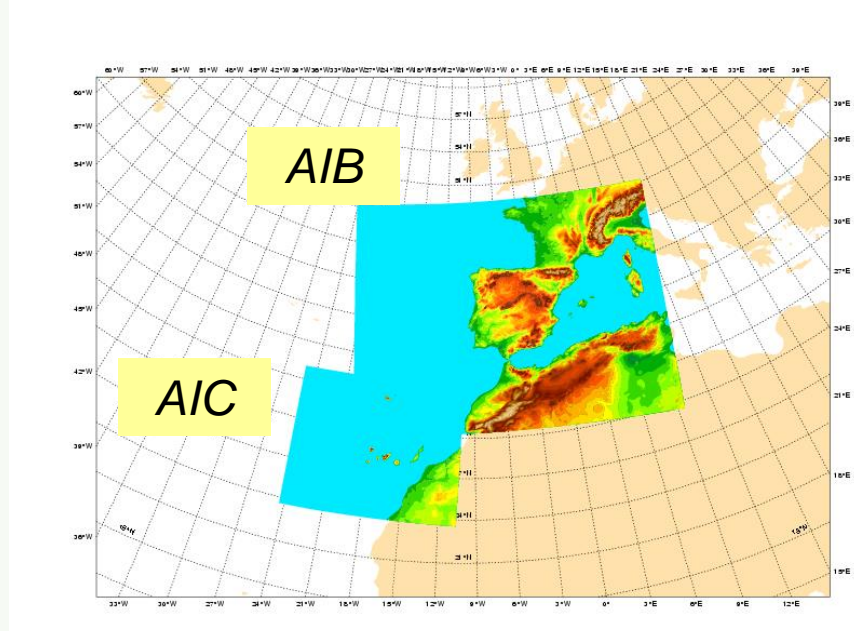


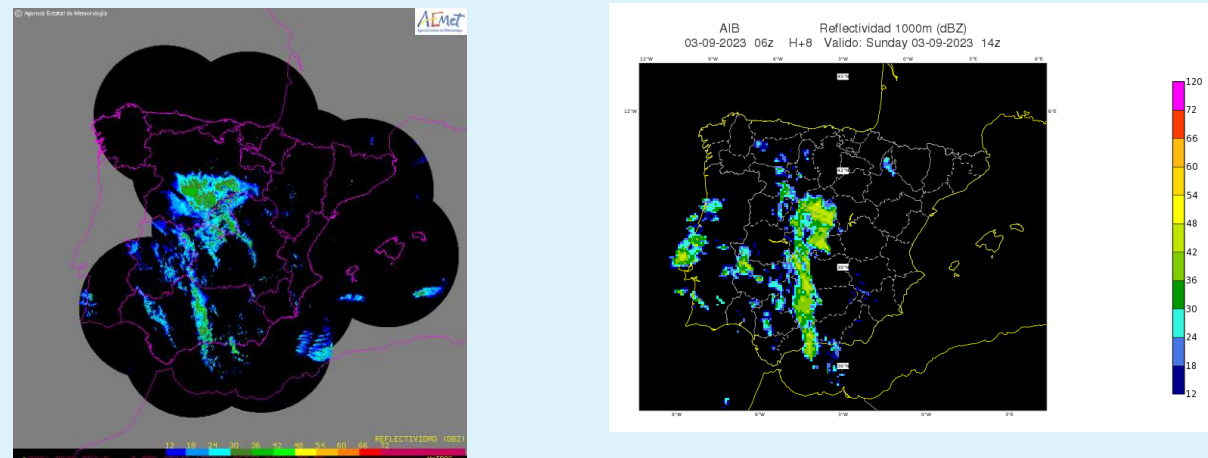
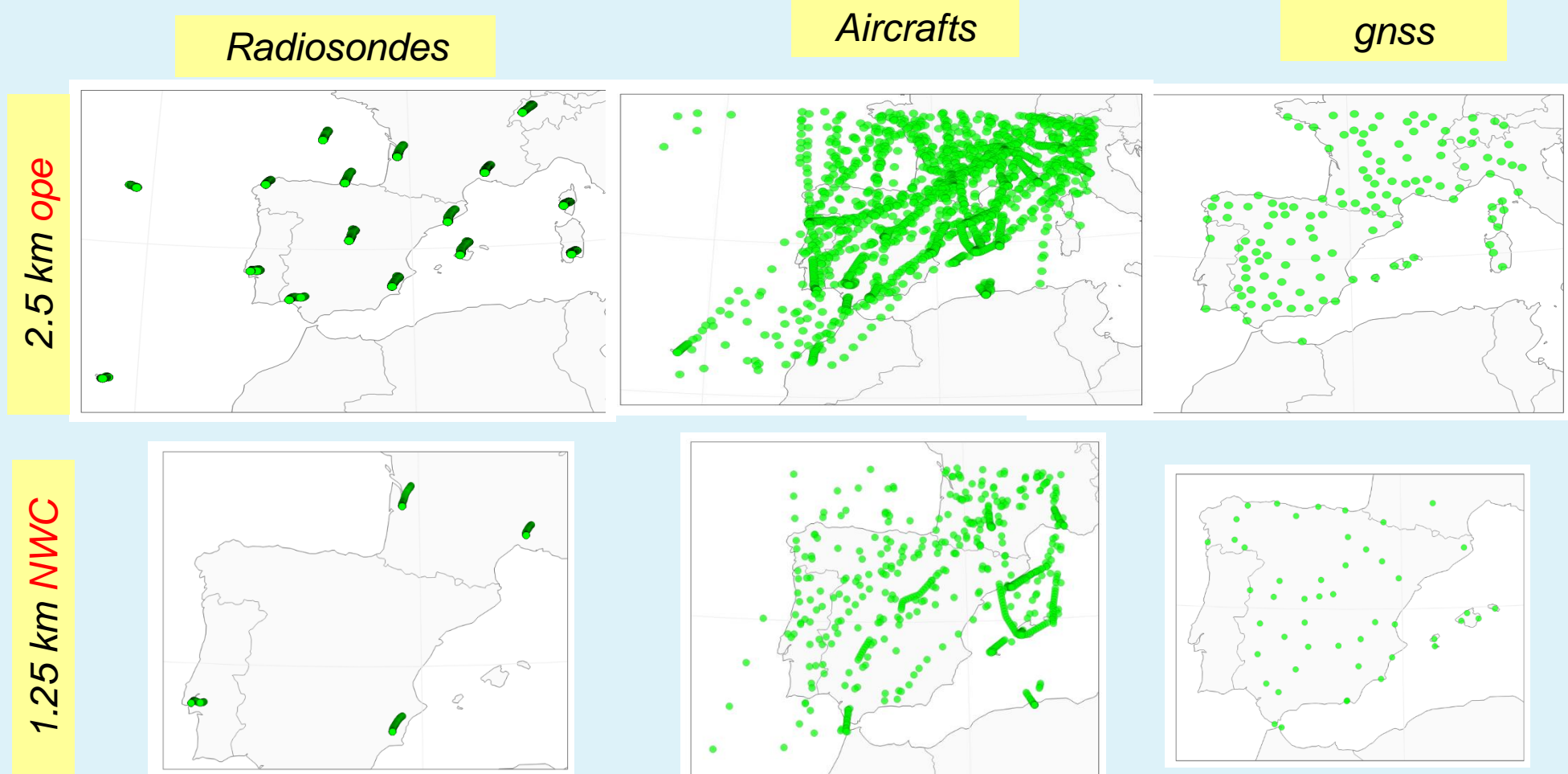
- Operational suite based on HARMONIE-AROME cycle 43h2.1.1 updated ¹ on 7th September 2021 to a new HPC cirrus and on 1st December 2022 to assimilate SERVIRI ² data
- 2.5 km** runs 4 times per day with a forecast length of 72 hours for 2 geographical domains (Iberian Peninsula and Canary Islands).
- 3DVar analysis** with **3hr cycle** incl. AMDAR humidity obs, radar reflectivities, ATOVS, GNSS ZTD, ASCAT wind, IASI and SEVIRI obs.
- IFS humidity in the blending process (LSMIX). Assimilation of T2m and rh2m in 3Dvar

