NEFODINA2
A new detection of convection for H-SAF convective precipitation product

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Davide Melfi 2016

THE EUMETSAT HYDROLOGICAL SATELLITE APPLICATION FACILITY (H-SAF)

The "*EUMETSAT Satellite Application Facility on support to Operational Hydrology and Water Management*" (H-SAF) was established by the EUMETSAT Council on July 3, 2005 and started activity at the official date of September 1, 2005 as part of the EUMETSAT SAF Network.

The H-SAF objectives are:

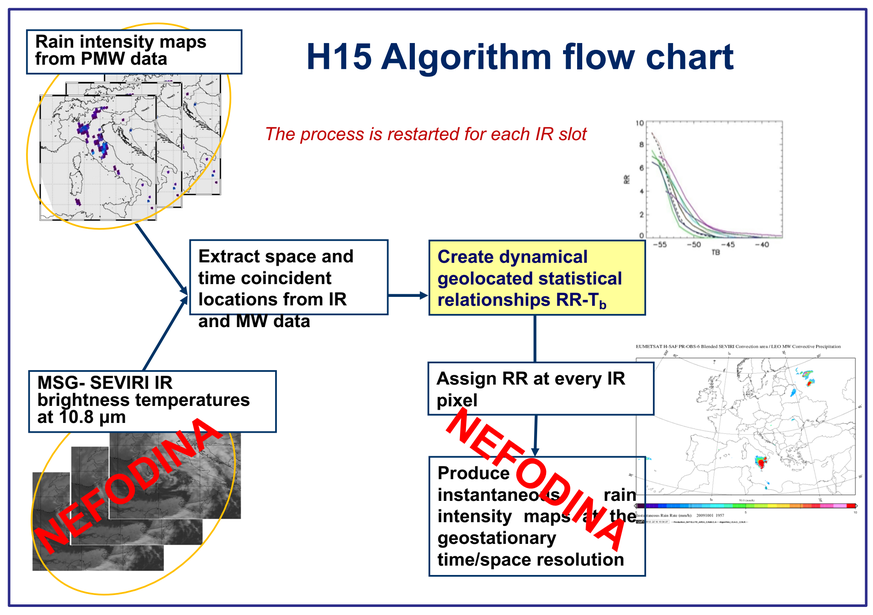
- ❑ to provide new satellite-derived products from existing and future satellites with sufficient time and space resolution to satisfy the needs of operational hydrology, by mean of the following identified products:
  - precipitation (liquid, solid, rate, accumulated);
  - soil moisture (at large-scale, at local-scale, at surface, in the roots region);
  - snow parameters (detection, cover, melting conditions, water equivalent);
- ❑ to perform independent validation of the usefulness of the new products for fighting against floods, landslides, avalanches, and evaluating water resources.

H SAF
Support to Operational Hydrology and Water Management

CONVECTIVE PRECIPITATION RETRIEVAL – H15 ALGORITHM

In the context of HSAF project, H15 is a multisensory algorithm based on the rapid-update technique (RU) (Turk and Miller, 2005) dedicated to convective precipitation. In the retrieval process the individuation of convective areas and their analysis is demanded to **NEFODINA** a fully automatic tool of Italian Meteorological Service.

The poster shows the results of a Visiting Scientist activity performed at COMet by Tor Vergata University of Rome with the aim to improve NEFODINA (http://hsaf.meteoam.it/documents/visiting-scientist/HSAF_VS14_03_Final_Report.pdf).
In particular this activity has explored the use of several SEVIRI channels for the development of a detector which could be used easily on different regions. An object oriented approach has been followed in order to have a very general algorithm ready for the porting on the full disk (H15B product).
The state of the art of the modern technologies has been applied to the software in order to reduce the computational time.



THE NEFODINA2 ALGORITHM

The main purpose of the Nefodina2 algorithm is able to detect and track convective events using the Meteosat Second Generation (MSG) data as unique data source.
The algorithm follows an Object Oriented (OO) approach in order to better handle the amount of data and to apply standard techniques for the properties definition of the detected objects.
The components used to characterise the convective objects are the following:

