

# Verification and Quality Assurance in HIRLAM-C Status 2019



## OUTLINE

- **Introduction**
- **Summary on Harmonie-Arome model issues in operational HIRLAM centres during Winter 2018-19.**
- **HIRLAM-C Users' Meeting : 2018 and 2019**
- **Outlook ?**

The RWP2019 on Quality Assurance for ALADIN & HIRLAM contains many important components mentioned further in ASM2019 :

**QA1** : New common objective verification developments in the framework of HARP



**QA2** : New shared developments of objective verification methods

**QA3** : Monitoring of the quality of Harmonie-Arome, e.g. from both objective and subjective verification in dialogue with Users of NWP

This presentation will focus mainly on

- Key forecasting issues in operational centres identified with forecasters during the winter season 2018-19 and possible consequences for future priorities.

## 1) Low level clouds and fog: A special challenge in winter 2018-19

Specific comments from forecasters on fog prediction:

**AEMET:** Many more forecast fog over sea than observed. - The model exaggerates the prediction of presence and extension of maritime advection fog (predicted fogs are in fact low clouds)

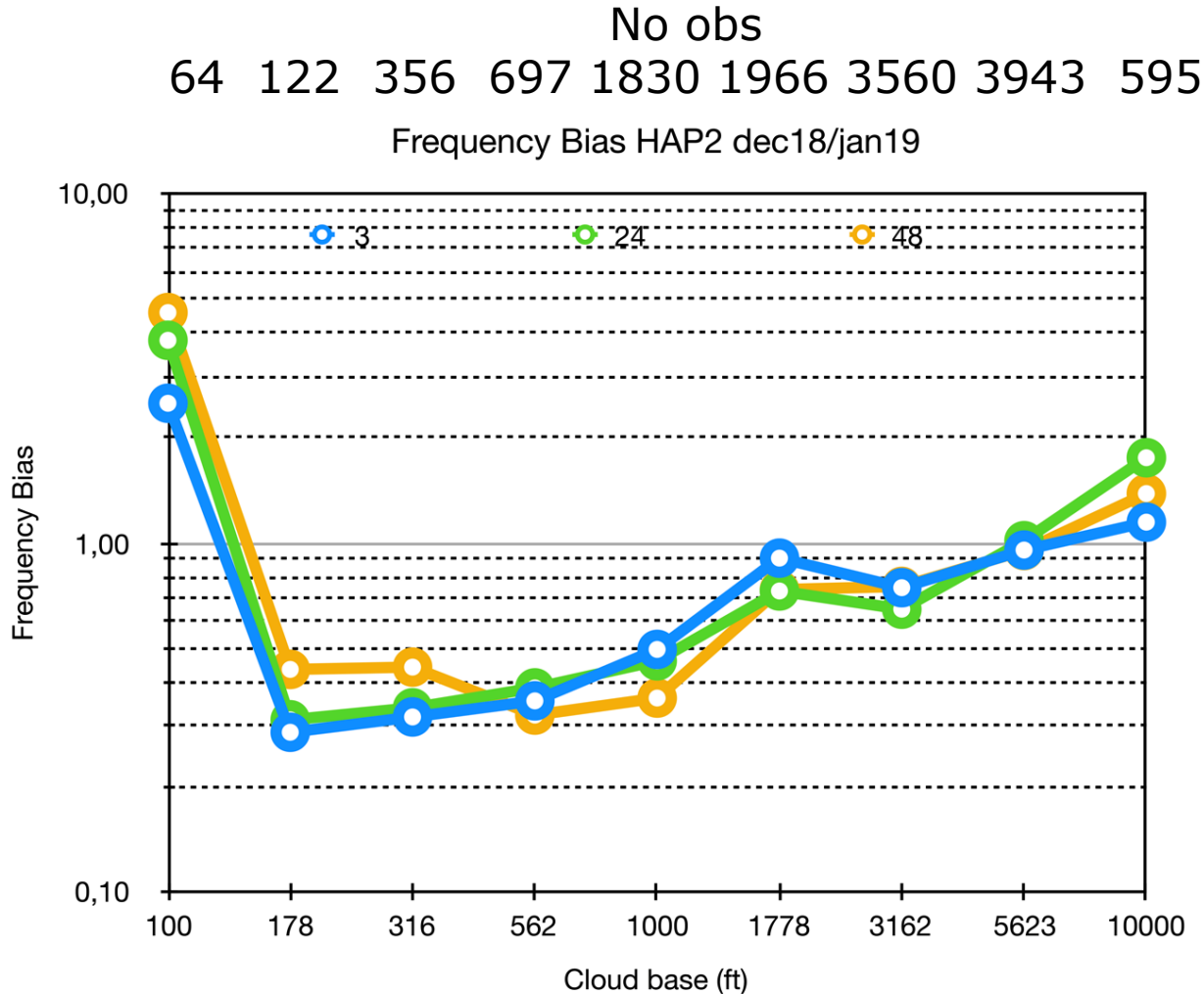
**DMI :** Forecaster at DMI: “It looks like HARMONIE has problems with high pressure/low inversion. The temperature may drop below 0°C in the middle of the day, e.g. over the sea, making it difficult to rely on clouds/visibility. This is a type of problem we have seen earlier over the years , - thought this problem was cured !”