- SAPP preprocessing for conventional observations
- Radar reflectivity using OPERA from BALRAD preprocessing including Spanish, Portuguese and French radars.
- Radar wind assimilated in passive mode.
- Retuned scales in CANARI
- 2 patches for Nature tile and disabling Surface Boundary layer Scheme
- Max Richardsson: XRISHIFT ³
- Increase roughness increasing heterogeneity of open land patch (FAKETREES)
- Orographic roughness parametrization OROTUR ⁴ enabled (to alleviate a positive Wind bias which is still too large)



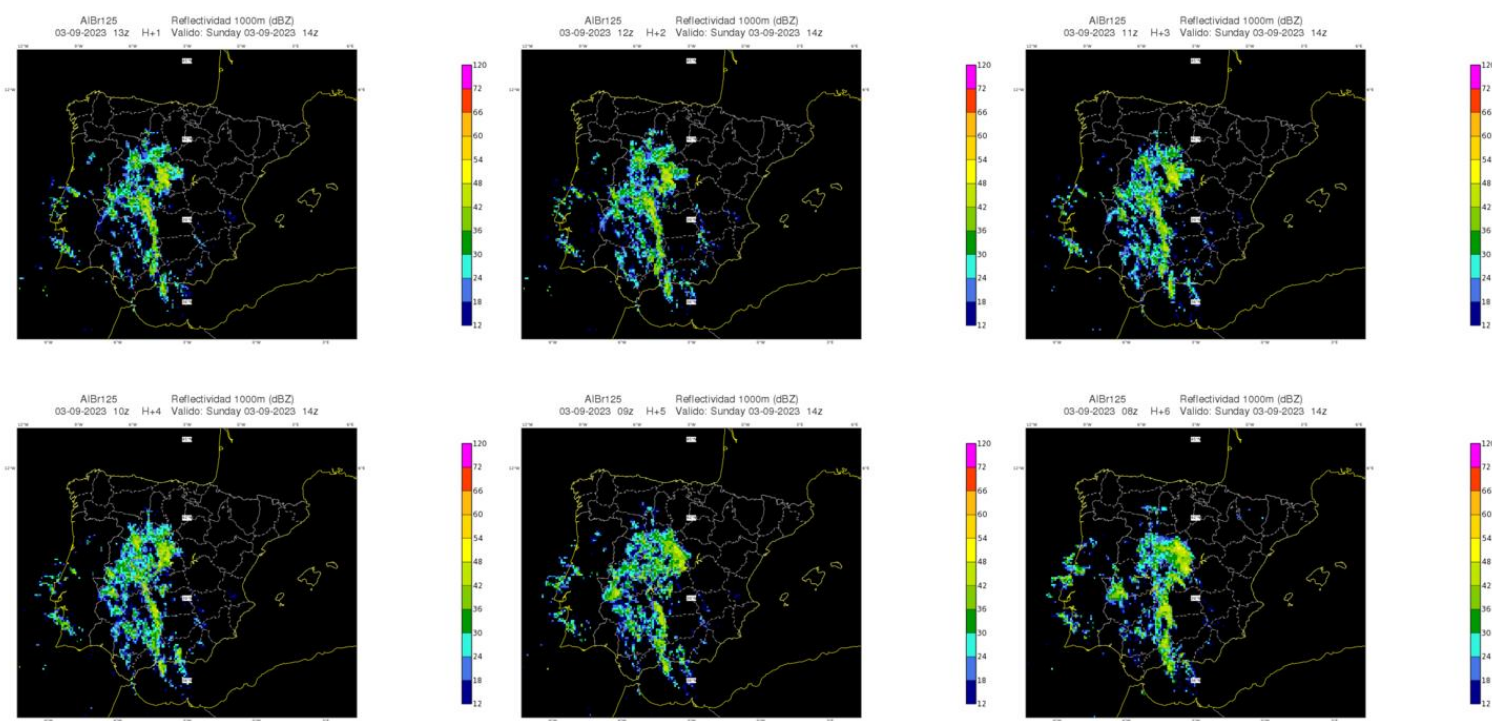
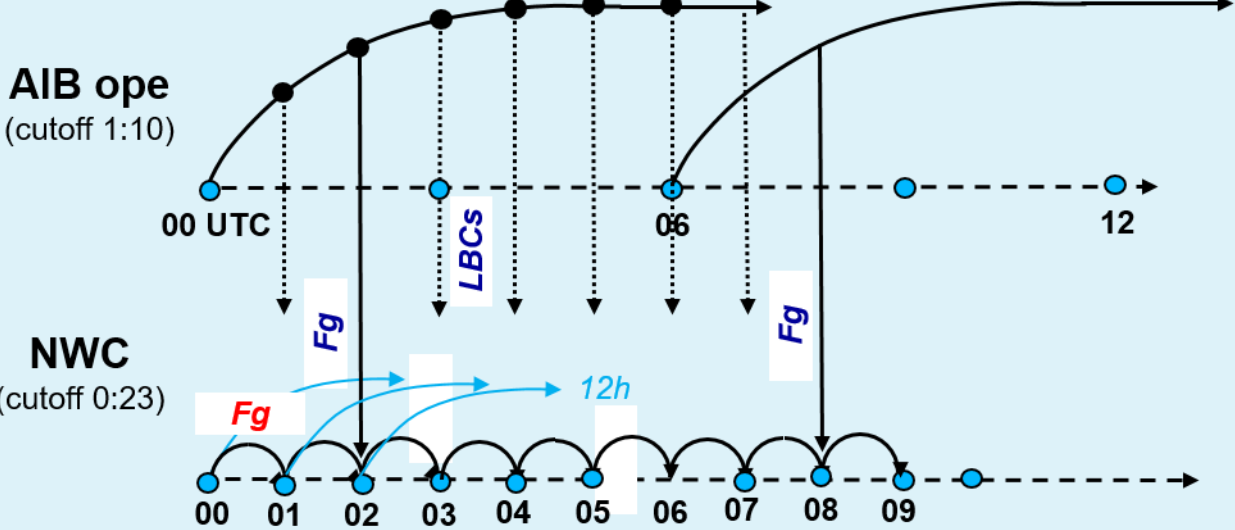
Nowcasting e-suite

