

Post Processing

Radar Data Quality Control at Deutscher Wetterdienst (DWD)

Manuel Werner

**Weather Radar Calibration and Monitoring Workshop,
Offenbach, 19.10.2017**

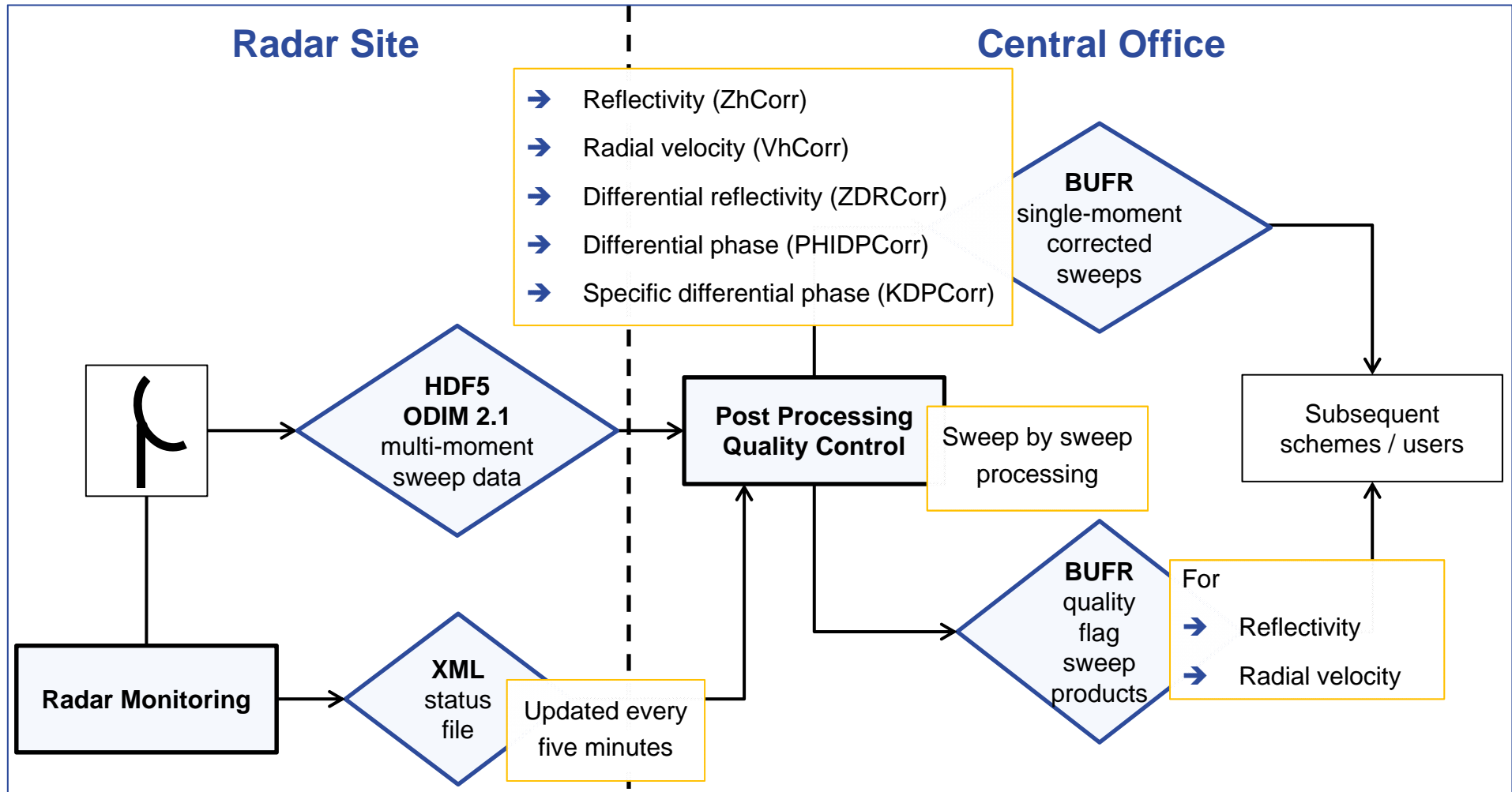
Outline

- 1. Post processing quality control and its linkage to radar monitoring**
2. Implementation and launch of HDF5 ODIM 2.2 format at DWD
3. Outlook



Post Processing Quality Control

→ Detection and correction of spurious echoes in polar radar data (sweeps) downstream



Quality Flag Products

- Quality flag products for
 - Reflectivity
 - Radial velocity

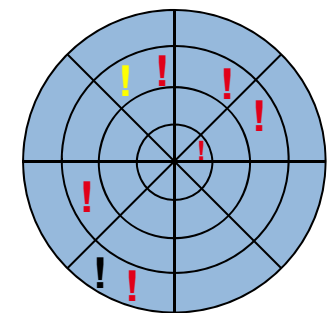
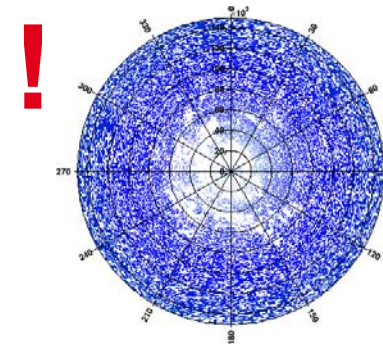
Contents:

„Sweep global“ information:

- Radar hardware
- Radar maintenance
- Corrupt image
- Radom attenuation
- ...

