VALIDATION OF THE NWC SAF CRR PRODUCT OVER THE GREEK AREA USING RAIN GAUGE DATA AS GROUND TRUTH

10-12/03/2020

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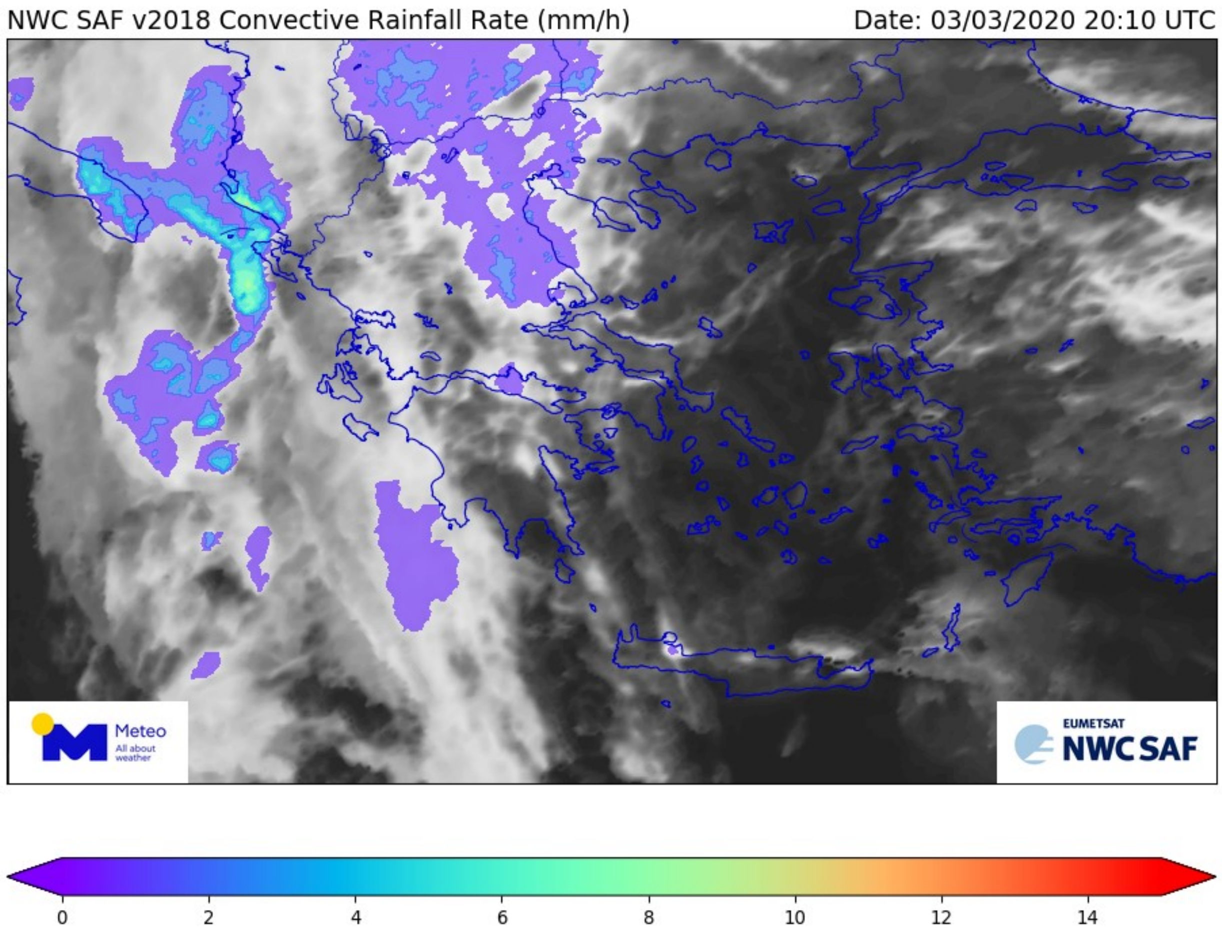
Introduction

- The METEO unit at the National Observatory of Athens operates the NWC SAF (Support to Nowcasting and Very Short Range Forecasting Satellite Application Facility) system since 2016.

