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.

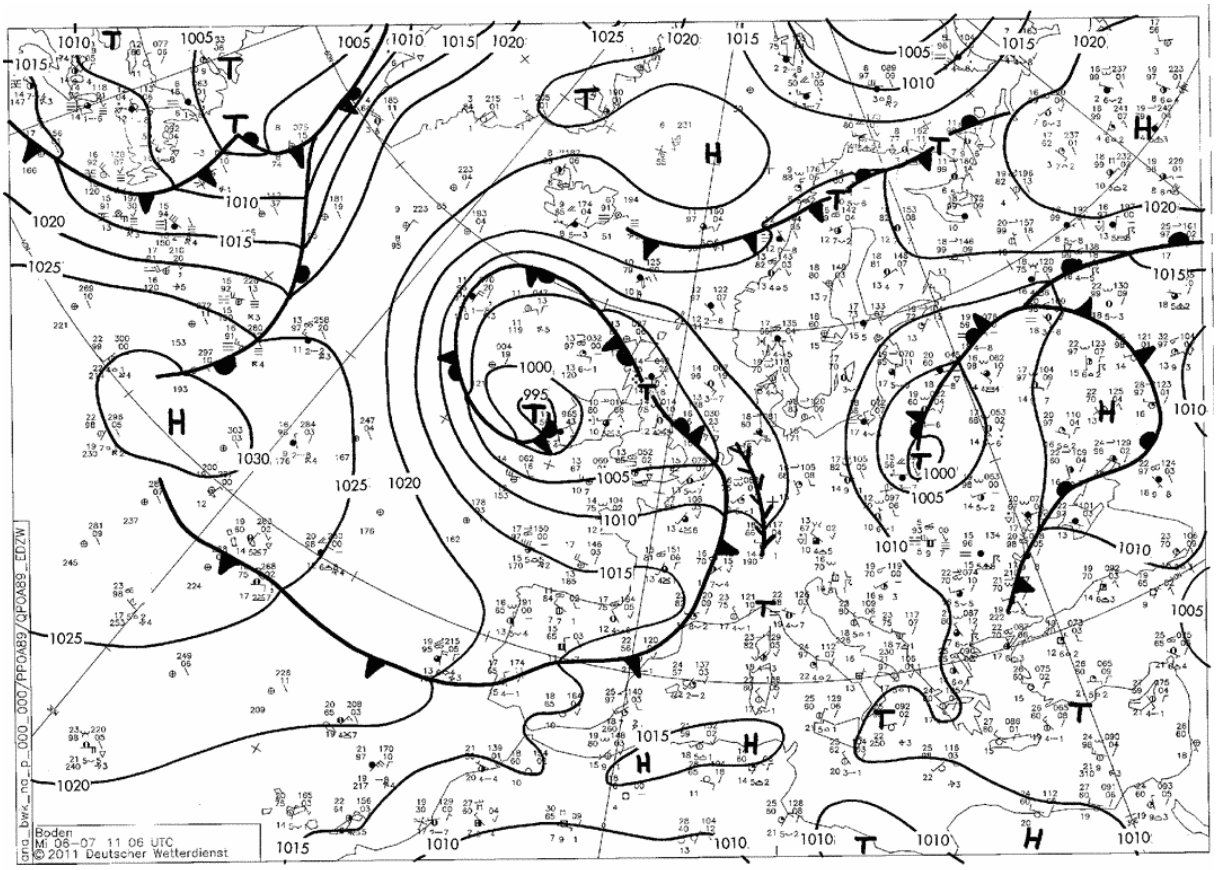

Fig.1 Synoptic chart at 0600 UTC on 6th of July 2011. Courtesy of Deutscher Wetterdienst.

Data and products used

Reference data: data from Polish automatic rain gauges network (IMWM-NRI)
H-SAF product: PR-OBS-3
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 of precipitation moving slowly across Poland. The highest peak measured by rain gauges is of about 11.2 mm/h, at the same time radar records 20.2 mm/h while PR-OBS-3 shows a peak value of 5.6 mm/h.

On the Fig.3 the PR-OBS-3 product is visualized for the morning overpass. 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.

