<u>Description of the case study</u>

During the night and early morning of the 14th of July 2011 the significant cloud layer expanding in the West of the country and slowly moving East produced precipitation and local storms. On the southern shores of the Baltic sea and in Pomerania region the precipitation was described as average to high. The rest of the country was covered by thin layer of clouds at that time. The minimal temperature recorded on the NE part of Poland reached 14°C, the maximum temperature was 19°C on the SW. Wind speed records show 60 km/h in the western regions of the country (during the storms up to 80 km/h) of E and SE direction turning to SW. The weather forecast estimated the precipitation within the storm areas up to 40 mm.

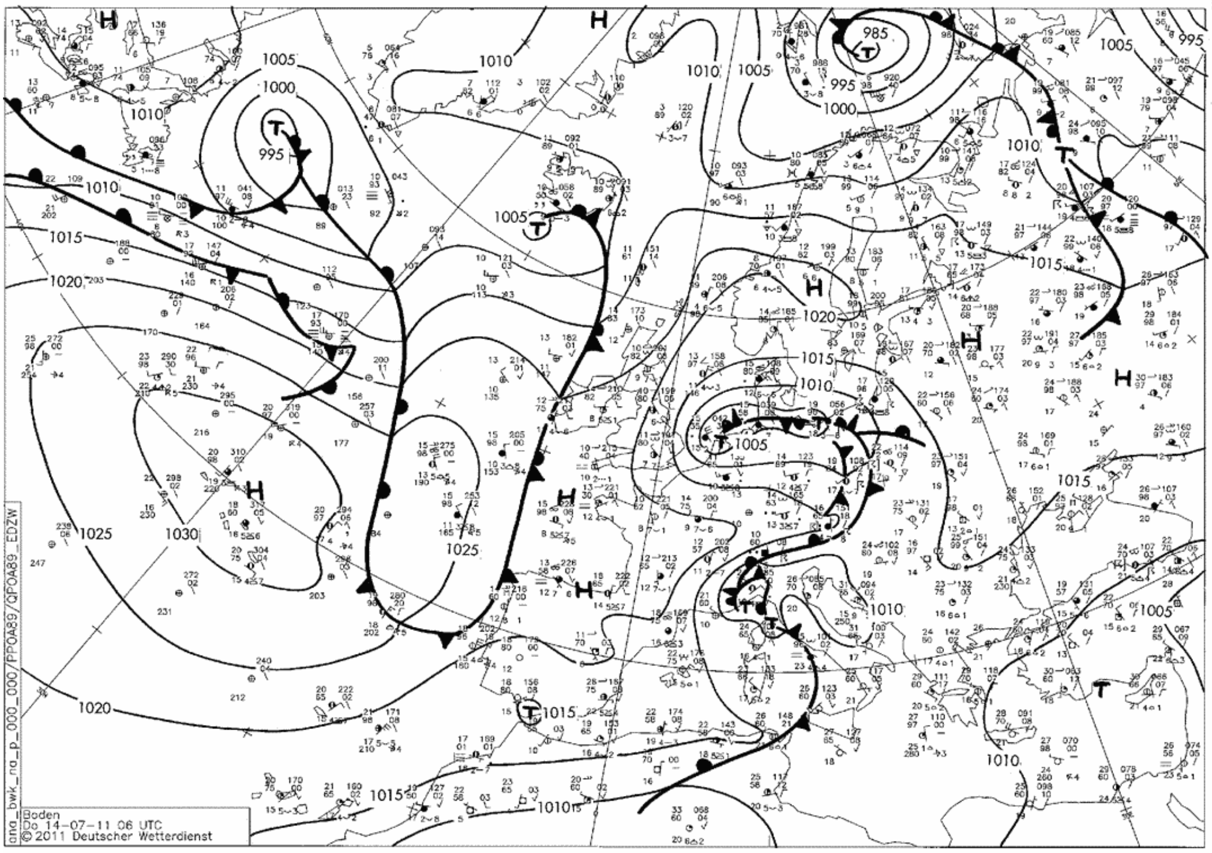

Fig.1 Synoptic chart at 0600 UTC on 14th of July 2011. Courtesy of Deutscher Wetterdienst.