- Real time suite running over the Iberian peninsula and Balearic Islands. Based on Harmonie-Arome cycle 43h2.1.1 with **1.25 km resolution**, H-Arome nesting, 3DVar hourly cycle with **+23 min cut-off time**. Using conventional observations + radar reflectivity + GNSS-ZTD (fast processing) + SEVIRI WV. H+12 each hour

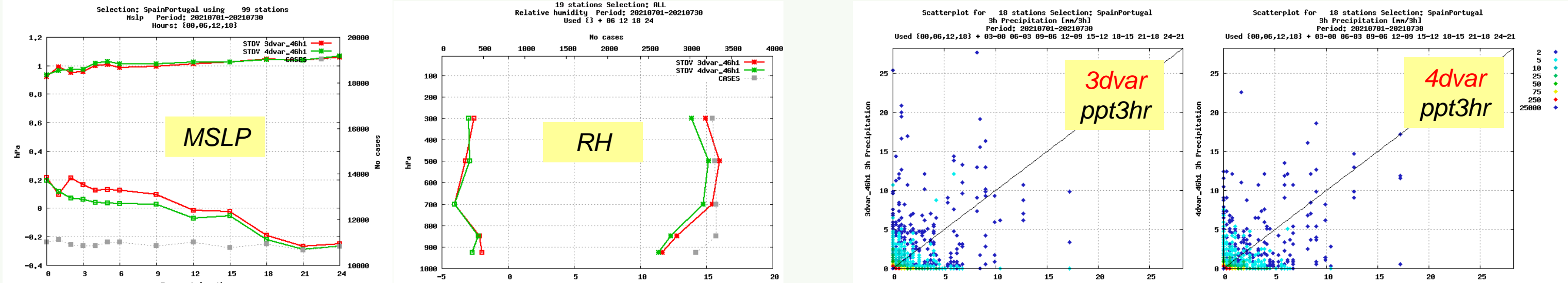


Radar reflectivity for 2023-09-03 at 14 UTC (Cutoff low with flooding in Madrid and Toledo). Radar and operational H+8 (upper panels) compared to Nowcasting poor man EPS build with H+1 to H+6 forecasts from the NWC suite (lower panels). Some spin up effects can be seen in the NWC suite

