Selecting the Standard Azimuth

PGN Forum #1

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Why are these entries important?

Instrument Specific Configuration File

```
1   Settings at previous use of Pandora #132
2   Selected location (short name) -> UHMT
3   Instrument usage mode -> 0
4   Last window coordinates [pixels] -> 0 0 1920 1044
5   Beep mode -> 0
6   Data output mode -> 0
7   X-axis parameter -> 0
8   Show author information -> 0
9   Custom cursor -> rd_cur.cur
10  Camera data mode -> 0
11  Freeze alignment history -> 0
12  Figure draw mode -> 3
13  Show grid lines -> 0
14  Make logarithmic figures -> 0
15  Tracker parking zenith angle and azimuth -> 90.0 90.0
16  Tracker warming interval [min] -> 60
17  Maximum pointing adjustment [deg] -> 20.0
18  Positioning system tracking update interval [ms] -> 200
19  Positioning system logging interval [s] -> 60
20  Standard azimuth for elevation scans [deg] -> 0.00
21  Maximum unobstructed pointing zenith angle at standard azimuth [deg] -> 89.00
22  Required motion limit clearance for tracker reset [deg] -> 20.00
23  Maximum allowed azimuth correction [deg] -> 70.00
24  Maximum allowed zenith angle correction [deg] -> 5.00
25  Debug mode -> NONE
26  Current session connected hardware parts -> NONE
27
```

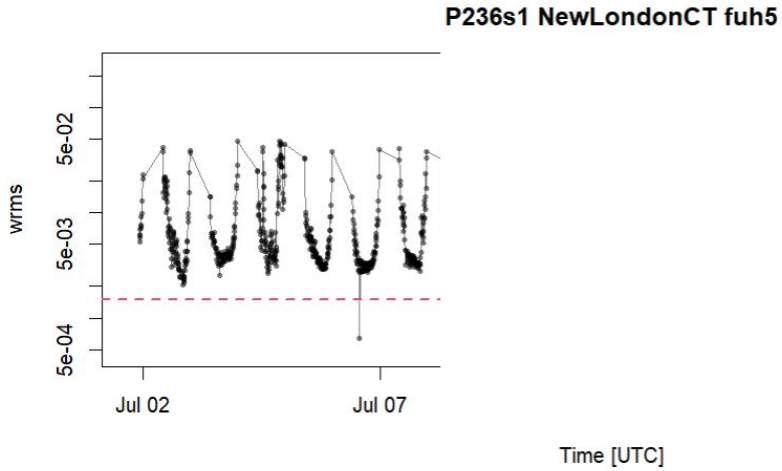
Default Settings

Why are these entries important?

Because if they are wrong the output of the sky algorithm for surface concentration and profiles is wrong!

Here an example …

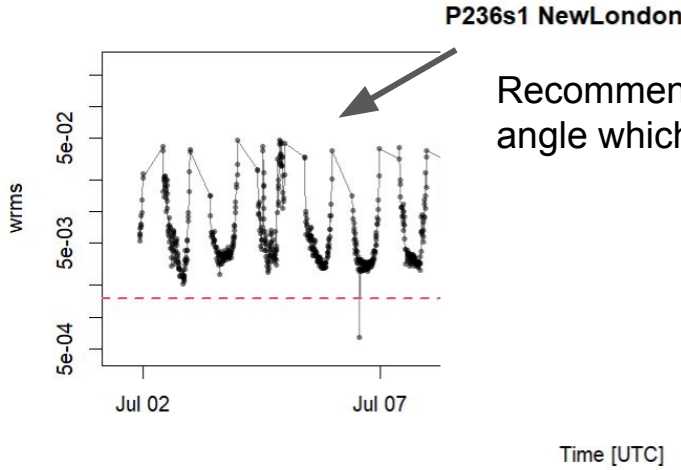
Example of improper choice of azimuth direction



Weighted rms of spectral fitting **(wrms)** used for quality flags.

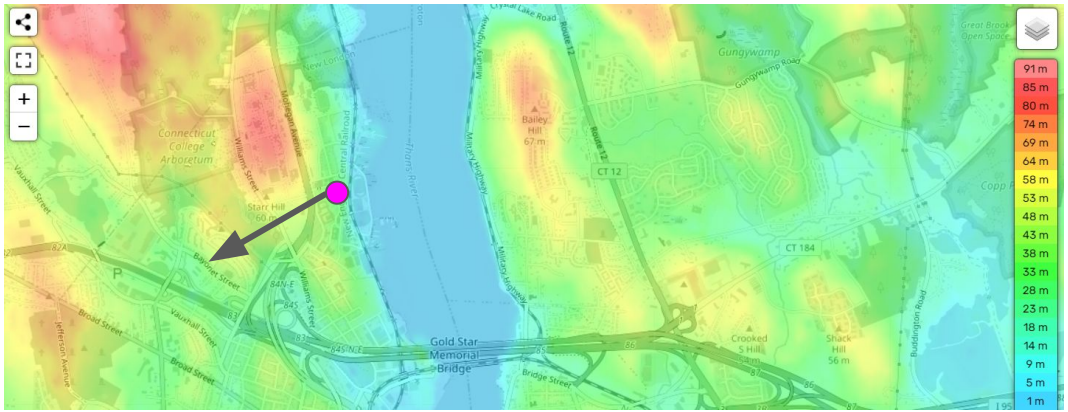
- - - Limit for medium/low data quality

Example of improper choice of azimuth direction



Recommendation to check azimuth angle which was set to 240

Weighted rms of spectral fitting **(wrms)** used for quality flags.
- - - Limit for medium/low data quality