- In the present work, the 2016 version of the NWC SAF software, driven by the HERMES (based on the WRF model) operational forecasts, is utilized.

NWC SAF Convective Rainfall Rate visualization example by the National Observatory of Athens / meteo.gr



Some basic remarks

- ***Basic question:*** Which is the product skill in estimating the convective rainfall over the Greek area?
- ***General idea:*** Compute rainfall accumulations from the CRR product and compare them to weather stations rainfall accumulations
- ***Main focus:*** Does the CRR product delineates successfully convection areas?
- ***A-priori concern:*** Inherent difficulty to separate convective from non-convective precipitation

Area, period and data of analysis

- ***Area:*** Greece

- ***Period of analysis:*** 2018

- ***Data:***
  - CRR 15-minutes nighttime algorithm estimations.
  - 10-minutes rainfall data from 375 automated weather stations all over Greece
  - Both datasets were upscaled to 30-minutes values

Methodology

- 10 minutes were added to the SEVIRI slot time for every CRR estimation to account for the actual time of the scanning of Greece (e.g. XX:00 SEVIRI slot shifted to XX:10)
- Each of the CRR estimations is divided by a factor of four (4) to compute rainfall accumulation for each 15 minutes period.
- Add XX:10 and XX:25 rain accumulations to get XX:00-XX:30 accumulation. Similarly the XX:40 and XX:55 accumulations are added to get the XX:30-(XX+1):00 accumulation.
- XX:10, XX:20 and XX:30 rainfall accumulations from weather stations were added to get XX:00-XX:30 accumulations. Similarly the XX:40, XX:50 and (XX+1):00 accumulations are added to get the XX:30-(XX+1):00 accumulation.

Methodology

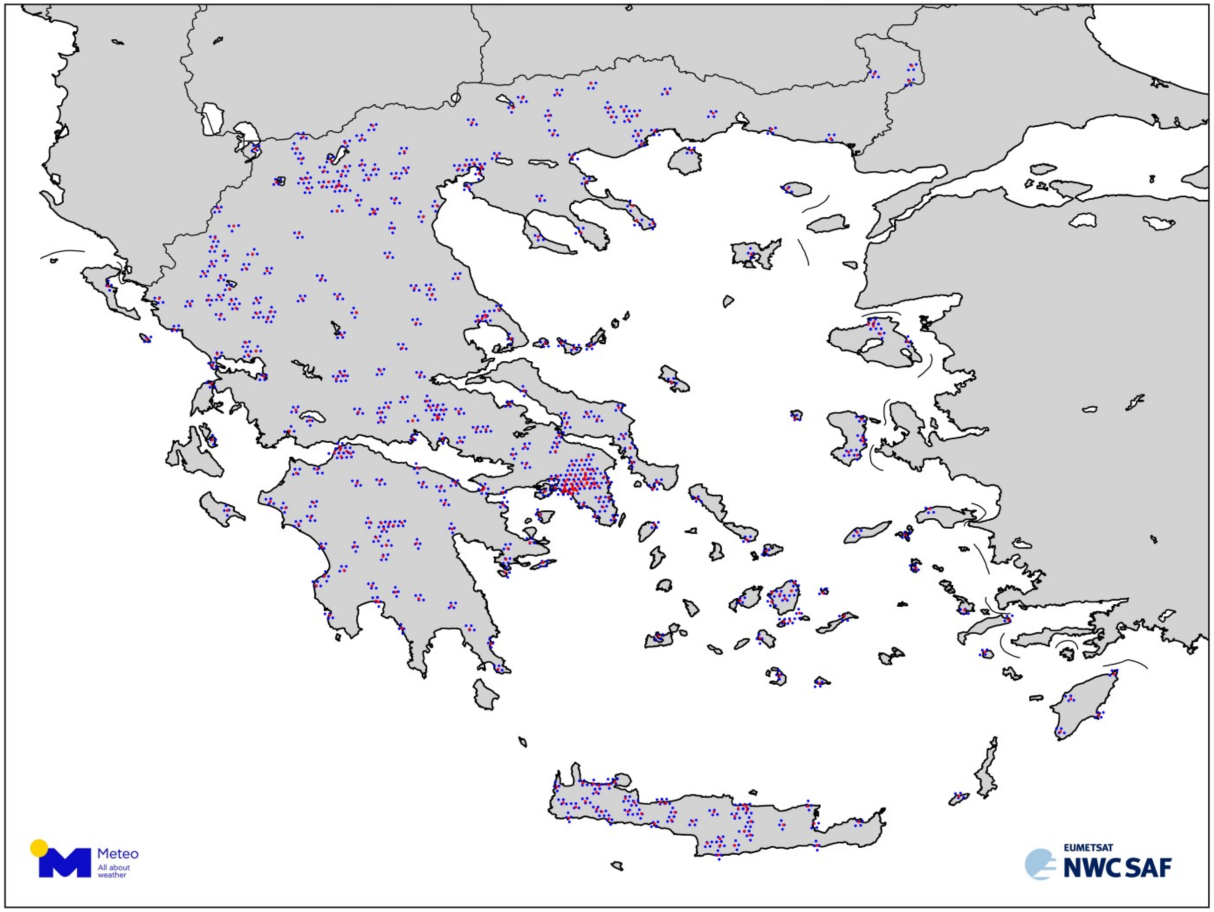
- ***Weather stations sites and SEVIRI grid points do not coincide.*** To account for this displacement the ***four nearest SEVIRI grid neighbors to each of the weather stations are included in the analysis.*** The maximum of the 4 CRR values is compared against the weather station data.

