AROME-NWC, a nowcasting tool based on AROME-France : description and experimentation

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38th EWGLAM and 23 SRNWP Meeting
Rome, 05 October 2016

Plan

- Description

- The use of AROME-NWC

AROME-NWC

- Why ? :

  - To extend the forecast range for nowcasting up to ~6h

  - To improve the extrapolation technics for thunderstorms Nowcasting (impact of topography, information on trends on phenomena)

  - Help to forecasters

- How ? : adaptation of a NWP data assimilation/forecast system efficient at convective scale :

  - hourly refreshed runs

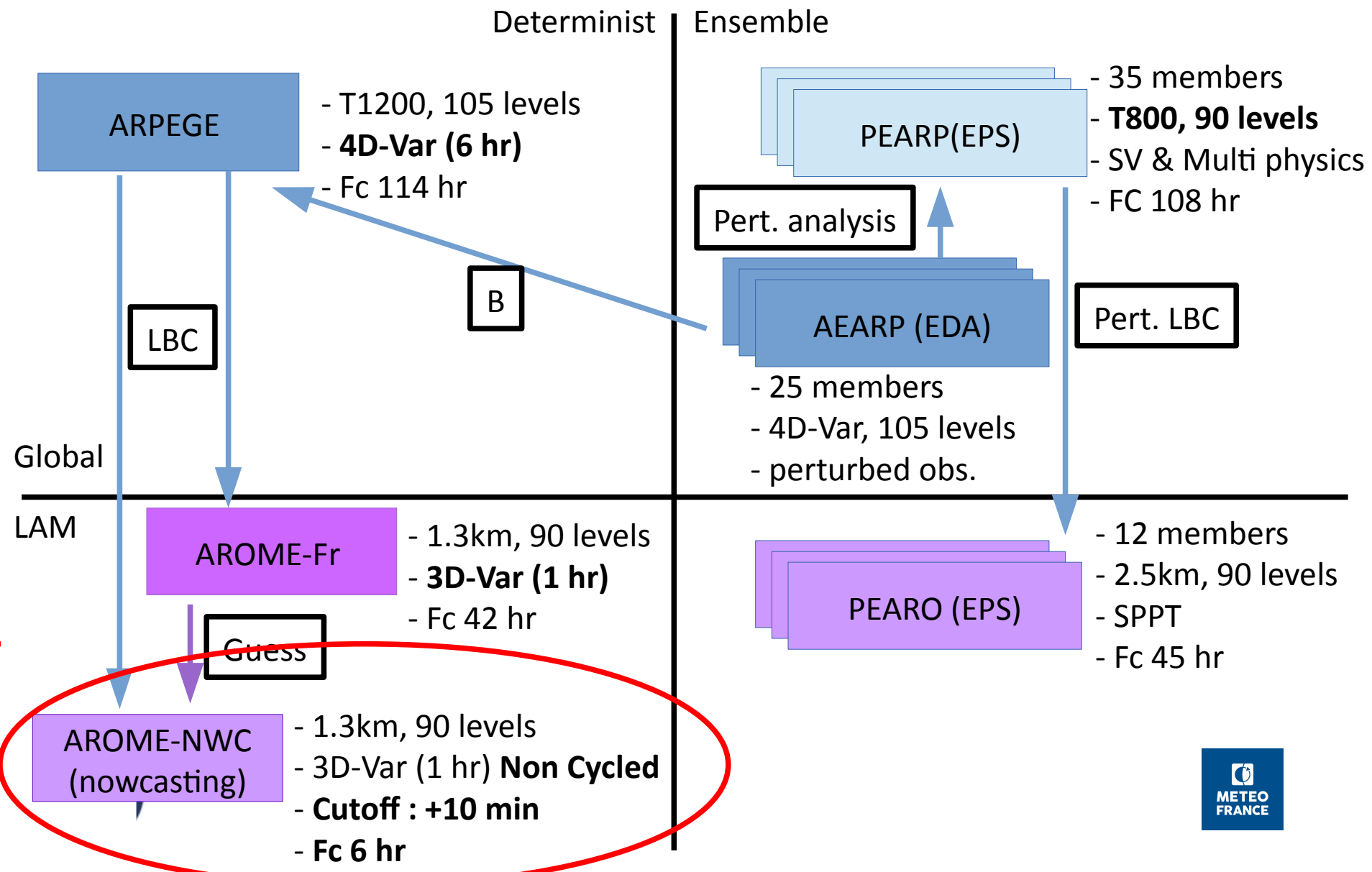
  - sub-hourly output (15 min)

  - available within 30 min after the latest observations

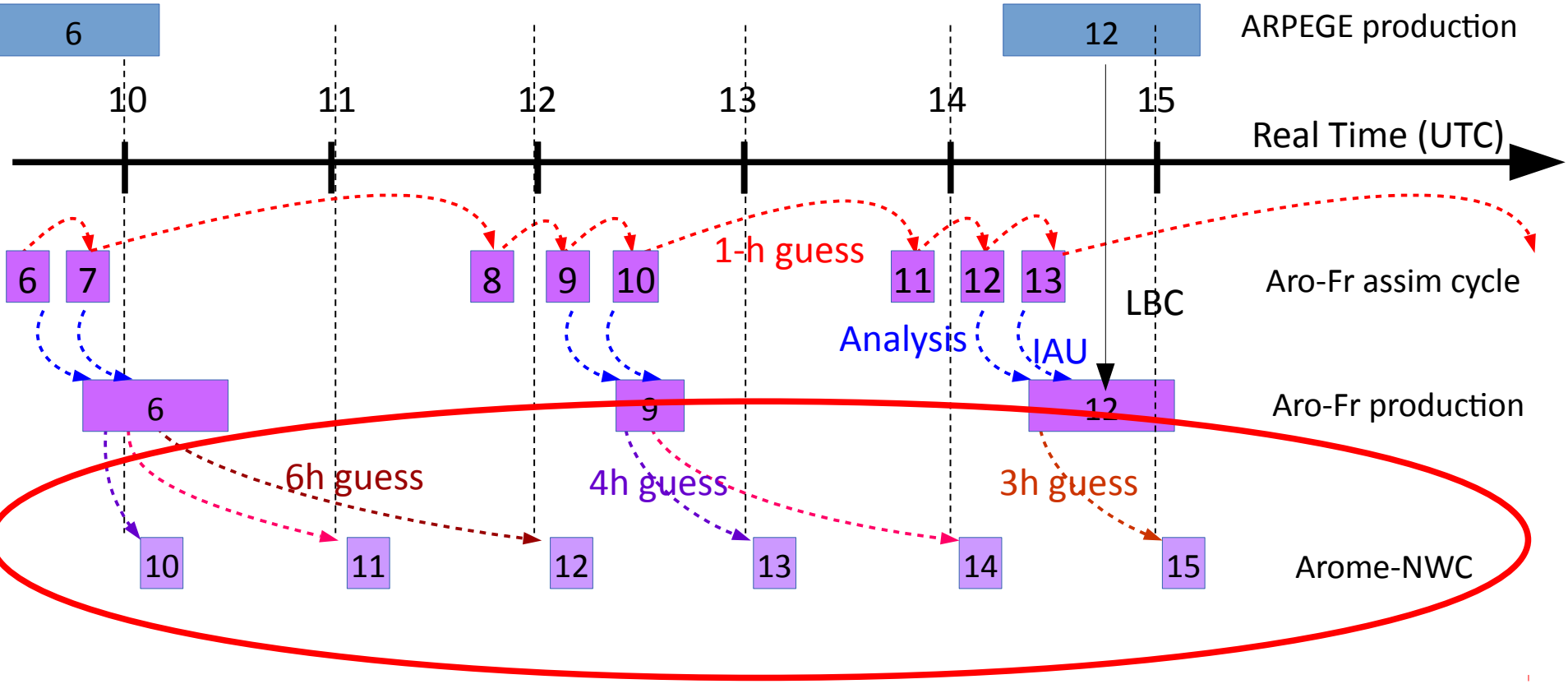
- Auger et al. 2014 (QJRMS)