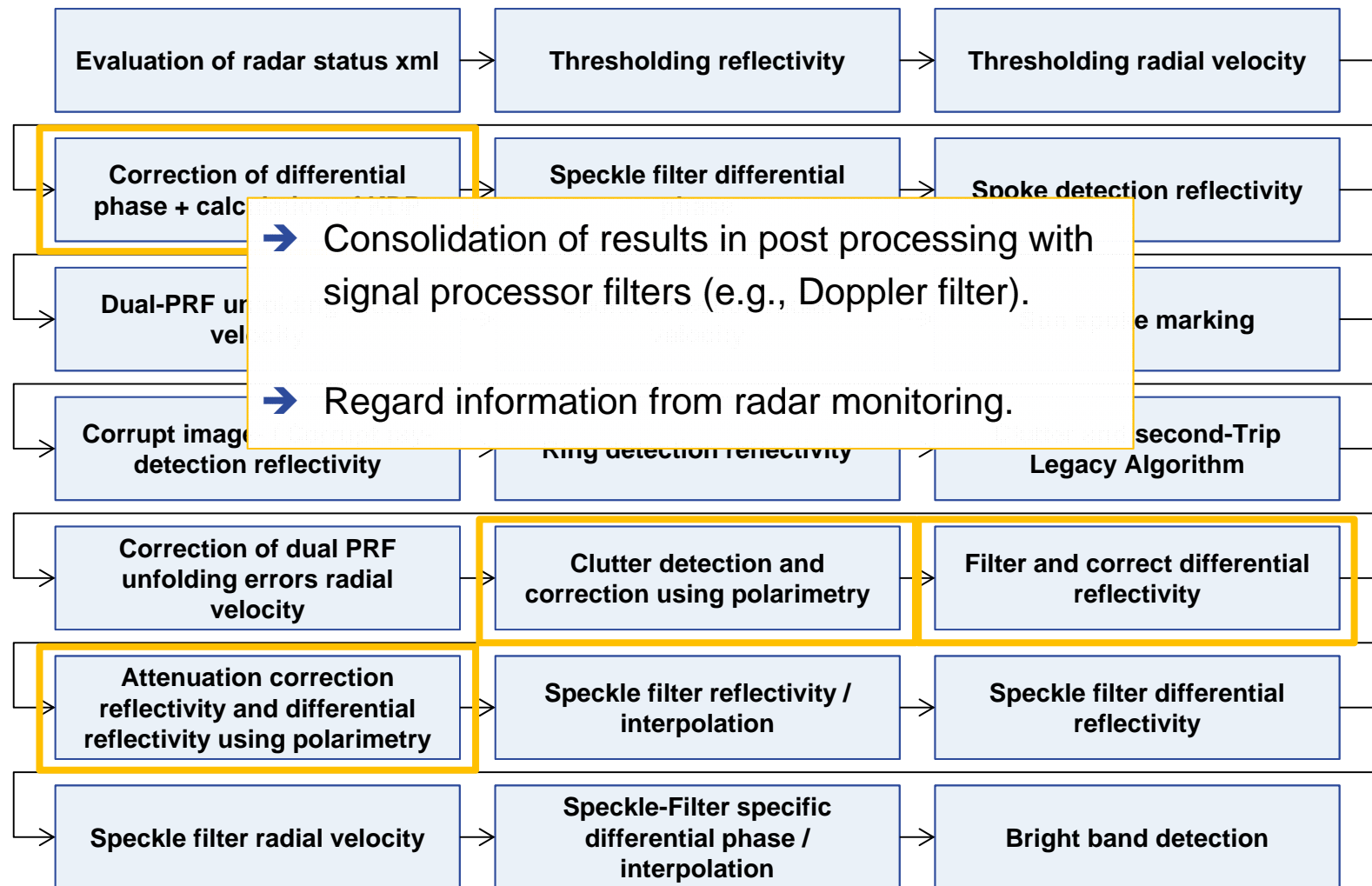
„Pixel by pixel“ information:

- Signal processor overflow
- Positive spokes / Negative spokes
- Positive rings / Negative rings
- Static clutter / Variable clutter
- Second trip
- Propagation path attenuation
- Bright band
- Radial velocity aliasing
- ...

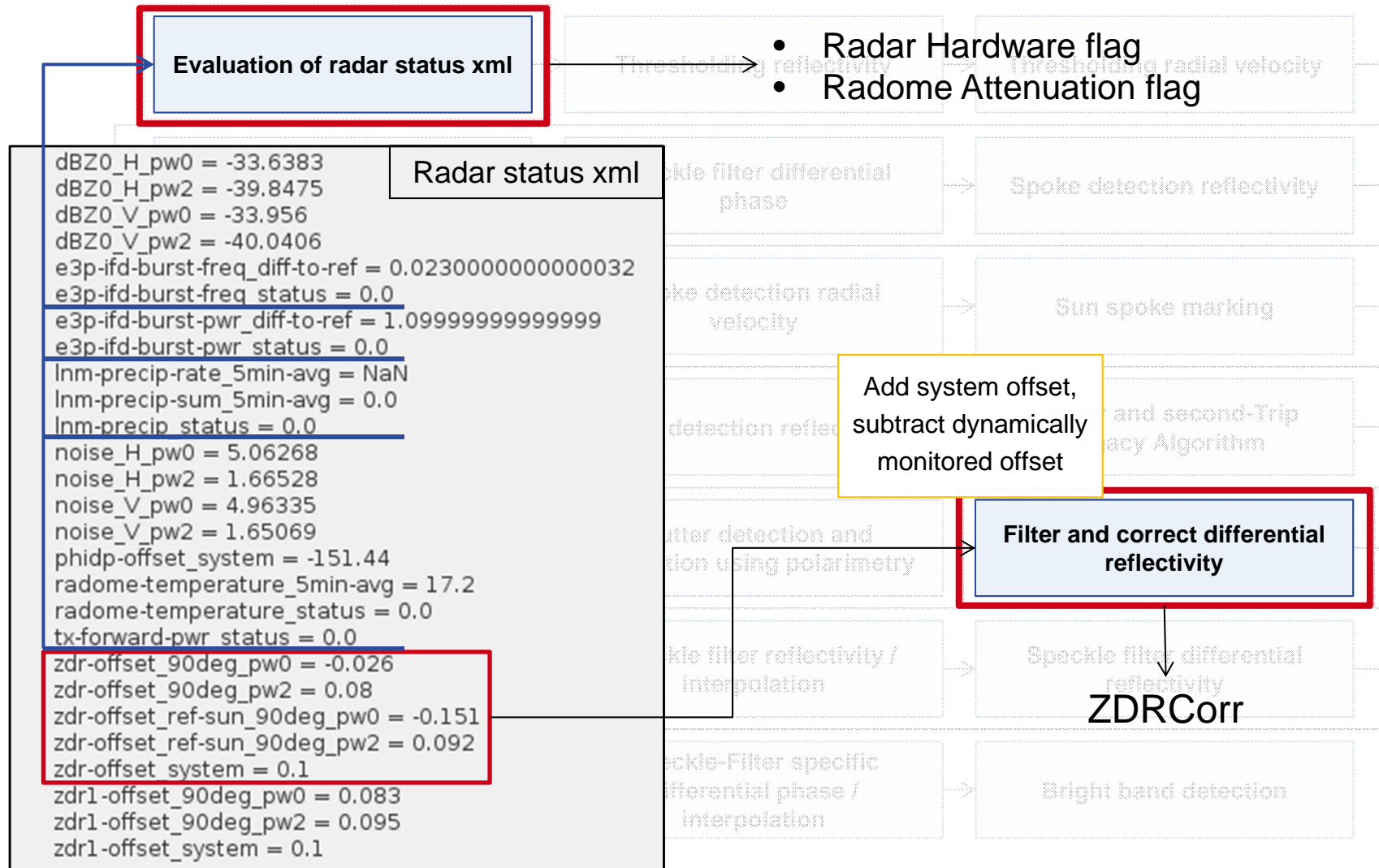


QA Algorithm Chain

→ We start from uncorrected quantities (UZ_h, UnV_h, UZDR, UPHIDP, URHOHV, etc.) ...

