Use of **BT** of **SEVIRI** in the **AEMET NWP department.**

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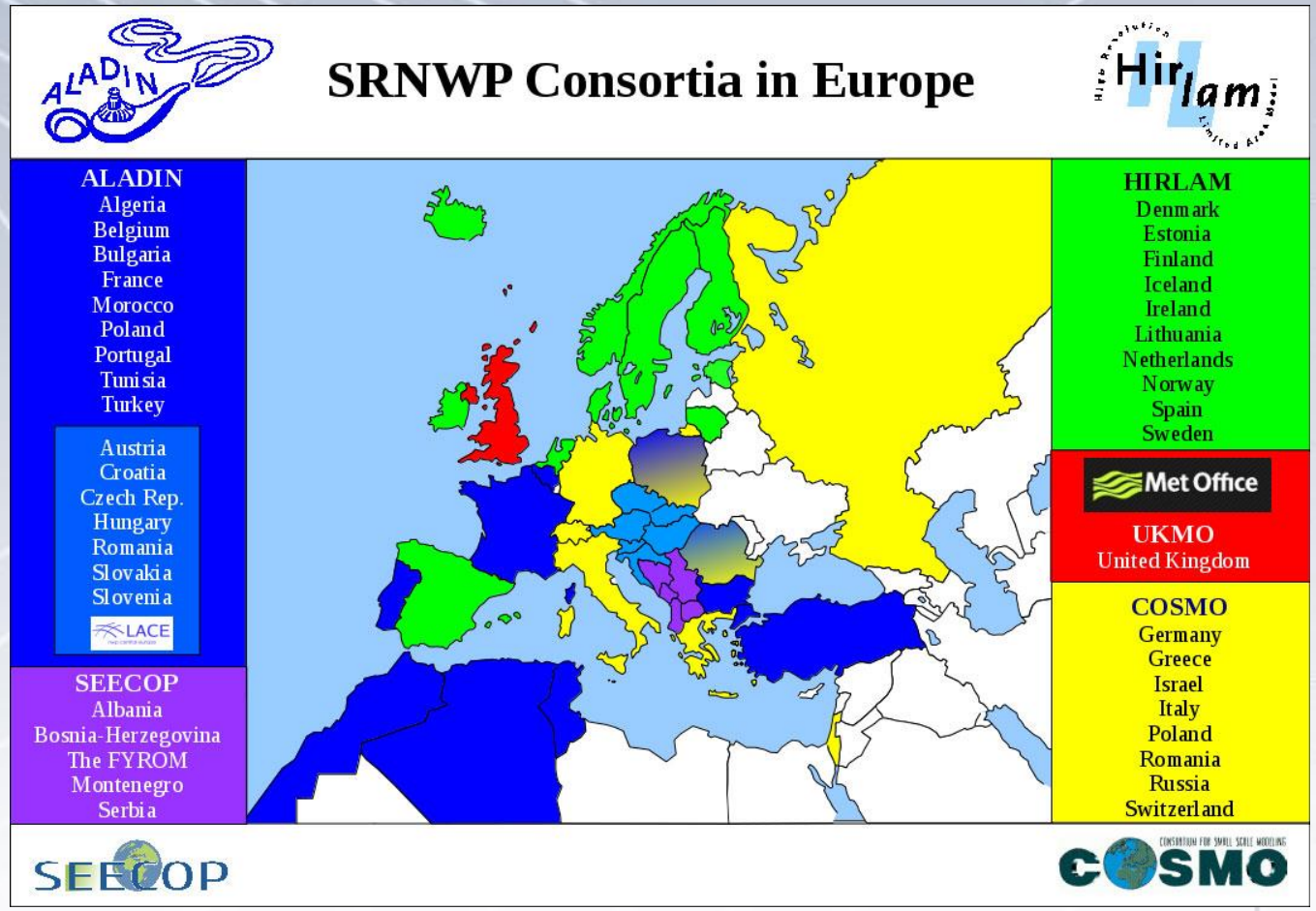
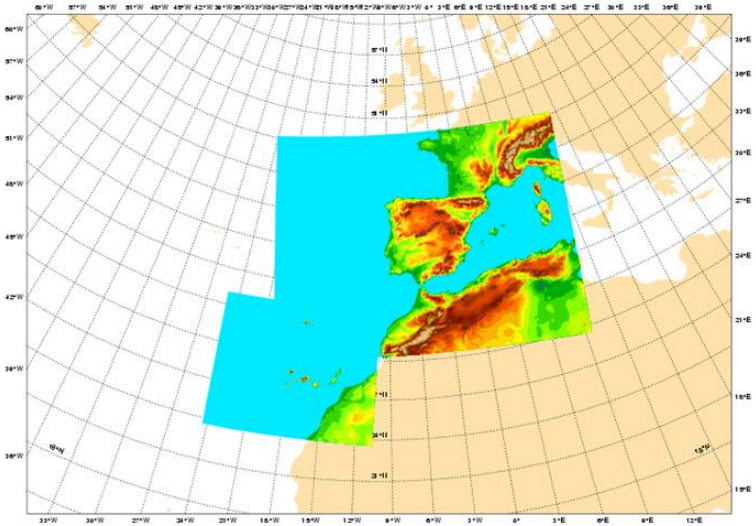
Introduction