- Seasonal analysis is performed to identify possible differences and ***establish the need for separate verification for each season***

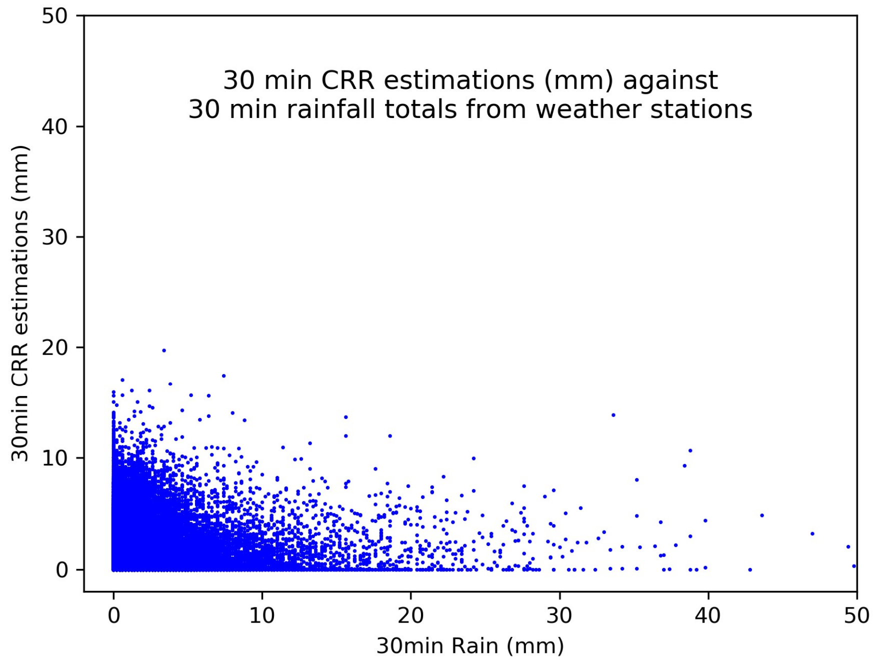
- ***Basic statistics*** (POD, FAR, POFD, Accuracy and BIAS) are ***computed and examined***

