Use and evaluation of ECMWF products at Météo-France

Nadine Aniort, Isabelle Charon, Brigitte Dubuisson, Jean-Christophe Vincendon, Jean-Pierre Ceron, Bernard Roulet, Jean-François Raynal, Frédéric Gayrard, Nicole Girardot

and Christophe Cassou (CERFACS)

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Outline

Feedback from the forcasters

- tropical cyclones
- snow
- blocking persistance

Weather regimes

- seasonal forecast
- monthly forecast

Experimental products

- vertical profile
- chi and psi plots

Requirements and suggestions

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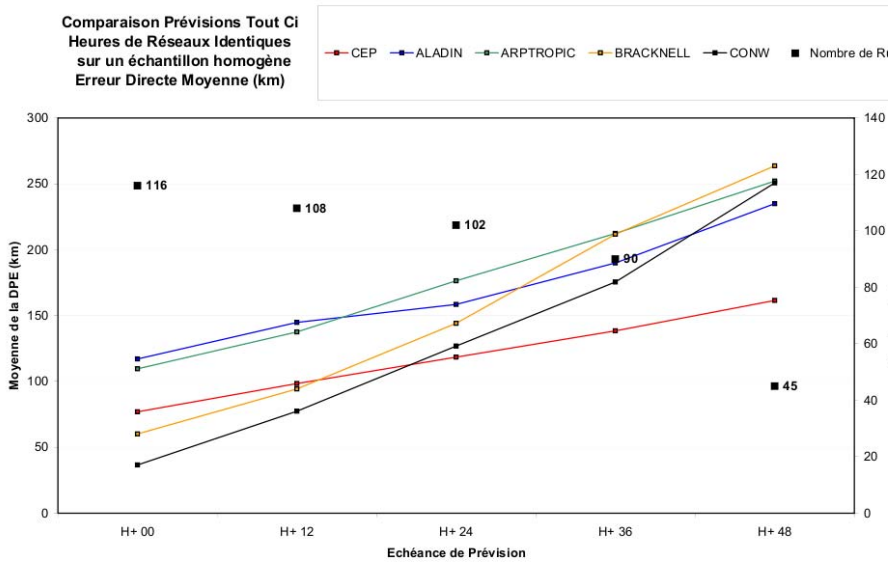
Feedback from the forecasters
tropical cyclones

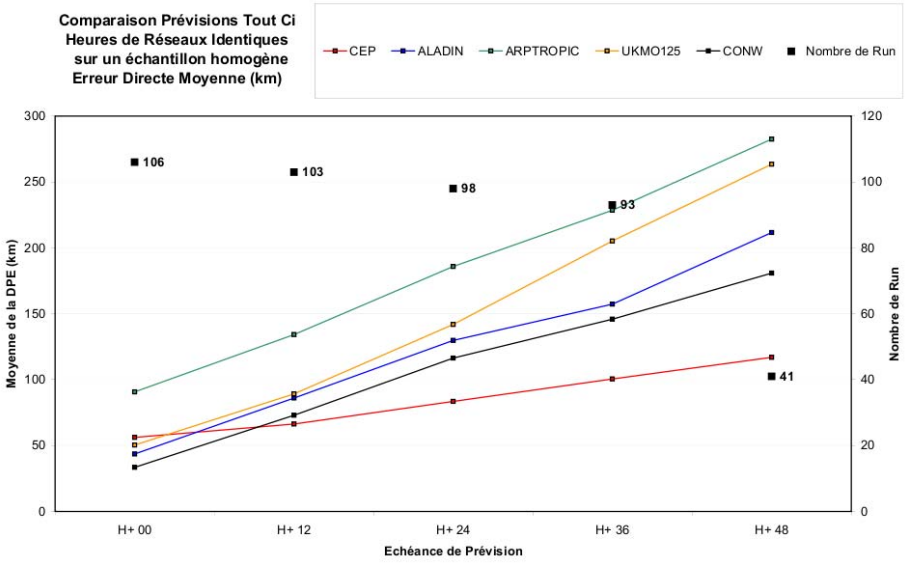
Very good performance of T799, confirmed by the RSMC La Reunion :

