

Some verification of Alaro Cy46 in the Aemet-gsreps

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Alaro-1 WDs. Kraków, Polska. 04/03/2025



Agencia Estatal de Meteorología



Acknowledgements

- To Martin Bellus and Ján Mašek for all their work time devoted to this. I have felt very well working with you.
- To Juanjo Gómez to create the probabilistic scores and to Alfons Callado and the gsreps group for making the succesful Aemet-gsreps posible. To Samuel Viana to get the Deode 500m run.

Index

- Brief description of configurations
- Some CPU cost comparison
- Deterministic & Probabilistic verification
- Subjective verification: “Dana de València”

Brief description of configurations

Harmonie Cy40

- Operational in Aemet-gsreps
- Based in tag 40h11

Alaro Cy40

- Not operational in Aemet-gsreps (15 members at the moment), due to a suboptimal inherited setup.

Brief description of configurations

Harmonie Cy46

- In pre-operational stage
- Based in tag 46h11 from Harmonie repo

Alaro Cy46

- In pre-operational stage
- Based in cy46t1_bf07 from MF repo + some added code to equalize it to NonHydro CHMI (Prague) operational ALARO

Brief description of configurations

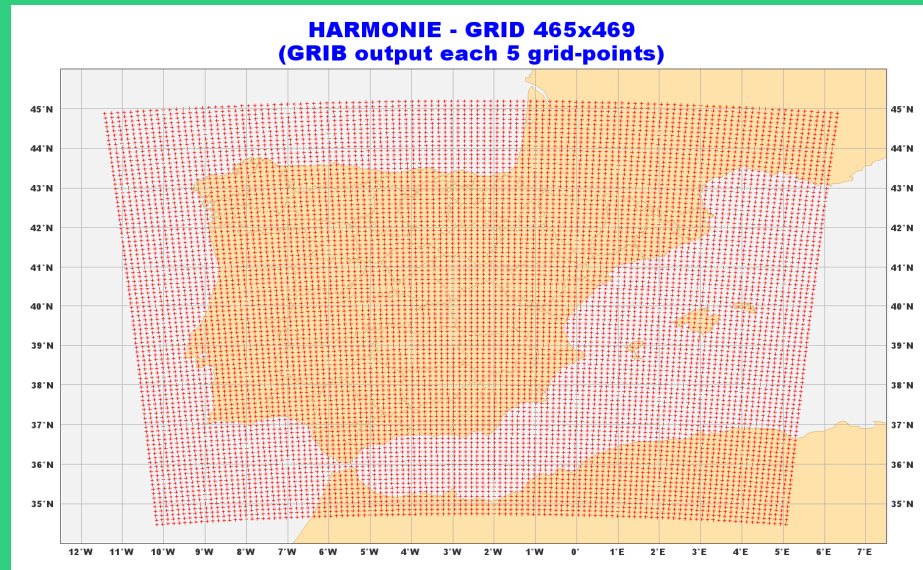
* **NOTE:** Since the use of the binary compiled with cy46t1_bf07 there has not been ANY technical issue on the EMCWF HPCF when launching the Alaro Cy46T setup. In the past we suffered from many memory issues when using the Alaro setup on the “h” code repository, probably due to code divergences, which can be very complicated to fix.

* **NOTE:** No data assimilation is done, so all the forecasts start from a downscaled host model cold start.

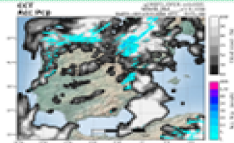
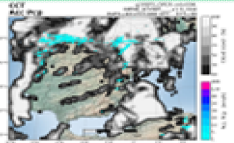
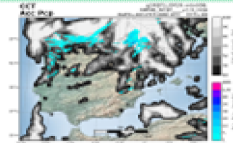
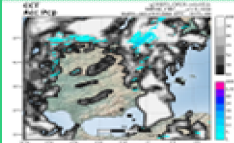
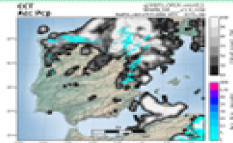
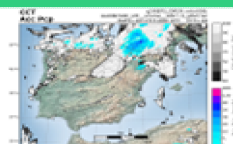
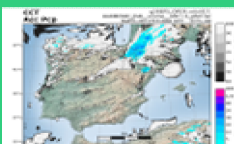
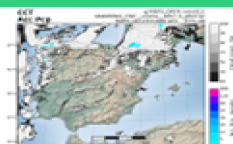
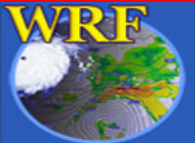
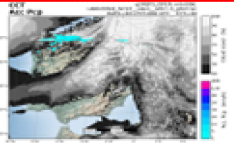
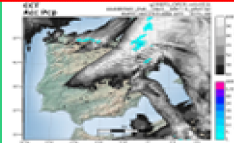
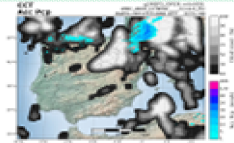
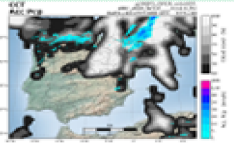
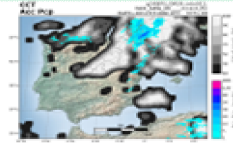
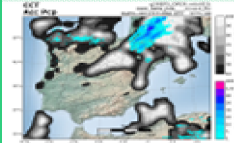
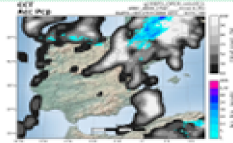
Brief description of configurations

Operational domain:

At the moment the operational domain covers the Iberian Peninsula with $n_x=576$ x $n_y=480$ x $n_{lev}=65$ and 2.5 km horizontal resolution. Quite small. This to be enlarged!



Brief description of configurations: BCs

Multi-BCs	ECMWF / IFS	NCEP / GFS	MF / ARPÈGE	JMA / GSM	CMC / GEM
Multi-NWP					
HARMONIE 					
ALARO 					
WRF ARW 					
NMMB 					

CPU cost comparison

- All tests are run at ECMWF HPCF using nprocx=16 & nprocy=32
- Model time step = 60 seconds

	NODES	THREADS	F90 REALS PRECISION	TSTEPS/ (SECS RT)	TOTAL RT H+72 FCST	RT/HCy46_RT	SBU's
Harmonie Cy40 (oper)	4	1	DOUBLE	~2	2689 SECS	5,26	6656
Harmonie Cy46	16	8	SINGLE	~10	511 SECS	1	6882
Alaro Cy46	16	8	DOUBLE	~3	1539 SECS	3,01	18026

Deterministic verification

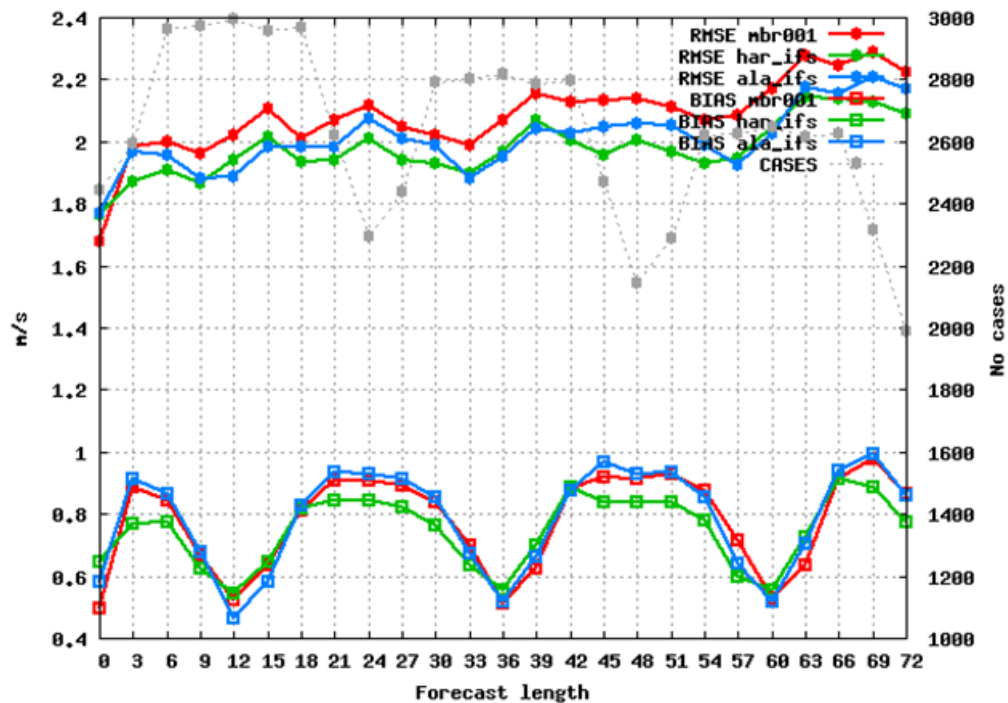
- Period: 2025020100 – 2025021900, 19 days
- H+72 forecasts initialized at 00 UTC only
- $Rmse^2 = Stdv^2 + Bias^2$
- For precipitation:
 - False Alarm Ratio (FAR): Number of false alarms per total number of warning of alarms (the lower the better)
 - Equitable Threat Score (ETS) measure the skill of a forecast relative to chance (the higher the better)