**MetEireann:** Sea fog extent can be overestimated sometimes drastically so. Radiation and frontal fog events tend to be quite well forecast but again a tendency towards overestimation. Again this may link to cloud cover forecasting issues. In the moist high pressure in the days around Christmas, model guidance was particularly poor

# Key forecasting issues in operational centres identified with forecasters during winter season 2018-19



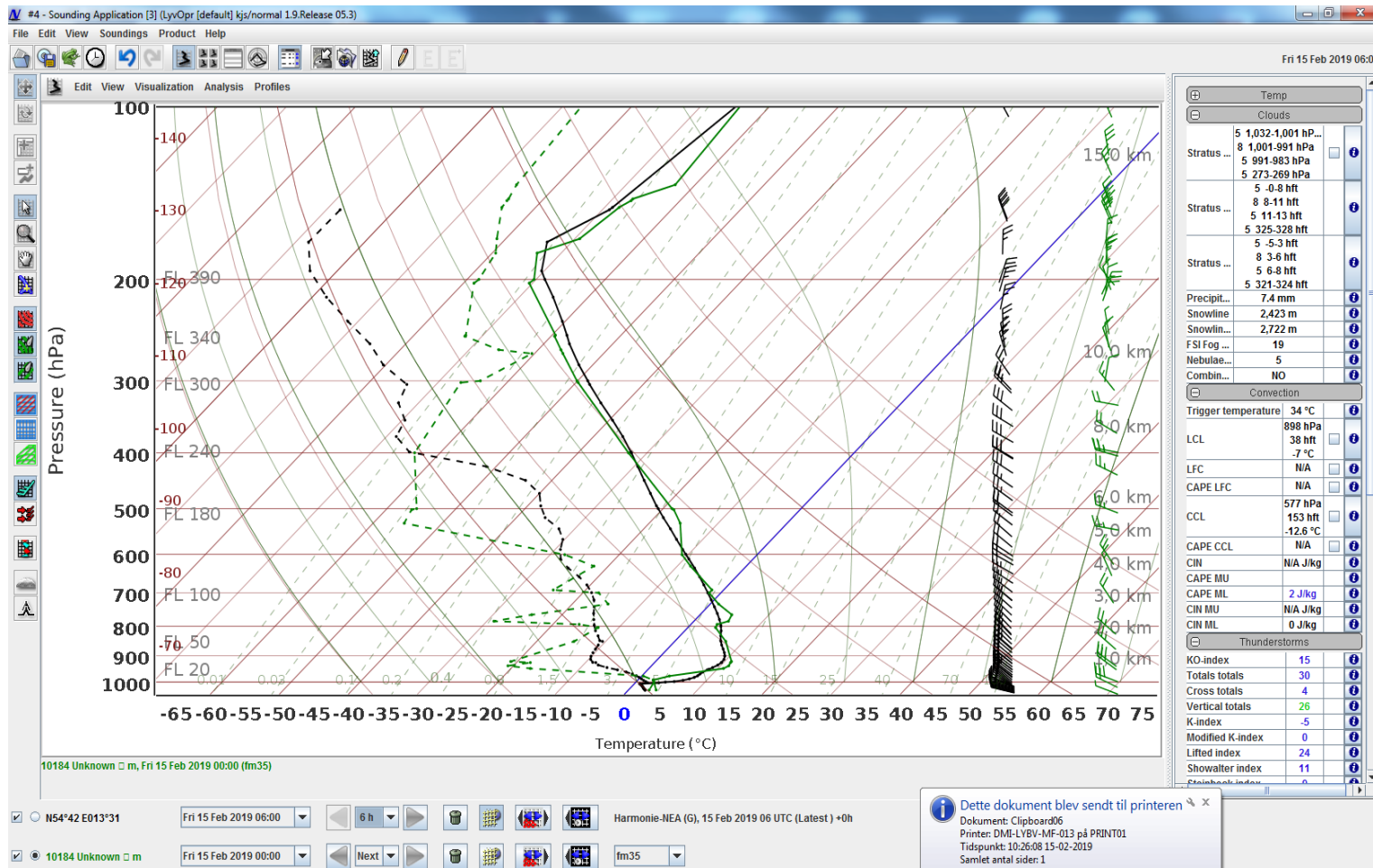
## 1) Low level clouds and fog: A special challenge in winter 2018-19



