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Support to Operational Hydrology and Water Management

Introduction of radar data quality control procedure in Poland and its impact on validation of H-SAF precipitation products

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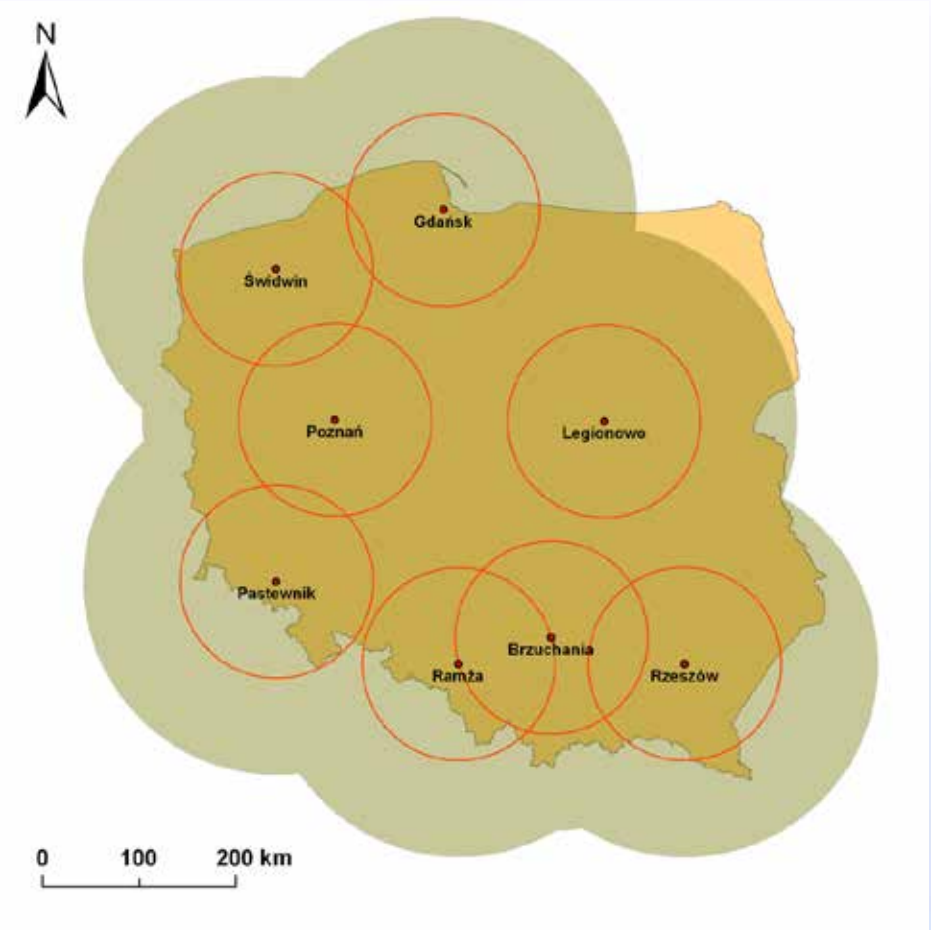
Outline

- Polish radar network.
- Radar data QC scheme.
- Application of QC radar data for H-SAF validation.
- Preliminary assessment of QC radar data on the validation results (H03 as an example).
- Conclusions.

Radar network



The meteorological radar network POLRAD consists of eight GEMATRONIK GmbH devices and covers almost whole territory of Poland.

POLRAD radars are automated, unattended and remotely-controlled.

Radar remote steering and data processing is controlled by RAINBOW software build on UNIX platform.

Each of the radars provides unified precipitation field for its perimeter. Also a composite map of Poland (a composition of 8 individual maps) is generated for operational use.

Radar data for H-SAF validation

To validate the satellite precipitation products the Surface Rainfall Intensity (SRI) hydrological product was chosen.

The SRI generates an image of the rainfall intensity in a user-selectable surface layer (SRI level) every 10 minutes.

As operational radar data processing chain does not include the data quality characterisation, the values of Quality Index used in the satellite derived precipitation are as default set to 1.

Radar data QC scheme

A set of quality control algorithms developed in the framework of the RADVOL-QC system has been implemented in Poland.

The algorithms are dedicated to 3-D radar reflectivity data (volumes) provided by a weather radar with single-polarization of the beam.

The system consists of two paths of data processing:

- quality correction - reduction of uncertainty in the data
- quality characterization - generation of map of quality index (QI) that can be attached to the data.

Radar data QC scheme

- The quality correction scheme includes the following steps:
  - removal of geometrically shaped non-meteorological echoes (from the Sun and other emitters),
  - removal of measurement noise (specks),
  - beam blockage correction,
  - attenuation in the rain correction.

Radar data QC scheme

- The quality characterisation scheme comprises the following features:
  - technical parameters of radar and its configuration (QISYS),
  - radar beam vertical and horizontal broadening (QIBROAD),
  - presence of ground clutter (QIGC),
  - presence of ‘spike’ type echoes (QISPIKE),
  - presence of ‘speck’ type echoes (QISPECK),
  - radar beam blocking by ground targets (QIPBB),
  - attenuation of radar beam in rain (QIATT).