- Operationnal since March 2016

Meteo-France NWP system : Current situation



Plan



- AROME-NWC cut-off : + 10 min Versus 1h30 to 2h30 for AROME-France
- The background which is provided by the most recent AROME-France available run can be from 2 to 6 hours old

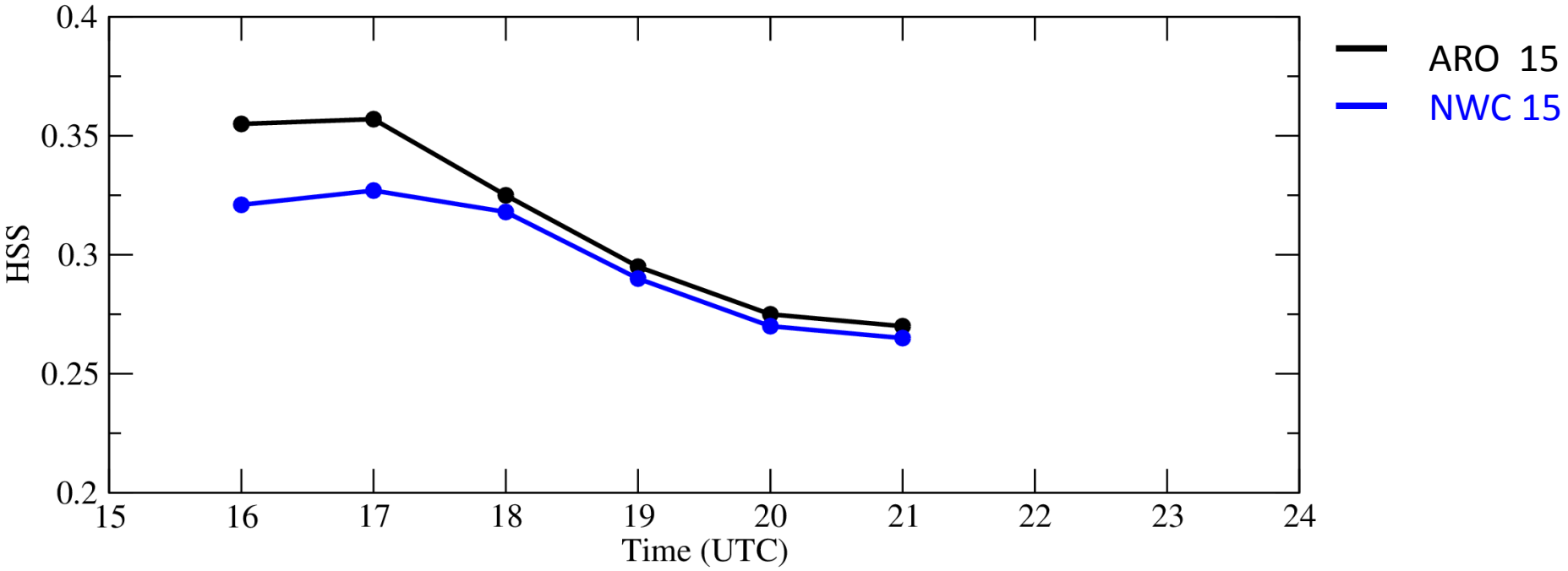
Cut-off Impact on the obs number

	AROME-France (12 UTC)	AROME-NWC
cutoff	+2h15	+10 min
Nb of available obs.	~1,3 millions	~ 709 000
Nb of assimilated obs.	110 000	82 000
Radar	75 000	75 000
Surface	7 500	5 200
Aircraft	3 200	1 200
Sounding	11 000	300
Satellites	14 000	40
GNSS	1 500	0

- Assimilated observations mainly provided by RADAR and screen-level measurements
- Less aircrafts and soundings, no satellites and GNSS observations compared to AROME-France.

AROME-NWC performances

HSS for 1h precipitation : 2 mm/h threshold



- 15 UTC AROME-Fr run is better than 15 UTC AROME-NWC run : more observations assimilated, guess more recent

