Reference Frame Coordination

EUREF Analysis Centres Workshop
October 16-17, 2019, Warsaw, Poland

J. Legrand, C.Bruyninx
Royal Observatory of Belgium

ROYAL OBSERVATORY OF BELGIUM

EUREF GB81, Warsaw, 16-17 October, 2019

Summary

- Station Classification
- Tool for Selecting Reference Stations

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Station Classification

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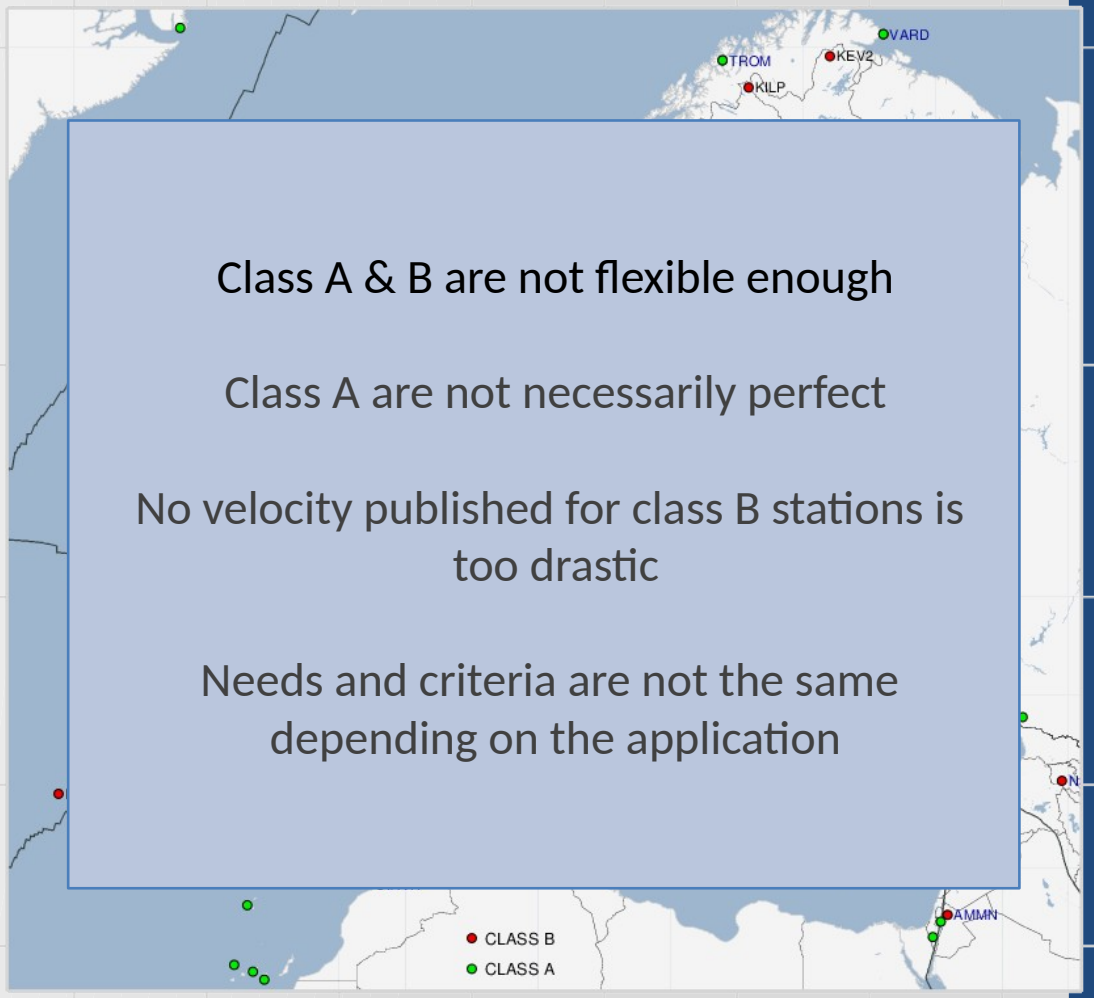
EPN multi-year solution: reference solution in Europe

Class A
Suitable as reference station
for ETRS89 densifications
Positions at the 1 cm precision at all epochs
and velocities at the 1 mm/yr precision
Positions & Velocities are published

Class B
Not suitable as reference station
for ETRS89 densifications
Positions have a 1 cm precision
at the epoch of minimal variance
Positions at epoch of minimal variance are published
Velocities are not published



Class A & B are not flexible enough

Class A are not necessarily perfect

No velocity published for class B stations is too drastic

Needs and criteria are not the same depending on the application

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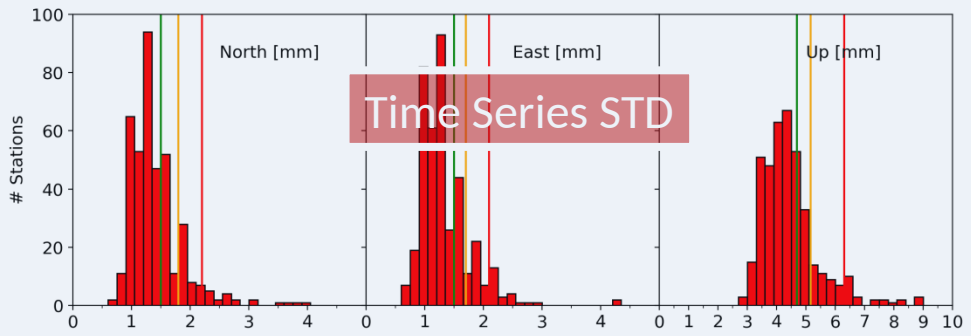
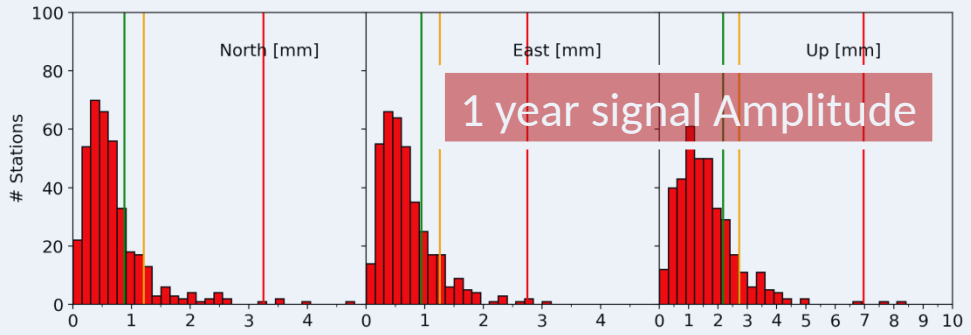
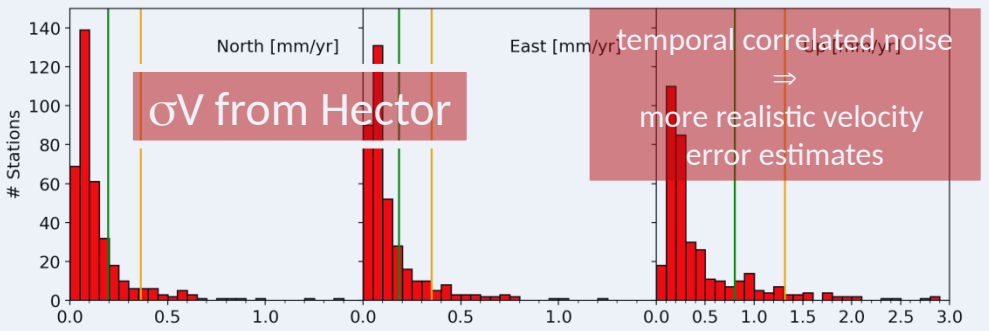
Criteria used

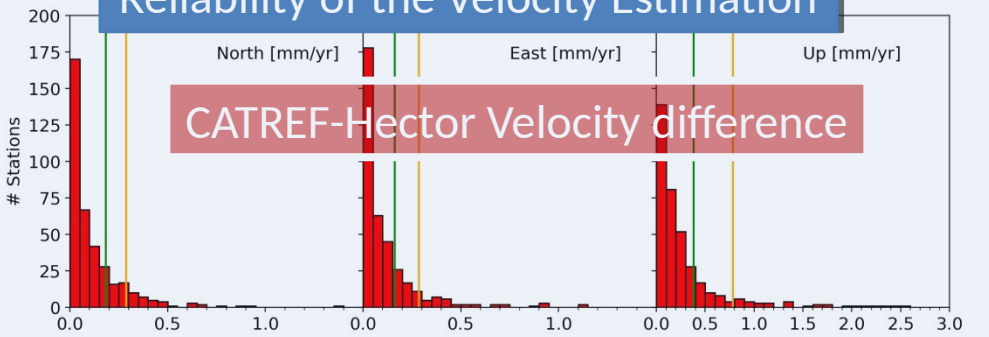
Position Time Series Scattering & Signals