Frequency bias of cloud base (ft) verified over the Netherlands. The 3 curves apply to forecast lengths of 3 h (blue) , 24 h ( green) and 48h (yellow) respectively.

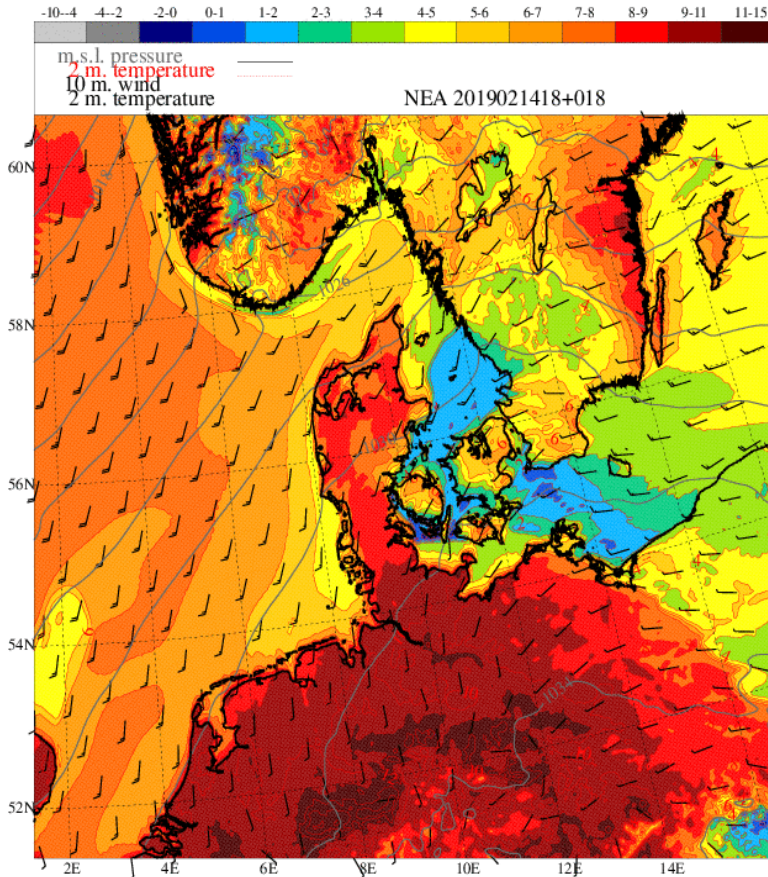
(From sander Tijm 2019)

# Example of strong inversion conditions over Denmark



Model sounding (black) and measured sounding (green) for 15 February 2019, at a location in southern part of Denmark. The model has produced a non-precipitating fog layer.