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AROME-NWC performances

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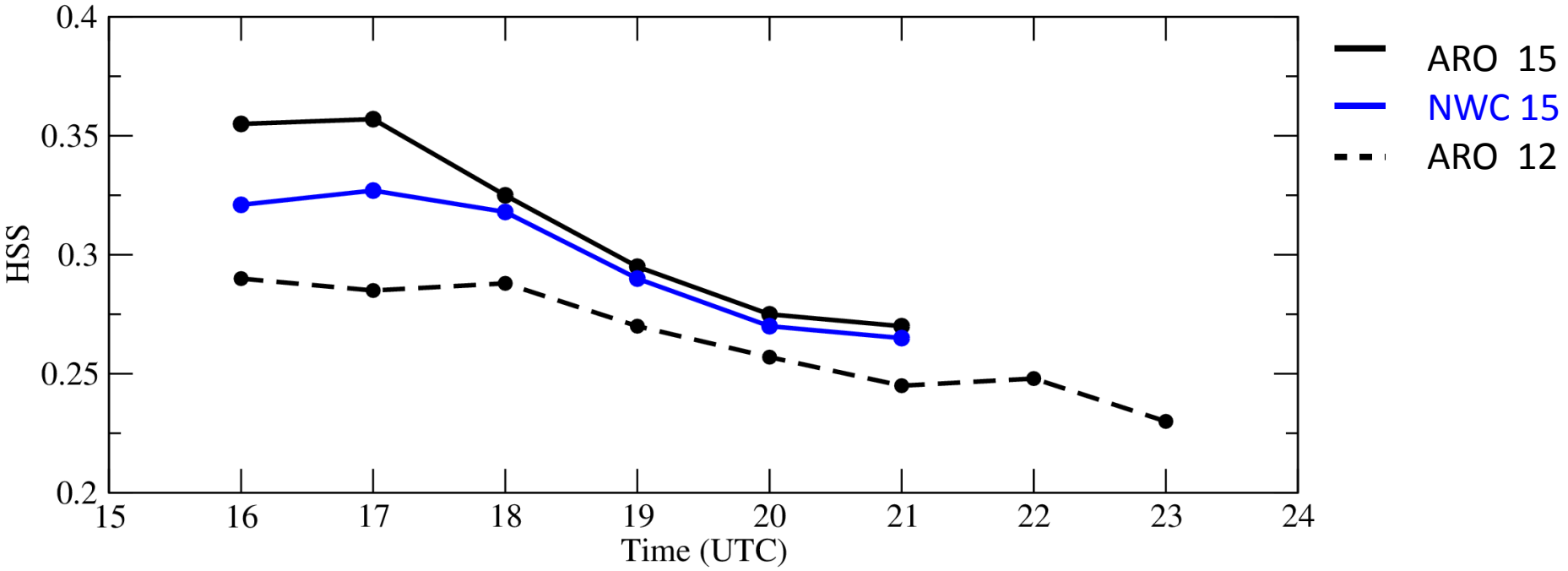

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AROME-NWC performances

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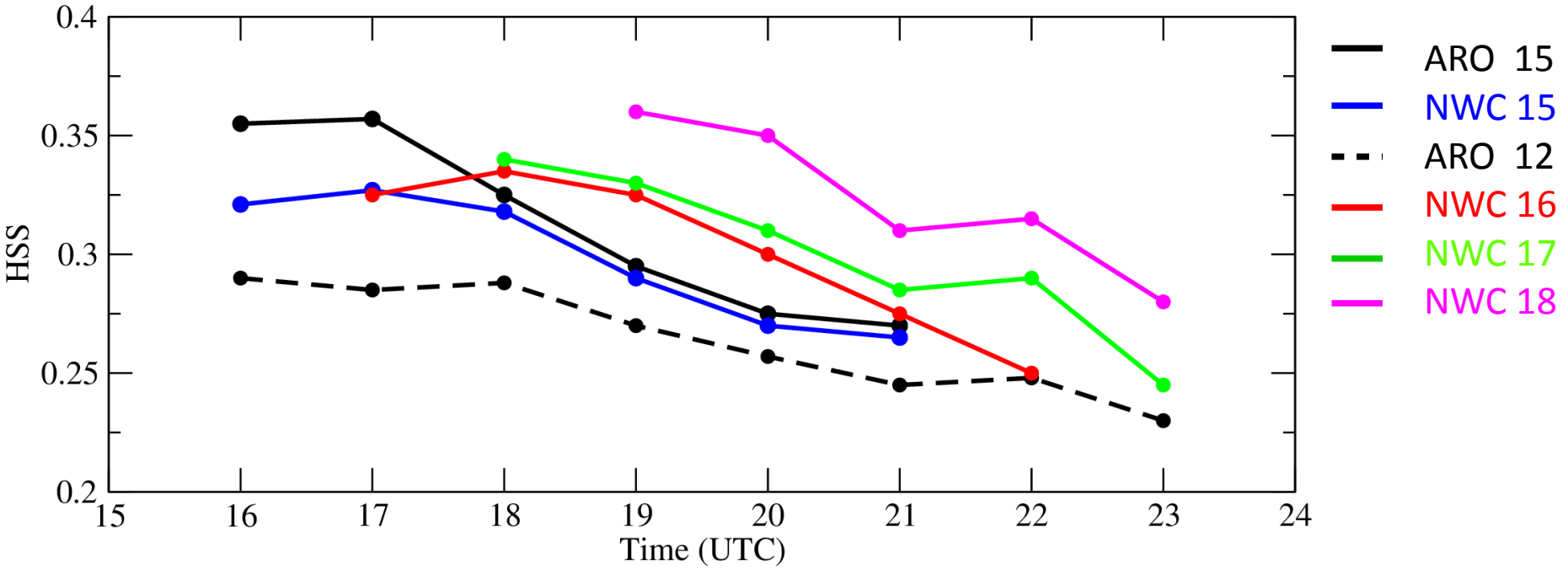

- 15 UTC AROME-Fr run is better than 15 UTC AROME-NWC run : more observations assimilated, guess more recent
- AROME-NWC runs are better than the last AROME-Fr run available at the same time
- The last AROME-NWC run is better than the previous one.