Deterministic verification: IFS BCs

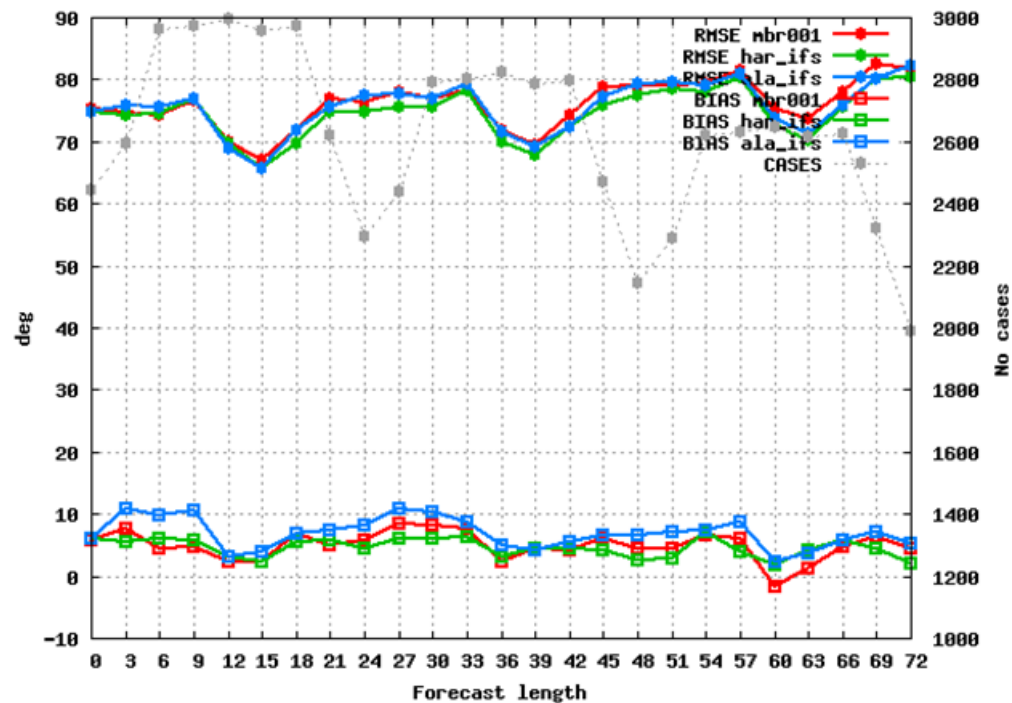
S10m

D10m

Selection: ALL using 177 stations
U10m Period: 20250201-20250219
Hours: {00}



Selection: ALL using 177 stations
Wind direction Period: 20250201-20250219
Hours: {00}

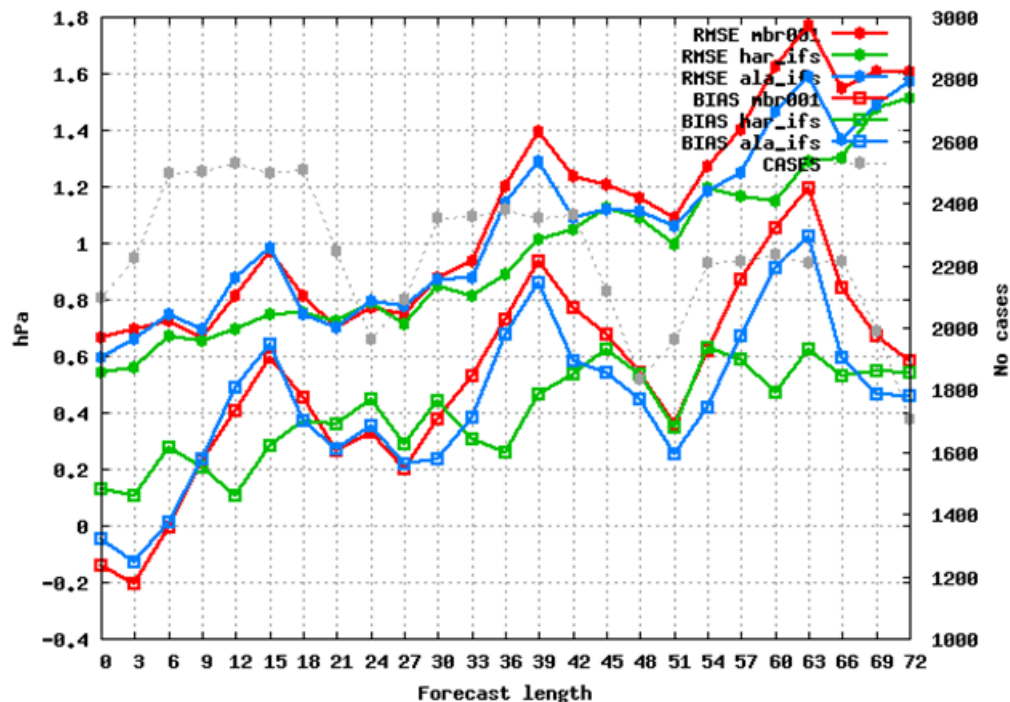


Deterministic verification: IFS BCs

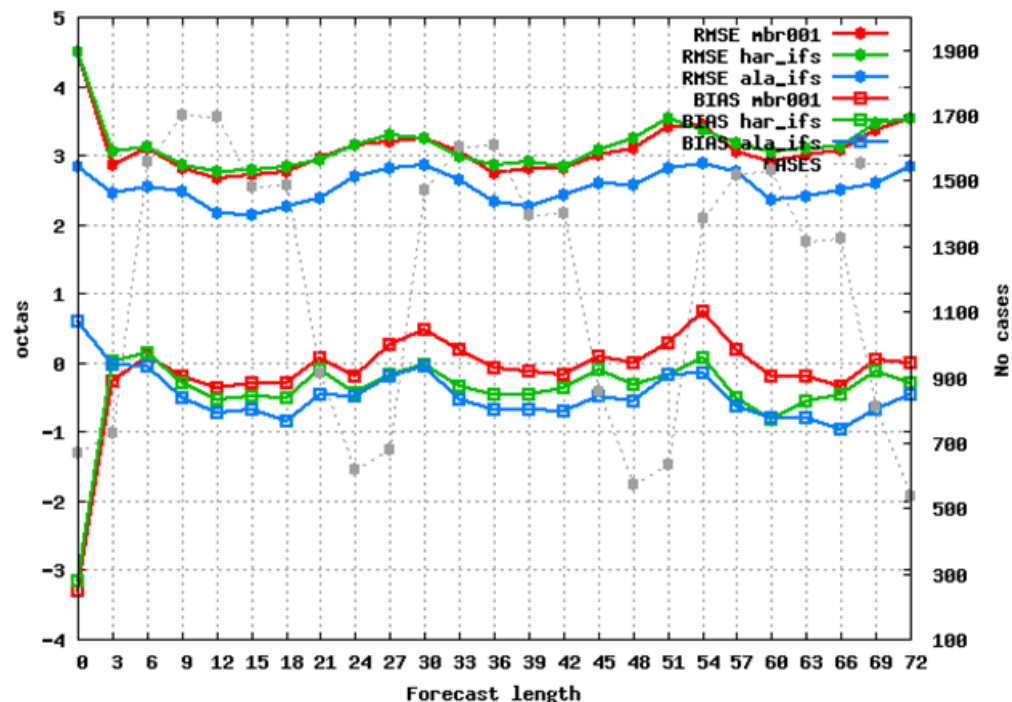
MSLP

CC

Selection: ALL using 150 stations
Mslp Period: 20250201-20250219
Hours: {00}



Selection: ALL using 127 stations
Cloud cover Period: 20250201-20250219
Hours: {00}

