



UMR 3589



Object-Based Aviation Convection Forecasts from Global Ensemble Model

Adrien Warnan (Météo-France Met Services for Aviation)

Lucie Rottner (Météo-France, National Centre for Meteorological Research)

04.05.2020

EGU 2020, Vienna

adrien.warnan@meteo.fr

www.meteofrance

Aeronautical Project Context



- With rising air traffic, there is an increasing need to get probabilistic forecasts to support flight management.
- The goal of this project is to provide convection forecast probabilities for 24 to 48 hours ahead.

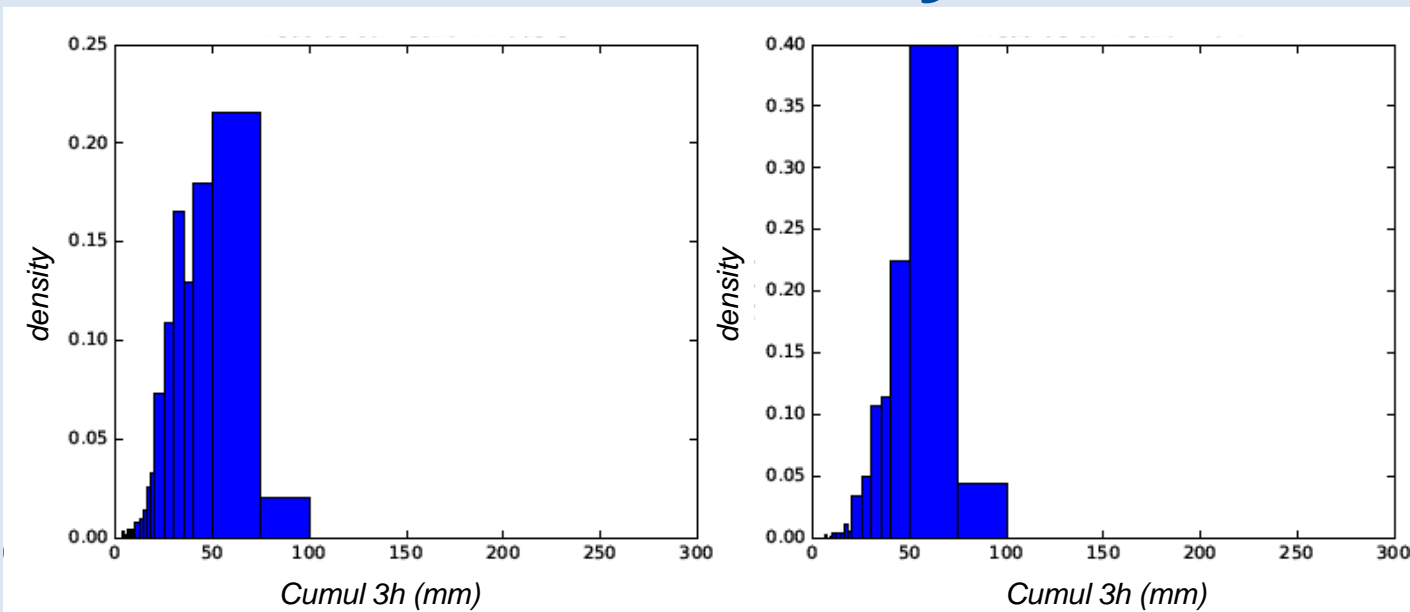


Météo-France (meteofrance.fr)



- The global ensemble prediction system ARPEGE (Météo-France) was used to make convection forecast probabilities.
- The similarity-based method was used to put convection probabilities into convection forecasted objects (Rottner *et al.*, 2019: *The similarity-based method: a new object detection method for deterministic and ensemble weather forecasts*)