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Plan

- Description

- The use of AROME-NWC

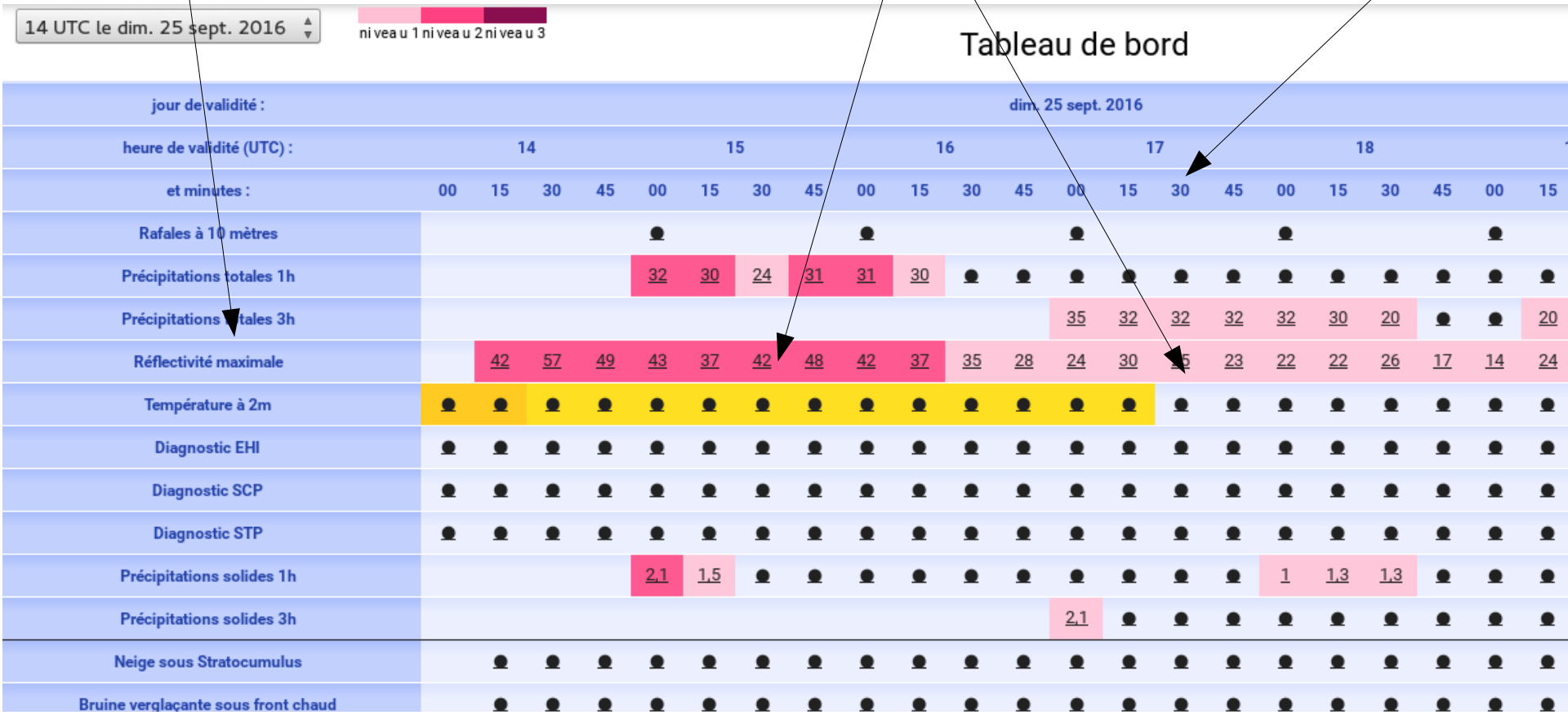
Web-dashboard for forecasters

- Lots of informations : need to help forecasters to quickly identify the meteorological situation and the parameters to monitor

Parameters : rain, max reflectivity, Severe convection index, visibility diagnostics