Area, stations sites and SEVIRI grid nearest neighbors

NOA-meteo weather stations (red dots) / SEVIRI grid Nearest Neighbors (blue dots)



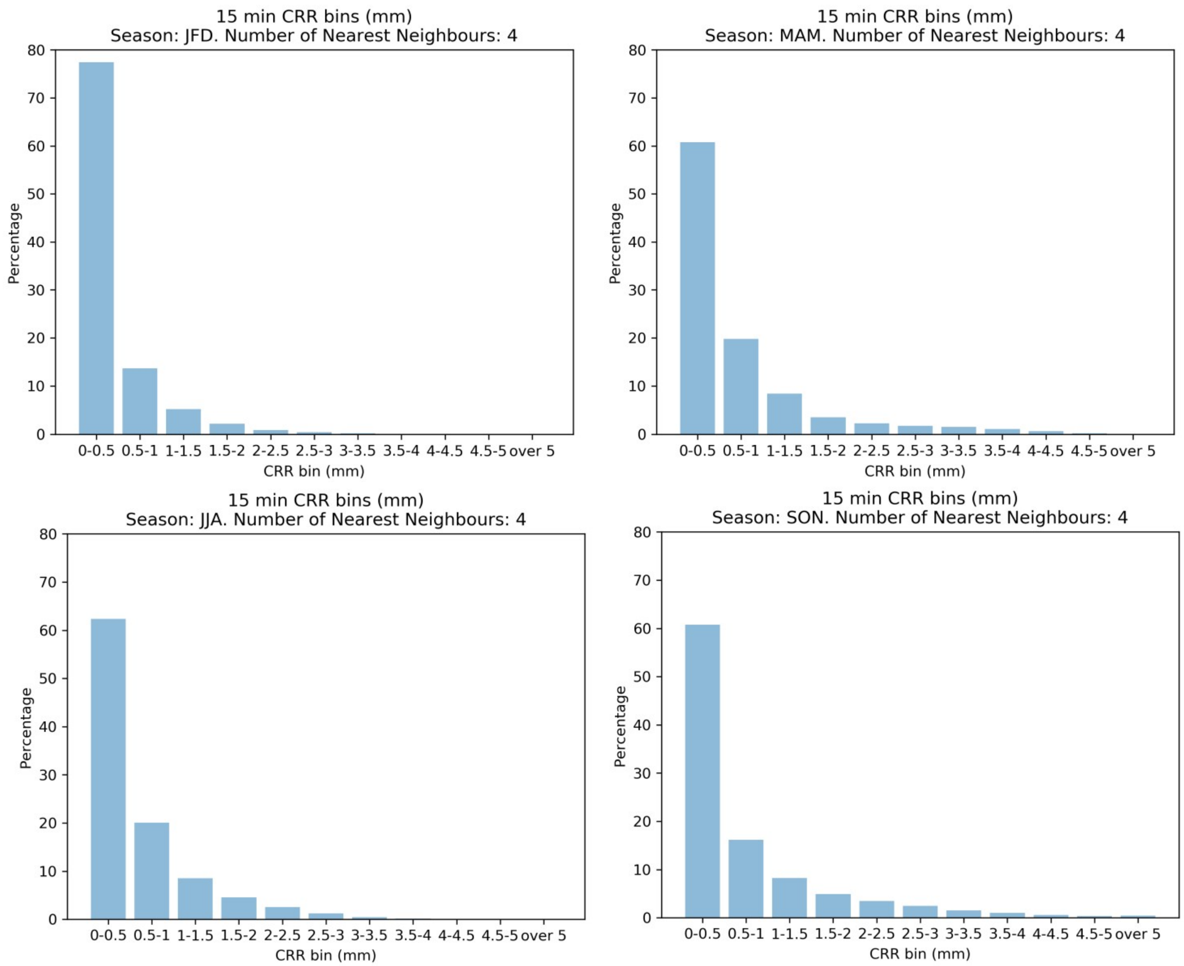
A first look at the data



- Wider distribution of weather station data
- Extreme values of precipitation are “suppressed” by the CRR nighttime algorithm

