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METEO FRANCE

Trying to understand the antenna pointing variability at X-band

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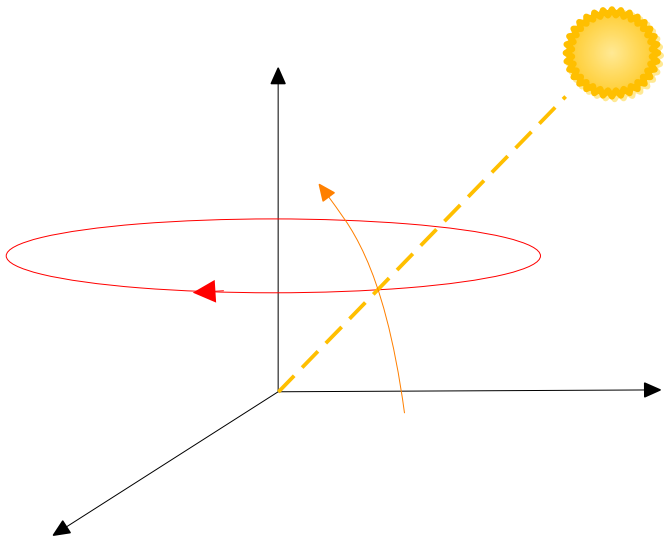
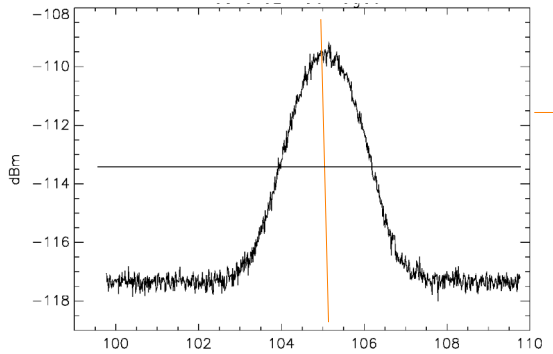
WXRCALMON2021, 17-19 November 2021, Toulouse

Sun tracking at METEO-FRANCE

Antenna pointing checked by sun tracking : - twice a month for each radar
- human-made, at any time, sun elevation > 10°

Sun tracking : - one complete scan clockwise at sun elevation

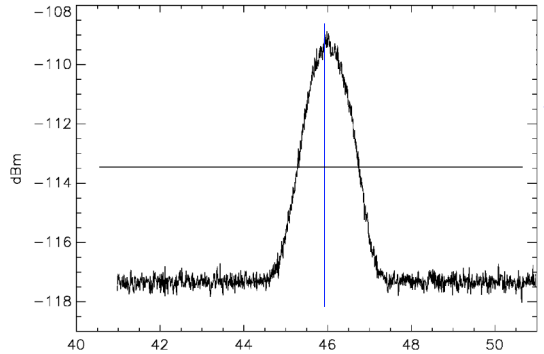




observed azimuth of the sun =
azimuth of the maximum of signal
(barycentre of the top of the curve)

→ azimuth pointing error

- 20° scan upwards at sun azimuth corrected for the azimuth pointing error



observed sun elevation =
elevation of the maximum of signal
(barycentre of the top of the curve)

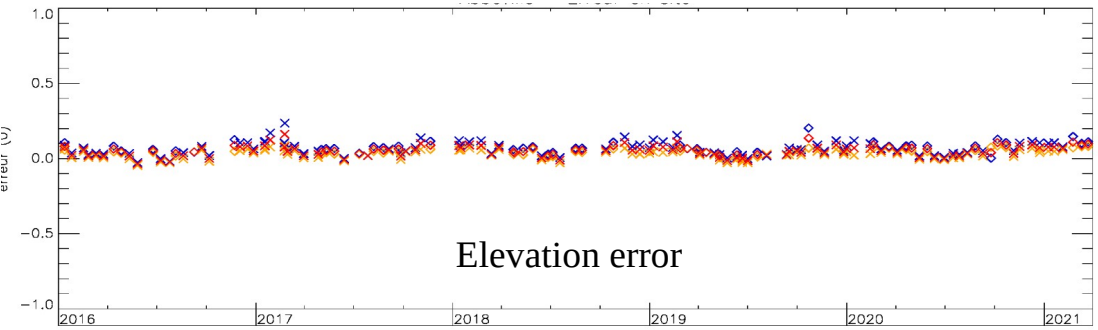
→ elevation pointing error

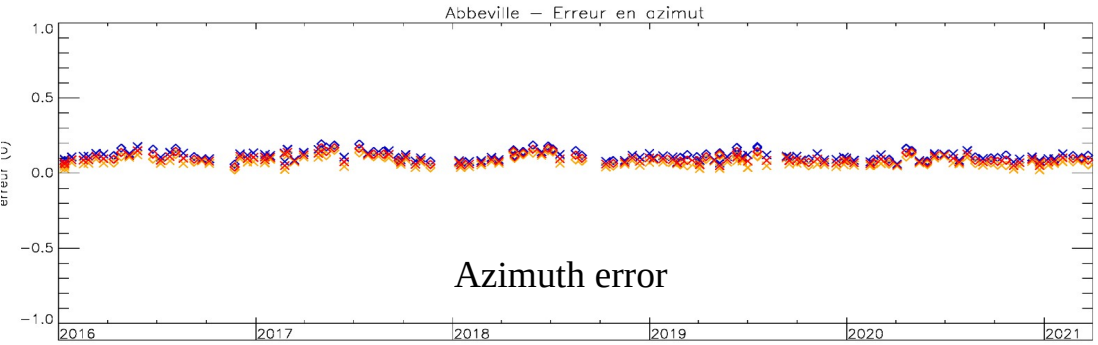
- and the same counter-clockwise and downwards

Results of sun tracking

C-BAND

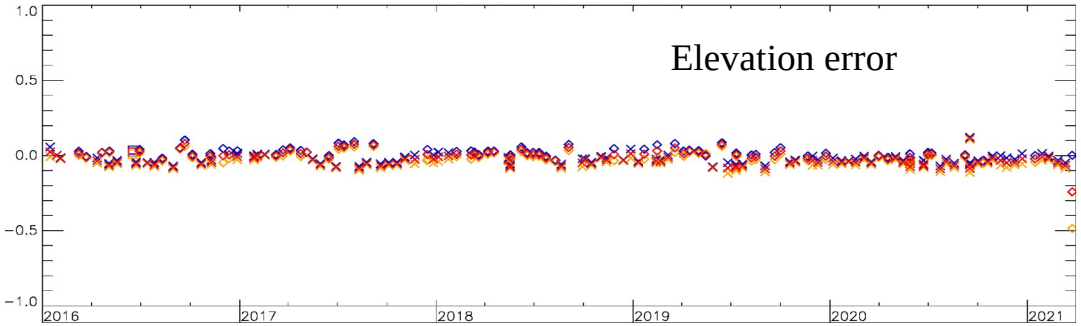
ABBEVILLE





5 years period (01/2016 - 03/2021)