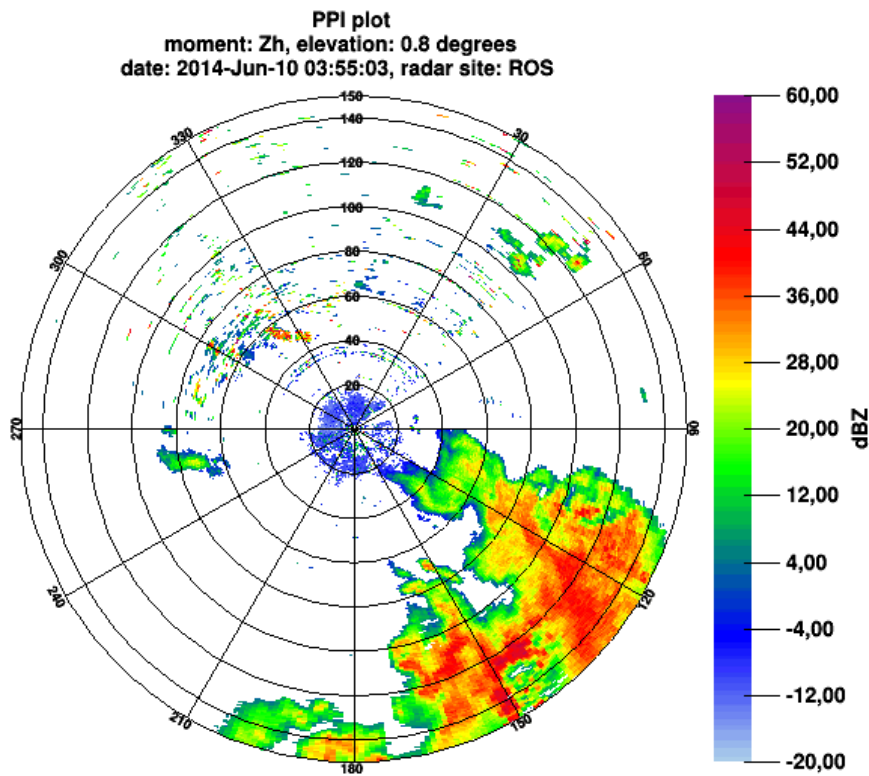


Current Use of Radar Monitoring

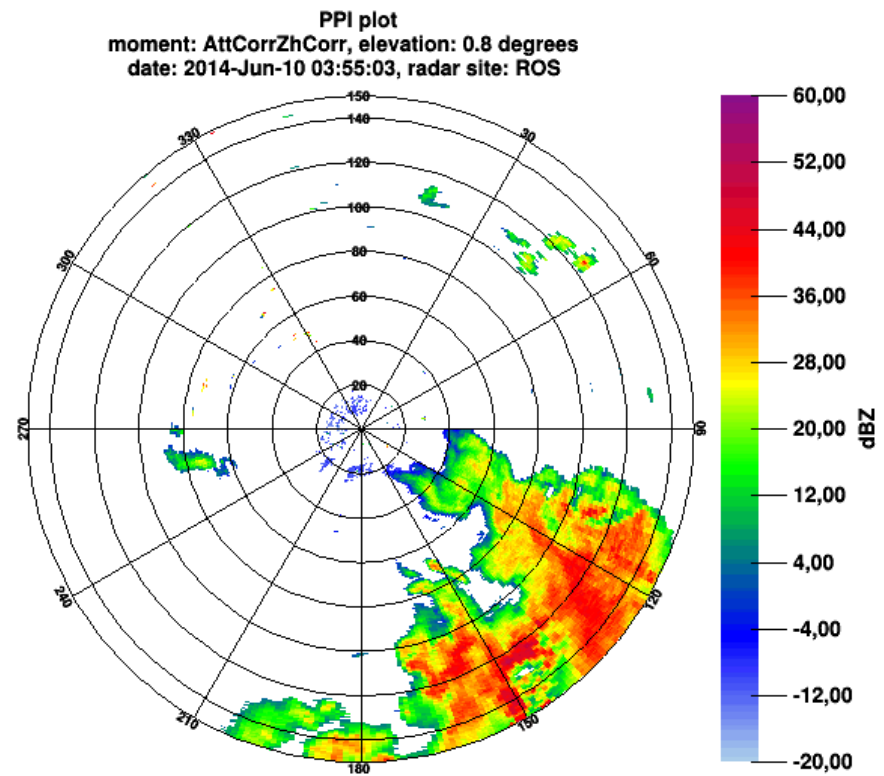


Corrected Reflectivity

Corrected Reflectivity (only signal processor filters)



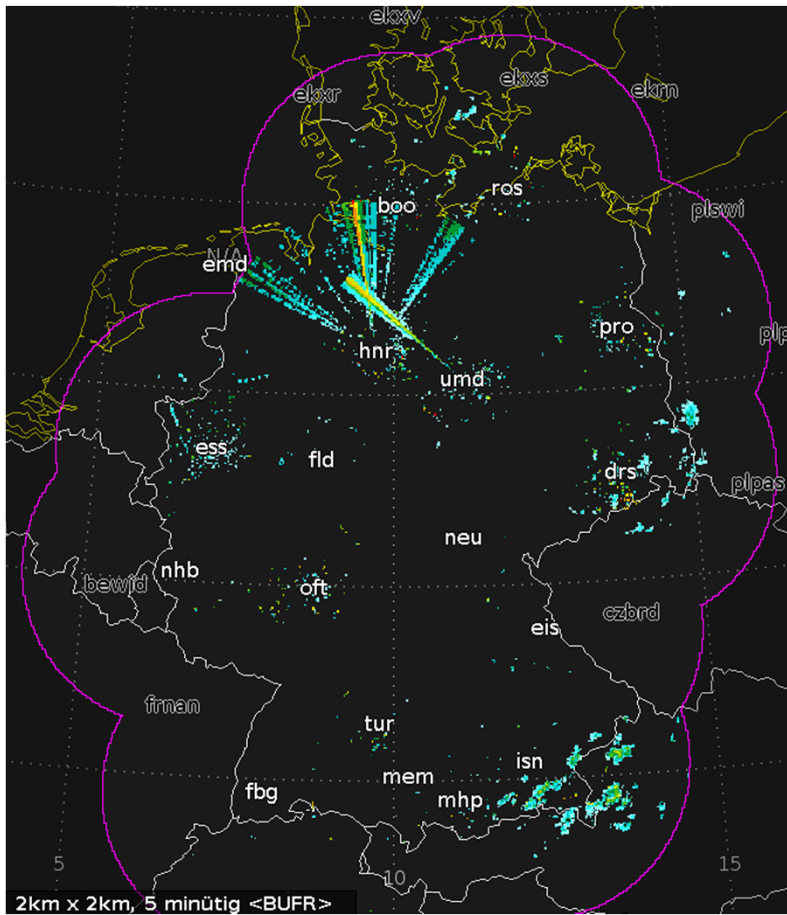
Corrected Reflectivity (POLARA)