# Key forecasting issues in operational centres identified with forecasters during winter season 2018-19



On the same day (15/2 2019 ) low model temperatures predicted by the DMI Harmonie-Arome were prevailing in some sea areas in southern Scandinavia

Cooling of the fog has been possible in day time due to radiative cooling of the fog layer. The model precipitation is zero.

The real 2m temperature over the sea at 12 UTC 15/2 was ~around 2°C , in the model it is around 0 °C .

# Key forecasting issues in operational centres identified with forecasters during winter season 2018-19

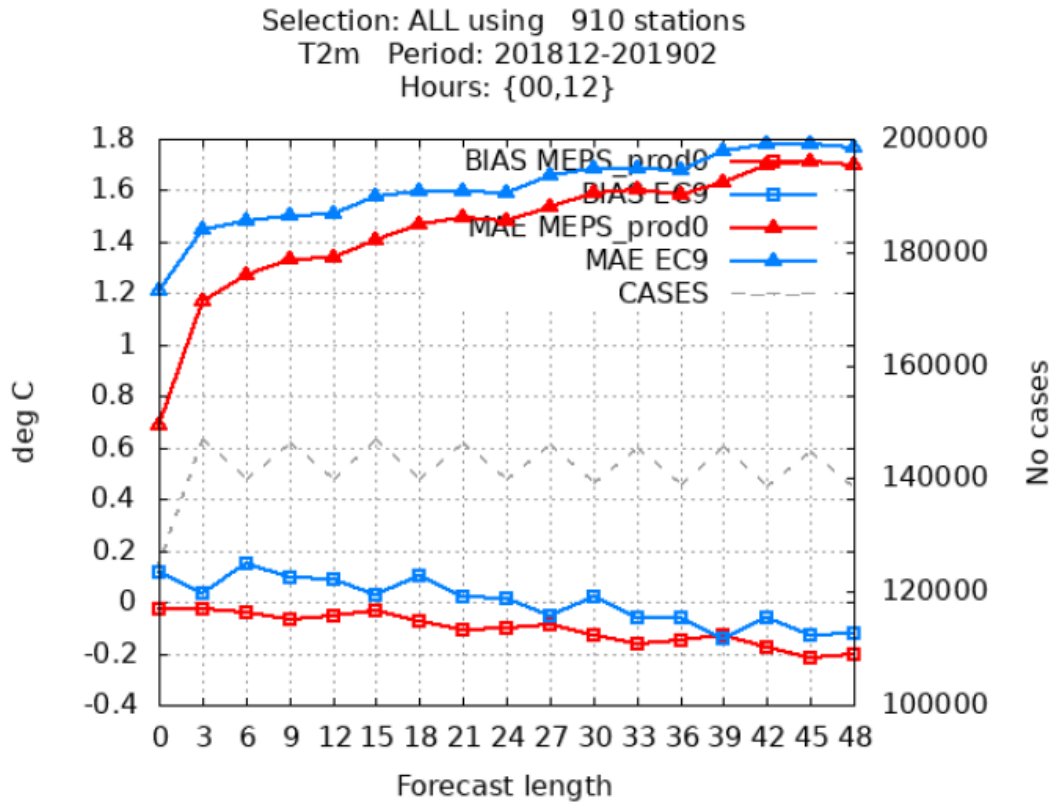


Fig.1

The figure shows  
2m temperature , BIAS and MAE  
Dec 2018- Feb 2019 : Forecast  
length verification:  
based on MetCoOp large station  
list : Comparison with ECMWF

First view on T2m results of  
Harmonie-Arome gives a very  
good impression of results !