- Total Number of CRR=0 and rain=0: 5019781 (93.3%)
- Total Number of CRR=0 and rain>0: 163517 (3.0%)
- Total Number of CRR>0 and rain=0: 133336 (2.5%)
- Total Number of CRR>0 and rain>0: 63747 (1.2%)

Seasonal analysis



- Lower CRR estimations during cold season, that are primarily attributed to lower convective activity
- A seasonal analysis of the estimation efficiency may be necessary.

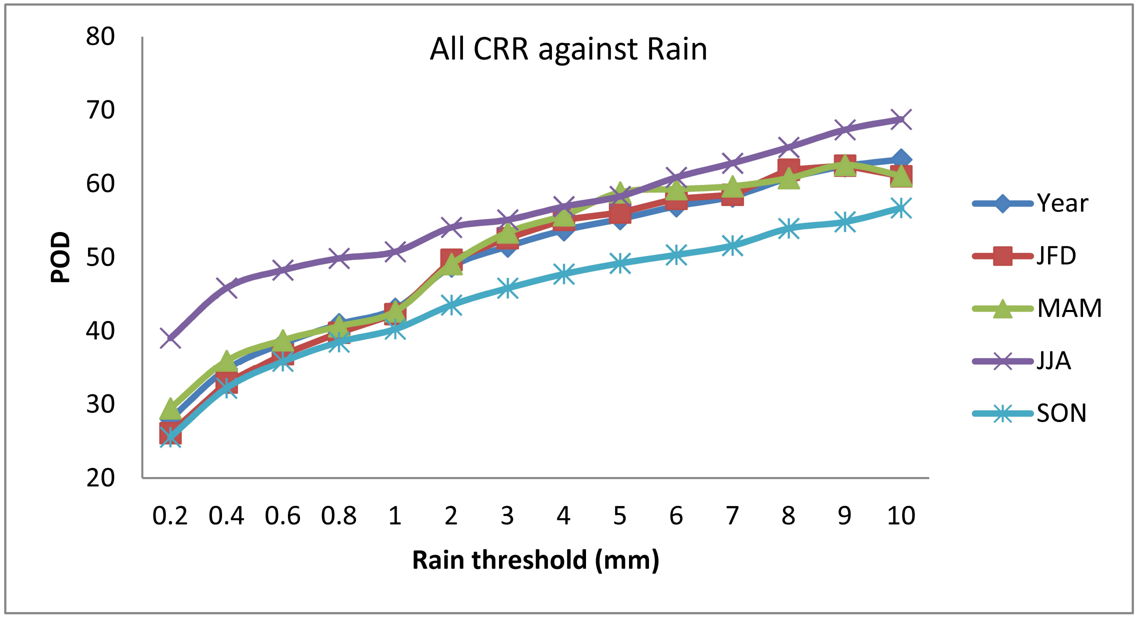
Statistics

Annual dataset
CRR & Rain gauge
data threshold: 0 mm

Hits	63747
False Alarms	133336
Misses	163517
Correct Negatives	5019781
POD	28.05%
FAR	67.65%
POFD	2.59%
Accuracy	94.48%
BIAS	0.87

- Very high Accuracy due to high amount of correct negative values
- Low POD. Result of non-convective rainfall?
- Very high FAR. CRR indentifies extensive areas as convective, but no rainfall is recorded.
- Very low POFD. False alarms are very few compared to correct negatives
- BIAS close to 1. Not of significance if we think of POD and FAR values.