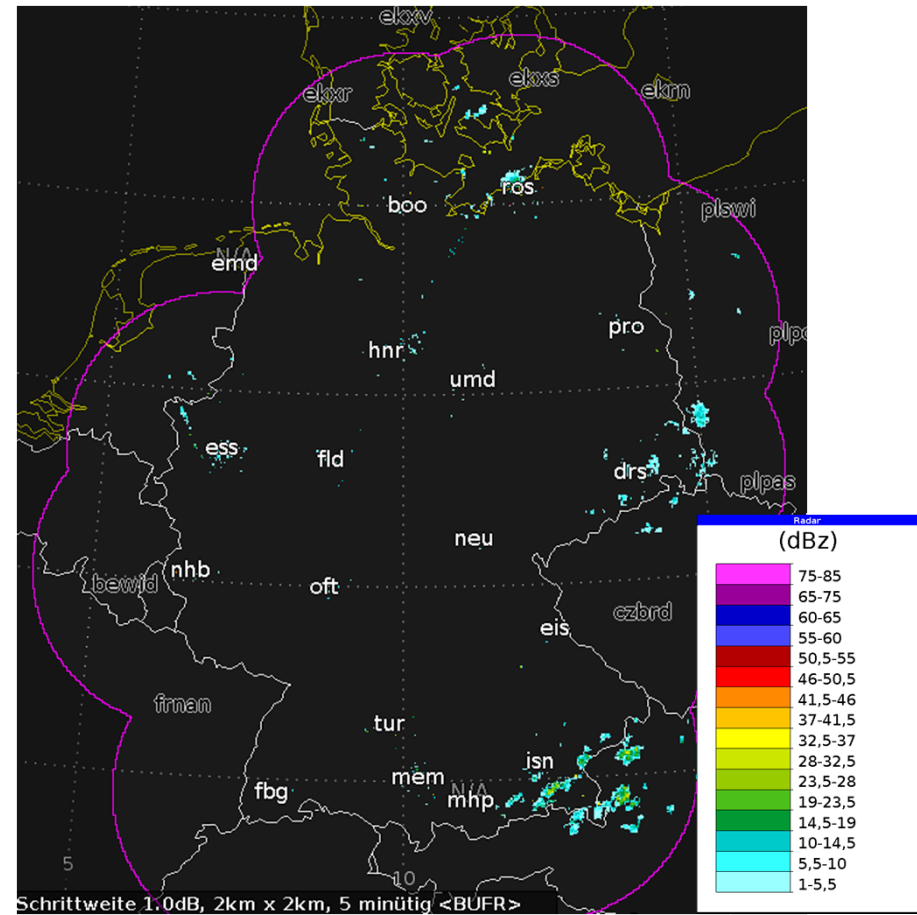
Examples

→ 27.5.2015, 13:00 UTC, LMAX

Legacy



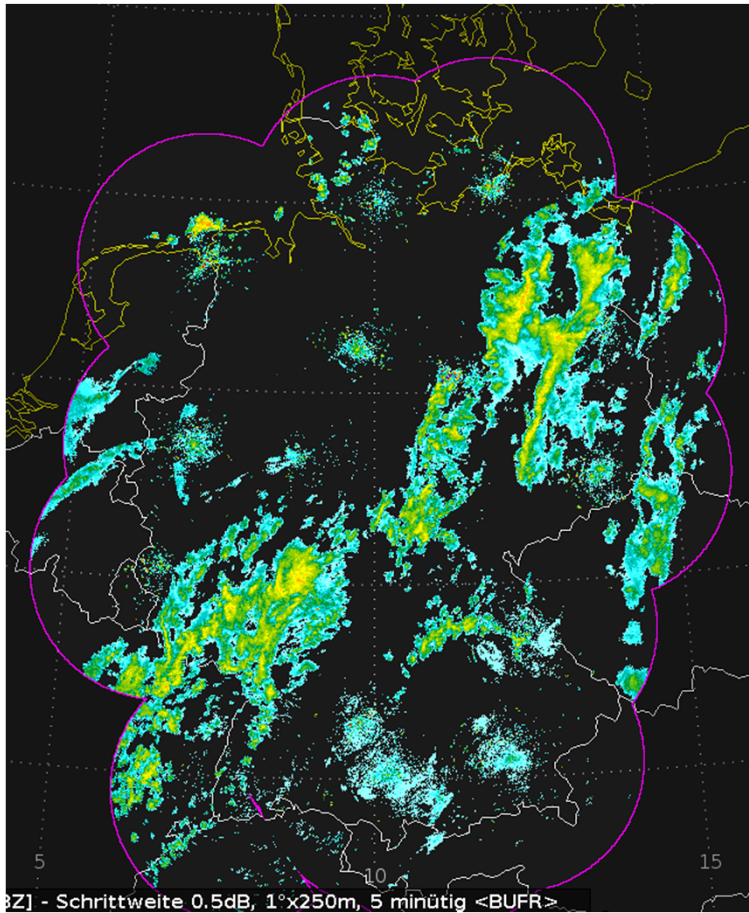
POLARA



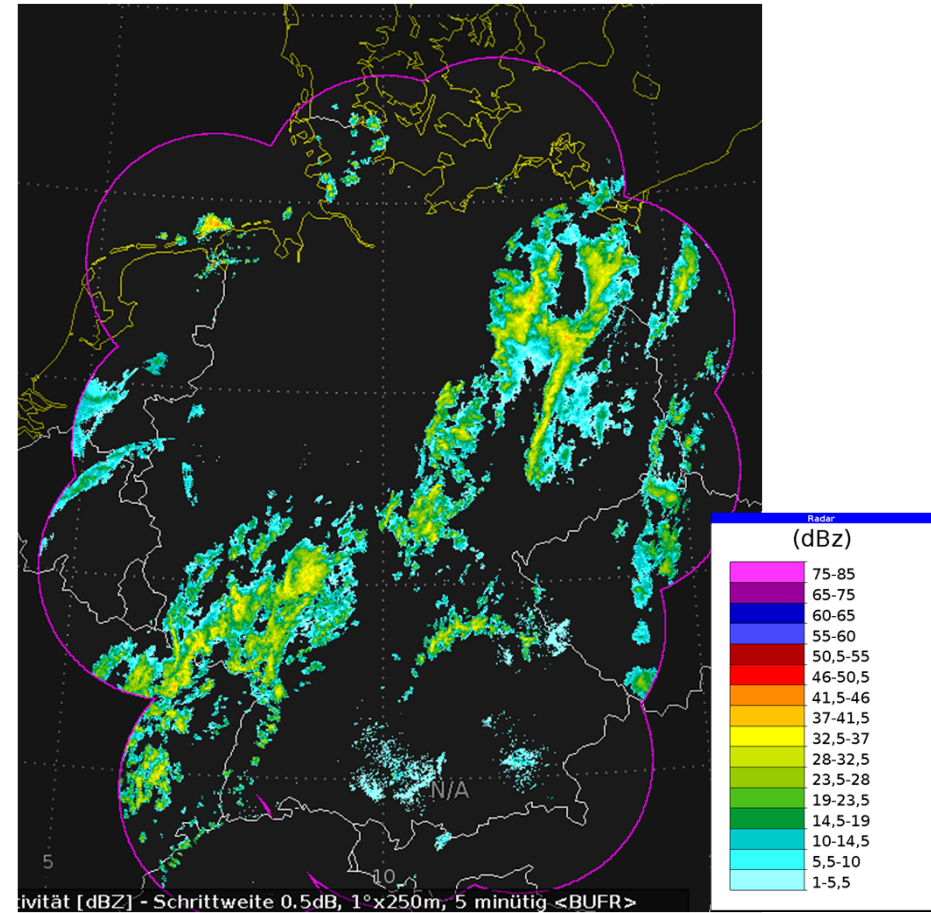
Examples

→ 1.6.2015, 08:00 UTC, Precipitation Scan

Legacy



POLARA



Outline

1. Post processing quality control and its linkage to radar monitoring
- 2. Implementation and launch of HDF5 ODIM 2.2 format at DWD**
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- New HDF5 data format for encoding of radar sweeps implemented
- According to OPERA HDF5 file format Version 2.2
- Much more meta-information now encoded
- Operational supply scheduled for 23.10.2017

EUMETNET OPERA weather radar information model for implementation with the HDF5 file format

Version 2.2

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³Royal Netherlands Meteorological Institute, De Bilt, Netherlands