Convective storms where observed over the country on that night. The precipitation was accompanied by lightning activity. On the Fig.2, the lightning activity map for twenty minutes time span (0120 UTC -0140 UTC) is presented (0124 UTC sensor overpass). The map was constructed on the base of data from Polish Lighting Detection System, PERUN.

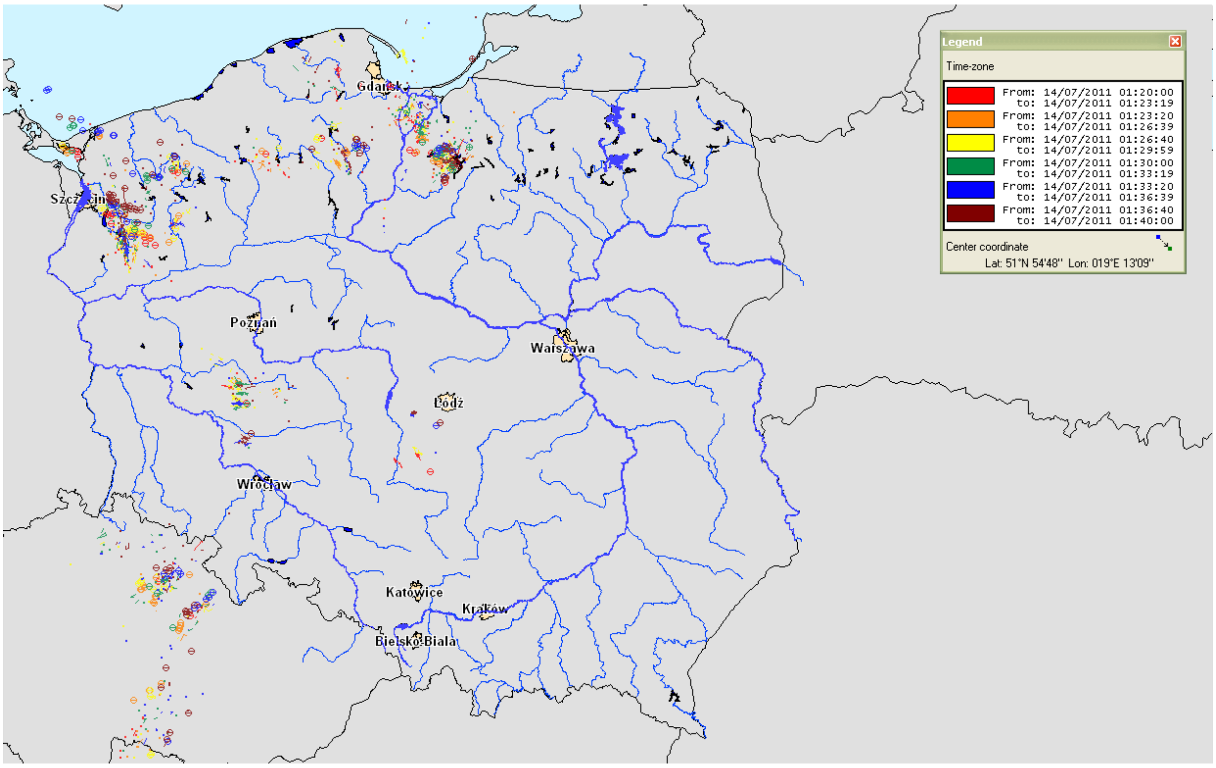

Fig.2 Total lighting map of Poland showing electrical activity between 0120 UTC - 0140 UTC on 14th of July 2011.

Vaisala lightning sensors installed in Poland detected 403 intra cloud events, 5 positive cloud-to-ground events and 285 negative cloud-to-ground events in the reference time period.

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)
- Polish Lighting Detection System, PERUN (IMWM-NRI)
- Weather charts (courtesy of Deutscher Wetterdienst)

Comparison

This event is dominated by convective systems of limited spatial scales moving across Poland. The highest peak measured by rain gauges is of about 15.1 mm/h, at the same time radar reports 56.5 mm/h while PR-OBS-2 shows a peak value of 24.8 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.

