Verification of Low Clouds and Fog using a Spatial Verification Method

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NWP Area
AEMET

- Verification of clouds
- SAL algorithm
- HARMONIE verification of low clouds
- Conlusions, further work

Clouds are difficult to verify but necessary to do

The Cloudnet project aims to produce vertical profiles of cloud and aerosol properties at high temporal and spatial resolution with the following objectives:

To optimise the use of existing data sets to develop and validate new cloud remote sensing synergy algorithms.

To continuously evaluate the representation of clouds in climate and weather forecast models.

To demonstrate the potential of an operational network to improve the representation of clouds in models.

Clouds are difficult to verify but necessary to do: model .vs. observations

Observations

Parameters

Cloud mask, cloud cover, liquid water content, brightness T, top/base cloud, synthetic satellite images...

Methodology

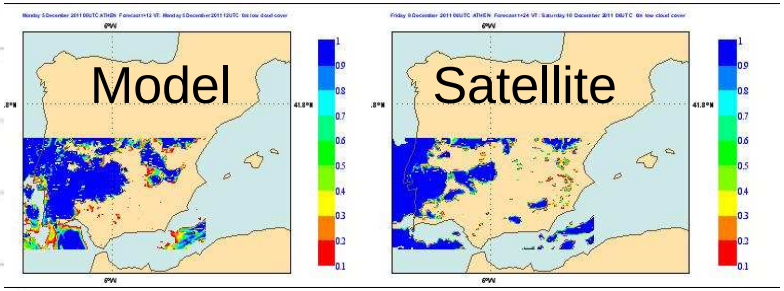
Continuos: BIAS, MAE, STDV

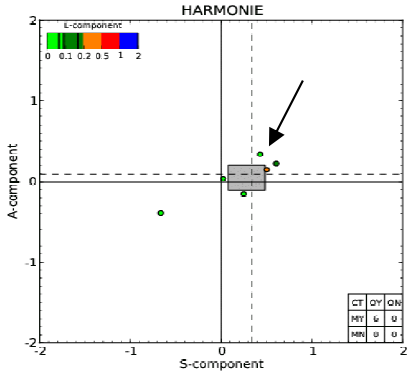
Contingency table scores: log-odds ratio, SEDS...

Contiguos Rain Area (CRA)
Neighborhood Method
Intensity Scale Method...

Structure Amplitude Location

Wernli et al, 2009, Weather Forecast.





S = [-2,2] **A = [-2,2]** **L = [0,2]**

Ideally S=A=L=0

S > 0, A > 0 => model overestimates the observations.

High L => bad location of the structures.

The dashed lines show the median of the S and A distributions, while the shadowed rectangle shows the inter-quartile ranges (IQR).

#**date** acc[h] coMOx coMOy coOBx coOBy sumMO[mm] sumOB[mm] thrMO[mm] thrOB[mm] #oMO #oOB vol/oMO vol/oOB **S A L** A B C D delta maxDistanceInDomain numberOfNonMdv thresholdFactor fileMod fileObs ME(bias) MSE

#==========

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20111205 24 146.54 108.98 124.33 100.38 27308.71 21781.33 0.800 0.800 54 147 10991.92 5873.89 **0.607 0.225 0.195** 1 0 0 0 2779.9692 1236039.5 72853 1.2500000 mad_36h14bf_74_fc20111205_0000_012_VLC.grb pnwAemetGeoUps_ob20111205_1200_000_VLC_gridHARM.grb 0.076 0.220

20111206 24 166.26 109.80 156.93 100.58 35008.50 30191.17 0.800 0.800 84 142 18282.14 10932.87 **0.503 0.148 0.213** 1 0 0 0 2779.9692 1236039.5 72584 1.2500000 mad_36h14bf_74_fc20111206_0000_012_VLC.grb pnwAemetGeoUps_ob20111206_1200_000_VLC_gridHARM.grb 0.066 0.248

Thanks to Carlos Santos (AEMET)

