

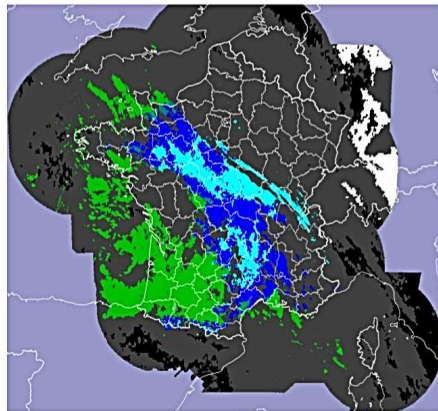
At the observation department of Meteo France, we developed products merging several sources of observations. Some of these products are of particular interest to aeronautical users.

## HYDRE : rain, freezing rain, snow, hail, ...

HYDRE product delivers every five minutes a ground precipitation type over France (rain, freezing rain, snow, ice pellets and hail) using weather radar and satellite, ground observations and NWP forecasts.

Winter precipitation types rely on the structure of the vertical profile of temperature, which is derived from latest NWP forecasts. Ground observations are used to apply corrections to the vertical profile.

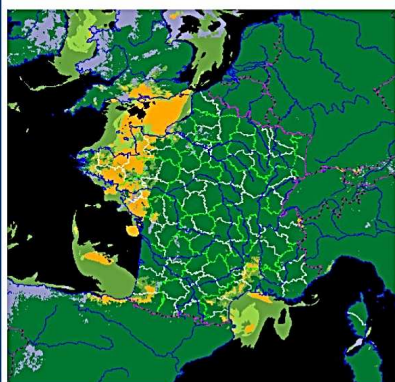
Hail determination is done by combining observed weather radar data (polarimetry and reflectivity) and freezing level forecast.



HYDRE ground precipitation type, 18/01/2016 11.00 TU

Black	No precipitation / No snow lying on the ground
White	No precipitation / Snow lying on the ground
Dark Grey	No precipitation / Invisible ground (night or clouds)
Light Green	Drizzle/Rain
Red	Drizzle/Rain over frozen ground
Dark Red	Freezing drizzle/rain
Teal	Rain and snow mixed
Blue	Snow
Cyan	Snow lying on the ground
Purple	Ice pellets
Orange	Hail

## CARIBOU : fog and mist



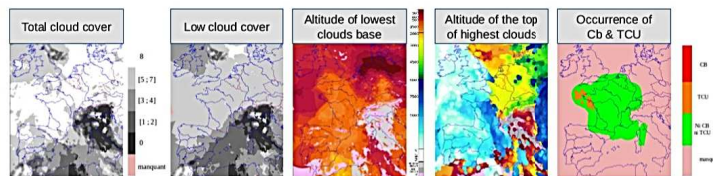
Black	no risk over sea
Light Blue	risk not estimated
Orange	high-level risk
Yellow	medium-level risk
Light Green	low-level risk
Dark Green	no risk

CARIBOU product provides an hourly analysis of a probable occurrence of fog or mist. The decision algorithm is different on land and over sea. It combines the MSG cloud classification, the French 5' radar rainfall estimation (only on land), hourly analyses of relative humidity and wind speed computed from AROME NWP forecasts and ground observations and, over sea, fields of dewpoint temperature and sea surface temperature from AROME.

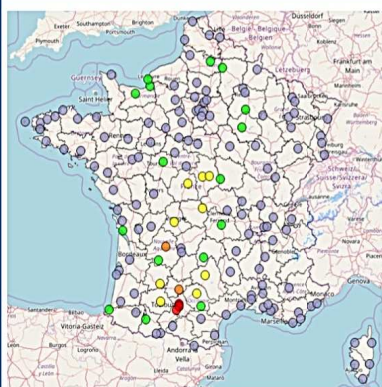
## CAPRICORNE : cloud cover

CAPRICORNE product merges data from satellites, radar, lightning sensors and local observations. It provides every hour a spatial analysis of the meteorological parameters describing cloud cover:

- total cloud cover } kriging with external drift (using a total cloud cover background made from MSG cloud classification)
- low cloud cover }
- altitude of lowest clouds base } ordinary kriging
- altitude of the top of highest clouds } provided by MSG products
- occurrence of hazardous clouds for aviation (Cb and TCU) } obtained from lightning strikes and radar reflectivity threshold overruns



## MACMA : CB and TS in METAR AUTO



Red	CB + TS	Orange	CB + VCTS
Yellow	CB	Green	TCU
Light Blue	none	Black	unavailable

**Exemple METAR :**  
 METAR LFBO 250800Z AUTO  
 27008KT 9999 TSRA FEW011///  
 BKN016/// BKN021/// III CB 16/14  
 Q1021 TEMPO RA BKN008  
 BKN020=

MACMA product provides automatic reporting of convective conditions for aviation. It includes the TCU, CB, TS and VCTS codes to supplement the information of automatic observation messages METAR AUTO and OBSMET AUTO. It combines the French 5' radar reflectivity composite and lightning strikes detection.

## CERVUS : visibility

CERVUS product provides hourly maps corresponding to the probability of observing visibility values lower than a given threshold.

- CERVUS algorithm is based on 3 steps, applied every hour :
- 1- spatialization of *in situ* observed visibility values thanks to a multiple linear regression involving meteorological and geographical predictors
  - 2- spatial interpolation of residuals which allows to improve the results by looking for a better correspondence with the available observations of visibility
  - 3- evaluation of the probability distribution on each point

