

LETKF with a like-operational HARMONIE-AROME in AEMET

**Pau Escribà. AEMET Catalonia
HIRLAM-ALADIN All Staff Meeting
April 1th to 4th 2019. Madrid**



OUTLINE

- **Operational 3DVAR in AEMET and like-operational LETKF / 3DVAR comparison**
- **Period of study: October 2018 and SpinUp**
- **Some diagnostics and Verification**
- **Sant Llorenç d'Escardassar case**
- **Further work**
- **Summary**

Basics of Operational 3DVAR in AEMET

- **Observations assimilated:**

Conventional (SYNOP, DRIBU, BUOYS, TEMP, AIRCRAFT, PILOT and GNSS)

ATOVS (AMSUA and AMSUB)

- **Geometry is:**

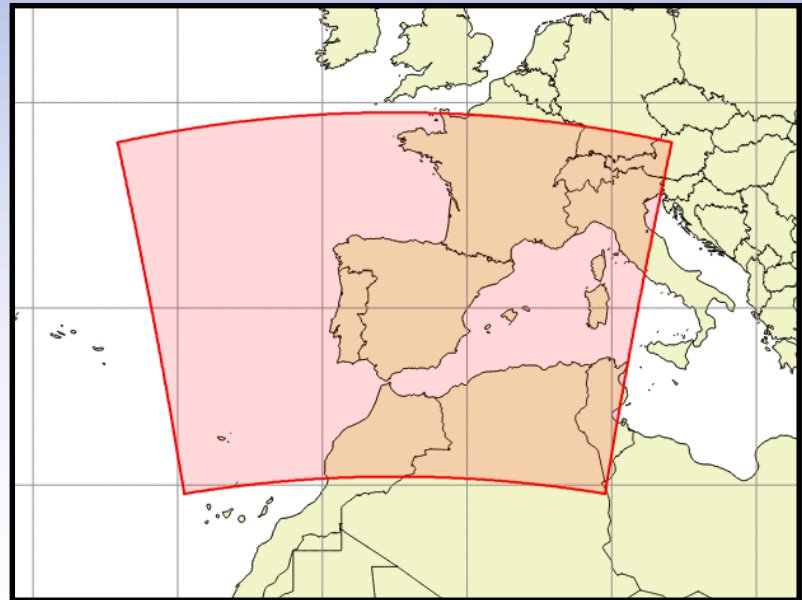
