

Different aspects of use and evaluation of ECMWF products at Météo-France

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Outline

Control and monitoring

- monitoring of observations and models
- continuous assessment of the models

Forecasting

- informations about french models
- problems after models changes
- multi-models / multi-ensembles
- seasonal forecasting

Statistical post-processing

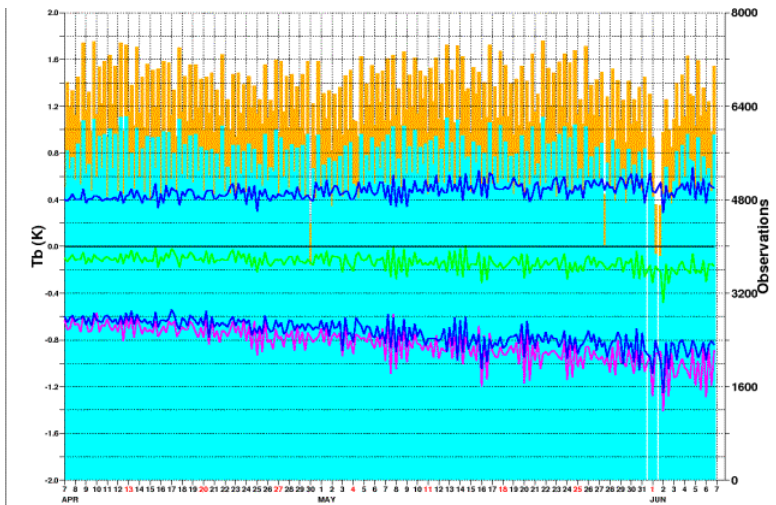
- mixed statistical post-processing
- monthly forecast
- calibration of EPS windspeed distribution

Control and Monitoring

Monitoring of the observations

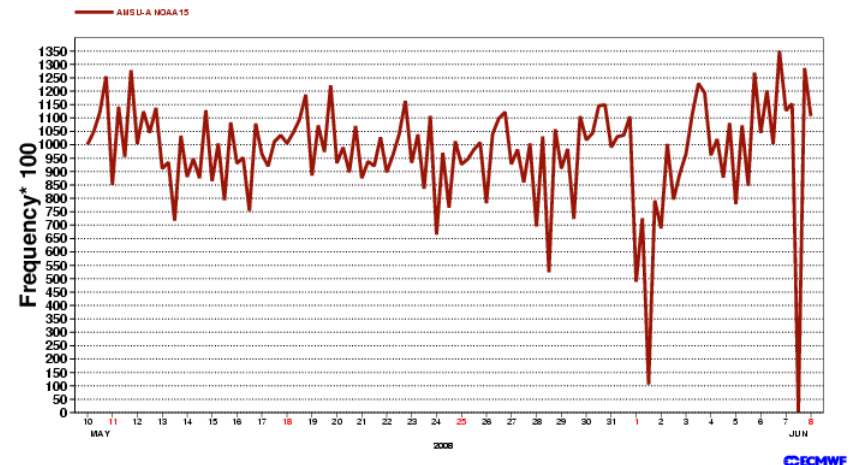
The number and quality of observations is daily monitored on an internal web server...

Time serie of the number of obs and obs-guess



... And the ECMWF web server is used as securing server for this monitoring.

ATOVS AMSU-A availability



→ **goal** : quickly detect and correct the problems with observations.

Control and Monitoring

Monitoring of the models

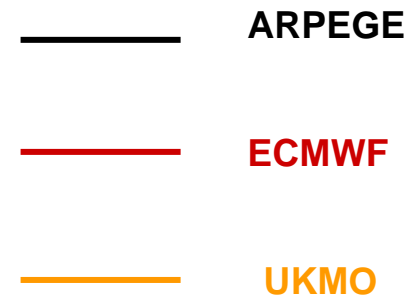
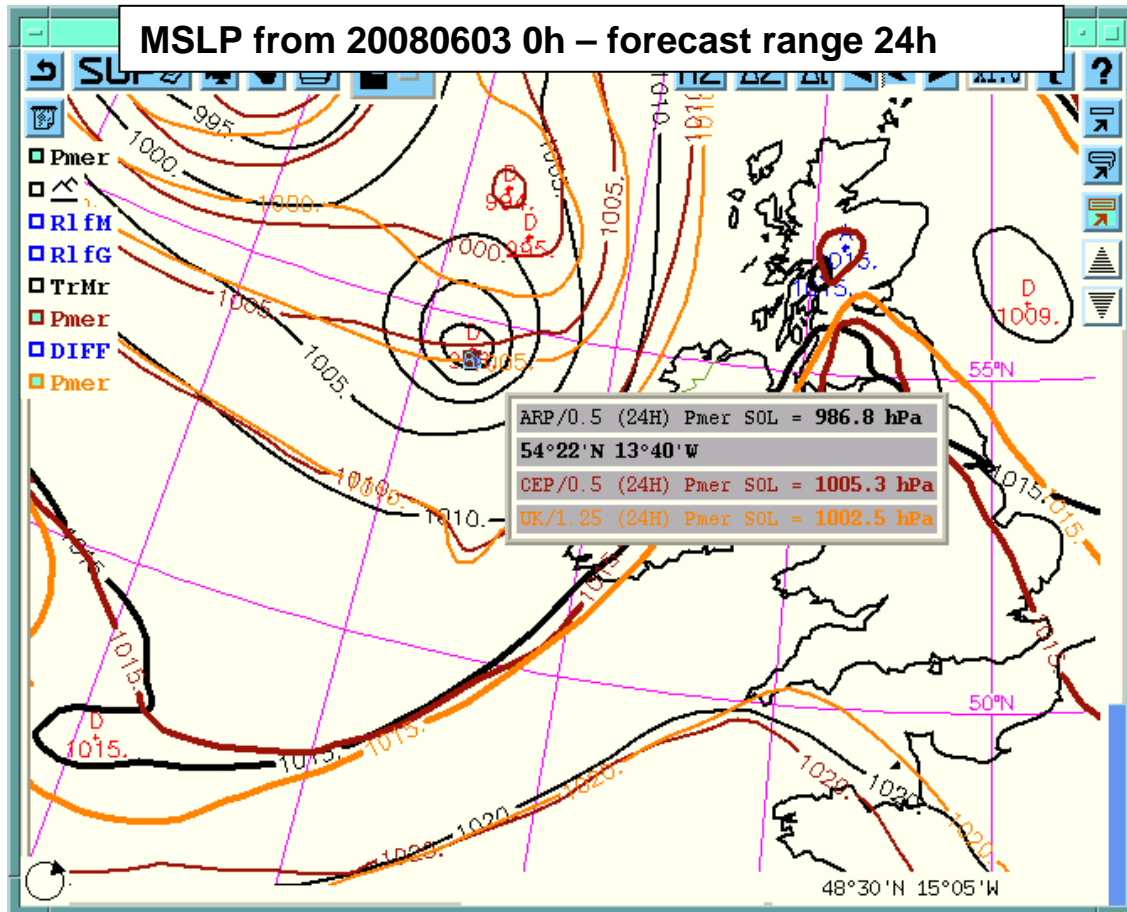
What is monitored ?

