Description of the case study

On the 6th of July 2011 Poland was under a very strong influence of huge, built up and mature low pressure system of the Mediterranean origin. The Low center was located over Poland recently but on 6th of July it started to move towards East (western Ukraine). On the eastern peripheries of that Low a few shallow centers of low pressure were developed on a frontal zone fed by two air masses of different physical characteristics. The warm front heading from NE was losing its power and cloud layer due to downdrafts which resulted with no precipitating areas in the western regions of Poland. The eastern part of the country was cowered by stratiform layer of precipitating clouds of moderate and monotonous rainfall events.

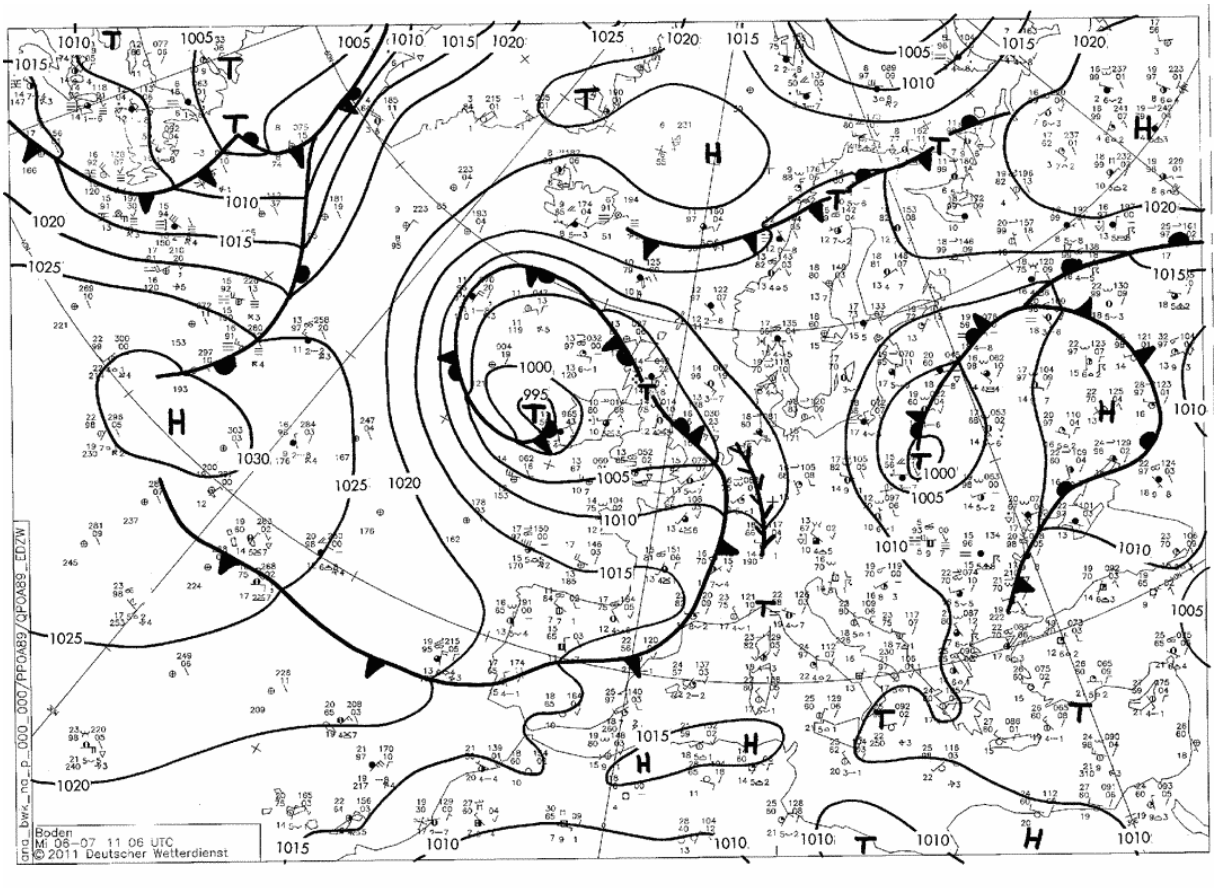

Fig.1 Synoptic chart at 0600 UTC on 6th of July 2011. Courtesy of Deutscher Wetterdienst.

Data and products used

Reference data: data from Polish automatic rain gauges network (IMWM-NRI)
H-SAF product: PR-OBS-5 3h cumulation
Ancillary data (used for case analysis):

- Polish meteorological radar network, POLRAD (IMWM-NRI)
- Weather charts (courtesy of Deutscher Wetterdienst)

Comparison

This event is dominated by stratiform system moving across Poland. The highest peak measured by rain gauges is of about 18.9 mm, at the same time radar recorded 24.5 mm while PR-OBS-5 shows a peak value of 12.5 mm.