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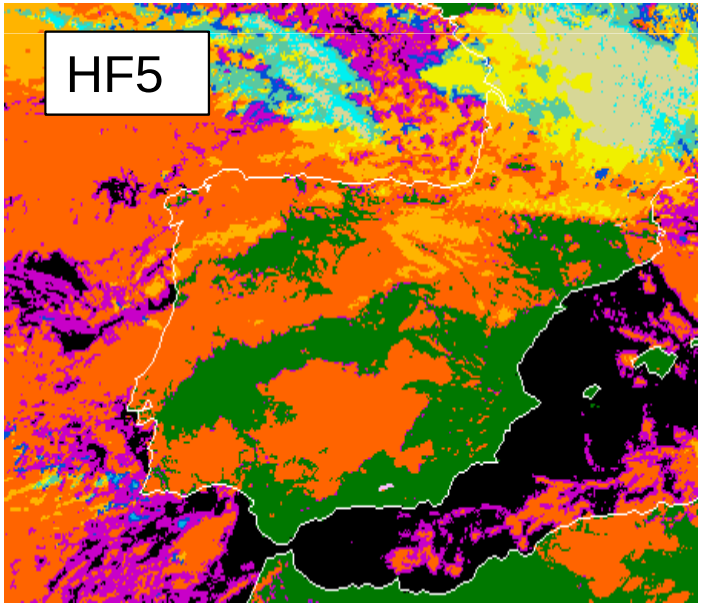
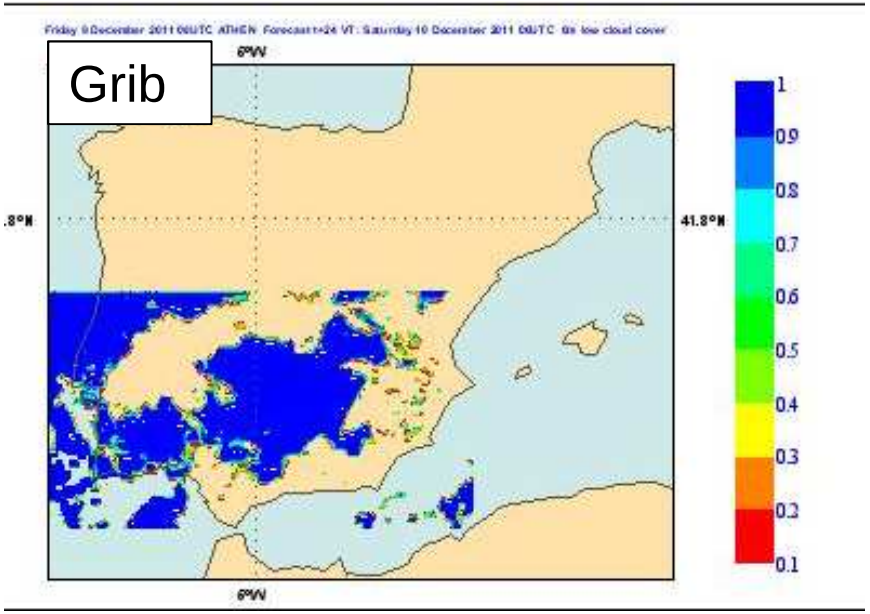
The EUMETSAT Network of Satellite Application Facilities
NWC SAF
Support to Nowcasting and Very Short Range Forecasting

http://www.nwcsaf.org/

MSG v2012.2 images
Satellite Application Facility **cloud type product**
Native satellite files converted **to grib files**, filtered low clouds.
Horizontal resolution ~ 3 km