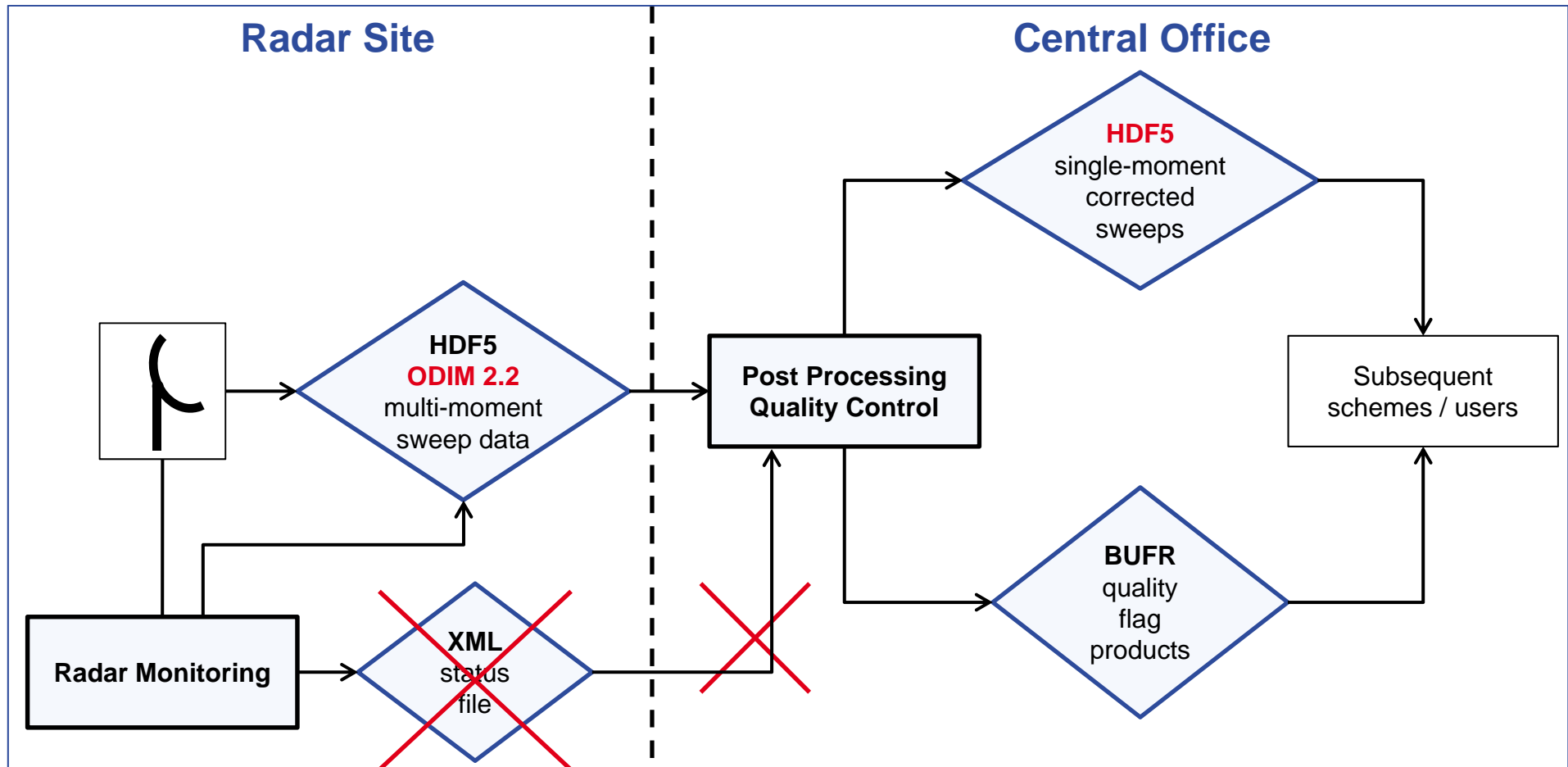
on behalf of EUMETNET OPERA

March 21, 2014

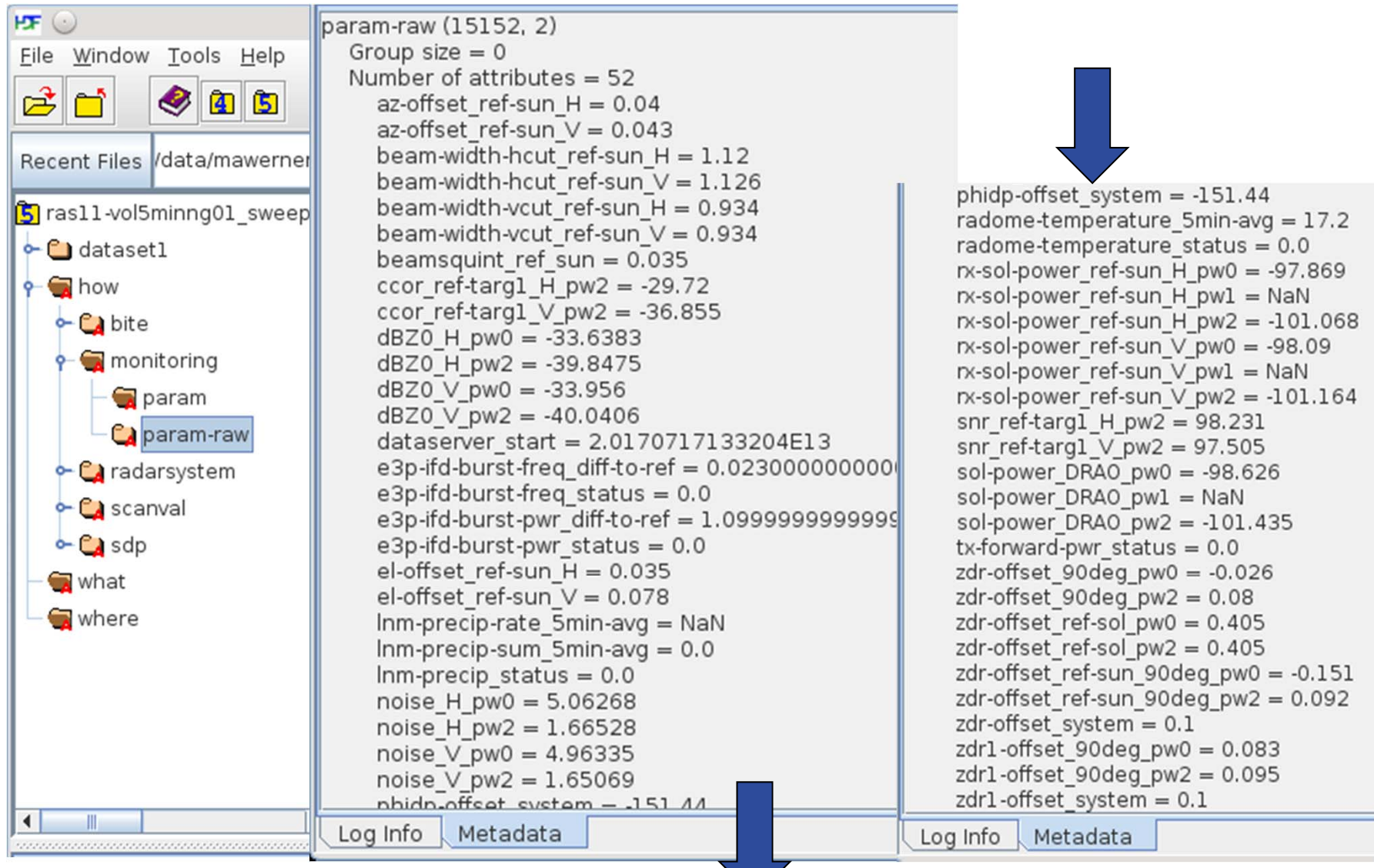
Abstract

This document specifies an information model with which the encoding, decoding and management of data and products from weather radar systems may be facilitated, primarily for the purposes of international exchange in Europe. An implementation of this information model is also specified which makes use of the HDF5 file format developed and maintained by the HDF Group. The result manifests itself in the form of truly self-describing weather radar data files highly suitable for environments where data exchange between radars from different manufacturers, different organizations, and/or different countries is conducted. The ability to include quality information, in the forms of metadata and binary arrays, is included in a powerful and flexible manner. This information model constitutes an official second-generation European standard exchange format for weather radar datasets. Because the netCDF file format is built on HDF5, we also try to ensure that our information model will be compliant with netCDF.

Post Processing Quality Control



Extended monitoring information



param-row (15152, 2)
Group size = 0
Number of attributes = 52

- az-offset_ref-sun_H = 0.04
- az-offset_ref-sun_V = 0.043
- beam-width-hcut_ref-sun_H = 1.12
- beam-width-hcut_ref-sun_V = 1.126
- beam-width-vcut_ref-sun_H = 0.934
- beam-width-vcut_ref-sun_V = 0.934
- beamsquint_ref_sun = 0.035
- ccor_ref-targ1_H_pw2 = -29.72