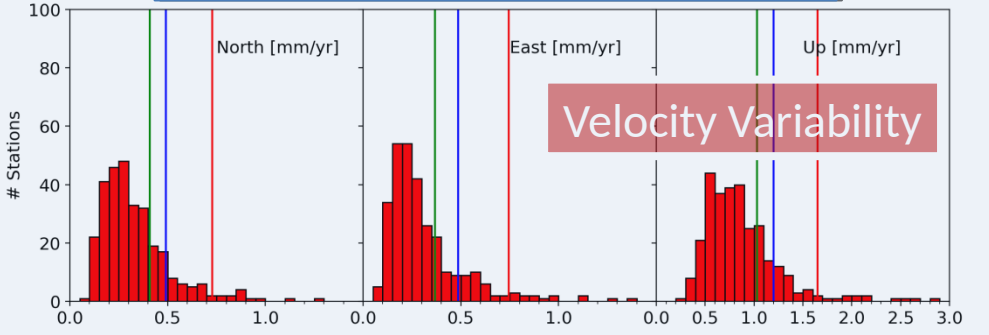




Reliability of the Velocity Estimation



Stability of the Station Over Time



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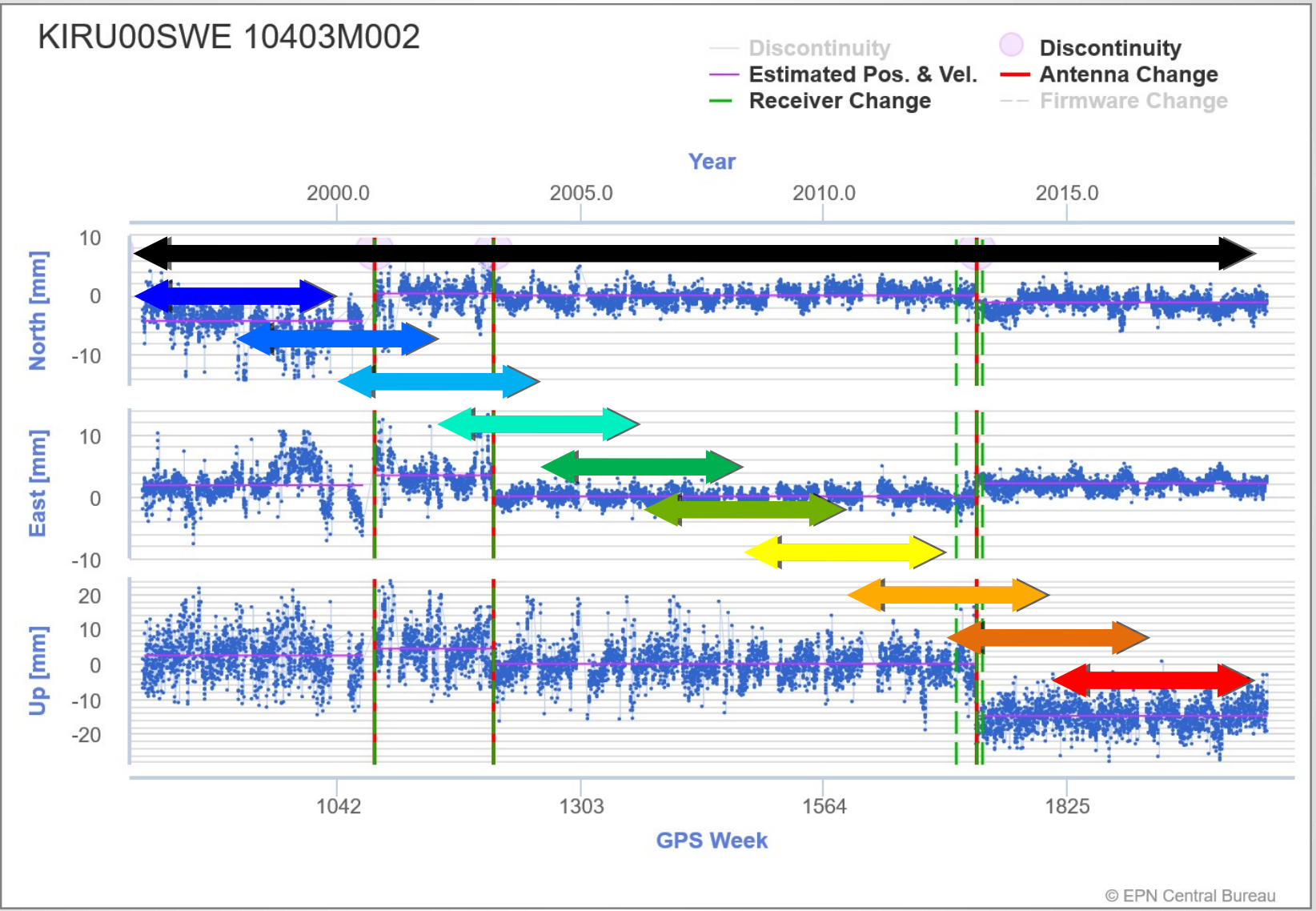
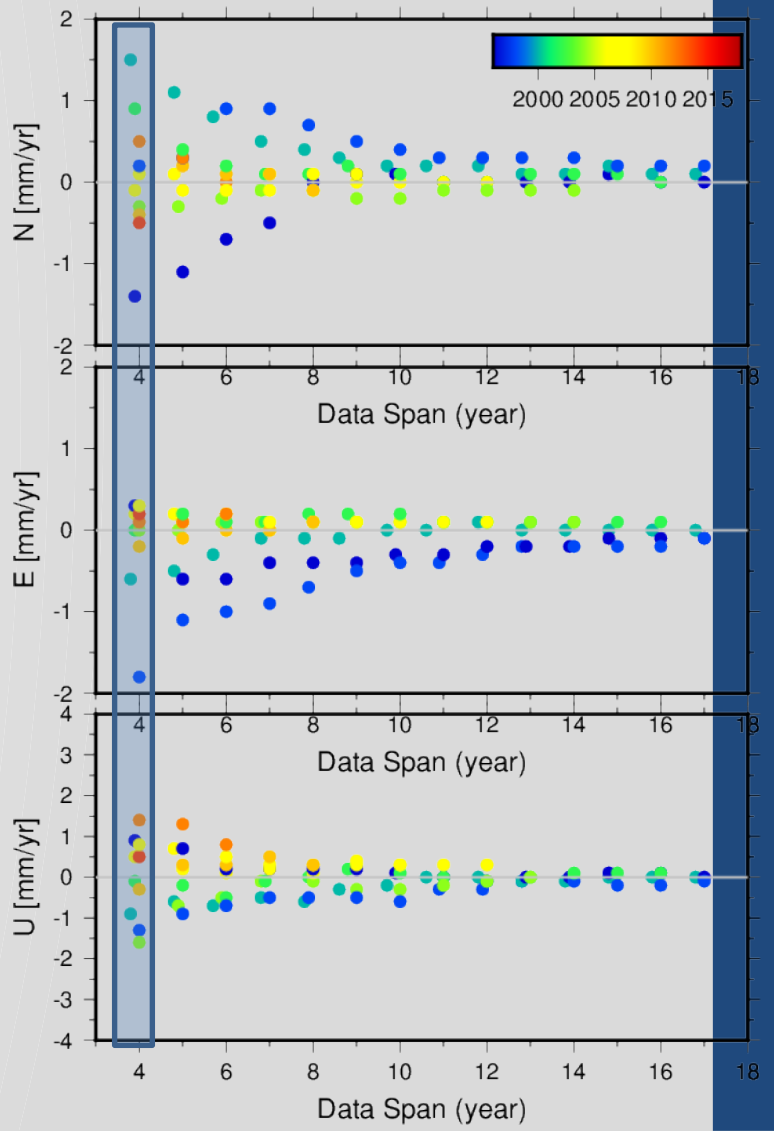
Velocity Variability

Input time series: position time series with jumps and trends





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Velocity Variability

Input time series: position time series with jumps and trends

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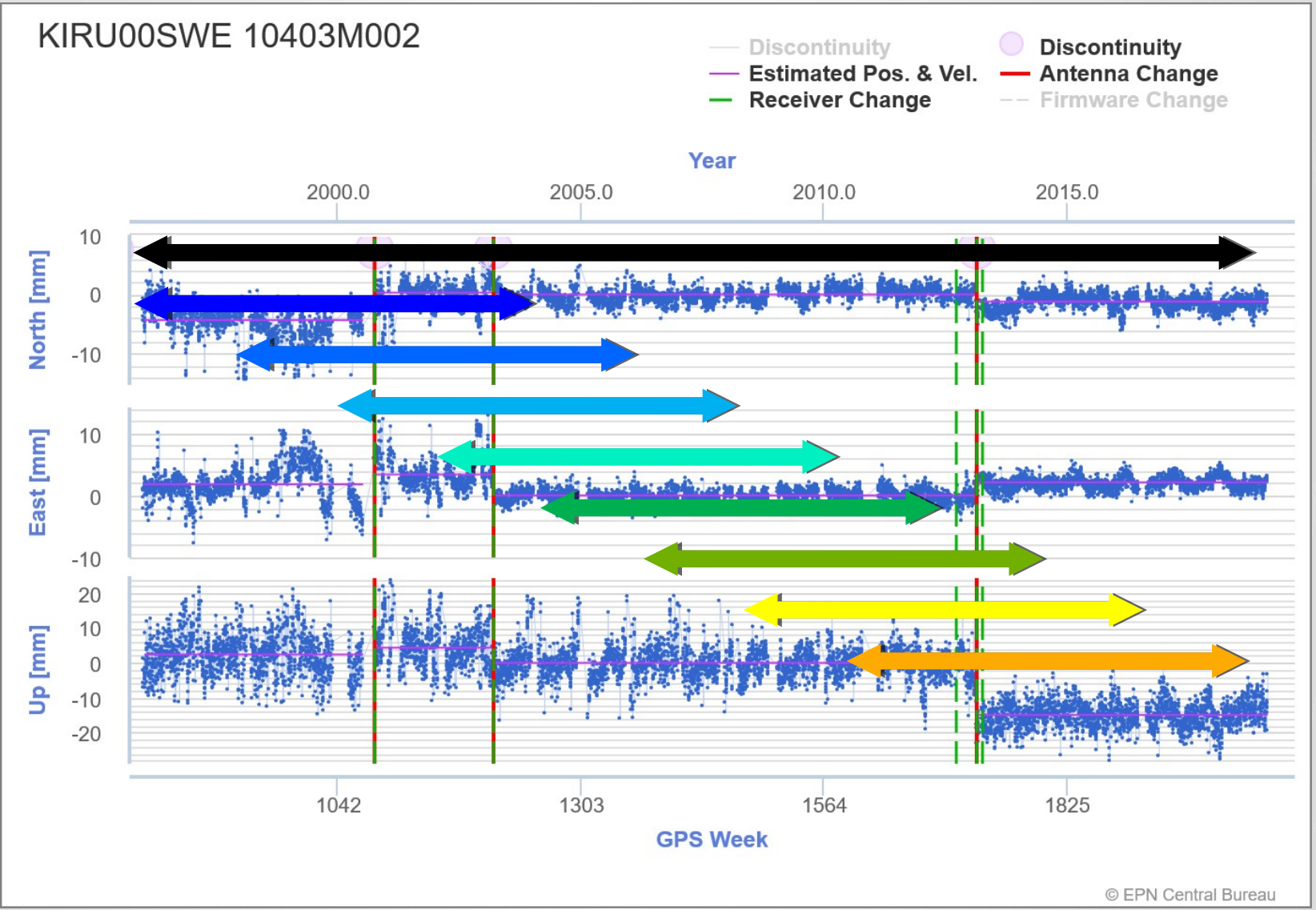