- The different consortia of limited area model in Europe can be shown on the right picture.
- Spain belongs to Hirlam consortia.
  - The name of the high resolution model is HARMONIE-AROME.
- But Hirlam, ALADIN and LACE (also part of ALADIN) will unify at the of 2021



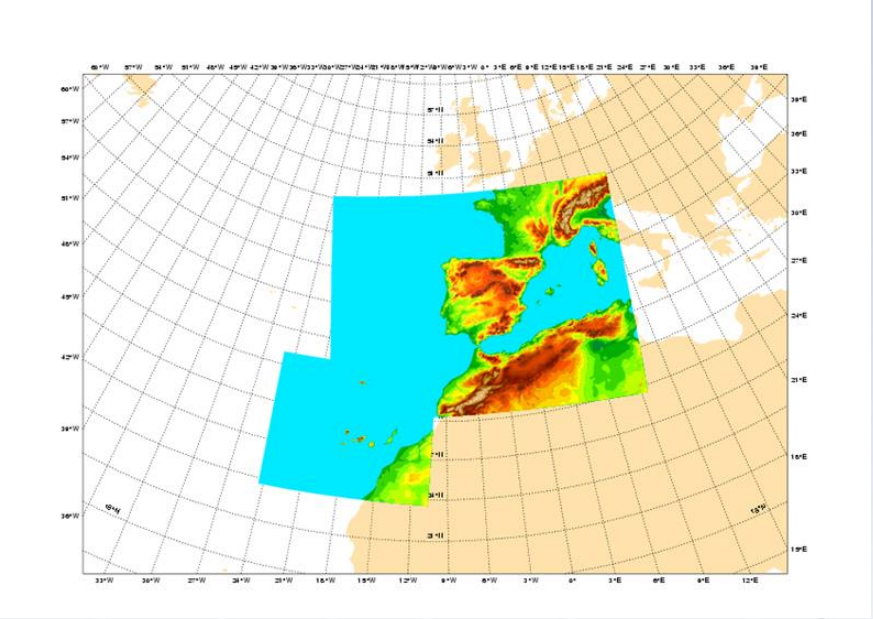
Introduction

- HARMONIE-AROME operational suite is based on **v40h1.1 (Bengtsson et al.)** and it is one of the **HARMONIE RCRs** used to monitor the quality of the reference system:
  - 2 geographical domains (Iberian Peninsula and Canary Islands).
  - **2.5 km** runs 8 times per day with 48 hours forecast length and 15 min output.
  - **3D-Var upper air analysis** with 1:10 cutoff time including **ATOVS and GNSS slant delay** data.
  - Surface data assimilation with optimal interpolation.
  - **AROME physics**: Explicit deep convection, SURFEX, ICE3 microphysics, HARATU turbulence and EDMFM shallow convection.
  - Run in AEMET´s **ATOS** (previous **BULL**) computer having 324 Nodes and 168 Teraflops.