https://en-gb.topographic-map.com/

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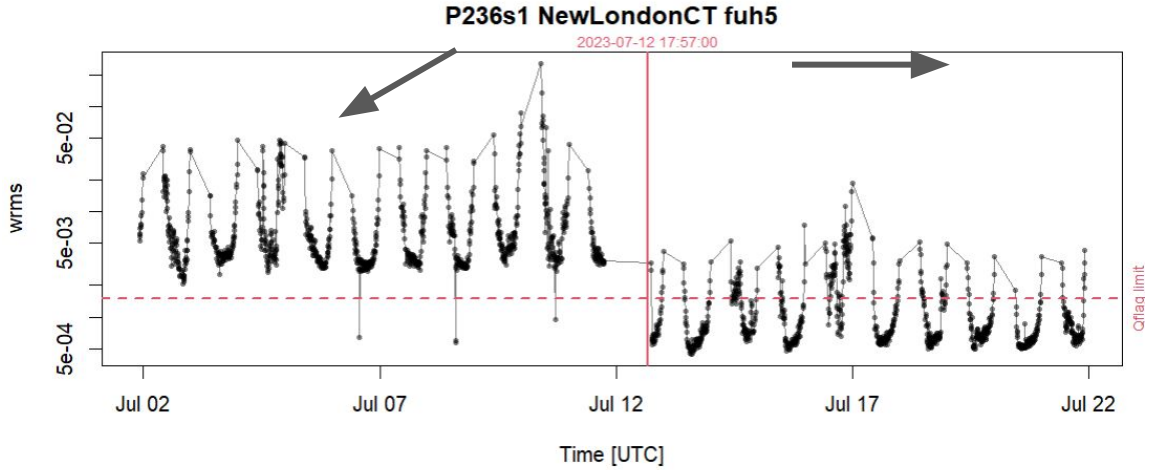

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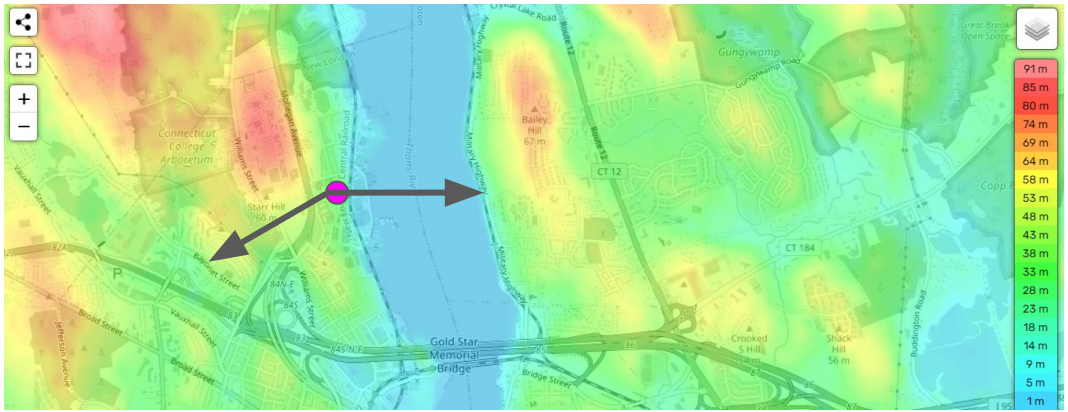

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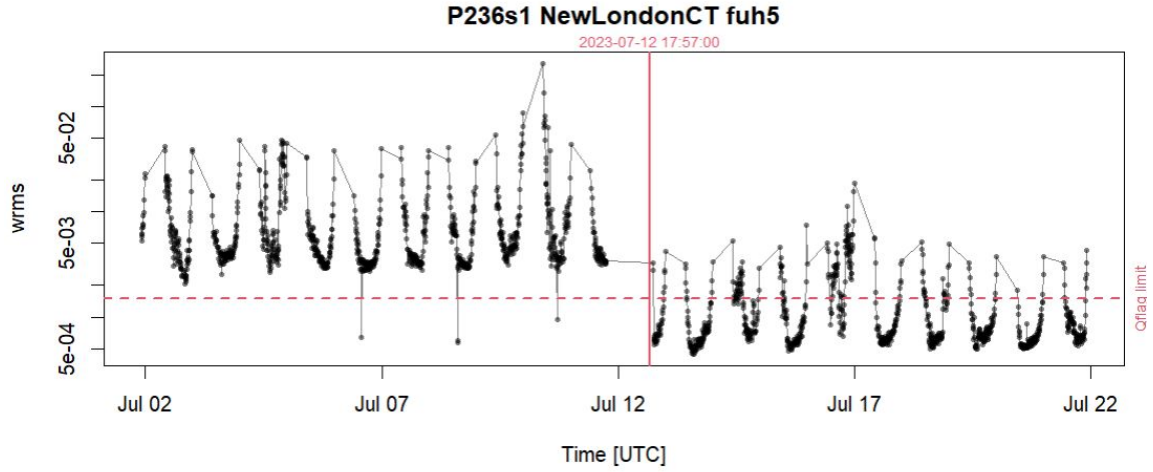
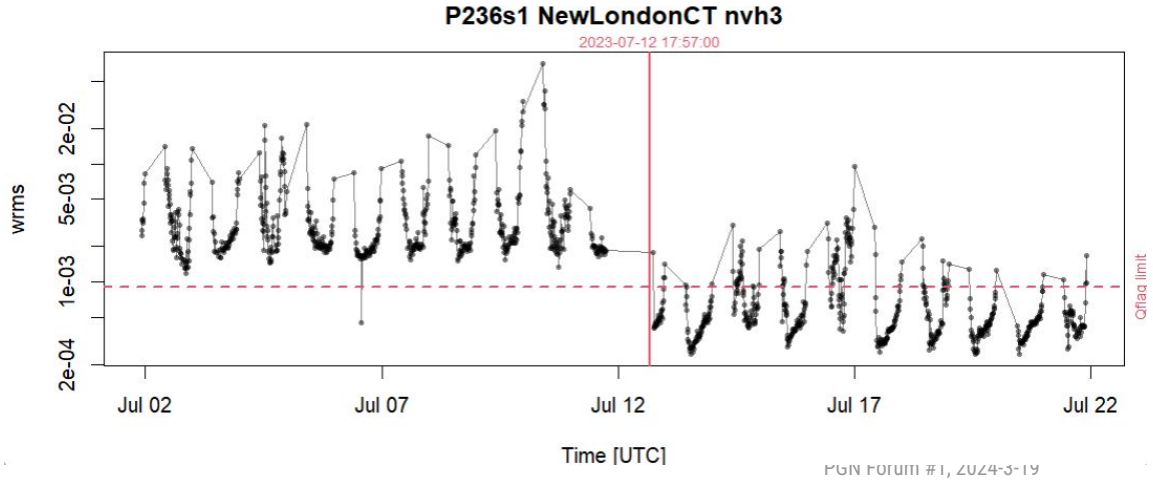
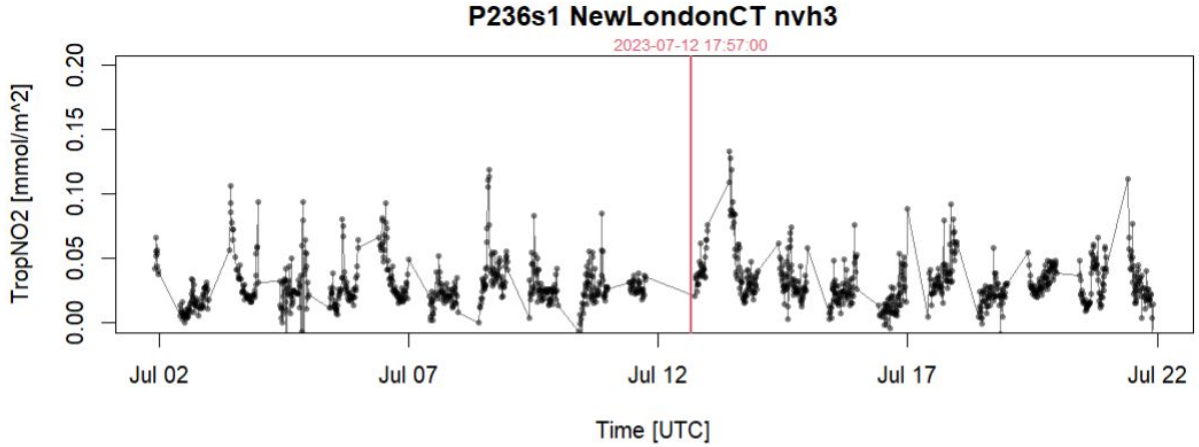