Example of observation use (2023-06-21 at 12 UTC). To benefit from the better obs coverage in the operational suite, every 6hr an H+2 First Guess from the host is used for upper air fields (see cycles fig below)



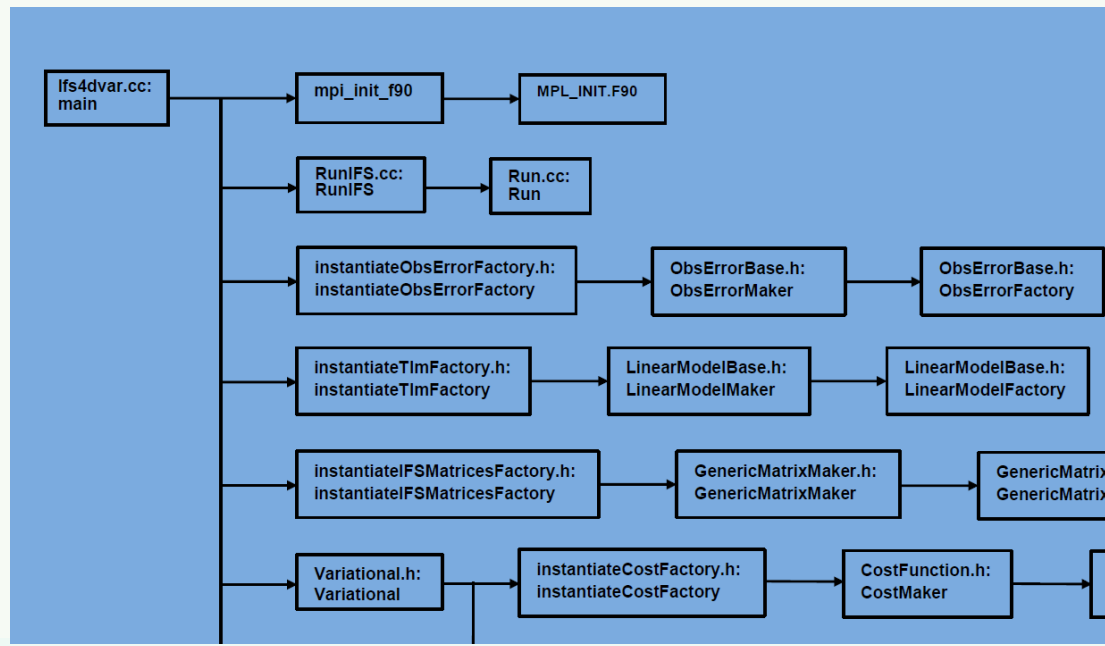
Evaluation of 4DVAR in cy46h1 at AEMET and ECMWF (work in progress). Parallel runs for different periods are being performed using all operational observations.



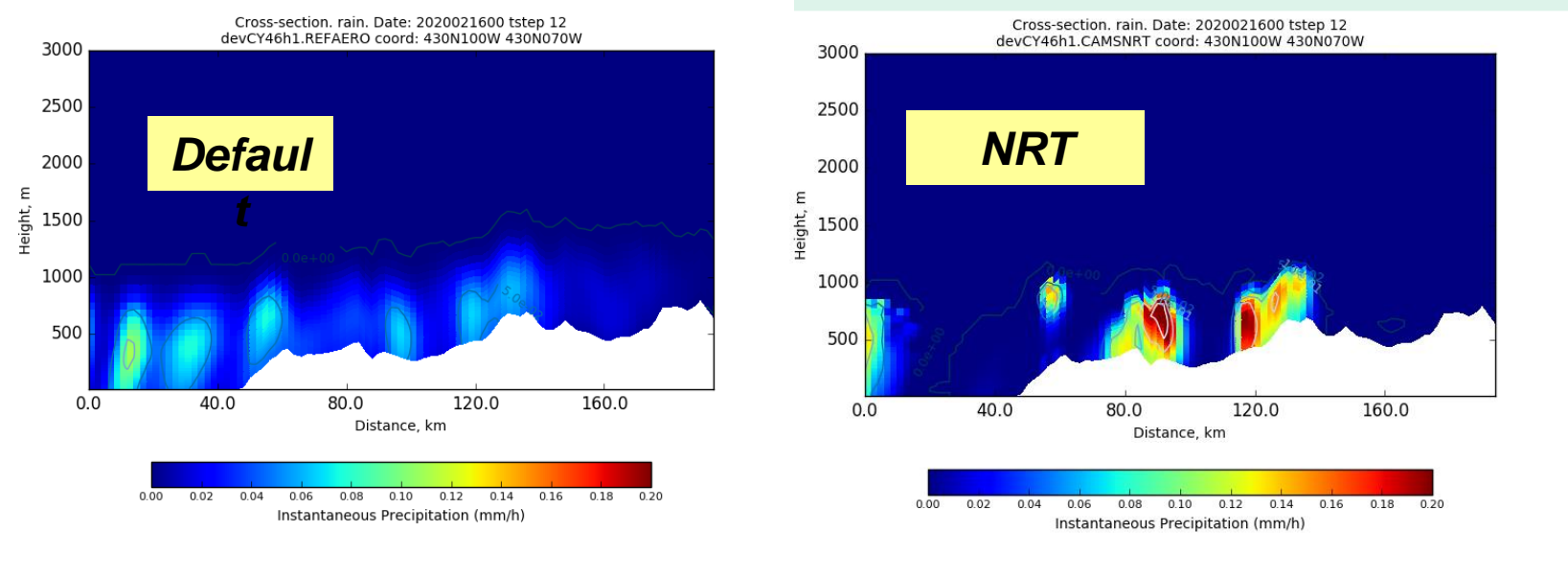
Preliminary results using only conventional observations for July 2021. Main impact is seen in RH profiles where a clear improvement is found and in precipitation. Little or negative impact is seen in screen level variables probably due to the lack of coupling between surface and upper air assimilation