On the Fig.3 the PR-OBS-5 product is visualized for the morning 3h cumulation. For comparison, the distribution of 10 minute precipitation obtained from RG and radar data measured at closest to the given time slot is presented. All precipitation maps were prepared using Nearest Neighbor method.

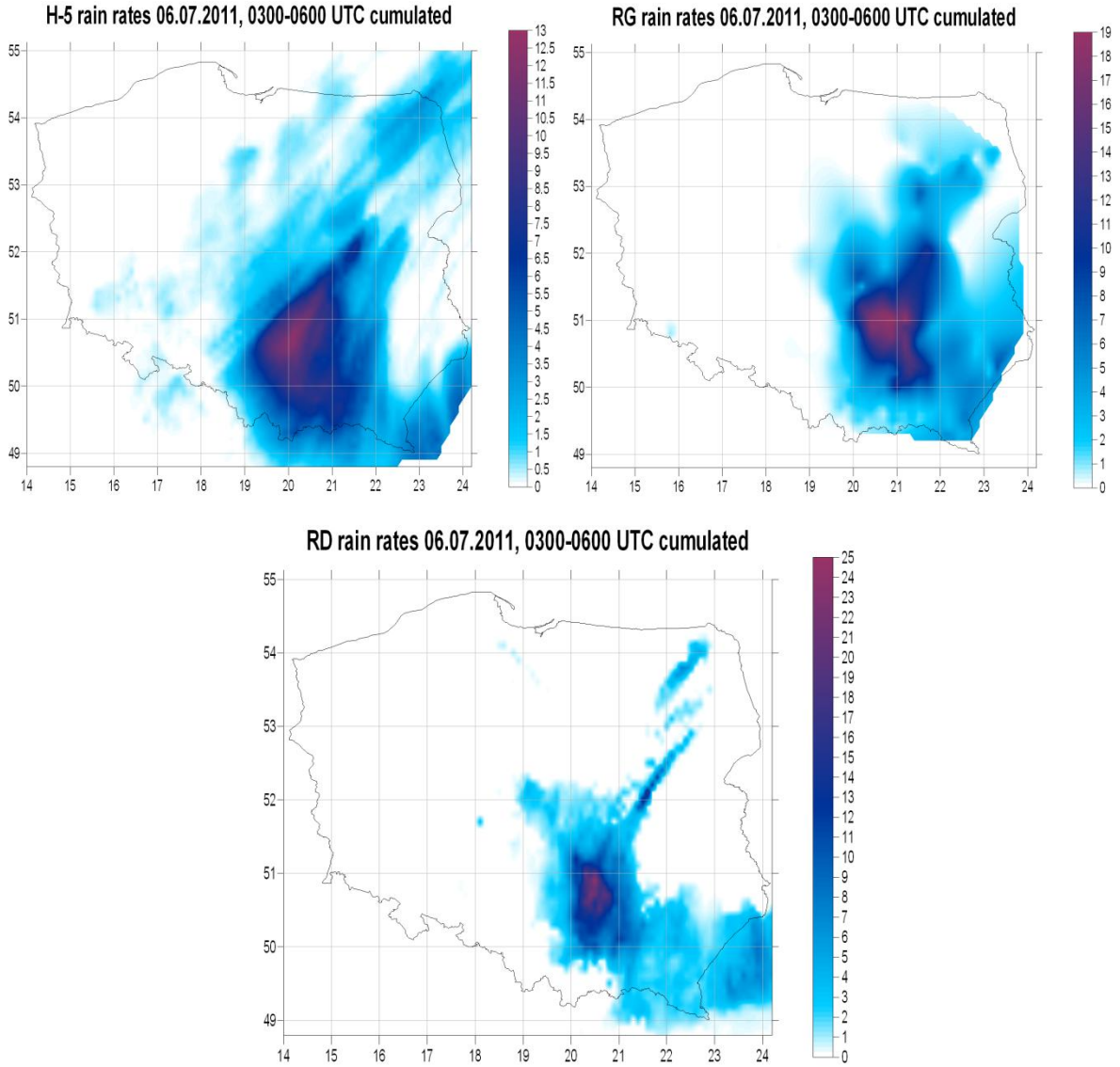

Fig.3 Cumulated PR-OBS-5 from 0300 – 0600 UTC on the 6th of July 2011 (left panel), cumulated precipitation interpolated from RG data from 0300 – 0600 UTC (right panel) and cumulated precipitation derived from radar data from 0300 – 0600 UTC (bottom panel). *Note diverse scale notation!*

Both satellite product and rain gauge maps show good spatial correlation but also good mutual relations of the rainfall amounts. Traditionally radar map overestimates the amounts of rainfall and also underestimate the area of precipitation. All three maps show dry region on W of Poland.