Radar data QC scheme

- The final Quality Index is determined from all quality indices using the multiplicative formula:

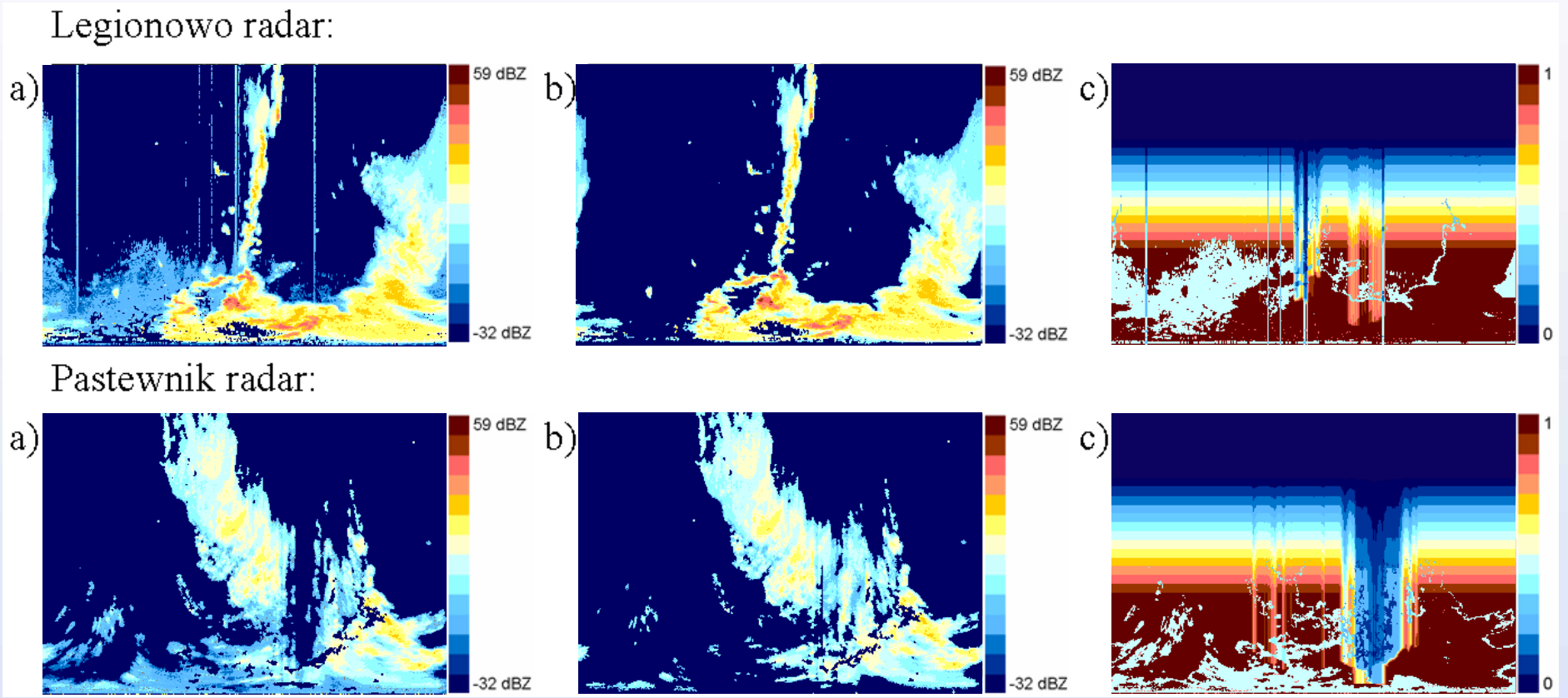
$$QI = \tilde{O}_{i=1}^{7} w_i \acute{} I_i$$

where w_i are the weights of particular quality indices.

- The scheme was implemented at the beginning of May 2014, however it is not used operationally in the IMGW-PIB.

For details please refer to: K. Osrodka, J. Szturc and A. Jurczyk, Chain of data quality algorithms for 3-D single-polarization radar reflectivity (RADVOL-QC system), *Meteorol. Appl*. **21**: 256–270 (2014)