Use of RESTART mode (P. Escribà). For a given time step, RESTART mode writes all the fields need by MASTERODB (fluxes, T-DT tendencies, etc) to permit continuation of the model integration without information lost. In the context of 4DVAR this method is being evaluated to pass the information from the First Guess

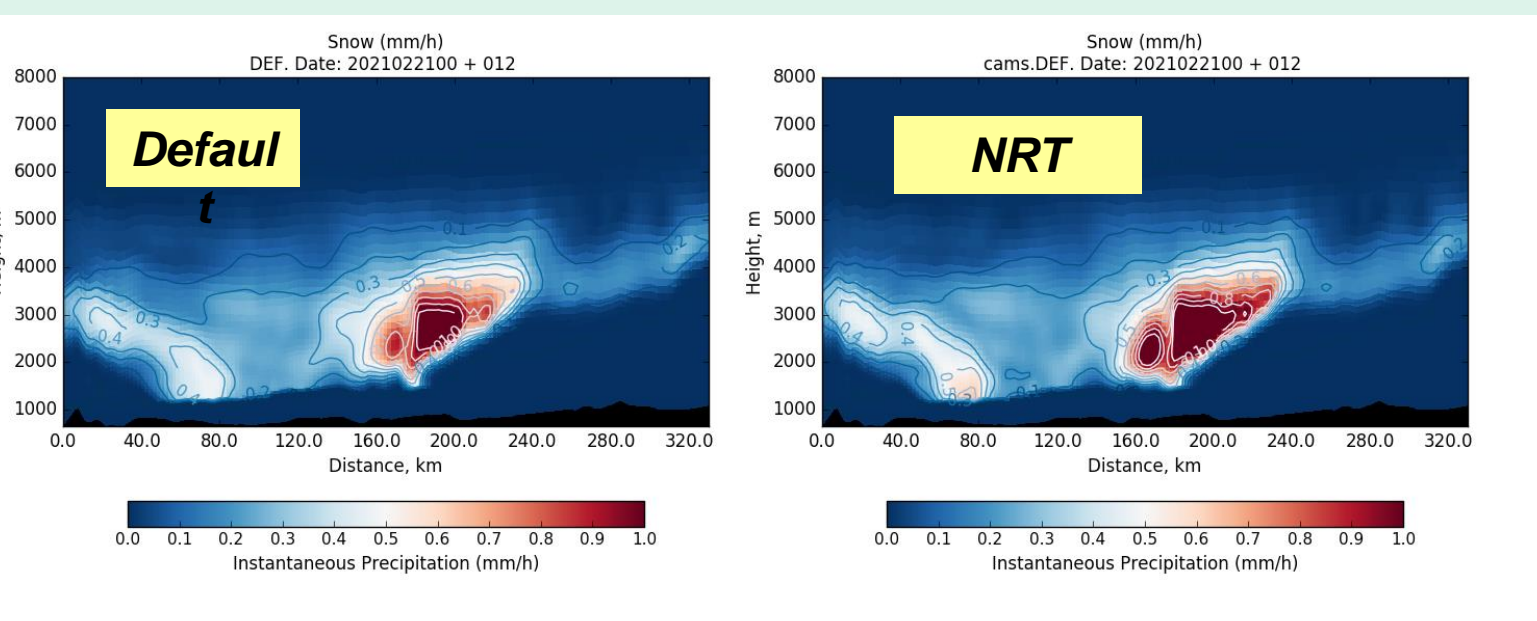
Understanding OOPS (P. Escribà). With the aim to prepare HARMONIE 4DVAR to work under OOPS, a detailed description of a 3DVAR experiment workflow with a brief explanation of each step has been done using the DDT debugger tool (screenshot shown)



Exploration of the use of near real time aerosols on precipitation



The introduction of near real time aerosols for the calculation of cloud droplets modify the precipitation distribution and intensity, increasing the showers (HARMONIE-AROME cy46h1). Cross section of the intensity of the rain in a warm rain case



The modification of cloud droplets has an impact on the snow. In the cases when the cloud droplet number concentration is reduced, the riming process is going to increase the snow concentration as it depends on the cloud droplet diameter which is going to be bigger