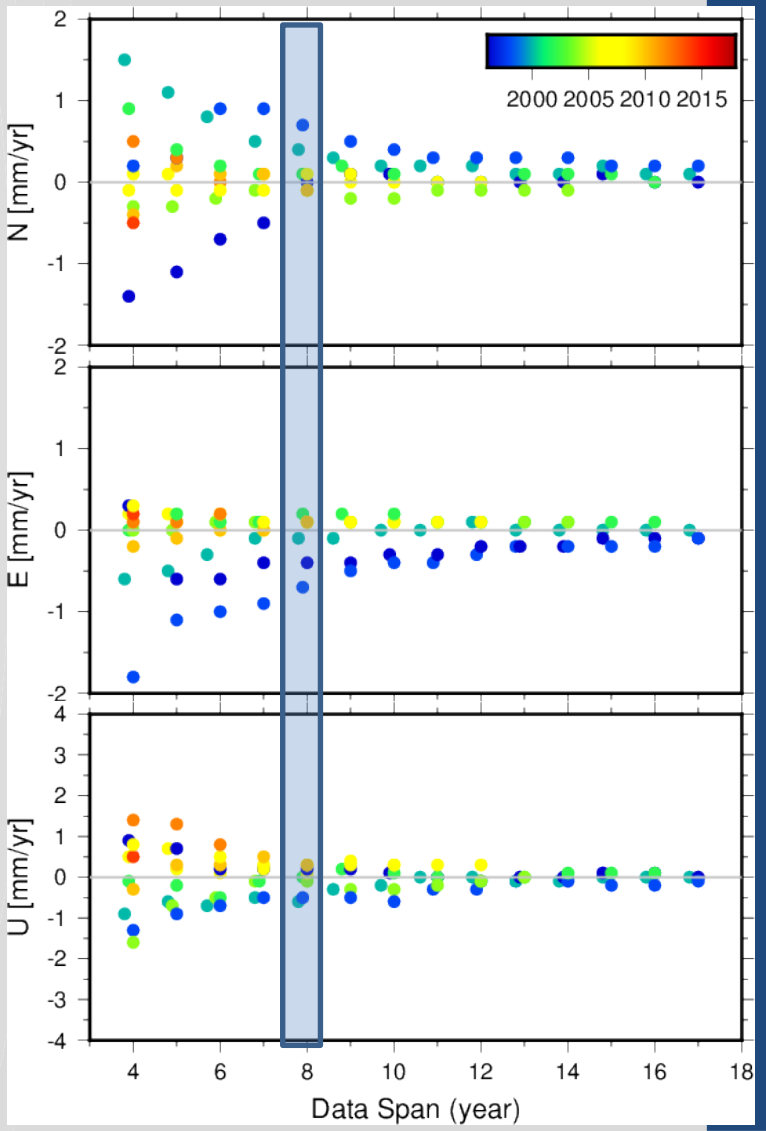

Velocity Variability

Input time series: position time series with jumps and trends

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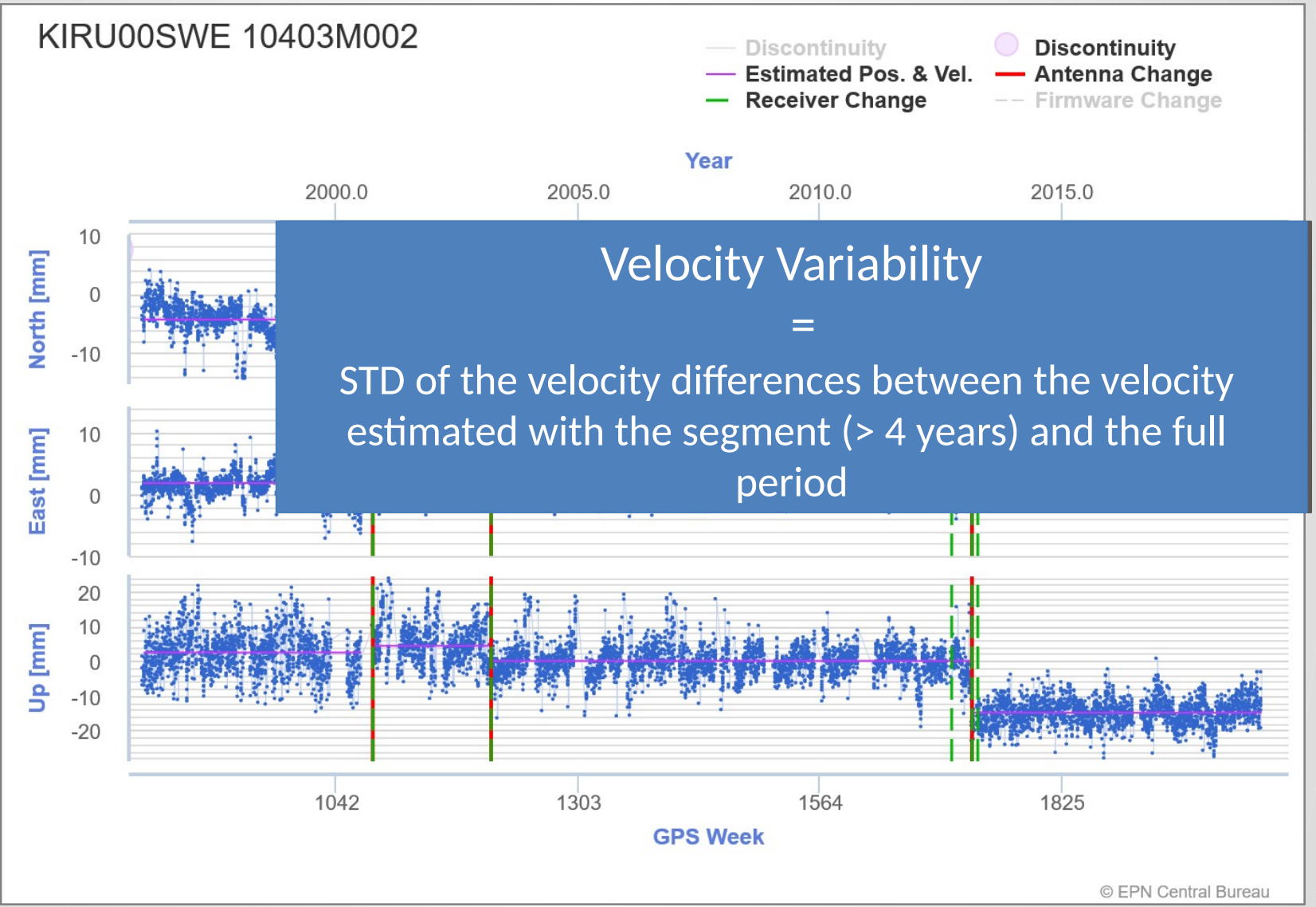
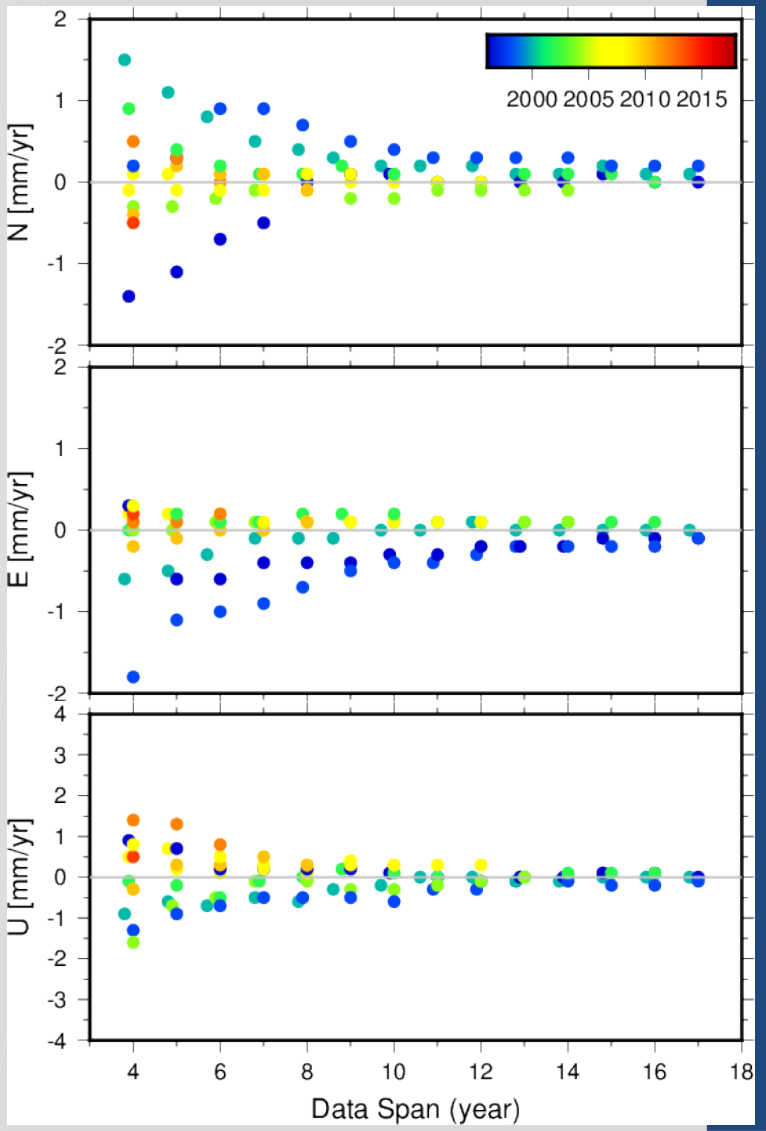


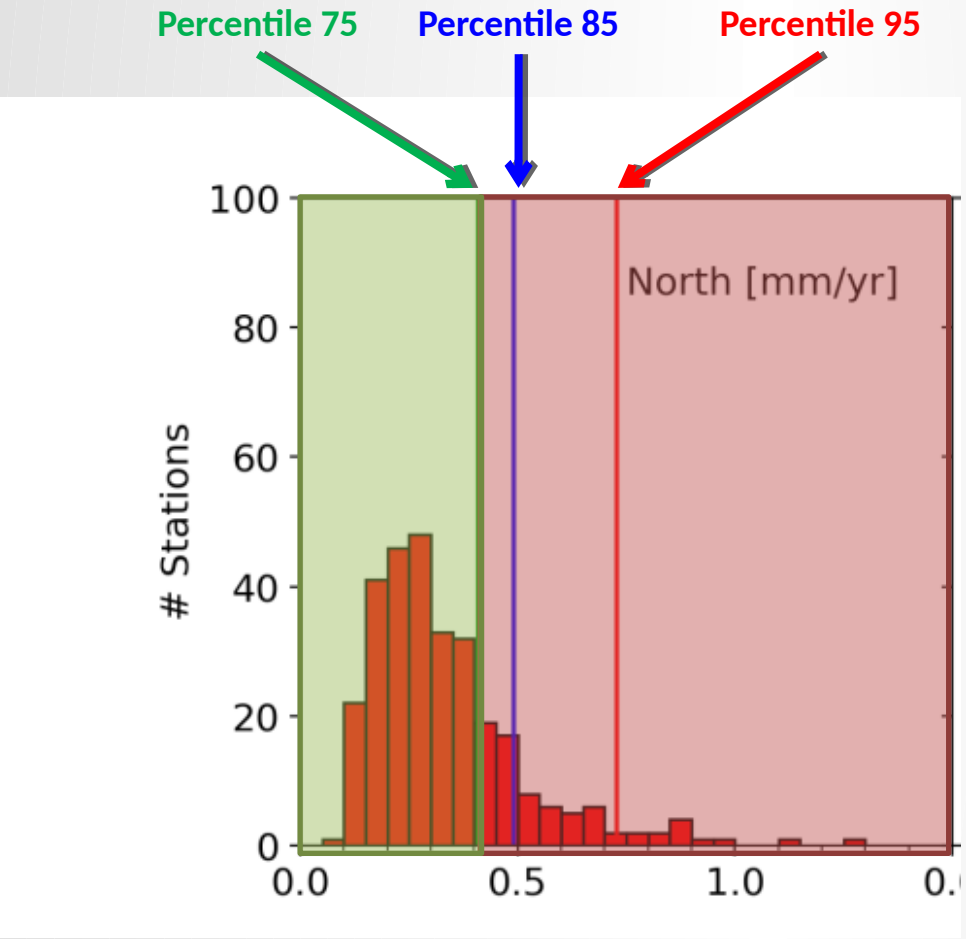
Velocity Variability

=

STD of the velocity differences between the velocity estimated with the segment (> 4 years) and the full period



Classification



- Value < Percentile 75
  - Keep 75% of the stations having the best performance for the considered criteria
  - Reject 25 % of the stations having the worst performance for the considered criteria

Class Name	#	Time Span	Velocity variability	Time series RMS	Amplitude 1Y signal	$DV_{Catref-Hector}$	σ_{Hector}	Position difference C2055-C2040	Velocity difference C2055-C2040	ETRF2014 Velocity	
C0	48		< Percentile 75								Most Stable Stations
C1	31		< Percentile 75								
C2	45		< Percenti								able but Noisy Seasonal Signals
C3	16										Less Stable
C4	9										
C5	82				centile 95 iation < Percentile 85						Even Less Stable
NR Not Recommended	110		At least 1 criteria > Percentile 95 or velocity variation > Percentile 85 or Short time series with 1 criteria > Percentile 85								Not Recommended
Short No velocities	78	< 3 yr									No velocities published

What to do with this classification?