BORDEAUX

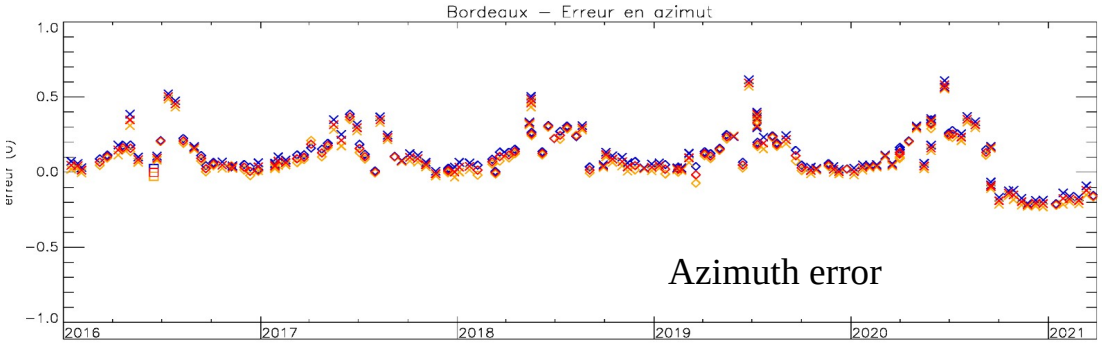


Usually :

consistent, low dispersion

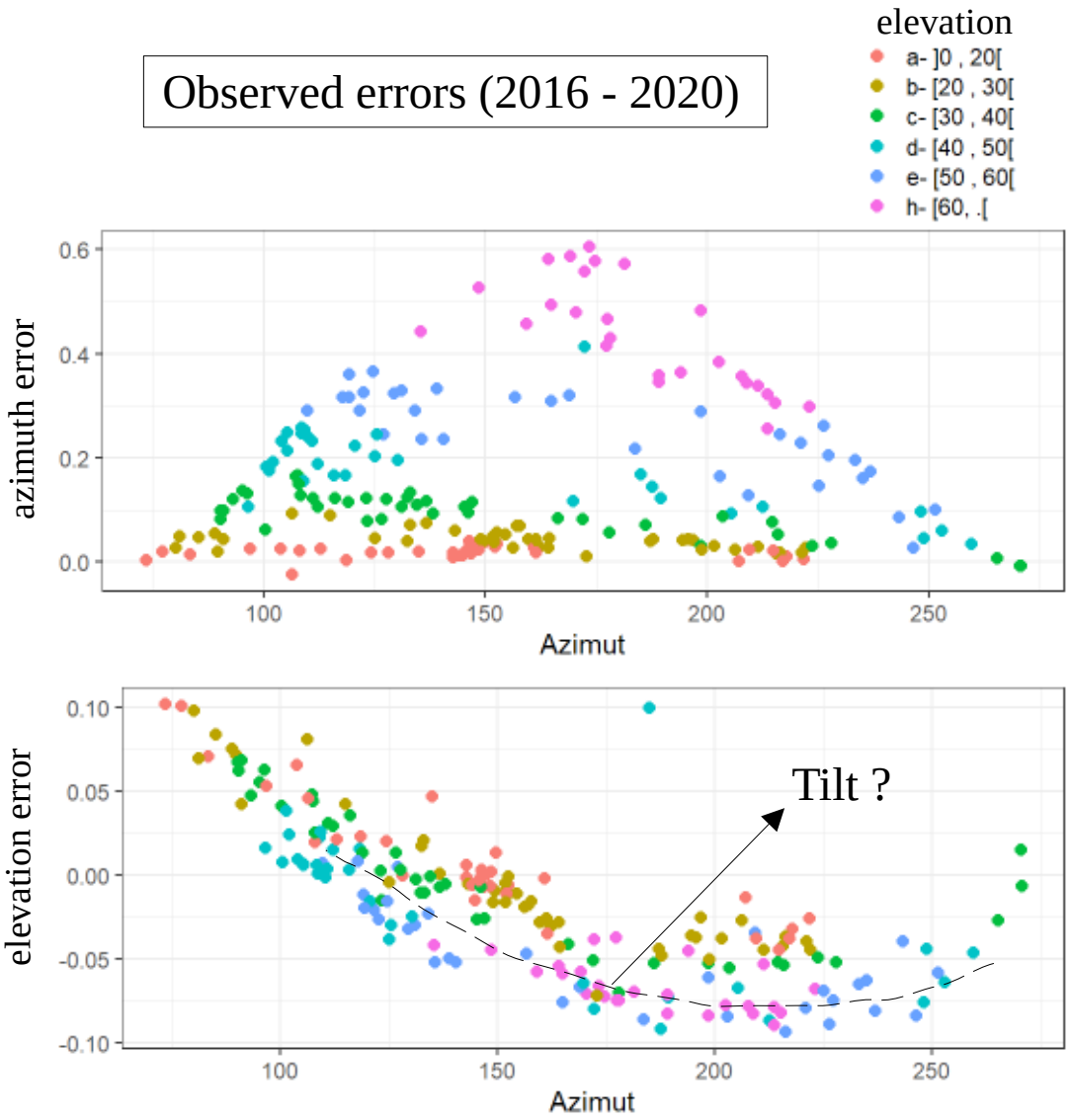
For some radars :

