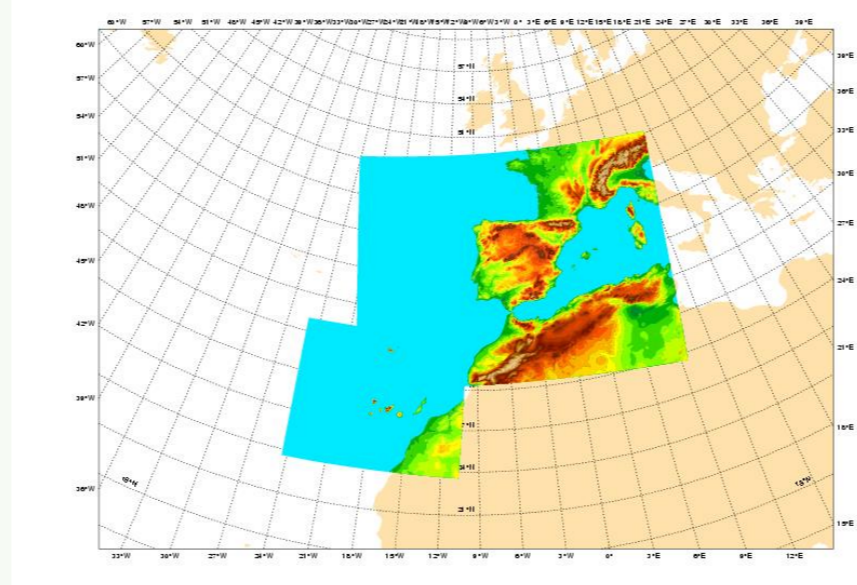


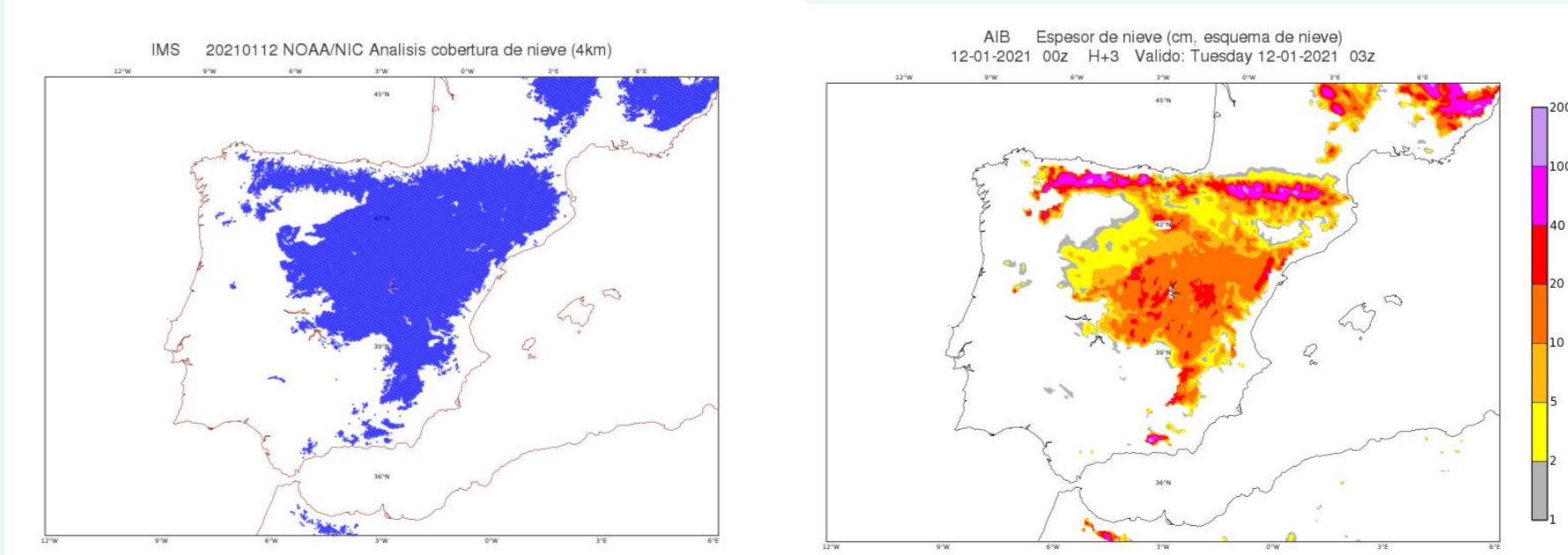
OPERATIONAL SUITE
HARMONIE-AROME

- Operational suite based on HARMONIE-AROME cycle 40h1.1
- **2.5 km** runs 4 times per day with a **forecast length of 72 hours** for 2 geographical domains (Iberian Peninsula and Canary Islands).
 - ALADIN **NH dynamics** and **1-hr boundaries** from ECMWF
 - Surface data assimilation Canary with optimal interpolation.
 - SAPP preprocessing for conventional observations
 - **3DVar analysis** with **3hr cycle** incl. AMDAR humidity obs, radar reflectivities, ATOVS, GNSS ZTD, ASCAT wind and IASI obs.