Other activities

- Testing the roughness sublayer in SURFEX: Implications for vegetation- atmosphere coupling (Viana and Shapkalijevski presentation)
- Tuning of error statistics and quality control in Data Assimilation (Sanchez-Arriola et al. presentation)
- Improvement initialization methods for nowcasting and sub-hour DA (Geijo, 2023 ⁵)

Highlights

- Nowcasting e-suite running in real time. 1.25 km H+12 runs every hour with 23 min cutoff time. A poor man H+6 EPS can be formed. The early delivery is able to compensate the fewer obs entering the analysis.
- Multi-model EPS (ySREPS). EFI and SOT for rain, snow, gusts, Tmax and Tmin included.
- Single Precision. SP seems to work well in cy46h1 forecasts and will be used in the nowcasting suite, EPS and Very High Resolution simulations.
- Spatial Verification. Spatial Verification is being tested using different data sources. It seems it has potential to compare forecasts of different resolutions and show if high resolution simulations are able to improve coarse resolution runs. It needs supervision
- Impact of the use of Near Real Time aerosols on precipitation. The introduction of NRT aerosols for the calculation of cloud droplets modify the precipitation distribution and intensity

ATOS-Bull High Performance Computer updated

- It is composed of two identical clusters each with
 - 140 compute nodes mounted on Bull Sequana X440 A5 chassis. Each node with
 - 2 AMD EPYC™7742 processors (64 cores)
 - 256 GB DDR4-3200 memory

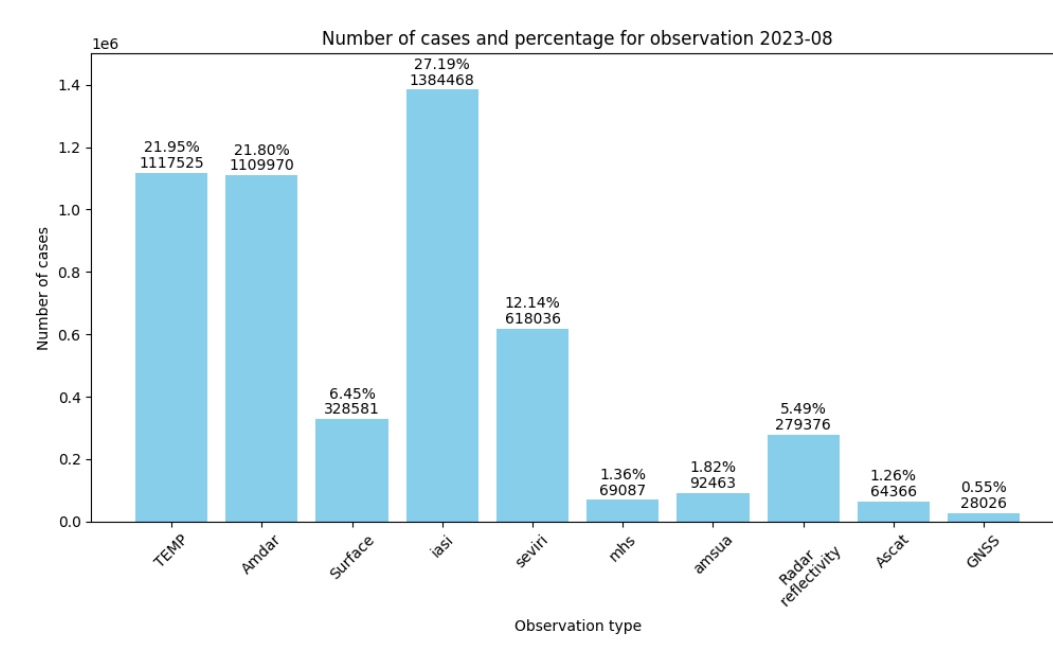


Use of observations

Satellite data used

Satellite	MW T sounding	MW hum sounding	IR sounding
NOAA-18	AMSUA		
NOAA-19	AMSUA	MHS	
METOP-B	AMSUA	MHS	IASI
METOP-C	AMSUA	MHS	IASI
MSG			SEVIRI

IASI channels	
CO2 High	38,51,63,85,104,109,167
CO2 Middle	173,180,185,193,199,205,207,212,224,230,236,239,242,243,249,296,386
CO2 Low	333,337,345,389,432
WV	2701,2819,2910,2919,2991,2993,3002,3008,3014,3098,3207,3228,3281,3309,3322,3438,3442