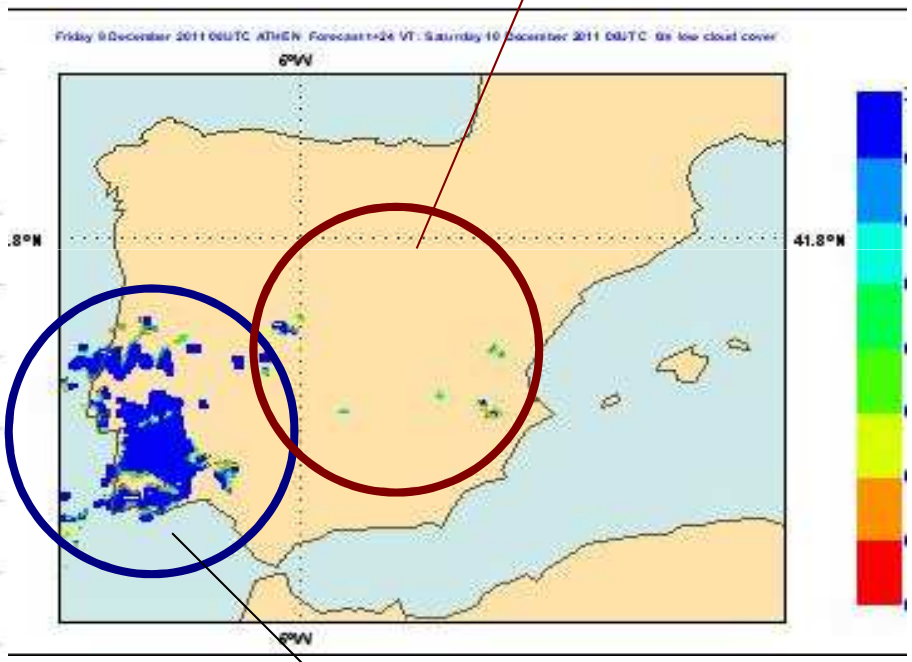


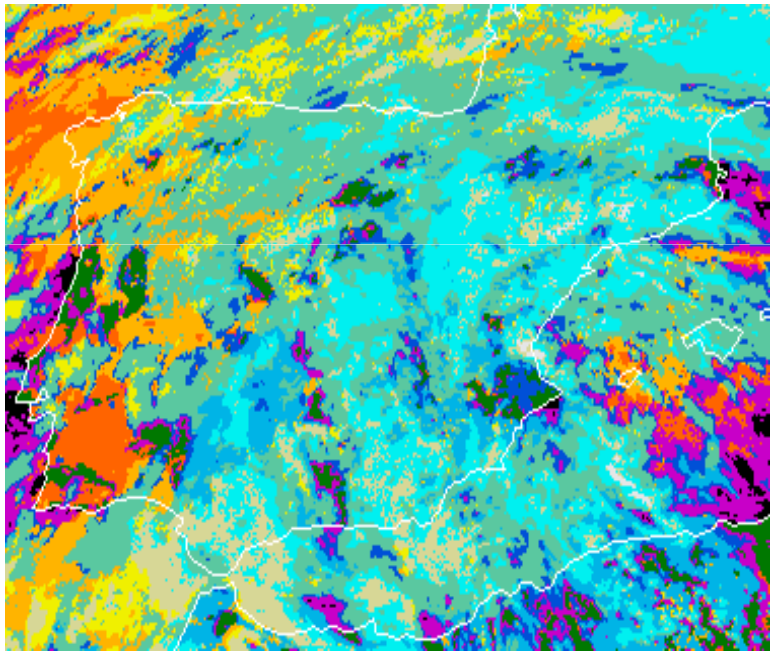
Filter very low and low clouds



Some considerations...

