VALIDATION OF THE CRR PRODUCT OF THE NWCSAF SOFTWARE PACKAGE VERSION 2010

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INTRODUCTION:

The Convective Rainfall Rate (CRR) algorithm developed within the context of the SAF on Support to Forecasting and Very Short Range Forecasting (SAFNWC), estimates rainfall rates from convective systems, using data from 3R, WV and VHS SWEF SEVERAL channels.

An interesting activity related to convection, this information has been included in the current version of the product. In order to test the possible improvements of the product when using lightning information, a validation process that compares current version and the previous one, has been carried out. This validation includes two different studies, a subjective validation against radar and an objective validation over the whole year 2008.

An objective validation over Hungary has also been performed in order to test the value of the product out of the calibration region.

VALIDATION METHOD:

Radar rain rates have been used as truth data in the validation process. This objective validation process has been based on ground truth.

Both radar rain rates and ECHOTOP radar products have been used to perform the validation. Each validation has been performed with the corresponding one in the CRR image. In order to validate only the convective area, a validation area has been selected taking into account the convective area that has been calculated in each image (Figure 2).

To do that, radar rain rates and ECHOTOP images have been used. In the validation process, the areas inside a 5 by 5 window centered on each pixel have been selected. So, one out of every three pixels of the radar image located in the validation area has been matched with the corresponding one in the CRR image.

Accuracy and categorical statistics have been calculated with those pairs of values. Statistics scores have been calculated for instantaneous rates as well as for accumulations. As the results are quite similar only the instantaneous rain rates results are presented in this paper.

OBJECTIVE VALIDATION OVER SPAIN:

The objective validation over Spain compares the CRR product version 2009 to version 2010 which can use the lightning information as an optional input. This validation has been carried out for 85 stations, by comparing the precipitation obtained with the CRR data to the ground truth available from the Spanish Meteorological Institute. The use of lightning data has been experimented using the corrections with the default values.

CONCLUSION:

Regarding the accuracy statistics, median error is very close to zero in both cases 2D and 2D calibration, and the difference between both values is small. Percentile values shows a small characteristic of 2D calibration, in the case of the highest rates, the rain rates usually assigned by 2D calibration are lower than the ones assigned by the 3D calibration. This fact leads to an RMS error in 2D calibration smaller than in 3D case.

The use of lightning data has very low impact in statistics scores although they are a bit better in the new version.

OBJECTIVE VALIDATION OVER HUNGARY:

The Hungarian meteorological service (OMSZ) performed last year within the framework of SAFNWC Visiting Scientist Activities a validation work including a subjective validation against Hungarian radar data and an objective validation against Hungarian rain gauges for the period 15 May to 15 September 2009.

In order to complement the OMSZ work, a parallel validation has been carried out using radar data for the same period and region. The radar products used to compare with the OMSZ have been used to validate only the convective area, in order to validate only the convective area, a validation area has been achieved taking into account the convective area that has been calculated in each image (Figure 2).

The categorical statistics show that POD is higher than FMR and FNR error were obtained because the precipitation measured was greater.

Regarding the categorical statistics, better results were obtained over Hungary. The reason could be that Hungarian reflectivity is in the vertical radar digital correction better to cloud (Figure 2).

In general, similar results were obtained for both validations over Spain and over Hungary against radar data.

SUBJECTIVE VALIDATION OVER SPAIN:

Convective Rainfall Rate product is thought to be used by forecasters. Besides the intensity of precipitation it is also important monitoring the precipitation pattern as well as its evolution. In order to check this kind of information, a subjective validation has been carried out.

This investigation has been performed over Spain. In version 2010, CRR product can also use the lightning information. This subjective validation compares the radar precipitation pattern with CRR data obtained with and without lightning information. This validation has been performed over Spain.

In this case, where CRR have to use the 2D Calibration matrices and is not able to catch the new nuclei that CRR by itself was missing in version 2009. Figure 10 shows how two hours later the convective system is decaying. At this stage CRR version 2009 misses the entire precipitation pattern but CRR version 2010 shows precipitation pattern according to the radar. This precipitation pattern showed by the CRR has been already confirmed using the lightning information.

Three images of the same event at different times are shown below. All of them took place during the night of 20 calibration was used. These examples show the added value of the lightning information in the time evolution of the convective events during the night. Figure 8 shows the situation occurred on the 29-06-2008 at 23:00 UTC. At this time CRR shows the overall pattern of the radar, with a lower intensity. There is a high density of lightning in those areas where the radar shows higher intensity of precipitation. This fact allows CRR version 2010 to catch the main features of precipitation according to the radar with more accurate localization and more accurate intensity. Figure 9 shows the validation of the CRR against lightning data available in the area shown in Figure 8. The use of lightning data has very low impact in statistics scores although they are a bit better in the new version.

CONCLUSION:

When CRR is using the 3D Calibration, lightning information helps the precipitation pattern and in some cases it is more accurately what maximum of precipitation. In general, there are no big differences using or not the lightning information with the 3D Calibration.

Lightning information is very important when CRR is working with the 2D Calibration. CRR with 2D Calibration provides less quality results than CRR with 3D Calibration. In this respect lightning information helps CRR obtaining better results in order to provide better quality information. In these cases most precipitation nuclei are caught, the quantifying of precipitation-patterns are more adjusted to the one measured by the radar and subjective situations are better detected.

In this case CRR has been run with the 3D calibration matrices. Lightning information fills the CRR pattern in an appropriate way and both CRR show more accurate intensities according to the radar.