Direct Position Error

Cyclonic season 2006/2007



Cyclonic season 2007/2008



ECMWF
ALADIN
ARPEGE (non stretched)
UKMO
American CONSENSUS

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Feedback from the forecasters

snow problems

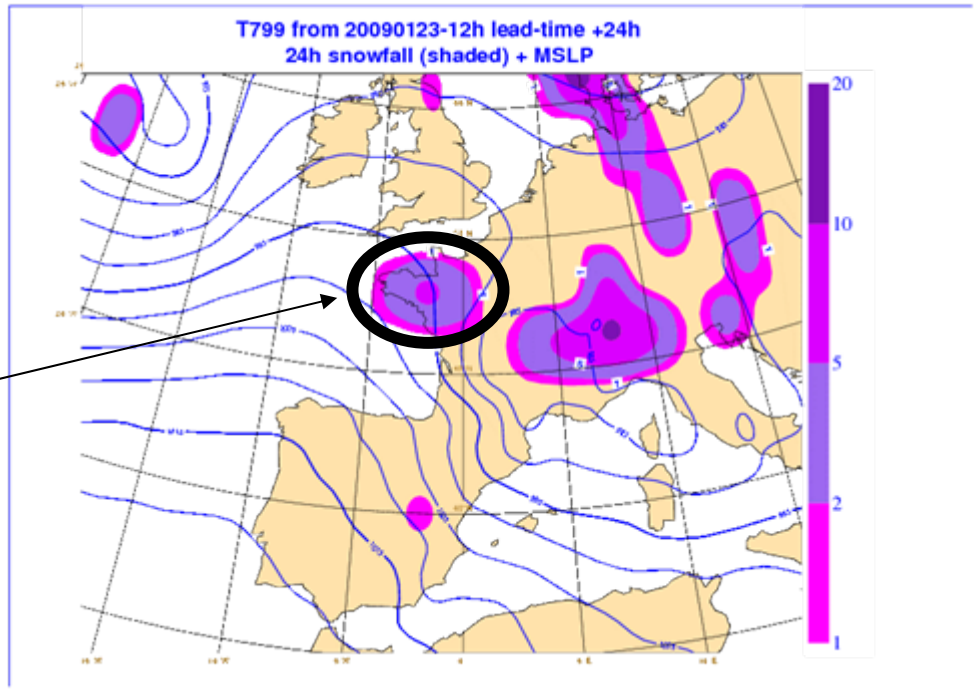
much better during last winter (cy35r1 in sept. 2008)

... but not perfect :

- **the areas covered by snowfall are often too large**
- **sometimes inconsistency between snowfall and temperature**

T799 from 20090523 12h
Lead time 24h
24h snowfall (shaded)
MSLP (lines)

Up to 5mm equivalent liquid water



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Feedback from the forecasters
underpersistance of blocking events

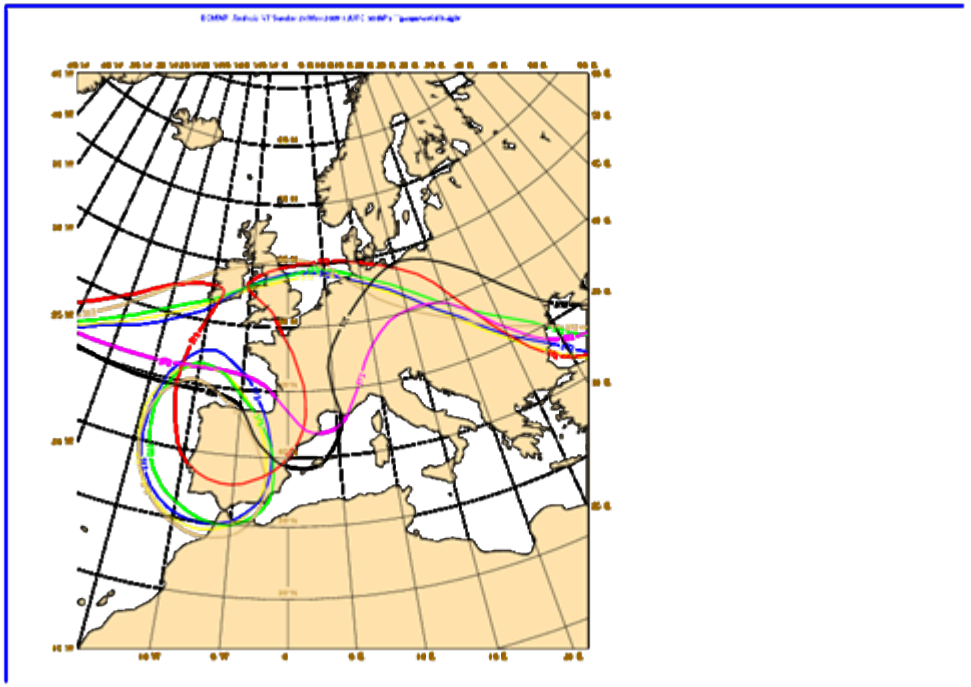
noticed with EPS

General feeling : the blocking patterns circulate too quickly

One example :