set to missing data values



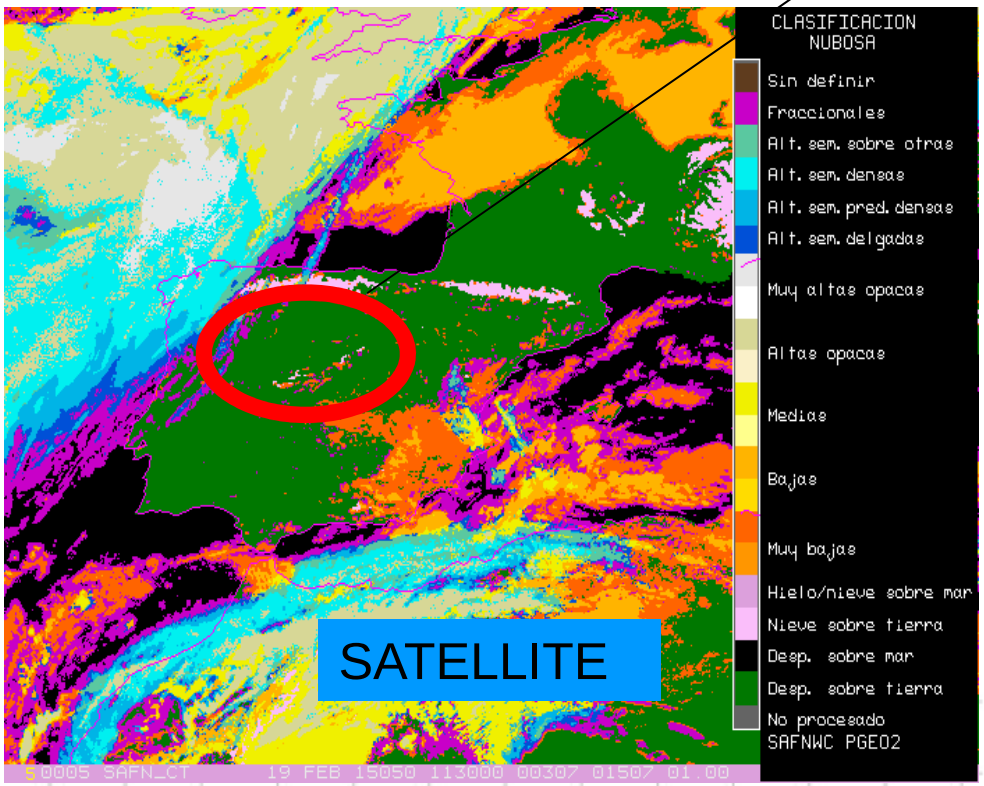


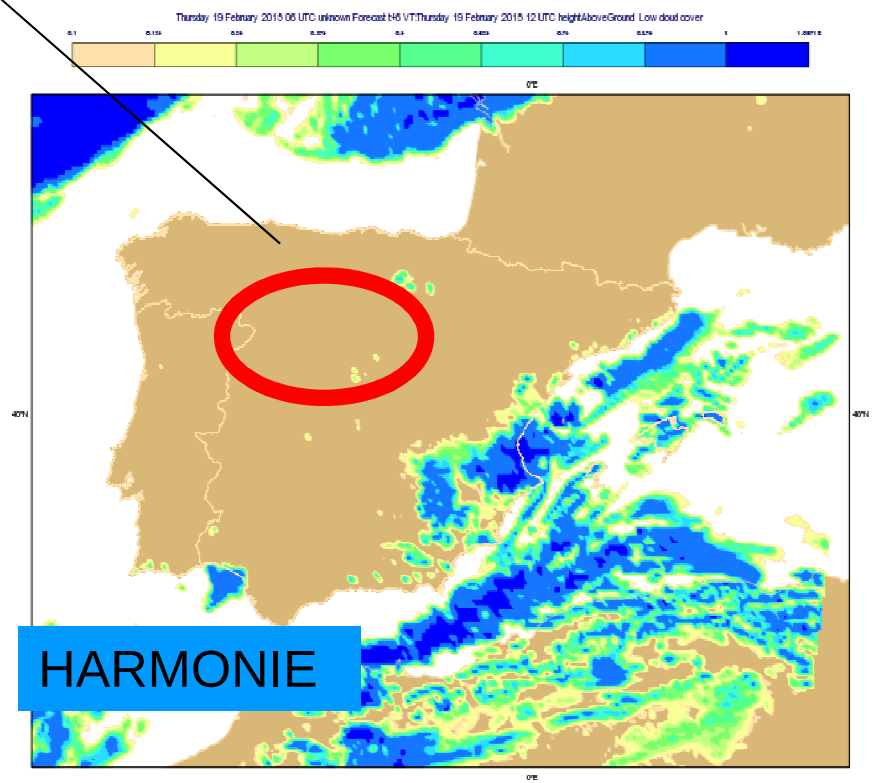
low and very low clouds

Some considerations...

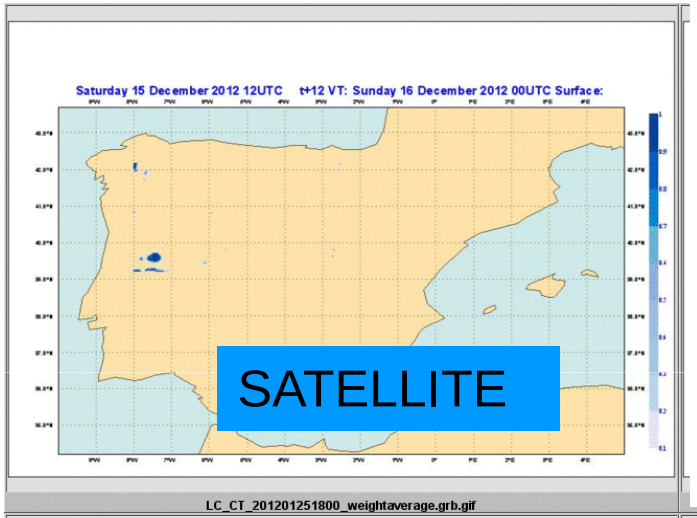
High sensitivity of SAL to small objects

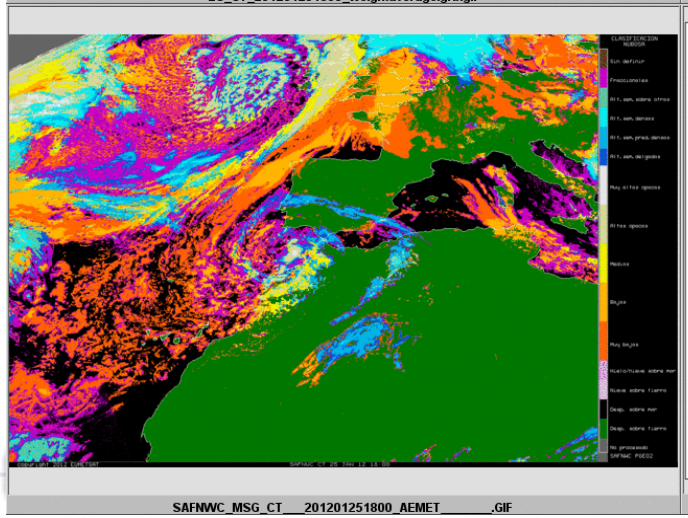
Good prediction, bad SAL verification

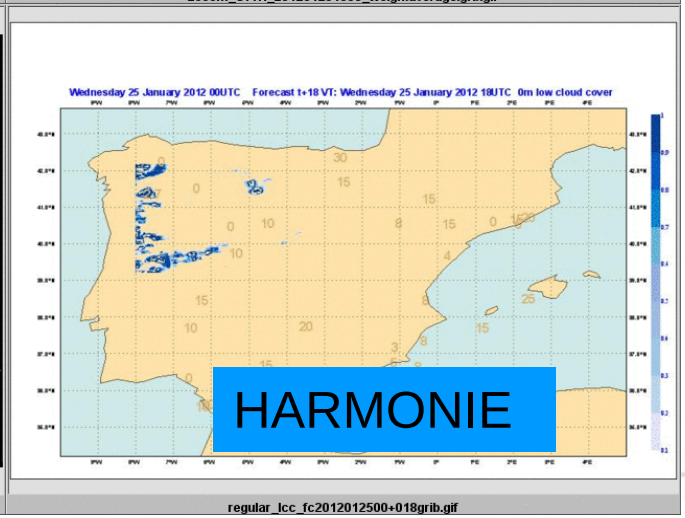




Some considerations...







Few and small objects

Almost impossible pinpoint the place.

Bad prediction?