	Comparison ARPEGE / UKMO / ECMWF / ALADIN	Jumpiness of ARPEGE and ALADIN	Verification of precipitations and special events
Synoptic scale			
Weather parameters			

Control and Monitoring

Monitoring of the models

Example of event noted : difference between models



ECMWF users meeting 2008



METEO FRANCE
Toujours un temps d'avance

Control and Monitoring

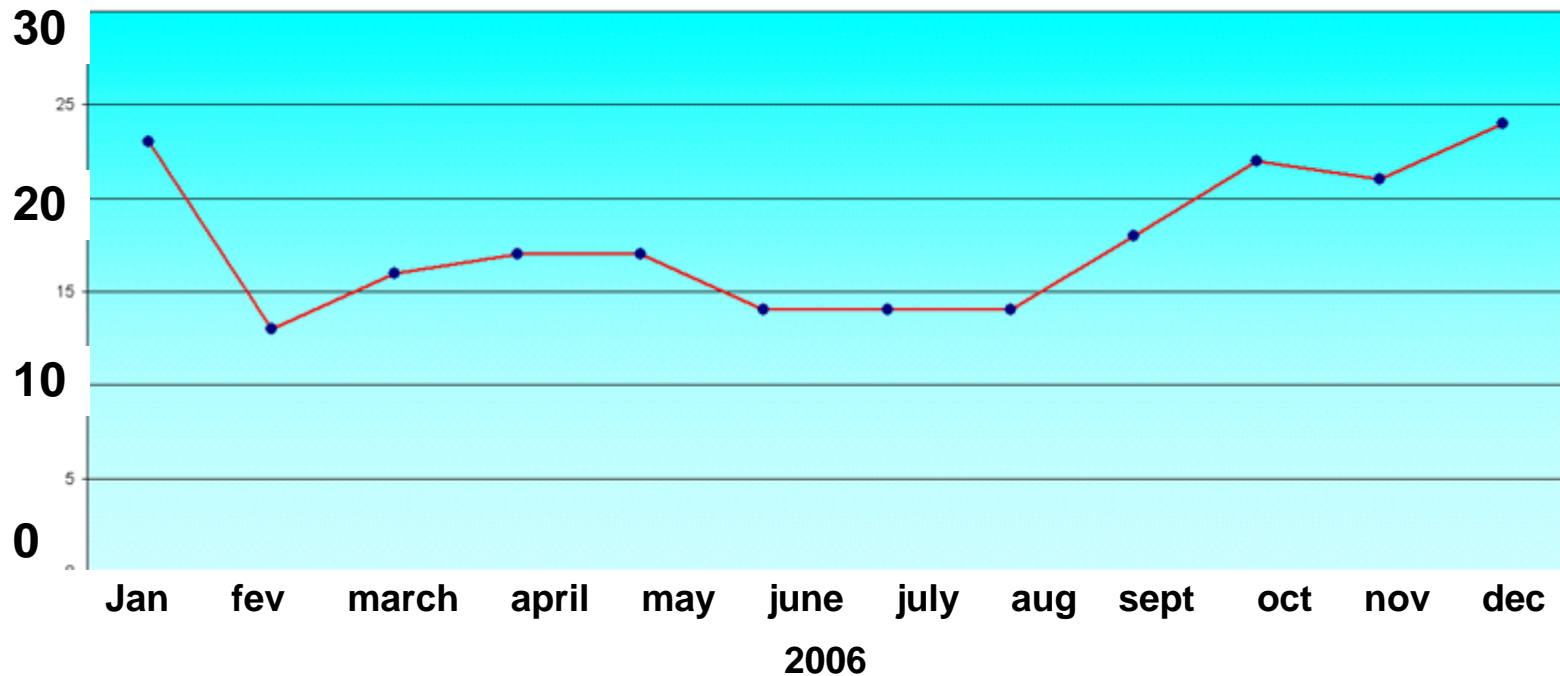
Monitoring of the models

Monthly report : textual synthesis on the cases of warnings, inconsistency between models, jumpiness of ARPEGE

Annual report : synthetic table and graphics

→ Many informations

Number of cases of difference between ARPEGE and ECMWF



Control and Monitoring

Continuous assessment of the models

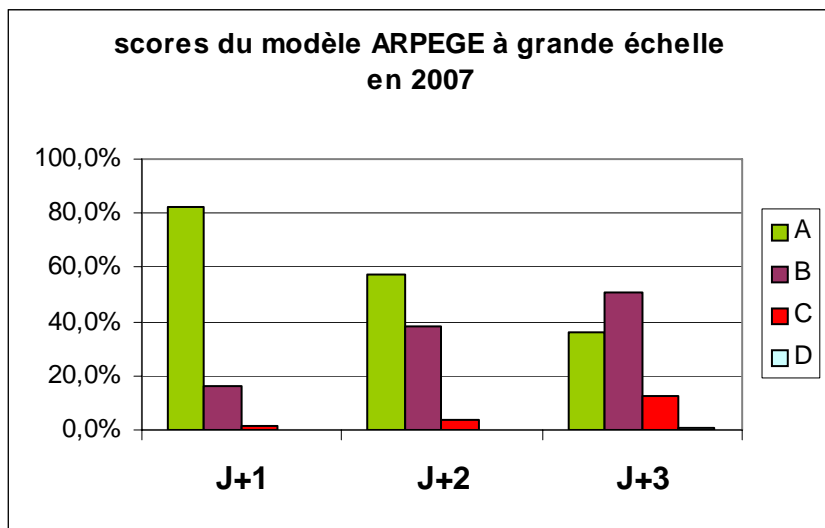
- The forecasters control daily the D+1, D+2, D+3 model output
- They control separately synoptic scale (Z500, T500, MSLP...) and low layers of the atmosphere (HU 925 hPa, precipitations...)
- They can give 4 marks A, B, C or D
 - ✓ A : error of chronology < 3h
error of location < 1/8 french territory
 - ✓ B : error of chronology < 6h
error of location < 1/4 french territory
 - ✓ C : error of chronology < 12h
error of location < 1/2 french territory
 - ✓ D : errors > 1/2 territory or errors > 12 h
- Other informations are also noted : subjective uncertainty, weather regime, problems in the forecast (choice of the model...)

Control and Monitoring

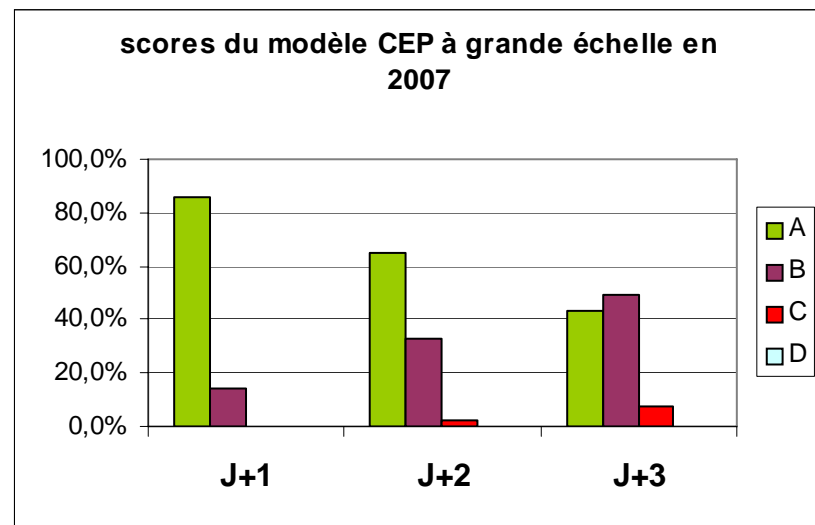
Continuous assessment of the models

Results for 2007, synoptic scale marks

ARPEGE



ECMWF



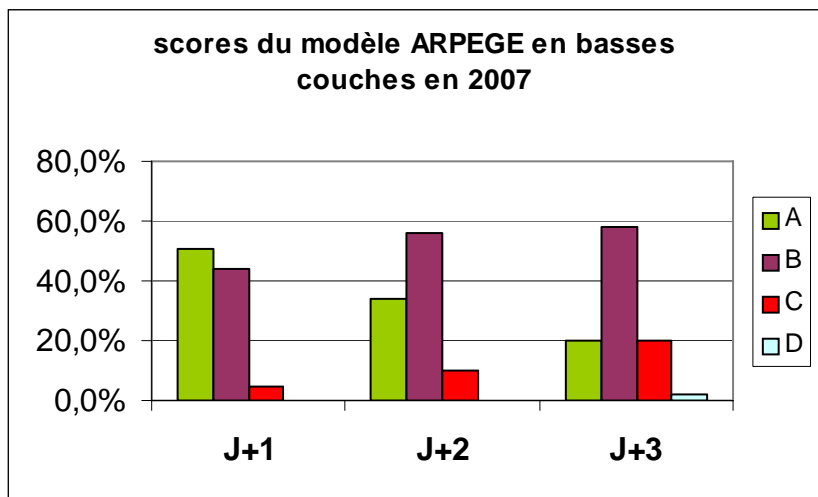
→ Similar results for D+1, ECMWF slightly better for D+2, D+3

