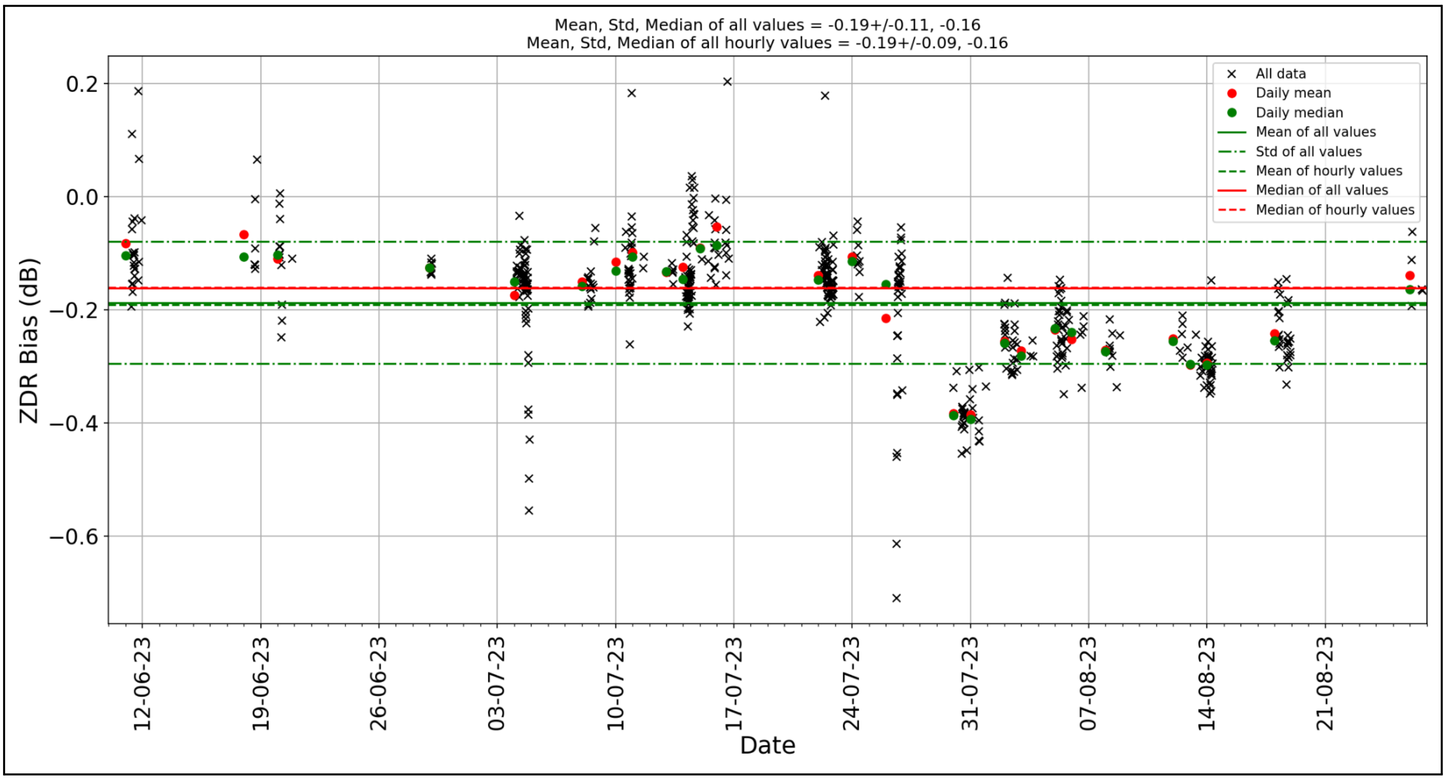
ncas-mobile-x-band-radar-1 (NXPol-1)