significant azimuth errors during summer

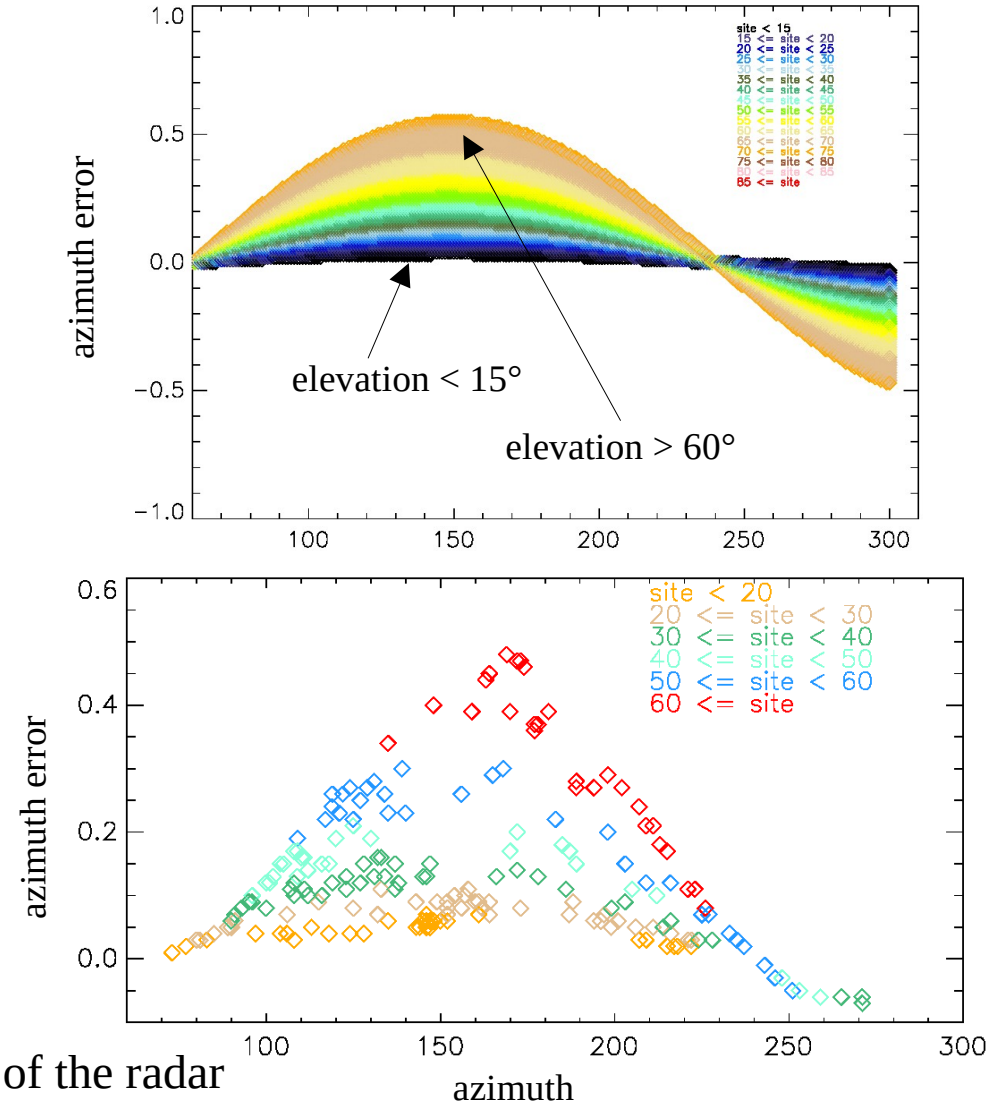


Errors due to a tilt of the radar : Bordeaux

Observed errors (2016 - 2020)



Simulated errors (tilt 0.2° - higher azimuth 240°)



→ the azimuth pointing errors are at least partly due to a tilt of the radar

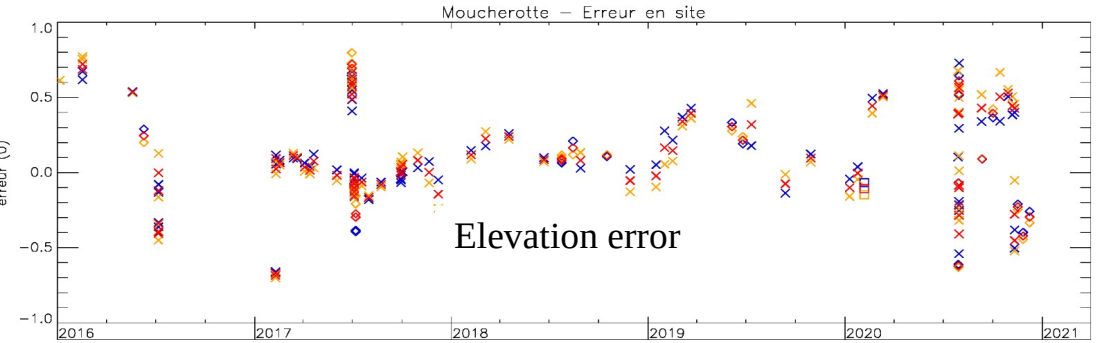
Results of sun tracking

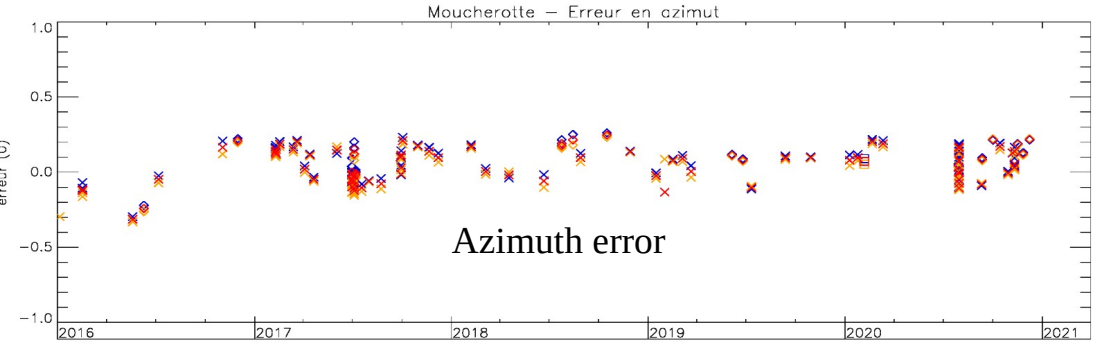
X-BAND

X-band : 50DX in the Alps (4) + 60DX not in the Alps (2)

