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.

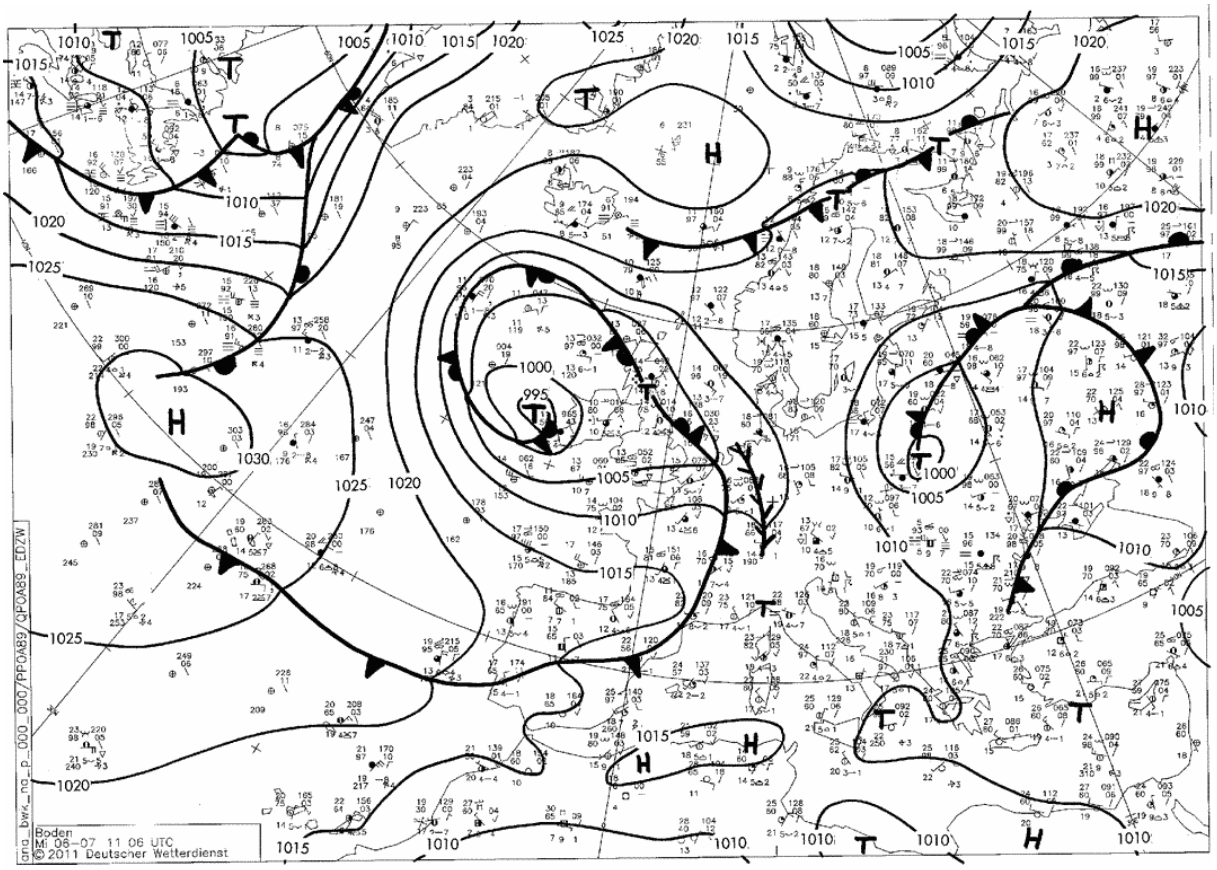

Fig.1 Synoptic chart at 0600 UTC on 6th of July 2011. Courtesy of Deutscher Wetterdienst.

Data and products used

Reference data: data from Polish automatic rain gauges network (IMWM-NRI)
H-SAF product: PR-OBS-2
Ancillary data (used for case analysis):
Polish meteorological radar network, POLRAD (IMWM-NRI)
Weather charts (courtesy of Wetterzentrale)

Comparison

This event is dominated by stratiform precipitation system located in the East Poland and moving slowly towards Ukraine. The highest peak measured by rain gauges is of about 6.4 mm/h, at the same time radar reports 15.0 mm/h while PR-OBS-2 shows a peak value of 5.0 mm/h.

On the Fig.3 the PR-OBS-2 product is visualized for the night overpass. For comparison, the distribution of 10 minute precipitation obtained from RG and radar data measured at closest to the given time slot are presented. All precipitation maps were prepared using Nearest Neighbor method.