NLON=1152

NLAT=864

NLEV=65

2.5 km RESOLUTION

- **HARMONIE 40h11 tag**



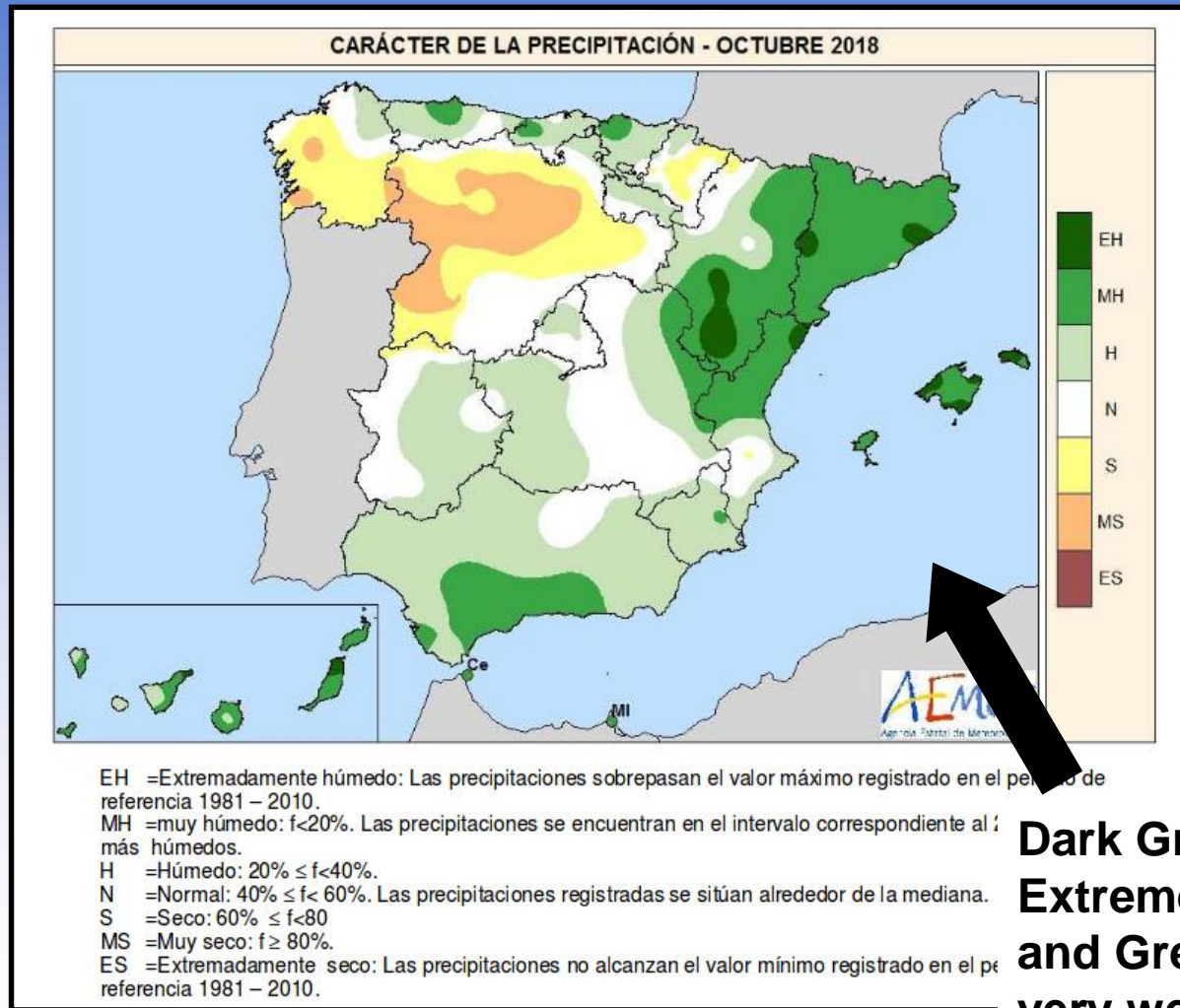
Basics of like-operational LETKF / 3DVAR comparison

- All observations like operational **plus assimilation of Rh2m&T2m** observations (LSOE=.FALSE.) and **LSMIX** of **U, V, T and Q**.
- **10 ensemble members**, as “cheap” basic LETKF configuration.
- **tag 40h111 of HARMONIE-AROME** for both LETKF and 3DVAR.
- I have run 3 hour assimilation cycles and 36 hour forecasts for 00, 06, 12 and 18 UTC cycles for all **October 2018**. For SpinUp, the whole September.

Period of study: October 2018 (Disaster in PCP)

