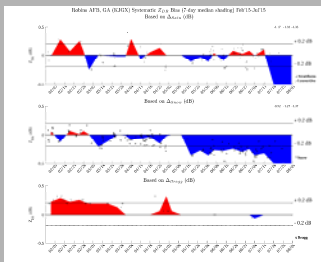
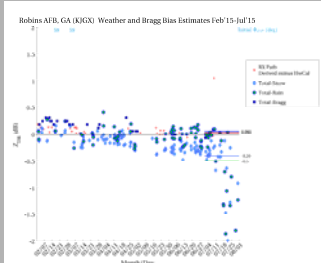


Percentage of US radars deemed to be within +/- 0.2 dB ZDR error, based on rain, snow, and Bragg scatter.

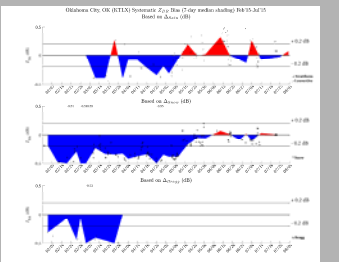


Radars site with a failing rotary joint, was in tolerance but drifted out of tolerance as seen in this time series plot of the three estimates.

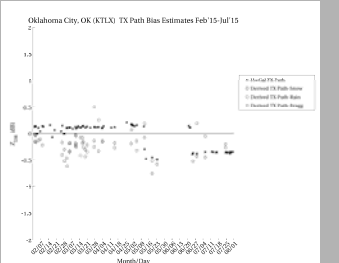


Receive path bias (measured) plotted with the external estimates showing hardware failure.

US radars use rain, dry snow, solar, and Bragg scatter estimates to supplement automatic hardware calibrations and advise sites needing adjustments



Radars site with early calibration and transmitter power issues, brought into tolerance through maintenance actions.



Plot of transmit path analysis showing measured bias and external estimates not in agreement prior to maintenance action.



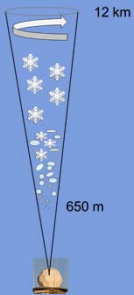
275217 Monitoring Radar System ZDR Accuracy: S and C-Band Operational Experiences in the US and Germany



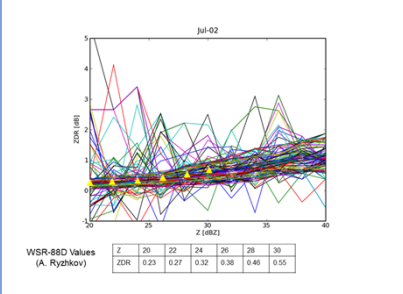
US and German Radars Use Expected ZDR Values in Rain and Solar Scans to Measure System Bias

US: S-band radar uses scans below 20 degrees elevation
DWD: C-band radar uses vertical scans

Both use solar intercepts for receive path bias estimates (Holleman et al. 2010)

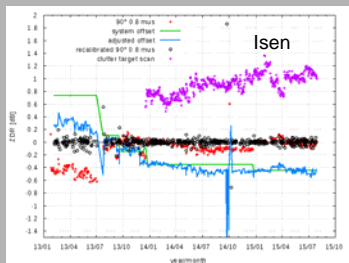


Intrinsic ZDR for rain in vertical scanning is 0 dB, while non-vertical scans depend on Z as seen below

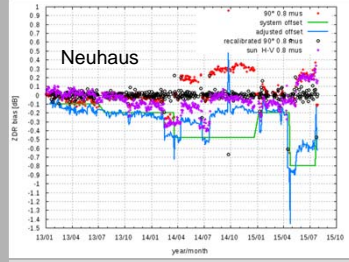


- Rain estimates - vertical scanning is the best option
- Non-vertical scans - Bragg scatter is most accurate
- External targets are useful for fixing hardware issues
- Automating use of external estimates is desirable

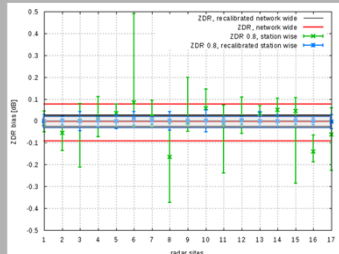
DWD radars use rain and solar estimates to update the fixed ZDR bias offset and to identify hardware failures



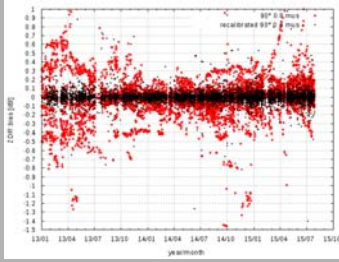
ZDR system offset, the adjusted offset based on birdbath scan. The adjusted bias, computed once a day, is used to obtain ZDR = 0 dB. ZDR from clutter is not stable enough for ZDR monitoring



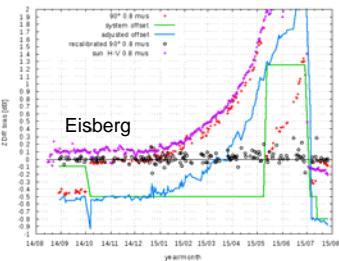
Between 14/04 and 15/01 unknown source of ZDR bias. Corrected by adjusted bias. ZDR bias increase 15/04 due to a hardware upgrade.



Statistics of ZDR bias radar station wise (17) and for the whole network. The recalibrated ZDR is well within target accuracy, station wise and on average.



Bias corrected ZDR (using adjusted offset) and ZDR based on the system offset (in red) for the whole network since 2013/01, based on birdbath data.



Example of a TR-limiter failure, visible both in birdbath and solar data. TR limiter in V channel was replaced 15/07.