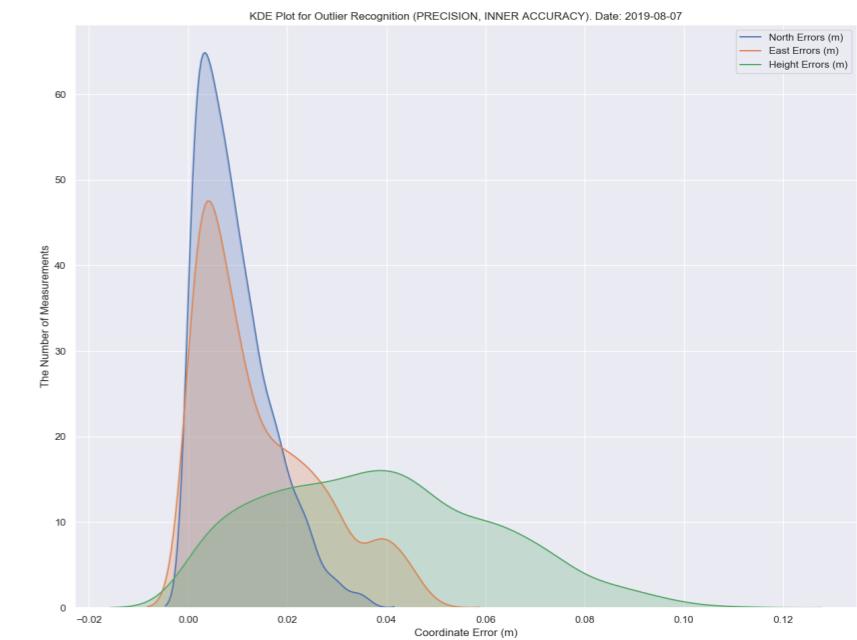
METHOD-1



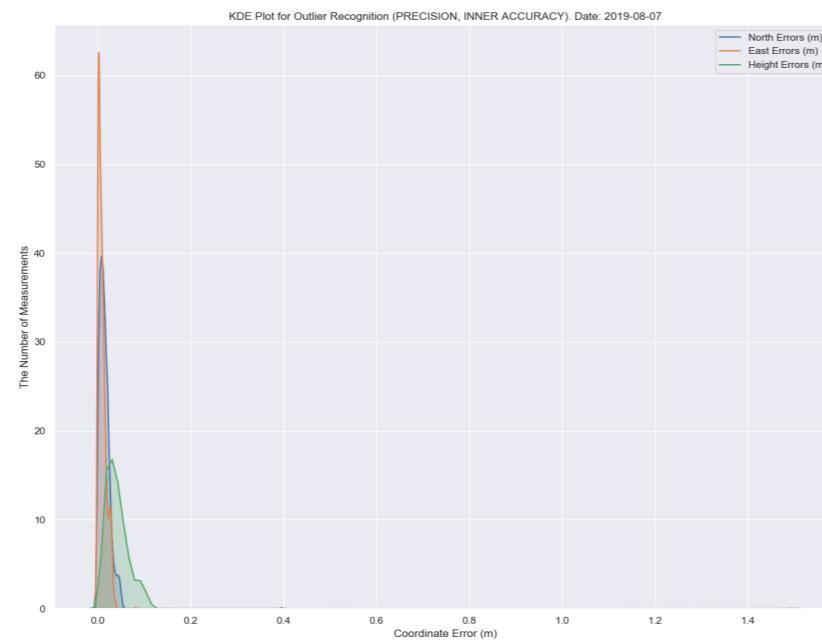
METHOD-2



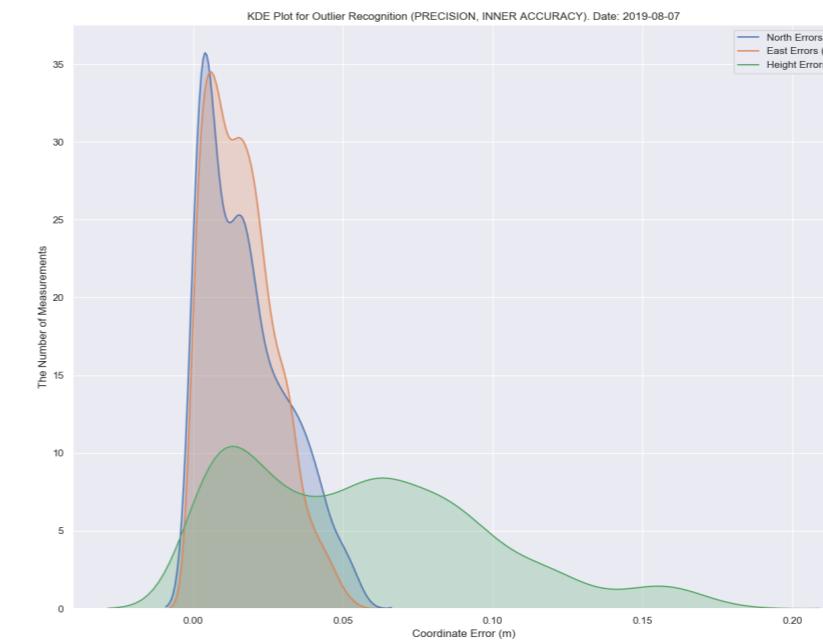
METHOD-3



METHOD-4