threshold excedence alert (3 alert levels) based on quantile

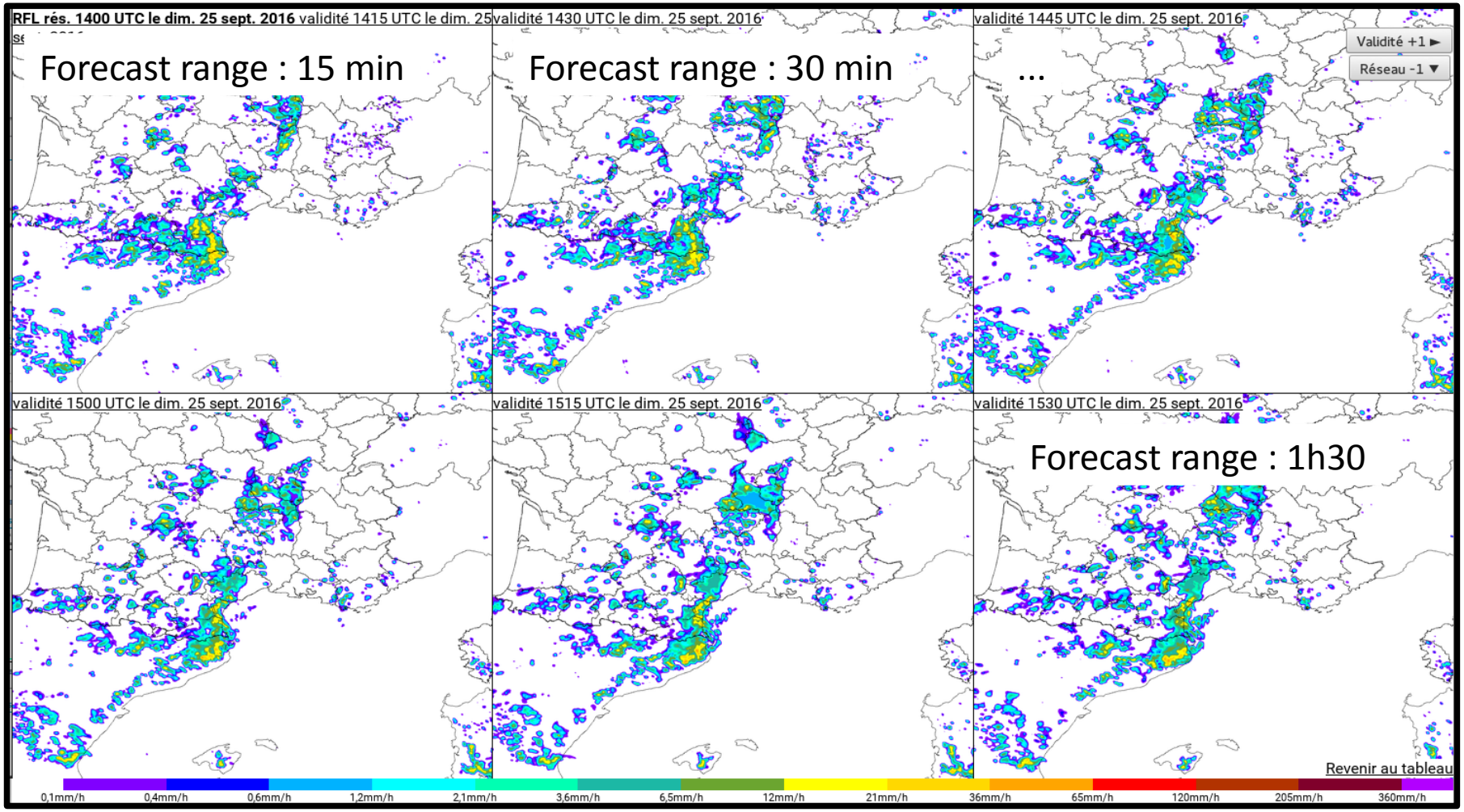
Validity time



2 visualisation modes

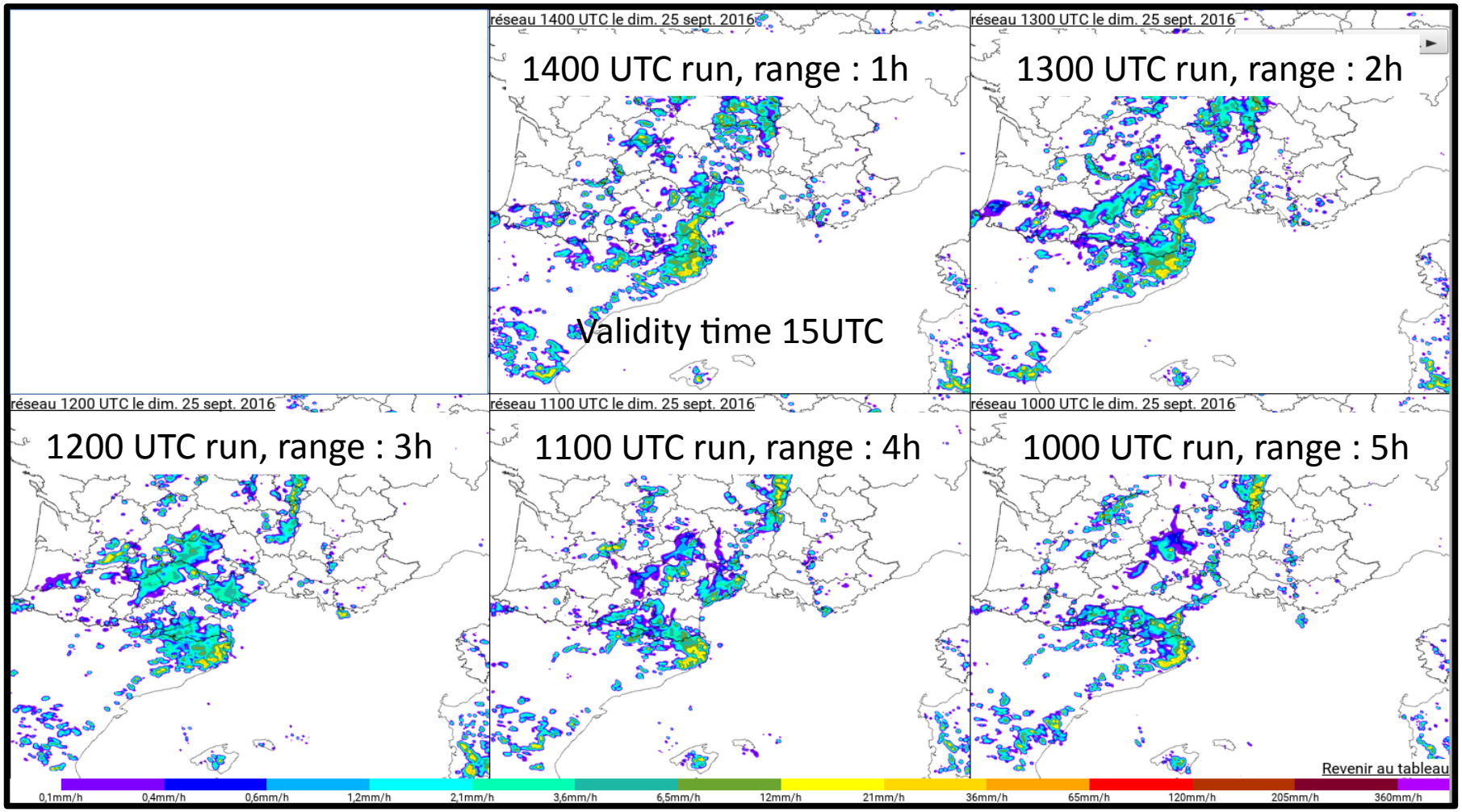
- For an AROME-NWC run : 6 forecast ranges on the same plot