Tool for Selecting Reference Stations

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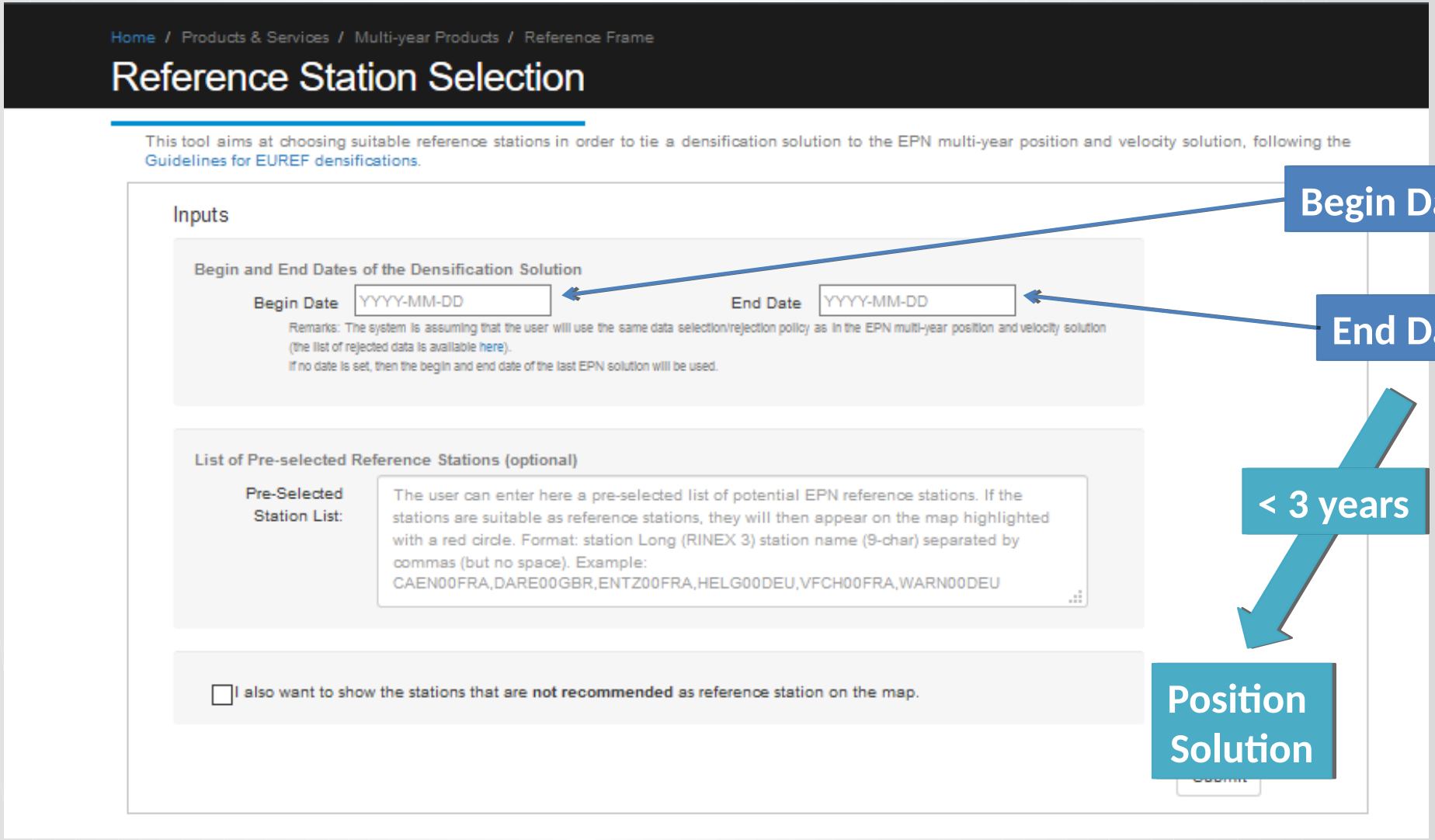
Web page: http://epncb.oma.be/_productsservices/RFC/



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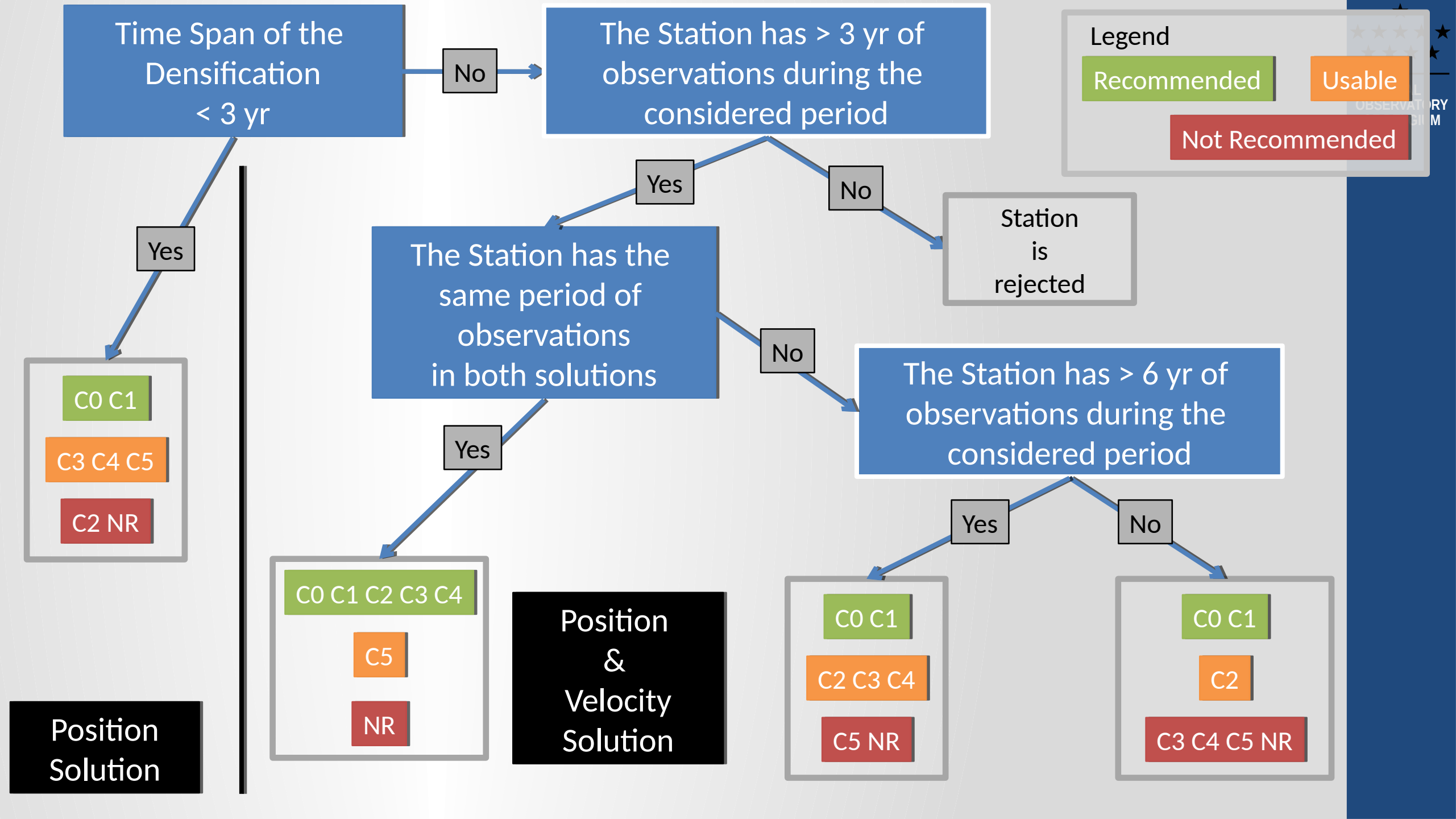
Time Span of the Densification < 3 yr
No
The Station has > 3 yr of observations during the considered period
Legend
Recommended
Usable
Not Recommended
Yes
No
Station is rejected
Yes
The Station has the same period of observations in both solutions
No
The Station has > 6 yr of observations during the considered period
C0 C1
C3 C4 C5
C2 NR
Yes
No
Yes
No
C0 C1 C2 C3 C4
C5
NR
C0 C1
C2 C3 C4
C5 NR
C0 C1
C2
C3 C4 C5 NR
Position Solution
Position & Velocity Solution

Position & Velocity Solution

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Home / Products & Services / Multi-year Products / Reference Frame

Reference Station Selection

This tool aims at choosing suitable reference stations in order to tie a densification solution to the EPN multi-year position and velocity solution, following the Guidelines for EUREF densifications.

Inputs

Begin and End Dates of the Densification Solution

Begin Date 2007-01-01 End Date 2018-12-30

Remarks: The system is assuming that the user will use the same data selection/rejection policy as in the EPN multi-year position and velocity solution (the list of rejected data is available here).
If no date is set, then the begin and end date of the last EPN solution will be used.

List of Pre-selected Reference Stations (optional)

Pre-Selected Station List:

The user can enter here a pre-selected list of potential EPN reference stations. If the stations are suitable as reference stations, they will then appear on the map highlighted with a red circle.
Format: station Long (RINEX 3) station name (9-char) separated by commas (but no space).
Example: CAEN00FRA,DARE00GBR,ENTZ00FRA,HELG00DEU,VFCH00FRA,WARN00DEU

☐ I also want to show the stations that are **not recommended** as reference station on the map.

Submit

Results

Begin and End Dates of the Densification Solution

Date Begin: 2007-01-01 / GPS Week 1408 / 2007/001
Date End: 2018-12-30 / GPS Week 2034 / 2018/364

The Densification Solution has 12 years of data.
Criteria for a Position & Velocity Solution are applied.