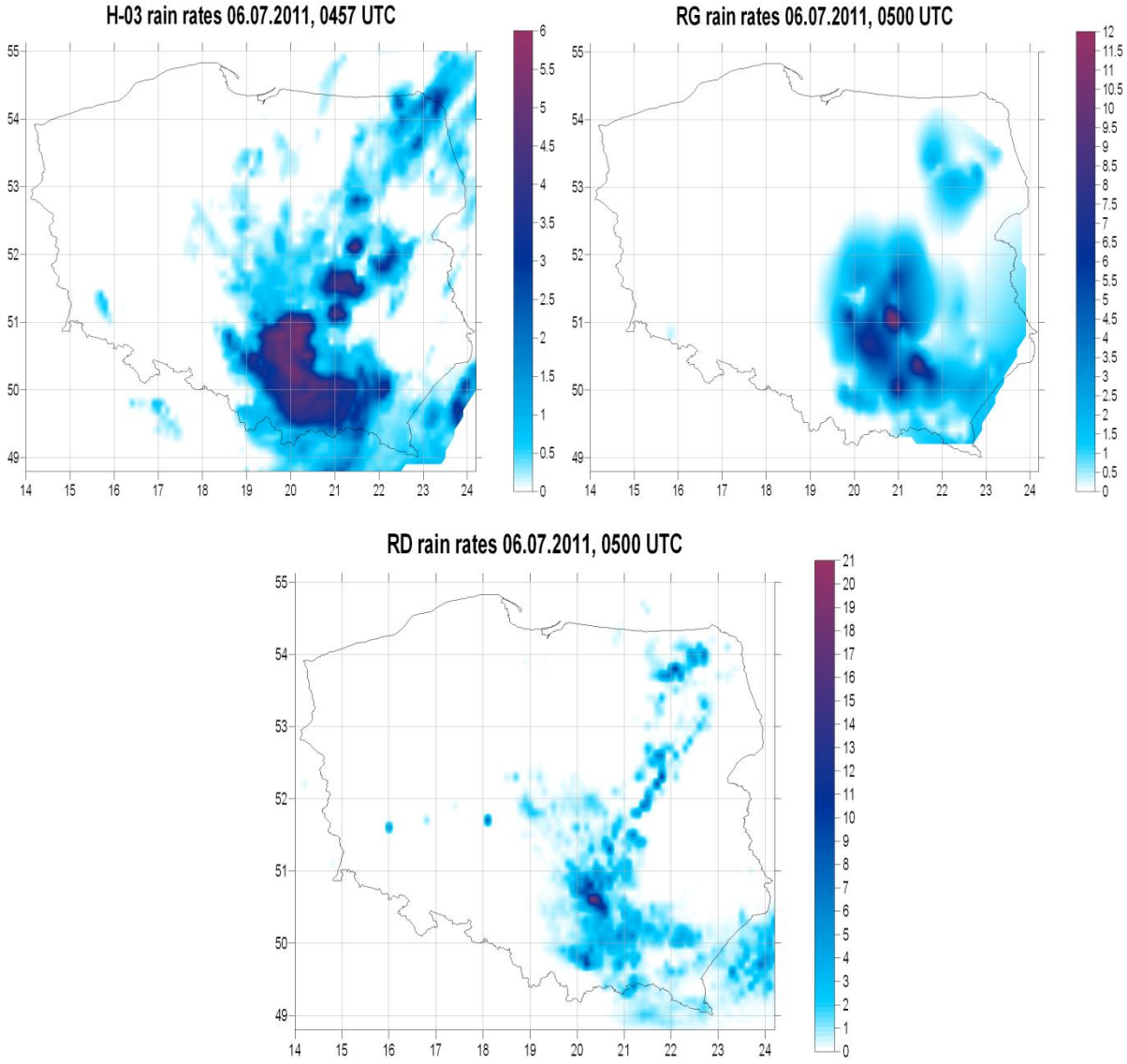

Fig.3 PR-OBS-3 at 0457 UTC on the 6th of July 2011 (left panel), 10 minute precipitation interpolated from RG data at 0500 UTC (right panel) and 10 minute precipitation derived from radar data at 0500 UTC (bottom panel). *Note diverse scale notation!*

All maps agree with each other considering the peak values of precipitation location. There is no agreement when the precipitation area is considered. The H-03 resembling the cloud shape enlarges the real rainfall area strongly. Although the rainfall area of precipitation on rain gauges and H-03

maps is close to similar, the peak rainfall on the satellite product map is only half of that on rain gauge map.