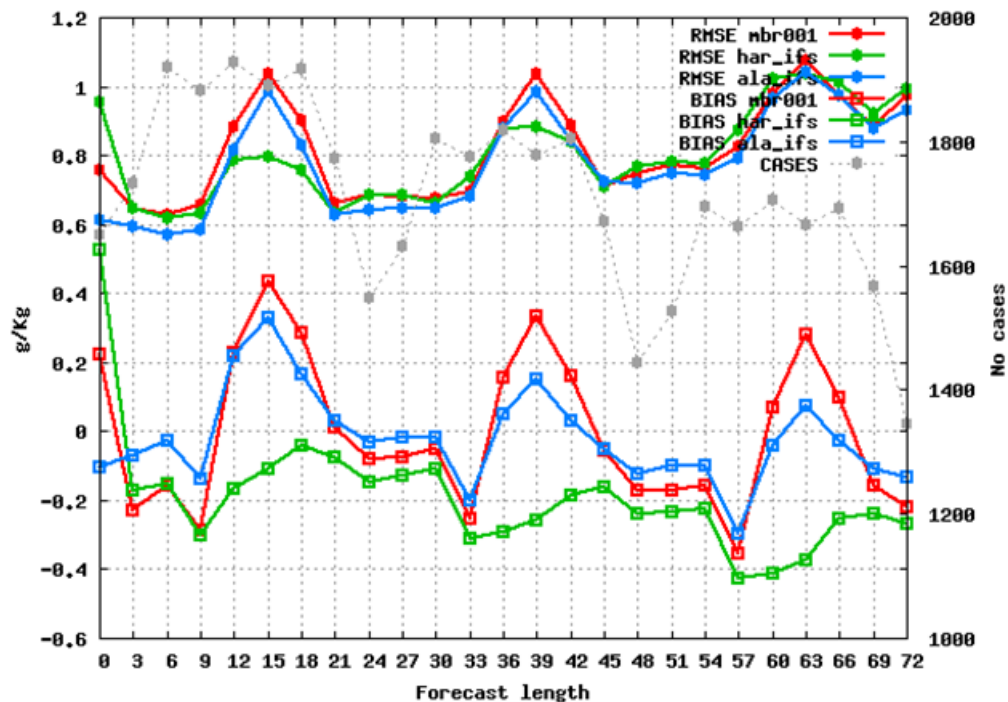


Deterministic verification: IFS BCs

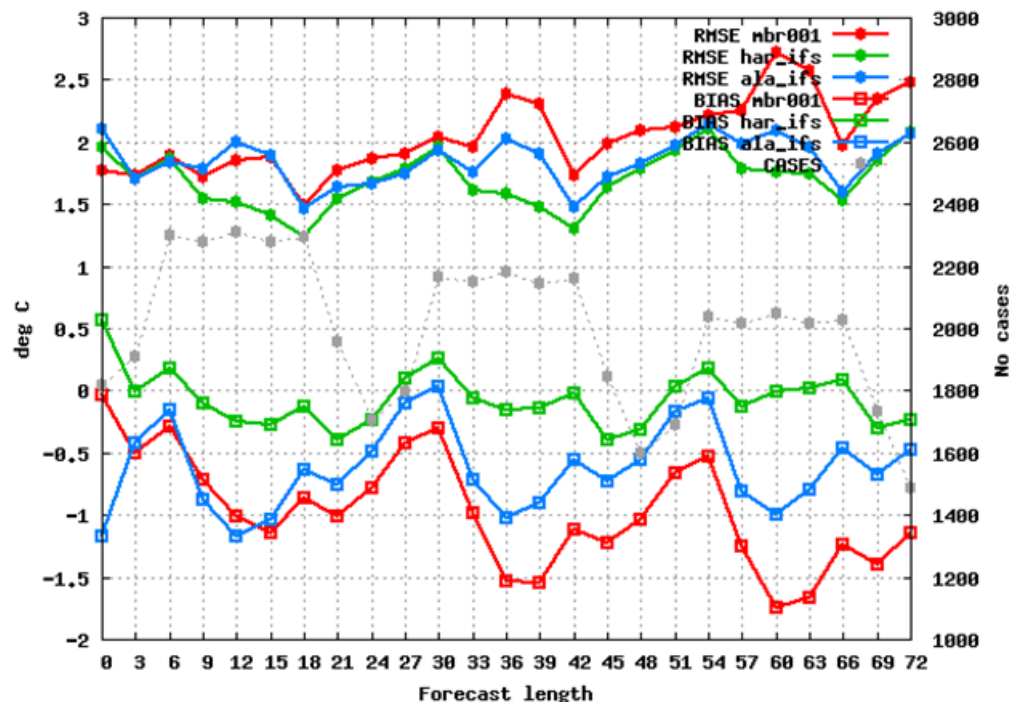
Q2m

T2m

Selection: ALL using 118 stations
Q2m Period: 20250201-20250219
Hours: {00}



Selection: ALL using 138 stations
T2m Period: 20250201-20250219
Hours: {00}

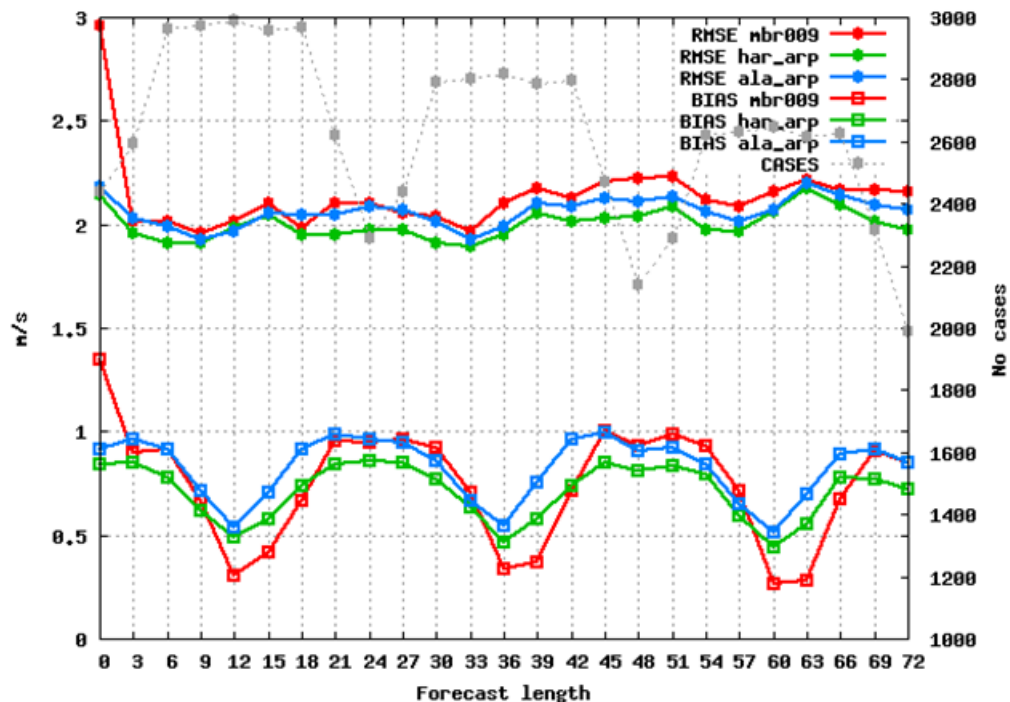


Deterministic verification: ARPEGE BCs

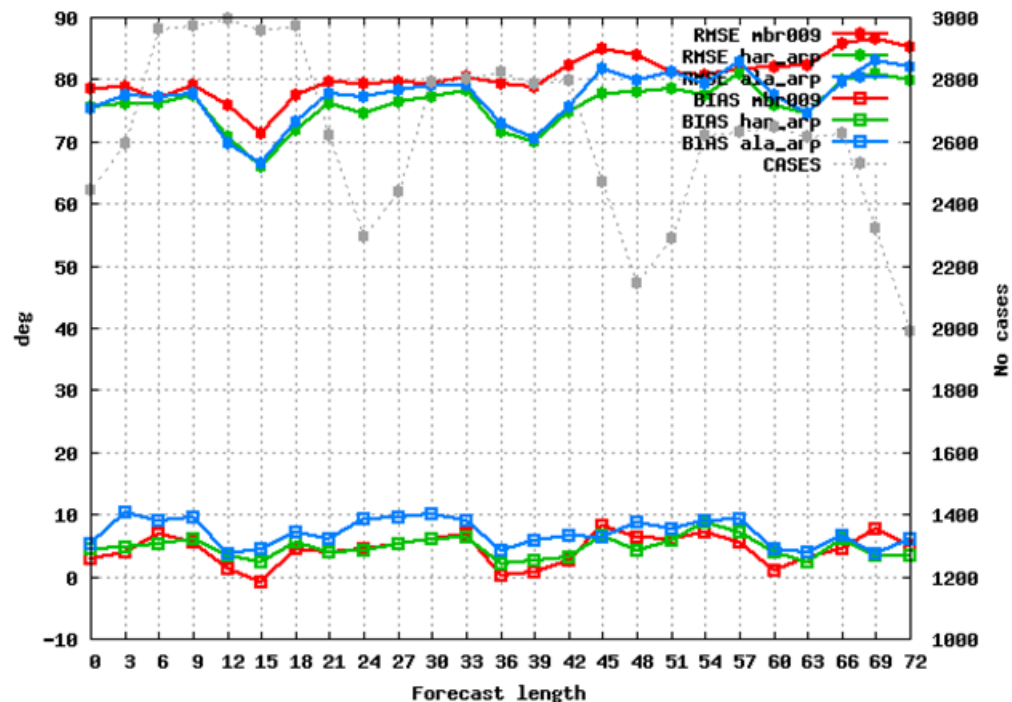
S10m

D10m

Selection: ALL using 177 stations
U10m Period: 20250201-20250219
Hours: {00}



Selection: ALL using 177 stations
Wind direction Period: 20250201-20250219
Hours: {00}