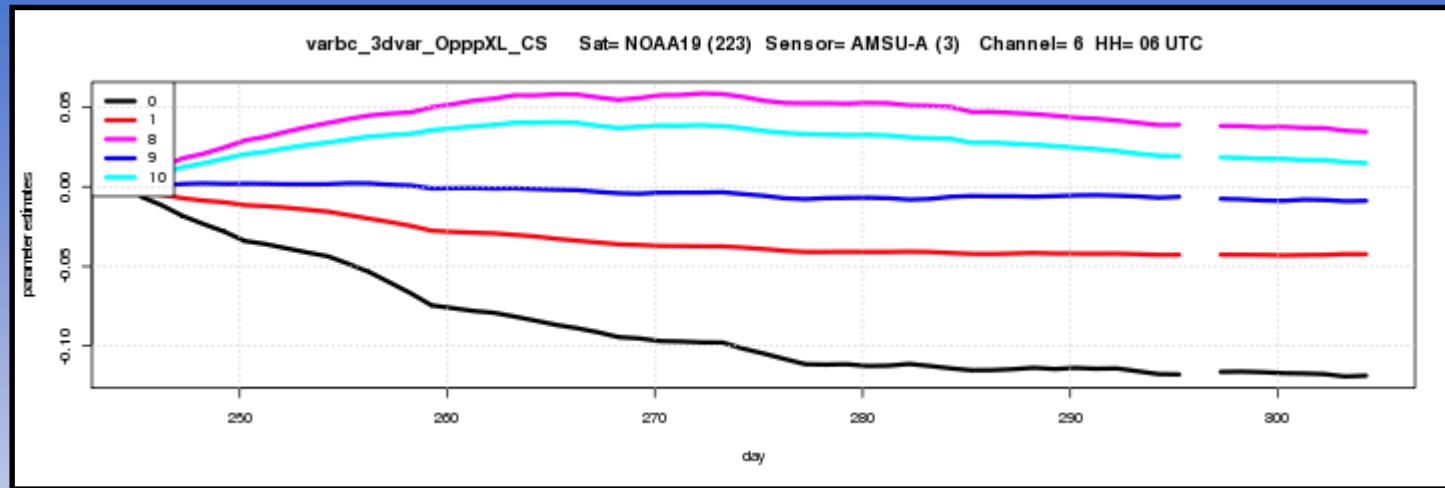
- **October 2018** has been in Spain a dramatic month with respect to Precipitation. 4 big cases:
 - **Sant Llorenç des Cardassar (Majorca):** 13 people death. **Models couldn't forecast the extreme convective system**
 - **Leslie Ex-Hurricane** crossing all Iberian Peninsula, causing also many death people in the South East of France
 - **Mediterranean “Llevantada”** easterlies, red alarm in Valencia Region with more than 300mm
 - **Malaga stationary convective case** with one death person and again more than 300 mm

Period of study: October 2018 (Disaster in PCP)



**Dark Green is
Extremely wet
and Green is
very wet...**

SpinUp VARBC for ATOVS (and GNSS)



Nice convergence of predictors for Channel 6 of AMSUA on NOAA19.

Here 2 months of data, 1 month for SpinUp and 1 month for verification

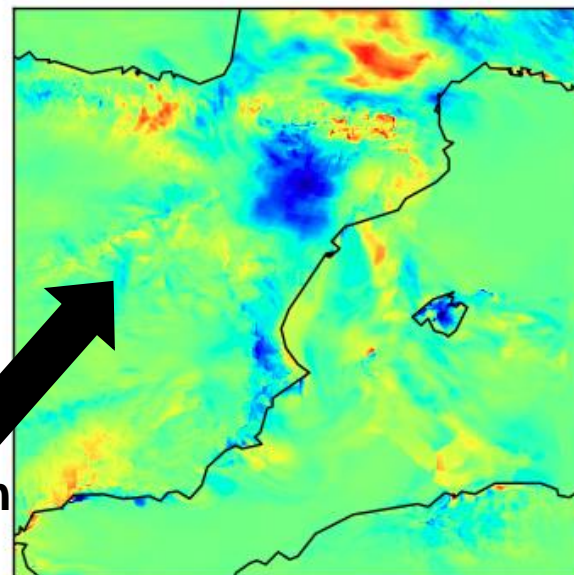
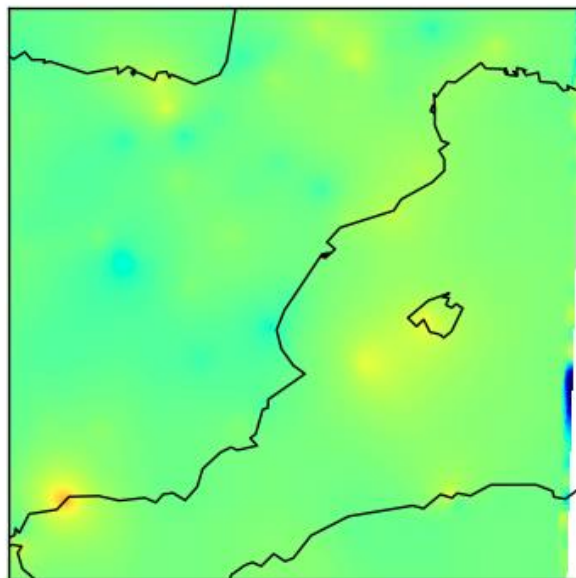
Verification Period