Control and Monitoring

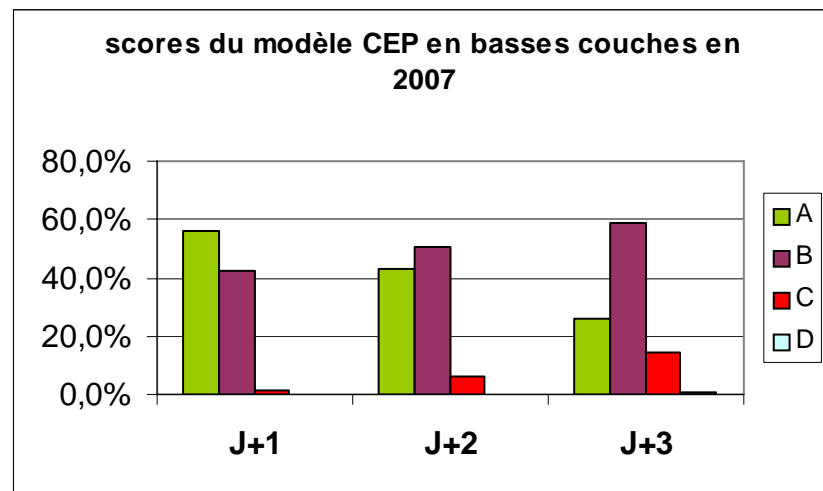
Continuous assessment of the models

Results for 2007, low layers marks

ARPEGE



ECMWF

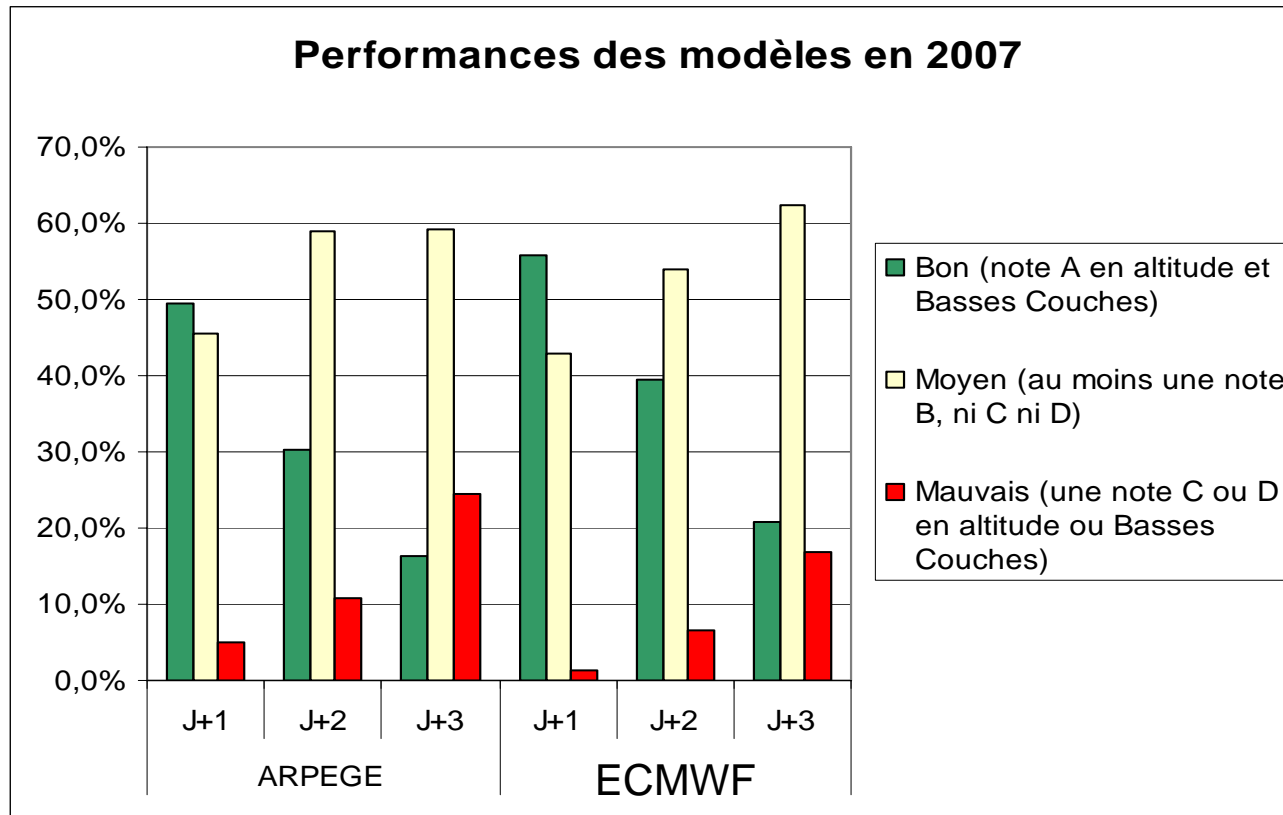


→ ECMWF better, the difference increases with lead time

Control and Monitoring

Continuous assessment of the models

Results mixing synoptic scale and low layers - 2007



■
**Mark A for both
 synoptic scale and
 low layer**

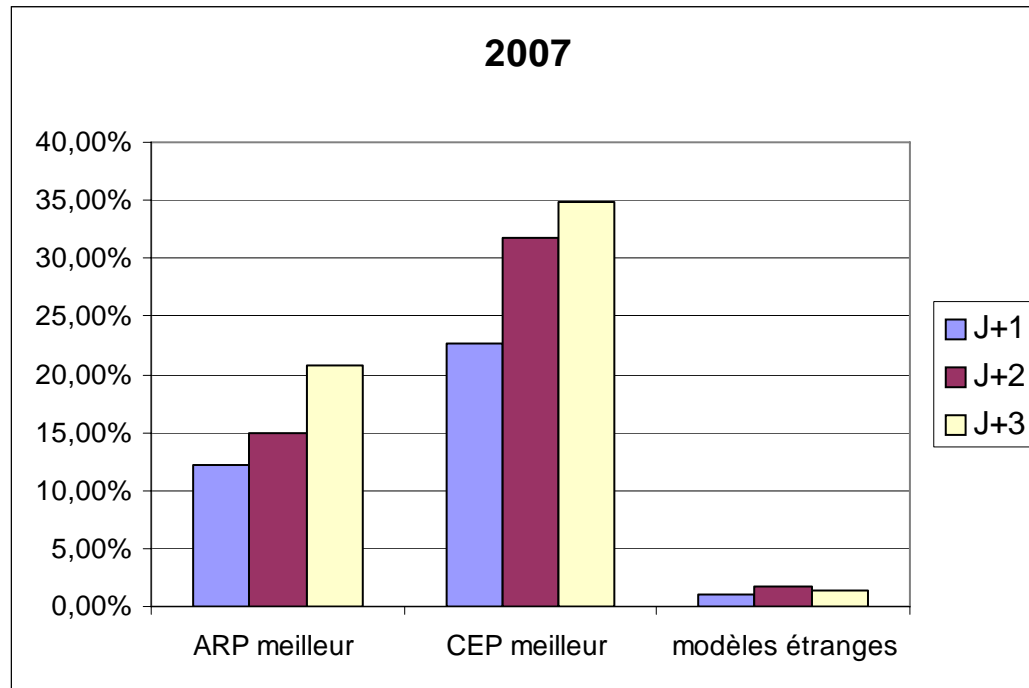
■
**Mark A and B
 mixed**

■
**At least one mark
 C or D**

Control and Monitoring

Continuous assessment of the models

Results for cases when ARPEGE and ECMWF get different marks
(that means the models disagree)



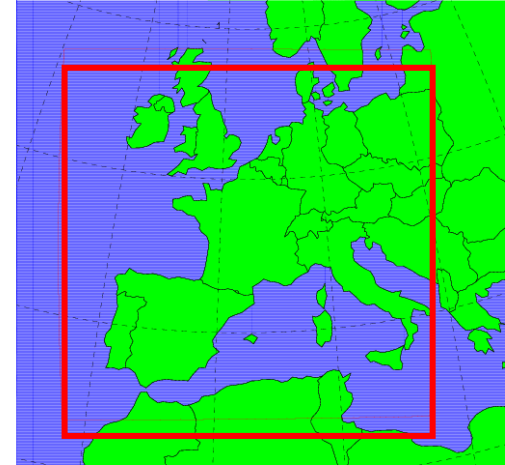
→ When ECMWF and ARPEGE disagree, ECMWF is better around 2 times out of 3