Radar data QC scheme - outcome

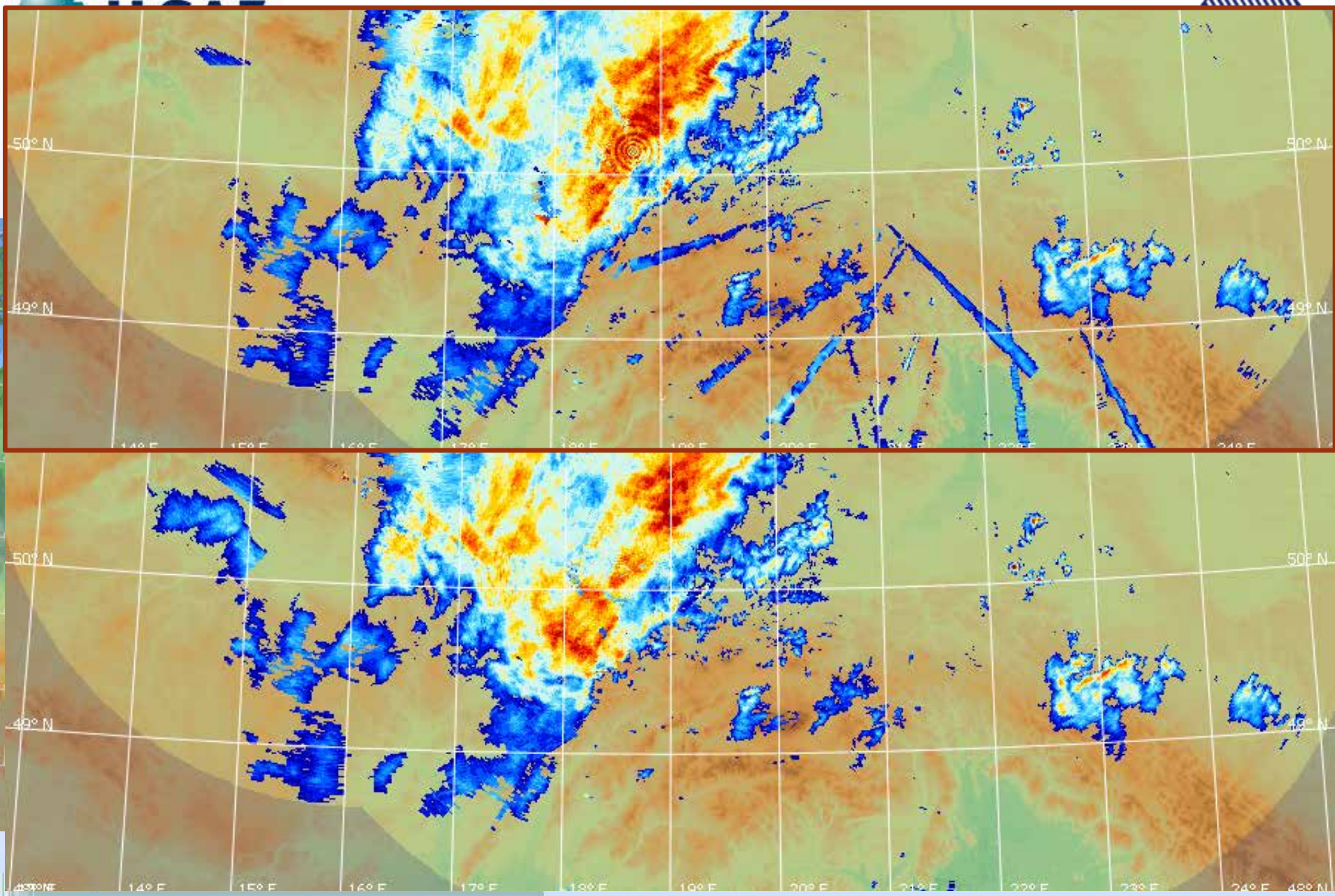


Uncorrected data

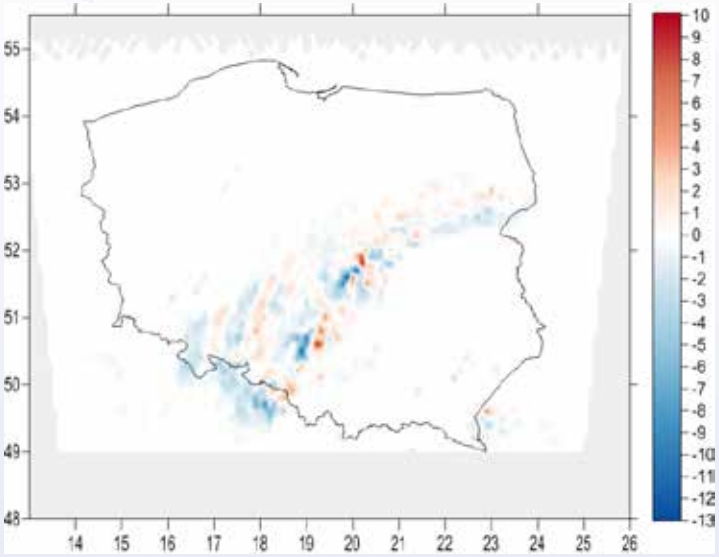
Corrected data

QI field

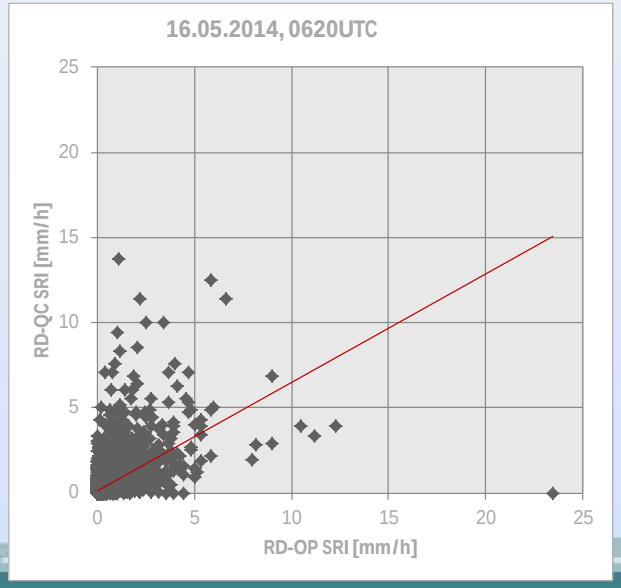
Courtesy of J.Szturc

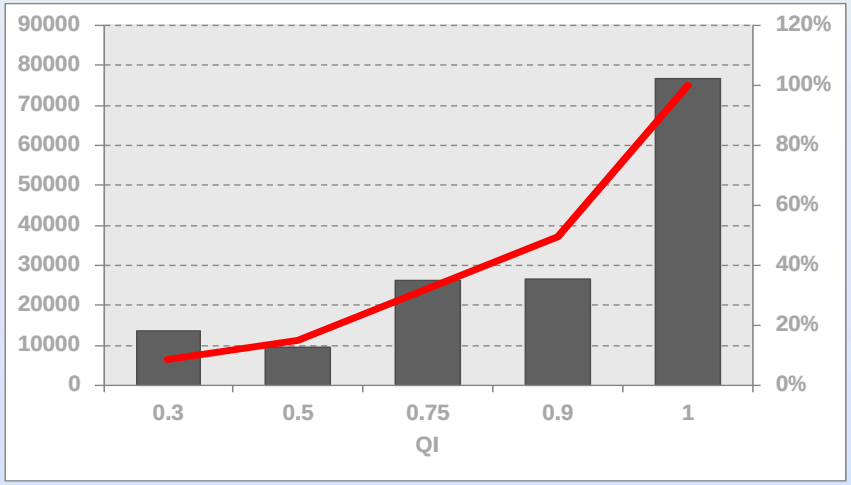

50° N
49° N
14° E
15° E
16° E
17° E
18° E
19° E
20° E
21° E
22° E
23° E
24° E

Radar data QC scheme - outcome for 16.05.2014



Difference of operational and quality controlled radar Surface Rainfall Intensity (mm/h)