- ccor_ref-targ1_V_pw2 = -36.855
- dBZ0_H_pw0 = -33.6383
- dBZ0_H_pw2 = -39.8475
- dBZ0_V_pw0 = -33.956
- dBZ0_V_pw2 = -40.0406
- dataserver_start = 2.0170717133204E13
- e3p-ifd-burst-freq_diff-to-ref = 0.0230000000000
- e3p-ifd-burst-freq_status = 0.0
- e3p-ifd-burst-pwr_diff-to-ref = 1.0999999999999
- e3p-ifd-burst-pwr_status = 0.0
- el-offset_ref-sun_H = 0.035
- el-offset_ref-sun_V = 0.078
- lnm-precip-rate_5min-avg = NaN
- lnm-precip-sum_5min-avg = 0.0
- lnm-precip_status = 0.0
- noise_H_pw0 = 5.06268
- noise_H_pw2 = 1.66528
- noise_V_pw0 = 4.96335
- noise_V_pw2 = 1.65069
- phidp-offset_system = -151.44

phidp-offset_system = -151.44
radome-temperature_5min-avg = 17.2
radome-temperature_status = 0.0
rx-sol-power_ref-sun_H_pw0 = -97.869
rx-sol-power_ref-sun_H_pw1 = NaN
rx-sol-power_ref-sun_H_pw2 = -101.068
rx-sol-power_ref-sun_V_pw0 = -98.09
rx-sol-power_ref-sun_V_pw1 = NaN
rx-sol-power_ref-sun_V_pw2 = -101.164
snr_ref-targ1_H_pw2 = 98.231
snr_ref-targ1_V_pw2 = 97.505
sol-power_DRA0_pw0 = -98.626
sol-power_DRA0_pw1 = NaN
sol-power_DRA0_pw2 = -101.435
tx-forward-pwr_status = 0.0
zdr-offset_90deg_pw0 = -0.026
zdr-offset_90deg_pw2 = 0.08
zdr-offset_ref-sol_pw0 = 0.405
zdr-offset_ref-sol_pw2 = 0.405
zdr-offset_ref-sun_90deg_pw0 = -0.151
zdr-offset_ref-sun_90deg_pw2 = 0.092
zdr-offset_system = 0.1
zdr1-offset_90deg_pw0 = 0.083
zdr1-offset_90deg_pw2 = 0.095
zdr1-offset_system = 0.1

Log Info Metadata



And many more meta information

→ Muran BITE messages

→ Signal processor parameters, filter settings

→ Scan parameters

→ Radar system parameters

→ ...