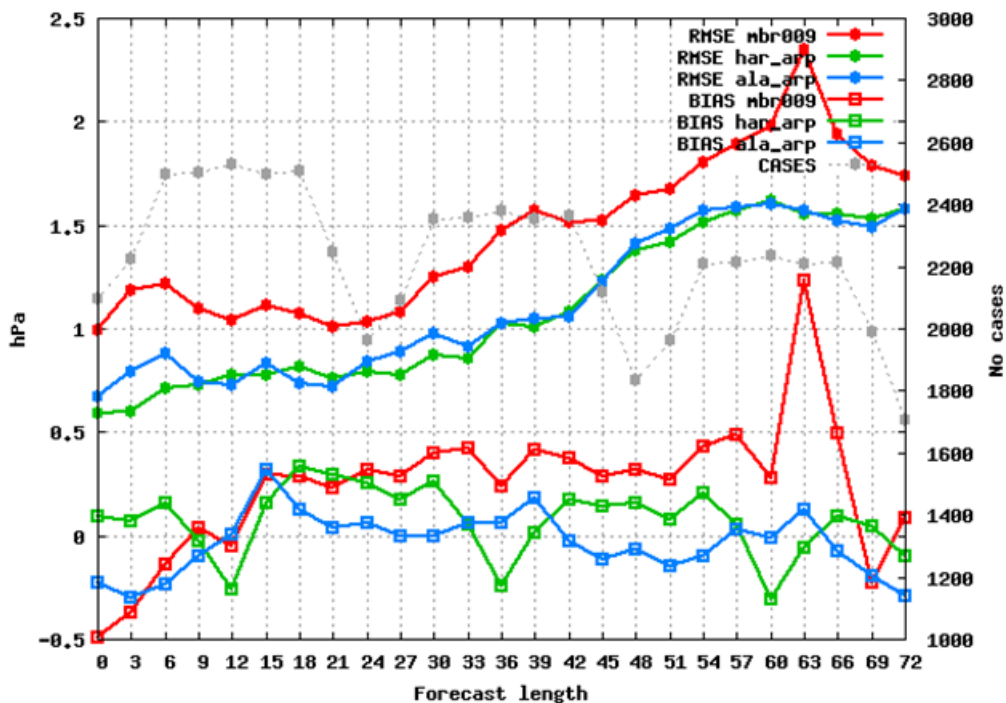


Deterministic verification: ARPEGE BCs

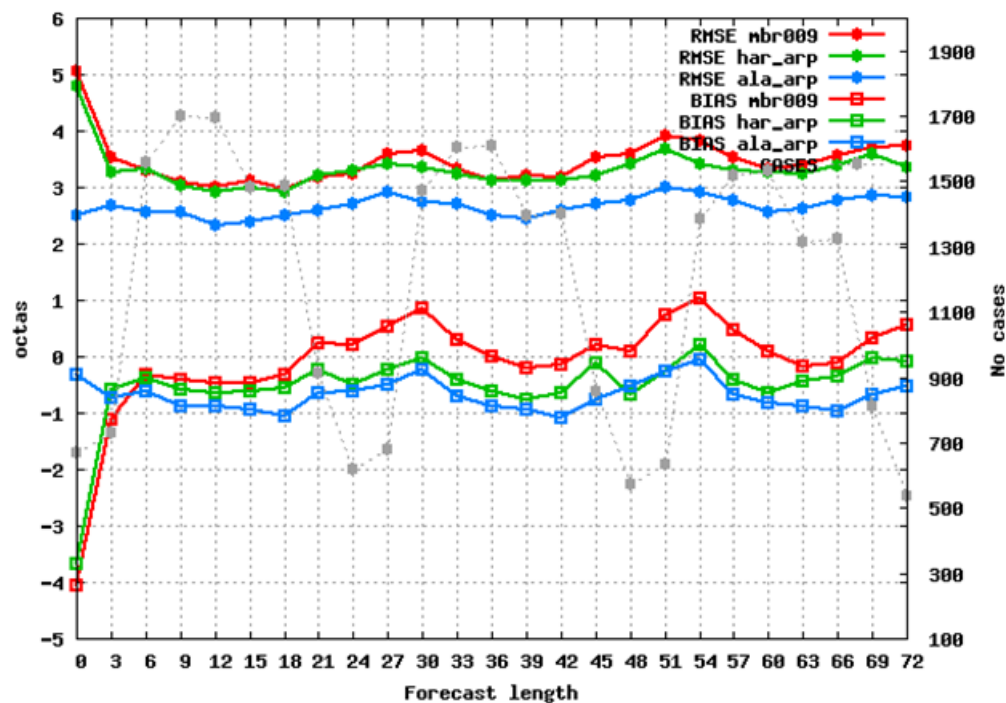
MSLP

CC

Selection: ALL using 150 stations
Mslp Period: 20250201-20250219
Hours: {00}



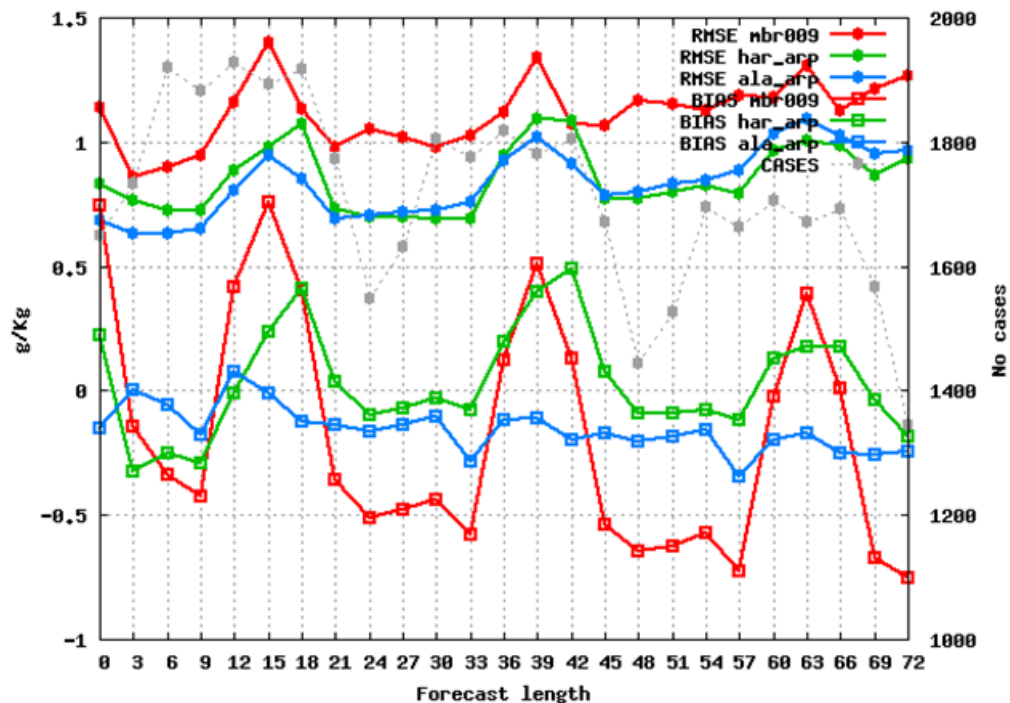
Selection: ALL using 127 stations
Cloud cover Period: 20250201-20250219
Hours: {00}