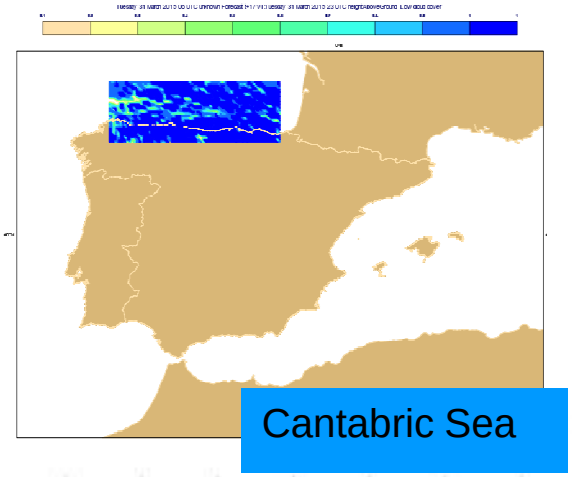
The experiments

HARMONIE v38h1.2 – Low Cloud Cover

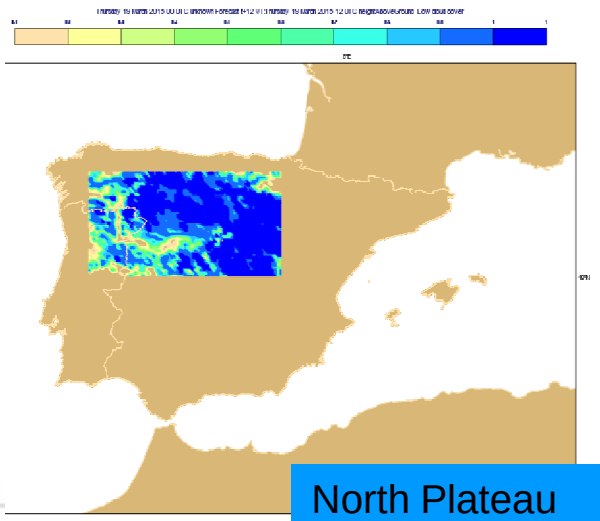
Three different regions (three different regimes?)

Period: January → March, 2015

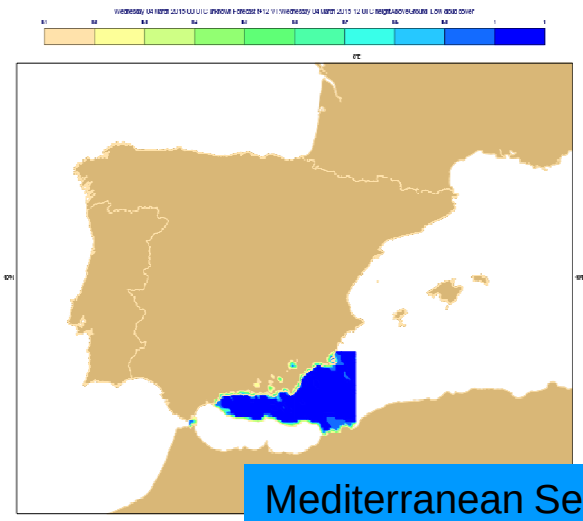
Satellite product : Cloud Type - Low and Very Low clouds (SAFNowcasting)