25 september 14 UTC run



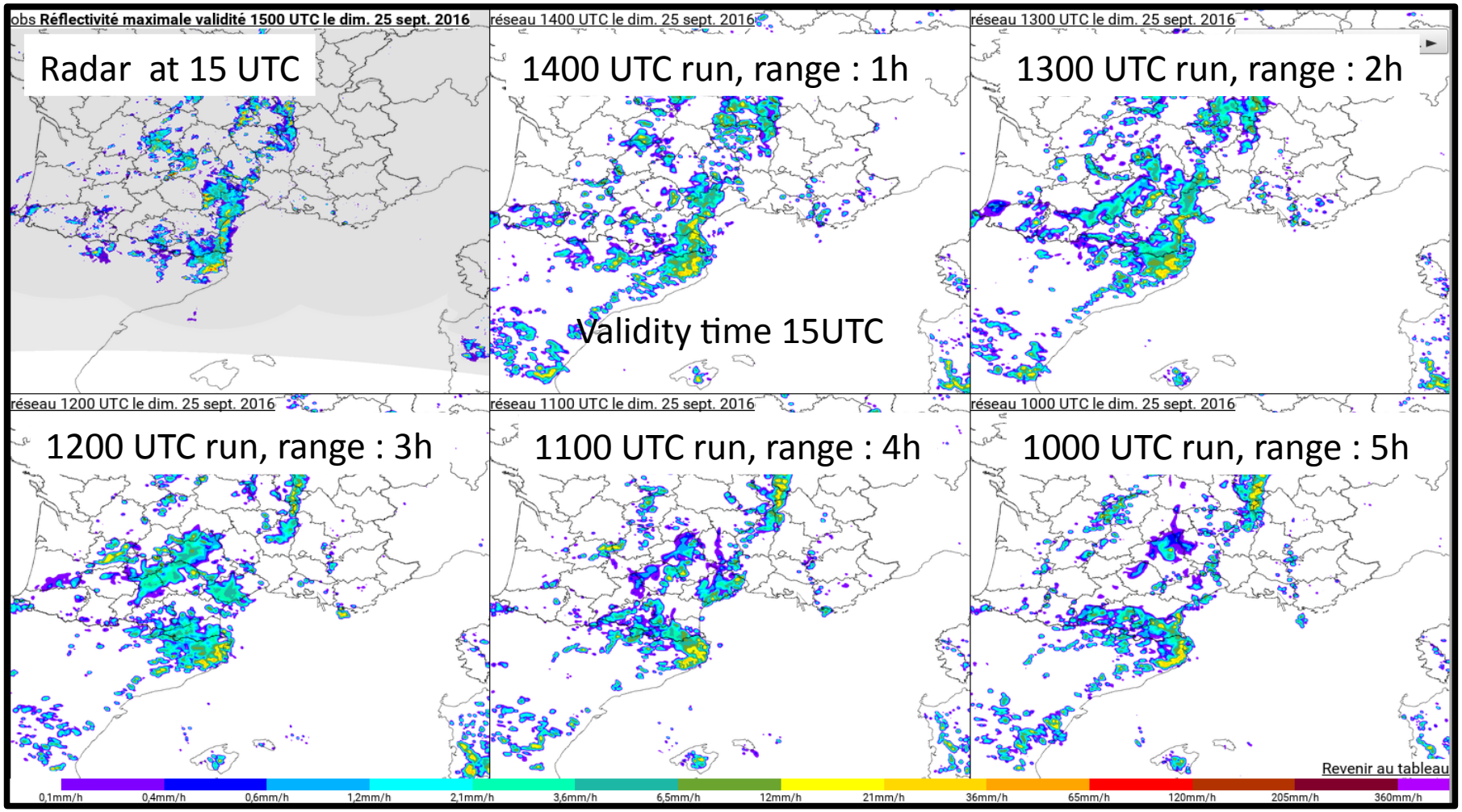
2 visualisation modes

- For a given validity time : the differents forecasts ranges valid at the same time from the differents AROME-NWC runs (« poor-man » ensemble like mode).



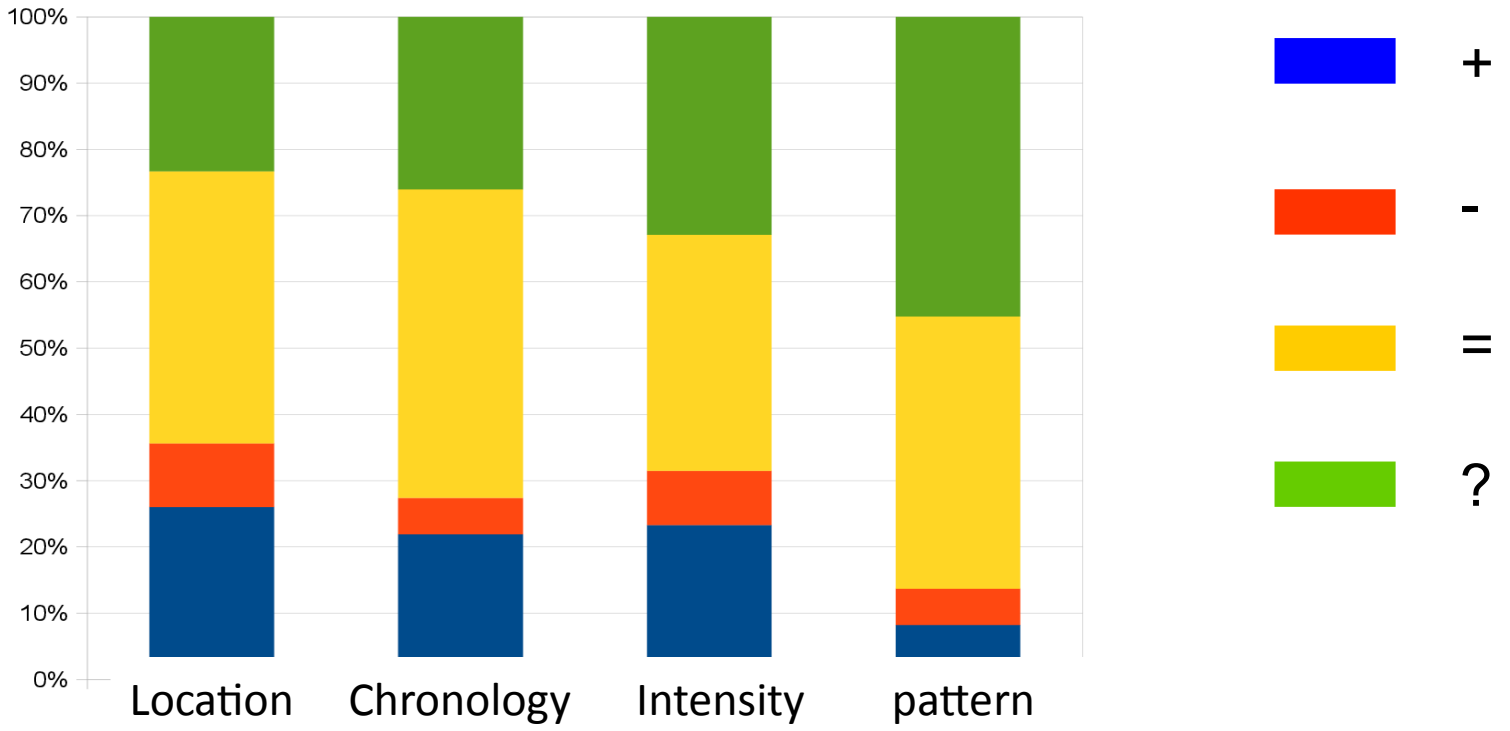
2 visualisation modes

- For the same validity hour : the differents forecasts ranges valid at the same time from the differents AROME-NWC runs (« poor-man » ensemble like mode). Can be confronted to observations in order to evaluate the system consistency