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-3 product to recognize the precipitation was analysed using dichotomous statistics parameters. The 0.25mm/h 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-3 on the 6th July 2011

Parameter	Scores
POD	0.83
FAR	0.50
CSI	0.45

Higher value of POD than the value of FAR indicate that the product ability to recognize the startiform precipitation is good.

The quality of PR-OBS-3 in estimating the stratiform precipitation is presented on the Figure 4. The points on the scatter plot are mostly arranged below and over the diagonal, what indicates that PR-OBS-3 tends to overestimate light precipitation and underestimate moderate one.

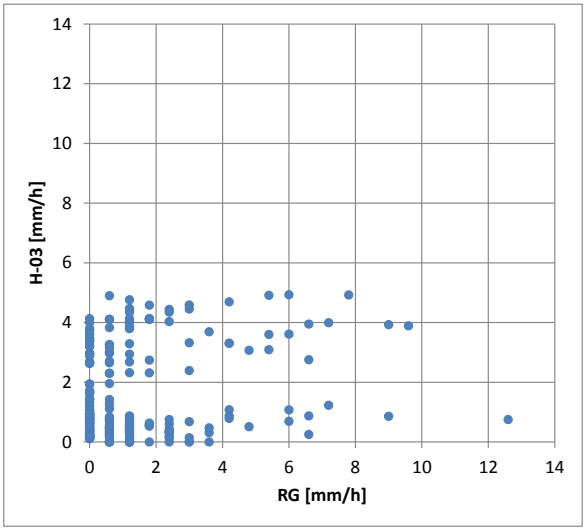

Fig.4 Scatter plot for measured (RG) and satellite derived (H-03) rain rate obtained for all PR-OBS-3 data on the 6th of July 2011

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.

It is clear that PR-OBS-3 skill to recognize no-rain and moderate precipitation situations are low – respectively, only 25 out of 136 and 44 out of 94 of ground cases was properly allocated by satellite product. The light precipitation is not properly recognized as well – only 13 out of 37 were recognized properly.

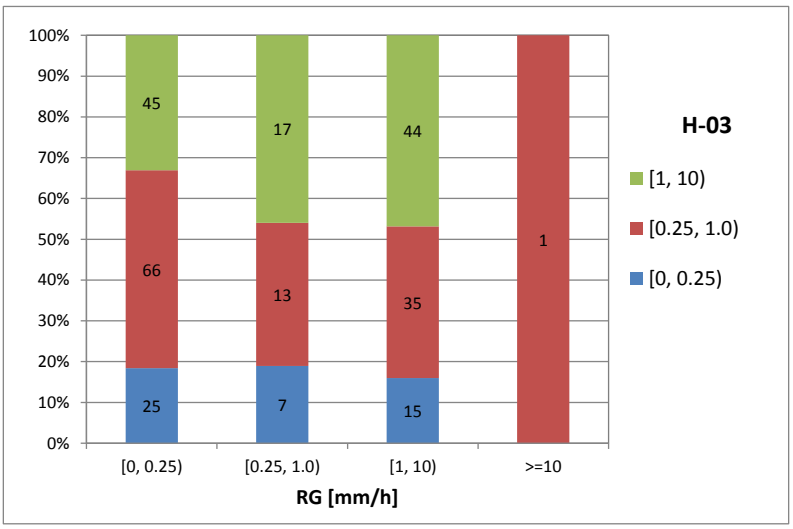

Fig.5 Percentage distribution of PR-OBS-3 precipitation classes in the rain classes defined using rain gauges (RG) data on the 6th of July 2011.

Some Conclusions

To sum it up, the analysis performed for situation with stratiform precipitation showed good ability of PR-OBS-3 product in recognition of precipitation layout. Also good relation between POD and FAR proves skill to recognize the precipitation. Unfortunately, H-03 strongly underestimates heavy and moderate precipitation and overestimates the moderate one. It also has low sensitivity in no rain detection.