List of Selected Stations

Click on the stations in the map to select them. Click again to deselect.

Selected Stations are highlighted with a red circle.

Then, click on **Export List** button to print the selected list of stations.

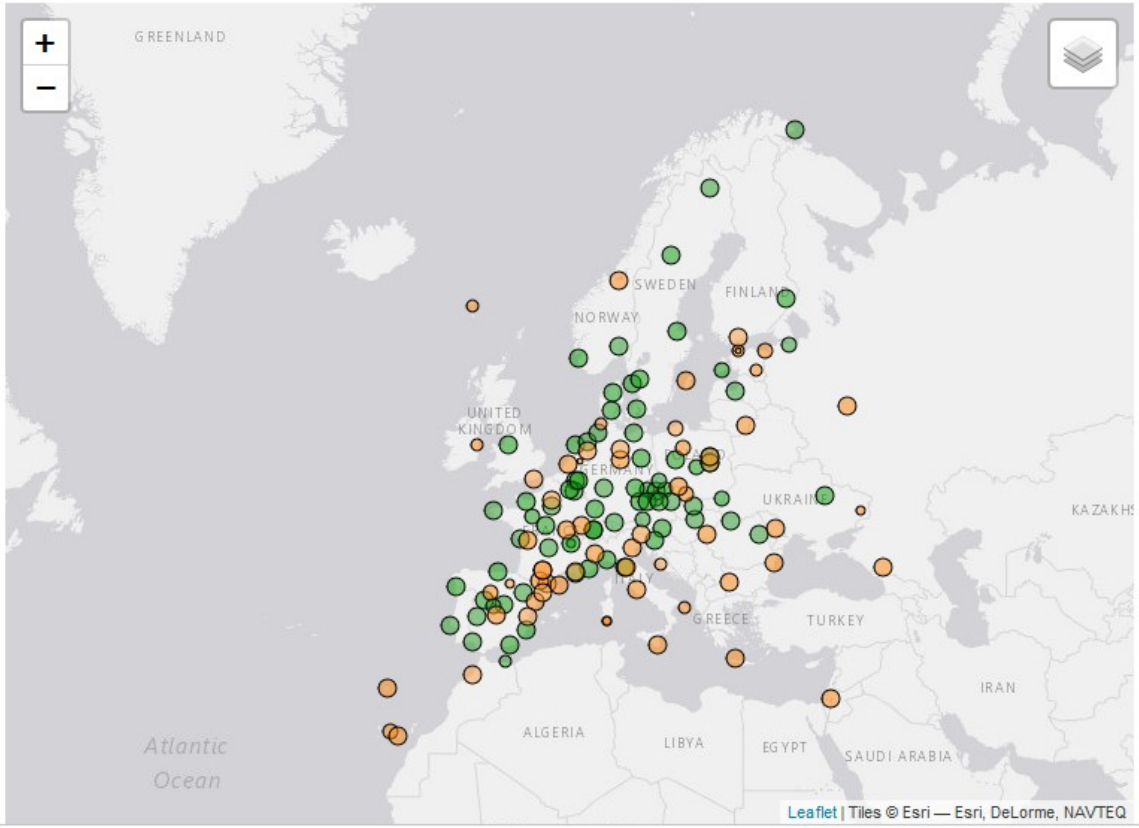
Export List

Map Legend

- stations recommended as reference stations,
- stations usable as reference stations but for which the user has to check thoroughly if the station fits its needs,

The size of the circle depends on the number of years of observations available in the EPN multi-year solution for the given period.
Only stations with more than 3 years of observations in the selected period are shown.

The stations are categorised in 8 different classes depending on their quality and stability in the EPN multi-year solution (from best to worst): C0, C1, C2, C3, C4, C5, NR, Short.



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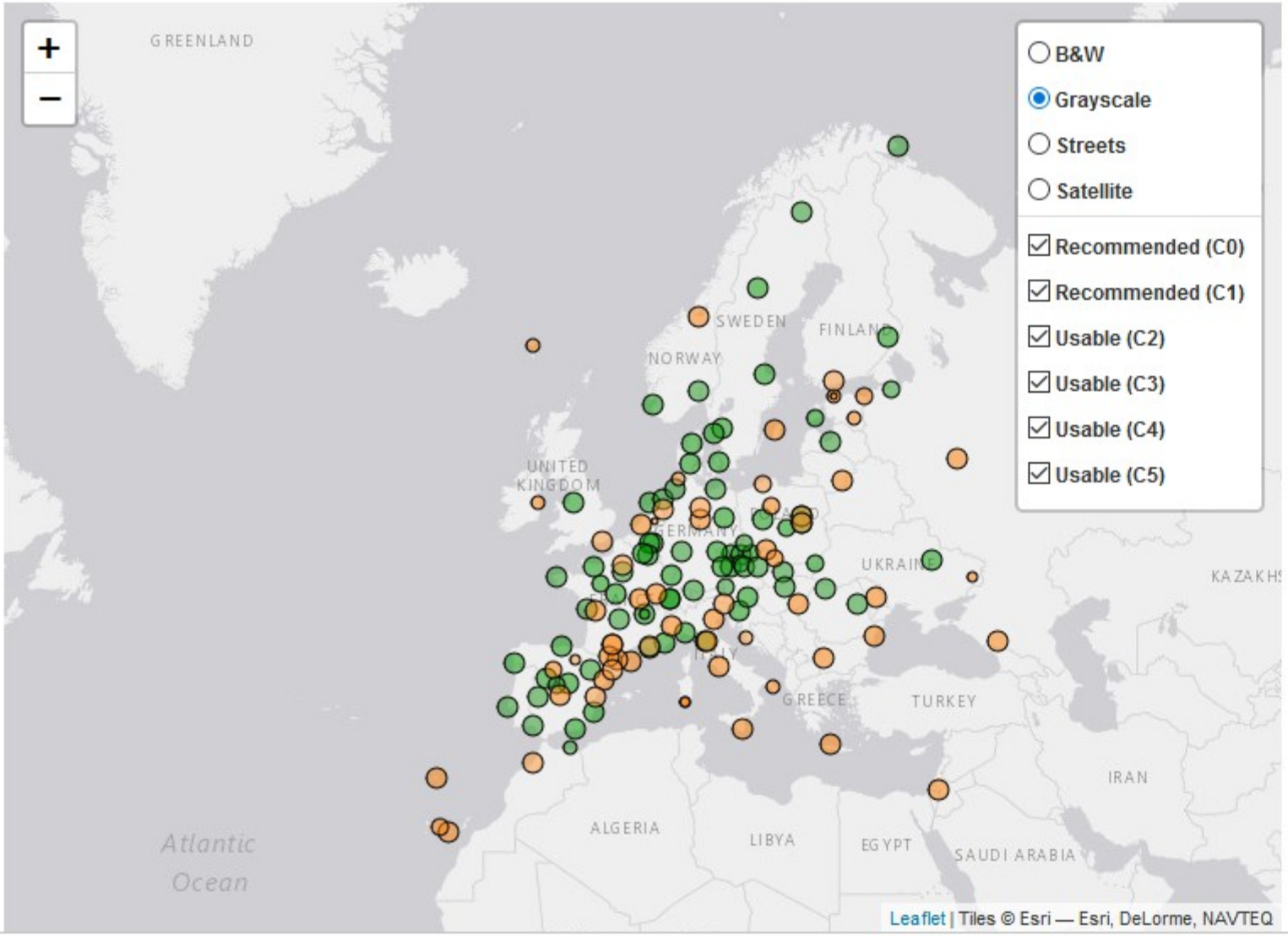

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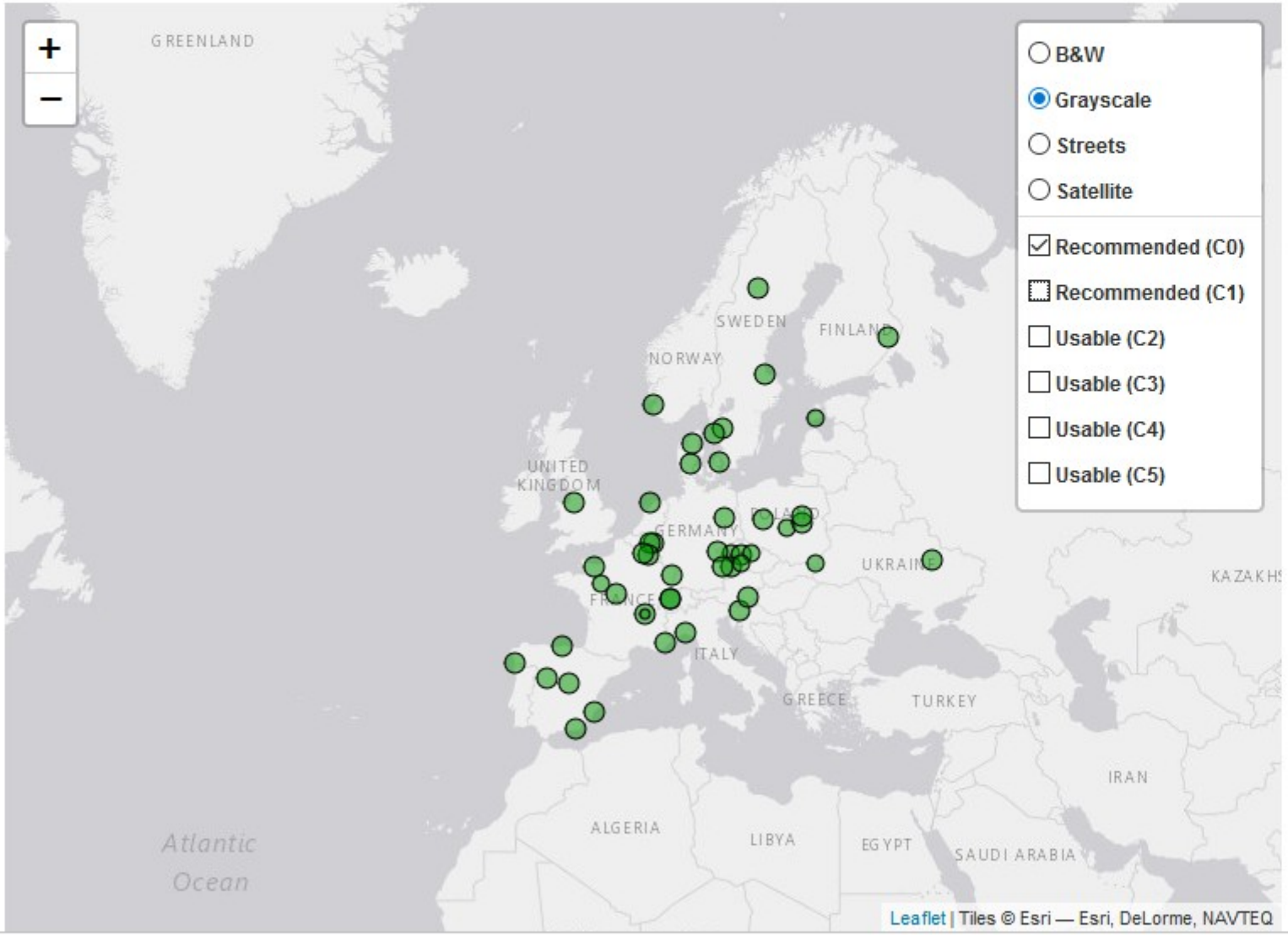