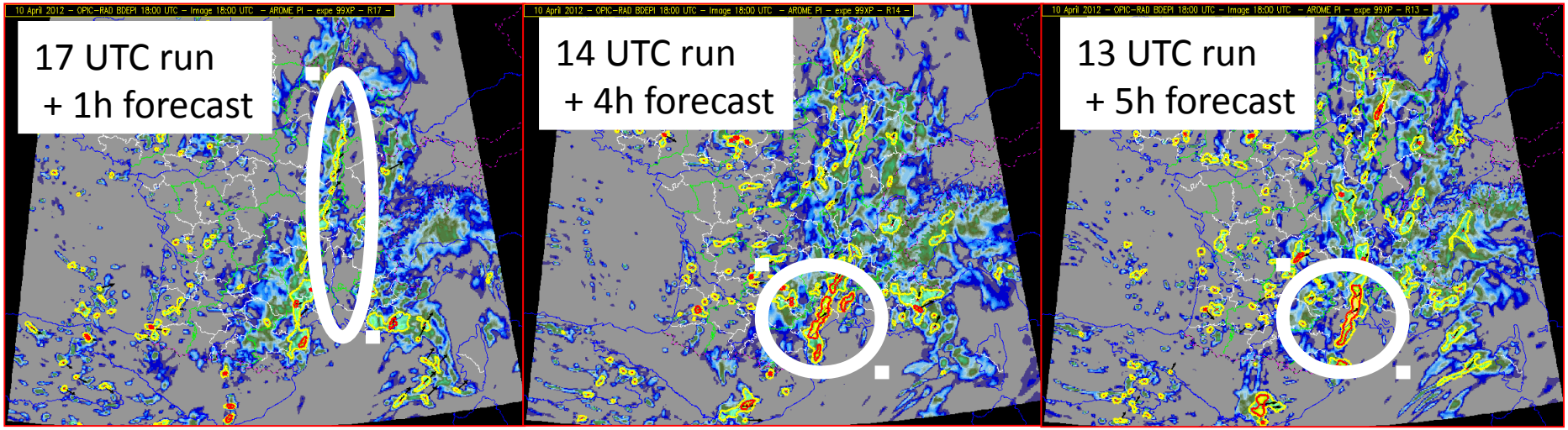
Subjective evaluation from Forecasters

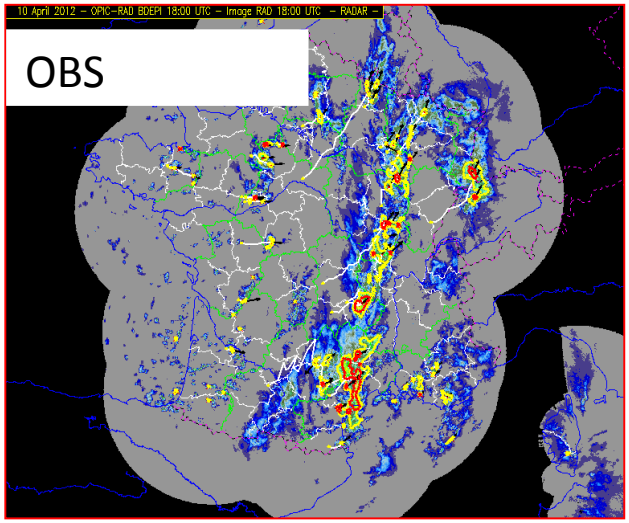
- Results from an experimentation with forecasters over 73 meteorological issues during different situations (convection, fog, wind,…) : How was AROME-NWC compared to AROME-Fr



Some forecaster critics

- the last AROME-NWC run is not necessarily/systematically the more accurate





Correct forecast of general features of reflectivity fields but

+1 hour: correct dry area eastward high reflectivity line

+4 and +5 hours: correct high reflectivity patterns in the South

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Some forecaster critics

- the last AROME-NWC run is not necessarily/systematically the more accurate

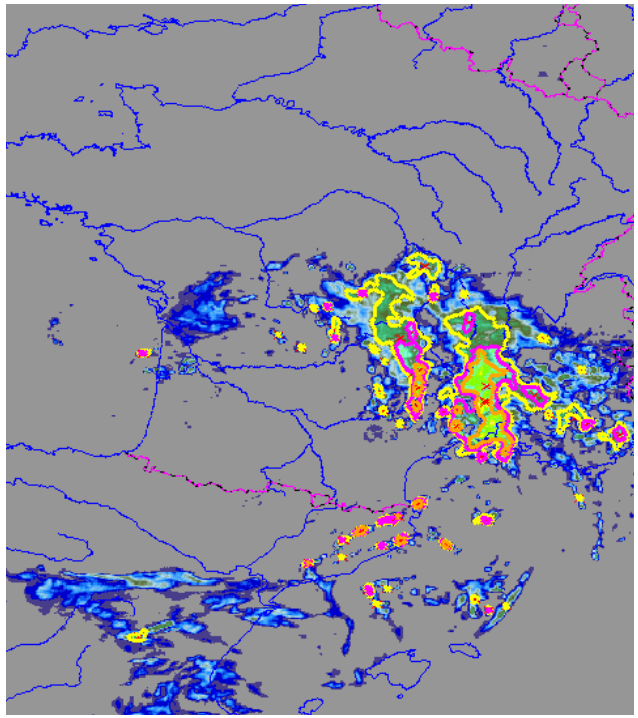
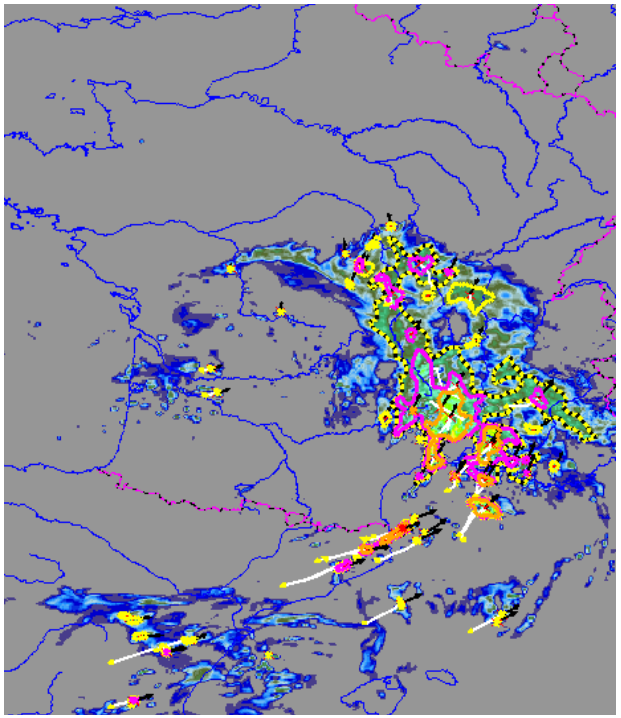
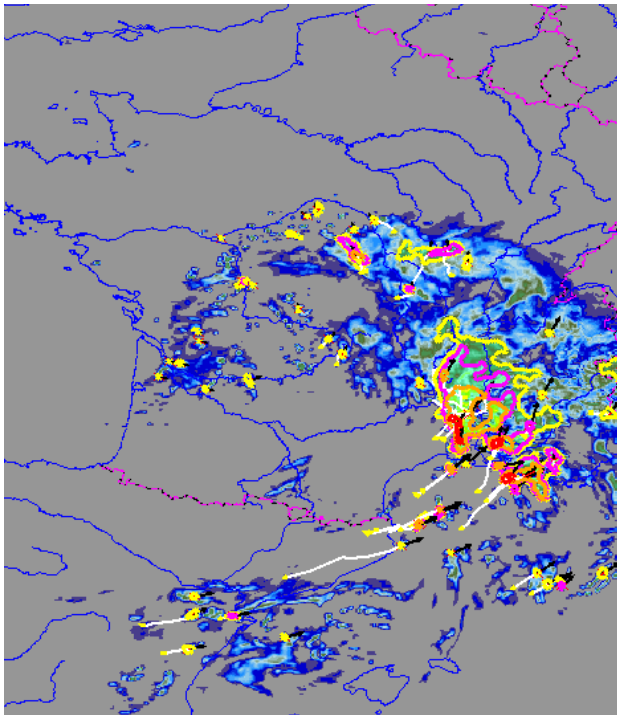
- even if the first forecast ranges seem to be modified in the right way by the observations, the model offers a solution close to the one proposed by the AROME-Fr guess in the following forecast ranges