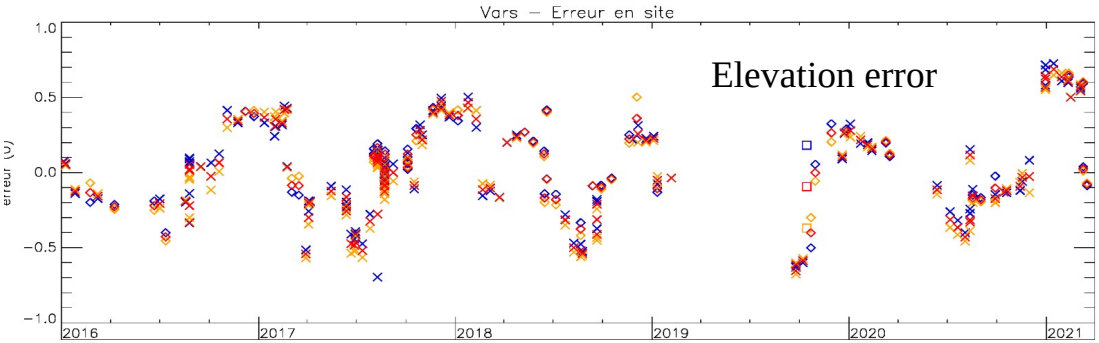
5 years period (01/2016 - 03/2021)

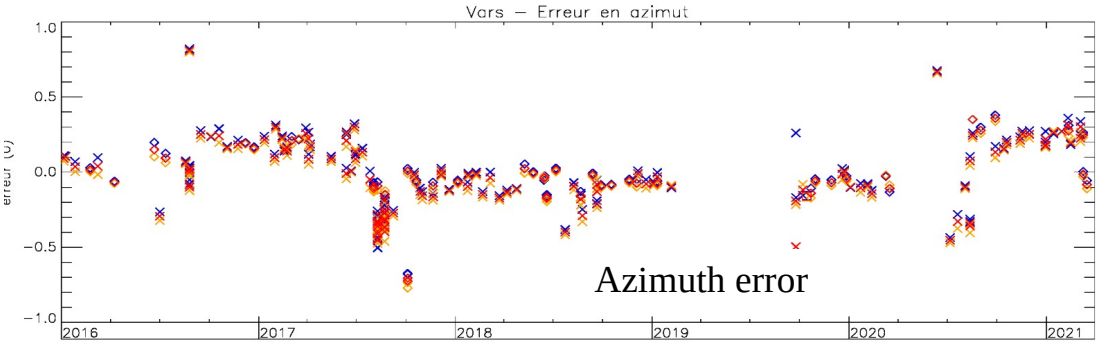
MOUCHEROTTE





VARS

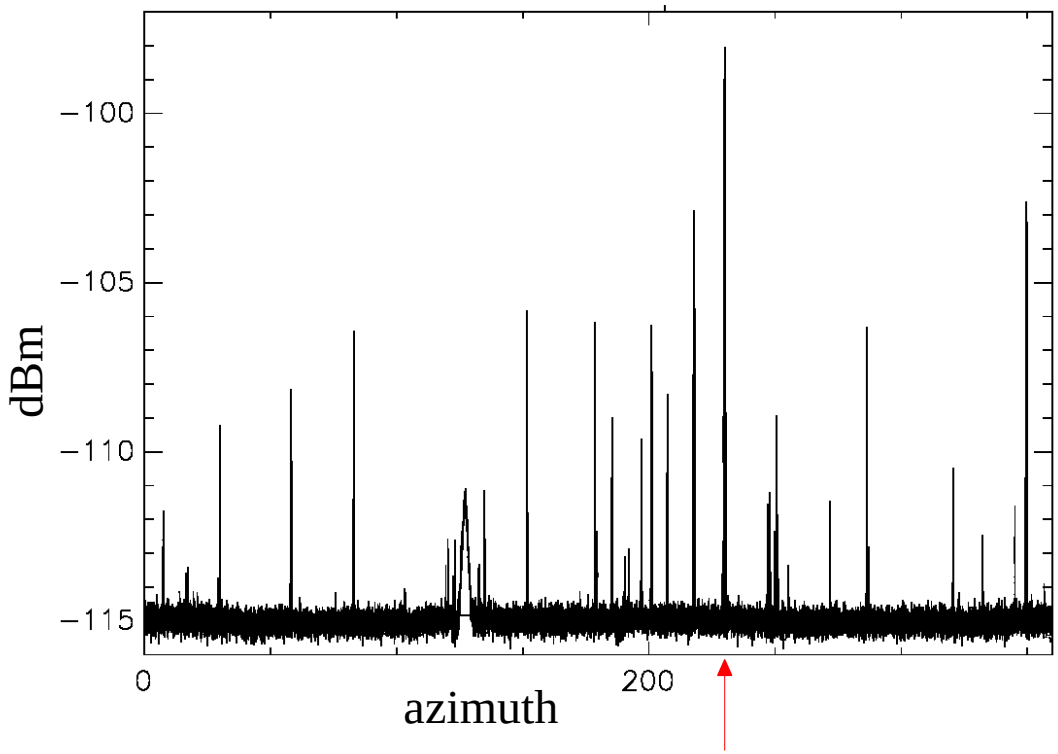




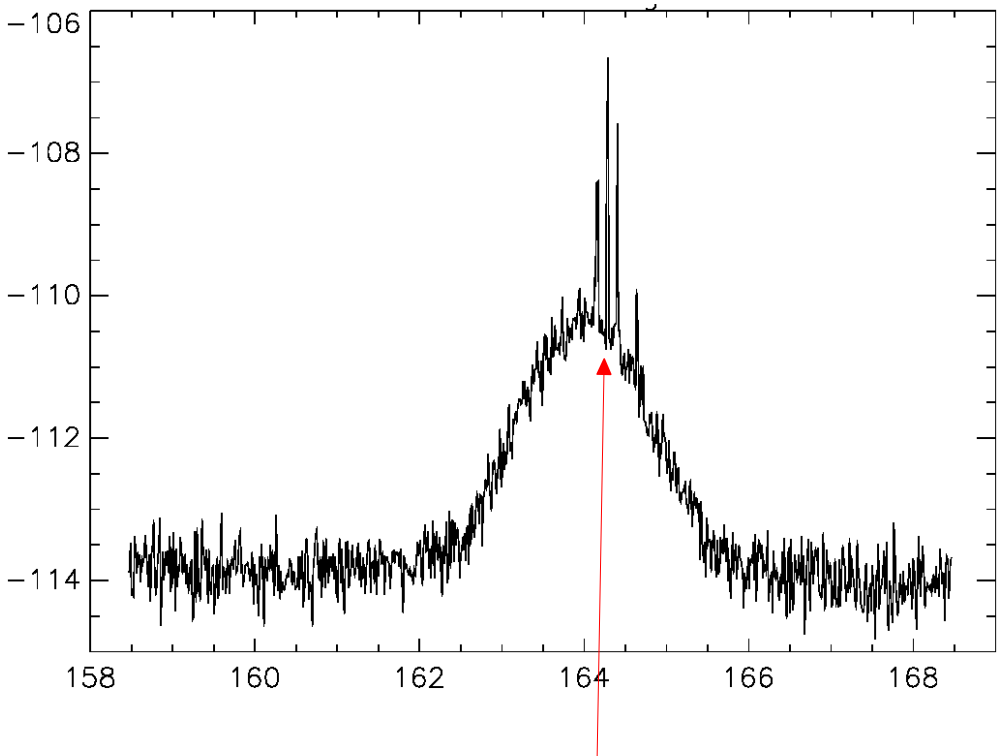
Sun tracking results for all X-band radars in the Alps (50DX) are erratic.
(and many software corrections of the elevation offset may have made the problem worse ...)