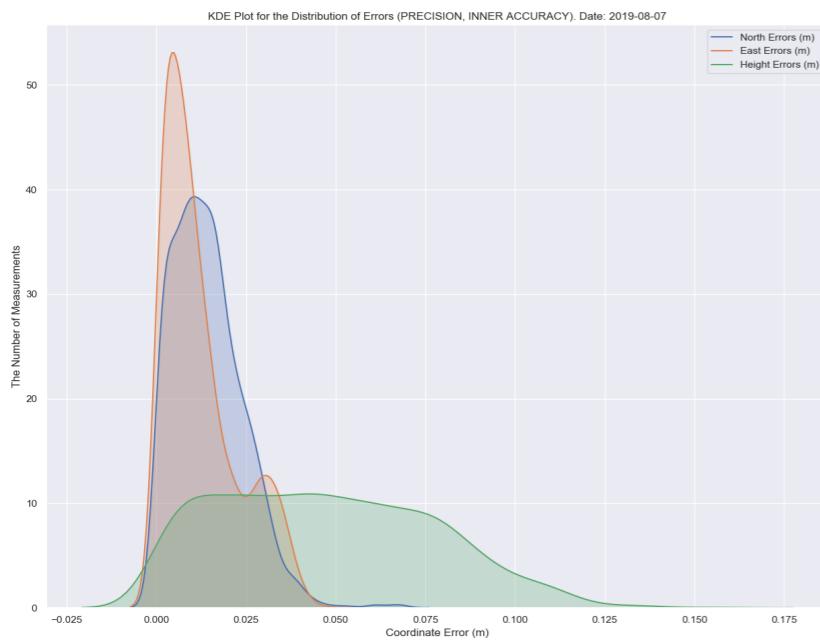


METHOD-5

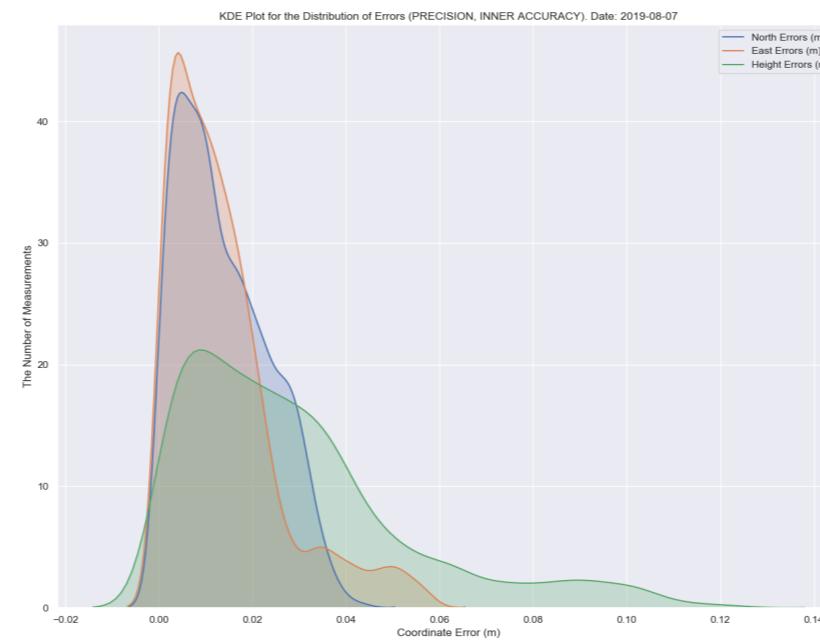


KDE Plot for the Distribution of Errors (PRECISION, INNER ACCURACY)