Forecasting

informations about french models

ALADIN coupled with ECMWF deterministic model

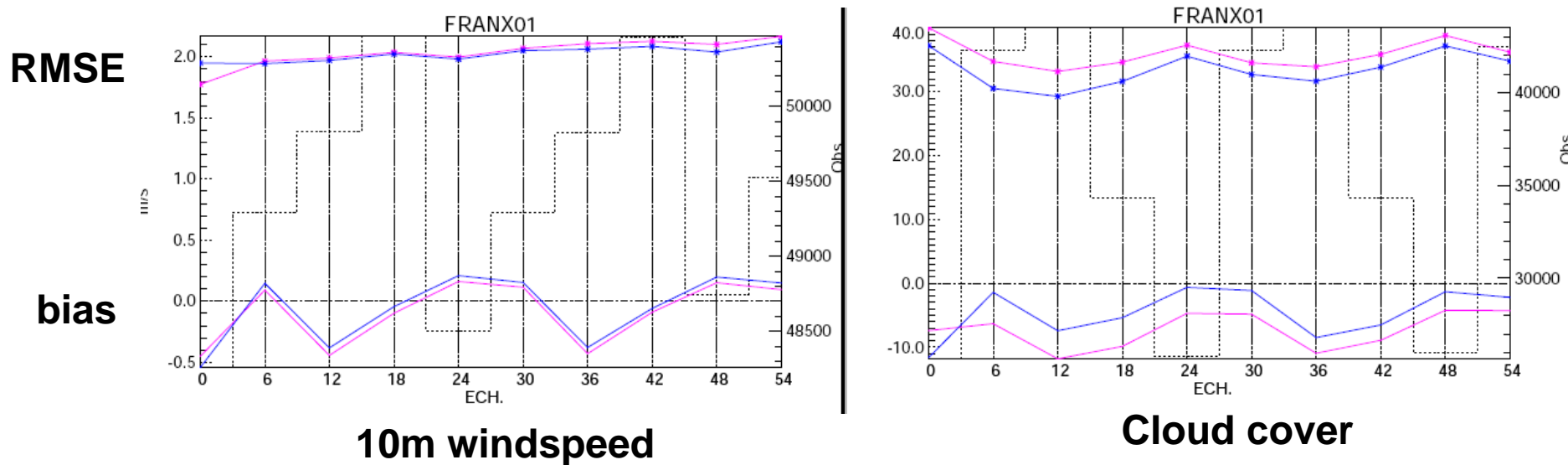
- ALADIN : Limited Area Model (9,5km)
 - experienced since september 2007
 - coupling files (every 3h) are made at ECMWF and transfered to Toulouse.
 - 2 times a day (0h and 12h), launched by an olive experiment
 - lead time=54h for 0h run, 42h for 12h run
- request for doing an ECMWF monitored suite (level 2)
- Interesting perspectives for tropical areas



Forecasting informations about french models

Evaluation of ALADIN coupled with ECMWF

— ALADIN coupled with ARPEGE
— ALADIN coupled with ECMWF



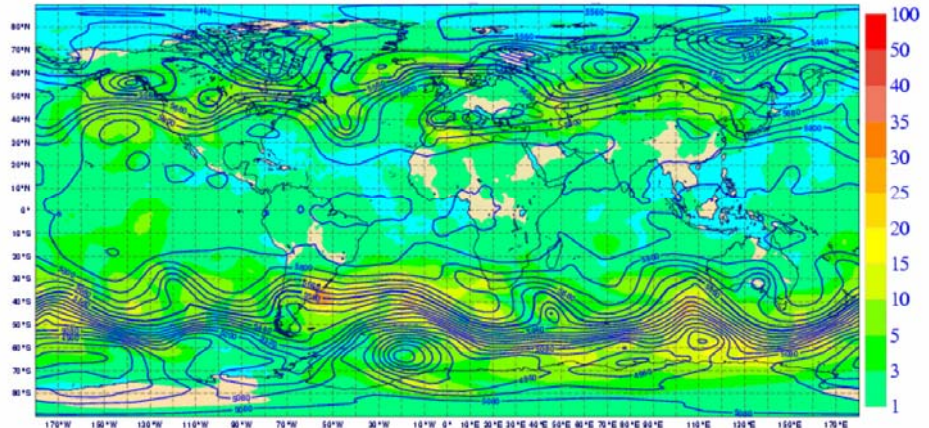
Forecasting informations about french models

Recent changes of french ensemble : PEARP

Changes in january 2008 :

- Vertical resolution (55 levels)
- perturbations over the whole globe
- Evolved singular vectors (last 24h)
- final term 108h (temporary ?)
- contribution for TIGGE

Ensemble spread – time range 0h - 20080608



NB : ARPEGE resolution has increased in february 2008 (T538 C2.4) → now the resolution of the ensemble (T358) is lower than the deterministic model.

Plans for 2009 :

Increase the number of members to ~40

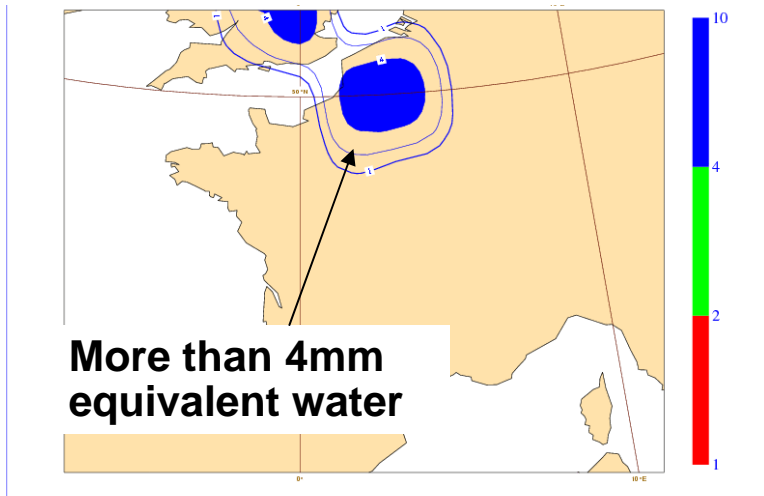
Perturbations in the model

Improve the initial perturbations

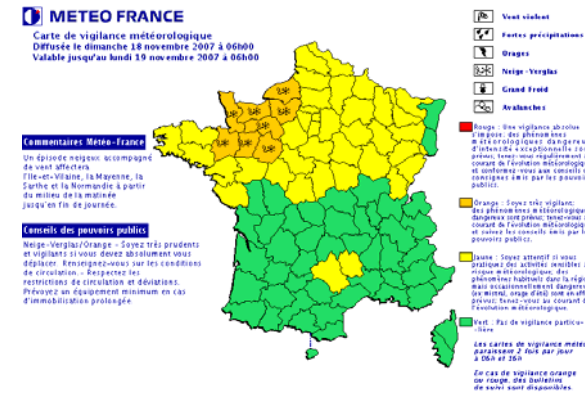
Forecasting Problems after model changes