Run in AEMET's BULL-ATOS HPC which includes 7760 processors

- Radar reflectivity using OPERA from BALRAD preprocessing including Spanish, Portuguese and French radars
- Inclusion of humidity of the host model (ECMWF) in the blending process to form the First Guess
- Assimilation of **T2m** and **rh2m** in **3DVar**
- Increasing wind drag coefficient to enhance surface roughness

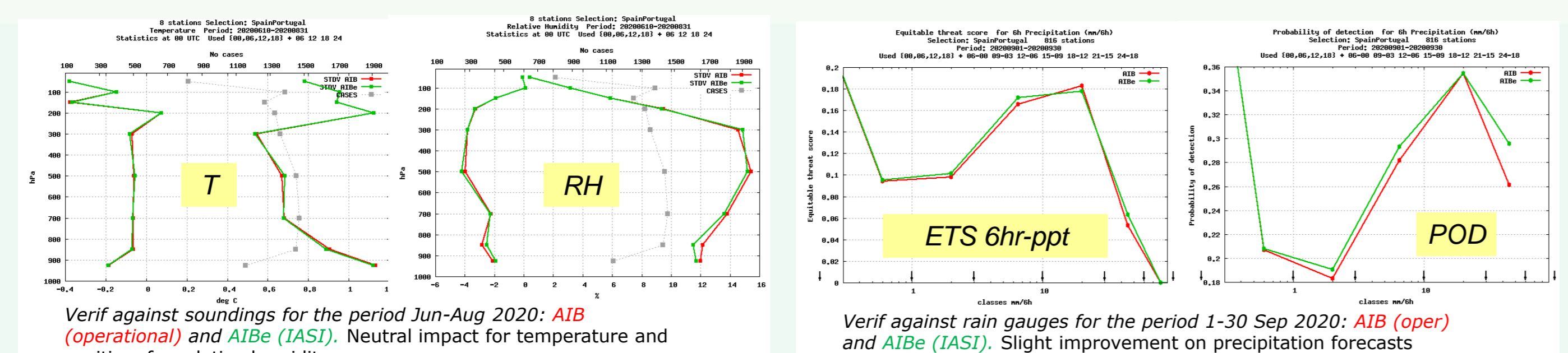


Snow depth forecast for Filomena storm compared with IMS cloud cover (not use in the analysis)

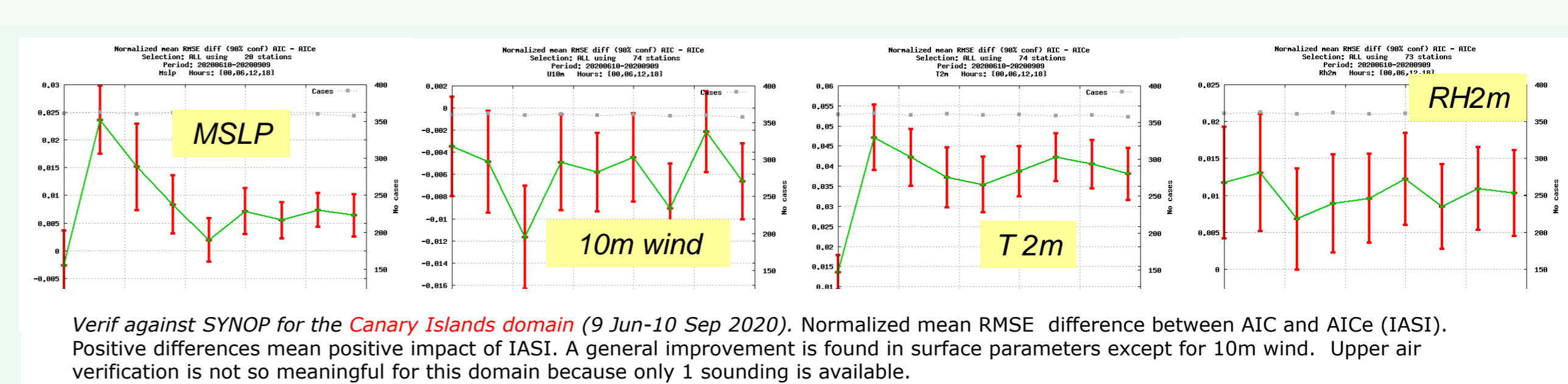
IASI data assimilation
jcampinsp@aemet.es