WHY ?

Impact of interferences



Computed sun azimuth = 229,83°



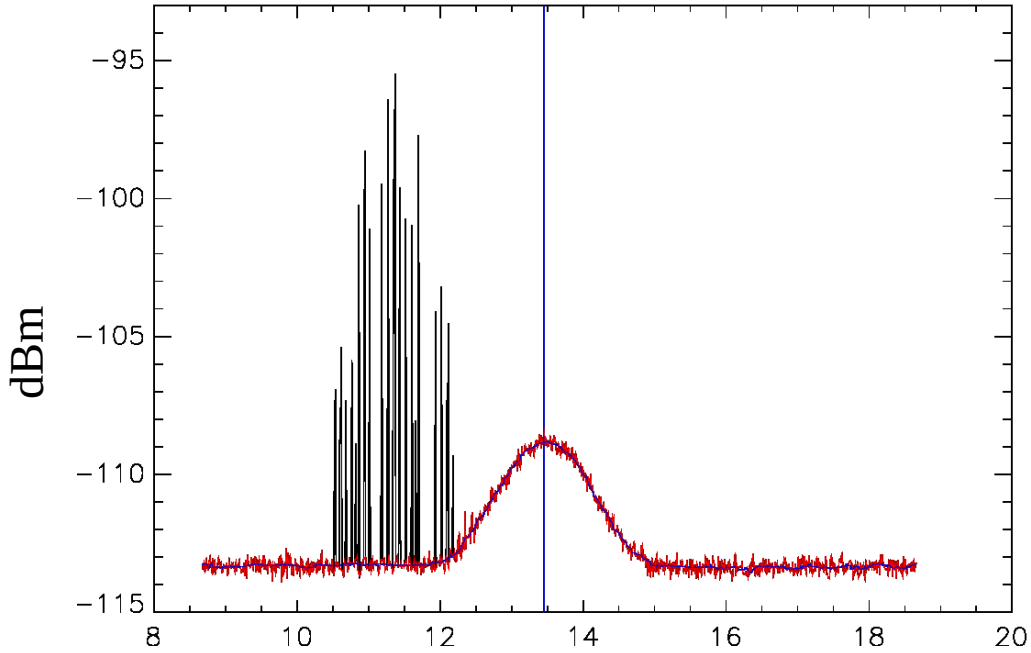
Barycentre miscomputed ...

The algorithm used to compute the position of the sun is not robust enough ...

Making our algorithm more robust against interferences

1/ Cleaning the interferences

(suppression of the data with power > median + 2 dB, median filter ± 0.15°)

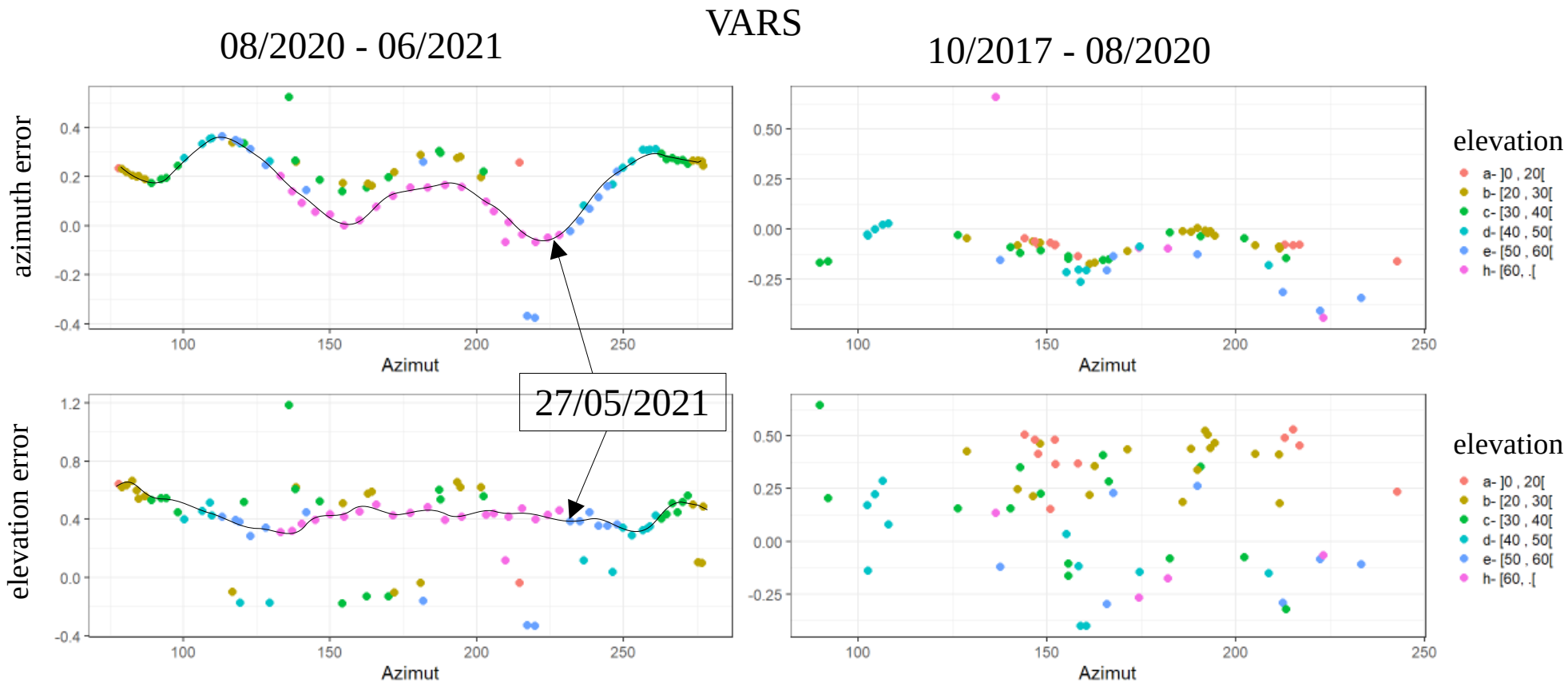


2/ Adjusting the signal with a gaussian curve

→ still under progress

« Interference-free » errors

Pointing errors were computed again over a period of 5 years with a cleaning of the interferences.
Results are corrected for offset modifications.