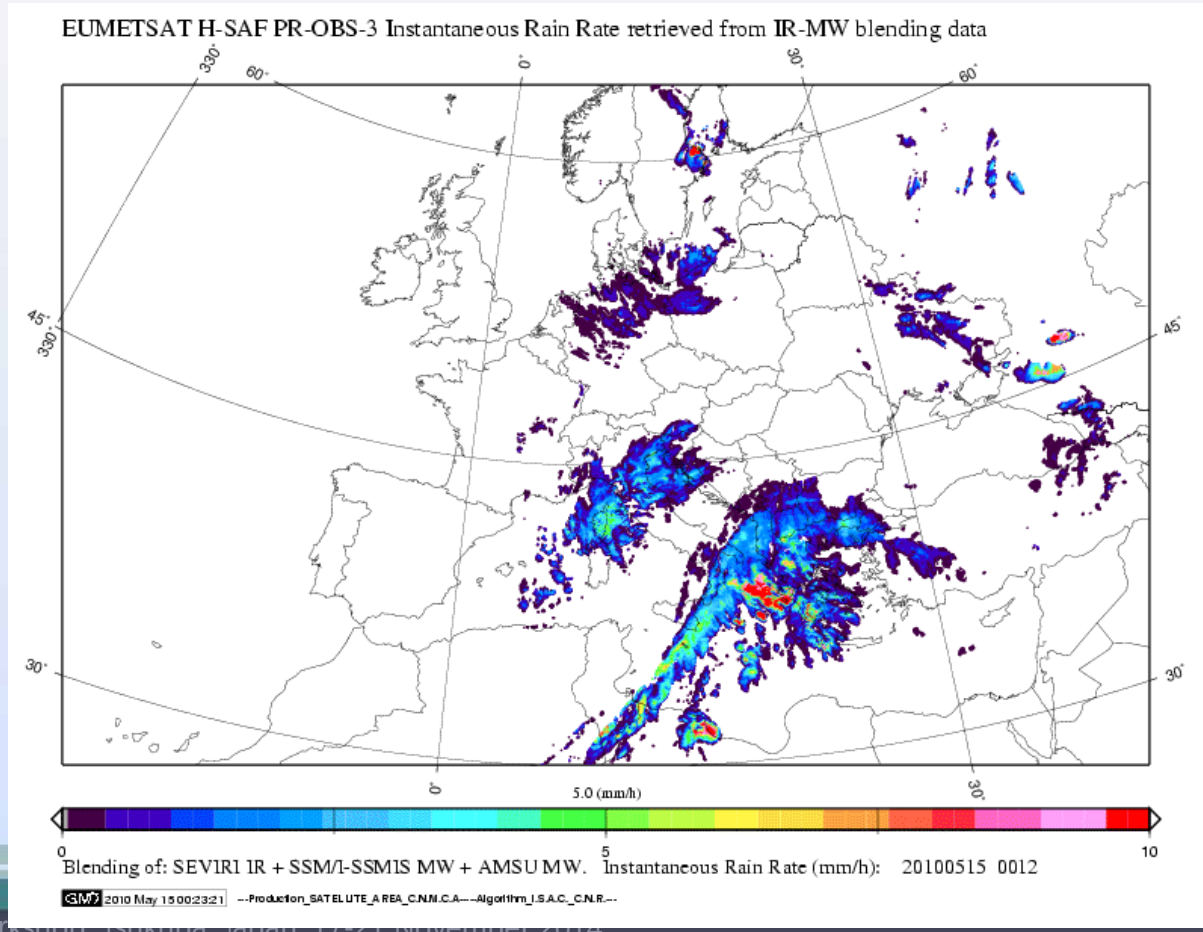


QC Radar data in H-SAF validation

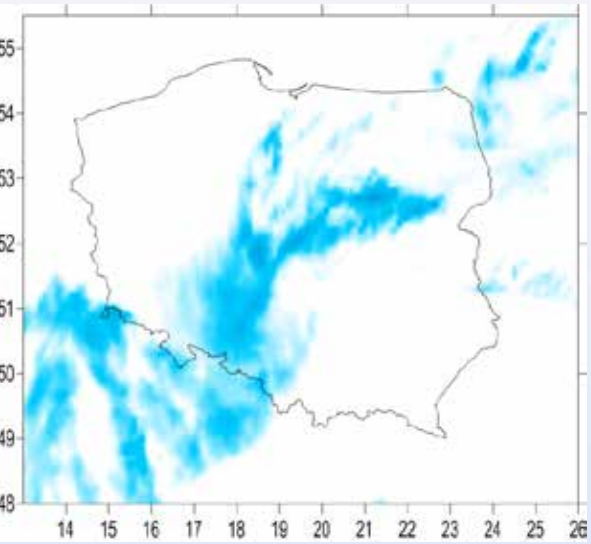
- Both, QC and operational SRI products were used for H-03 (IR/MW blending algorithm) validation.
- Validation were performed for the case of 16.05.2014 as well as for the period of May-July 2014 using H-SAF common software.
- The differences in the obtained results were analysed.