Deterministic verification: ARPEGE BCs

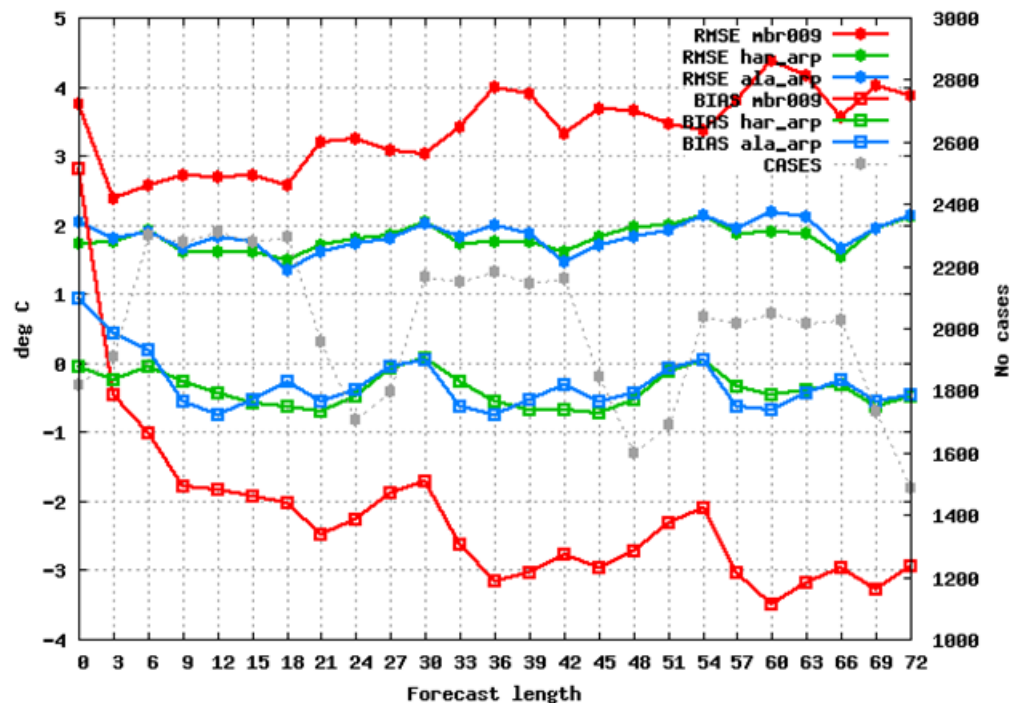
Q2m

Selection: ALL using 118 stations
Q2m Period: 20250201-20250219
Hours: {00}



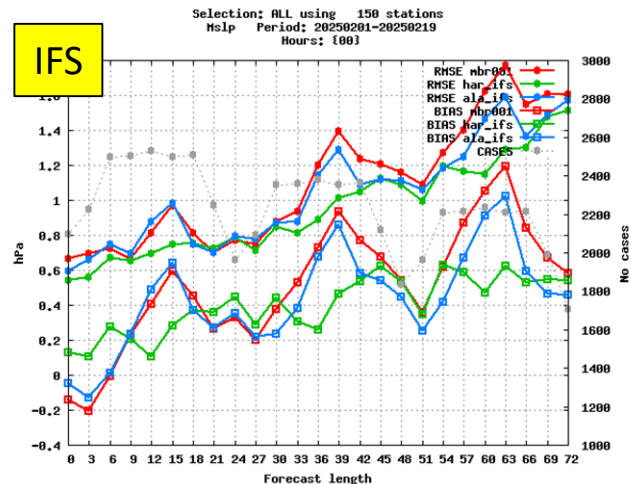
T2m

Selection: ALL using 138 stations
T2m Period: 20250201-20250219
Hours: {00}

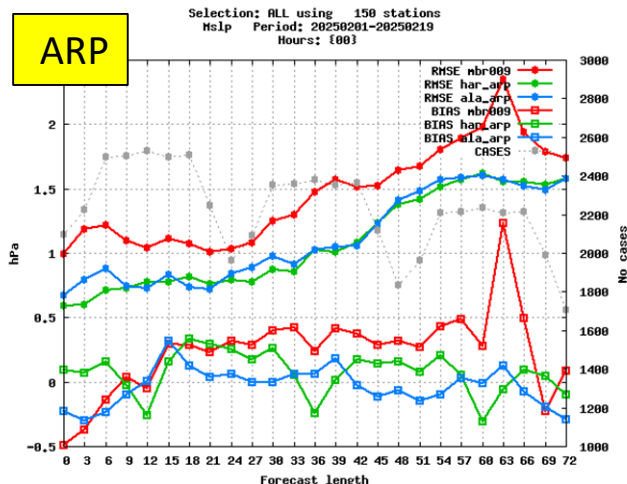


BCs summary: MSLP scores

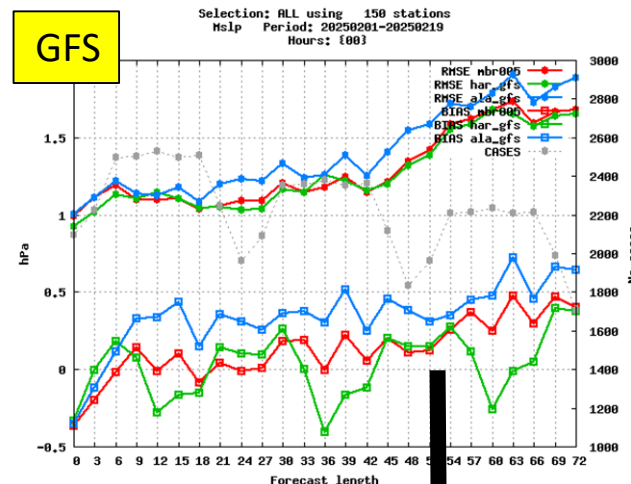
IFS



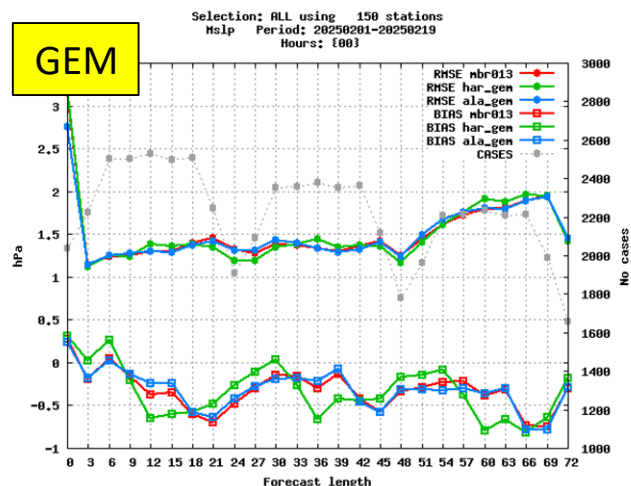
ARP



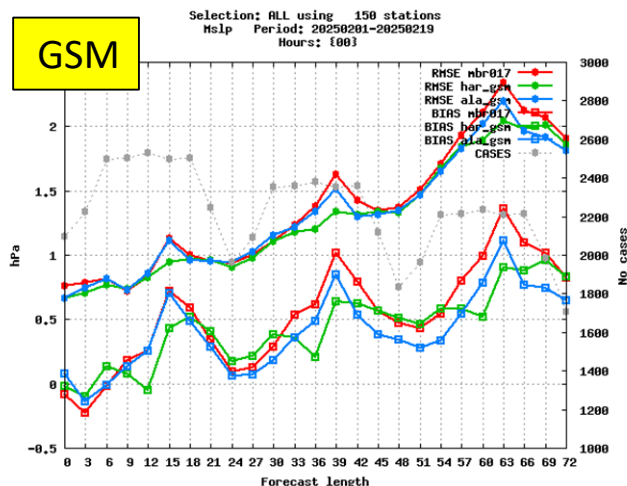
GFS



GEM

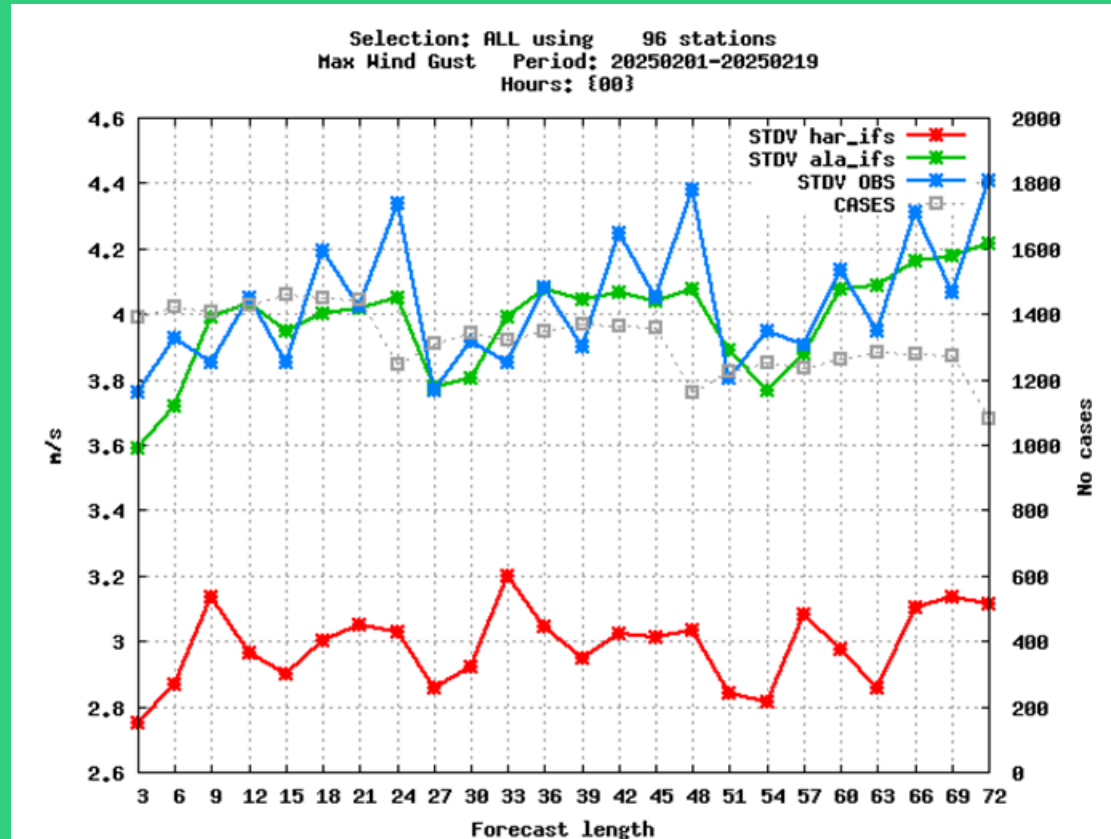


GSM



Bias in Alaro due to an issue with humidity in the vertical?

MaxWind Gusts in CY46