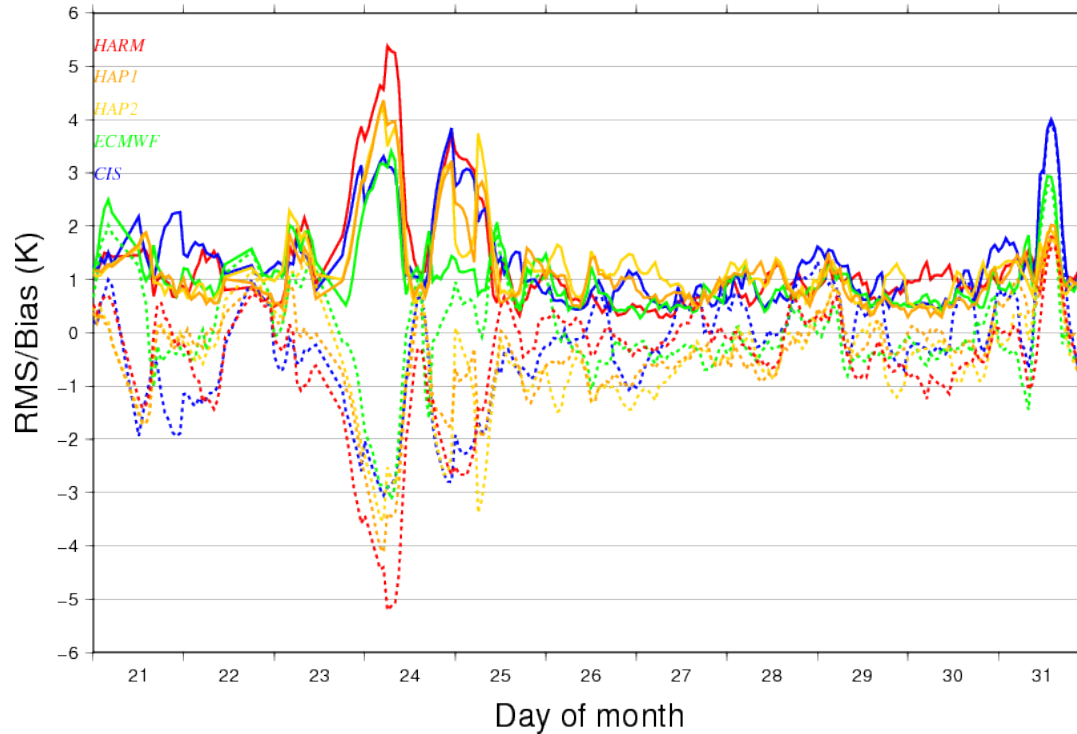
BUT going more into details  
including also results from other  
HIRLAM centres reveals  
important features of much  
larger errors which are hidden in  
simple overview statistics such  
as that given in Fig.1