H-03 general information

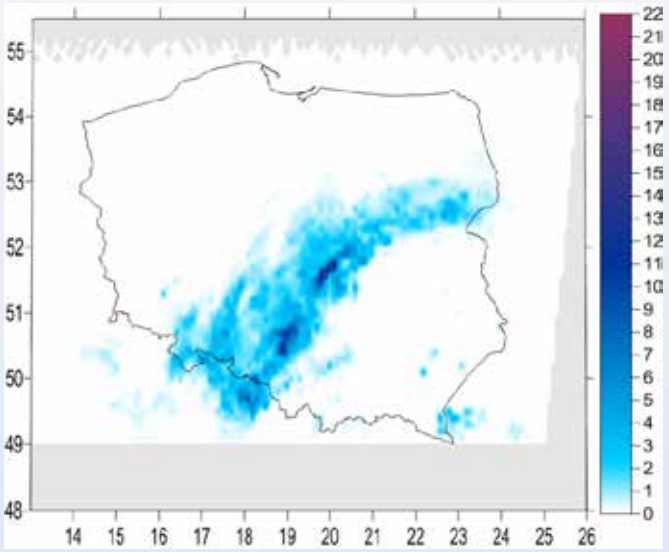
- IR/MW blending algorithm
- Uses SEVIRI/IR and SSMI, AMSU, MHS / MW data
- 15 minute temporal resolution
- SEVIRI spatial resolution.



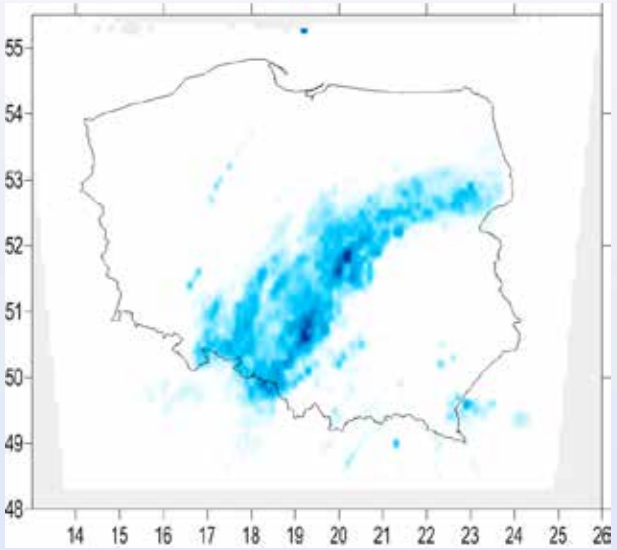
QC Radar data in H-SAF validation-case of 16.05.2014



H-03 rainfall intensity (mm/h)

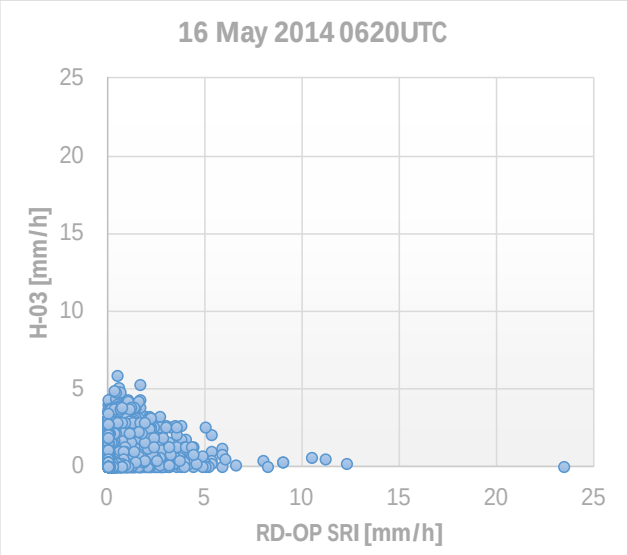


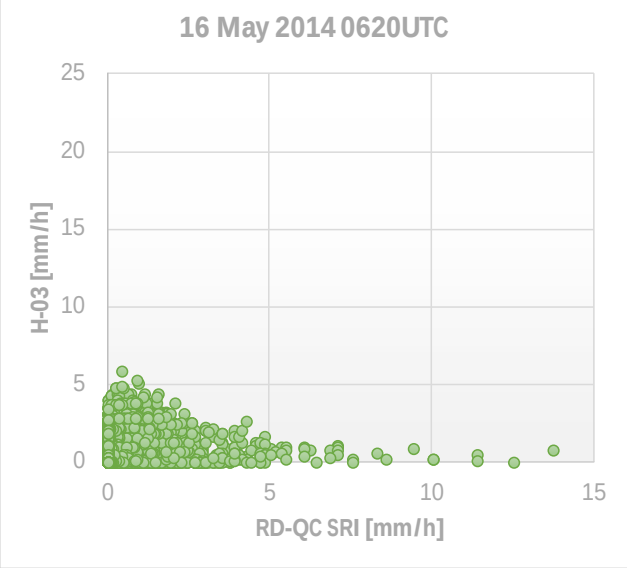
Quality controlled SRI (mm/h)



Operational SRI (mm/h)