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→ Scenarios sometimes occurring despite post processing quality control:

→ More residual clutter, spokes, rings
than „normal“

→ Rotated data

→ Decreased reflectivities

→ Empty data sets

→ ...

Reasons can be

→ Any kind of radar system
component malfunction

→ Bugs in radar software
suite

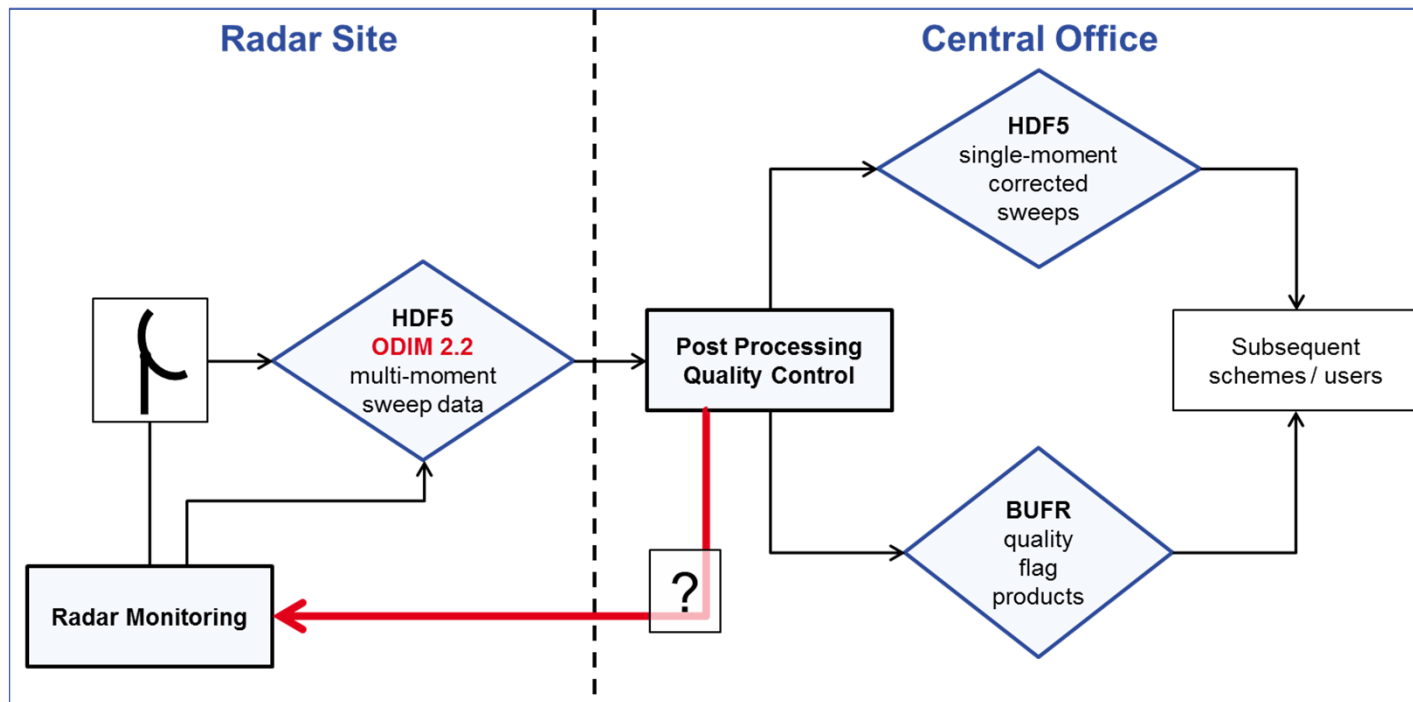
→ Human failure (e.g.,
messed up settings)

→ We need to become aware of such events. Automatically.

→ We are best warned before the problem occurs.

Further Steps

- Use monitoring information actively in the generation of corrected products!
 - Suppress output generation or fill whole product with NO_DATA escape value in case severe problems are detected in radar monitoring!
- Feedback to radar monitoring?

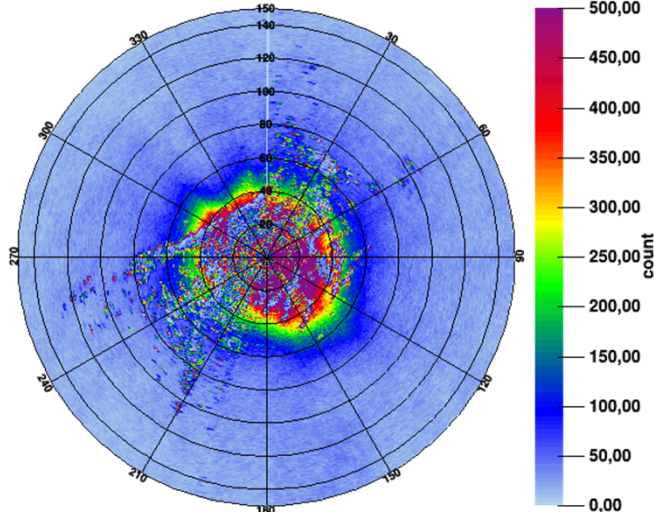


QA flag statistics (monthly)