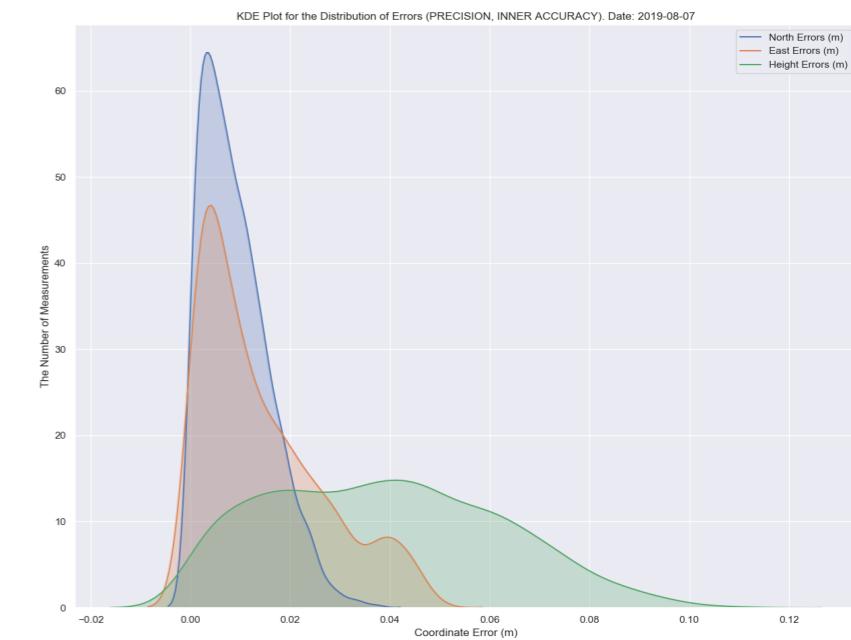
METHOD-1



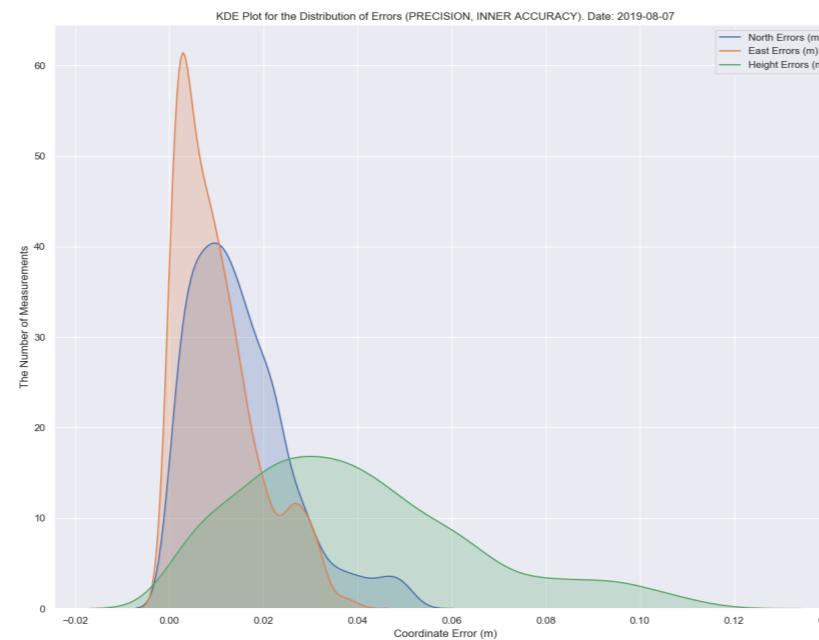
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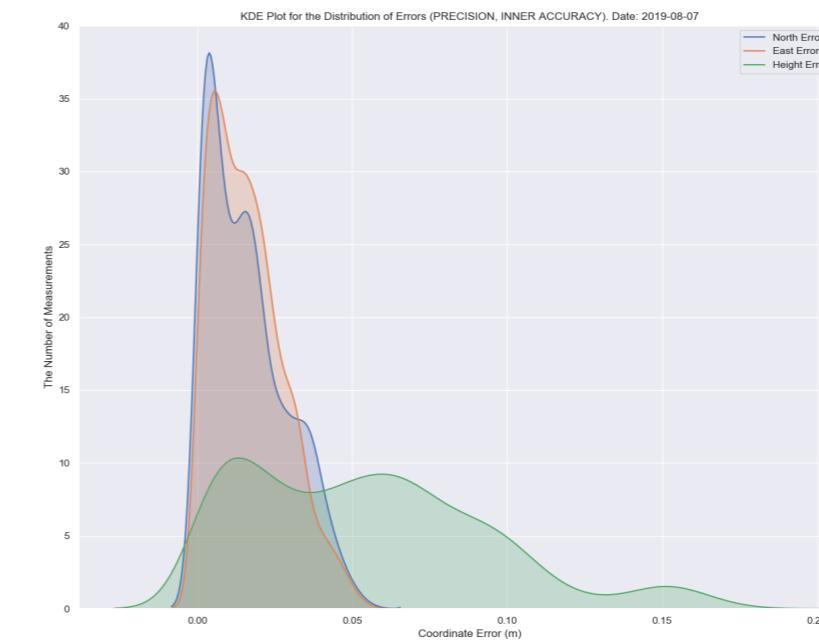
METHOD-3