Snowfall during winter 2007-2008

Forecat from 20071117 0h – time range 30-54h



→ False alarm in the warning system

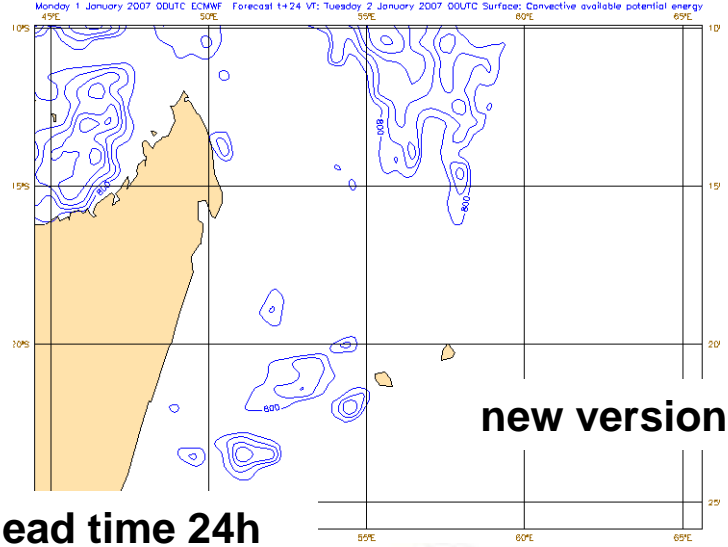
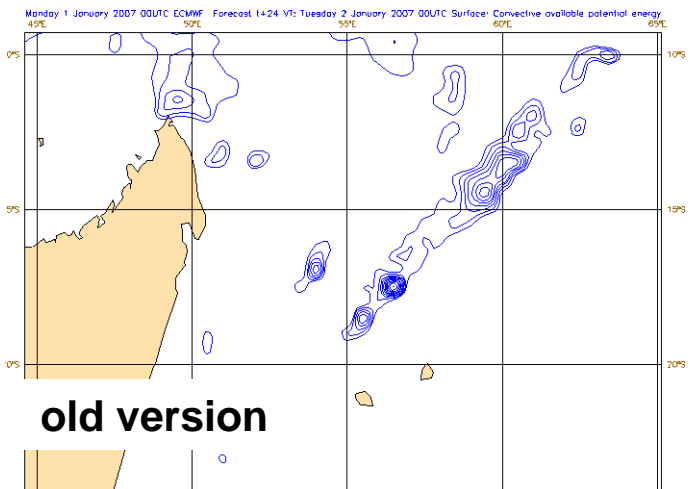
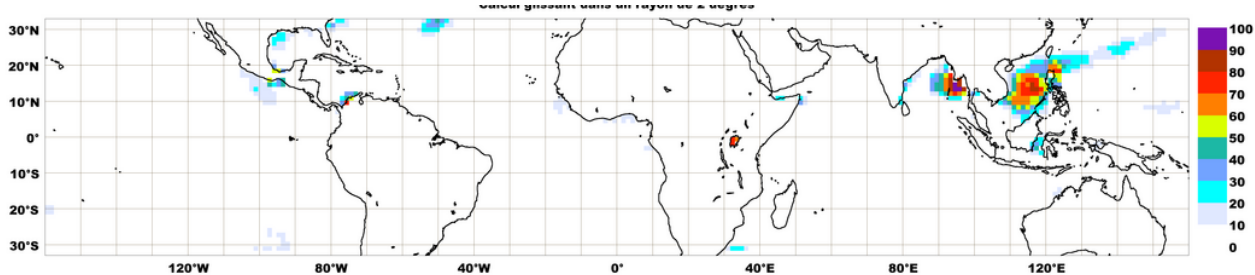


According to the forecasters, ECMWF was better during winter 2006-2007

Forecasting Problems after model changes

CAPE over tropical areas

Index of tropical cyclogenesis calculated with different EPS parameters, including CAPE



Forecast from 20070101 – lead time 24h

Forecasting

Problems after model changes

NB : good feed-back from ECMWF !

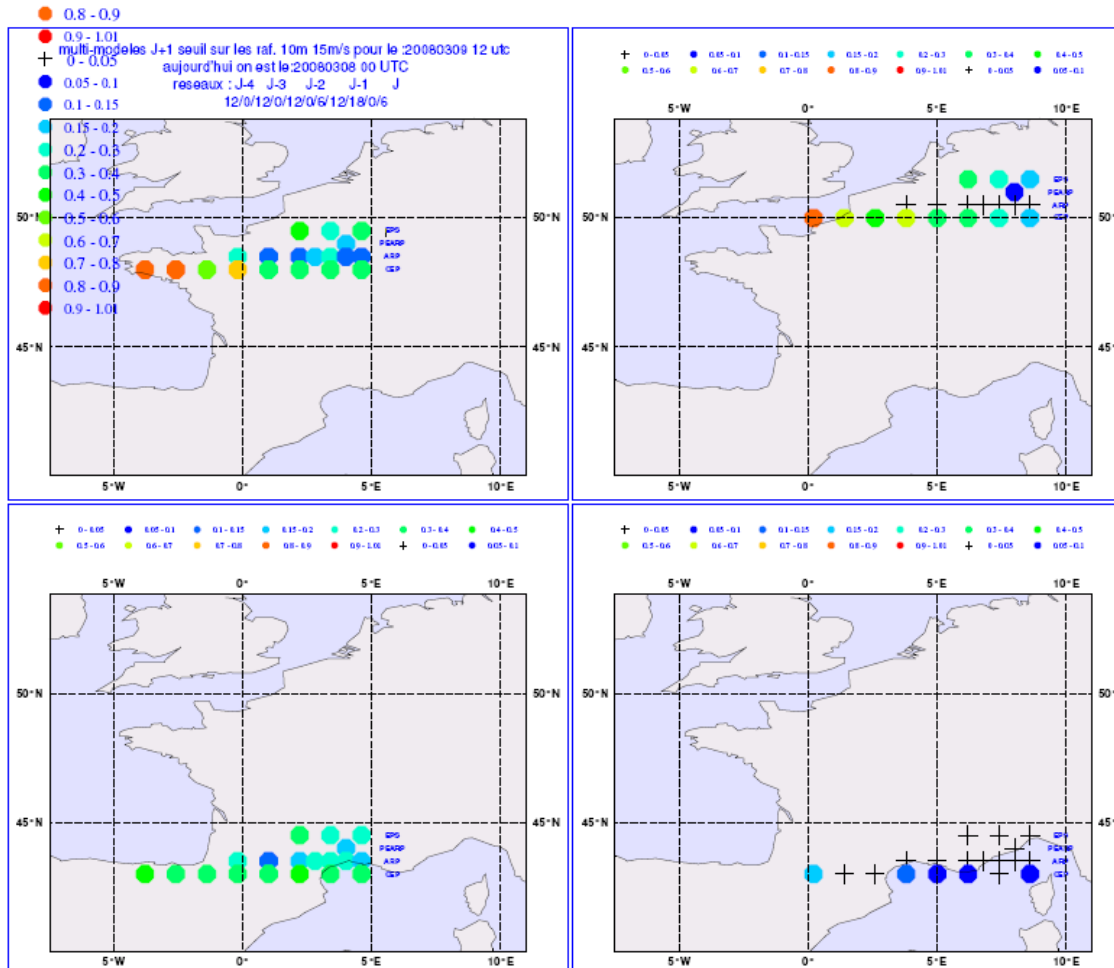
Request / Suggestions :

- **give more information about the impact of change on the weather parameters**
- **run the new version of model on specific cases**

Forecasting

Multi-models / Multi-ensembles

Maps for early warnings : successive forecasts of different models and ensembles : ARPEGE, ECMWF, PEARP, EPS



France is separated in 4 areas

The color indicates the risk of windspeed severe event

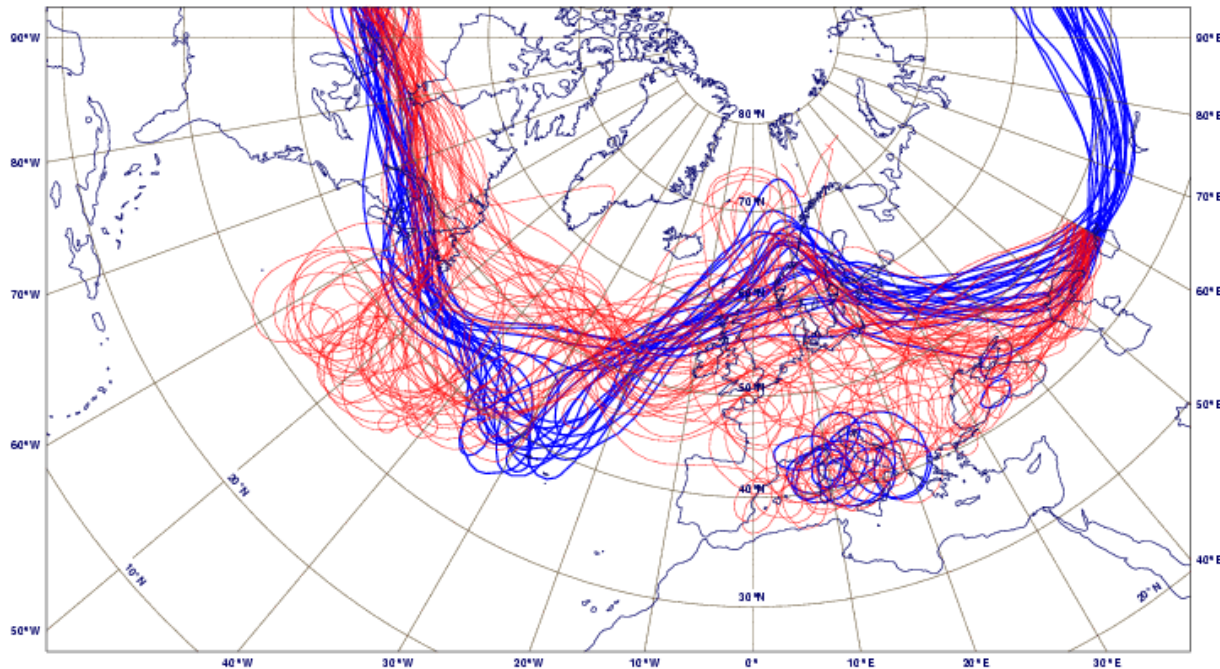
The points to the left represent the oldest forecast