- in some convective situations, strong variability between the different successive AROME-NWC runs (jumpiness)

=> we will have to adress these problems in a near future...

Convection Nowcasting Object

- Detection and follow-up of convective objects on AROME-NWC simulated reflectivities

Data fusion (O.Mestre, P. Cau)

- Two « experts » :

  - 2PIR method : Identification of cell displacement, diagnosis of motion field and extrapolation of observed radar reflectivities each 5 min up to 3hr

  - the last AROME-NWC run available

- Fusion = α 2PIR + (1- α) AROME-NWC

- α defined by a dynamical 24h training : forecast range dependent and horizontaly homogeneous

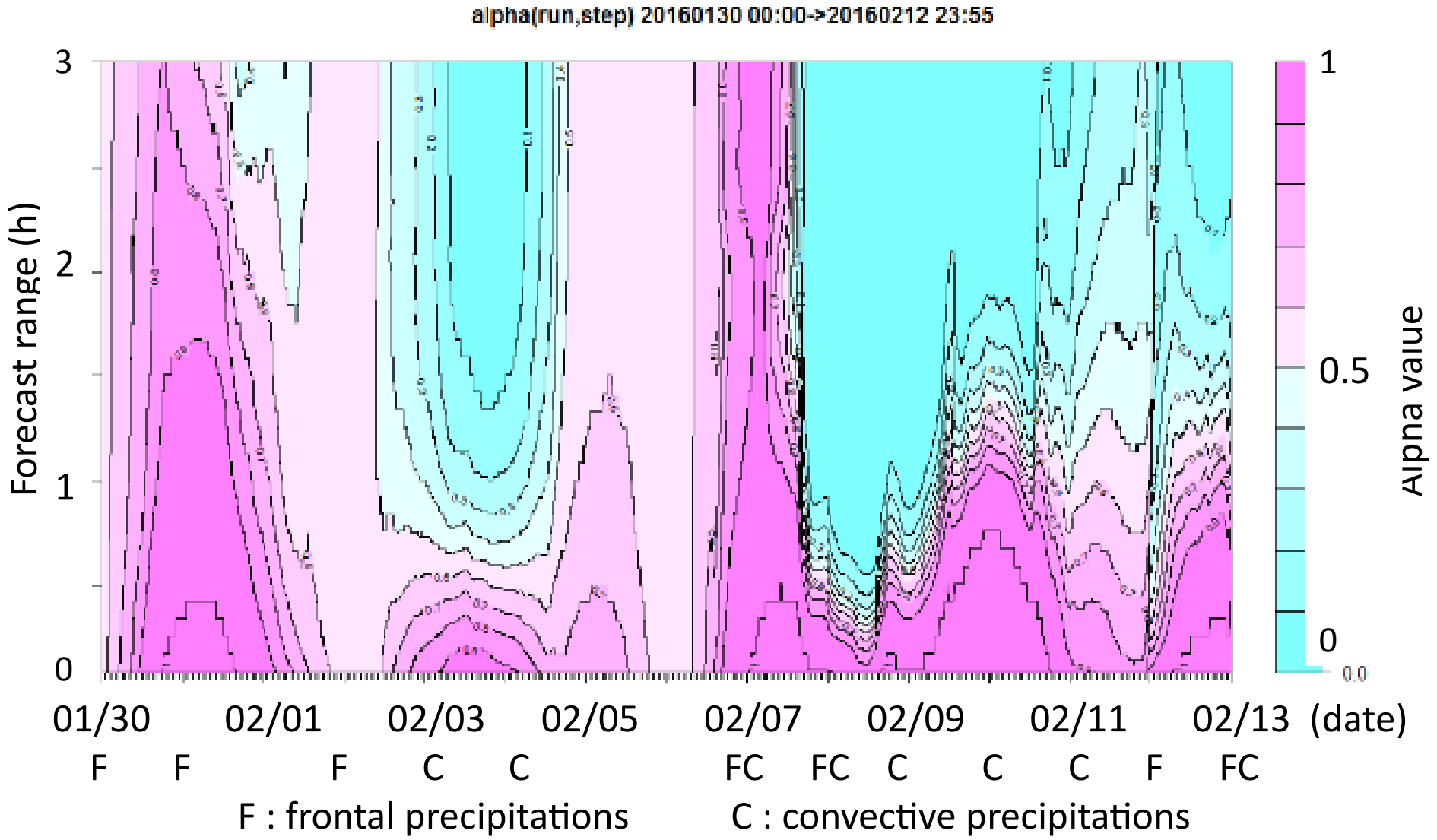
- Verification and training : radar QPE

- Stategy : to be better than the best expert (to minimize the regret)

  (see for example : Auer, P., Cesa-Bianchi, N., & Gentile, C., 2002. *Adaptive and self-confident on-line learning algorithms*. J. of Computer and System Sciences, 64, p. 48-75.)

Data fusion (O.Mestre, P. Cau)

- Fusion = α 2PIR (extrapolation) + (1- α) AROME-NWC (NWP)



Conclusion

- **AROME-NWC :** not a new model but a new engineering production built for nowcasting
- **Used by forecasters :** need to adapt, condense and highlight the relevant information
- **Used in a data fusion process**

Thanks for your attention

Any Question ?

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Toujours un temps d'avance