Summary of results: no calibration offsets applied to ZDR or Z

a. ZDR bias

i. Analysis of 90° birdbath scans

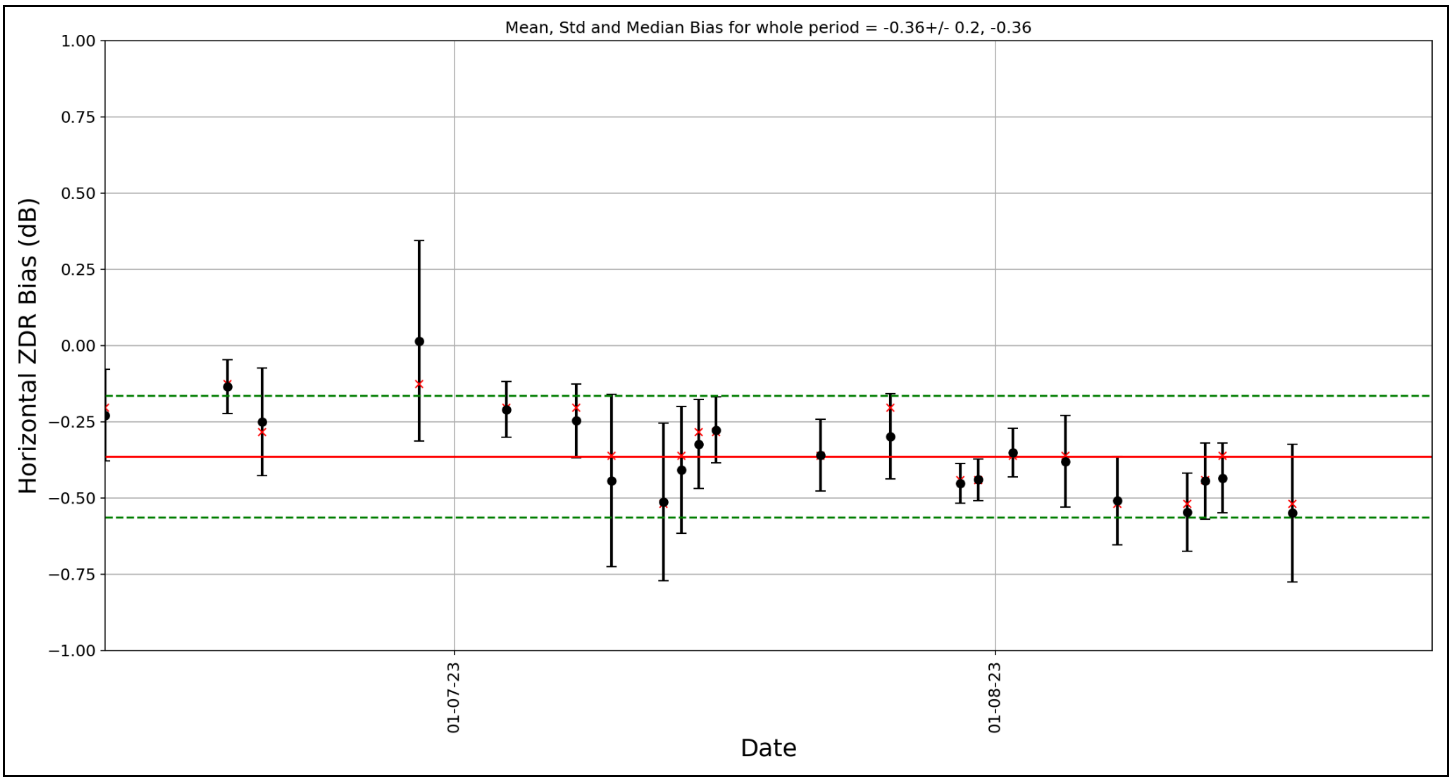


The above figure shows an overall median bias of -0.16 dB for the whole of the project. There appears to be a change in bias after 26/07/23, becoming more negative, but perhaps returning to a similar value on the 26/08/23.

The scanning pattern for WOEST is a sequence of 12 PPIs from 1.5° to 17° using a short pulse width of 0.5μs, called “cloud scans”, followed by a sequence of 6 PPIs from 1.5° to 6.5° using a long pulse width of 2μs, called “boundary layer scans”, followed by a 90° birdbath scan using the short pulse width, and finally an RHI scan at 180° azimuth from 1° to 40° elevation also using the long pulse width. The full sequence repeats every 10 minutes.