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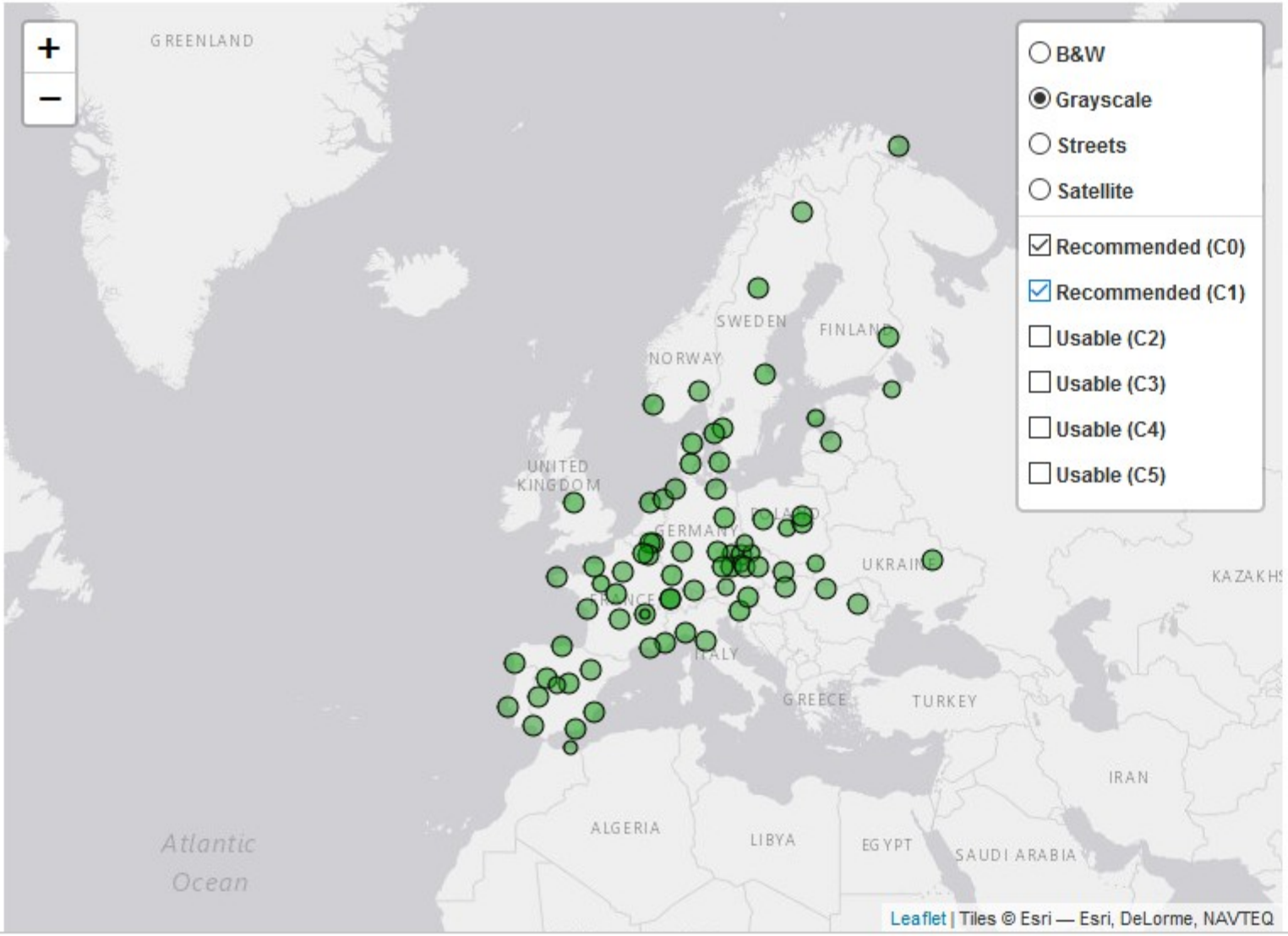

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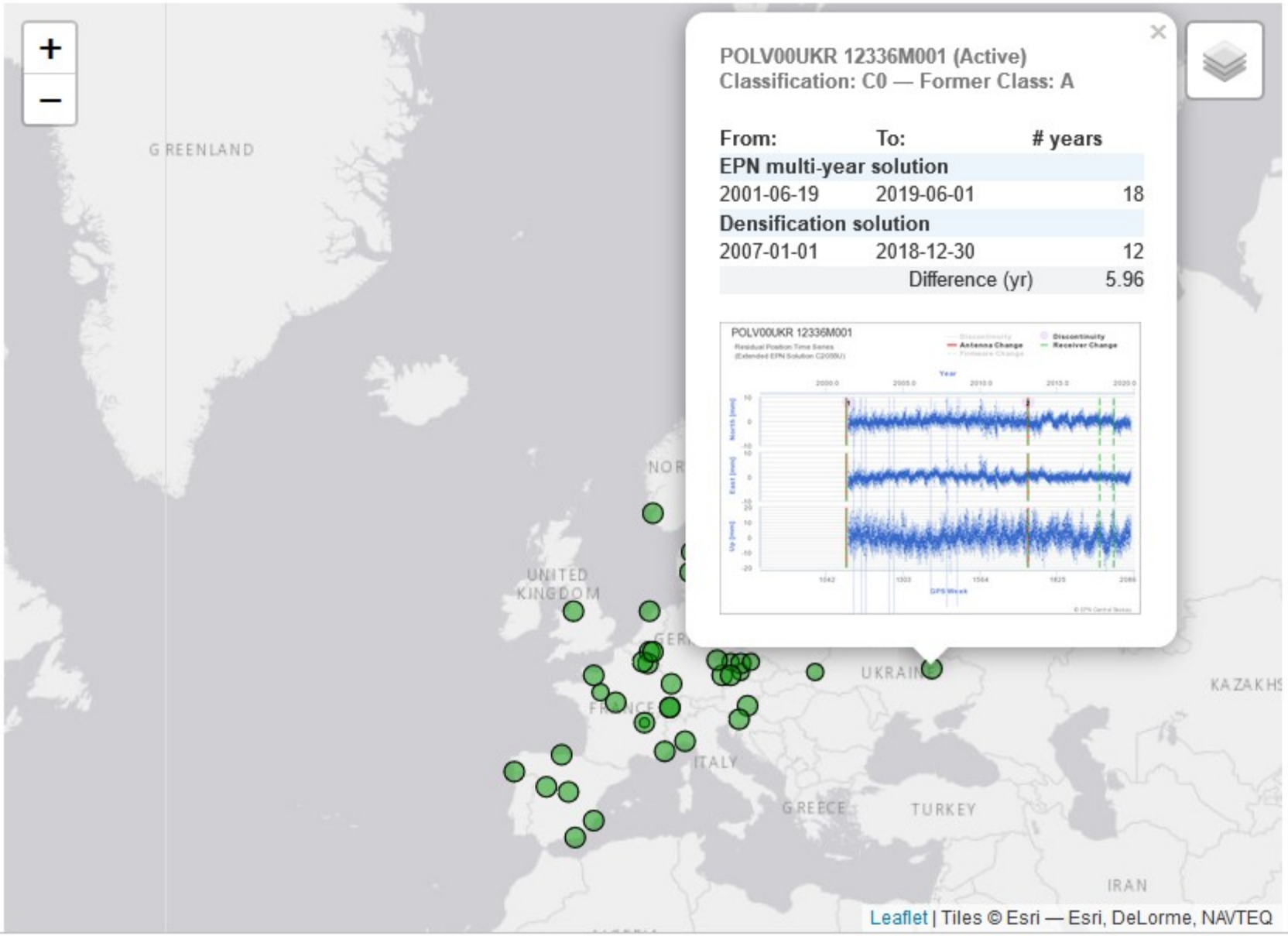

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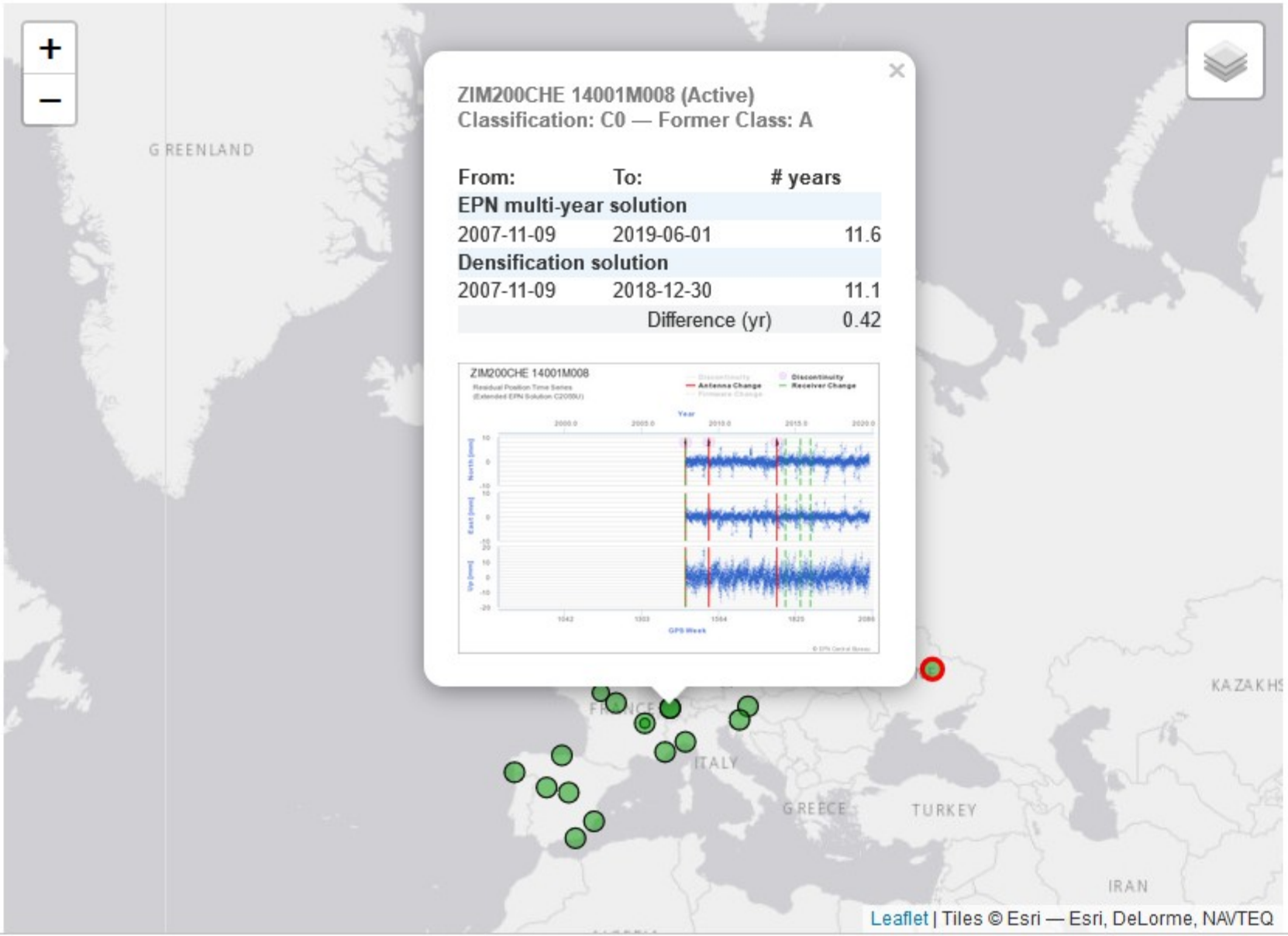