Assimilation of clear-sky IASI radiances
Operational since 15th December 2020 (cycle 40h1.1)
Overall, it has a neutral or slight positive impact on forecasts for both domains. Methodology and results are explained in Campins and Navascués, 2021. ALADIN-HIRLAM NL 16
On going test to implement IASI DA on cy43 suite

- Sensitivity tests**
- 3-hr cycling with H+24 at 00, 06, 12 and 18 utc.
 - Sensitivity tests: 10th June to 30 Sept 2020 for the 2 domains: Iberian peninsula and Balearics Islands (AIBe) and Canary Islands (AICe)
 - VarBC: 24h cycling update; 6 predictors; NBG=2000
 - IASI METOP-B available at 09-12-21 UTC for AIBe and at 00-09-12-21 UTC for AICe 50/51 channels (25/26 CO2 and 25 H2O bands) for AIBe/AICe



Verif against soundings for the period Jun-Aug 2020: AIB (operational) and AIBe (IASI). Neutral impact for temperature and positive for relative humidity



Verif against SYNOP for the Canary Islands domain (9 Jun-10 Sep 2020). Normalized mean RMSE difference between AIC and AICe (IASI). Positive differences mean positive impact of IASI. A general improvement is found in surface parameters except for 10m wind. Upper air verification is not so meaningful for this domain because only 1 sounding is available.

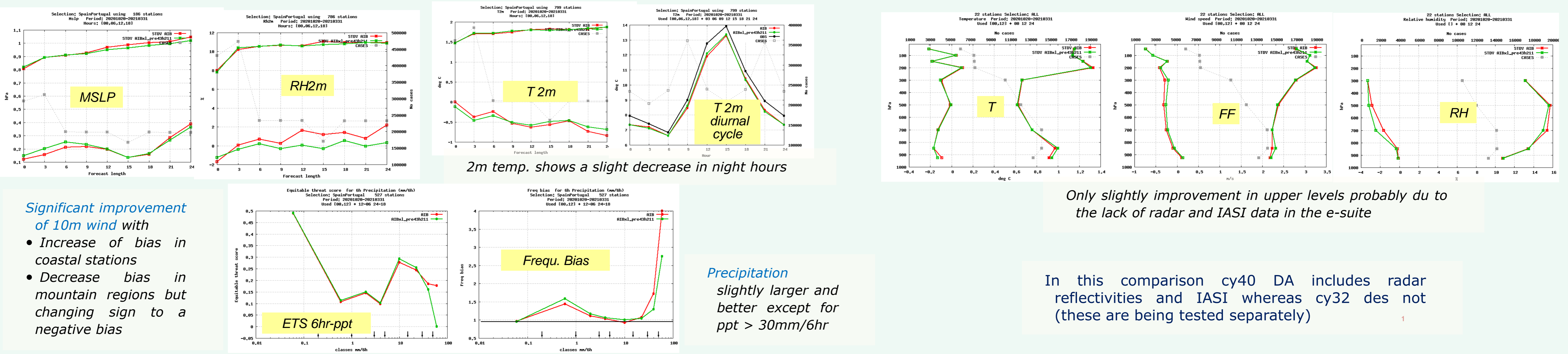
New HPC System at AEMET

- New High Performance Computer available from April 2021** (1st Phase) compose of two identical clusters each with
- 140 compute nodes mounted on Bull Sequana X440 A5 chasis. Each node with
 - 2 AMD EPYC™7742 processors (64 cores)
 - 256 GB DDR4-3200 memory
 - SSD Disc with 240
 - 4 login/control nodes
 - 4 pre/postprocess nodes
 - 2 I/O nodes
 - 500 TB lustre disc
 - This will increase the computer capacity at least 6 times. The system will be enhanced in 2023 with 48 additional compute nodes