MaxWindGust are much better for ALARO! These are IFS BCs

Verification IFS BCs relative to Cy40 HARMONIE

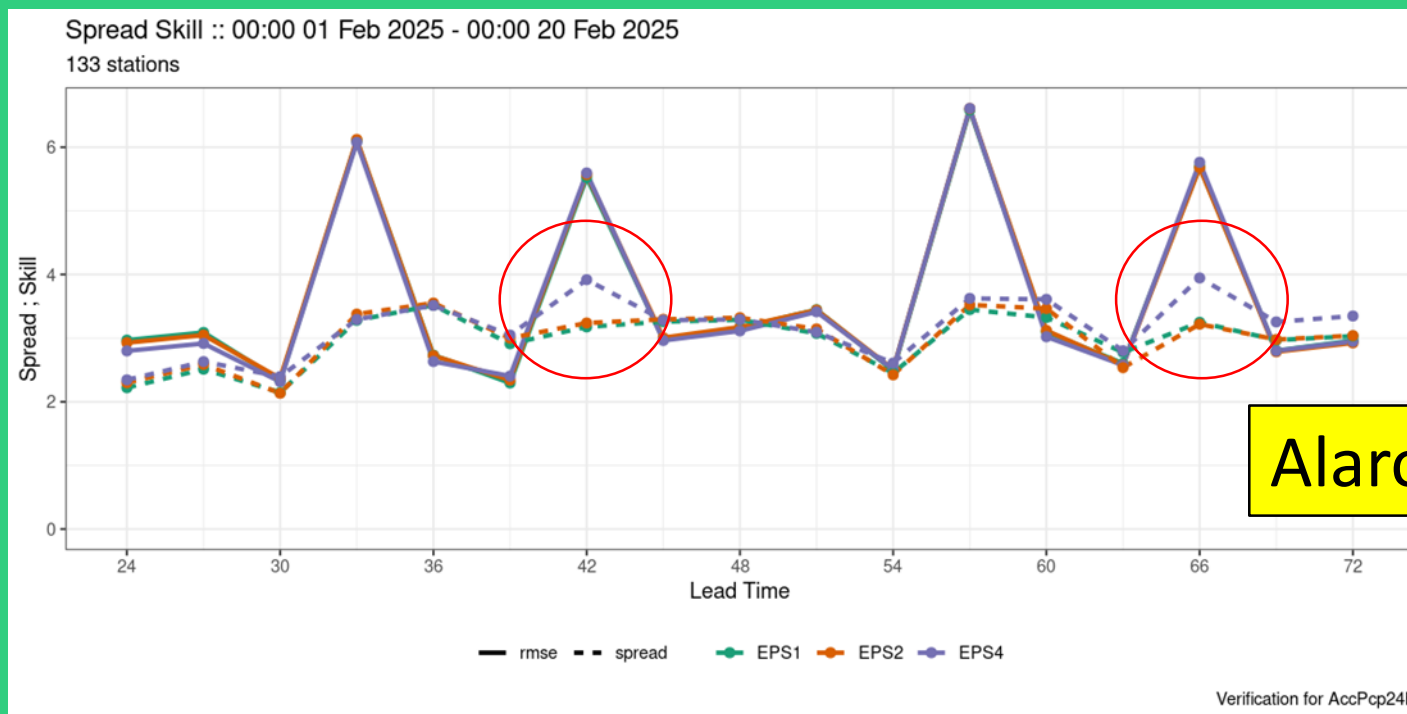
	Cy46 HARMONIE		Cy46 ALARO	
	RMSE	BIAS	RMSE	BIAS
S10m	++	+	+	=
D10m	+	=	=	-
MSLP	++	++	+	+
CC	=	-	++	--
Q2m	++	=	+	+
T2m	++	++	+	+
PCP24	Both better for mean thresholds and HARMONIE more better			
MaxWindGust	Don't have it in CY40 but ALARO much better than HARMONIE			

Probabilistic verification

- Same forecasts as deterministic verification
- EPS1: 15 members: 5WRFs, 5NMMBs, 5HarCy40
- EPS2: 15 members: 5WRFs, 5NMMBs, 5HarCy46
- EPS4: 20 members: 5WRFs, 5NMMBs, 5HarCy46, 5AlaroCy46
- Spread – skill diagrams