Forecasting

Multi-models / Multi-ensembles

Z500 spaghetti, NCEP and ECMWF ensembles

Z500 - echeance : 144h - isoligne 568 damgp - modele du 03/06/2008 12h
BLEU=NCEP (21 runs) - ROUGE=CEPMMT (51 runs)



Forecasting

Seasonal forecast

The seasonal report

- written every month, for the following 3 months
- elaborated by a group of several experts (oceanography, climatology, seasonal forecast...)
- complete technical report (analysis, forecast, ocean and atmosphere, weather regimes...)
- some products and informations available on the public web server

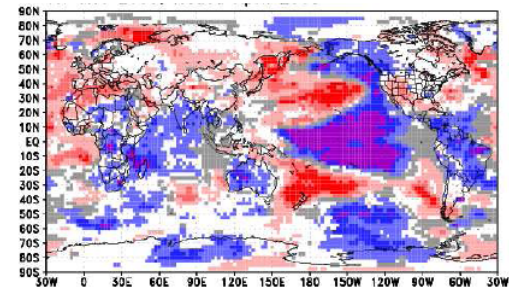
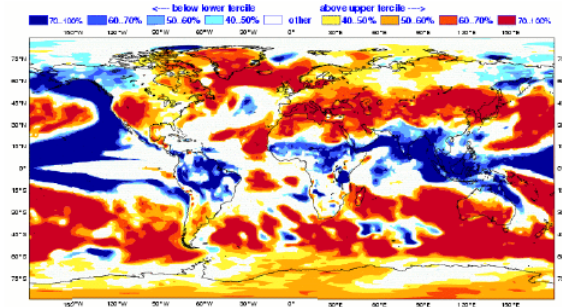
Forecasting

Seasonal forecast

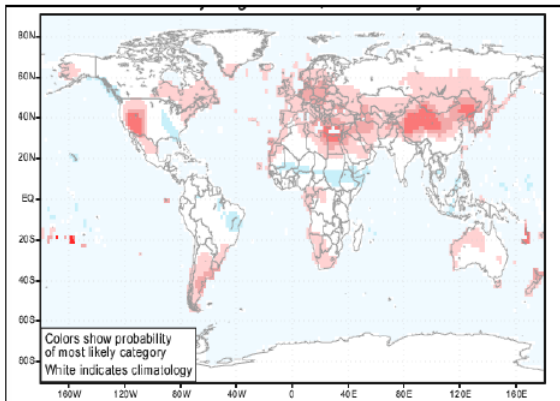
Several systems are used : UKMO, ECMWF, IRI, JMA, Météo-France

Example of temperature maps :

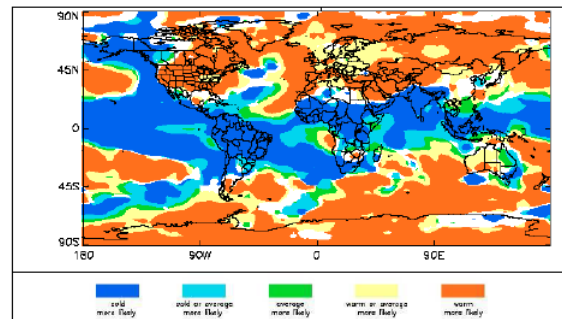
ECMWF



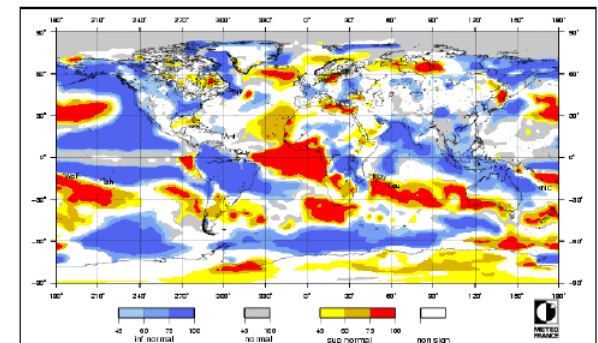
JMA



IRI



UKMO



MF

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Forecasting

Seasonal forecast

Example of final product available on the public web site :

Tendancies for the temperatures

MODELES	France Métropole	Antilles	Guyane	Réunion	Mayotte	Nouvelle- Calédonie	Wallis et Futuna	Polynésie	St Pierre et Miquelon
CEP									
IRI									
MF									
Met Office									
JMA									
Synthèse									
Scénario privilégié par Météo-France									



T inférieure à la normale (froid)



T proche de la normale



T supérieure à la normale (chaud)



Pas de scénario privilégié

Forecasting

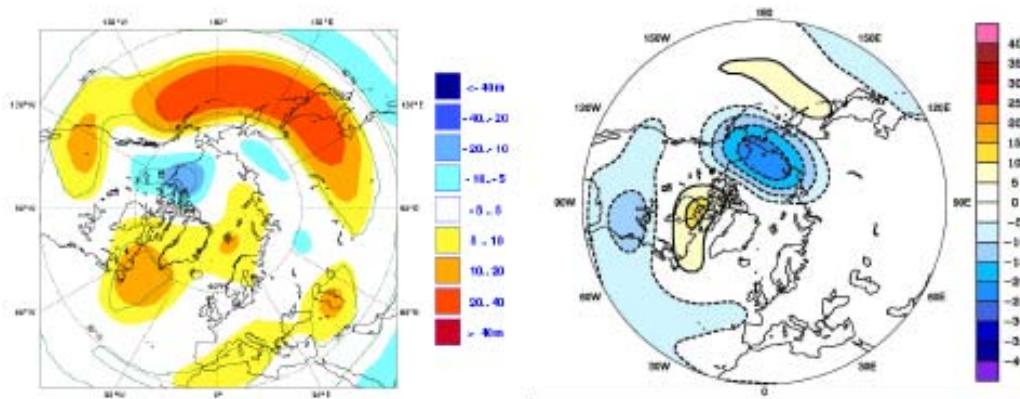
Seasonal forecast

Since 2008, the monthly forecast is also an element of information that is used.

Z500 anomaly

From
seasonal
forecast

JJA 2008



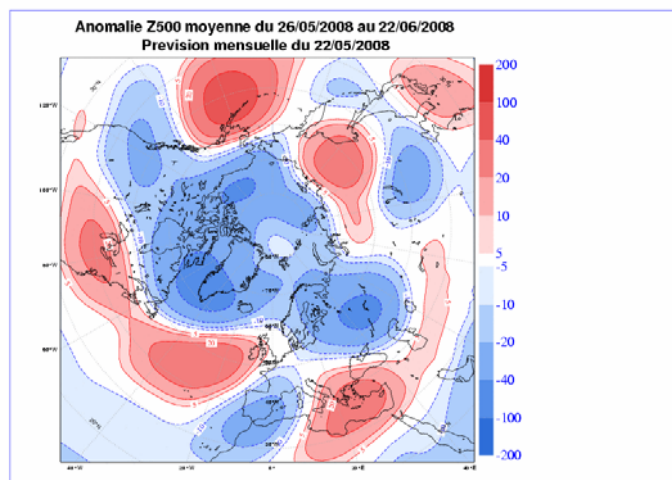
ECMWF

MF

Z500 anomaly

From monthly
forecast

(22/05/2008)



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Forecasting

Seasonal forecast

Request from the seasonal forecast community :