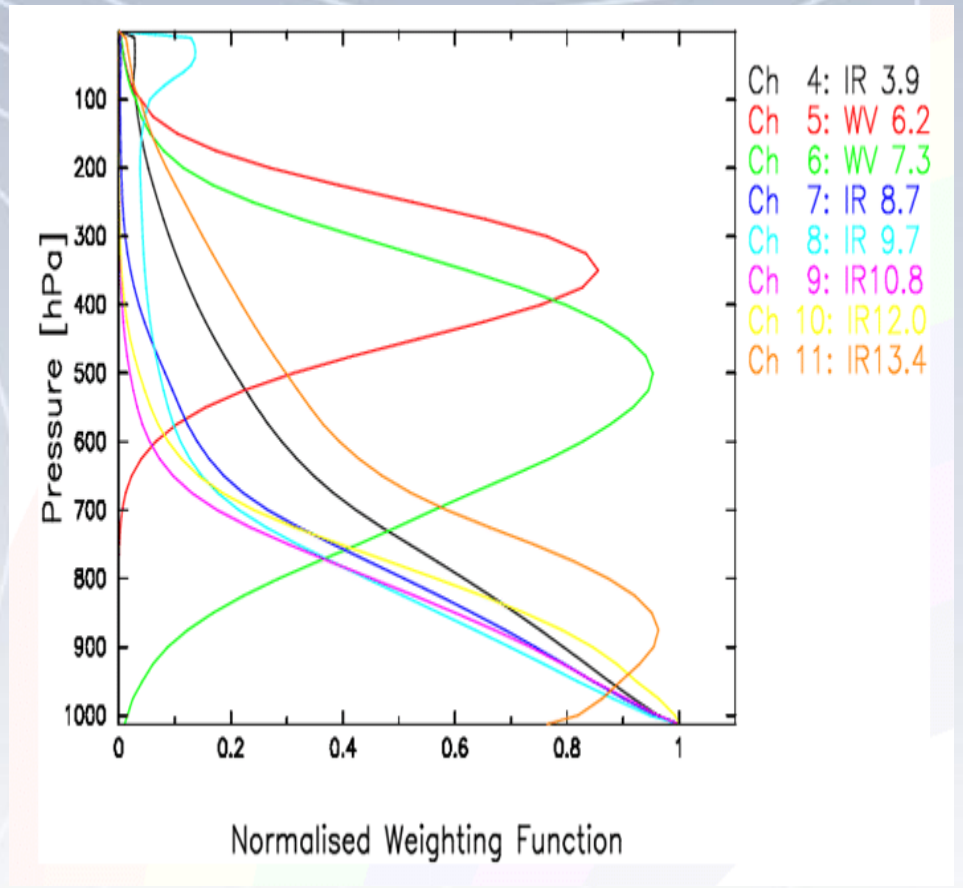
Introduction

- Due to the location of our domain it makes sense to assimilate Geostationary satellite information.
  - The observation is arriving on time for the analysis time.
  - SEVIRI data will be assimilated in all cycles.
    - Not like the observations of POLAR satellite (over our latitude).
  - Interesting observations for using in a RUC. (Rapid Update Cycle).



Experimental suite.

- I made a Harmonie suite for testing the data.
- The version of the suite is cycle 43h2tg1. This version will be the new official release.
- For the moment, the test is being done over the **Iberian Domain**.
- With **3D-Var** assimilation using **only conventional observations + SEVIRI**.
  - **NO ATOVS, GNSS or RADAR**.
- The **rttov** model version used in this Harmonie suite is **11**.

