Comparison of Nowcasting SAF precipitation products with OPERA radar data

M.A. Revuelta, X. Calbet, J.A. Lahuerta, P. Rípodas

Nowcasting SAF. AEMET. C/Leonardo Prieto Casto 8, 28071 Madrid (Spain)

Introduction

Geostationary Meteorological satellites provide us with observations of the Earth's atmosphere with great spatial and temporal coverage. However, these observations must be contrasted against ground-based observations. In the case of precipitation, radar is the most appropriate instrument to make comparisons with satellite products. However, radar networks with wide geographic coverage are scarce, which means that sometimes validations are carried out for relatively small regions.

OPERA (EUMETNET Radar Programme) [1][2] is a radar network that groups different European radar networks, providing compositions of them.

The Nowcasting SAF (NWC SAF, http://nwc-saf.eumetsat.int) software generated precipitation products derived from GEO Meteorological Satellites. Calibrations and validations of these products have been carried out against the Spanish AEMET radar network so far. Preliminary studies are currently being carried out to perform validations against OPERA data, thus extending the coverage of the validation. This poster shows the results of these studies.

Methods

The Convective Rainfall Rate from Cloud Physical Properties (CRR-Ph) is a Nowcasting SAF product that provides information on convective, and stratiform associated to convection, instantaneous rain rates and hourly accumulations (http://www.nwcsaf.org/crr-ph_description, [3]).

Two different algorithms for daytime and nighttime are used. Transition between day to night algorithm is produced at Solar Zenith Angle SZA > 70º. An improved version of these algorithms is being developed. The results shown in this poster use the operative version (NWC SAF GEO v2018).

Calibration and validation of CRR-Ph product need radar data. Currently the AEMET radar network is being used (see figure 1). OPERA covers more than 30 countries and contains more than 200 weather radars, including those belonging to the AEMET network (see figure 2) OPERA provides two parameters: surface Rainfall Rate (RFR) in mm/h and the columnar maximum reflectivity (dBZ). Both are compositions of all the available radars of the network.

With the objective of checking the performance of the satellite diurnal and nocturnal products, one daytime and one nighttime event with convective precipitation in 2016 have been chosen attending to the following criteria:

Daytime: at least 3 slots with more than 600 pixels with RFR > 20 mm/h and more than 100 pixels with RFR > 50 mm/h.

Nighttime: 3 slots with more than 400 pixels with RFR > 20 mm/h and more than 60 pixels with RFR > 50 mm/h.

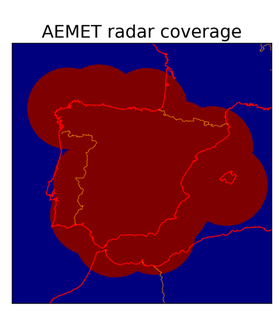

Figure 1: AEMET radar network coverage. Lcc projection

Figure 2: OPERA network coverage. Laea projection

Results

Attending to the criteria presented above the 28th of May 2016 (12:30 to 17:30) and the 10th of August 2016 (20:00 to 21:00) were chosen.

The satellite product has been reprojected to the OPERA projection, laea (Lambert Azimuthal Equal Area). Four plots are presented: RFR (top right), CRR-Ph (top left), an overlap of them in RBG -Red=RFR, Green=CRRPh- (bottom left) and the differences (bottom right).

Figure 3 shows a slot of the daytime event, at 15:00 UTC. A great number of convective cells can be seen scattered all around the Iberian Peninsula, Central and Eastern Europe. The satellite product identifies these cells.

Figure 4 shows a slot of the nighttime event, at 21:00 UTC. Larger rainfall areas are shown in the Southern Iberian Peninsula, northern Italy and Eastern Europe. Bottom maps show that the differences between both parameters are numerically smaller than in the previous case. This might indicate that the difficulty in the right positioning and intensity calculation of rainfall from satellite measurements is higher in the case of small cells.