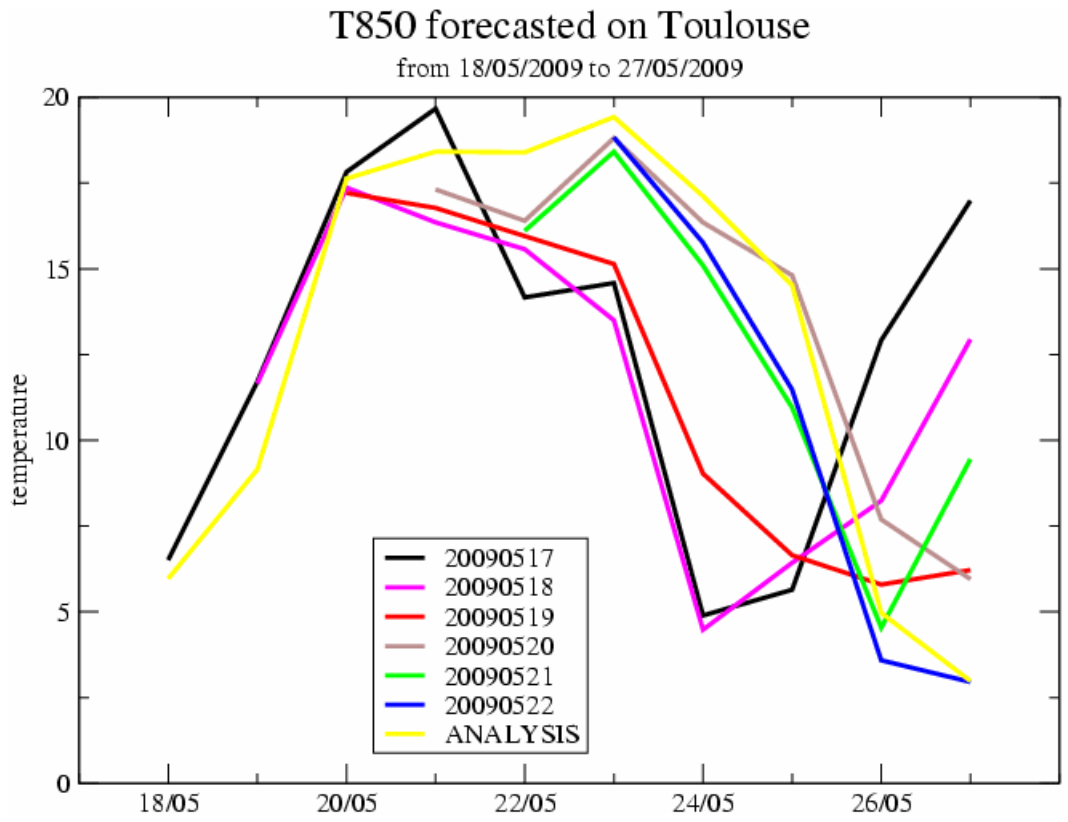
All forecasts valid on 20090524 12h
Z500 – isoline 572 damgp
Unperturbed ensemble member

168h forecast
144h forecast
120h forecast
96h forecast
72h forecast
48h forecast
Analysis



Feedback from the forecasters
underpersistance of blocking events

This leads to large errors on temperature :



NB : traditionnal statistical post-processing can not correct it.

Feedback from the forecasters
underpersistance of blocking events

questions :

- can we confirm this default objectively ? Which diagnostic ?

- does it exist also in T799 ?