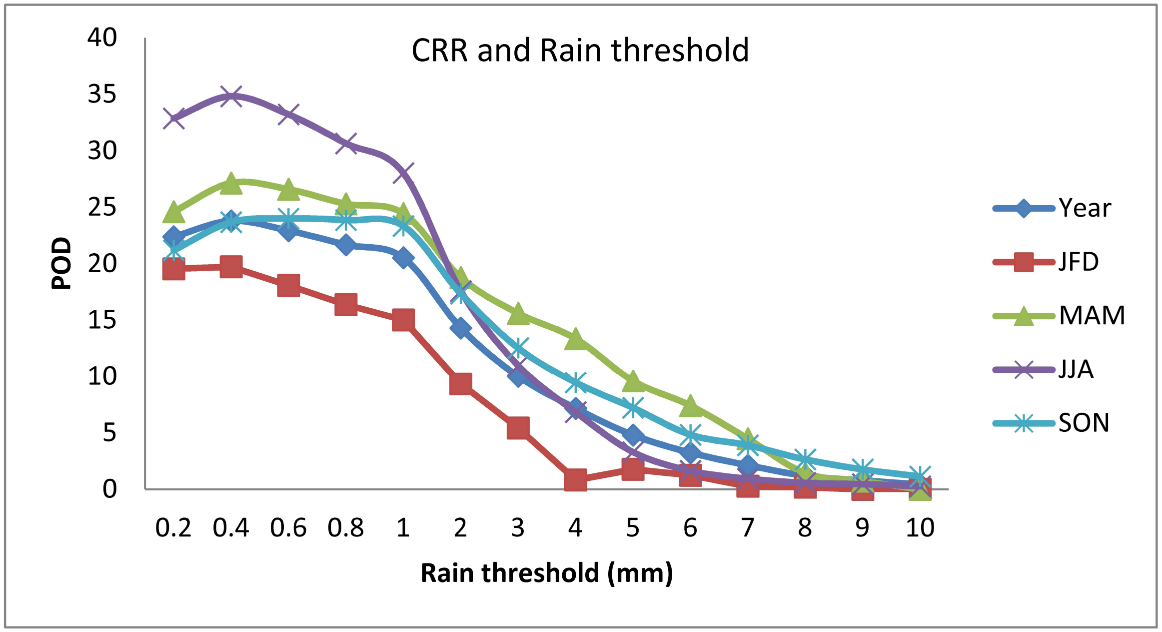
Statistics



All CRR estimations (>0mm) against various rainfall thresholds for annual and seasonal datasets

- Definite seasonal variability
  - Highest POD during Summer, Winter and Spring close to annual average, lowest POD during Autumn.
- Steady increase towards higher rain thresholds
  - High totals of convective rainfall are better detected.

Statistics



CRR estimations against rainfall for different thresholds and for annual and seasonal datasets

- Slight increase from 0.2 to 0.4 mm threshold
  - 0.2 rainfall recordings by weather stations could be the result of condensed humidity (e.g. morning dew, fog etc)
- Rapid decrease after the 1mm threshold
  - Heavy precipitation recorded by weather stations do not coincide with estimated heavy convective precipitation estimations

Conclusions

- CRR nighttime algorithm presents seasonal variability with lower values during the cold season due to limited convective activity
- Extreme values of precipitation are “suppressed” by the CRR nighttime algorithm
- Significant areas are falsely characterized as convective by the product
- Strong convection is better detected by the product although the real precipitation rates deviate from the estimated CRR values.
- Overall, the algorithm seems to overestimate the extend of convective areas while, at the same time, it underestimates the actual precipitation rates.