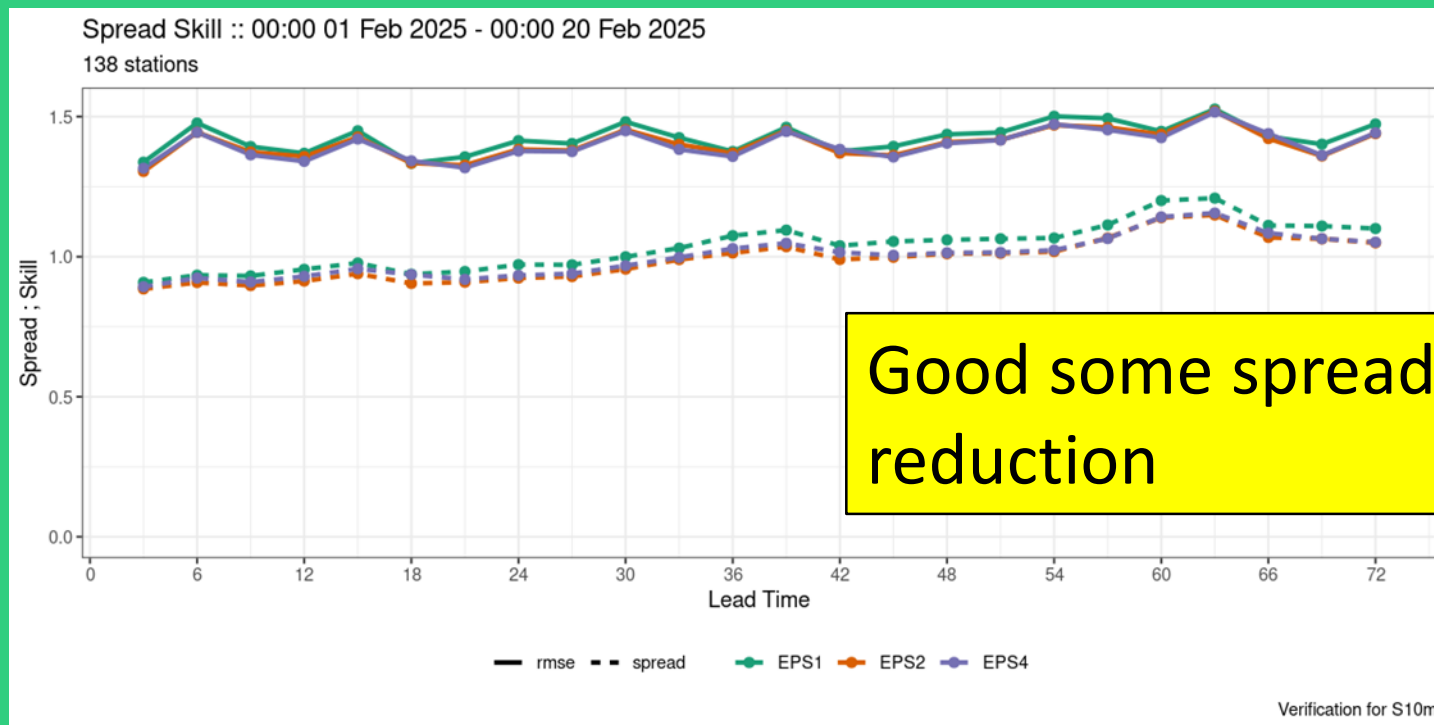
Probabilistic verification

AccPcp24



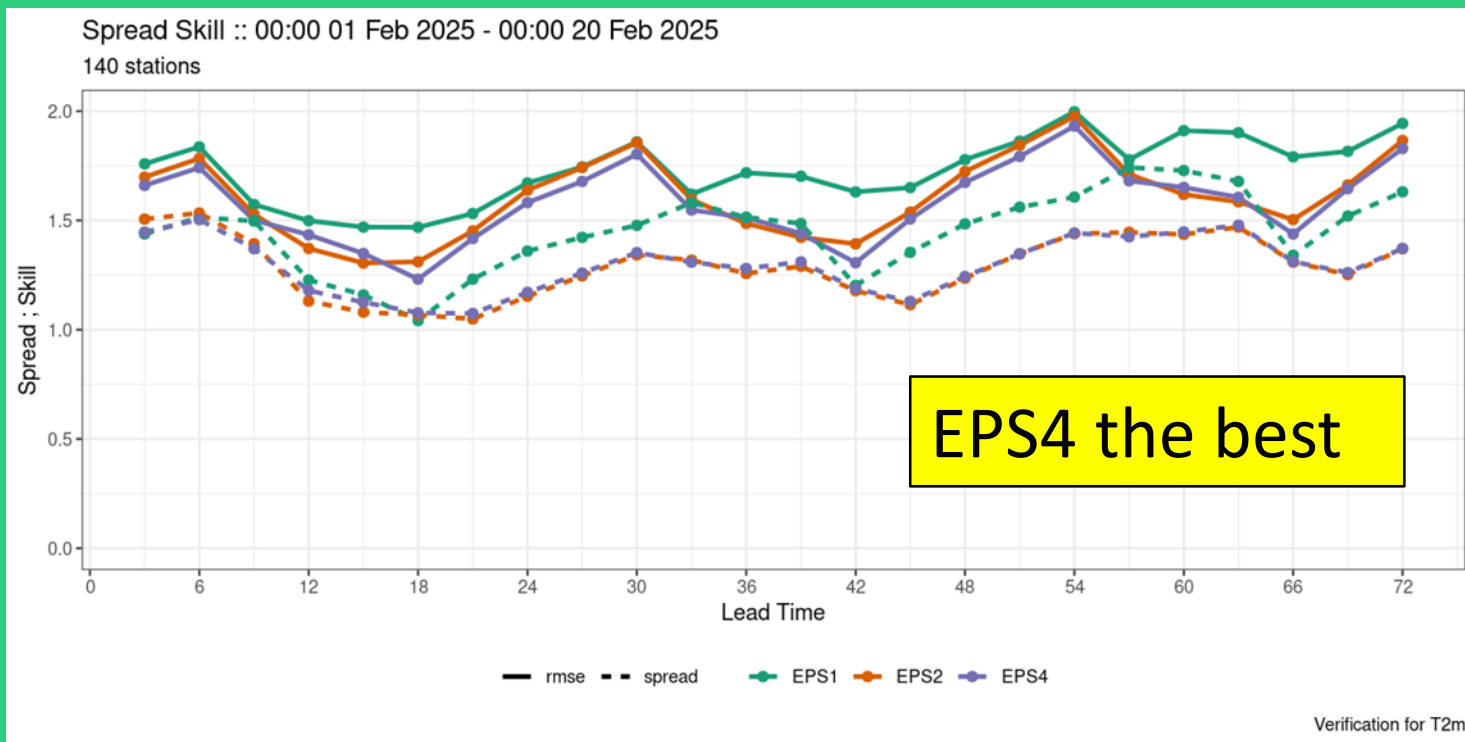
Probabilistic verification

S10m



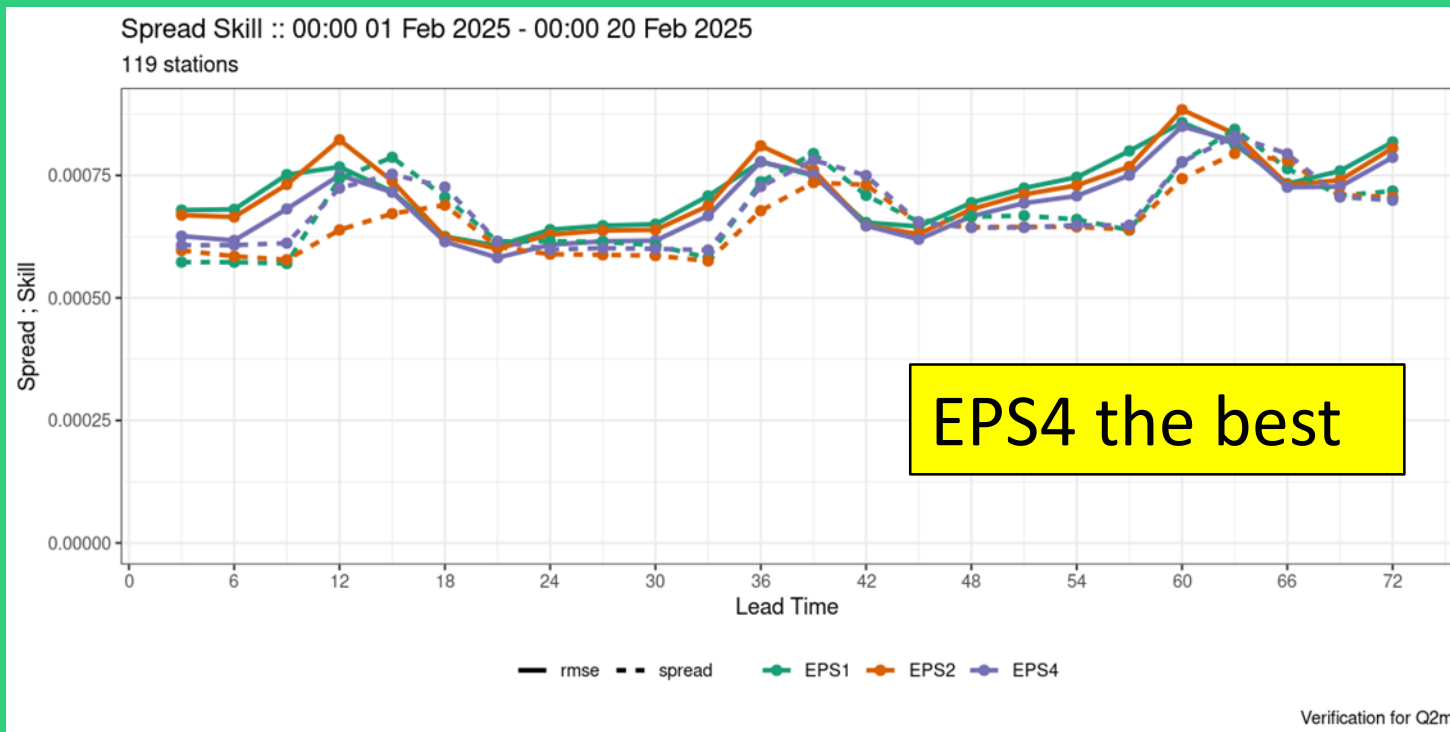
Probabilistic verification

T2m



Probabilistic verification

Q2m

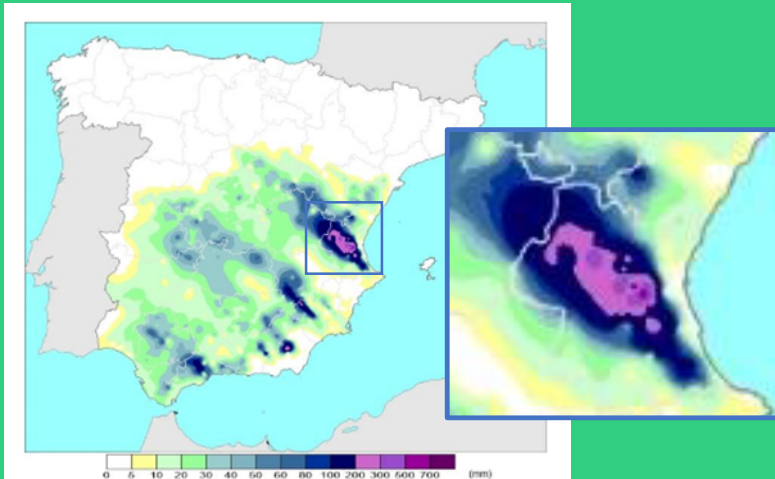


Objective verification of Cy46

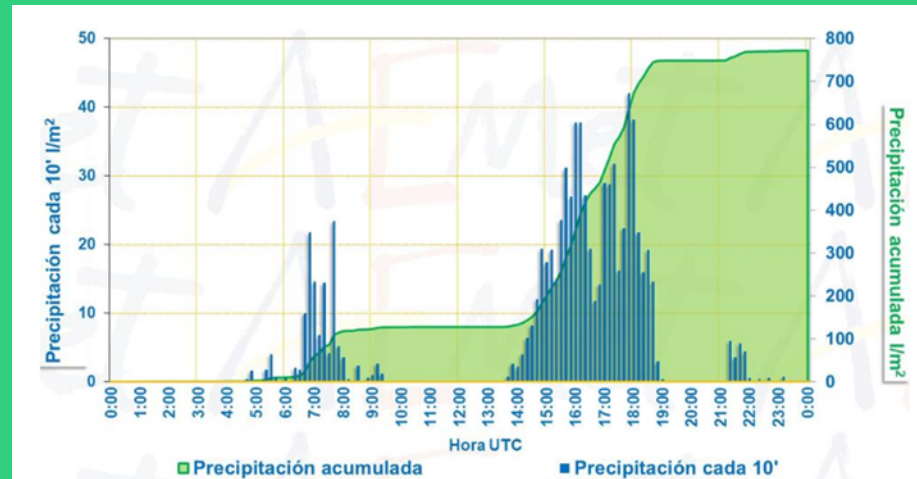
- Verification relative to Cy40 indicates IFS and ARPEGE give similar improvements (see Table in slide 22), clearly larger in ARPEGE due to the change from PL2ML. GEM and GSM have also similar improvements, not so large.
- It seems there is some issue with GFS probably related with humidity in the vertical resulting in too large FAR and MSLP bias for Alaro. To be checked and fixed.
- Spread-skill for some screen level parameters shows EPS4 (20 members including Alaro Cy46) has the best scores.

“Dana de València”, on 29 October 2024

- A deep low level pressure in high levels triggered a torrential rain that provoked more than 220 death people south of Valencia city, due to the sudden flooding by the small rivers. [Complete description \(in spanish\)](#)

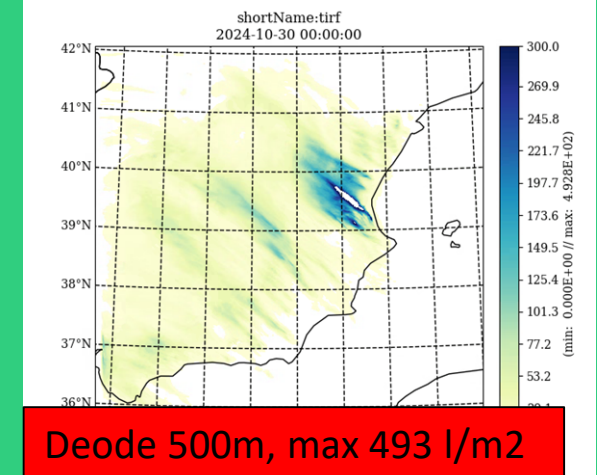