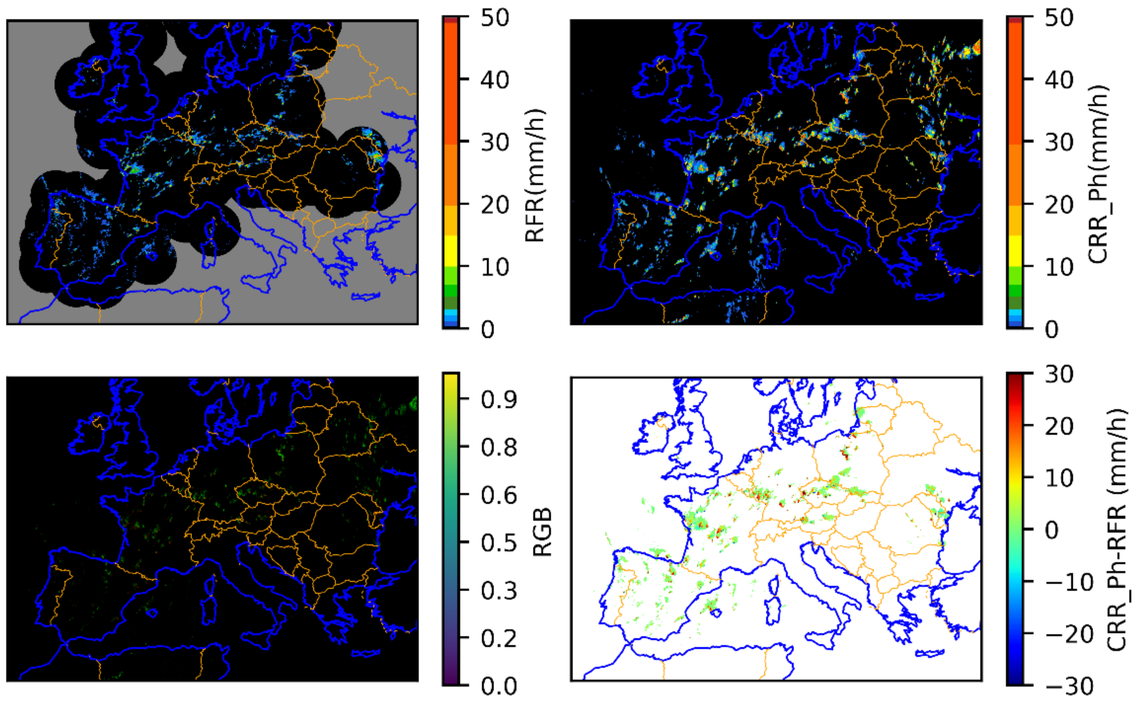

Figure 3: Daytime event. 28th of May 2016, 15:00 UTC

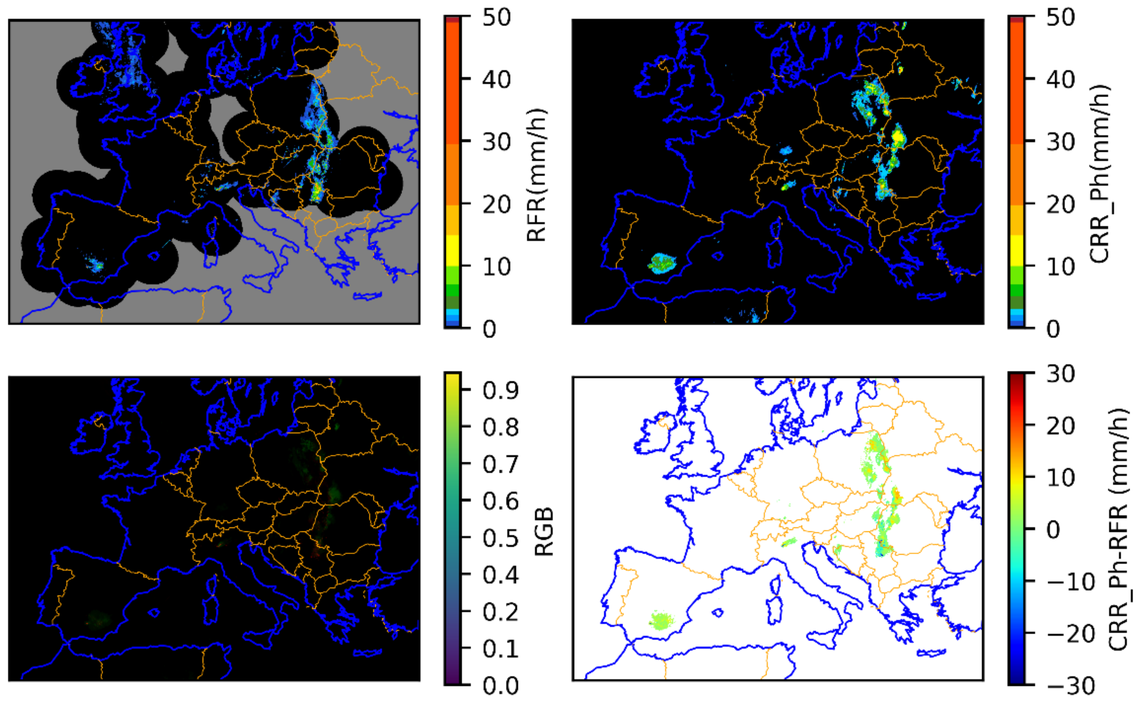

Figure 4: Nighttime event. 10th of August 2016, 21:00 UTC

Conclusions

From a qualitative point of view we can see that CRR-Ph reproduces the main features of the Opera RFR map, both rainfall areas and intensities, although in occasions the areas and intensities are overestimated by the satellite.

Statistic validation of the Nowcasting SAF CRR-Ph product with OPERA parameters will be performed for convective rainfall areas in the near future. Convective situations will be selected considering high values of surface rainfall rate and column maximum reflectivity dBZ values.

References

1. **Huuskonen A, Saltikoff E, Holleman I. 2014. *The operational weather radar network in Europe*. Bulletin of the American Meteorological Society 95: 6: 897– 907**
2. **Saltikoff E, Haase G, Delobbe L, Gaussiat N, Martet M, Idziorek D, Leijnse H, Novák P, Lukach M, Stephan K. *OPERA the Radar Project*. Atmos. 2019, 10, 320**
3. ***Algorithm Theoretical Basis Document for "Precipitation products from Cloud Physical Properties"* (NWC-CDOP2-GEO-AEMET-SCI-ATBDPrecipitation_v2.1), v2018**