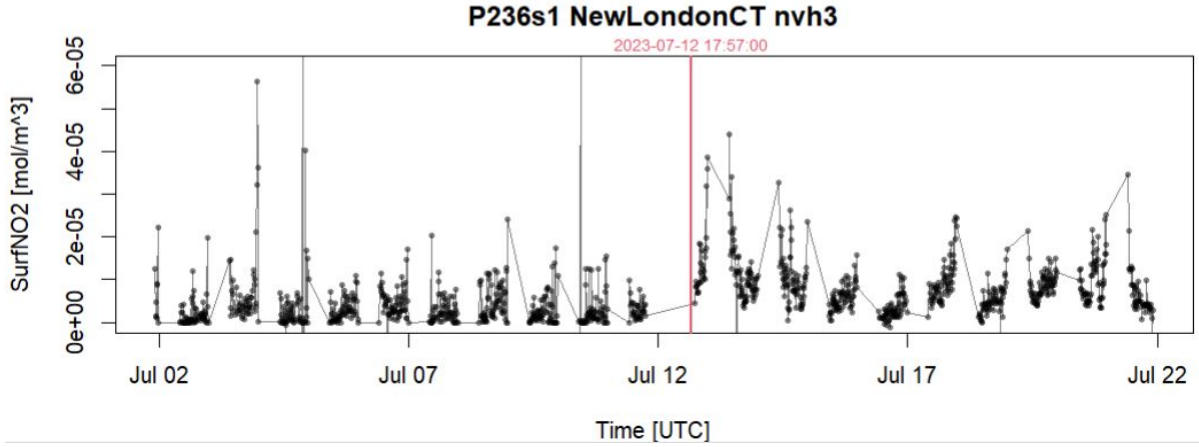


Weighted rms of spectral fitting **(wrms)** used for quality flags.
- - - Limit for medium/low data quality

Same impact on spectral fitting results for both HCHO (fuh5) and NO2 (nvh3) sky retrieval.

Example of improper choice of azimuth direction

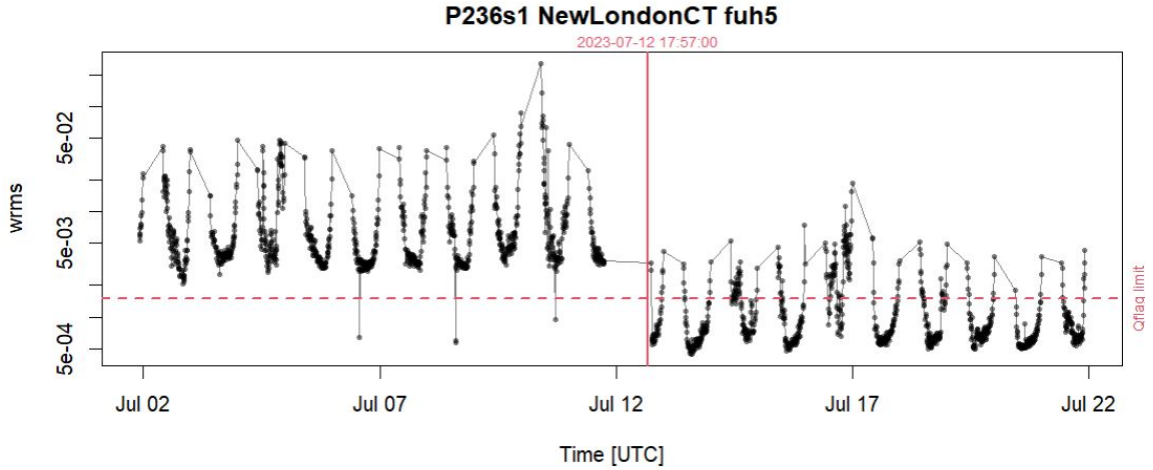




- Impact on tropospheric columns hardly visible.
- Surface concentration (and profiles) are wrong and show jumps in the timeseries