QC Radar data in H-SAF validation-case of 16.05.2014

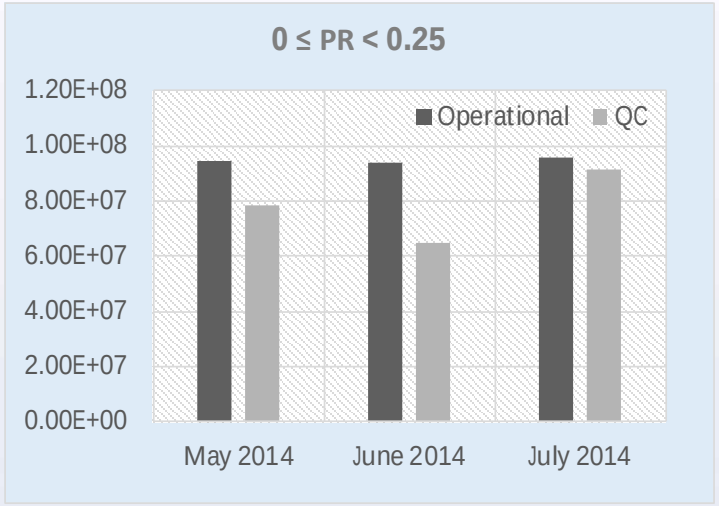


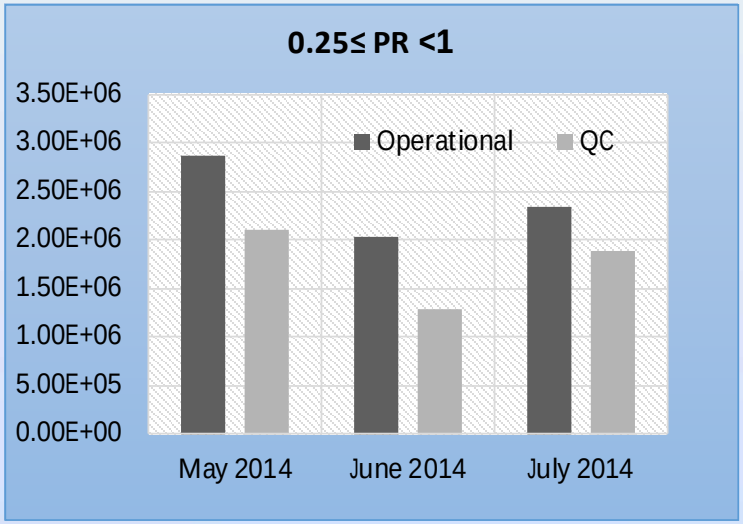


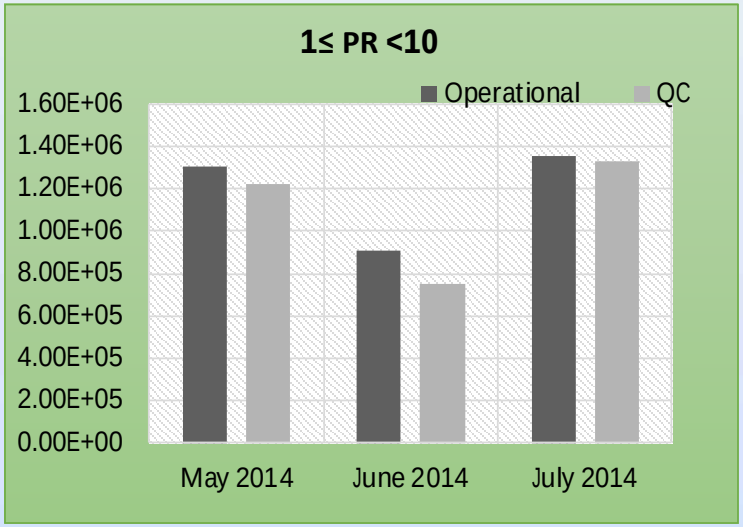
H-03	RD-OP	RD-QC
POD	0.73	0.77
FAR	0.68	0.61
ACC	0.77	0.79
CSI	0.28	0.35

H-03	RD-OP	RD-QC
Max Ground	23.44	13.76
Max Sat	5.87	5.87
Mean Ground	1.38	1.40
Mean Sat	1.25	1.25
ME	-0.13	-0.14
Diff. StDev	1.97	2.06
MBias	0.91	0.89
RMSE	1.97	2.07

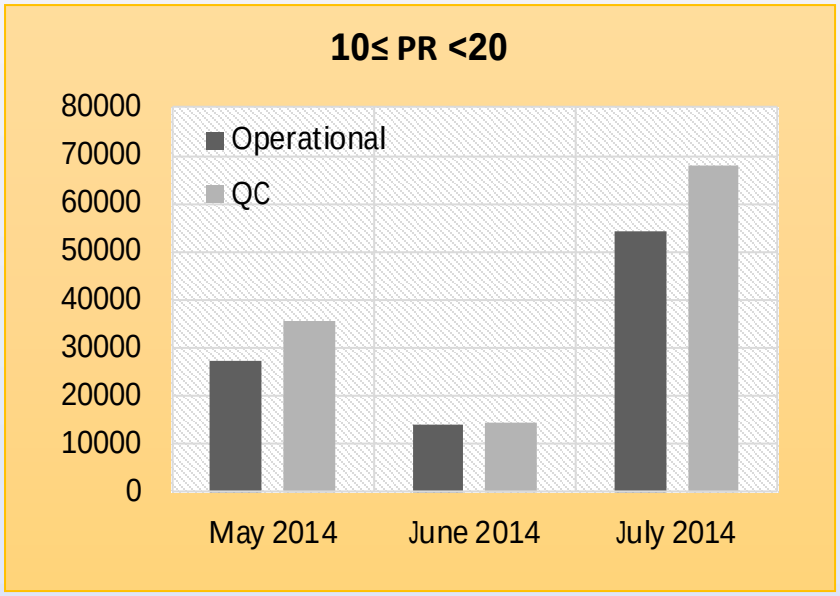
QC Radar data in H-SAF validation – monthly analysis