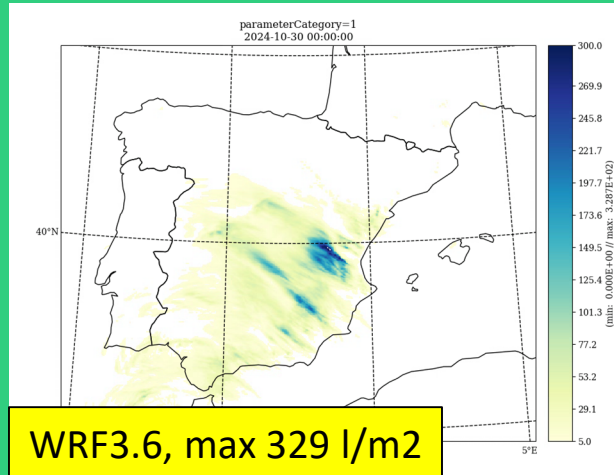
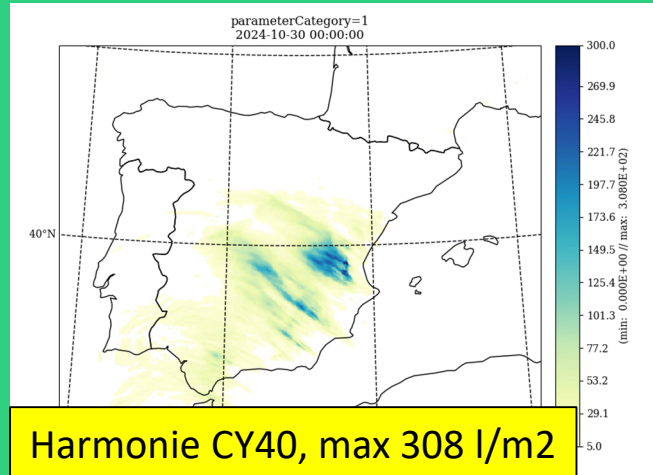
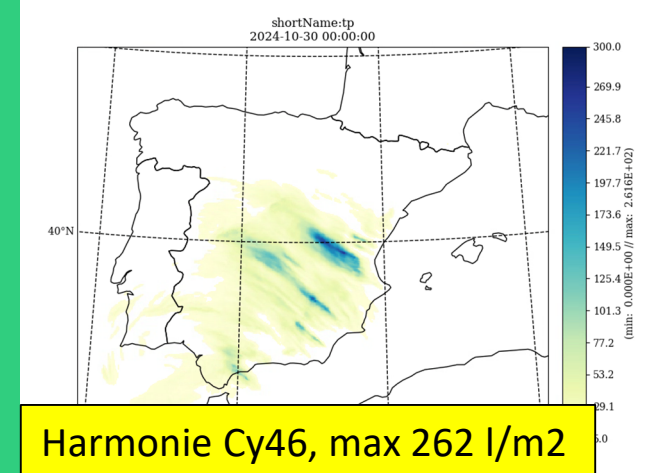
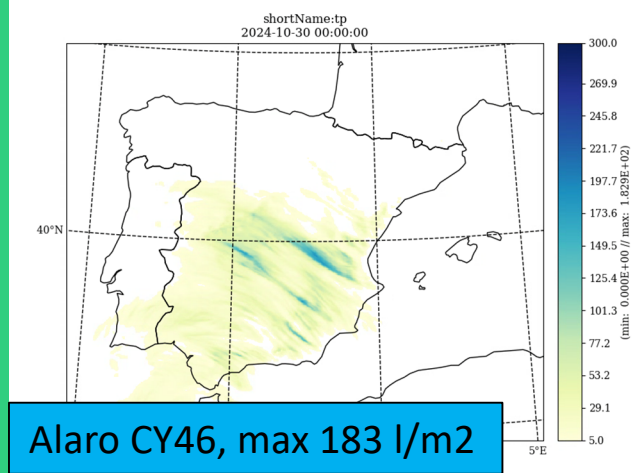
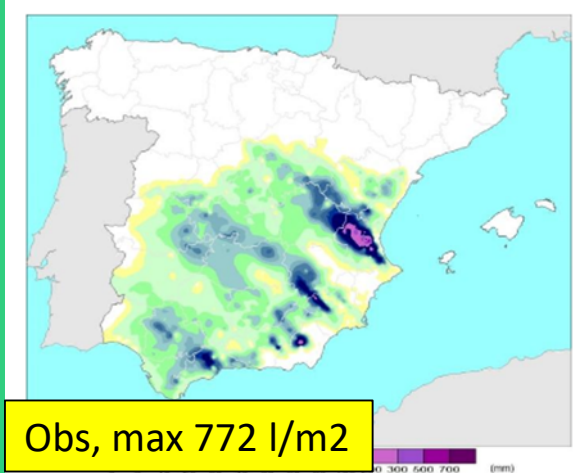


Map of accumulated
Precipitation for day 29/10



Daily observed precipitation in AEMET Turis station. Up to **772 l/m² accumulated in 24h.**
1h max 184 l/m² and 6h max 620 l/m²

“Dana de València”. H+24 AccPrec24 Forecasts IFS BCs



“Dana de València”, on 29 October 2024

- Very limited evaluation. Having a better diagnostics here (SAL, FSS, ...) and more similar cases would help to draw better conclusions. Said that:
- Clear relationship of the amount of rain with the spatial resolution (Deode run at 500 m, the best, almost 500 l/m²), for this extreme case. Still not enough...
- The structure of the precipitation seems well predicted by all Forecasts. With respect to the amount, Alaro CY46 gives the lowest one. Is this significative? Could be improved via namelist?
- Objective verification showed better scores in Cy46 –vs- CY40 for mean thresholds (10-20 l/m²), while seems the oposite for extreme threshods. Is this significative? Could be improved via namelist?

THANK YOU