Highlights of the e-suite

- E-suite based on HARMONIE-AROME cycle 43h2.1.1**
- Intended to become operational in the new HPC on May 2021.
 - New clay and sand database (SOILGRIDS).
 - 2 patches for Nature tile and disabling Surface Boundary layer Scheme.
 - Modified values of minimum stomatal resistance Rsmim
 - Increase Max Richardsson No to 0.2
 - Increase roughness increasing heterogeneity of open land patch (FAKETREES)
 - Orographic roughness parametrization OROTUR enabled
 - HARATU turbulence scheme update mixing top PBL
 - EDMF and microphysics optimizations
 - Modified increments of soil moisture in the OI assimilation scheme (POLYNOMES_ISBA_MF6)
 - 3DVar DA with 3hr cycles including AMDAR humidity obs, radar reflectivities, ATOVS, GNSS ZTD, ASCAT, IASI and T2m&rh2m. IFS humidity in the blending process (LSMIX).

Verification of the cy43 e-suite
gmorales@aemet.es



Significant improvement of 10m wind with

- Increase of bias in coastal stations
- Decrease bias in mountain regions but changing sign to a negative bias

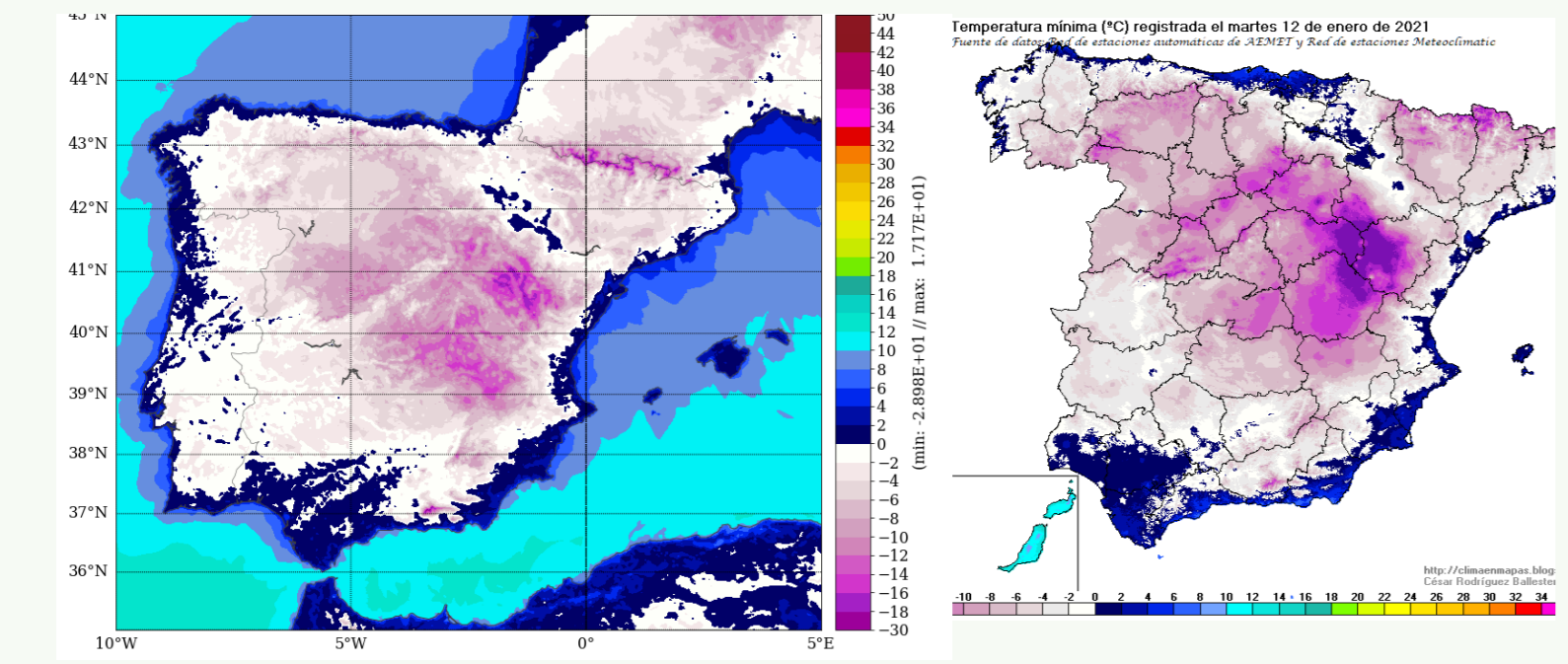
Precipitation slightly larger and better except for ppt > 30mm/6hr