Statistical scores

The results presented below were calculated on the satellite sub-dataset for which satellite pixels were attached to rain gauges. It means that precipitating satellite pixels which were not set in pairs with rain gauges (but are still present on the maps above) were excluded from this calculation.

The ability of PR-OBS-5 product to recognize the stratiform precipitation was analysed using dichotomous statistics parameters. The 1 mm threshold was used to discriminate rain and no-rain cases. In the Table 1 the values of Probability of Detection (POD), False Alarm Rate (FAR) and Critical Success Ratio (CSI) are presented.

Table 1 Results of the categorical statistics obtained for PR-OBS-5 on the 6th July 2011 0300 – 0600 UTC.

Parameter	Scores
POD	0.86
FAR	0.34
CSI	0.60

Higher value of POD than the value of FAR indicates that the product ability to recognize the stratiform precipitation is very good.

The quality of PR-OBS-5 in estimating the stratiform precipitation is presented on the Figure 4. The points on the scatter plot are mostly arranged above and along the diagonal, what indicates that PR-OBS-5 tends to underestimate the moderate precipitation.

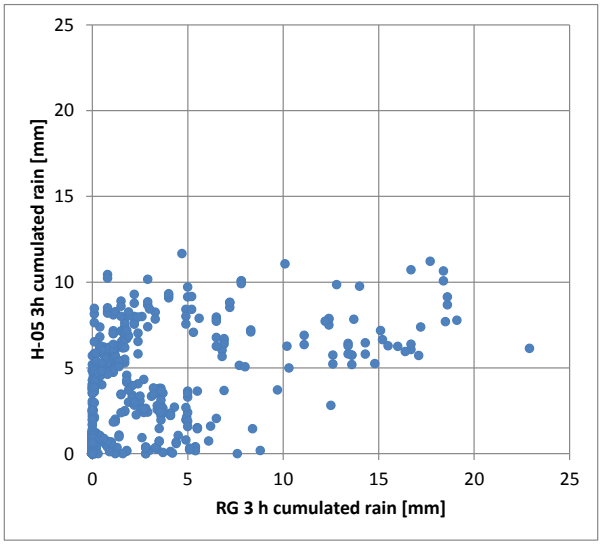

Fig.4 Scatter plot for measured (RG) and satellite derived (H-05) rain rate obtained for all PR-OBS-5 data on the 6th of July 2011 0300 – 0600 UTC.

Finally, the analysis of rain classes was performed. The categories were selected in accordance with the common validation method. Figure 5 shows the percentage distribution of satellite derived precipitation categories within each precipitation class defined using ground measurements.

One can easily notice very good ability of PR-OBS-5 to recognize both, no-rain and light precipitation situations – respectively, 229 out of 338 and 138 out of 202 ground cases were properly allocated by satellite product. The moderate precipitation is not properly recognized and is underestimated.

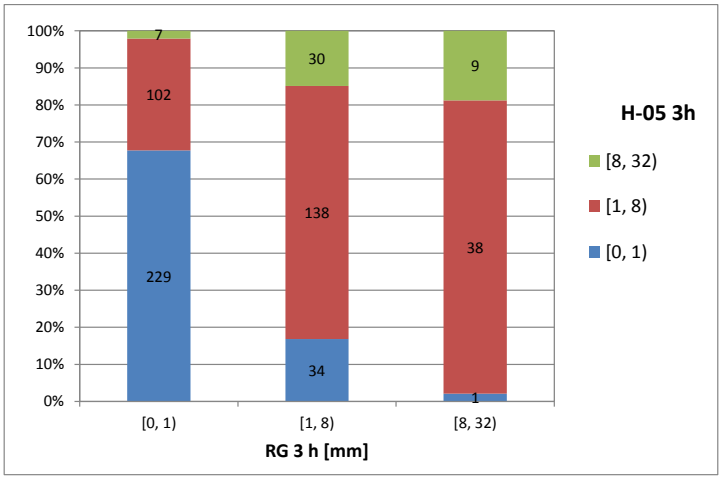

Fig.5 Percentage distribution of PR-OBS-5 precipitation classes in the rain classes defined using rain gauges (RG) data on the 6th of July 2011 0300 – 0600 UTC.

Some Conclusions

To sum it up, the analysis performed for situation with stratiform precipitation showed very good ability of PR-OBS-5 3h cumulation product in recognition of precipitation layout and rainfall amounts. Mutual relation between POD and FAR rates indicates that the product ability to recognize the stratiform precipitation is very good.

Also H-05 underestimates the moderate precipitation.