ii. Analysis of PPI cloud scans

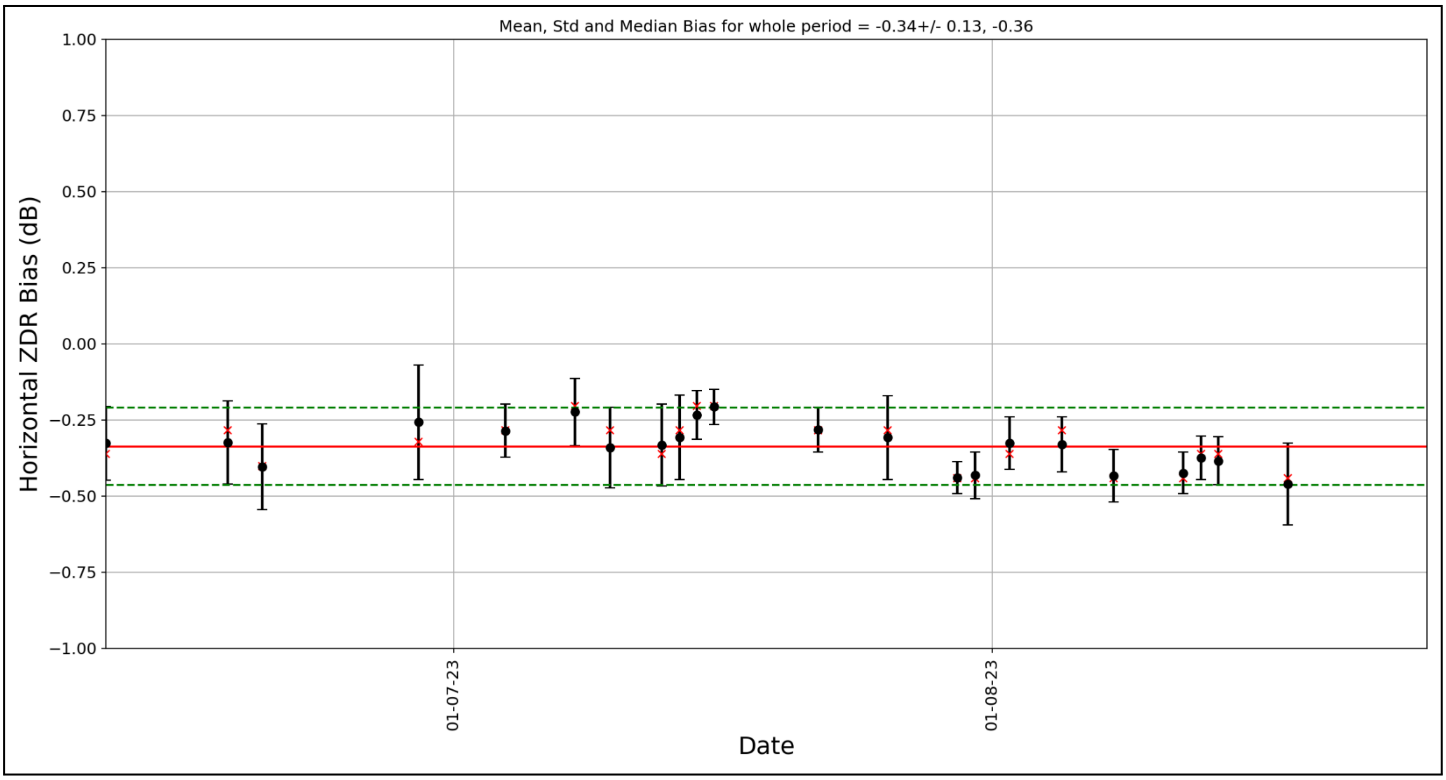
The plot below shows an overall ZDR bias of -0.36 dB



Light rain with a reflectivity between 15 and 18 dBZ should have a ZDR of 0.2dB. Therefore the actual bias in ZDR is -0.56 dB, which does not compare well with the bias estimated from the birdbath scans (-0.16dB).

iii. Analysis of PPI boundary-layer scans

The plot below shows a ZDR bias of -0.36 dB, suggesting an actual bias of -0.56 dB. We only have birdbath scans using the short pulse, therefore we cannot compare the PPI bias with that of the birdbath.



Prior to the campaign there were some repairs to, and replacement of, components of the receiver, which leads us to have less confidence in the stability and calibration of the system. We observed some jumps in ZDR between subsequent scans that appear to be a result of changes to the magnitude of the vertical reflectivity. This is believed to be a hardware issue rather than caused by meteorology.

Due to uncertainties in the accuracy of the calibration, we have decided not to apply any offsets to ZDR.