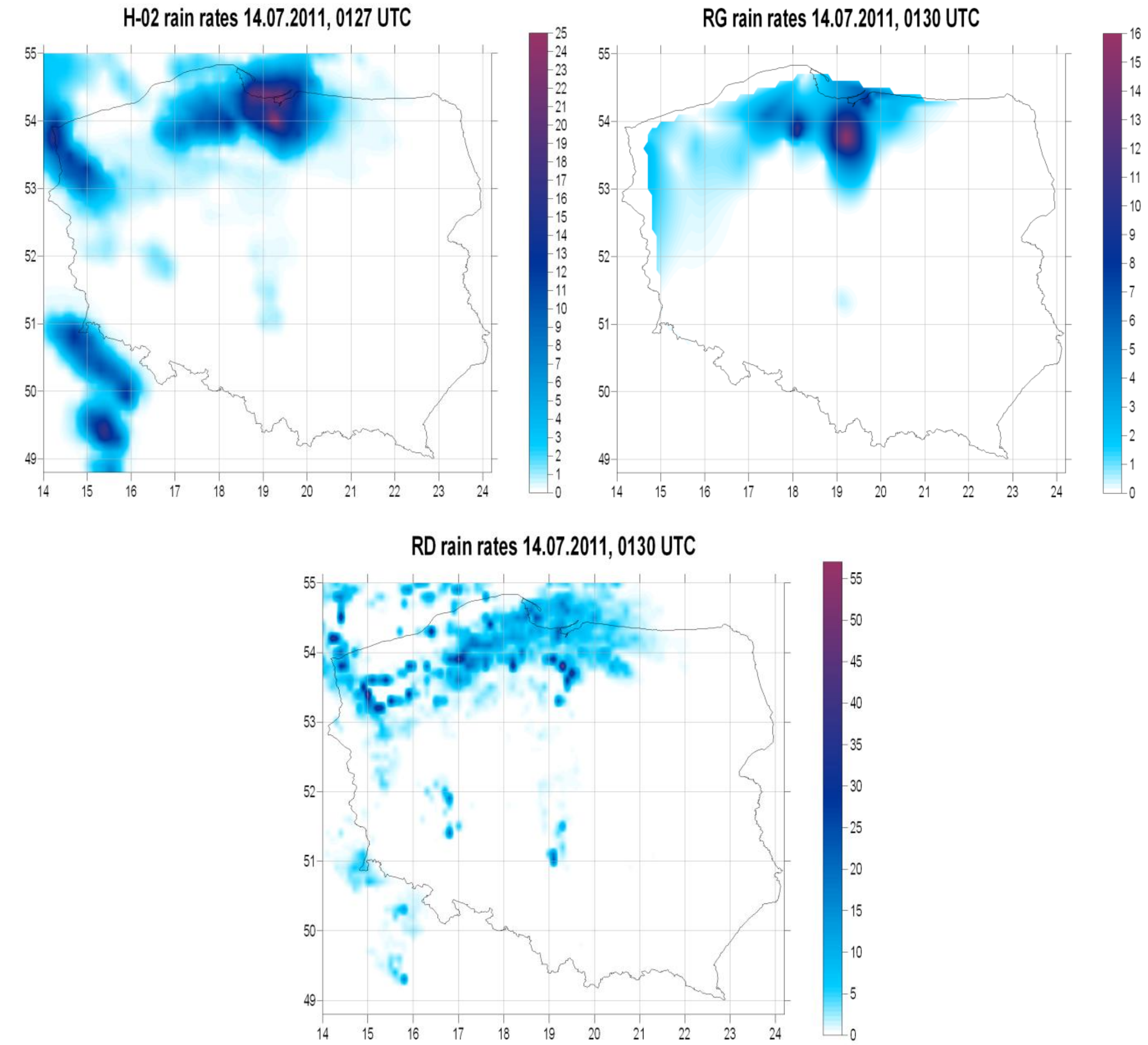

Fig.3 PR-OBS-2 at 0127 UTC on the 14th of July 2011 (left panel), 10 minute precipitation interpolated from RG data at 0124 UTC (right panel) and 10 minute precipitation derived from radar data at 0130 UTC (bottom panel). *Note diverse scale notation!*

On all maps, the precipitating areas reveal the lightning activity seen on the Figure 2 which proves H-02 skills of convective precipitation location. Satellite and radar maps present excellent spatial correlation on the precipitation areas. The rain gauge map lacks this correlation because of the interpolation of the rain gauge locations at the border of the domain.