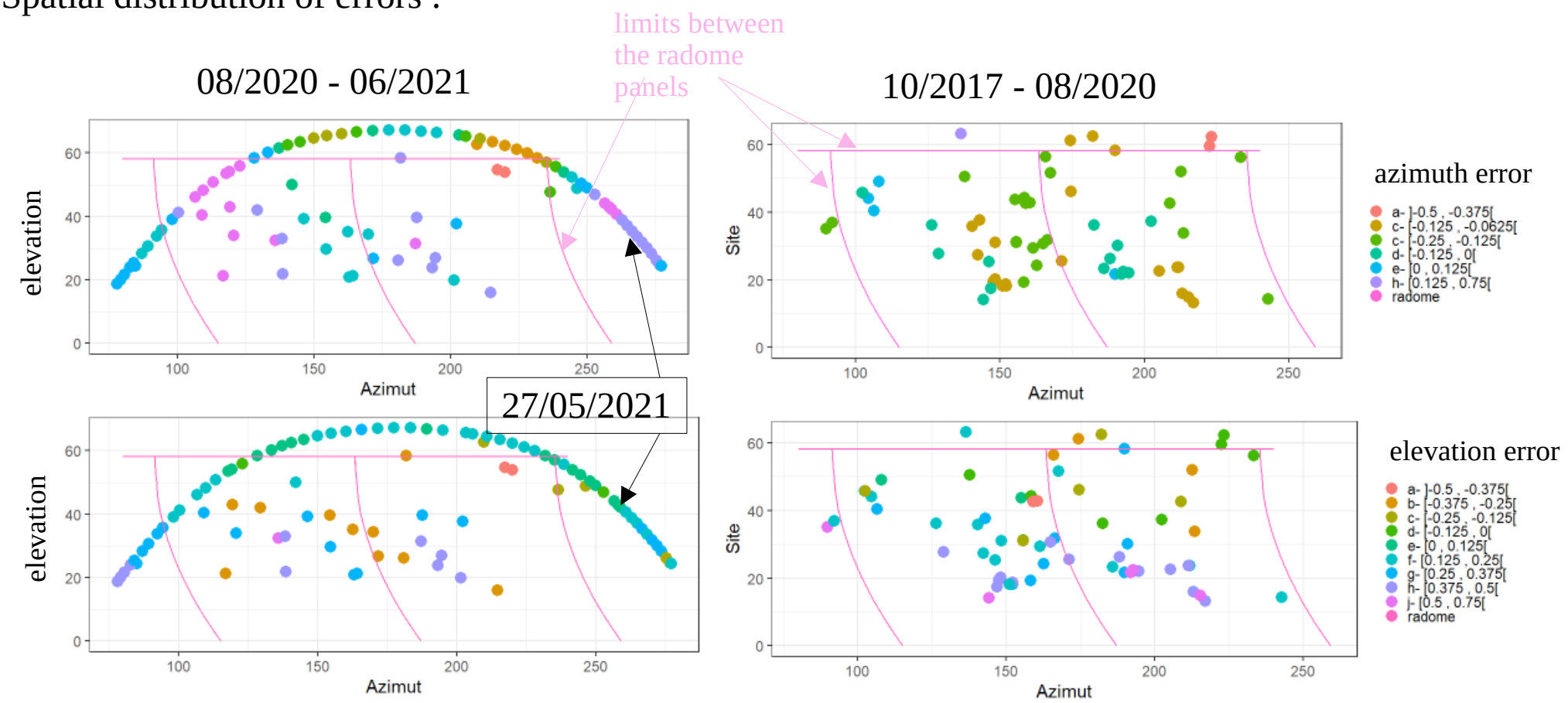


→ the impact of interferences is not the only explanation for the pointing errors variability !

Radome effects ?

X-band radomes (50DX) : 5 helical panels + 1 cap.

Spatial distribution of errors :



→ no evident correlation between the position of radome panels and azimuth/elevation pointing errors

And so ?

For X-band radars (50DX) :

- huge variability of the pointing errors, especially elevation error

- no evident explanation like tilt

- no evident correlation between pointing errors and limits between radome panels

Is the elevation offset really constant ?

Variability due to non-homogeneous radome panels ?

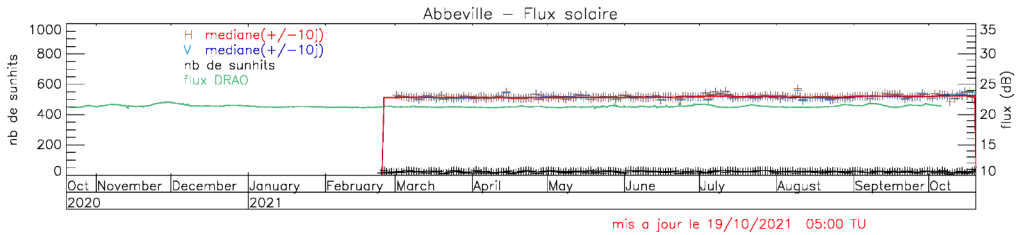
Method non valid for X-band ?

Or is the elevation offset slowly varying ?

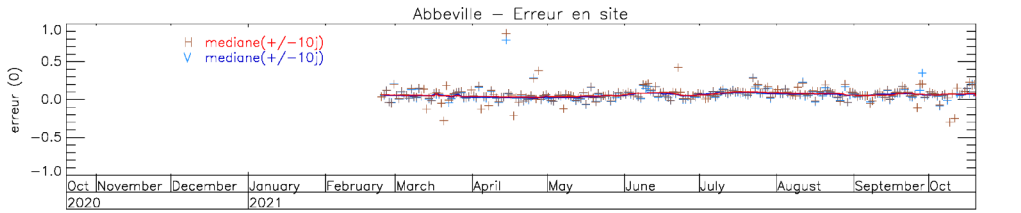
We decided to carry out measurements of the antenna elevation pointing during operational operation over a few weeks/months.