METHOD-4



METHOD-5



The PRECISION of the point (INNER accuracy) (m) HORIZONTAL

METHOD-1



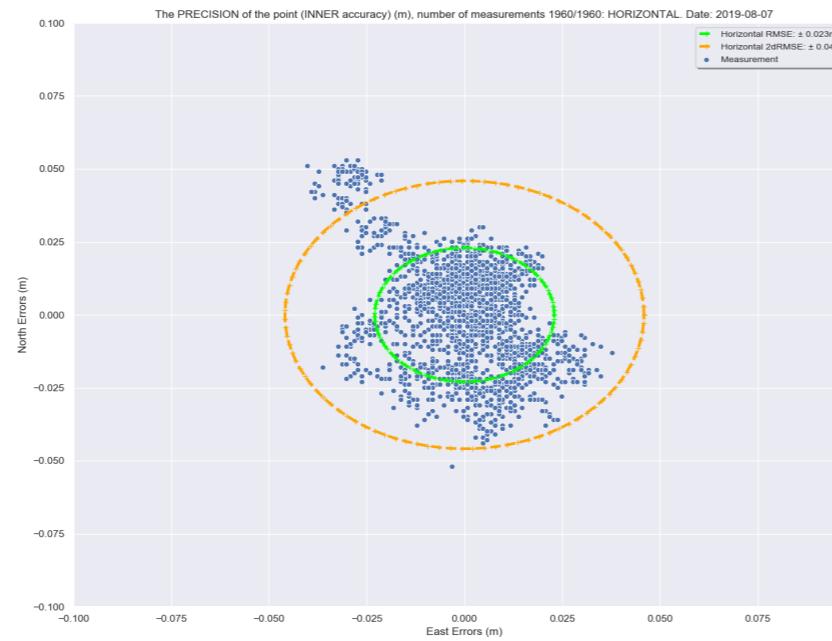
METHOD-2



METHOD-3



METHOD-4



METHOD-5



The PRECISION of the point (INNER accuracy) (m) NORTH

METHOD-1



METHOD-2



METHOD-3



METHOD-4



METHOD-5



The PRECISION of the point (INNER accuracy) (m) EAST

METHOD-1



METHOD-2



METHOD-3



METHOD-4