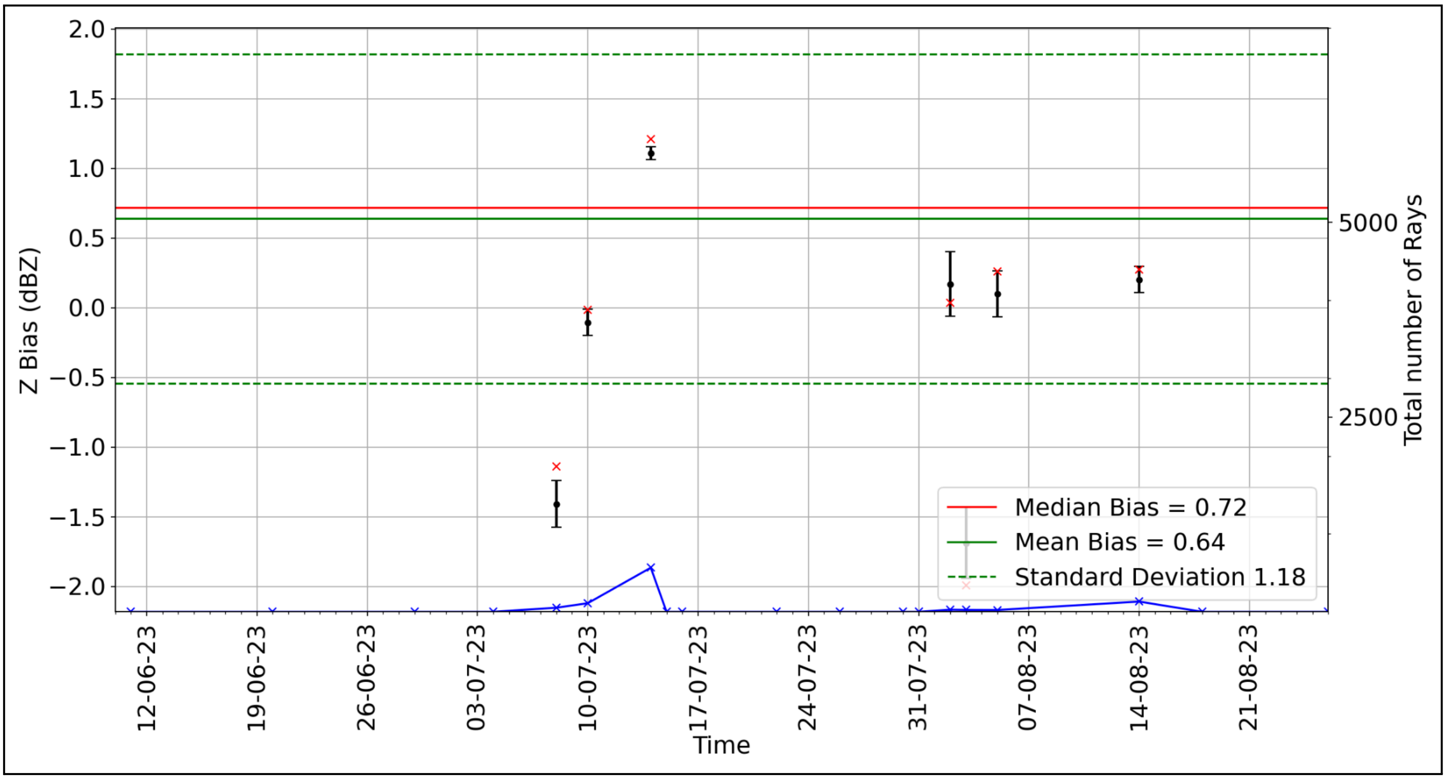
b. Z bias

The number of valid rays for this analysis is shown below, for the cloud scans on the left and the boundary layer scans on the right. The cloud scans used a scan rate of 20°/s whereas the boundary layer scans were 10°/s. Therefore the number of pulses was considerably less for the cloud scans and therefore the data is noisier than the boundary layer scans, which results in fewer rays meeting the criteria needed for the analysis.