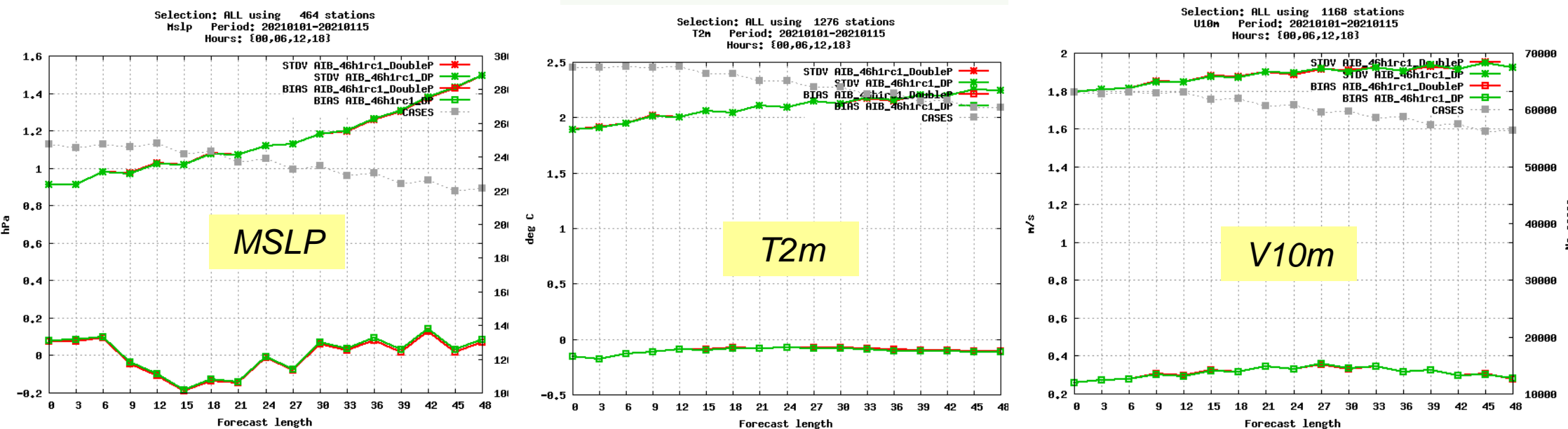


Number observations entering the Minimization during August 2023 and relative distribution for the different types

AMSU-A: 6, 7, 8, 9
MHS: 3, 4, 5
SEVIRI: WV6.2, WV7.3

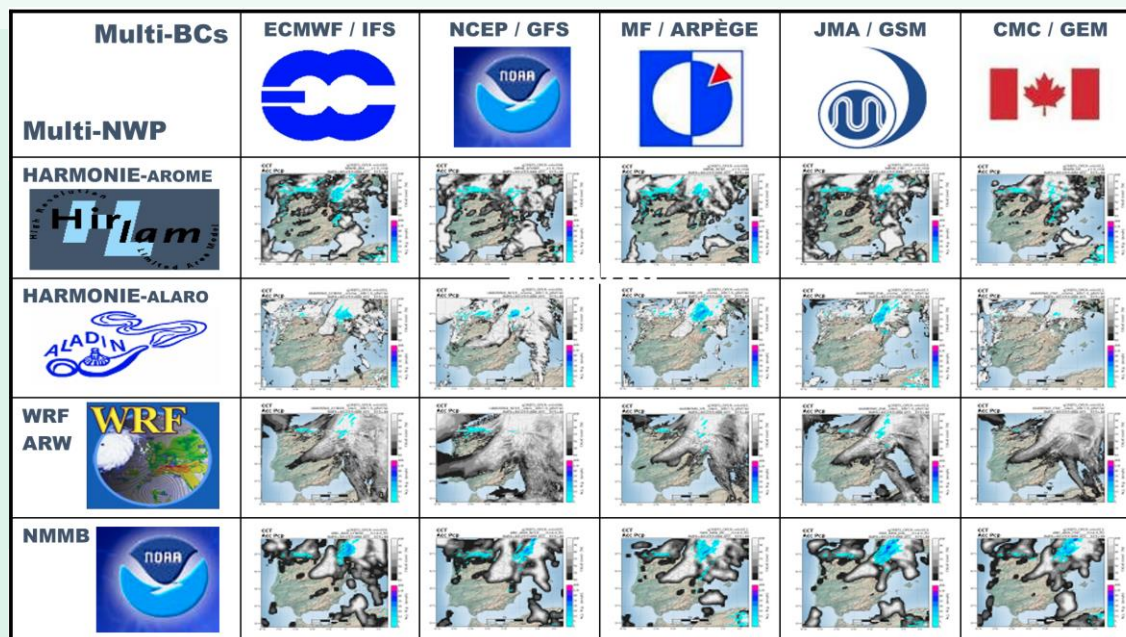
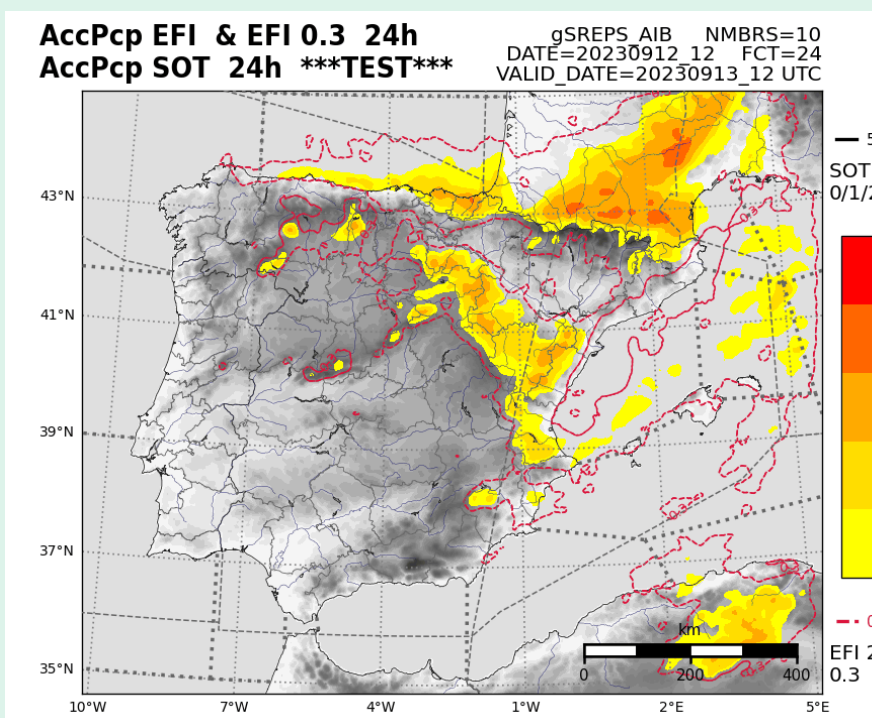
Impact of using Single Precision in the forecast model

Using cy46h1 we asses the impact of using dual precision. In this mode the binaries are compiled both in double and single precision. Single precision binaries are used to run the forecast, the rest of the processes use double precision binaries. Results show no important differences with respect to double precision forecast for a period of two weeks and a forecast length of 48h. There is a mean reduction of 28% in the time needed to run the forecast.