- does the ensemble increase this behavior ? (by selecting the more “active” members)

NB : it may be more important and penalizing at monthly time scale

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Weather regimes
seasonal forecasts : introduction

Full study from Etienne Chabot, with Brigitte Dubuisson, Jean-Pierre Céron (MF), Christophe Cassou and Laurent Terray (CERFACS)

- **Operational seasonal forecast :**
  - ✓ Worthy scores for tropical regions, for phenomenon like ENSO
  - ✓ But limited scores for mid-latitude regions

- **Weather regimes :**
  - ✓ Observed in the atmosphere at daily scale
  - ✓ Recurrent and quasi-stationary structures
  - ✓ Commonly persisting for 5 to 10 days
  - ✓ Representing the large scale circulation

- **Purpose of the study : assess the predictability of weather regimes at seasonal scale**
  - ✓ Spatial pattern
  - ✓ Mean frequency

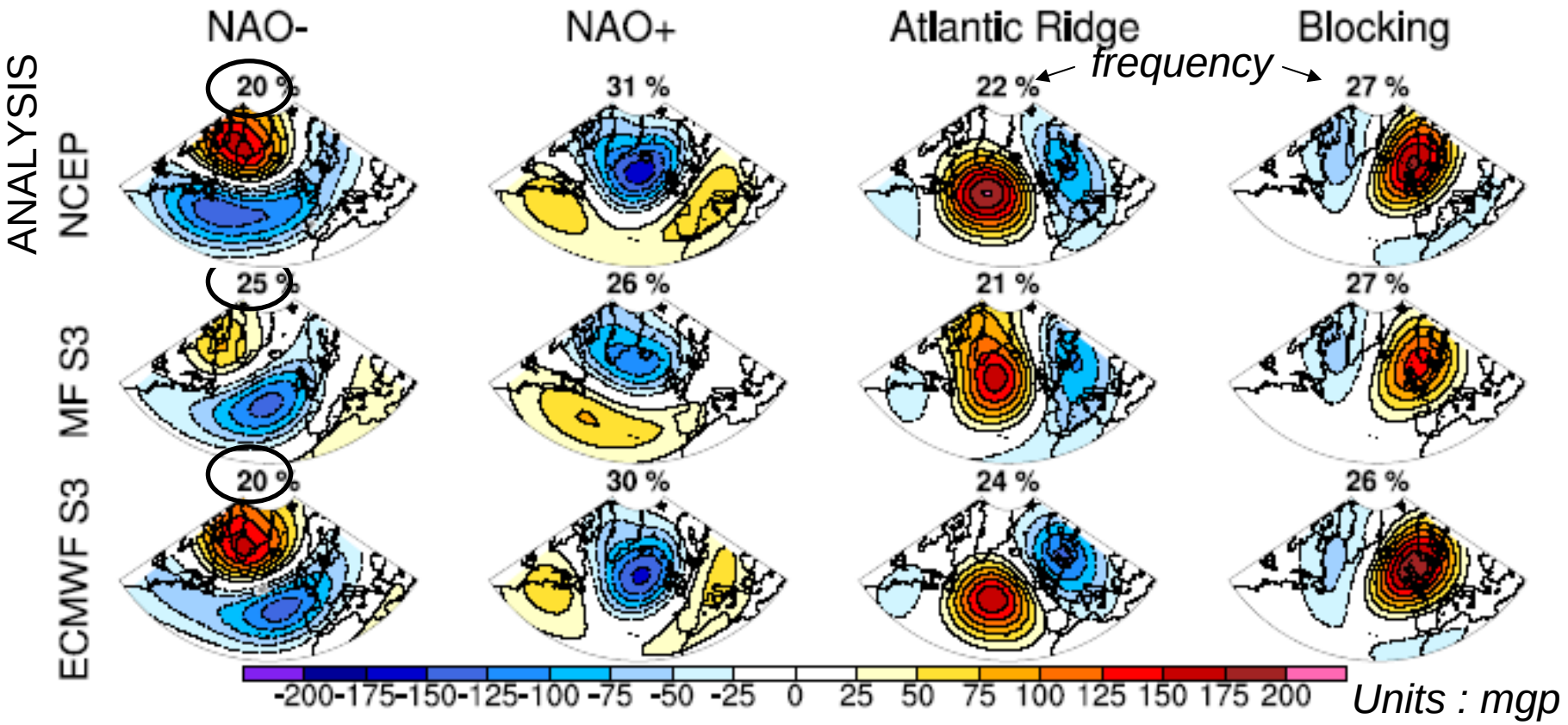
- **For 2 coupled operational model :** ECMWF and Meteo-France