METHOD-5



The PRECISION of the point (INNER accuracy) (m) VERTICAL

METHOD-1



METHOD-2



METHOD-3



METHOD-4



METHOD-5



The ACCURACY of the point (OUTER accuracy) (m) HORIZONTAL

METHOD-1



METHOD-2



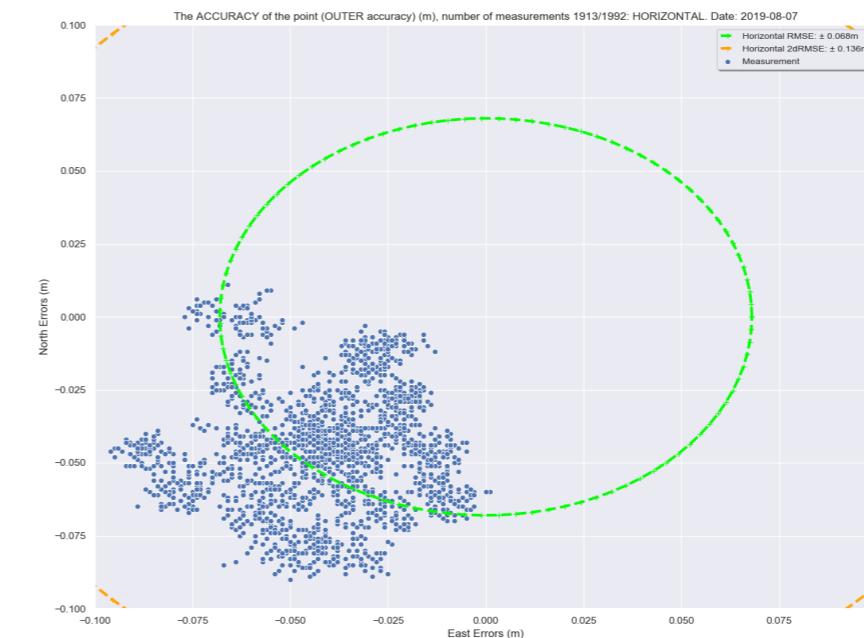
METHOD-3



METHOD-4

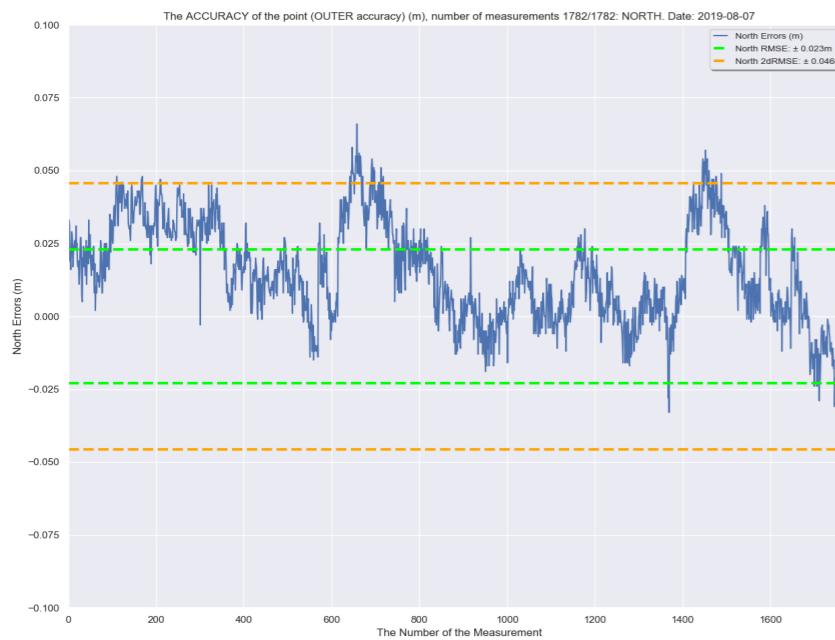


METHOD-5



The ACCURACY of the point (OUTER accuracy) (m) NORTH

METHOD-1