- Detector
- Tracker

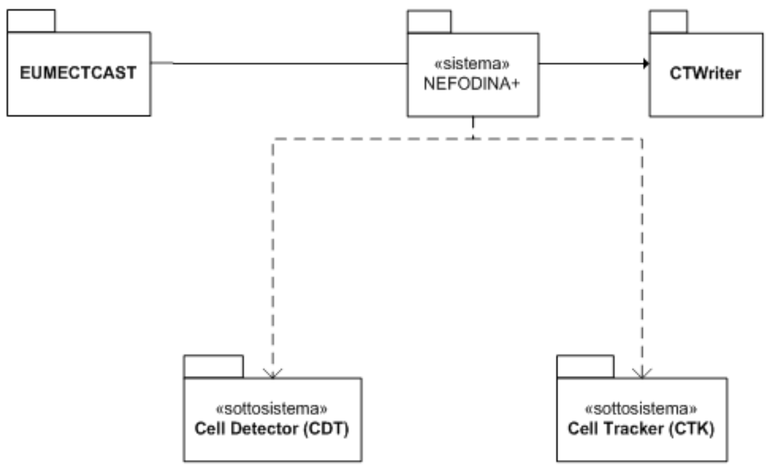


Figure 1: components view of the algorithm

The outputs of the previous steps are two binary maps regarding the convective object characterization at the upper layers of the atmosphere.
The **Tracker (CTK)** makes a temporal correlation between the objects detected at the previous time slots. The correlation is done by intersecting the objects at time $t-1$ (MYSQL database) with the objects detected at time t. If the intersection is not empty, then the objects are related through a parent-child relationship.

The **Detector (CDT)** applies a multispectral approach using two MSG channels for the detection of the convective areas, more specifically it apply the difference between the 6.2 μm and the 10.8 μm channels ([1]) in order to extract the top of the convective clouds.
After this step, the algorithm applies the K-means algorithm in order to identify the colder pixels on the 10.8 μm channel.
The k-means clustering is a method of vector quantization, originally from signal processing, that is popular for cluster analysis in data mining. K-means clustering aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster.
Applied to the Nefodina2, the clustering algorithm makes a partition of the convective pixels, identified at the previous stage, and it retains only the ones belonging to the colder class.
In this way it is possible to avoid the use of fixed thresholds and the algorithm could be applied to the full disk area.

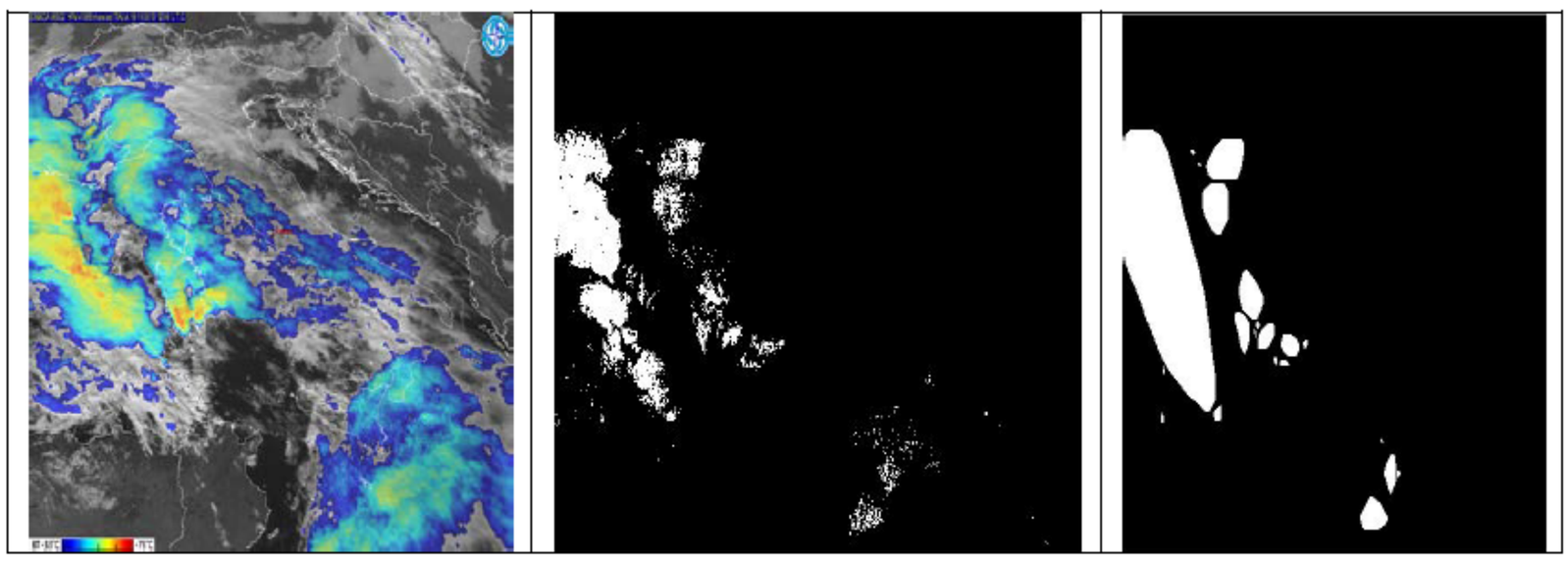


Figure 2: Nefodina2 detection steps. On the left the MSG input image. The center image shows the binary image deriving from the difference between the channel 5 and 9. The right image shows the object extraction by using a clustering algorithm.