Weather regimes
seasonal forecasts : introduction

- **Domain :** North Atlantic and Europe
- **Field : daily fiels of geopotential height at 500 hPa (Z500) anomalies**
- **Automatic classification into 4 clusters : *Michelangeli et al., 1995***
- **Similarity measure : euclidian distance**
- **Period : 1979 - 2007 (MF hindcast period)**
- **2 coupled models for seasonal forecasting :**
  - ✓ Météo-France System 3 (**MF**) : ARPEGE-Climat v4 T63L91 (*Déqué et al., 1994)* + *OPA in ORCA2 configuration (Madec et al., 1998)*
  - ✓ ECMWF System 3 (**ECMWF**) : IFS T159L62 + HOPE (*Anderson et al., 2006)*
- **Forecast for the DJF period (issued on 1th november)**

Weather regimes

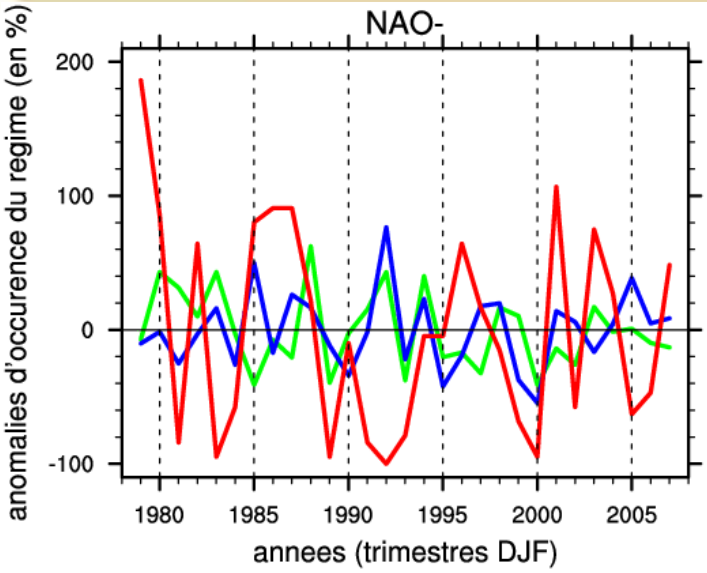
seasonal forecasts : weather patterns

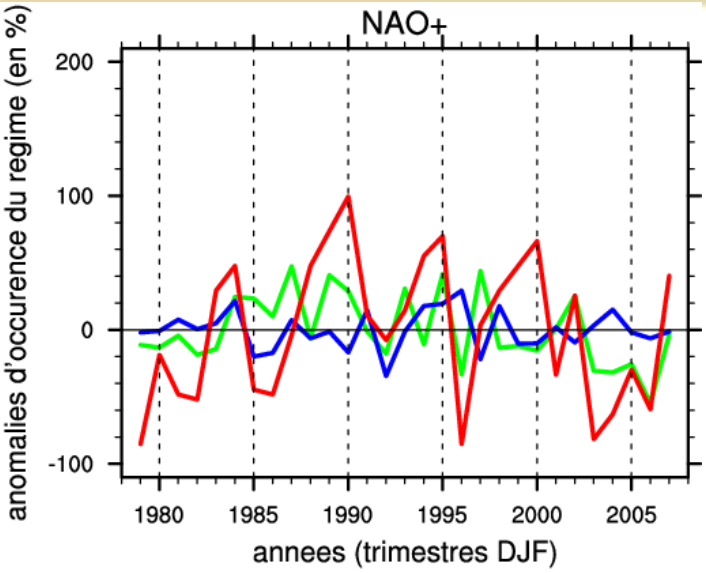


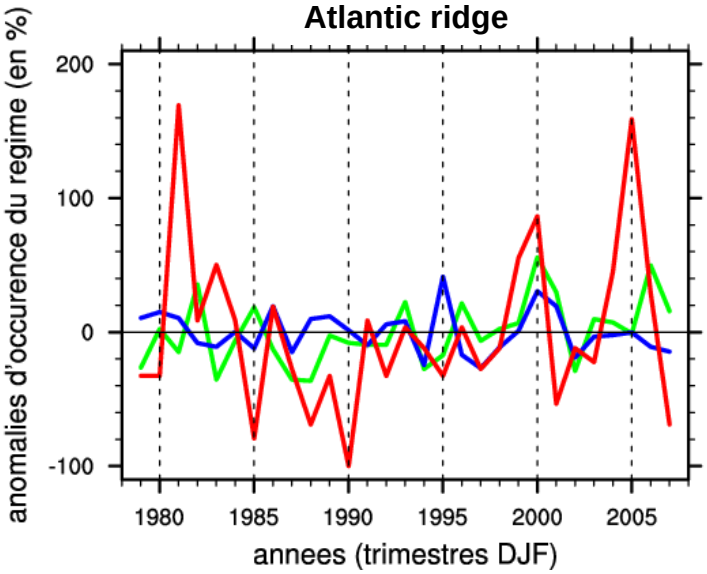
- Good representation of spatial patterns of the regimes in the models
- Overestimated frequency of NAO- regime and underestimated of NAO+ in MF
- The intensity of the regimes is too weak in MF