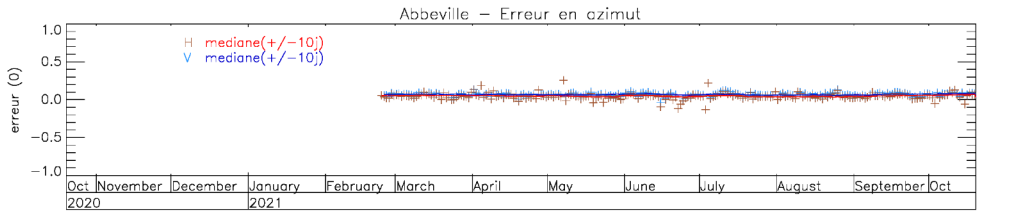
THANK YOU !

« OPERA » sun monitoring



mis a jour le 19/10/2021 05:00 TU





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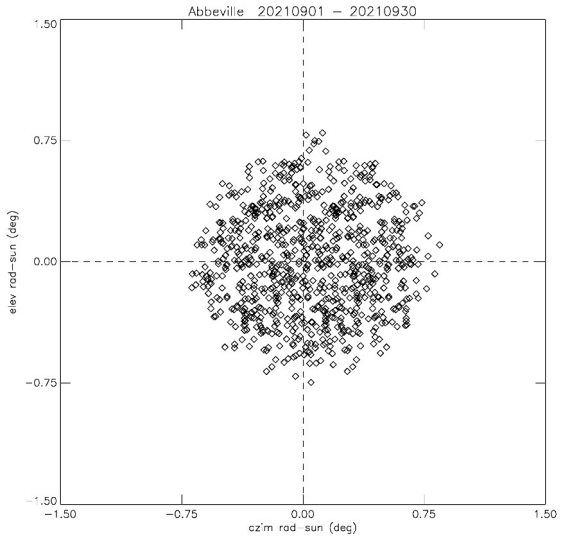
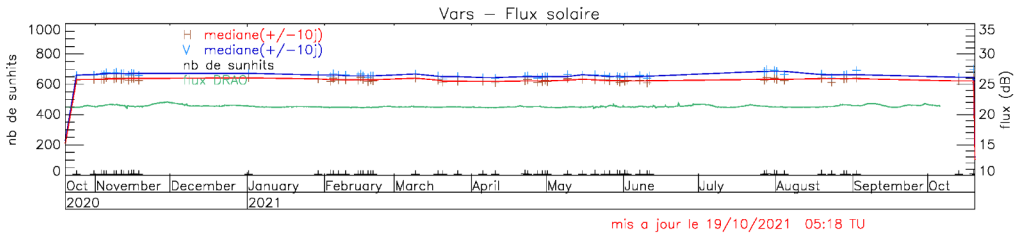


C-BAND



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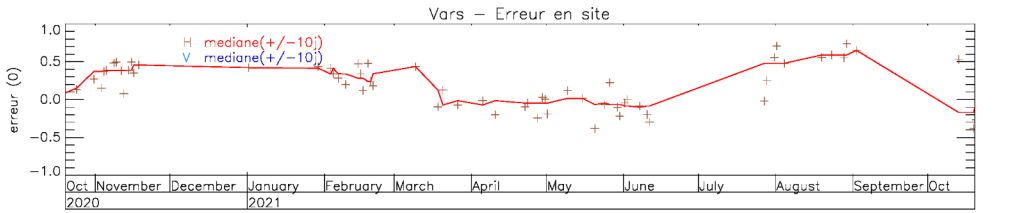

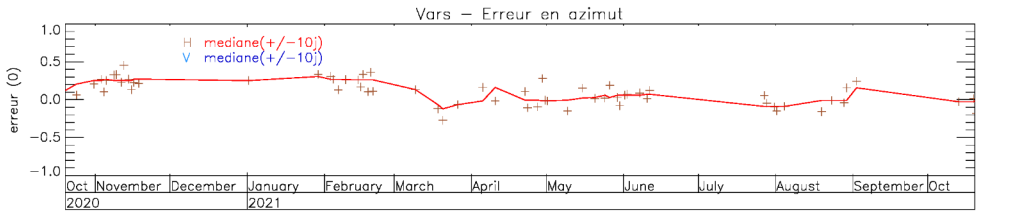

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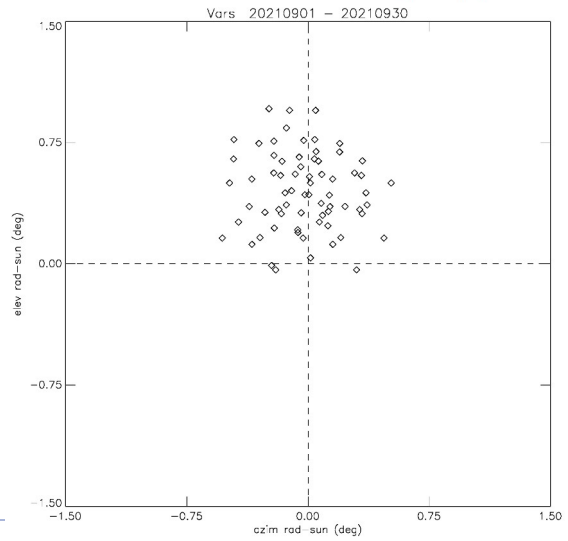
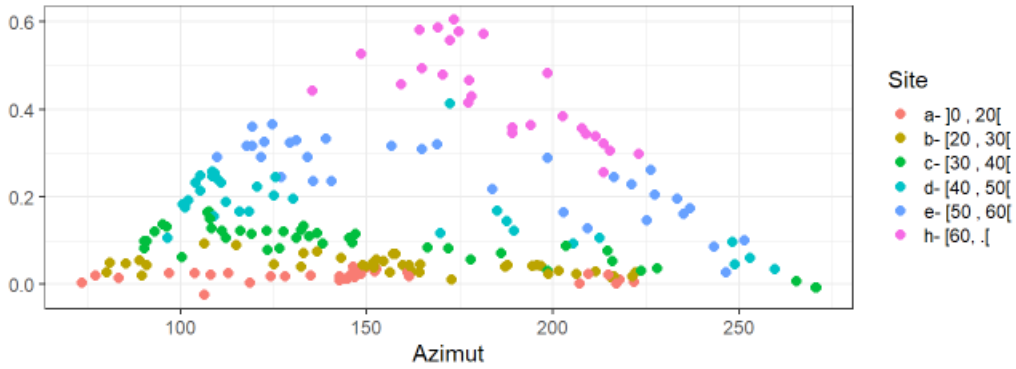
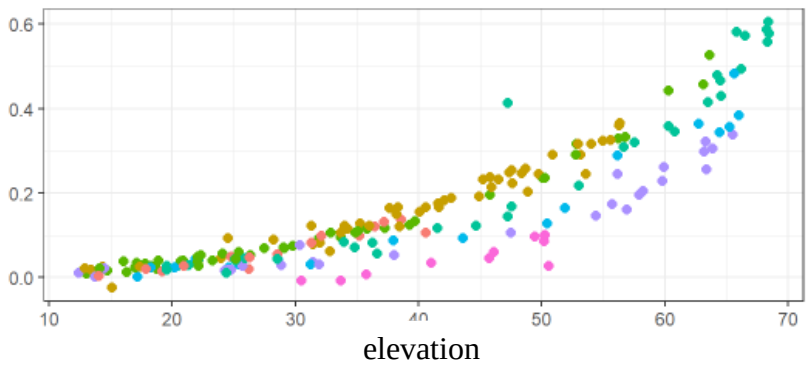