Cantabric Sea



North Plateau



Mediterranean Sea

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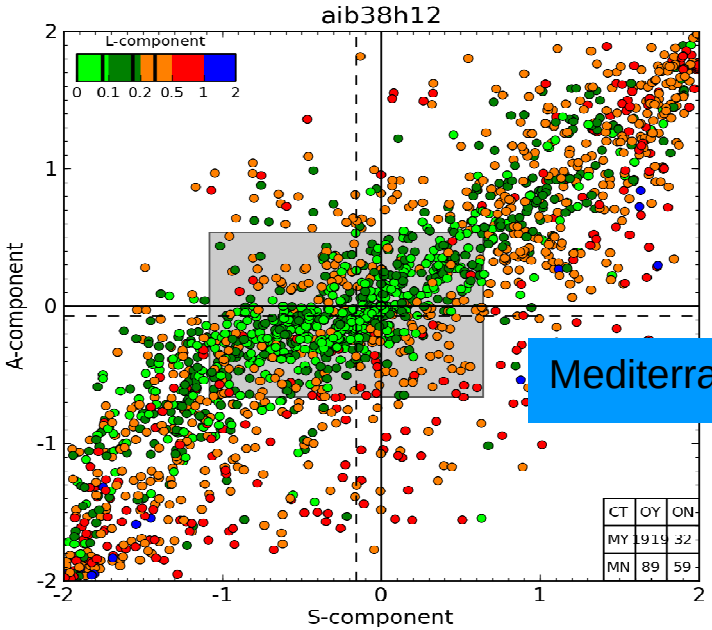
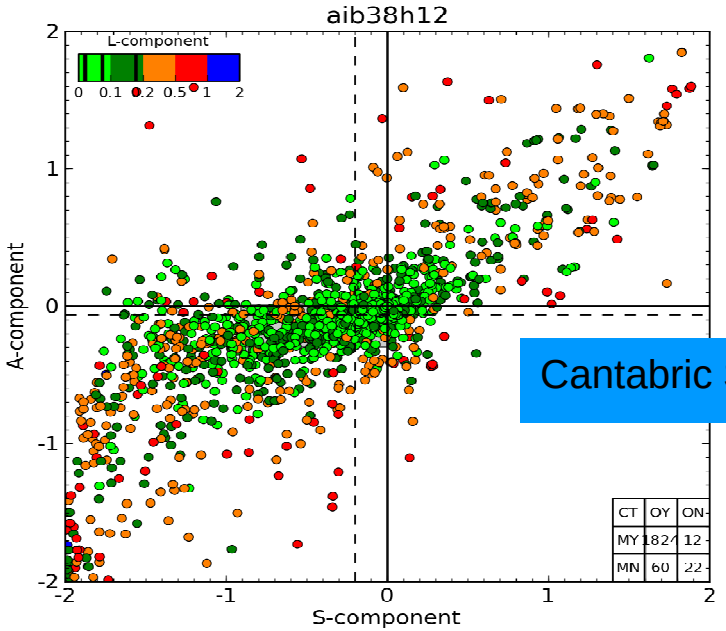
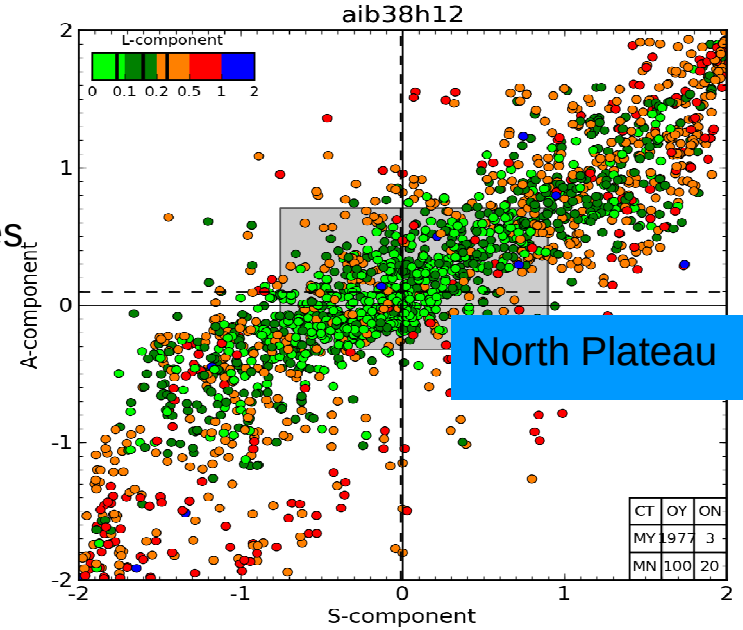
S, A, L aproximate 0 as a whole



Mediterranean Sea



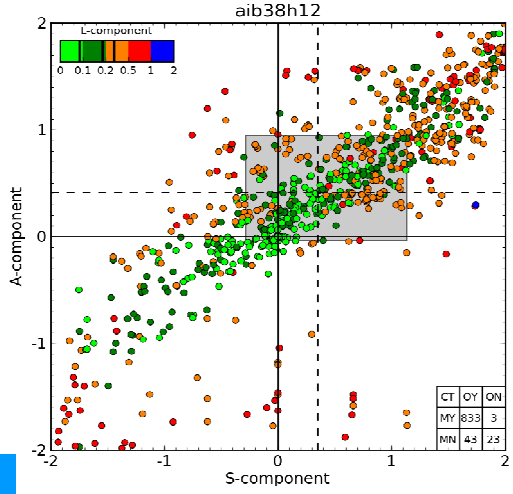
Cantabric Sea



North Plateau

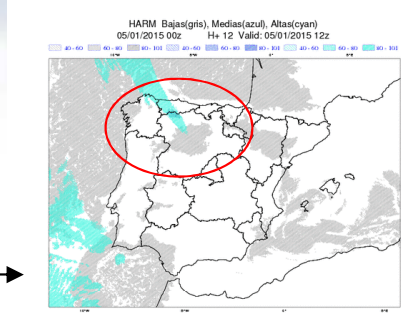
Highest disperssion in Mediterranean Area: local processes

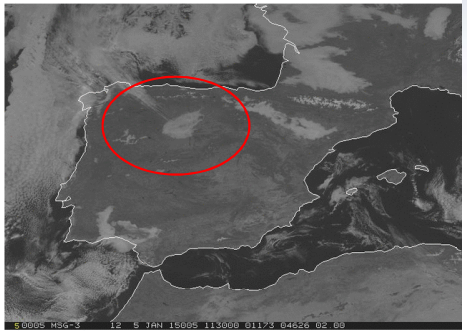
Smallest at the Cantabric Sea: synoptic forcing