Only slightly improvement in upper levels probably due to the lack of radar and IASI data in the e-suite

In this comparison cy40 DA includes radar reflectivities and IASI whereas cy32 des not (these are being tested separately)

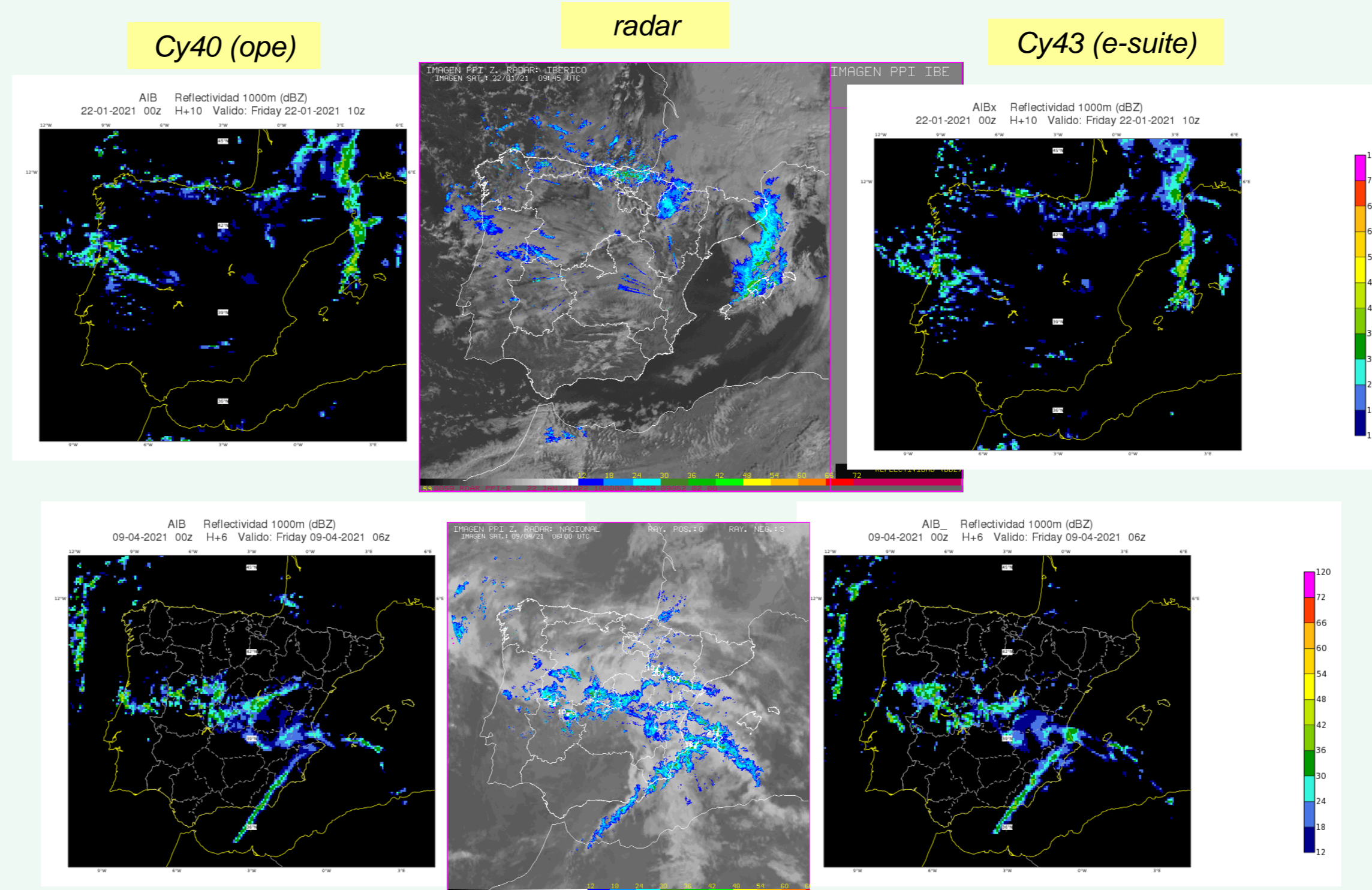
Minimum temp. in very stable conditions svianaj@aemet.es