List of Selected Stations

BUDP00DNK,DARE00GBR,KURE00EST,POLV00UKR,SULD00DNK,VIL000SWE,ZIM200CHE

Export List

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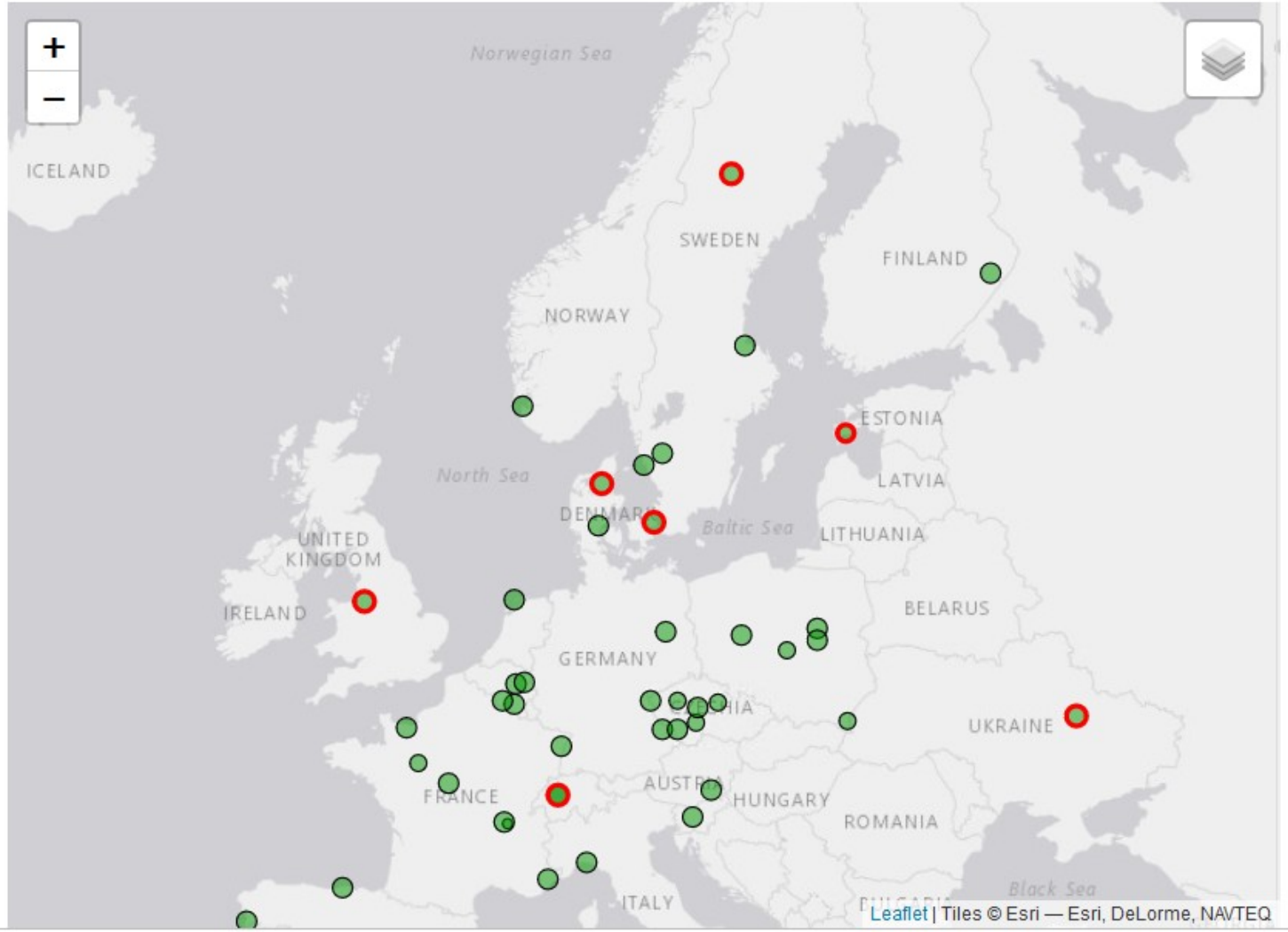

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Position Solution

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Inputs

Begin and End Dates of the Densification Solution

Begin Date: 2016-08-22

End Date: 2016-11-10

Remarks: The system is assuming that the user will use the same data selection/rejection policy as in the EPN multi-year position and velocity solution (the list of rejected data is available here).
If no date is set, then the begin and end date of the last EPN solution will be used.

List of Pre-selected Reference Stations (optional)

Pre-Selected Station List:

BOR100POL,BRUS00BEL,BRUX00BEL,BUCU00ROU,BZRG00ITA,DUB200HRV,GANP00SVK,GENO00ITA,GOPE00CZE,GRAS00FRA,GRAZ00AUT,GSR100SVN,IGMI00ITA,JOZE00POL,KARL00DEU,M0SE00ITA,MATE00ITA,MEDI00ITA,OBE400DEU,ORID00MKD,PENC00HUN,PORE00HRV,POTS00DEU,POZE00HRV,PULA00HRV,SABA00SRB,SOFI00BGR,SRJV00BIH,UZHL00UKR,VEN100ITA,WTZR00DEU,ZADA00HRV,ZIMM00CHE,ZOUF00ITA,

☑ I also want to show the stations that are **not recommended** as reference station on the map.

Submit

Results

Begin and End Dates of the Densification Solution

Date Begin: 2016-08-22 / GPS Week 1911 / 2016/235
Date End: 2016-11-10 / GPS Week 1922 / 2016/315

The Densification Solution has 81 days of data.
Criteria for a Position Solution are applied.

List of Selected Stations

Click on the stations in the map to select them. Click again to deselect.

Selected Stations are highlighted with a red circle.

Then, click on **Export List** button to print the selected list of stations.

Export List

Map Legend

- stations recommended as reference stations,
- stations usable as reference stations but for which the user has to check thoroughly if the station fits its needs,
- stations not recommended as reference stations.

The size of the circle depends on the number of days of observations available in the EPN multi-year solution during the given period.

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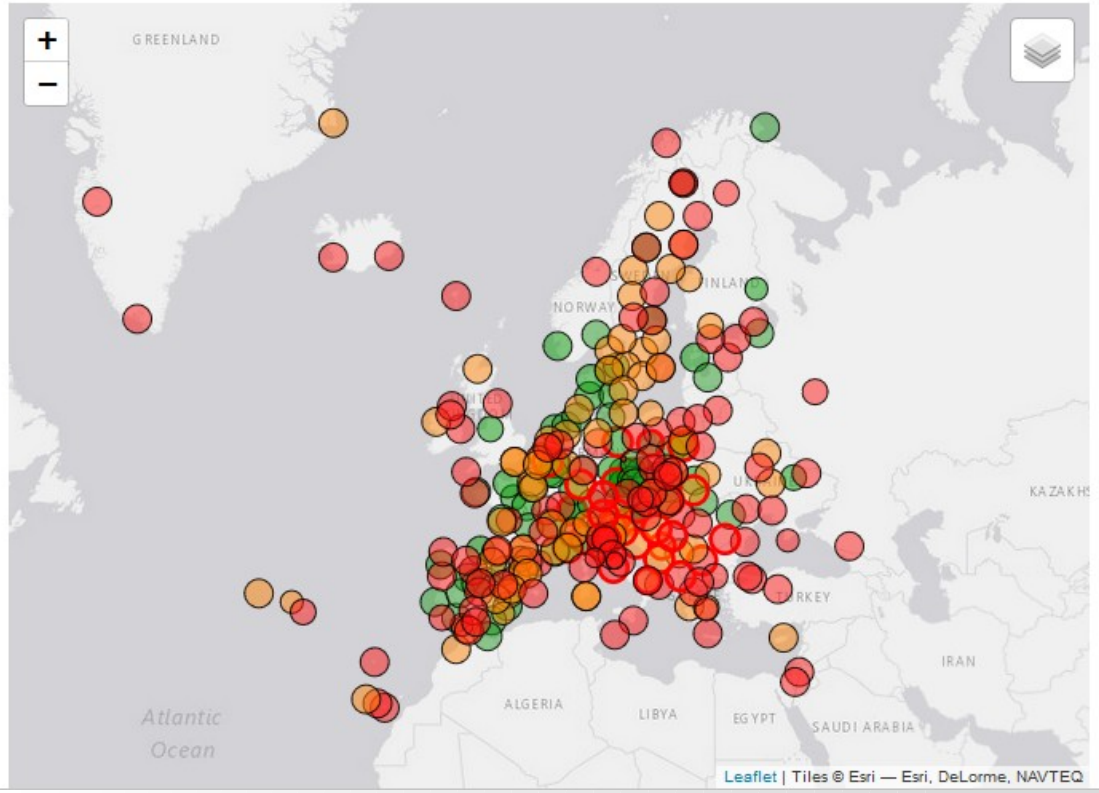