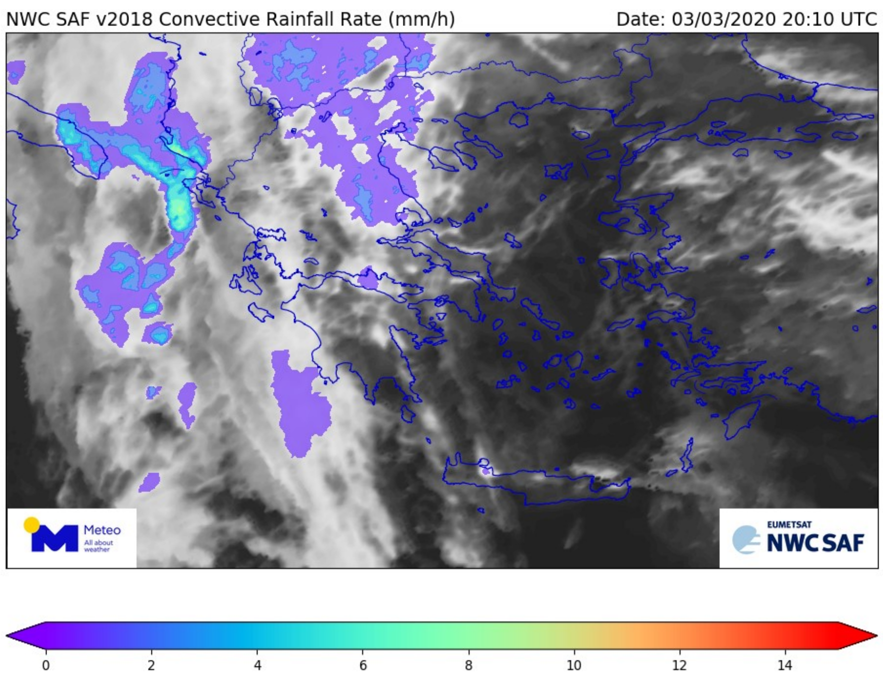
Future work

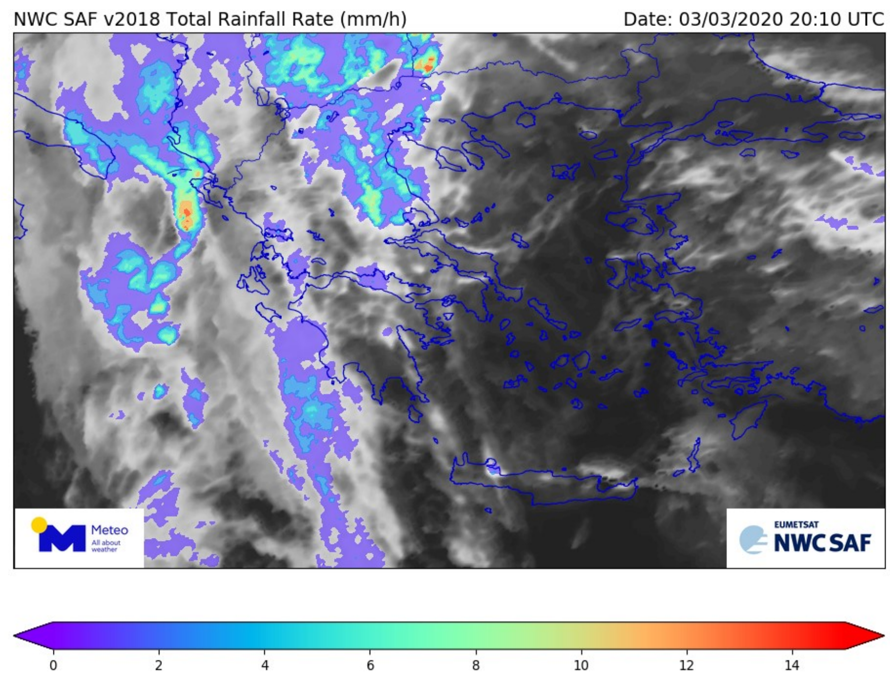
- Utilization of "ZEUS" lightning detection network to identify convective areas

- Utilization of other sources of data (e.g. ERA5 reanalysis CAPE or model data) to identify convective areas

- Perform similar analysis for the CRR-Ph product and PC / PC- Ph products

Some considerations…





- Setting WIN_FILTER_SEMISIZE and FILTER_THRESHOLD to zero (0) increases all values of CRR instead of just stratiform precipitation areas. Explanation?

THANK YOU