VALIDATION AND CASE STUDIES

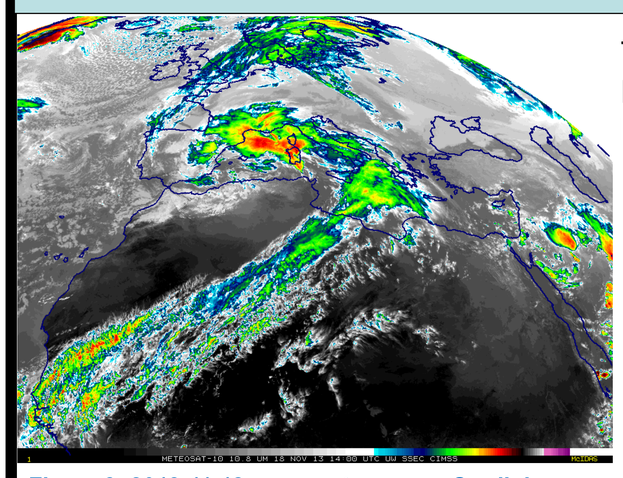
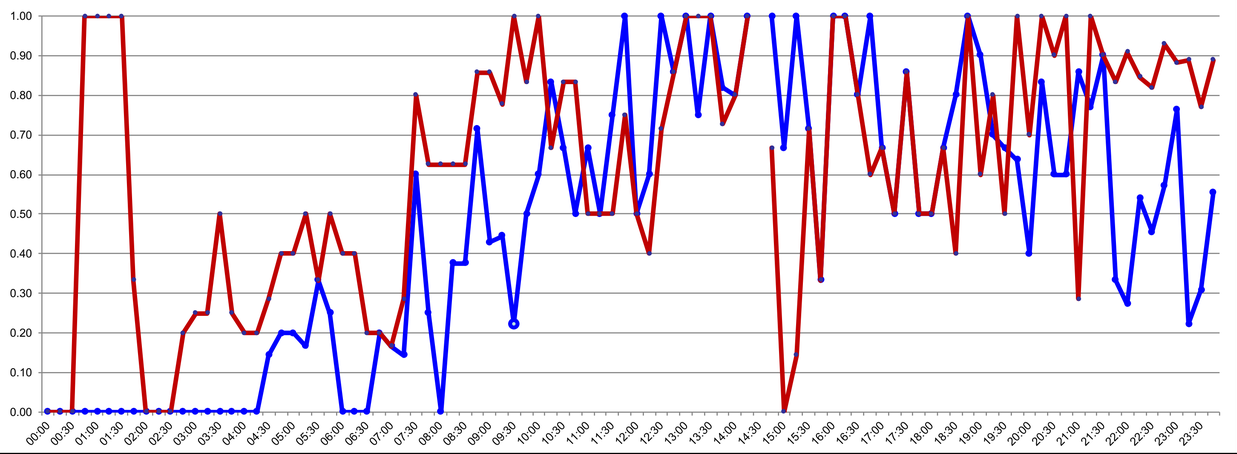


Figure 3: 2013-11-18 severe storm over Sardinia

The validation of the new software was performed by the MODE (Method for Object-based Diagnostic Evaluation) tool using ground Lightning networks (ATDNet, SALDN, Lampinet) data as ground truth and RDT (Rapid Development Thunderstorm) as comparator. Here an example, the 2013-11-18 severe storm over Sardinia.

The figure on the right shows the comparison between the POD scores of **Nefodina2** and **RDT**. It is possible to note that the Nefodina2 score is very sensitive to the number of strokes while the RDT POD is much more constant over the whole validation period. By the way, during the hours of the event the two models perform very well and the POD of both is above 0.6, with a better value for Nefodina2 in some step.



References: http://www.eumetsat.int http://hsaf.meteoam.it http://www.meteoam.it/ http://nefodina.meteoam.it/

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