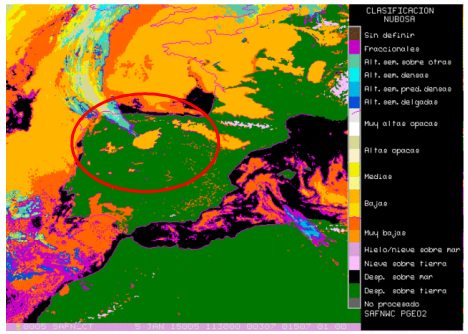


North Plateau

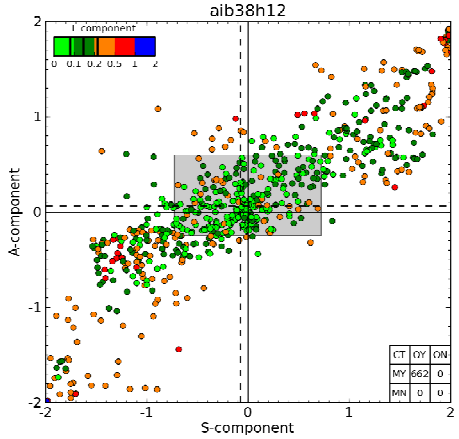
01/2015





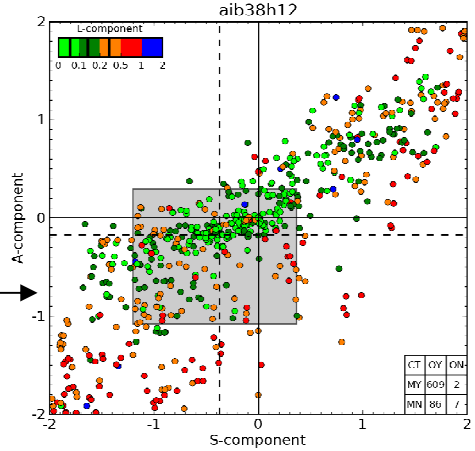


Over 50% cases fog was observed



02/2015

Different synoptic situations



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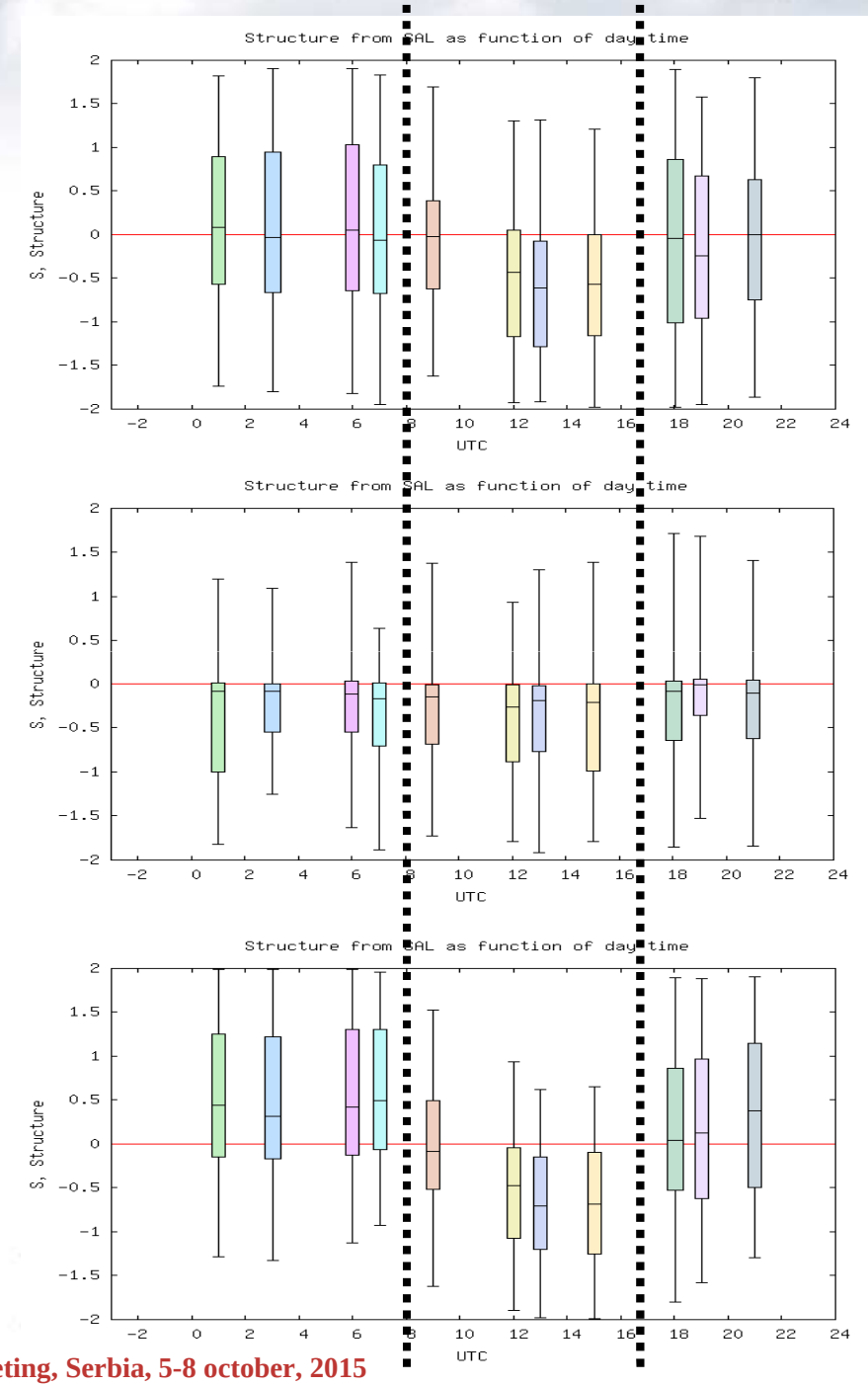
Mediterranean Sea