→ more EUROSIP products on the web site

Statistical post-processing

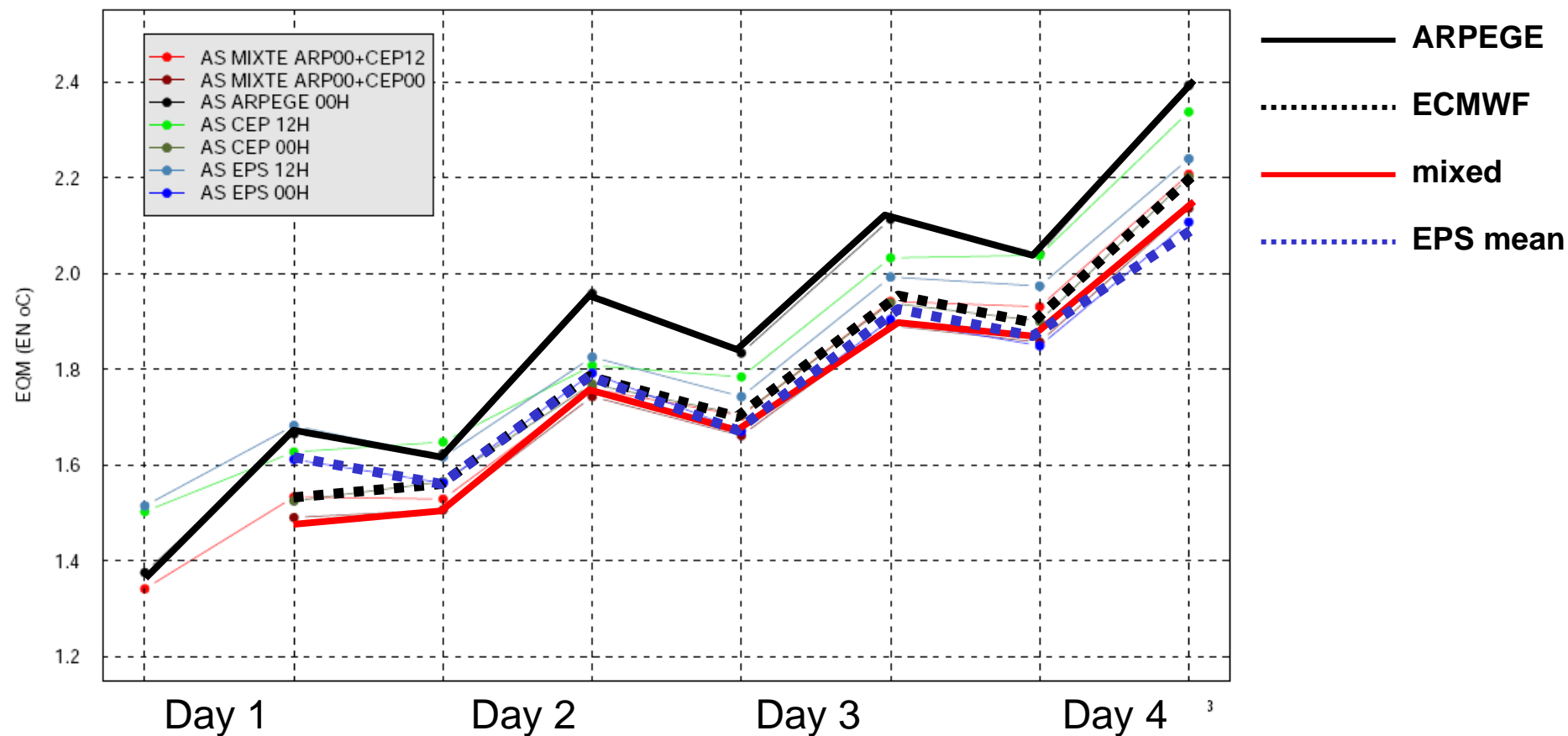
“mixed” statistical post-processing

Description :

- parameter : 2m temperature (every 3h and extreme temperatures)
- use of ARPEGE and ECMWF statistical adaptations together as predictors
- “barycentric” regression = linear regression with a constraint. The predictors of the two models are weighted and the sum of the coefficients must be equal to 1
- learning is made every day with the 40 last days

Statistical post-processing “mixed” statistical post-processing

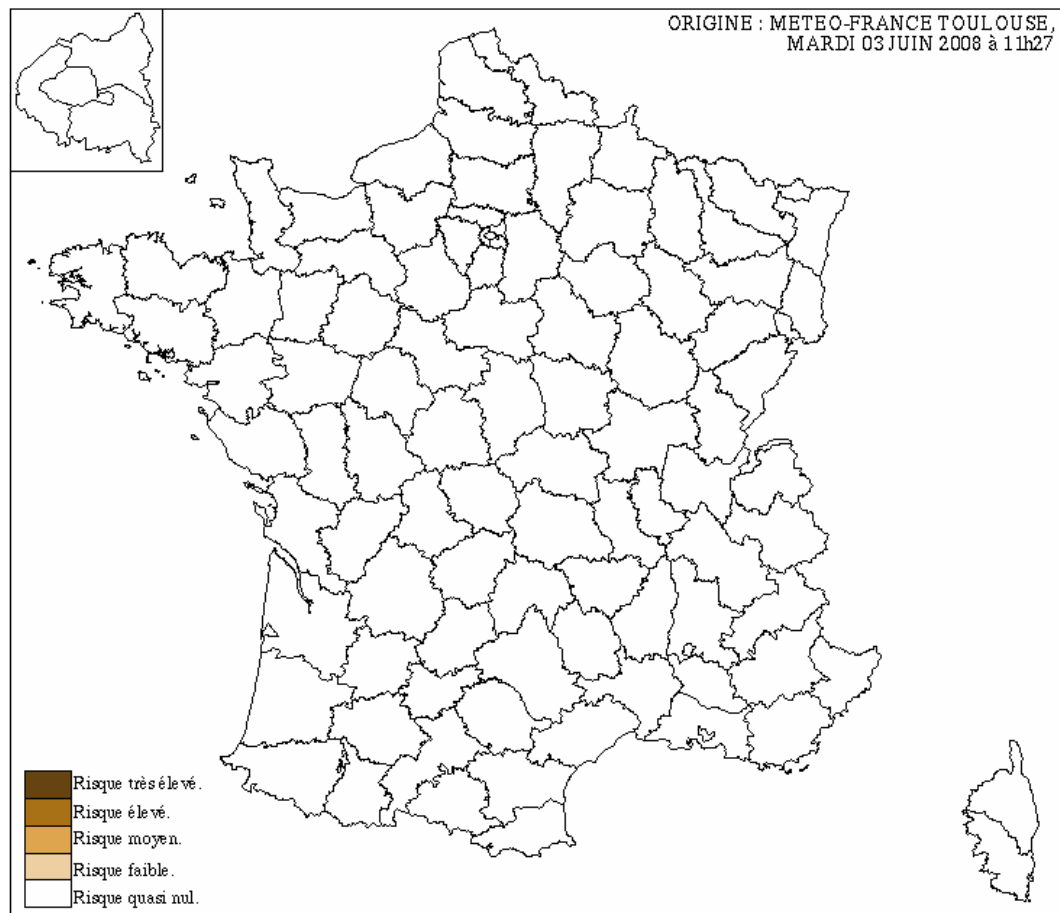
Min and max temperature RMSE for 2006, calculated over 26 stations



Statistical post-processing

“mixed” statistical post-processing

The « mixed » temperature will be used, during summer 2008 for the heat waves warnings.



Carte de risque biométéorologique nuit/jour du 03 juin.