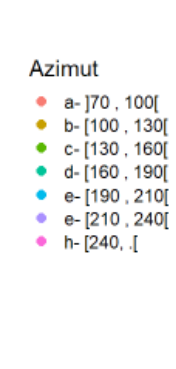
X-BAND

Bordeaux (C-band)

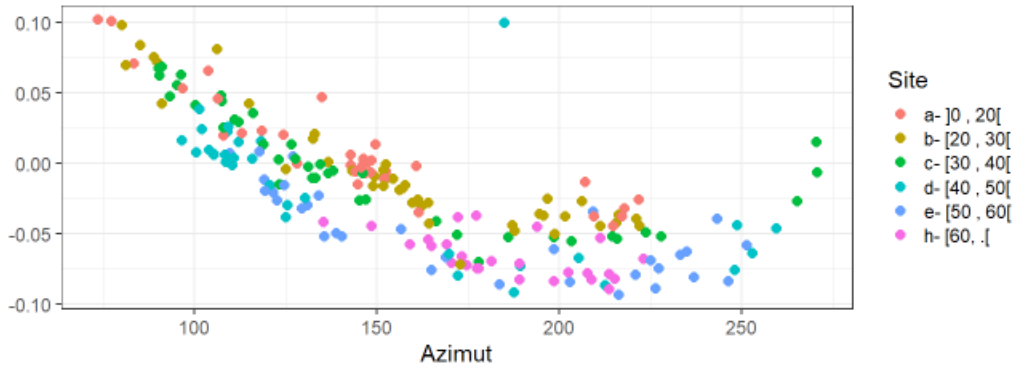
azimuth error

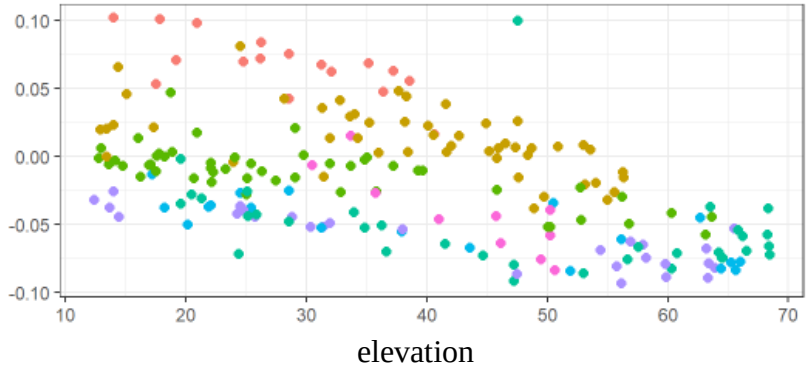






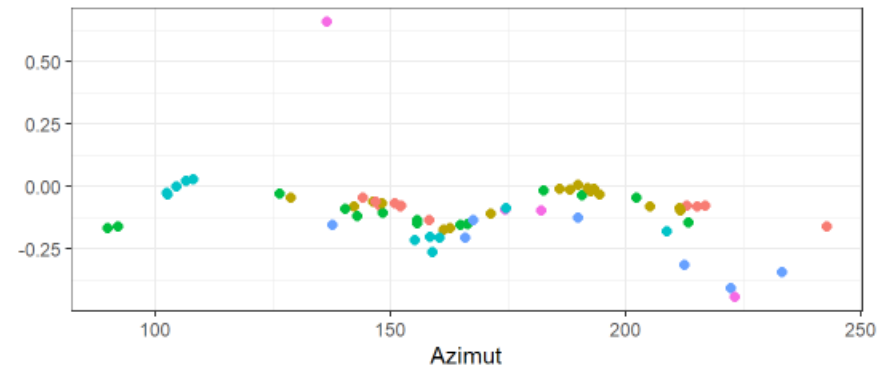
elevation error

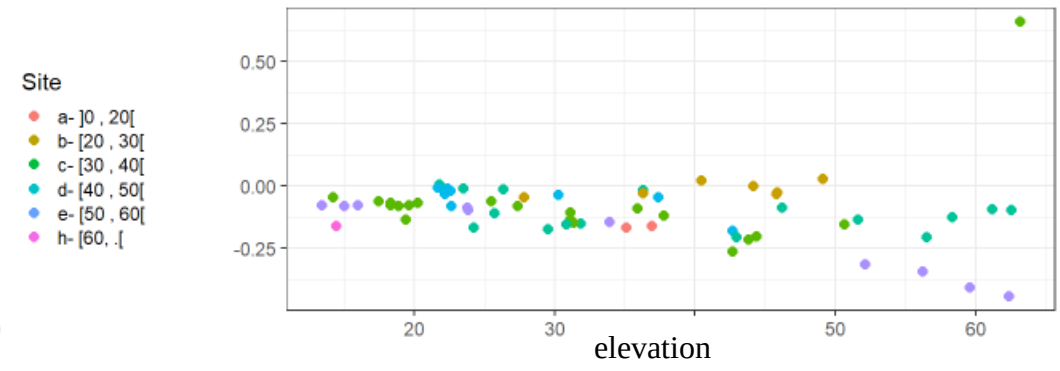


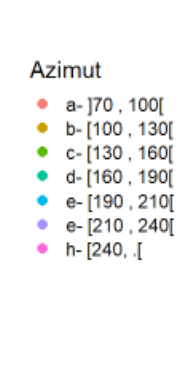


Vars (X-band, 50DX)

azimuth error







elevation error