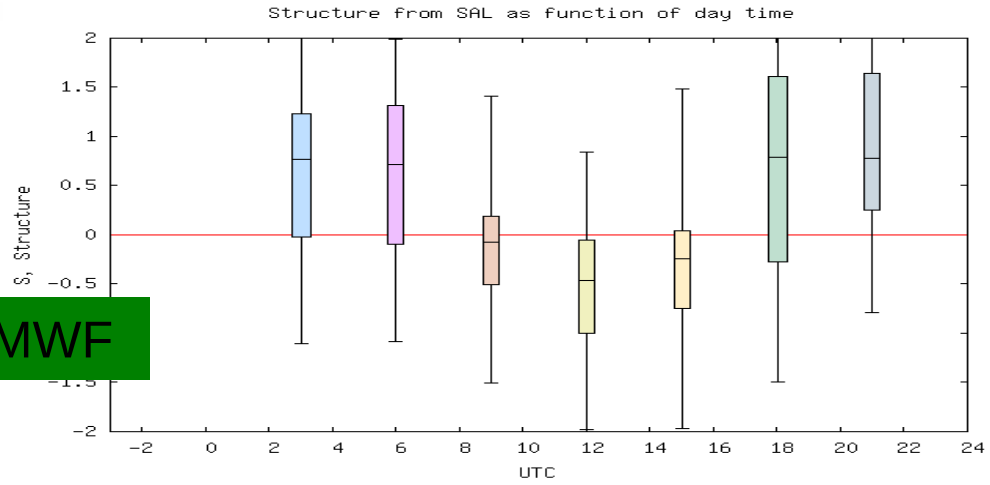
Cantabric Sea

North Plateau

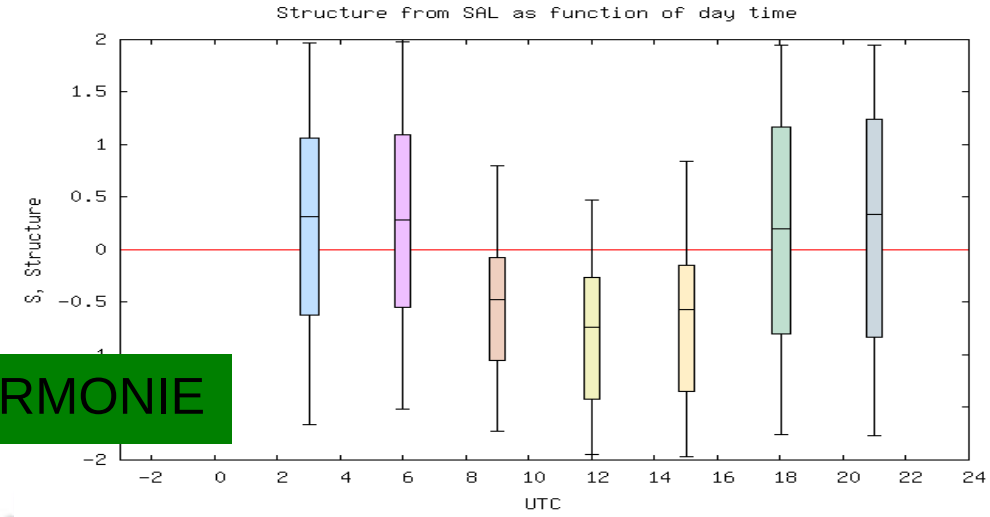


Diurnal cycle?

Except for Cantabric Sea there is underestimation during the daylight hours.



ECMWF



HARMONIE

This is something we have already noticed with the ECMWF model

Diurnal cycle?:

Satellite sensibility to low clouds is different when visible channel is included

Artificial diurnal cycle error

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CONCLUSIONS

Satellites provide **high temporal** and **spatial resolution** of cloud features

SAF Cloud Type: **valuable** product for **cloud assessment**
(althoug suffers from diurnal cycle errors)

SAL results confirm the subjective knowledge of cloud model behaviour,
specially for large structures

Regarding the model…

- Clouds are well reproduced when significant synoptic forcing (fronts, low pressures systems...)
- Overstimate fog over land
- Understimate low clouds and fog in the South Mediterranean.

Things that should be done

- Compare SAL results with a traditional point verification (different cloud properties?)
- Include clear skyes verification
- Different object-oriented method to compare results
- Longer verification to produce stronger conclusions
- Filter by different fenomena

THANK YOU!