With respect to **GNSS**, careful diagnosis of VARBC convergence has not been done due to technical difficulties. I follow the idea of “one month of SpinUp is enough”. Although better diagnosis is needed, **based on previous experiments, I don't think this can affect the main results of our comparison.** Besides, in both 3DVAR and LETKF, VARBC.CYCLE file is the same...

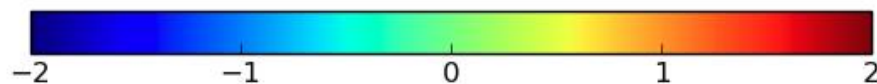
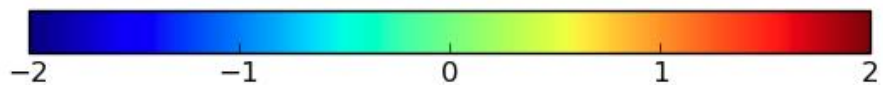
Some diagnostics: analysis increments of T65

3DVAR

LETKF

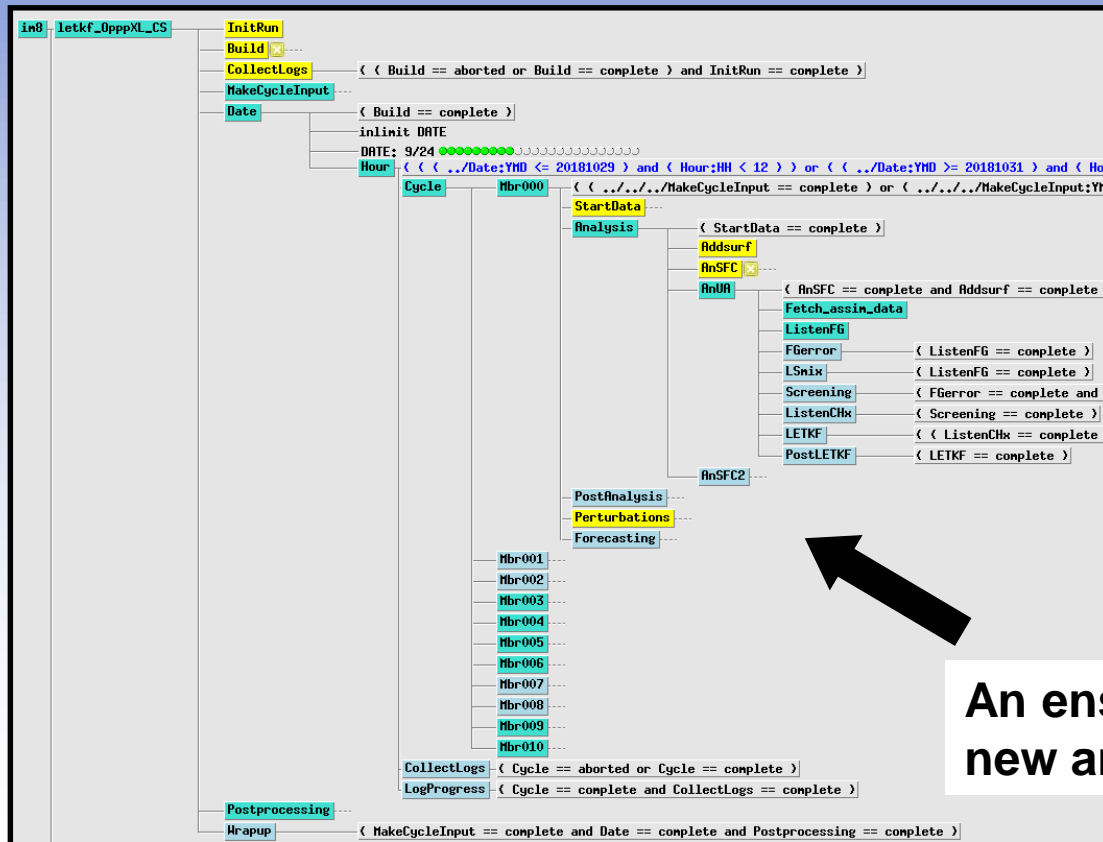


Better definition
of orographic
features



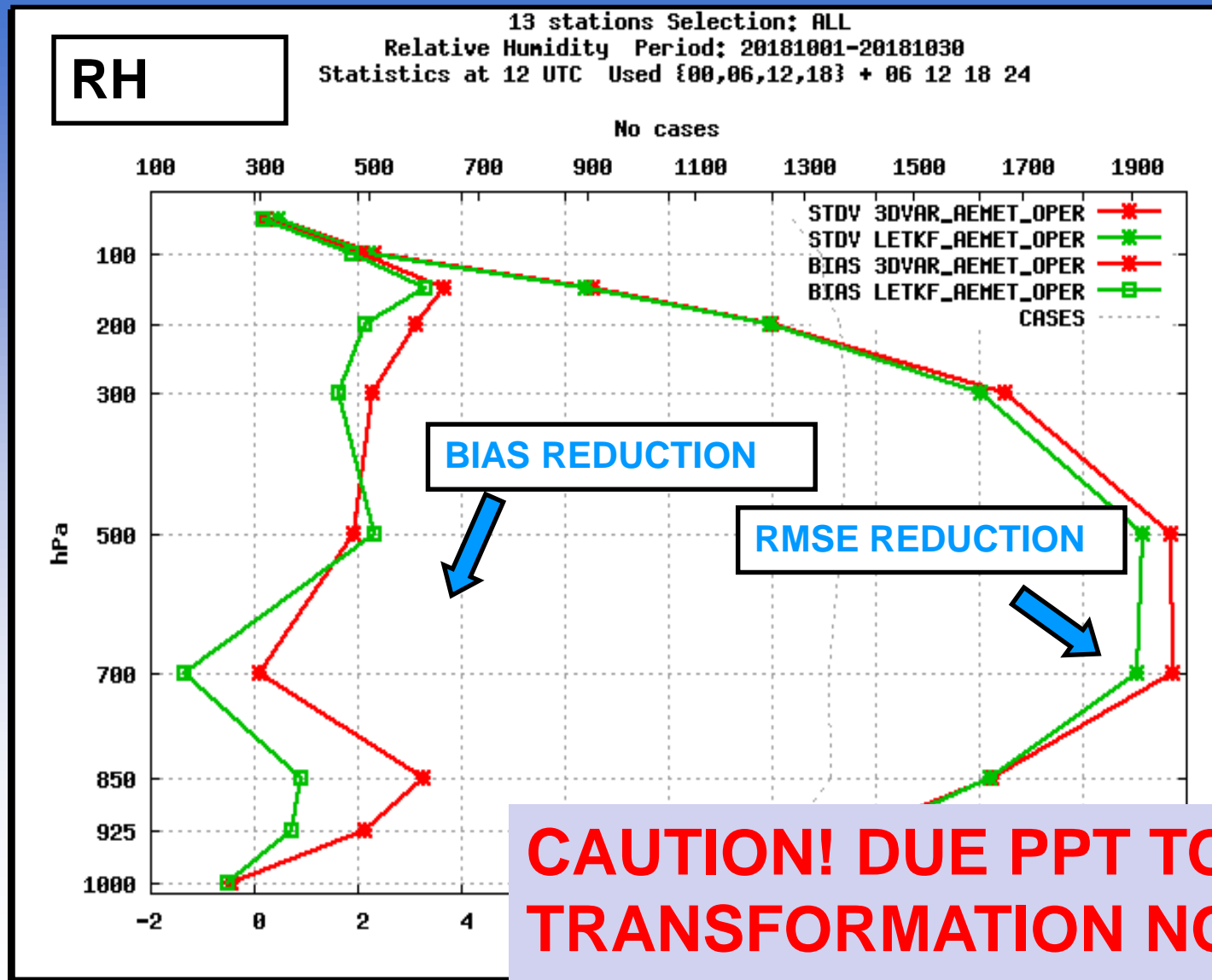
Some diagnostics: computational costs