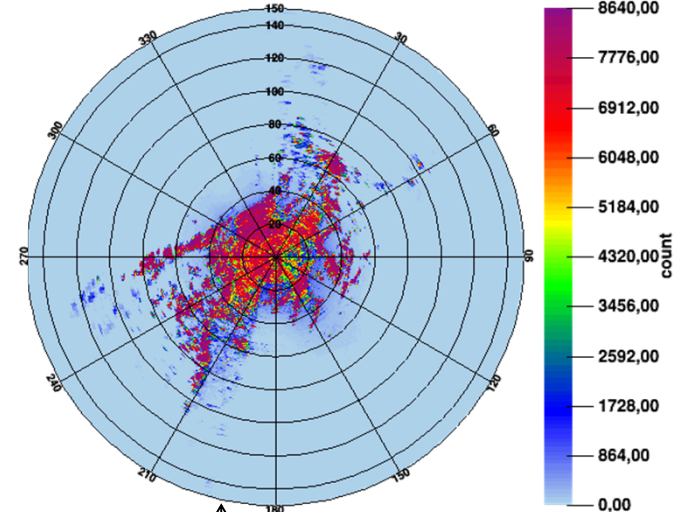


Sep 2016

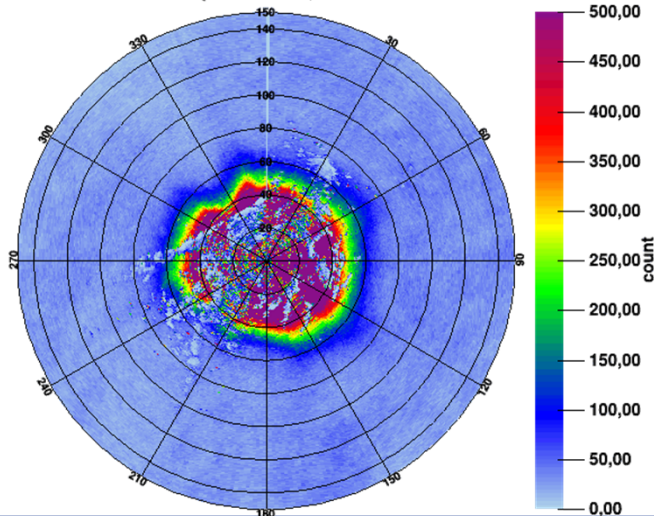
PPI plot
moment: FrequencyQZhVariableClutter43200m, elevation: 0.8 degrees
date: 2016-Sep-09 16:10:00, radar site: OFT



PPI plot
moment: FrequencyQZhStaticClutter43200m, elevation: 0.8 degrees
date: 2016-Sep-09 16:10:00, radar site: OFT



PPI plot
moment: FrequencyQZhBiological43200m, elevation: 0.8 degrees
date: 2016-Sep-09 16:10:00, radar site: OFT



Static clutter bit

Variable clutter bit

Biological clutter bit



- Post processing radar data quality control at DWD
 - Production of corrected quantities
 - Quality flag products
 - Consolidation of post processing information (dual-pol) and signal processor filters
 - Link with radar monitoring
- Radar data encoding in HDF5 ODIM 2.2
 - Measurement data
 - Corrected data in post processing
- Future steps:
 - Extend usage of radar monitoring
 - Feedback from post processing to radar monitoring

Contact:

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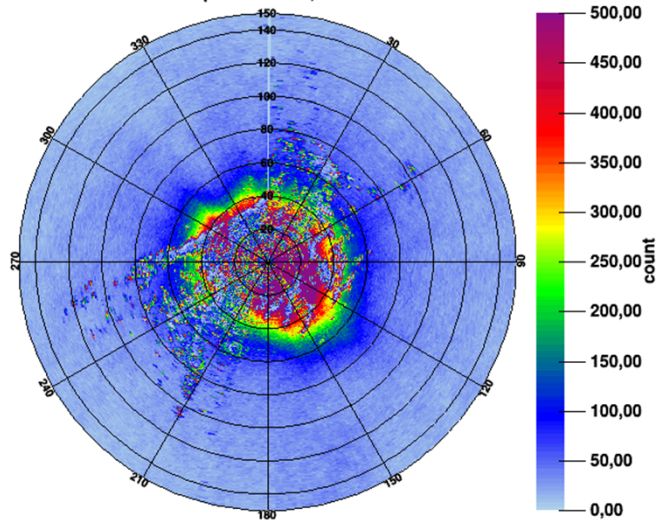
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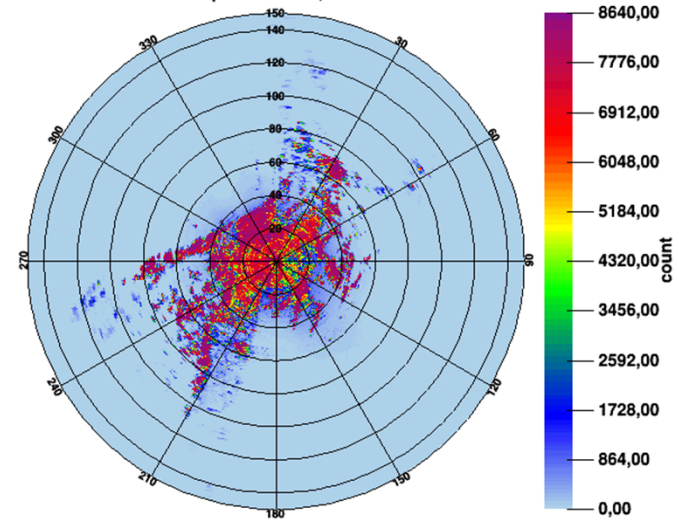


QA flag statistics

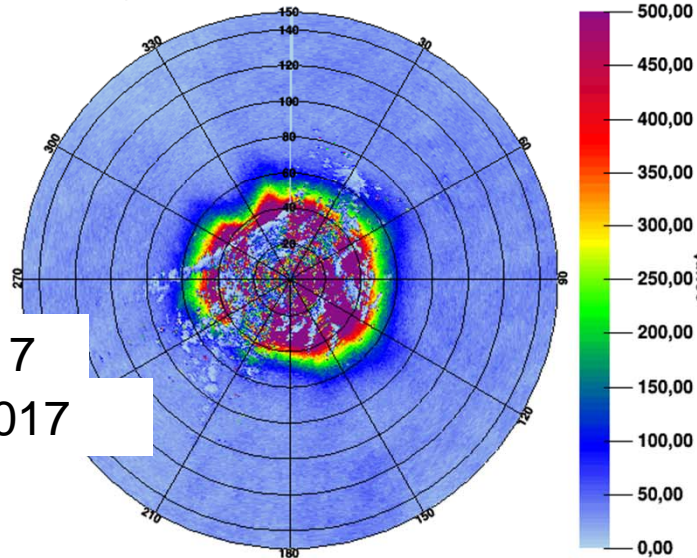
PPI plot
moment: FrequencyQZhVariableClutter43200m, elevation: 0.8 degrees
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Sep 2017
 Sep 2016 Dez 2016
 Nov 2016 Jan 2017
 Apr 2017 Feb 2017
 Mar 2017 May 2017
 Jun 2017 Jul 2017



Oct 2016
 Aug 2017
 Sep 2016



Post Processing Quality Control