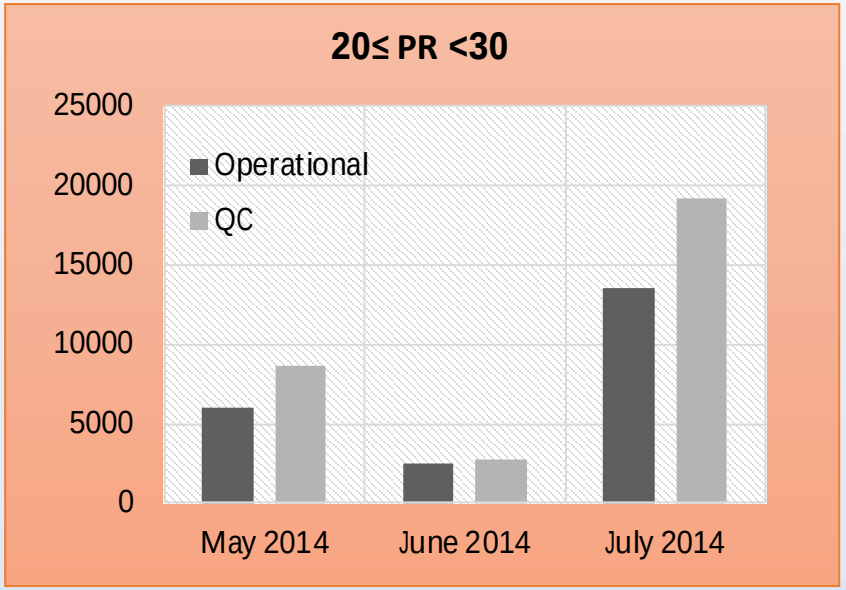






QC Radar data in H-SAF validation





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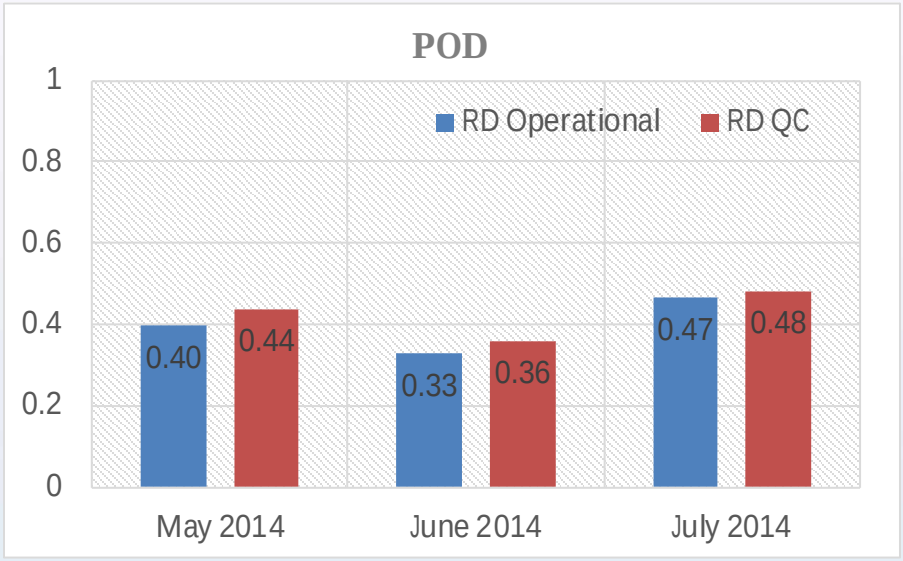