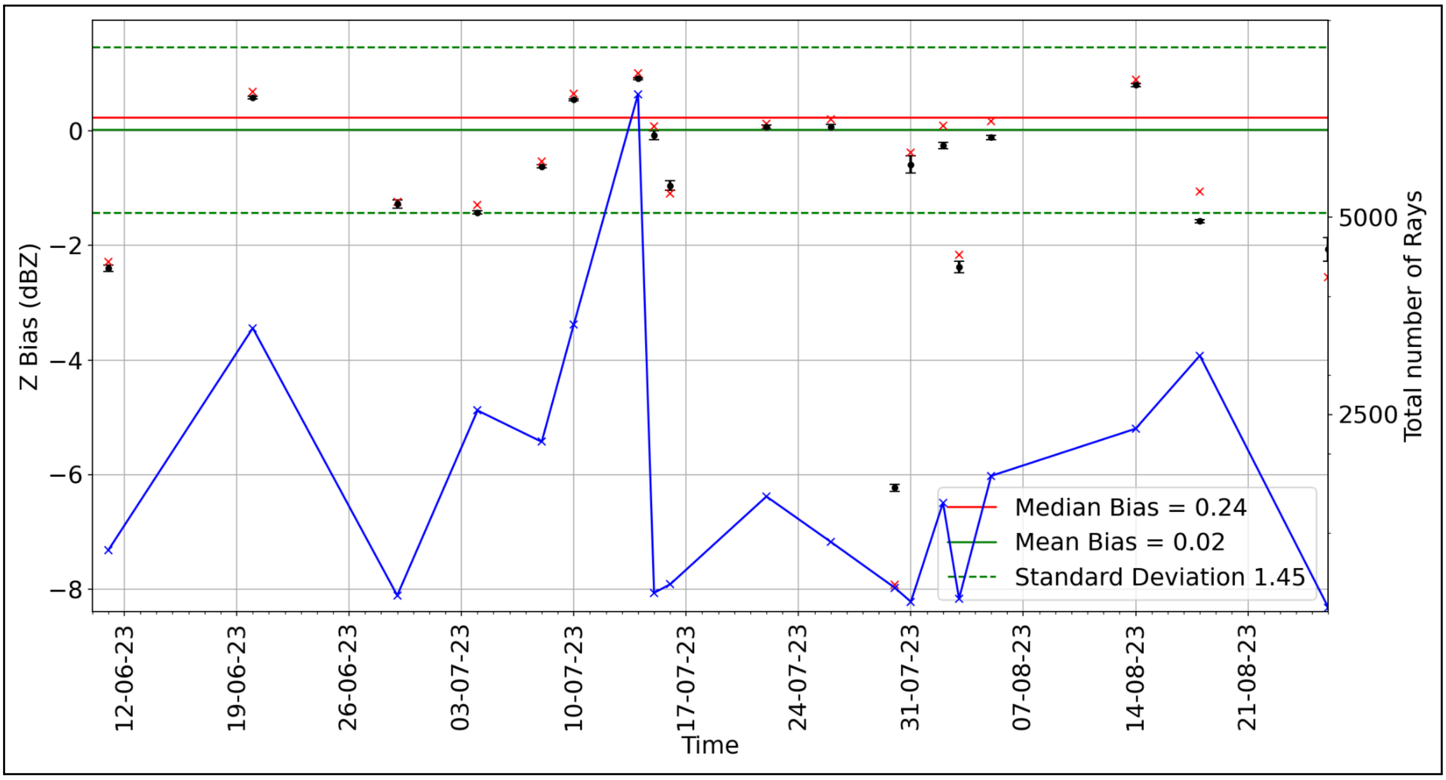
20230611	0.0
20230620	0.0
20230629	0.0
20230704	0.0
20230708	52.0
20230710	110.0
20230714	566.0
20230715	0.0
20230716	0.0
20230722	0.0
20230726	0.0
20230730	0.0
20230731	0.0
20230802	27.0
20230803	24.0
20230805	23.0
20230814	131.0
20230818	0.0
20230826	0.0

20230611	781.0
20230620	3595.0
20230629	207.0
20230704	2551.0
20230708	2154.0
20230710	3641.0
20230714	6556.0
20230715	240.0
20230716	348.0
20230722	1461.0
20230726	887.0
20230730	304.0
20230731	127.0
20230802	1381.0
20230803	166.0
20230805	1722.0
20230814	2320.0
20230818	3246.0
20230826	55.0

The plot below shows the Z bias for cloud scans with very few days with suitable data and consequently a large standard deviation. However the results suggest that the radar is fairly well calibrated in Z as the median value is < 1dBZ.



The plot below shows the Z bias for boundary-layer scans. Again there is a large standard deviation but the results have a median value of 0.24 dBZ.



We have decided not to apply any offsets to reflectivity for this dataset.