Minimum temperature in Filomena snowstorm (12/01/2021)



- Large areas of Spain were covered by snow in January 2021
- Problems in the representation of the stable boundary layer led to important biases in the minimum 2m temperature. XRIMAX=0.2 doesn't alleviate the problem

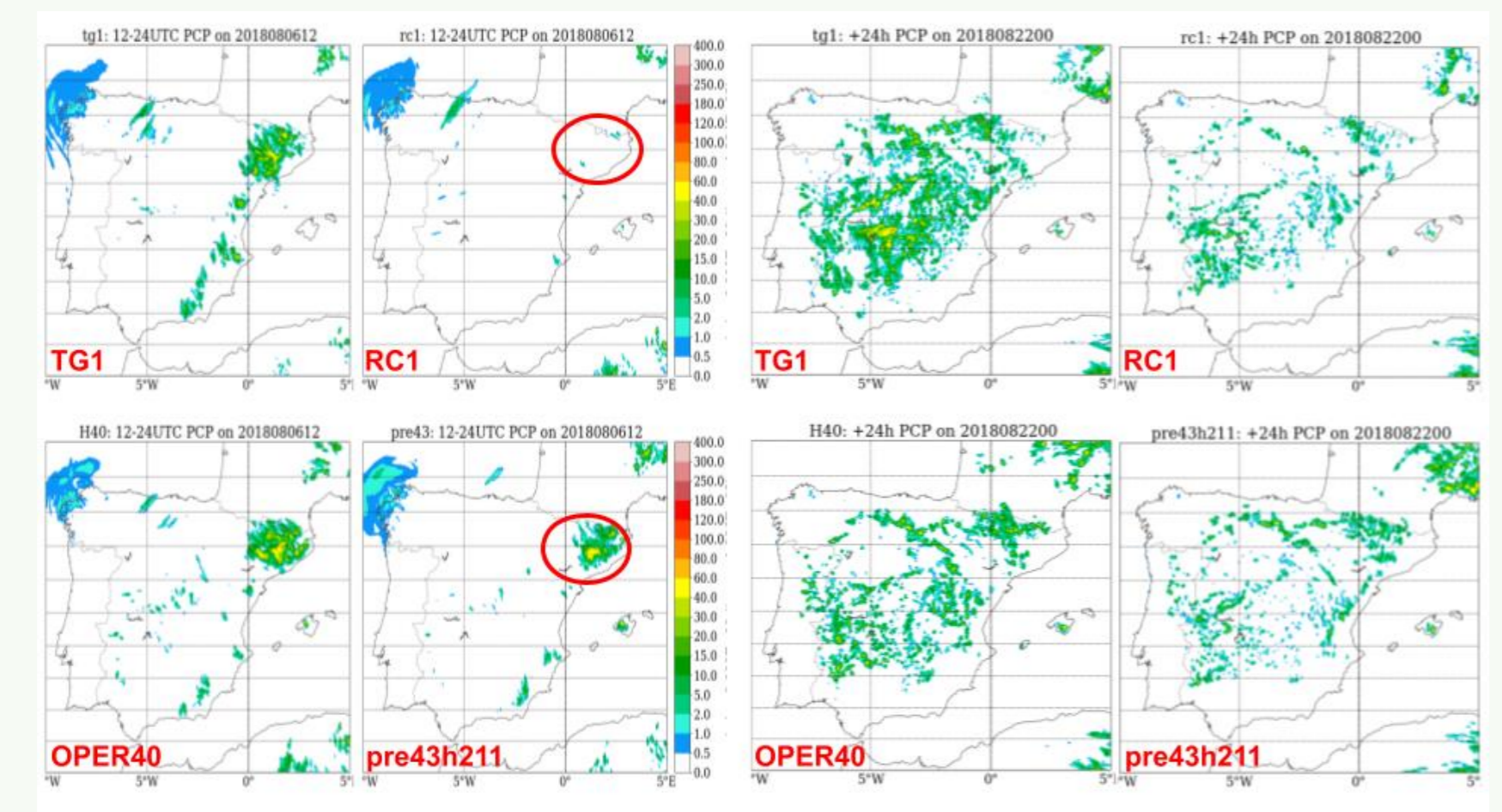
Precipitation in e-suite



Simulated reflectivity for two cases: 22.01.2021 at 10 utc (upper plot) and 09.04.2021 at 06 utc (lower plot). Although the operational suite includes radar and IASI DA, no big differences are found between both versions.