-> (low) quality flag makes sense and should not be used in the analysis.
-> generally both surface and tropospheric amount are affected, since the lowest highest angle is the reference

Example of improper choice of azimuth direction



Weighted rms of spectral fitting **(wrms)** used for quality flags.
- - - Limit for medium/low data quality

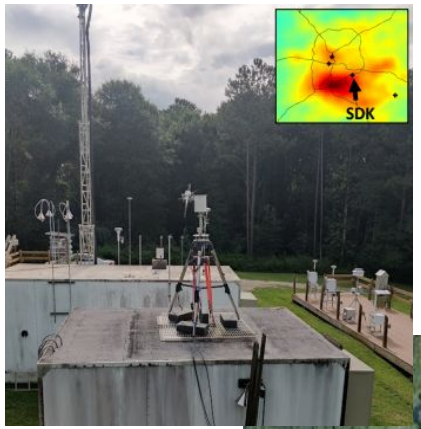
N.O. changed the azimuth direction.

- Perfectly documented in BlickM!
- Essential to understand changes in the data products during QAQC
- (Contaminated) raw measurements (L0) cannot be corrected!

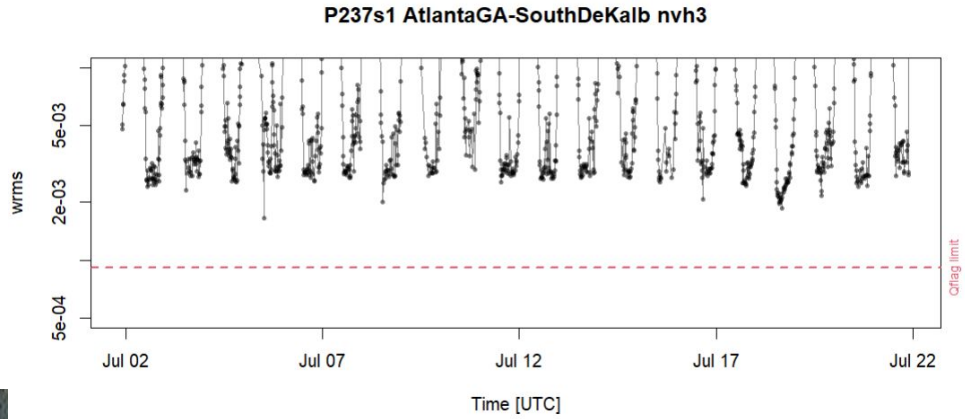
		Changed azimuth angle for sky scans from 240 to 90deg, instrument now looks lout over the river.	2023/07/12 17:57:05 UTC	DEarley

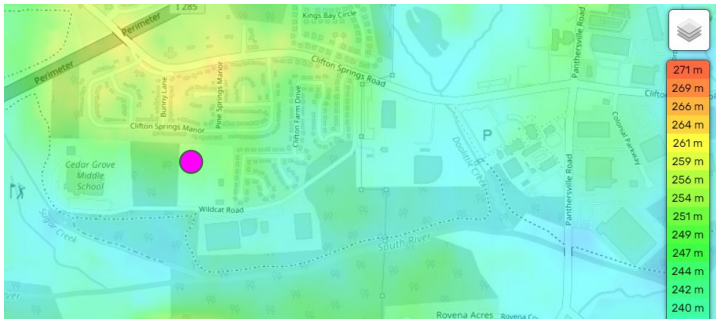
Example of improper choice of azimuth direction

Sometimes it is just not possible due to the surrounding. Still, PGN is processing data, but sky retrievals will be flagged.



P237s1
AtlantaGA-SouthDeKalb





https://en-gb.topographic-map.com/

What you should do …

A concise description of the meaning of these angles is in the Blick SW Suite Manual

1) Read this one page in the manual

5.5.1 Selecting the standard azimuth for elevation scans

The elevation scan routines EO, EU, EL and EK use the "Standard azimuth for elevation scans [deg]" from the instrument configuration file. To select this angle one should first inspect the horizon around the instrument location and determine, what the Horizon Viewing Zenith Angle (HorVZA) in every direction is. Note that only objects within a distance of 30 km need to be considered for this case. For example, if a building at azimuth 100° blocks the view to the sky up to an elevation of 2°, then HorVZA=88° in this direction. If in the same azimuth behind the building there is a mountain range, which blocks the view to the sky up to an elevation of 4°, then HorVZA is 86° in case the mountains are less than 30 km away, otherwise it stays at 88°. This inspection of the horizon can be done "by eye", hence there is no need to get the values very precisely.

The standard azimuth should be a direction, for which HorVZA is as close as possible to 90°, but at least 88°. Usually there are several options for this and the user can select that direction, which has the greatest interest with respect to his needs, e.g. for air quality monitoring. This is most often the direction towards a city or over a more densely populated area within a city, but can obviously be any other choice as well.

Once the standard azimuth is picked and written in the instrument configuration file, the HorVZA should be determined more accurately. The easiest way to do this is pointing the Pandora in this direction and looking along the head sensor as illustrated in figure 8. One can look along the hardware pointer on the Pandora head sensor mounting bracket and manually vary the pointing zenith angle of the Pandora until the exact HorVZA is known. Note that this should be done after the instrument is already properly aligned!