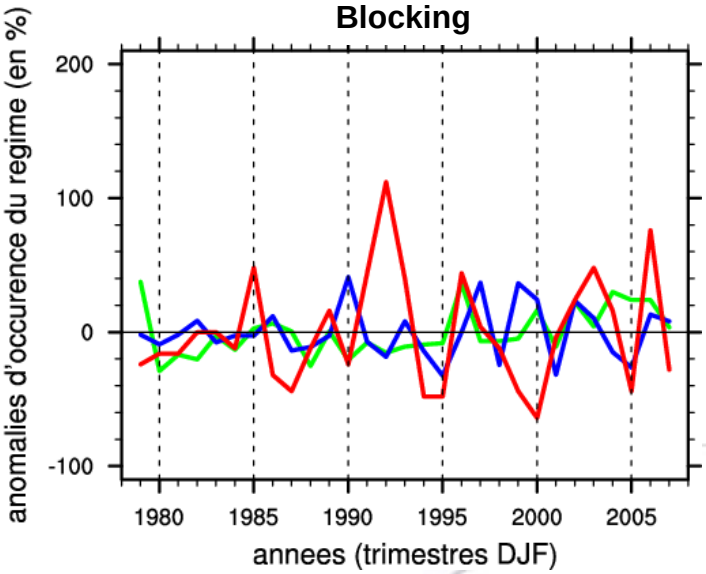
Weather regimes

seasonal forecasts : frequency anomalies









Analysis

MF

ECMWF

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Weather regimes

seasonal forecasts : frequency anomalies

	Correlation between frequency anomalies observed and forecasted MF model	Correlation between frequency anomalies observed and forecasted ECMWF model
NAO-	-0,18	0,09
Blocking	0,08	-0,02
Atlantic ridge	0,04	0,13
NAO+	0,40	-0,05

→ **low correlations**

Weather regimes

seasonal forecasts : frequency upper and lower tercile

False Alarmes
(if observed and forecasted terciles are opposite)

Hits
(if observed and forecasted terciles are identical)

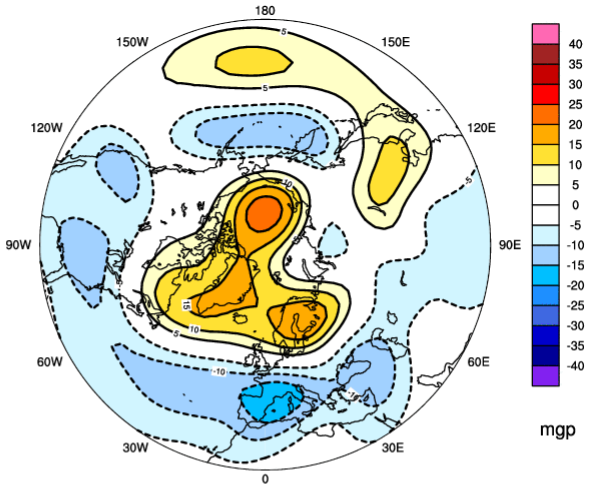
Scores - projection on model regimes	MF	ECMWF
NAO-	8 / 9	11 / 6
NAO+	10 / 3	10 / 6
Atl. Ridge	6 / 8	7 / 8
Blocking	10 / 7	10 / 6

Scores - projection on reanalysis	MF	ECMWF
NAO-	8 / 7	12 / 5
NAO+	15 / 4	10 / 8
Atl. Ridge	6 / 7	16 / 8
Blocking	7 / 6	16 / 5