# Key forecasting issues in operational centres identified with forecasters during winter season 2018-19



Verif T2m 201901-III all NL, fr=18-24



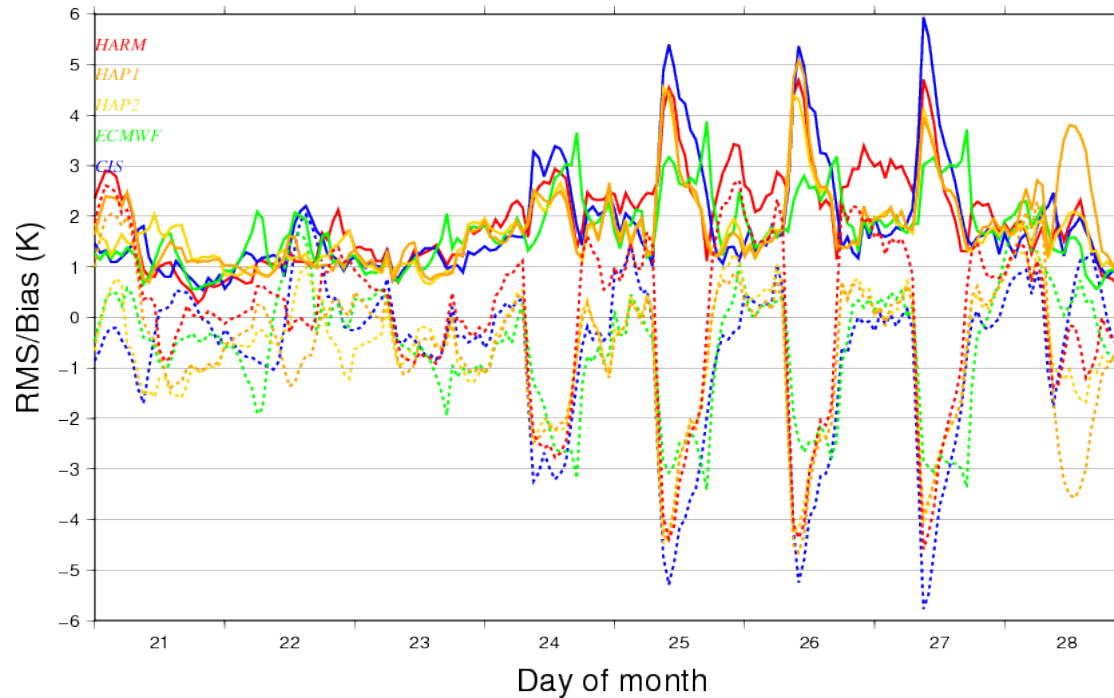
Temperature errors for the Netherlands in the third decade of January for old Harmonie HA36 (HARM), and other model versions : HA40h1.2tg2 -HARATU & -OCND2 (HAP1), HA4040h1.1.1 plus extra HARATU update (HAP2), In addition is shown ECMWF and HIRLAM 7.2 (CIS). Forecast range is 18-24 hours ( from Sander Tijm , 2019 )