Similarity-Based Method

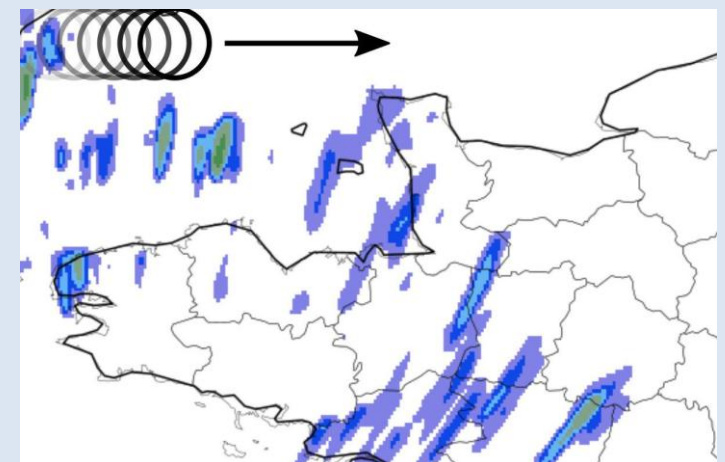


Precipitation distributions associated to moderate (left) and heavy (right) rainfall objects for 3 hours cumulated rainfall.

➤ The model field is scanned with sliding windows.

➤ The similarity between local PDF and reference PDFs is used to decide if the grid point belongs to an object of given severity level.

- It is a spatialization method to identify meteorological object. Several types (or severities) of objects are defined and associated reference PDFs are computed on past cases.
 - Raynaud *et al.*, 2015: *Application of a Bayesian weighting for short-range lagged ensemble forecasting at the convective scale*
 - Arbogast *et al.*, 2016: *Object-oriented processing of CRM precipitation forecasts by stochastic filtering*
 - Raynaud *et al.*, 2019: *Object-based verification metrics applied to the evaluation and weighting of convective-scale precipitation forecasts*



*Model field of rainfall sliding windows over North West of France (Rottner *et al.*, 2019)*

Results for September 21th, 2019

Results for September 21th, 2019 at 9:00 UTC from run 2019-09-20 at 18:00 UTC (so forecasted +15h)

➤ To discriminate convection objects in ARPEGE model we use the cloud top pressure of convection.

➤ We apply the similarity-based method for each member in ensemble prediction.

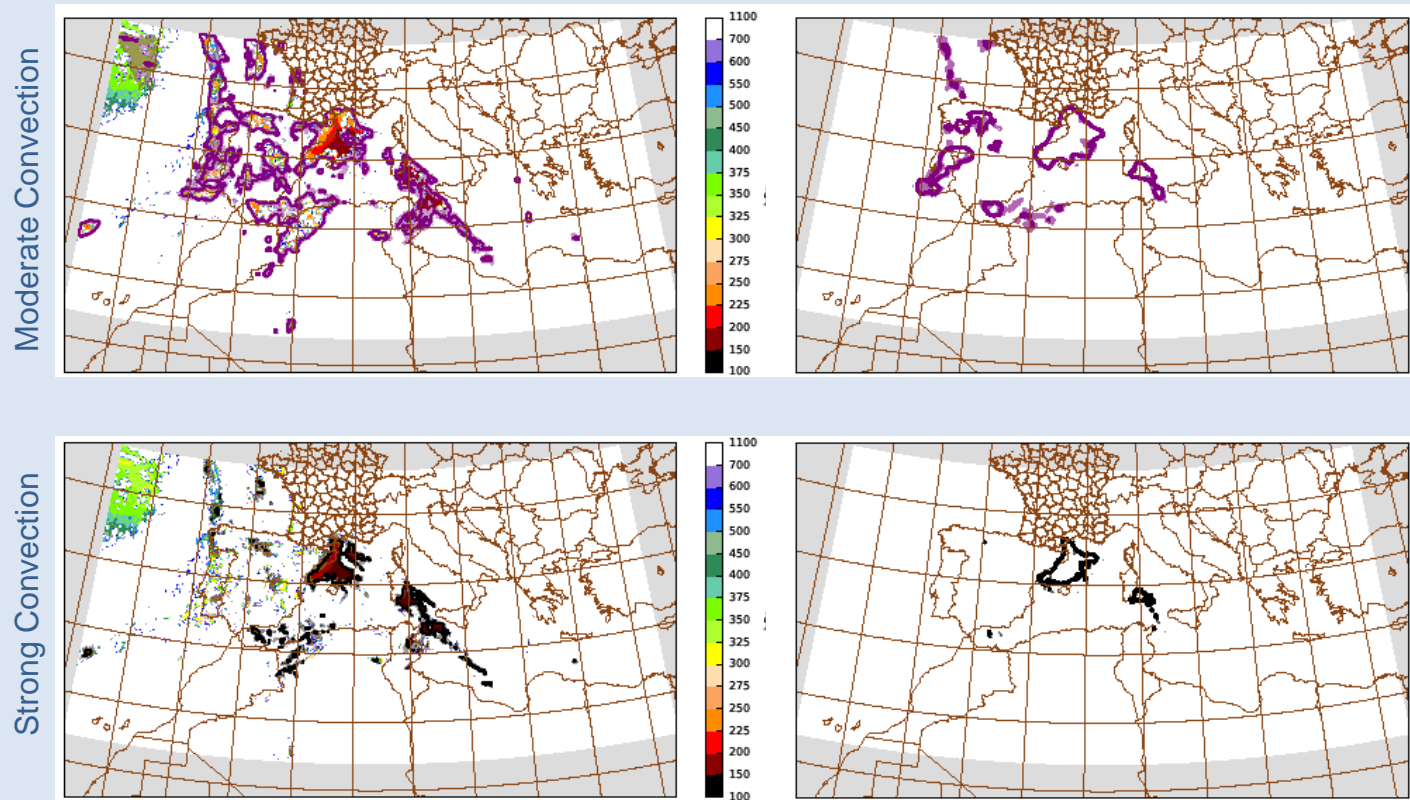
➤ Probability of convection fields are obtained.