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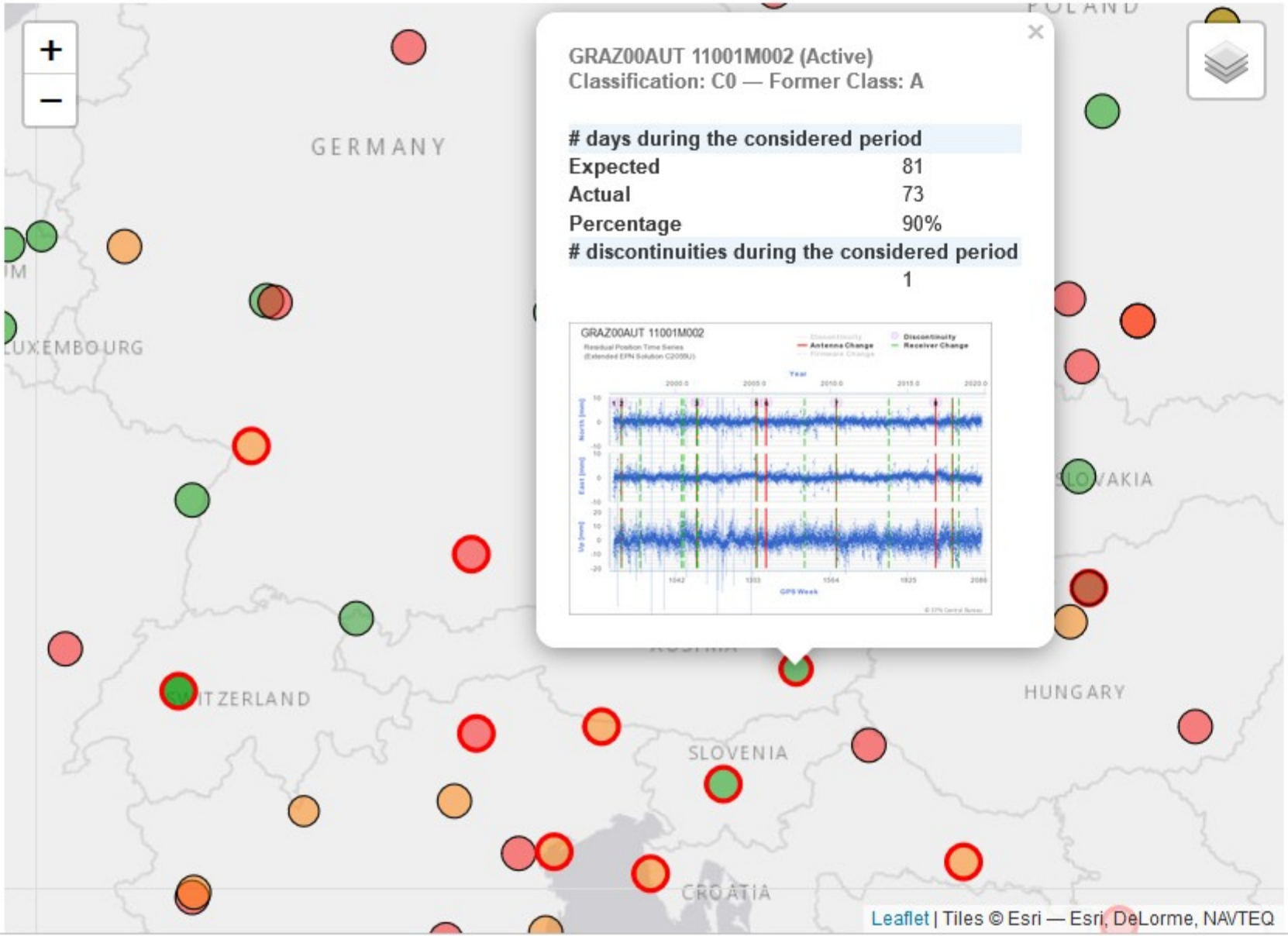

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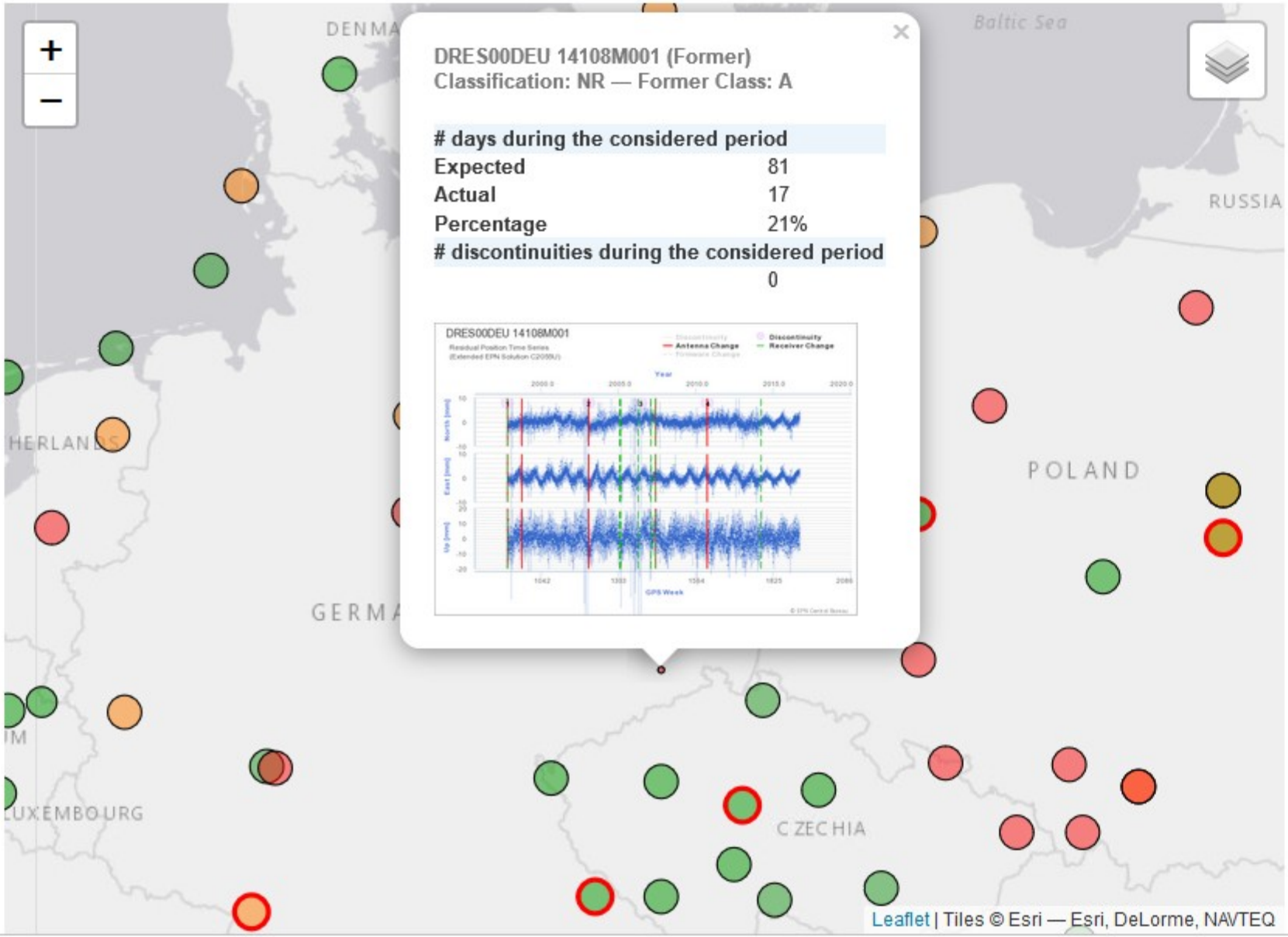
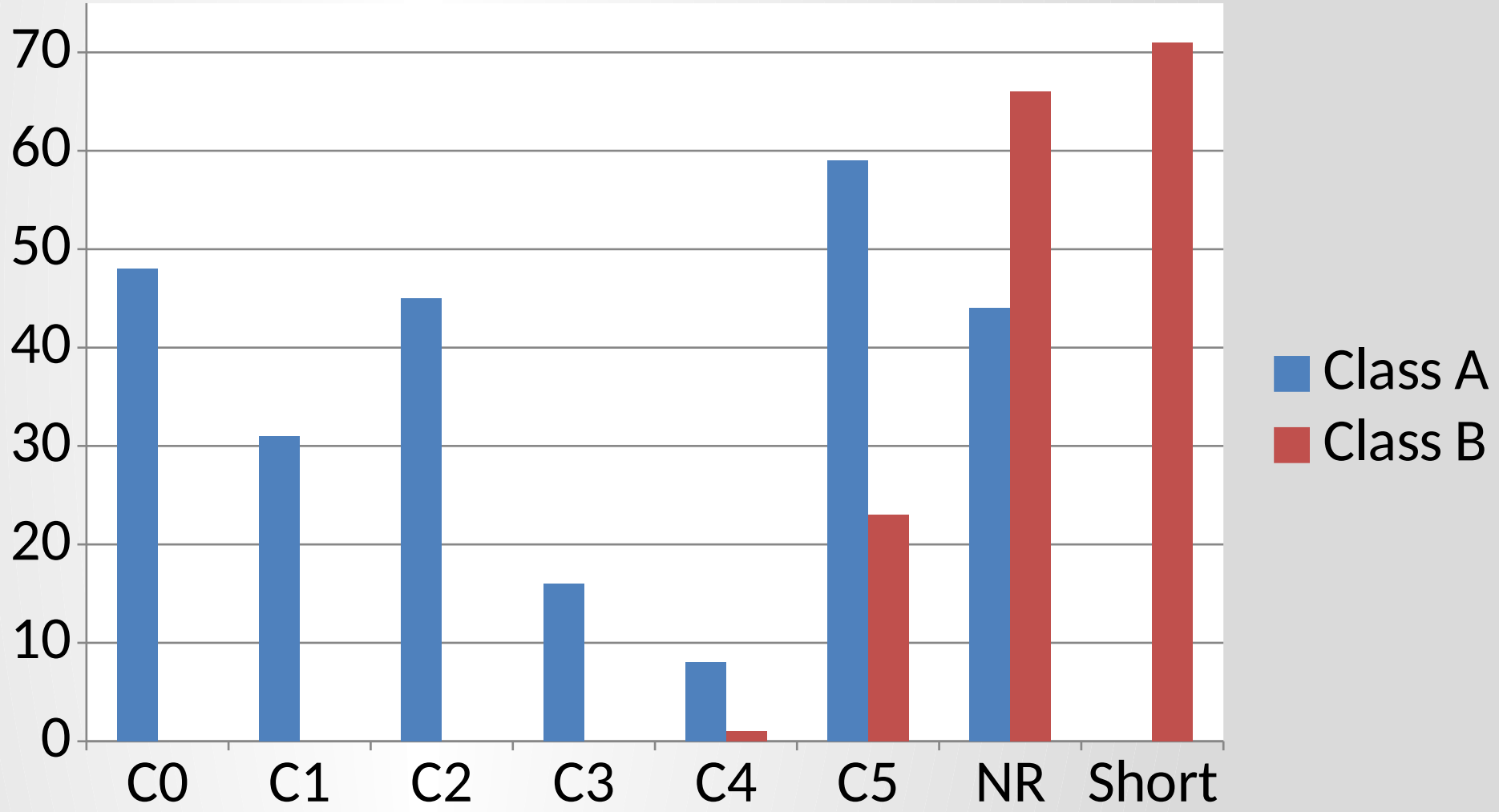


How the new classification agrees with Class A/B ?



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Conclusions

- The tool can help the user to select reference stations for:
  - Position Solutions
  - Position & Velocity Solutions
- Already operational
- Development of additional features
  - Additional outputs files can be created (SNX,SSC, discontinuity file, STA file…)
  - What are the needs & priorities of the users ?
- Criteria can be refined
  - Depending on user needs

- Please provide feedback to Juliette.Legrand@oma.be or epncb@oma.be

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