# Key forecasting issues in operational centres identified with forecasters during winter season 2018-19

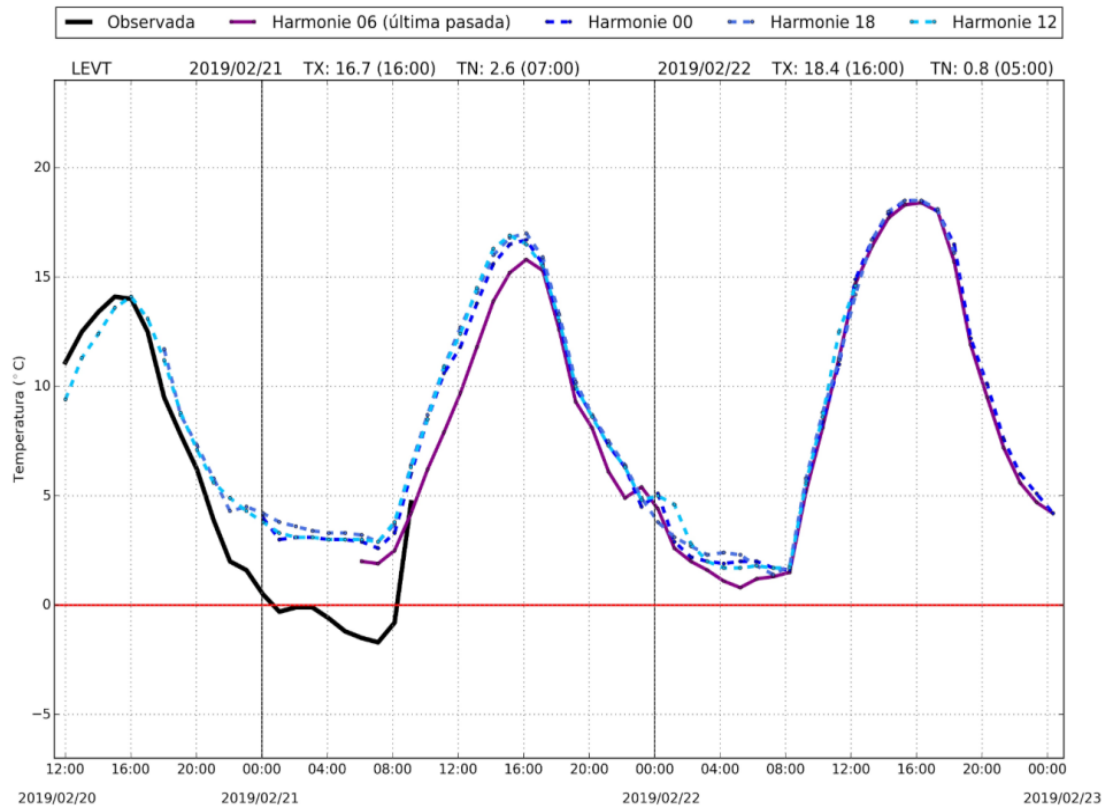


Verif T2m 201902-III all NL, fr=18-24



Temperature errors for the Netherlands in the third decade of February for old Harmonie HA36 (HARM), and other versions , HA40h1.2tg2 -HARATU & -OCND2 (HAP1), HA4040h1.1.1 plus extra HARATU update (HAP2), plus ECMWF and HIRLAM 7.2 (CIS). Forecast range is 18-24 hours. ( From Sander Tijm, 2019 )

# Key forecasting issues in operational centres identified with forecasters during winter season 2018-19



Temperatures estimated by the HARMONIE-AROME and observed (black line) in LEVT airport.

# Key forecasting issues in operational centres identified with forecasters during winter season 2018-19



In general, there have been two different types of causes for low level temperature problems

- 1) The first type is linked to poor cloud cover predictions.
- 
- 2) A second type of issue appears to be associated with very stable boundary layer conditions where the model tends to produce too high temperatures.
  - Lately a flux correction (critical Richardson number correction) has been suggested which seems to impact positively on this forecast problem

Other known factors which contribute to imperfect 2m temperatures

- 3) Imperfect surface fluxes , e.g. evaporation
- 4) Limitations in the snow scheme leading giving too high snow temperatures in the very cold end of the spectrum

## The new concept of a Harmonie-Arome Users' Meeting



The concept of a Harmonie-Arome Users' meeting has been discussed for a year. It was decided that we should arrange the first Users' Meeting in AEMET 6-7 November 2018.

The first day of the workshop was devoted mainly to presentations from each weather centre and presentations from the HIRLAM- C management group. These presentations were broadcasted to external users.

A workshop Web-site has been established

( <https://huw2018.aemet.es/> ) where all presentations are uploaded.



## The new concept of a Harmonie-Arome Users' Meeting



### Group discussions: 3 discussion groups were established

- 1) Weaknesses of the Harmonie model system and possible causes/ways to address them
- 2) New ways to use the model e.g. making use of ensemble information, more advanced data-assimilation and new nowcasting setups.
- 3) Post-processing and desired model products

In the Final discussions of the meeting it was concluded that the meeting had been very successful and given both forecasters and the HIRLAM management insights that they did not have before.

It was recommended that there should be a follow up meeting in 2019 and that a special topic should be chosen: The special topic of 2019 will be

**Special topic: “ Harmonie-output for warning-conditions “**

**Venue: Dublin**

## Key forecasting issues: Proposal for common 1D-MUSC studies on fog

### OUTLOOK ?

- In January 2017 there was a workshop in Météo -France regarding simulations of fog -
- It was concluded from very high resolution studies with the meso-NH model that the level of cloud water generated was too high
- Plans were formulated on how to proceed to make improvements. What is the status ? What about dedicated studies with MUSC, e.g. for fog over sea (the simplest case)
- The messages from the forecasters are clear: fogs are too frequent and persistent over the sea. Problems of overforecasting also exist over land. Here the situation is more complex. What will we do about it ?

END

*Gracias*