<u>Statistical scores</u>

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 convection 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 14th July 2011

Parameter	Scores
POD	1.00
FAR	0.50
CSI	0.50

The top value of POD shows excellent ability of H-02 to recognize the convective precipitation in this case however the FAR values remain high.

The quality of PR-OBS-2 in estimating the convective 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-2 tends to overestimate the precipitation except for the heavy ones.

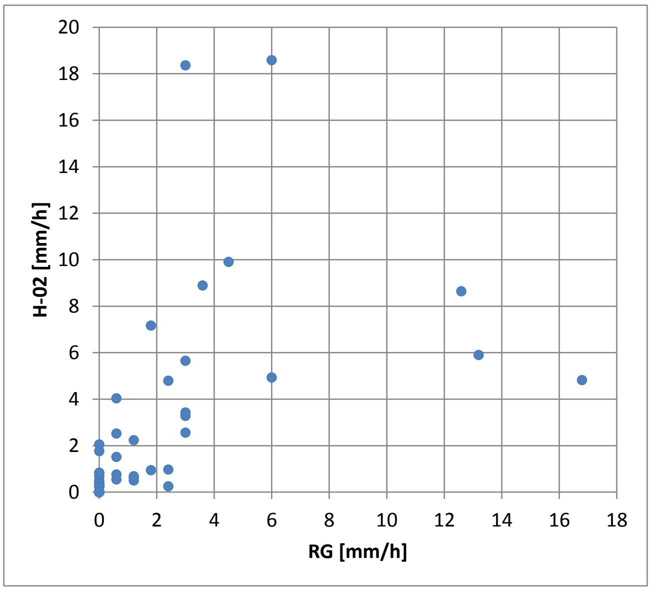

Fig.4 Scatter plot for measured (RG) and satellite derived (H-02) rain rate obtained for all PR-OBS-2 data on the 14th of July 2011

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.

One can easily notice very good ability of PR-OBS-2 to recognize both, no-rain and moderate precipitation situations – respectively, 211 out of 237 and 100% of ground cases were properly allocated by satellite product. The light precipitation is not properly recognized in most cases and it is overestimated. When heavy is considered, the PR-OBS-2 quality is not so good: almost all cases of the observed precipitation in this class are underestimated.

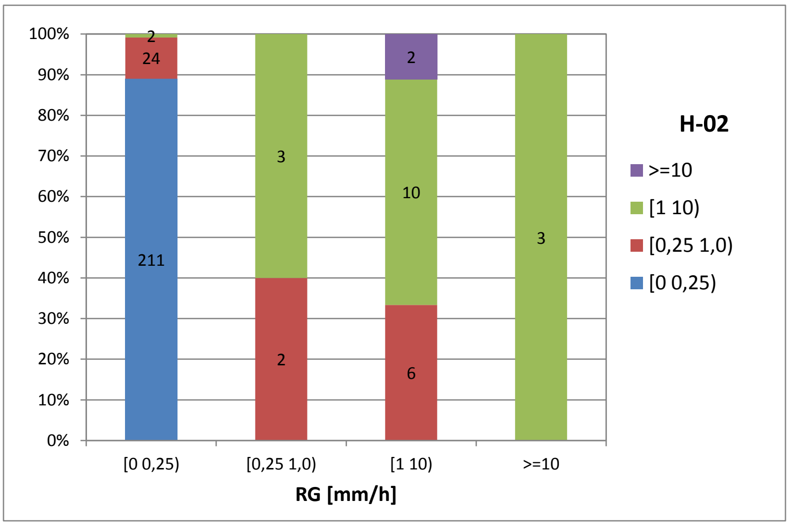

Fig.5 Percentage distribution of PR-OBS-2 precipitation classes in the rain classes defined using rain gauges (RG) data on the 14th of July 2011.

Some Conclusions

To sum it up, the analysis performed for situation with convective precipitation showed very good ability of PR-OBS-2 product in recognition of this kind of precipitation, especially light and moderate ones.

The product proves an excellent skills in convective precipitation recognition and also very good skills in its spatial location.