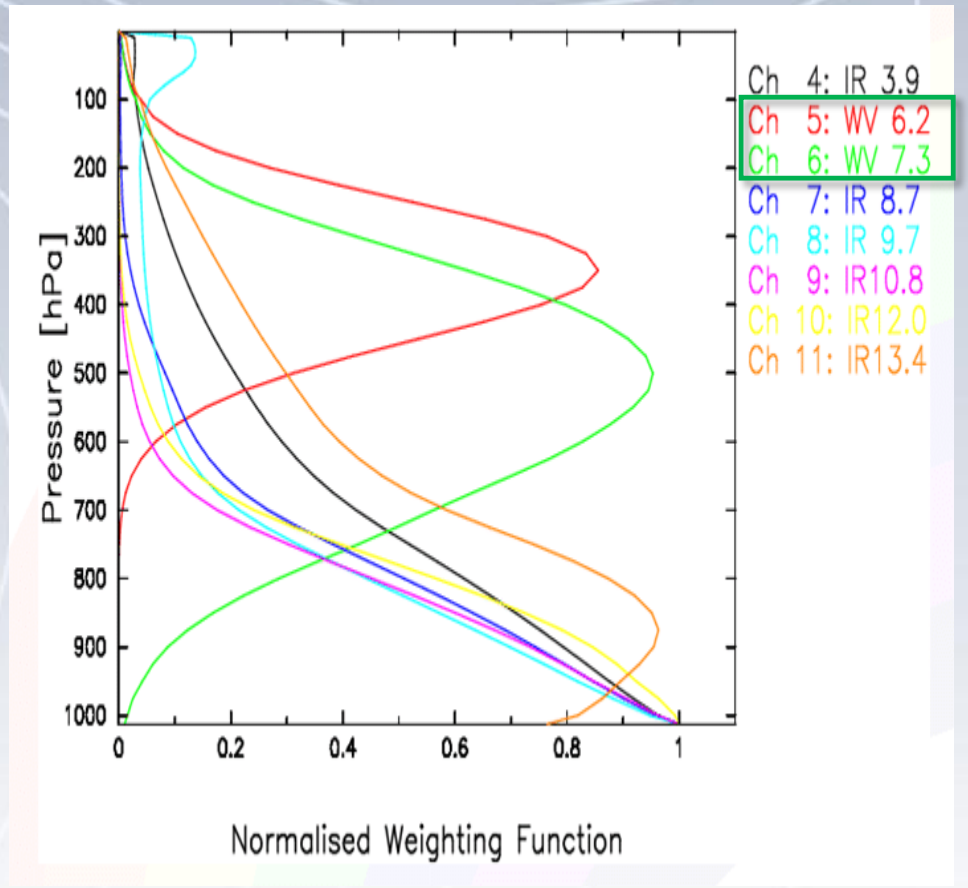


Weighting functions of SEVIRI, for a satellite nadir view for a standard midlatitude summer reference profile.

Lupo et al. 2013.

Experimental suite.

- For the moment we are only trying to assimilate **Brightness Temperature** of channels 5 and 6. (**Water Vapour channels 6.2 µm and 7.3 µm**)
  - Because they haven't got any influence from surface.
- Over sea and land, clear sky or above mid-level clouds.
  - We need the information of **CT and CTTP SAF GEO Products (v2018)**.
- Rttov model is used to change brightness temperature into radiance.



Weighting funtions of SEVIRI, for a satellite nadir view for a standard midlatitude summer reference profile.

Lupo et al. 2013.

- The variational Bias Correction was applied to the data.
  - It is an adaptive bias correction method where the bias is dependent on several factors:

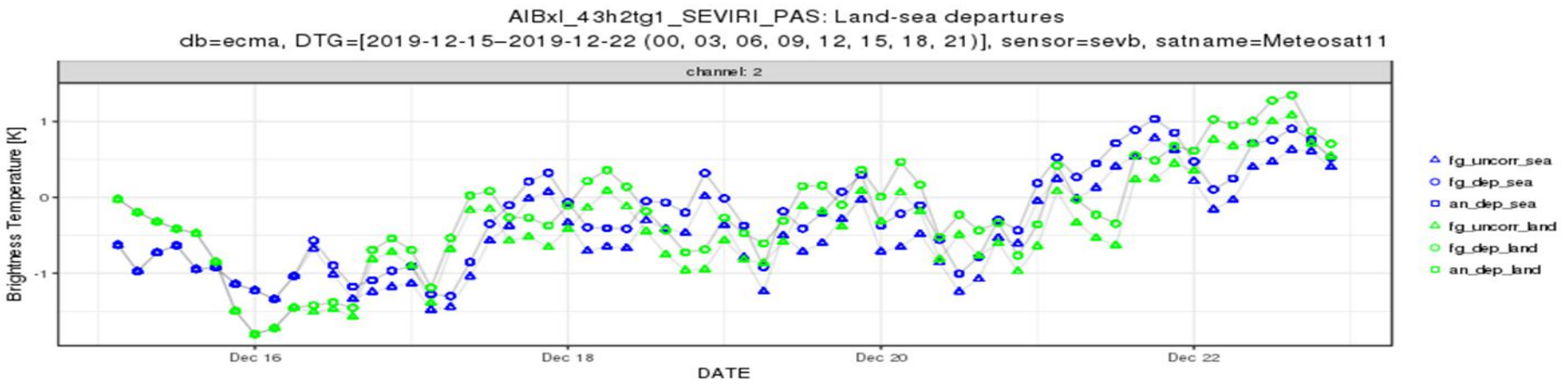
$$b(\beta, x) = \sum_{i=0}^{N_p} \beta_i \, p_i(x)$$

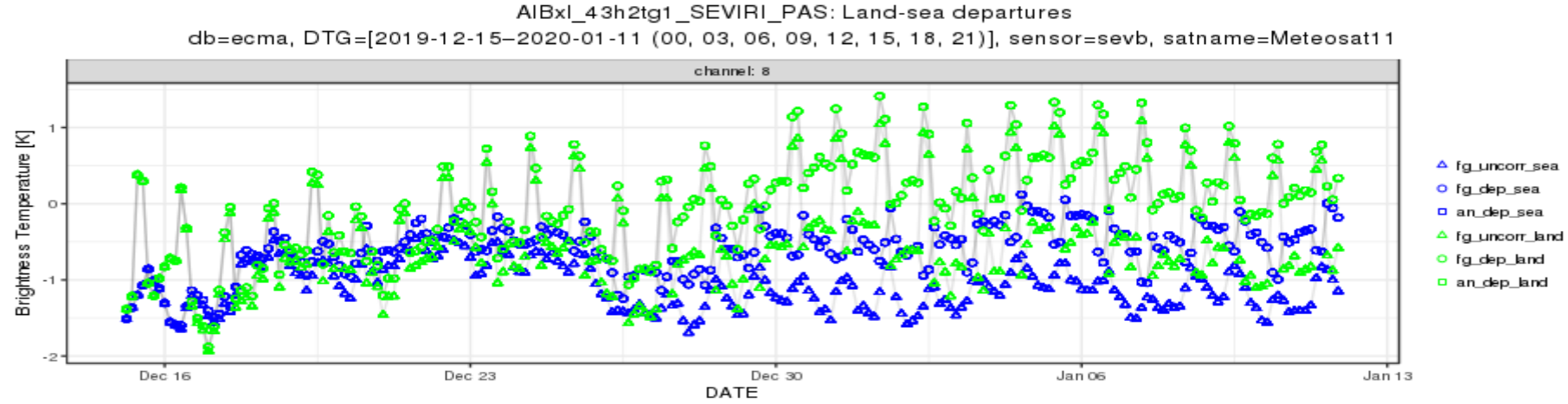
  - This method modifies the cost function to be minimized taking into account the different bias parameters (β). Not shown.
  - For this instrument we use this predictors (p)
    - P0 constant value.
    - P1 1000-300 hPa thickness air mass.
    - P2 200-50 hPa thickeness air mass.
    - P3 Surface temperature.
    - P4 Total column water vapor.
  - For more information consult at Dee (2005).

Experimental suite. Variational Bias Correction.