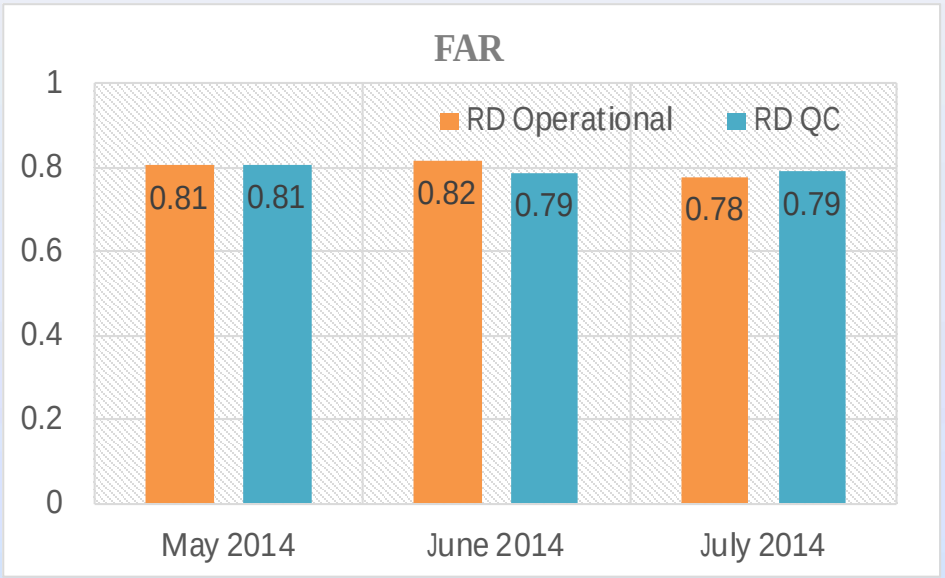

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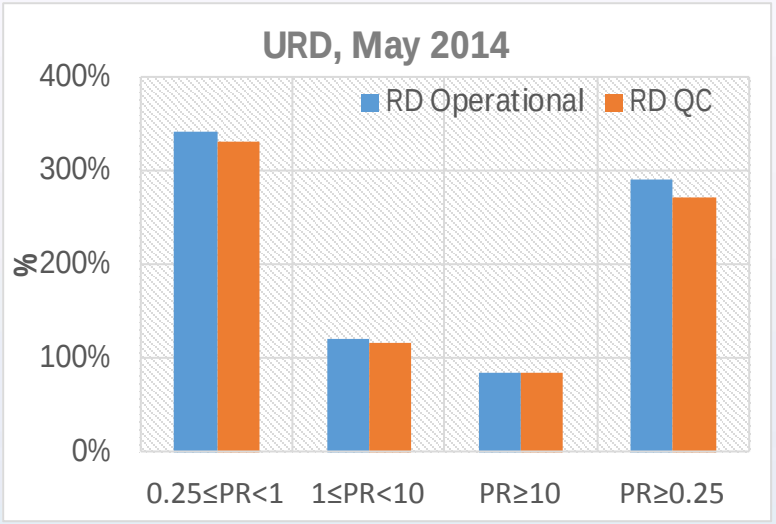
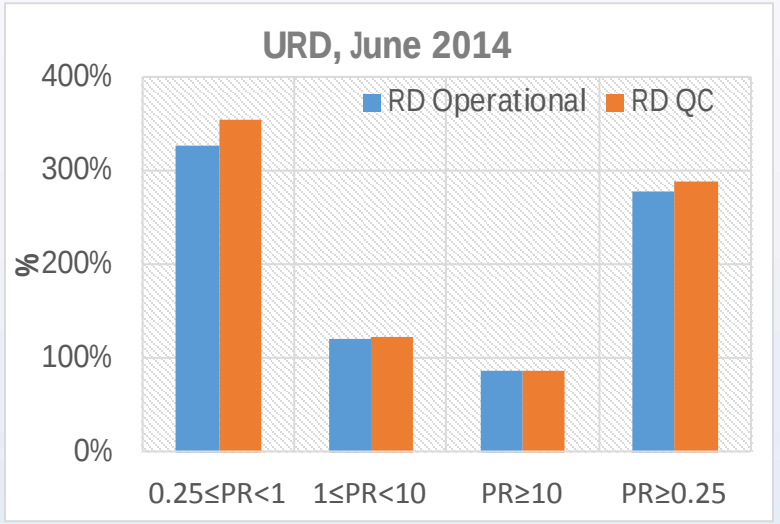
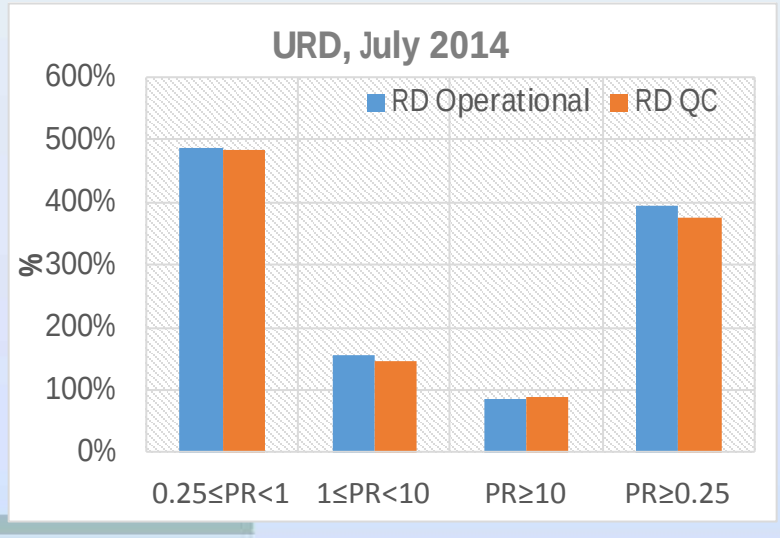
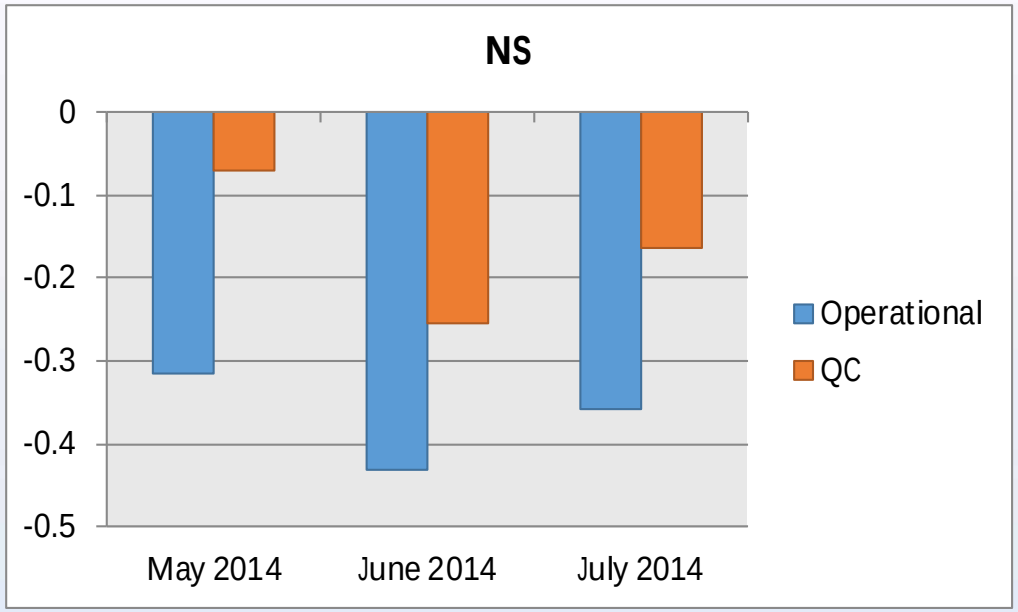






URD – Root square error

QC Radar data in H-SAF validation – monthly analysis



NS: Nash- Sutcliffe efficiency coefficient:

1 – perfect estimation

0 – as accurate as the mean of observed values

<0 - the mean of observed data is better estimator than the satellite product

Conclusions

- The preliminary results obtained for analysed period indicate that the use of quality controlled SRI data for H-03 validation has faint but positive effect on the obtained results.
- The POD values calculated with QC radar data are slightly bigger while the FAR values are the same or slightly lower.
- Although Nash-Sutcliffe efficiency coefficient values are still negative, introduction of QC radar data leads to its increase.
- The redistribution of precipitation intensity has been noticed for analysed period: the QC radar data includes less light and moderate precipitation and more heavy rainfall than the operational one.
- However the positive influence of the QC data on the validation results were found, its magnitude didn't meet the expectations.
- The further analysis will be conducted for longer time period and other H-SAF precipitation products.