The value finally to be written in the instrument configuration file is the "Maximum unobstructed pointing zenith angle at standard azimuth [deg]", which is 1° smaller than the determined HorVZA. The reason is that the Pandora sky FOV has a full angle of 1.5°, i.e. a region extending 0.75° around the pointing zenith angle is captured. Staying clear of the HorVZA by 1° ensures that no portion of the FOV looks into an object leaving a margin of a quarter degree.

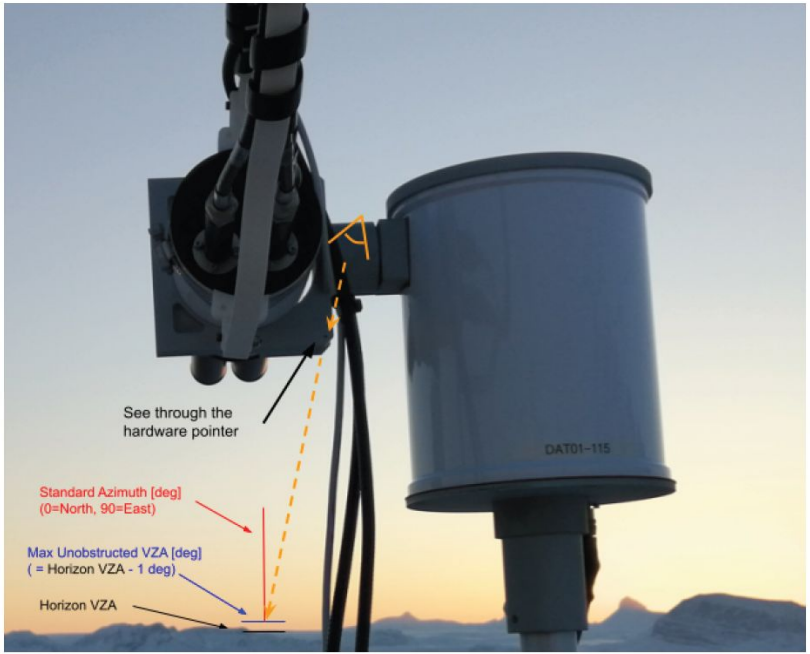
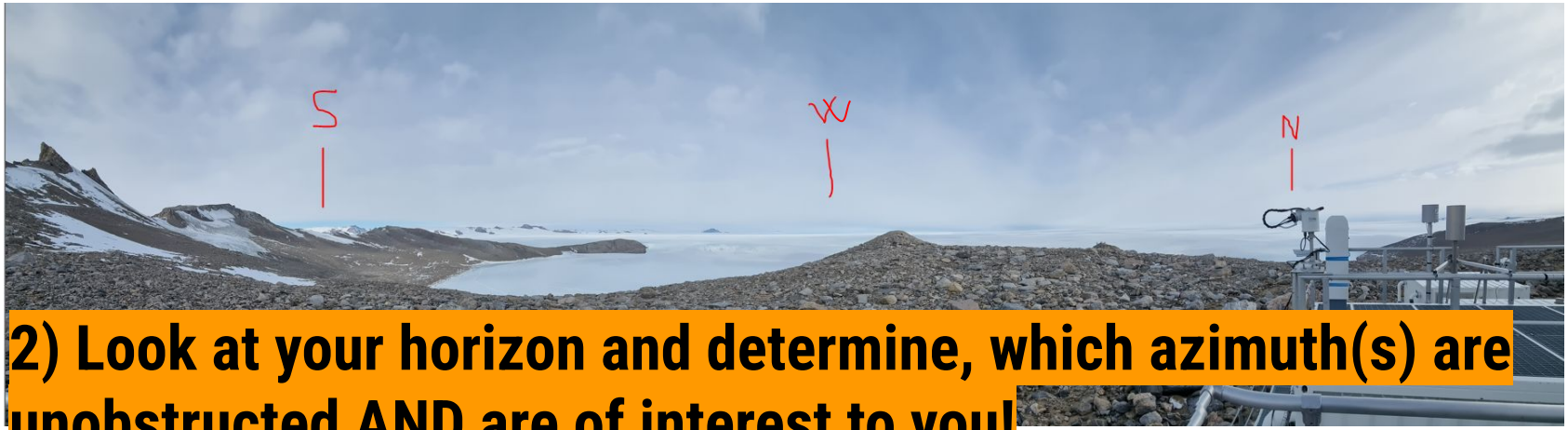


Figure 8: Illustration of the standard azimuth and maximum unobstructed VZA.

Azimuth angle for elevation scans



2) Look at your horizon and determine, which azimuth(s) are unobstructed AND are of interest to you!