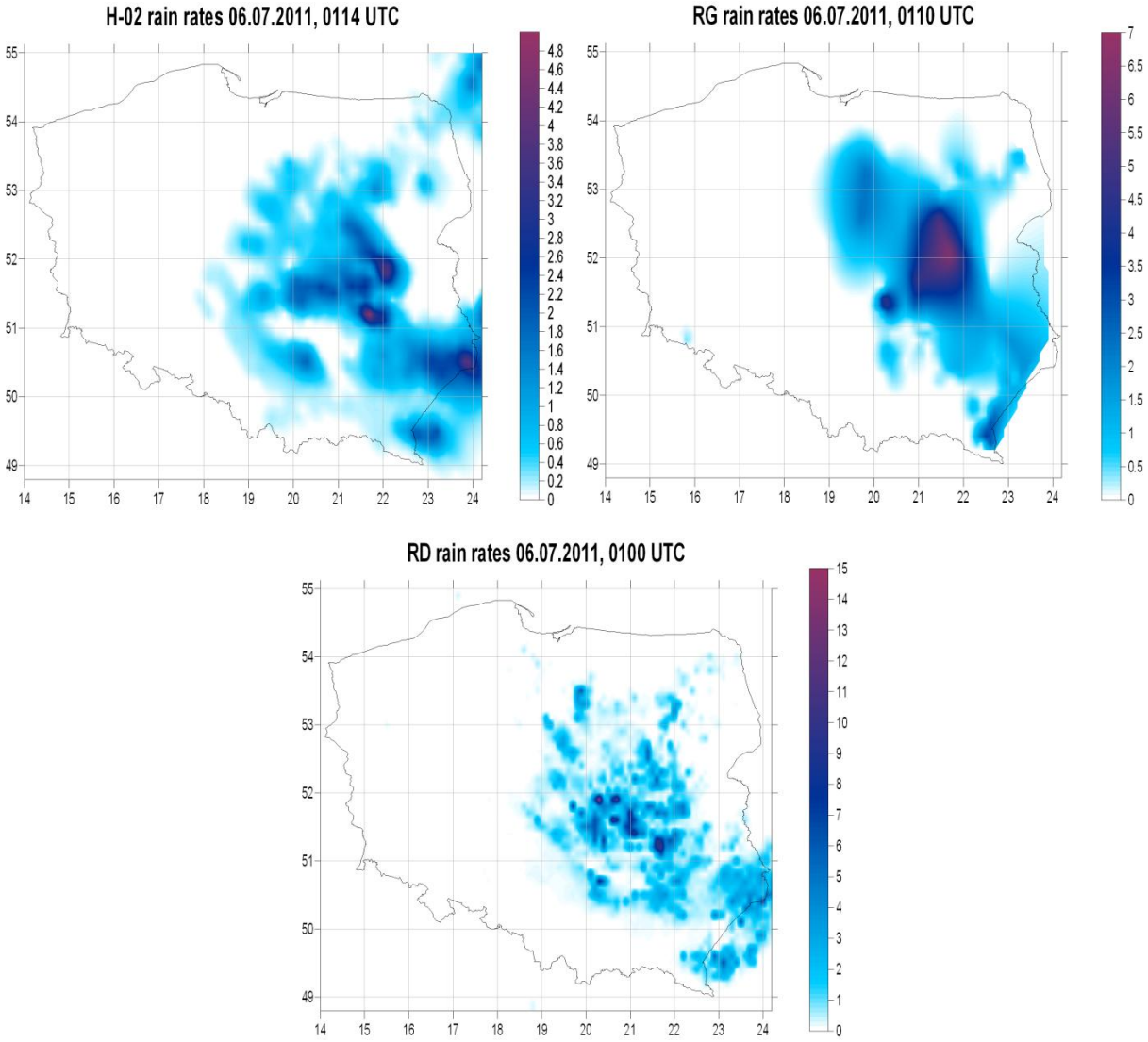

Fig.3 PR-OBS-2 at 0114 UTC on the 6th of July 2011 (left panel), 10 minute precipitation interpolated from RG data at 0110 UTC (right panel) and 10 minute precipitation derived from radar data at 0100 UTC (bottom panel). *Note diverse scale notation!*

All maps present similar precipitation area layout: E of Poland is in the rainfall, W is dry. The differences among the maximum precipitation cores are attributed to interpolation (rain gauge map) and satellite sensor scan properties (H-02 map). Despite good agreement between H-02 and rain gauge the high precipitation area on the border with Ukraine couldn't be detected (no rain gauges there). The traditional overestimation by radar is clearly visible on the radar map. The peak

precipitation is reported as three times overestimation of the H-02 but it is attached to very small peak areas.