➤ To provide convection objects, a threshold is applied to probability fields.

➤ The threshold probability has been compared to lightning observations for two months to get their calibration.

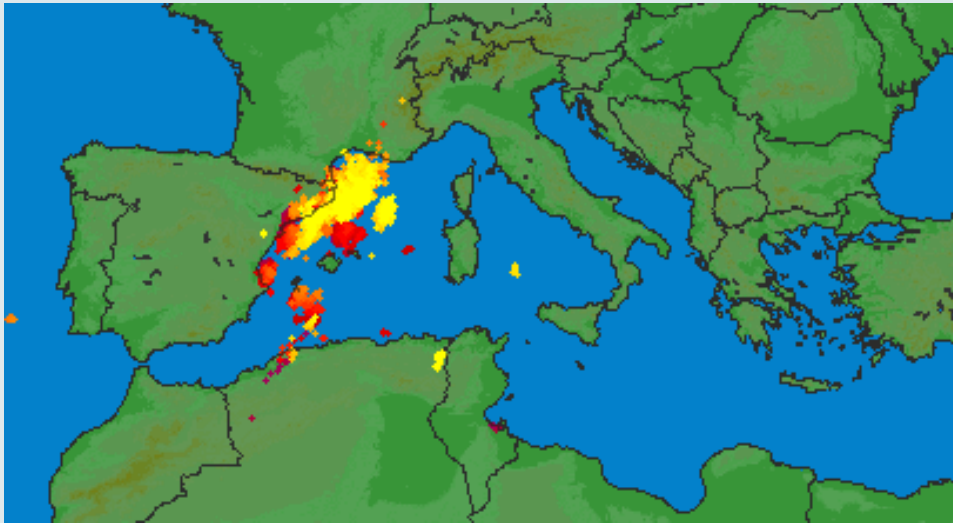
One Member

All Members



Convection objects overlaid on cloud top pressure field for one member of ARPEGE Ensemble Prediction System.

Convection objects for all members of ARPEGE Ensemble Prediction System.



Cumulated Lightnings Observation (3 hours) for September 21th, 2019, from 6:00 to 9:00 UTC (lightningmaps.org)



- There was a good agreement between the observation and the forecast for this strong convection over the Mediterranean Sea.

Future Work

- This method is presently used within other SESAR projects.
- A convection forecast experimentation will be held during Summer 2020 with the contribution of the convection probability objects from the similarity-based method.
- Other object detections are investigated (deep learning) to solve part of the computational cost of the similarity-based method.