AEMET-ySREPS

- Multi-model: 4 LAMs at 2.5 km
- Multi-boundaries: 5 Global models
- 3 domains: Iberian Peninsula, Canary Islands and Antarctica



2023 Novelties

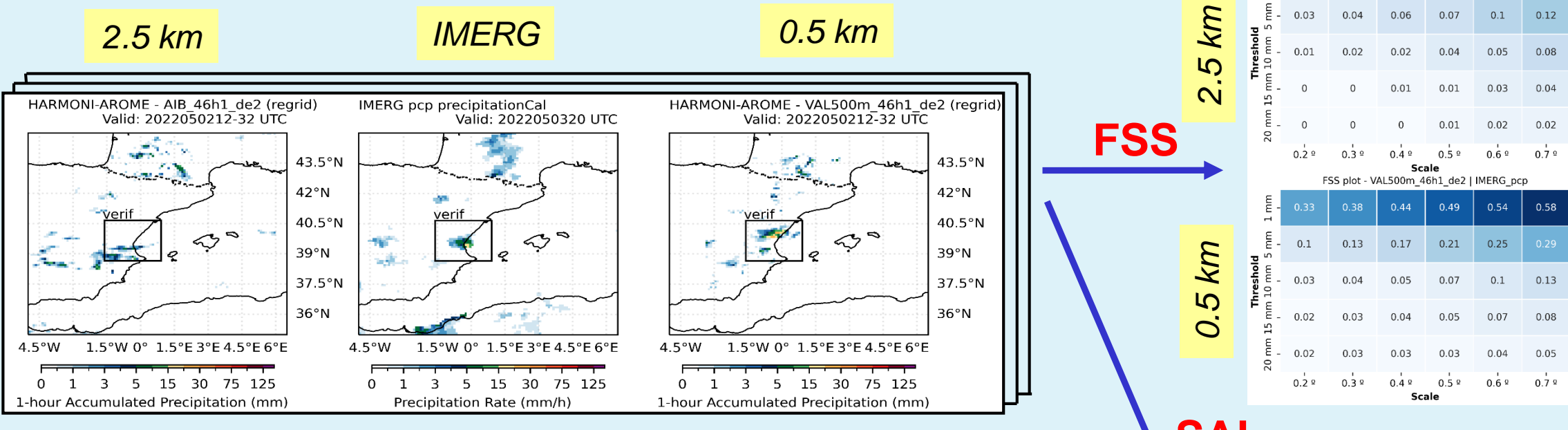
- Extended lead time up to 72 hours
- All domains with 2 cycles at 00 and 12 UTC
- EFI (Extreme Forecast Index) and SOT for rain, snow, wind gust and T2m max and Tmin

2024 Challenges

- Probabilistic vertical profiles
- Auto verification with HARP
- Update LAMs
- Larger domains
- Dynamic visor for products (ADAGUC from KNMI)

Evaluation of Very High Resolution forecasts using Spatial Verification

- Precipitation forecasts compared with IMERG sat data (0.1° resolution). Work done for DE_330 Project



FSS and SAL statistics for a high-impact convective storm in Valencia case (computed with 49 forecasts from 7 initializations). FSS clearly shows the improvement of the 500 m exps. Concerning SAL, the distribution of S, L values are closer to 0 for 500 m exp but lower absolute bias value (A) in the 2.5 km ones. Main limitation is that supervision is need in order to check the objects selected and the quality of the method

Next: Use SEVIRI brightness temperatura and OPERA reflectivity and precipitation data

⁰ Contributions: Javier Calvo, Alfons Callado, Joan Campins, María Díez, Pau Escribà, Teresa García, Juan Jesús González, Alberto Jiménez, Antonio Jiménez, Daniel Martín, Gema Morales, Jose M. Pérez de Gracia, Jana Sánchez-Arriola

References:

¹ Calvo et al. (2021): Evaluation of HARMONIE-AROME cycle 43h2.1 at AEMET. ACCORD Newsletter, 2
² Campins et al. (2022): Assimilation of clear-sky SEVIRI radiances in AEMET HARMONIE-AROME model. ACCORD Newsletter, 3
³ Homleid, M. (2022). Improving model performance in stable situations by using a pragmatic shift in the drag calculations - XRISHIFT. ACCORD Newsletter, 2.
⁴ Rontu, L. (2006): A study on parametrization of orography-related momentum fluxes in a synoptic-scale NWP model. Tellus A: Dynamic Meteorology and Oceanography
⁵ Geijo (2023): Exploring Sub-Hour DA in HARMONIE-AROME. ACCORD Newsletter, 4

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