METHOD-2



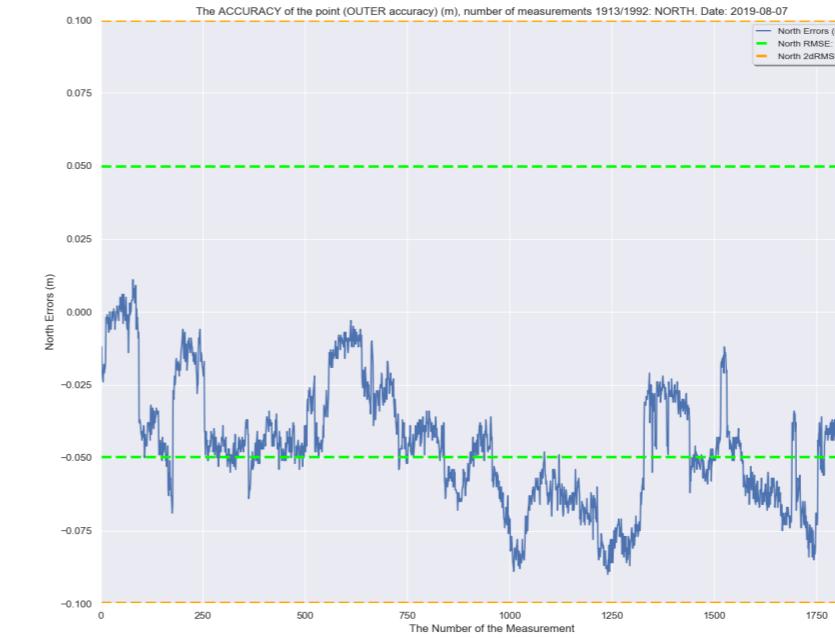
METHOD-3



METHOD-4



METHOD-5



The ACCURACY of the point (OUTER accuracy) (m) EAST

METHOD-1



METHOD-2



METHOD-3



METHOD-4



METHOD-5



The ACCURACY of the point (OUTER accuracy) (m) VERTICAL

METHOD-1



METHOD-2



METHOD-3



METHOD-4

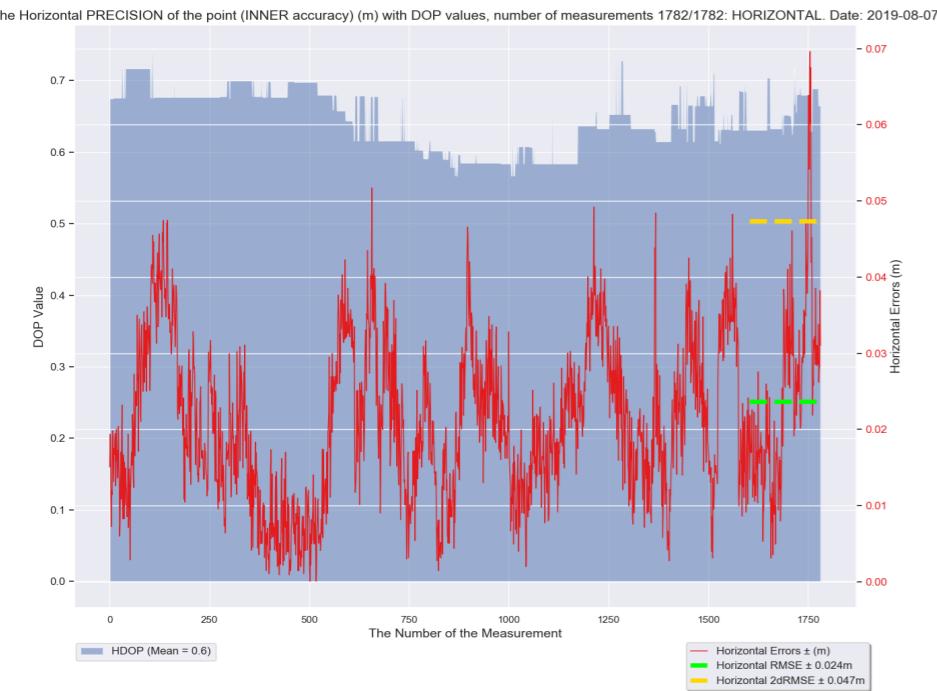


METHOD-5

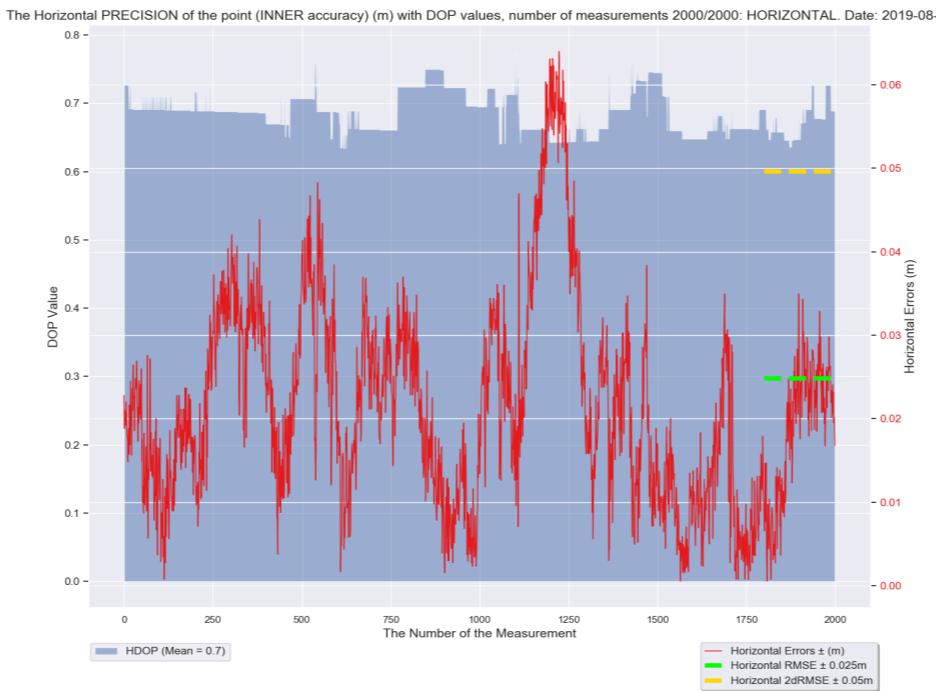