Correction campaign

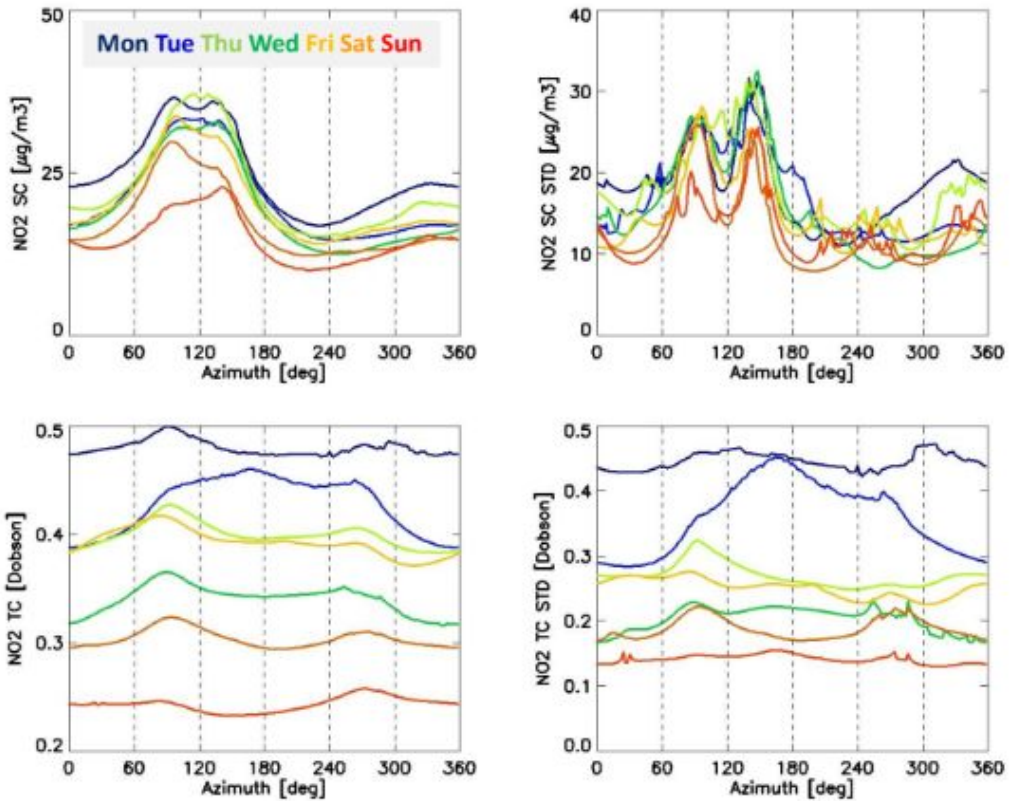
3) Help us finishing this “correction campaign”

	Gdrive	Local log		Config File		Comments	Actions taken
	(Yes/No -reason) No access- please tag MR or RR	Std Azimuth	Max Zenith	Std Azimuth	Max Zenith	Eg: Ok/Not Ok (why if not ok)	Please update the actions with date
P117	Yes	116	-	116	89	Max Zenith not mentioned on Local log	
P118	Yes	287	-			Offline at the moment. PC needs to be replaced	
P119	Yes	39	80	0	80	Wrong... need to verify	Local log updated on 20240229
P120	Yes	212	-	212	89	Max Zenith not mentioned on Local log	
P121	Yes	0	-	0	89	Not sure the values are correct, as P209 says in LL it AZI is 340 and P121, P209 and P101 are in same location	Discussing with DS; confirmed on 20240216
P126						Offline	
P129	Yes	233	89	233	89	Perfect	-
P130	Yes	180	-	180	89	Max Zenith not mentioned in local log	Local log updated on 20240215
P132	Yes	260	-	260	89	Max Zenith not mentioned in local log	
P133	-	-	-	-	-	Not yet installed. Also coming to LB for repairs	
P138	Yes	182	-	182	89	Max Zenith not mentioned in local log	
P152	Yes	315	-	315	89	Max Zenith not mentioned in local log	Local log updated on 20240215
P159	Yes	270	-	270	89	Max Zenith not mentioned in local log	
P162	Yes	0	89	0	89	Needs to verify	
P182	Yes	98	-	98	89	Max Zenith not mentioned in local log	
P209	Yes	340	89	0	89	Not sure the values are correct, as P209 says in LL it AZI is 340 and P121, P209 and P101 are in same location	Discussing with DS; confirmed on 20240216
P234	Yes	340	-	340	89	In LL: Standard azimuth for elevation scans [deg] (Izana) -> 340 (same as P209 and P121)	Currently at LB lab
P238	Yes	0	89	0	89	Using default values. It seems something is blocking view at azi 0 deg (PI, LO will be asked to update it)	Emailed: PI and LO
P239	Yes	181	-	0	89	Wrong; needs to verify	
P240	Yes	220	89	220	89	OK	-
P242	Yes	0	89	0	89	Not sure is correct: local log has ??	Emailed: PI and LO
P270	Yes	97	88	97	88	Perfect	-

What else could you do …

Maybe you want to map out a city?

NO2 amounts around Pandora 117 in Rome based on elevation scans in 6 azimuth directions



Characterisation of trace gases horizontal inhomogeneity in Urban atmosphere: a case study using Pandora sky measurements in the context of the Boundary-layer Air Quality Using Network of INstruments (BAQUNIN) Project

Stefano Casadio[1], Anna Maria Iannarelli[1], Marco Cacciani[2], Monica Campanelli[3], Martin Tiefengraber[4,5], Alexander Cede[4,6], Gabriele Mevi[1] and Enrico G. Cadau[7]

Obstacle Detection along the Horizon

The updated sky scan routines to preliminarily determine possible obstructions along the horizon where the instrument is located. These routines include a rough scan at 10-degree steps at various elevation angles, as well as dedicated scans at 2-degree steps along every quadrant of the horizon.

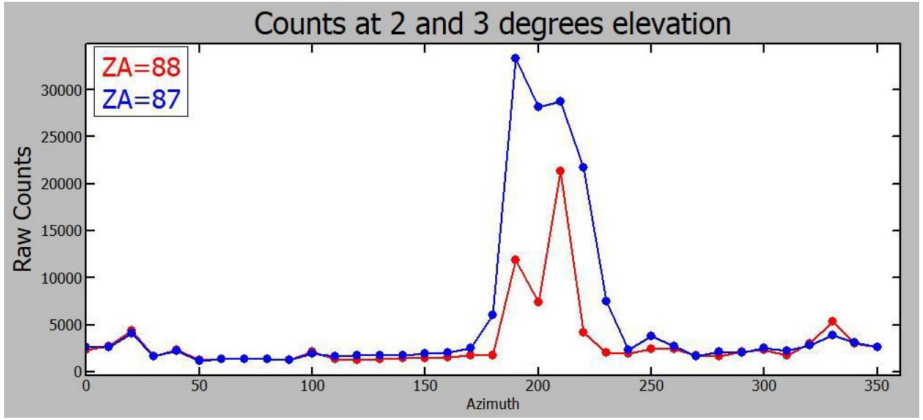


Figure 1: Example of HA (Horizon Average) routine at site Chapel Hill, NC. Graph shows best visibility for sky scans being between the azimuth angles 180° and 240° with the Zenith angles set to 88° and 87°.