- In terms of SBUs on ECMWF HPCF, an **LETKF with 10 ensemble members** costs as **9 3DVAR** analysis cycles



Verification

3DVAR
LETKF



CAUTION! DUE PPT TO PDF
TRANSFORMATION NOT ALL
PLOTS SHOWN HERE...

Sant Llorenç des Cardassar case (Majorca)

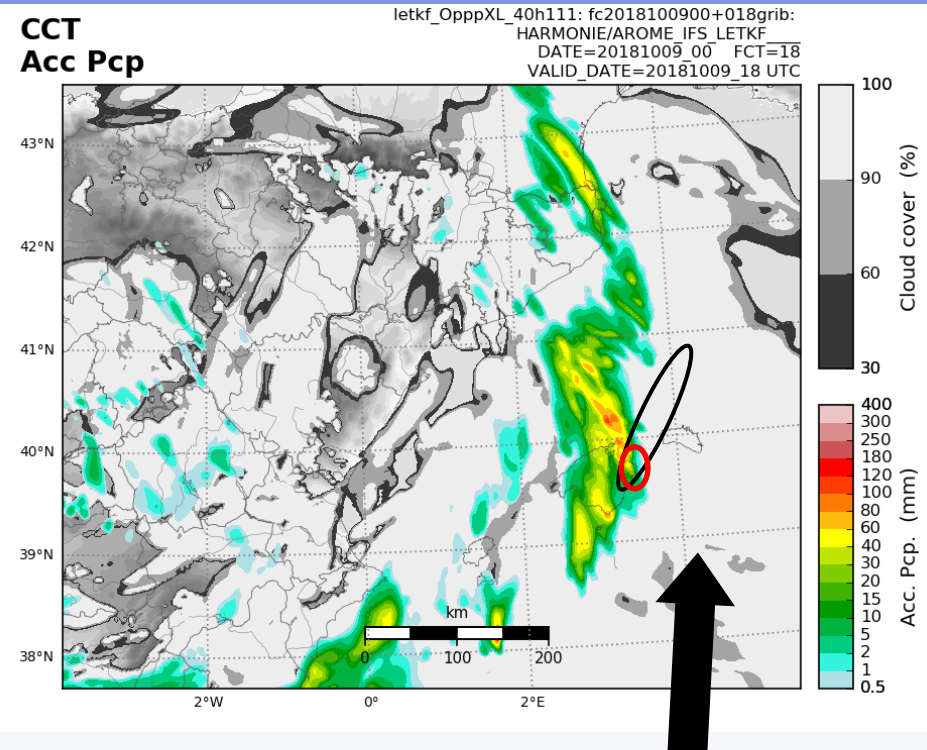
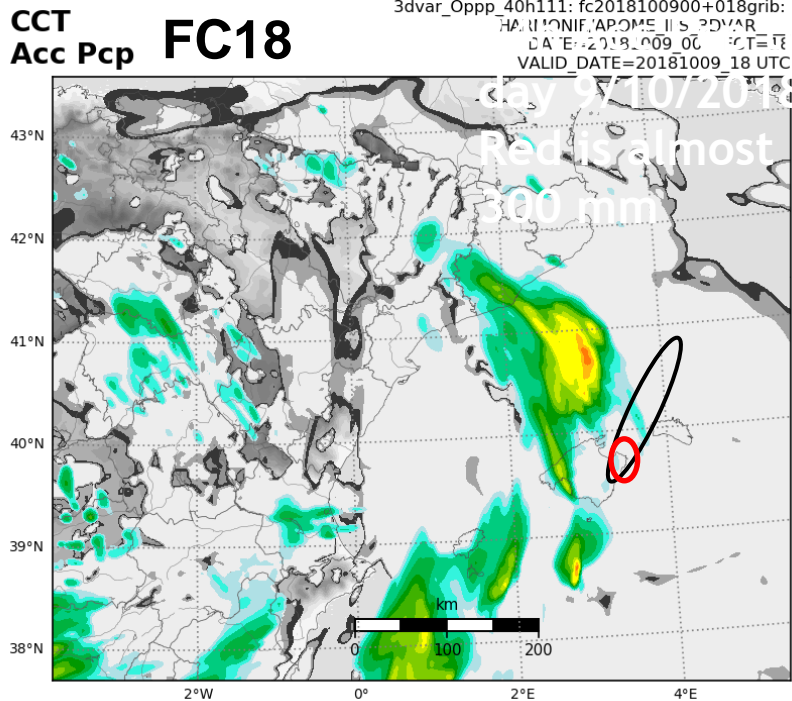
Sant Llorenç Baisin ○