The Horizontal PRECISION of the point (INNER accuracy) (m) with DOP values

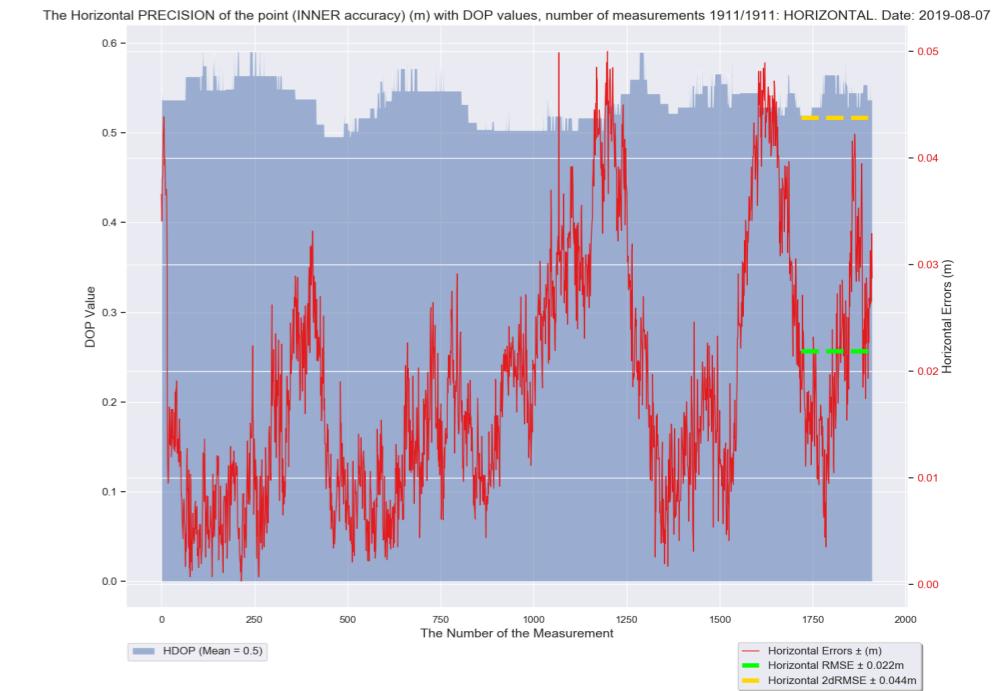
METHOD-1



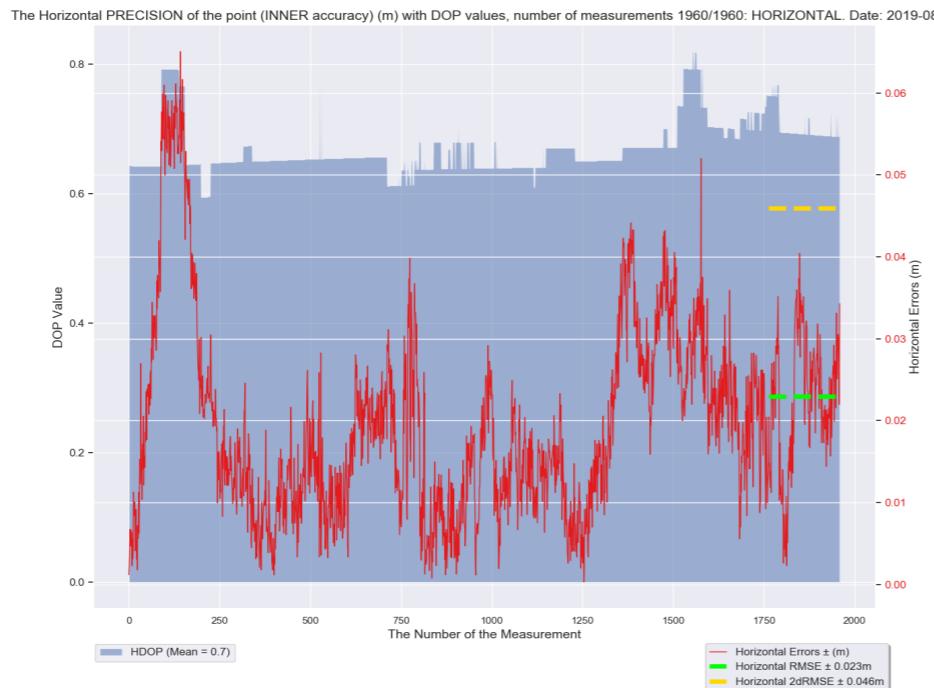
METHOD-2



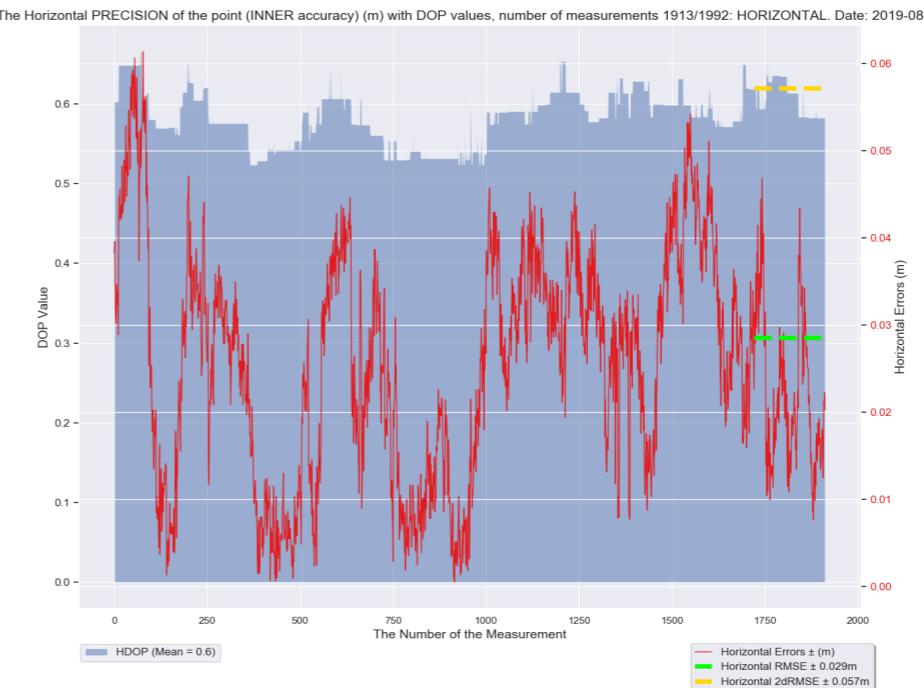
METHOD-3



METHOD-4

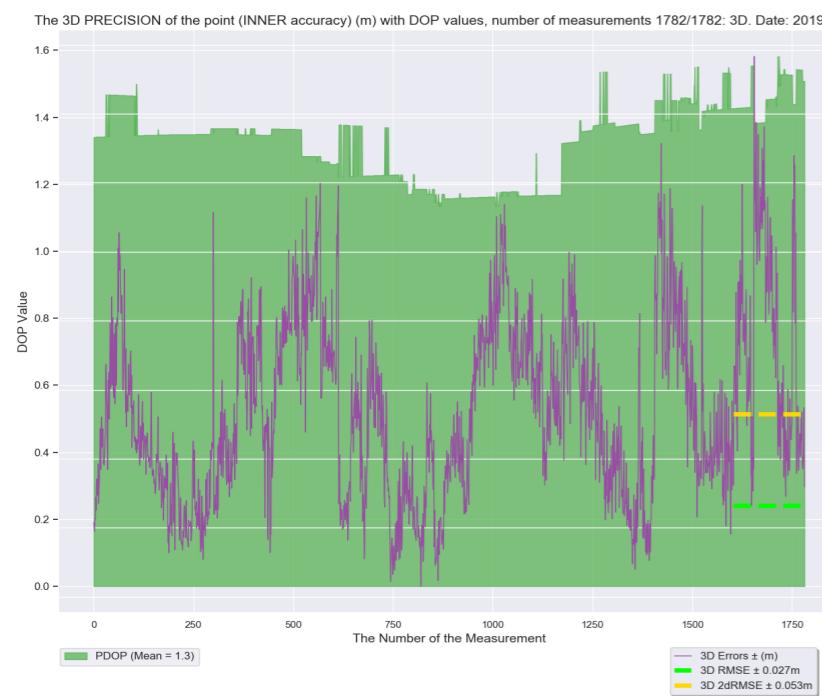


METHOD-5

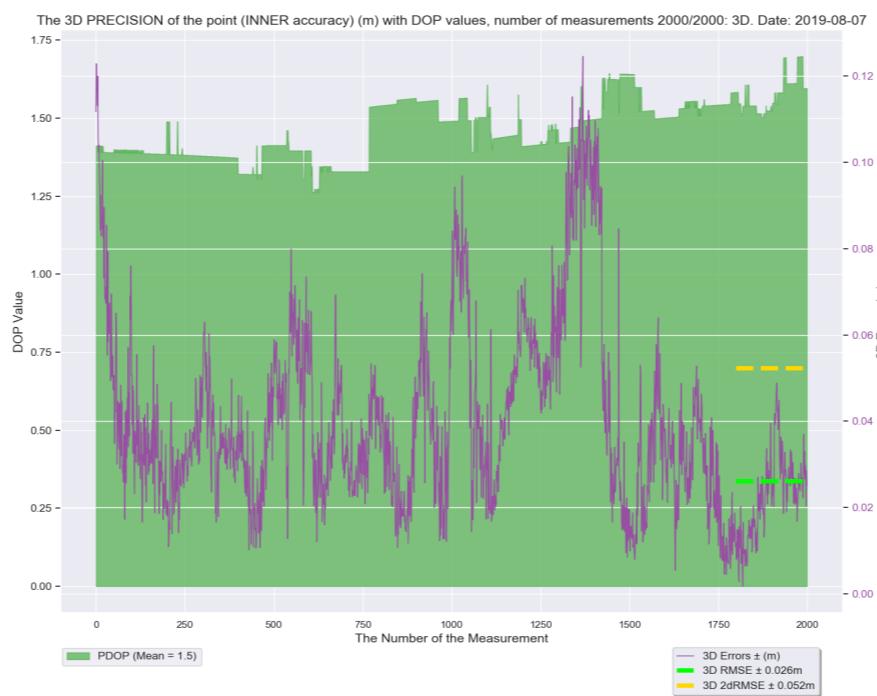


The 3D PRECISION of the point (INNER accuracy) (m) with DOP values