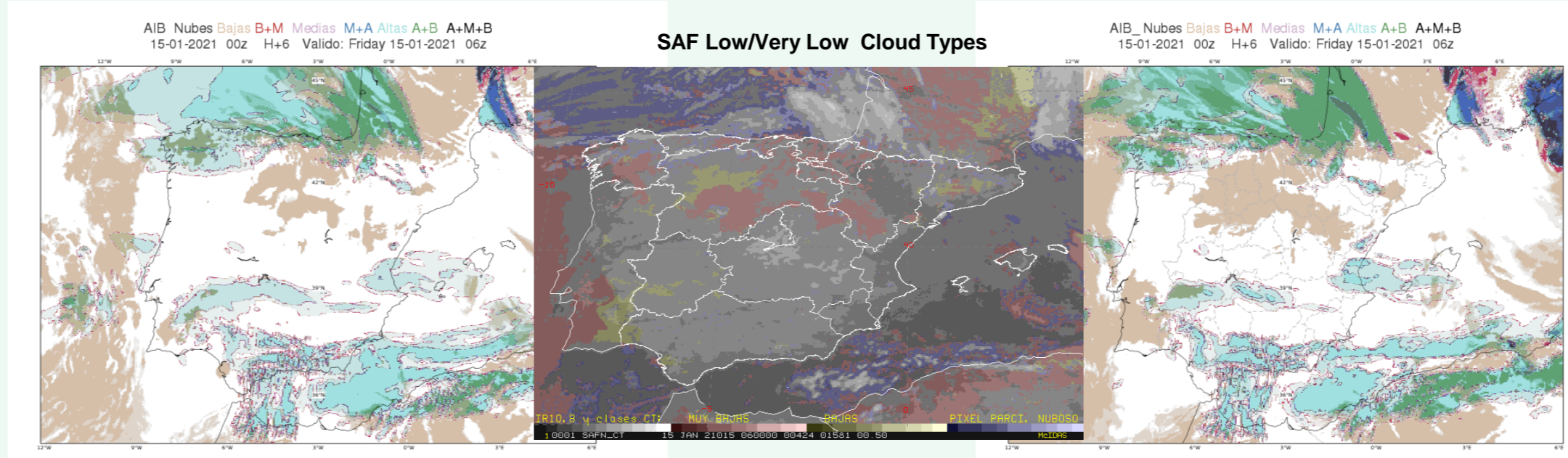
Summer convection svianaj@aemet.es

Summer convection: Missing precipitation



- RC1 missed convection in the summer season as compared to TG1 & operational (cy40). The specific cause could not be identified.
- With the final settings in pre43h211, convection is more comparable to OPER40, TG1 & observations.
- Convection is still too weak in days with low synoptic forcing (airmass thunderstorms).

Low clouds



Low clouds for 15.01.2021 at 6 utc: Comparison of cloud cover forecast with SAF Cloud Type highlighting low clouds. E-suite based on cy43 tends to produce more and thicker low clouds

Highlights

- New HPC system available since April 2021
 - In its 1st phase increases the computer capacity about 6 times
 - It will allow enhancement of the EPS prediction system at 2.5 km
 - Implement a nowcasting suite
 - Implement fine resolution on local domains
- e-suite based on HARMONIE-AROME cycle 43h.2.1 will become operational in may 2021. It will include
 - Radar Doppler wind
 - Scatterometer DA
 - IASI DA
 - Overall it improves scores in all seasons (not so clear in summer)
 - 10m wind improved by means or enhancing roughness through a orographic parametrization (OROTUR) and increasing heterogeneity of open land patch (FAKETREES)
 - No big change in the climatology of precipitation
 - Slightly increase of low level clouds
 - Major problem found has been the underestimation of airmass convection in summer