Radar Maximum Acc Pcp ○

3DVAR

2018100900 run

LETKF



**CAUTION! DUE PPT TO PDF
TRANSFORMATION NOT
ALL PLOTS SHOWN HERE...**

Could be by chance (I don't think so!)...
but **LETKF is CLOSER in SPACE**
and **in AMOUNT TO OBSERVED PCP**

Further work

- **Thinking in EPS mode and AEMET-gSREPS!! (see Alfons Callado's presentation on Thursday)**
- **Problem of coupling LETKF and SURFACE?**
- **Test SPP with LETKF**
- **Test other periods climatically independent**
- **Test hybrid 3DVAR/LETKF configuration**
- **Working week in DWD? (obs errors, radiances bias correction...)**

SUMMARY: 1 month verification (October 2018)

- **LETKF is better:**
 - **Clear reduction of RMSE for RH2M and slightly for T2M**
 - **U10M and G10M slightly reduction of BIAS and RMSE**
 - **Clear reduction (significant) of RH or Q error in the vertical**
 - **Slightly reduction of T and Z error in the vertical**
- **3DVAR is better:**
 - **RH2M and T2M bias (to be investigated)**
 - **High thresholds for U10M**
 - **CC and MSLP less bias**
- **LETKF better in PCP for all thresholds except for very high threshold for PCP6 and PCP12, which are degraded. Neutral impact on Wind in the vertical**

SUMMARY

- **Subjective verification of the dramatic non-modelled Sant Llorenç des Cardassar event (09/10/2018): LETKF gives better localization and intensity of observed convective precipitation, than 3DVAR. The event still not completely forecasted...**
- **All the results make LETKF a nice available algorithm to be used with HARMONIE-AROME either in deterministic and probabilistic mode.**
- **Further work for LETKF is planned.**

**Acknowledgements: Alfons
Callado, Joan Campins, Jana
Sanchez, Jelena Bojarova,**

SEE YOU IN BARCELONA