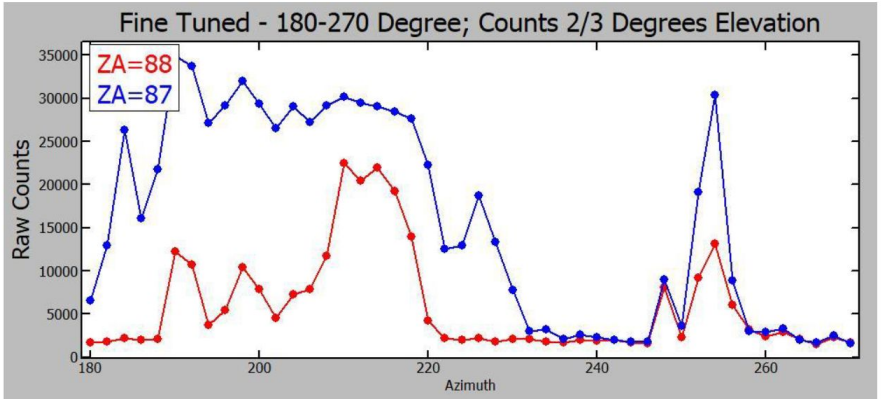


Figure 2: Example of H3 (Horizon Quarter 3) routine at site Chapel Hill, NC. Graph shows scans along the Azimuth angles in 2° intervals between 180-270° with the Zenith angles set to 88° and 87°. Azimuth angles 210° to 218° appear to be the best area with minimal obstructions.

Please note **only** use this sky scan routines to finalise the angles after you have determined the area of interest.

Obstacle Detection along the Horizon

The final decision regarding the azimuth direction for elevation scans must be made by the PI(s) and LO(s) depending on the research site of interest.

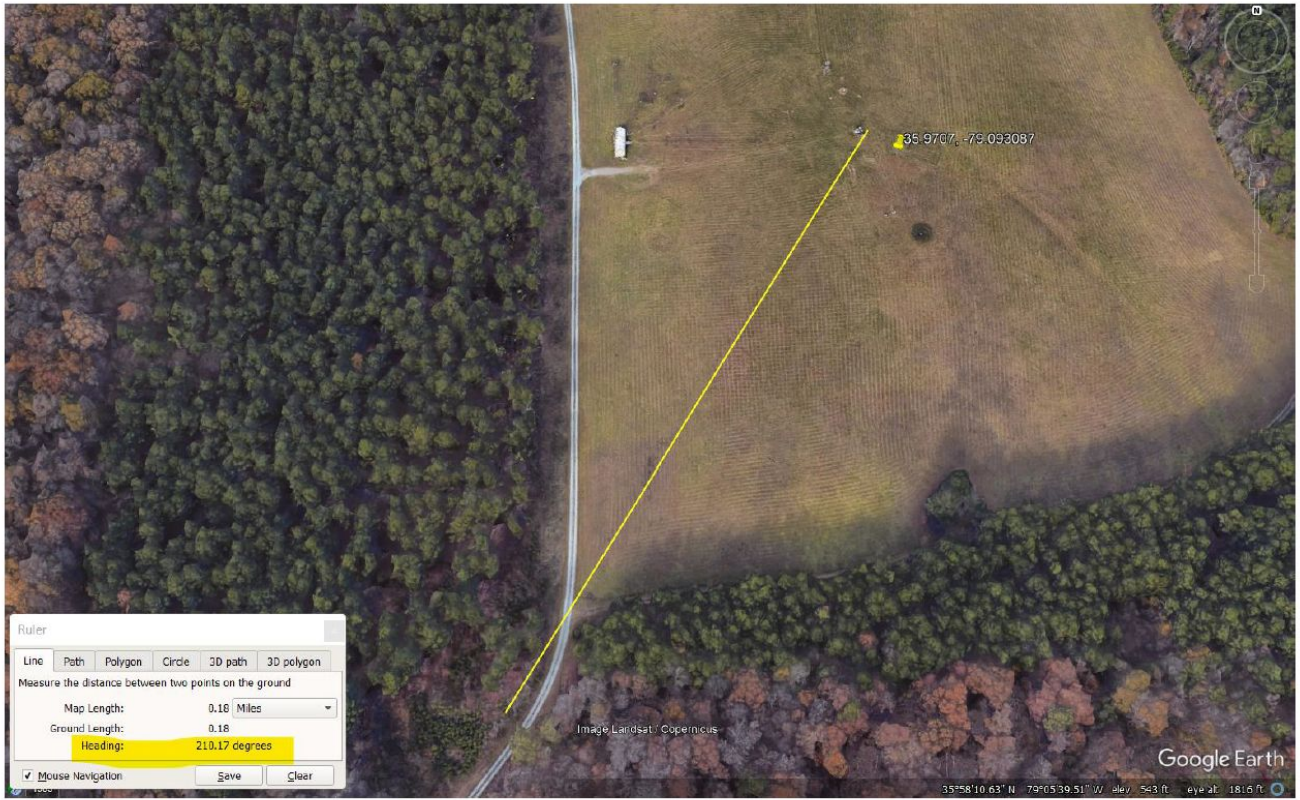


Figure 3: Example of an overview photo at site Chapel Hill, NC with a line drawn from Pandora to a clearing confirmation no obstructions of the determined Sky Scan Angle.