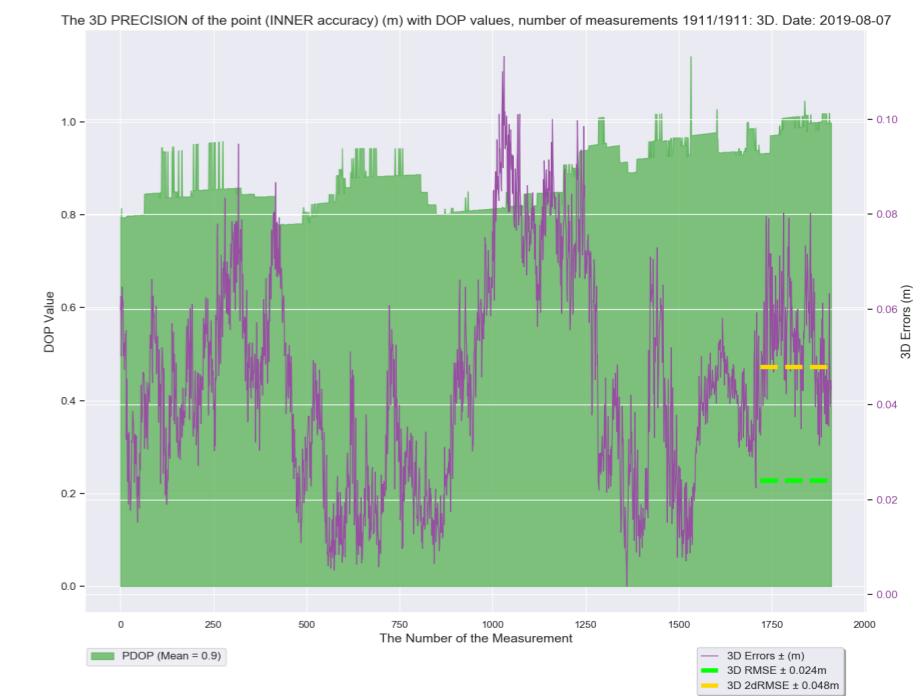
METHOD-1



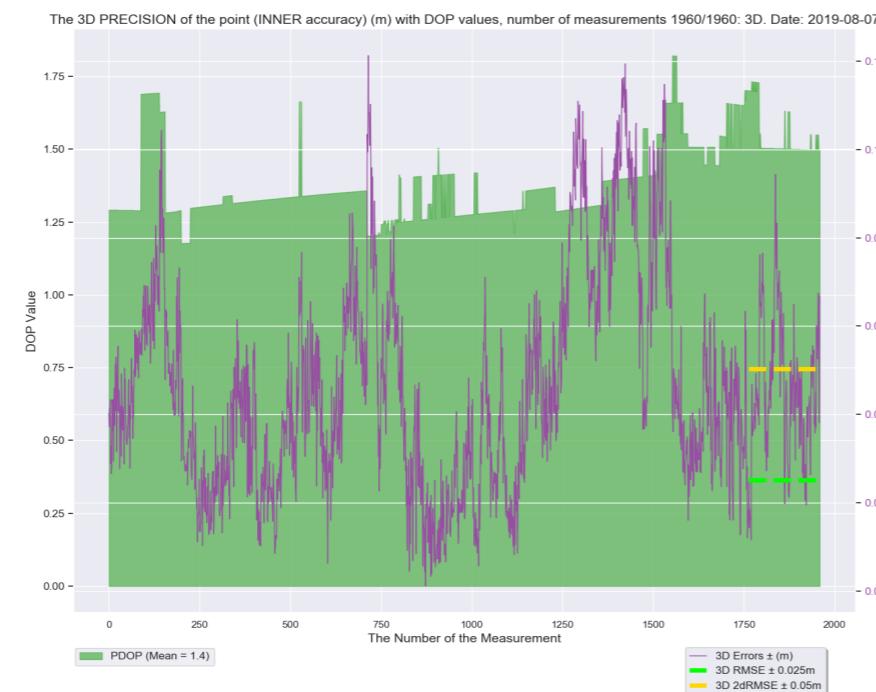
METHOD-2



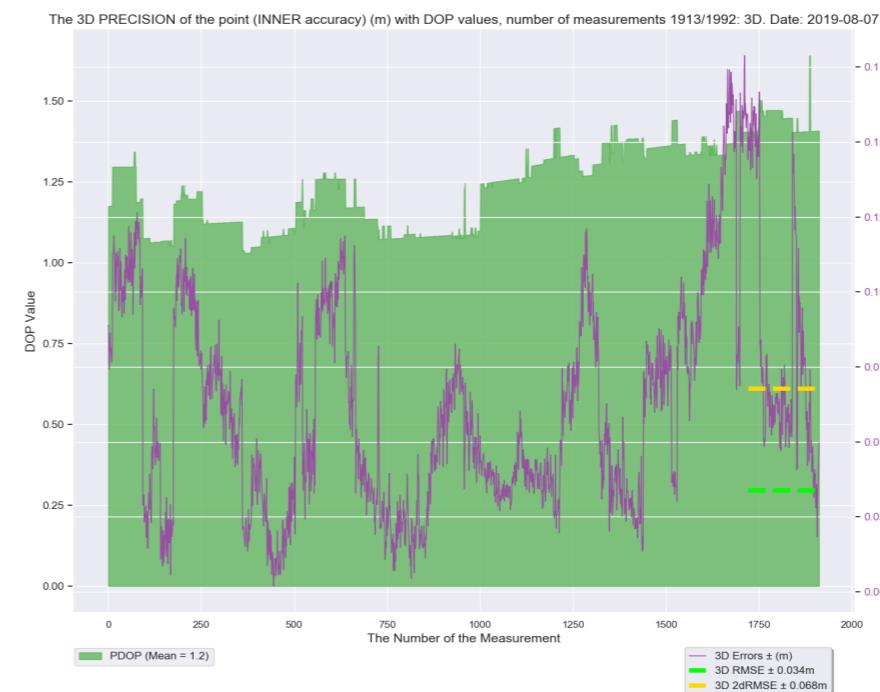
METHOD-3



METHOD-4



METHOD-5



Conclusions

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NLS repository: <https://github.com/nlsfi/nls-gnss-sofamesa>
Updated repository: <https://github.com/dmm809/nls-gnss-sofamesa>