- After one month we are pretty sure that the predictors of VarBC are calibrated.
- Not all the channels have the same bias and need the same time of calibration.
- Also, it is very clear that there are several channels that can not be used over land.
- In the future, we can try to assimilate channels related with the surface.

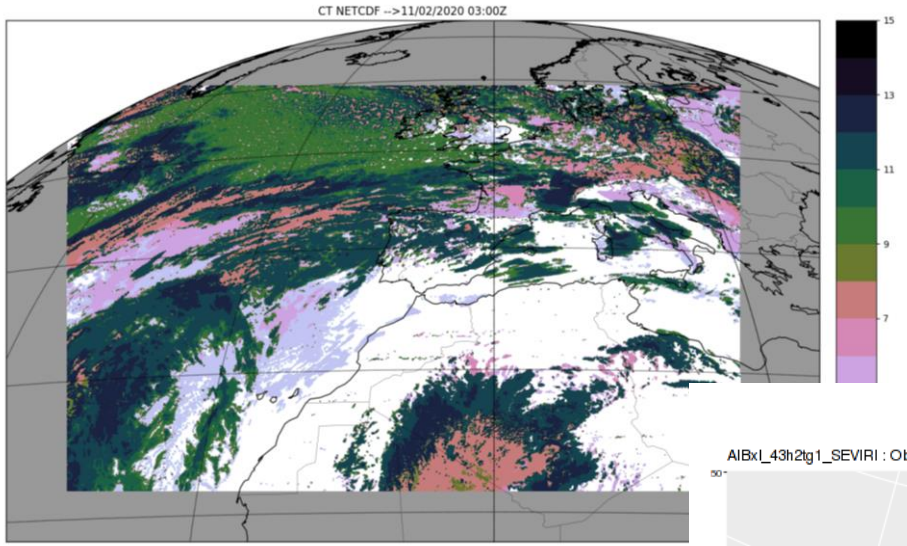
- An example of different behaviour of channels:

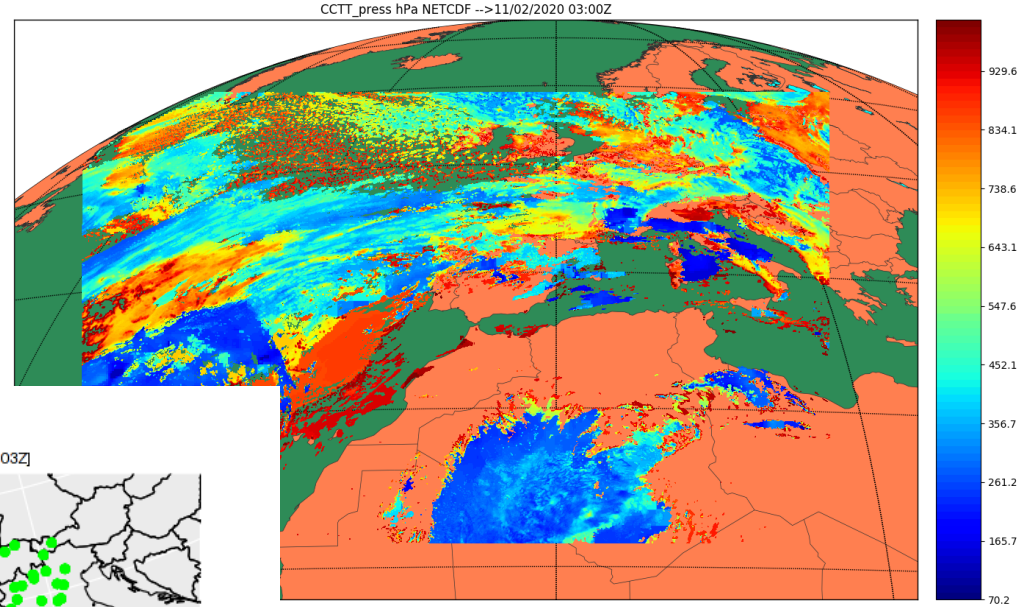


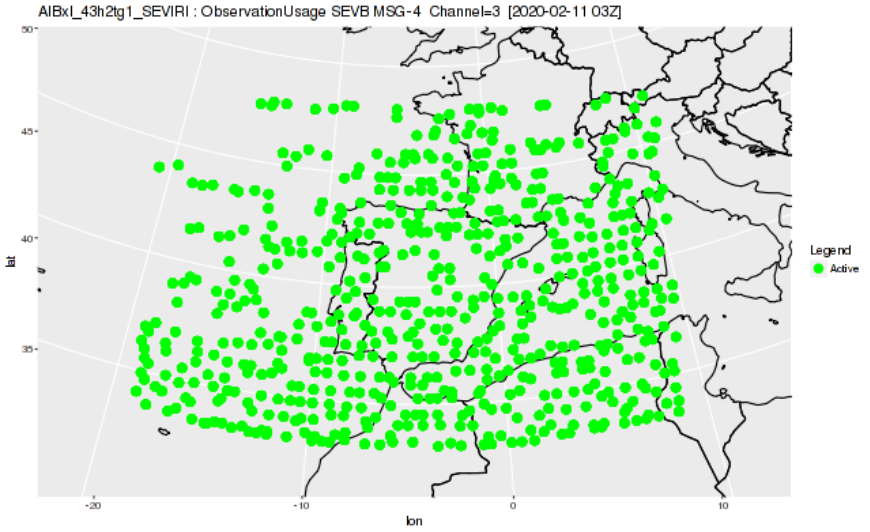


Experimental suite.

- The CT and CTTP products are used for choosing the active pixels.