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-2 product to recognize the stratiform 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-2 on the 6th July 2011

Parameter	Scores
POD	0.83
FAR	0.65
CSI	0.33

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

The quality of PR-OBS-2 in estimating the stratiform precipitation is presented on the Figure 4. The points on the scatter plot are mostly arranged below the diagonal, what indicates that PR-OBS-2 tends to underestimate the precipitation.

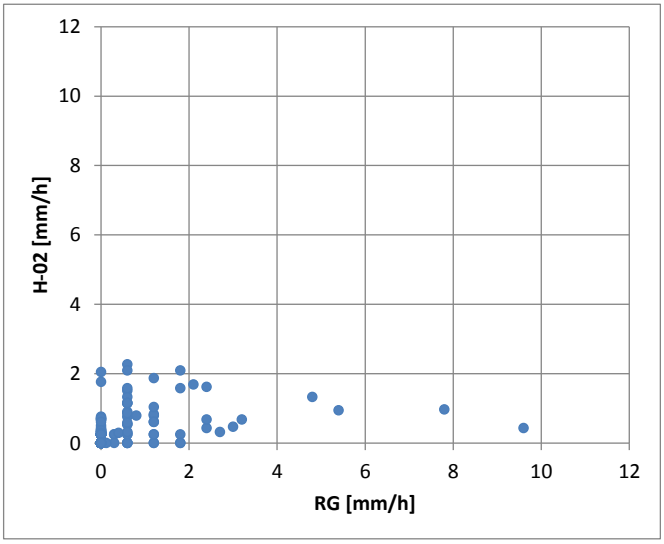

Fig.4 Scatter plot for measured (RG) and satellite derived (H-02) rain rate obtained for all PR-OBS-2 data on the 6th of July 2011

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 can be easily noticed that PR-OBS-2 recognizes both, no-rain and light precipitation situations easily – respectively, 111 out of 193 and 15 out of 26 ground cases was properly allocated by satellite product. The moderate precipitation is not properly recognized in most cases.

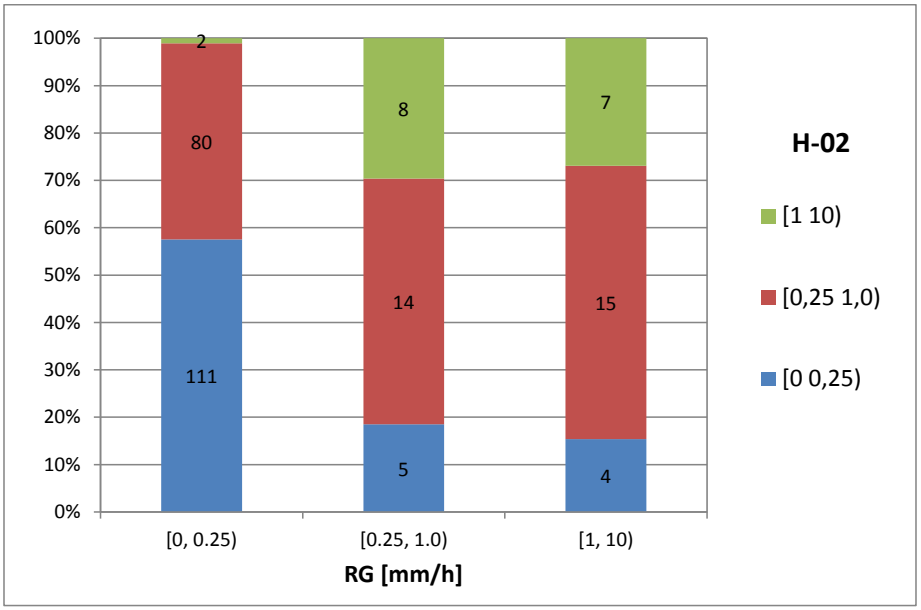

Fig.5 Percentage distribution of PR-OBS-2 precipitation classes in the rain classes defined using rain gauges (RG) data on the 6th of July 2011.

Some Conclusions

To sum it up, the analysis performed for situation with stratiform precipitation showed very good ability of PR-OBS-2 product in recognition of spatial layout of precipitation. POD values in comparison with FAR rates shows H-02 ability of stratiform precipitation recognition.

The product tends to strongly underestimate the moderate precipitation.