Determining the maximum unobstructed pointing zenith angle

In a similar manner, a routine will be developed to determine the maximum unobstructed pointing angle more precisely, based on the experience gained during the *Cabauw Intercomparison of Nitrogen Dioxide Measuring Instruments 2 (CINDI2) campaign.*

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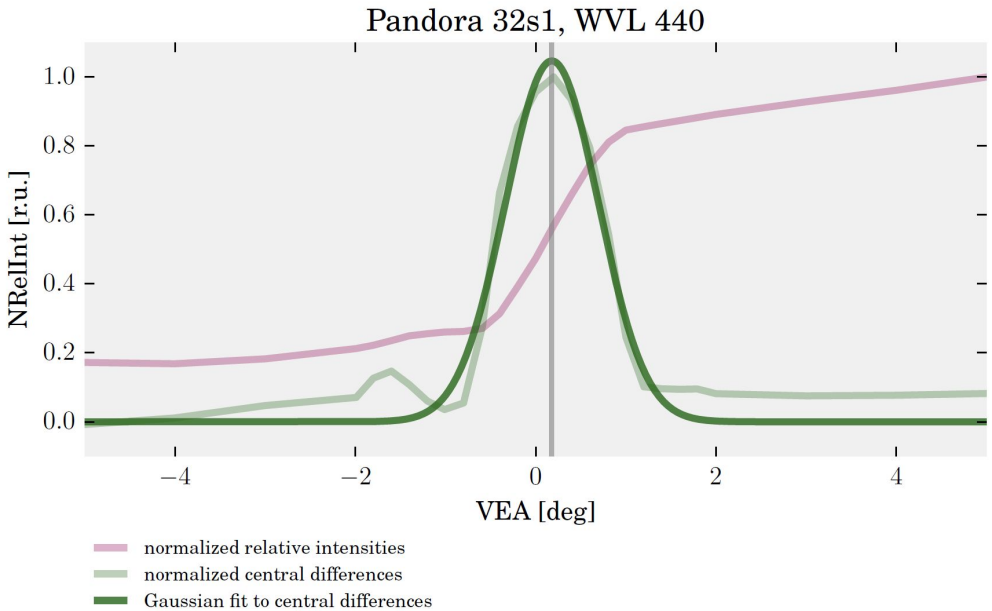

Figure 13: Retrieval of the elevation angle of the horizon (HorEA) based on EH routines. The red curve gives the (normalized) descending signal when pointing from 5 to -5° VEA. The normalized central differences from the signal curve is illustrated as light green curve, and a Gaussian fit in this curve as green line. The intercept of the gray vertical line with the x-axis gives the actual HorEA.

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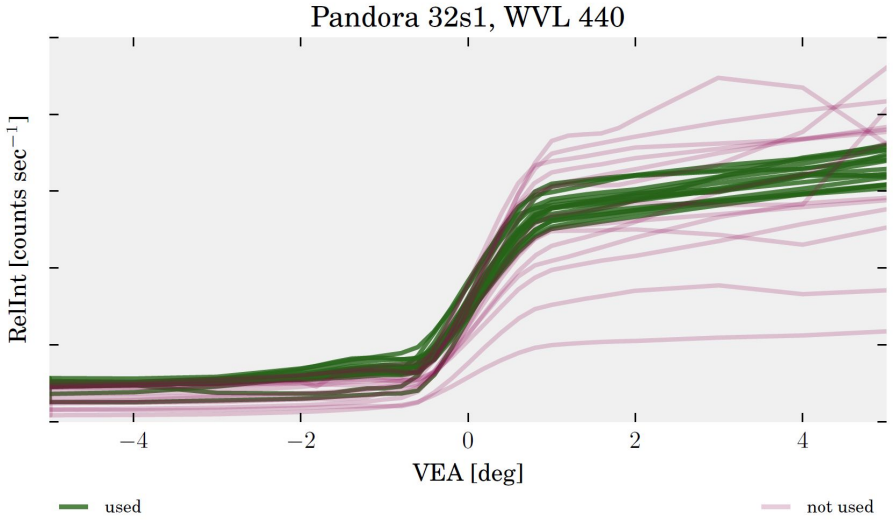
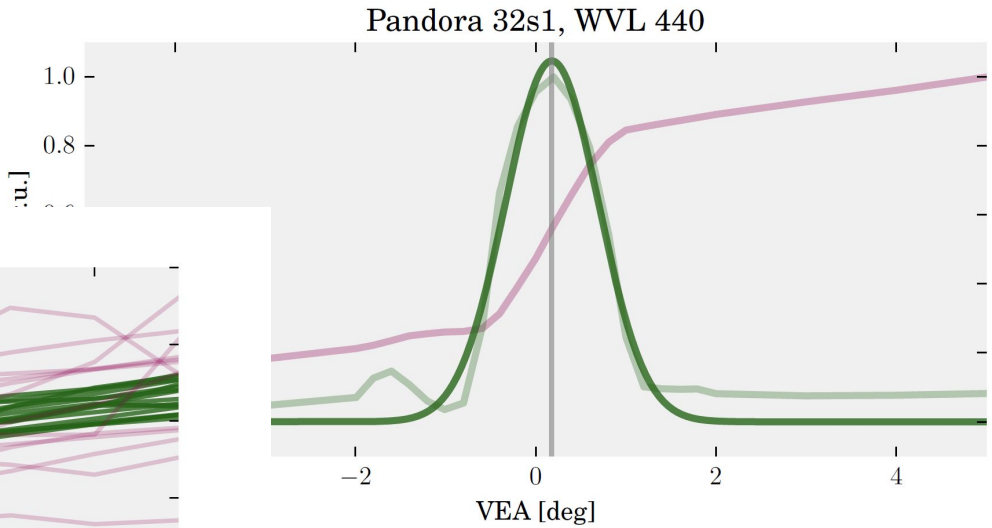


Figure 14: RelInts from all EH routines at 440 nm collected by Pandora 32s1. The VEAs within routine EH descend from 5 to -5 degrees. Only data exhibiting a comparable pattern are included in the comparison. By this we want to avoid cases, where the actual HorEA is smeared out by atmospheric conditions. Curves accepted by the selection criteria (1) are shown in green, the rejected curves in red.



ative intensities
tral differences
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