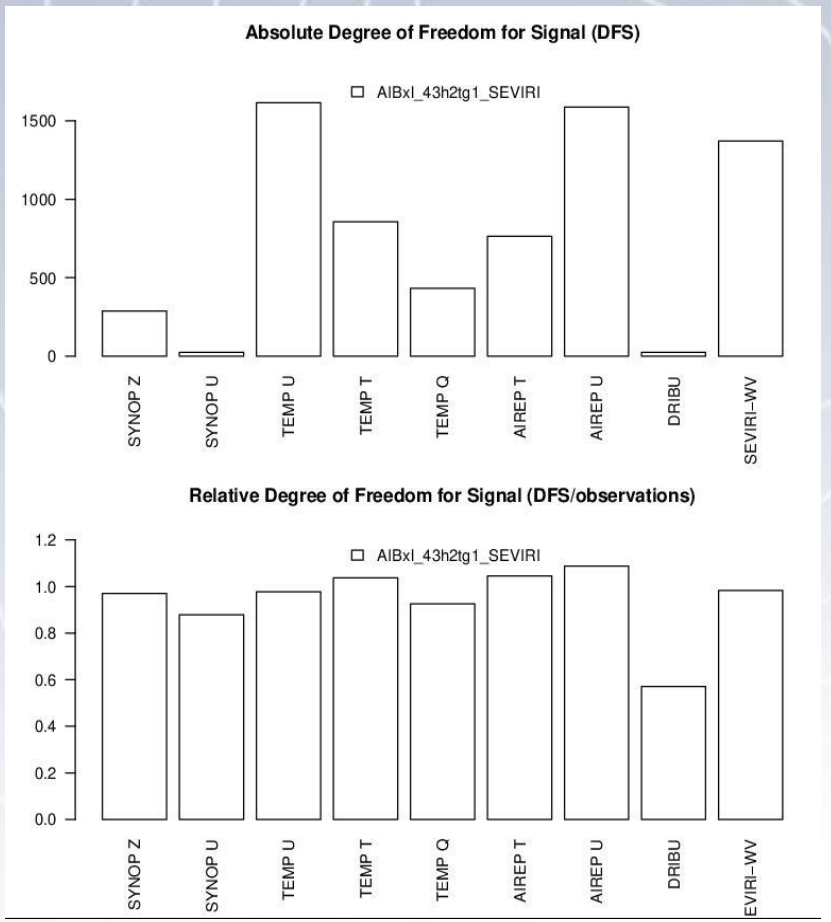


Channel WV 7.2 assimilated

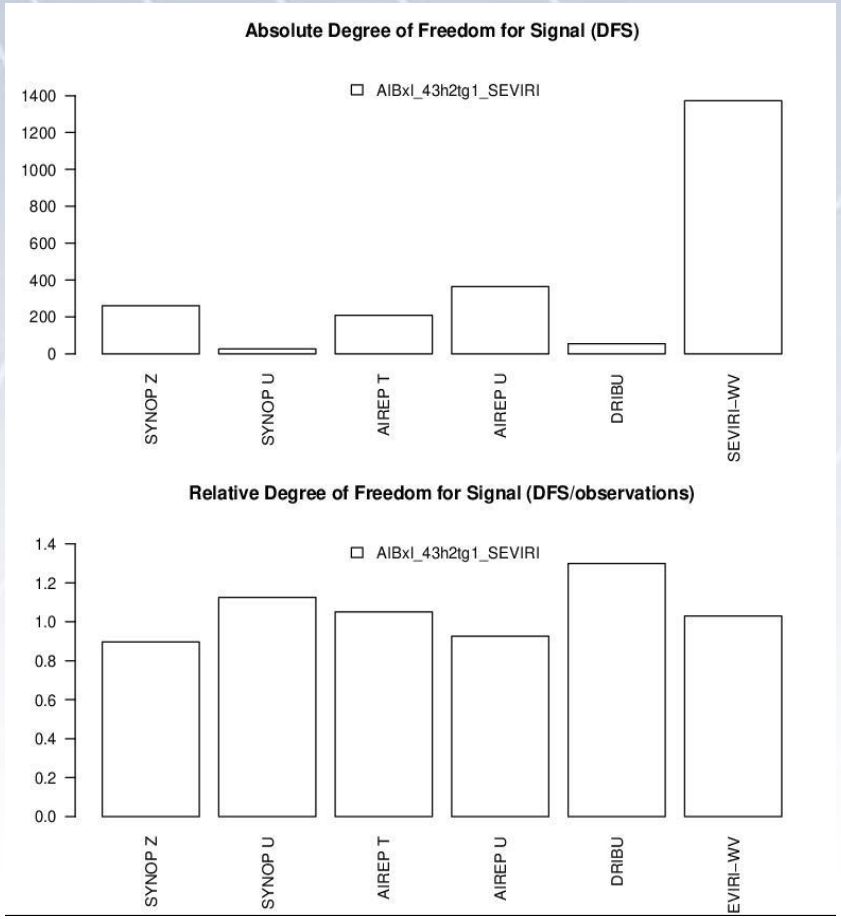
Experimental suite. DFS

- **Degree of Freedom for Signal** gives a measure of the observation influence in the analysis.
- The number of conventional observations assimilated are dependent on the analysis time.

2020-02-11 12 UTC Analysis



2020-02-11 03 UTC Analysis



What do we expect?

- We expect to **increase scores in precipitation forecast**, and a neutral effect on surface parameters.
- This source of data will be useful for a RUC suite.
  - The observations are available after 15 m.
  - The number of observations are constant for all cycle.
- Next step will be to make the same test over Canary Island domain.
  - The lack of observations in Canary Islands domain it is a well known problem in data assimilation and verification.
- Test the rest of channels over sea and over land using ATLAS database.
  - Land Surface emissivity database generated by Land-SAF.

Thank you very much!!!

References

- Bengtsson, L., and Coauthors, 2017: *The HARMONIE–AROME model configuration in the ALADIN–HIRLAM NWP system*. Mon. Wea. Rev., 145, 1919–1935.
- D. P. Dee, Bias and data assimilation, Quarterly Journal of the Royal Meteorological Society, 131, 613, (3323-3343), (2006).
- Lupu, C. and McNally A. P. Wind tracing with ozone-sensitive radiances from SEVIRI. EUMETSAT/ECMWF Fellowship Programme Research Report No. 31