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Toujours un temps d'avance

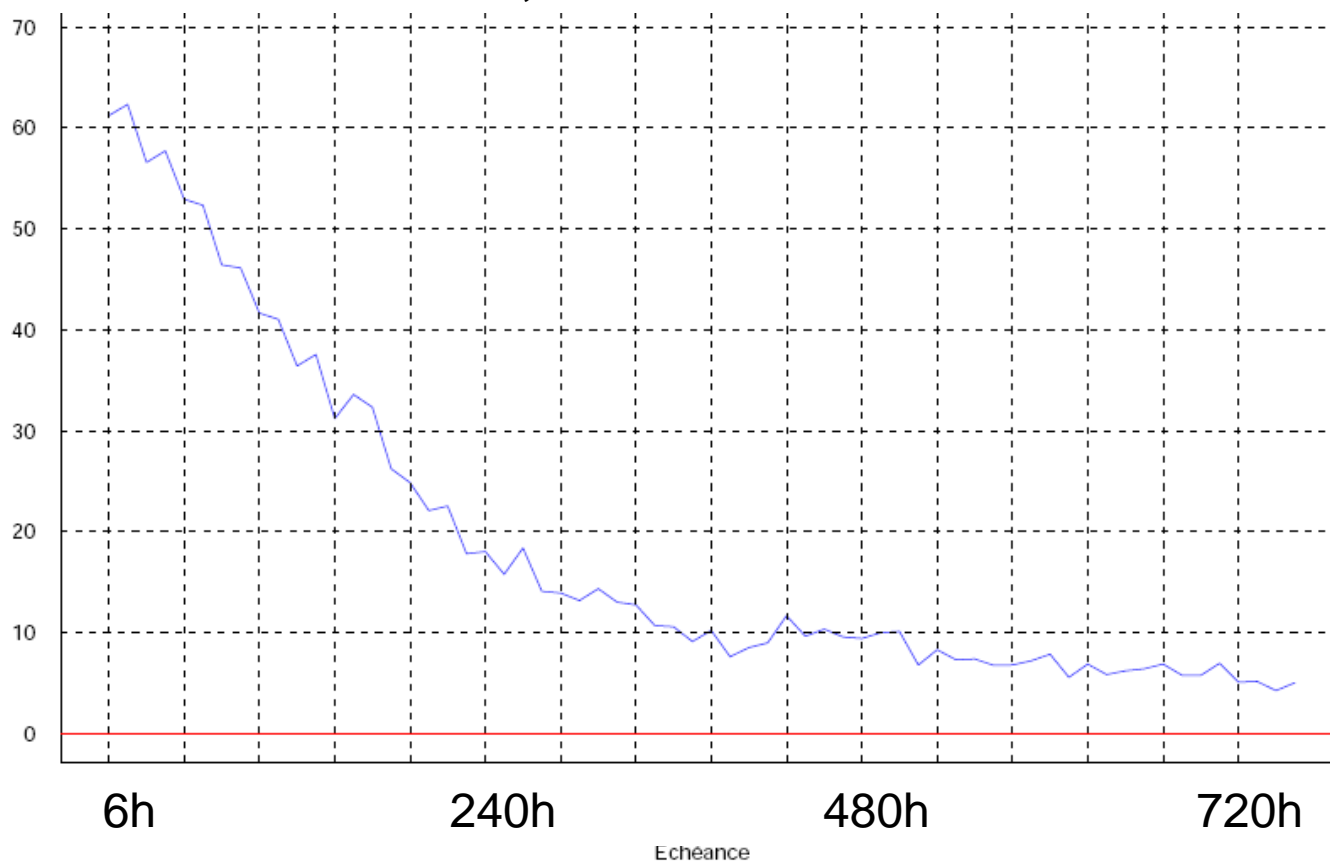
Statistical post-processing monthly forecast

Description :

- multiple linear regression
- 2m temperature, 850 and 500 hPa temperature as predictors
- pseudo perfect model : learning is made on the first 24h and then the coefficients are used for the further lead times.
- at this time, the hindcasts are not used
- at this time, runs separately from VAREPS
- runs on ecgate (monitoring level 1)

Statistical post-processing monthly forecast

**RMSE compared with climatology, expressed in terms of skill score
2004-2007, calculated over 26 stations**



Statistical post-processing

Calibration of EPS windspeed distribution

Research made by a student, Salima Benslimane, supported by Serge Farges

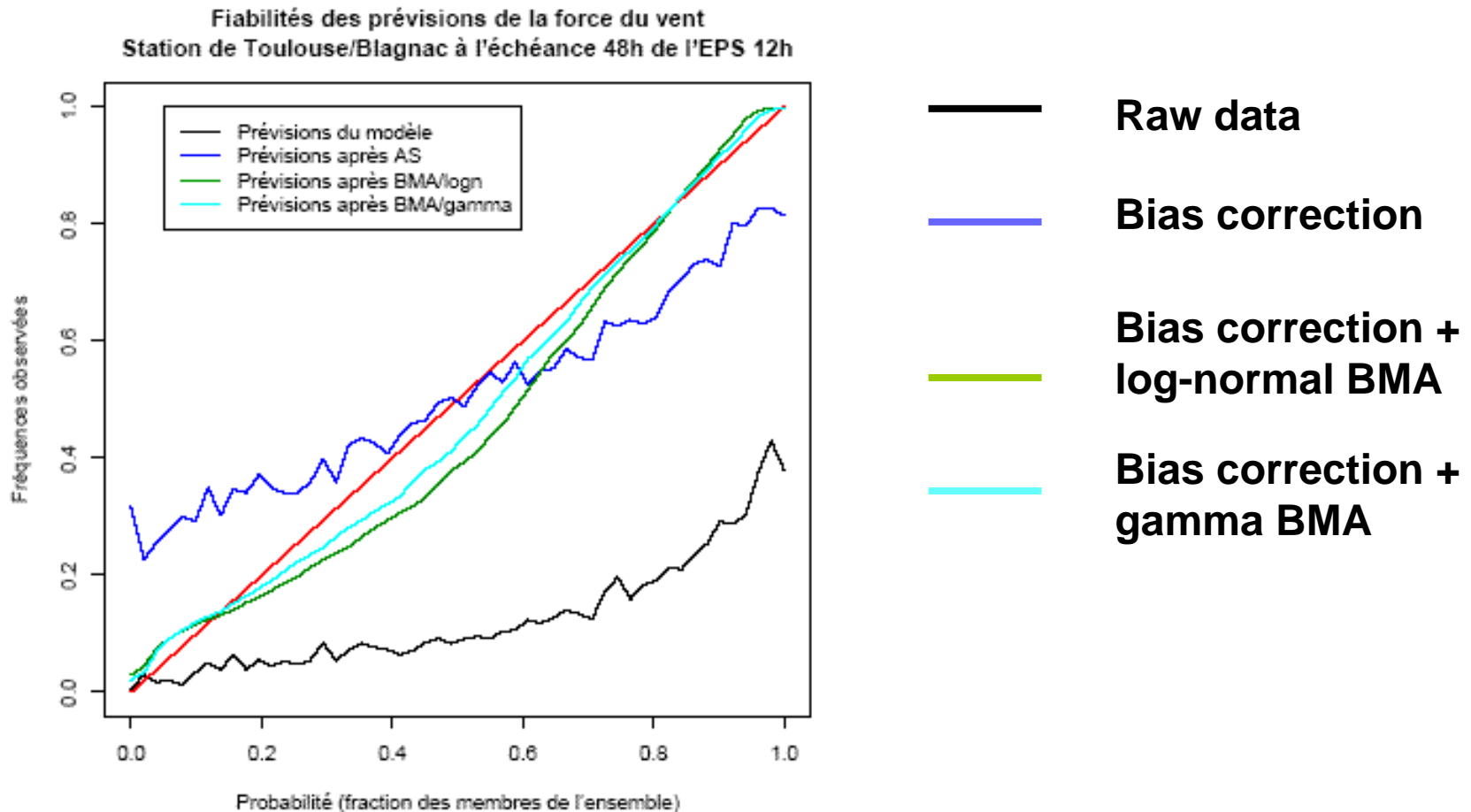
Description :

- first step : bias correction with multiple linear regression
- second step : local calibration with Bayesian Model Averaging (BMA)
- log-normal and gamma distributions have been tested
- minimisation of CRPS (analytic expression) to estimate the standard deviation of the distributions

Statistical post-processing

Calibration of EPS windspeed distribution

Reliability Diagram for Toulouse, lead time 48h



Summary

- **Large use of ECMWF products (for all time ranges)**
- **Large amount of monitoring and control data to explore**
- **Clear tendency to use multi-models / multi-ensembles**
- **Request for more information when models change**
- **Request for more EUROSIP products**

Acknowledgements

To ECMWF :

- Post-processing of new pressure levels
- Significativity of monthly forecasts (available in MARS)
- wave-EPsgrams

To Météo-France colleagues :

Jean-Luc Varon, Bruno Mornet, Guillaume Beffrey, Serge Farges, Jean-Pierre Ceron, Isabelle Charon, Bruno Lacroix, Hubert Brunet, Bernard Roulet, Alain Mougel, Thierry dupont, Jean-Daniel Gril, Philippe Arbogast