Weather regimes
seasonal forecasts : pre-operationnal product

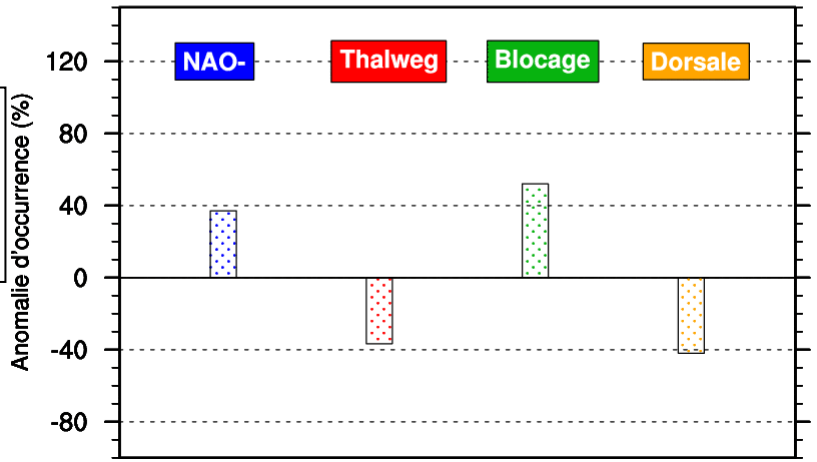
MF forecast for JAS 2008

Z500 Anomalies (mgp)



➢ the general circulation indicates more rainy weather over west-Europe

Weather regimes Frequency anomalies (%)



➢ large anomalies forecasted

➢ NAO- and Blocking more frequent

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Weather regimes
seasonal forecasts : preliminary results and perspectives

- **Models are able to simulate the spatial patterns of observed regimes**
- **Weak previsibility for the regimes' occurrence**
  - ✓ Only NAO+ regime in MF (4 false alarms and 15 hits)
  - ✓ Blocking regime in ECMWF (5 false alarms and 16 hits)
- **Better scores if projected on observed regimes**
- **Perspective** : Use of the regimes in the multi model EUROSIP

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Weather regimes
monthly forecast : introduction

Motivations :

- encouraging results with seasonal forecast, should be better with monthly forecast
- In order to find sources of predictability, especially for precipitations
- Link with medium-range forecast

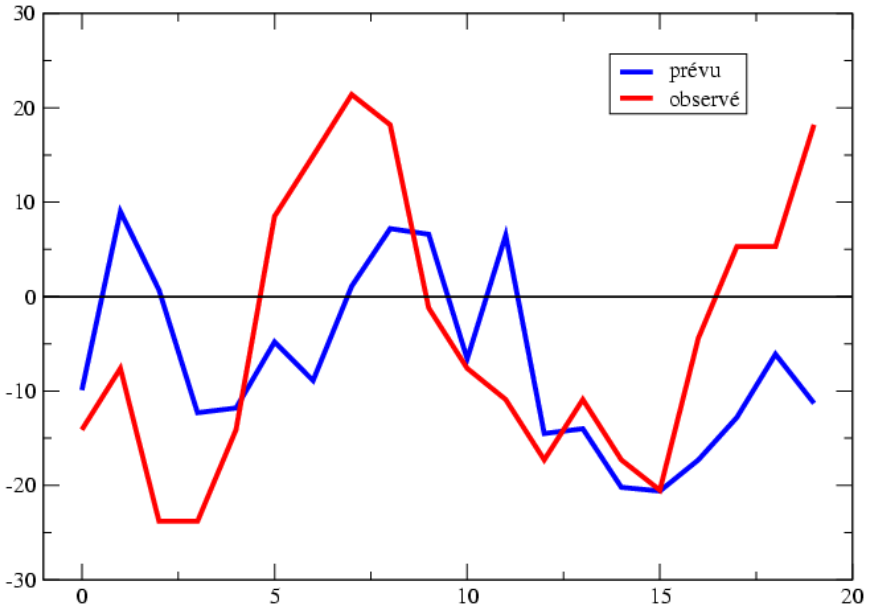
Differences :

- forecasts valid from november to march are used : 18 to 20 forecasts every winter
- study on 5 winters (2004-2005 to 2008-2009) covering november to march → sample size = 94

Weather regimes
monthly forecasts : frequency anomalies

- Comparison of forecasted and observed frequency anomalies for every weather regime
- NB : the full month of the forecast is used (lead time 24 to 768h)

Example : BLOCKING during winter 2008-2009



	Correlation between observed and forecasted anomalies
NAO-	0,65
Blocage	0,41
Dorsale Atl.	0,64
NAO+	0,62

Weather regimes
monthly forecasts : frequency anomaly

- Comparison of the sign of the anomaly
- Good forecast (hit) = observed and forecasted anomalies have same sign

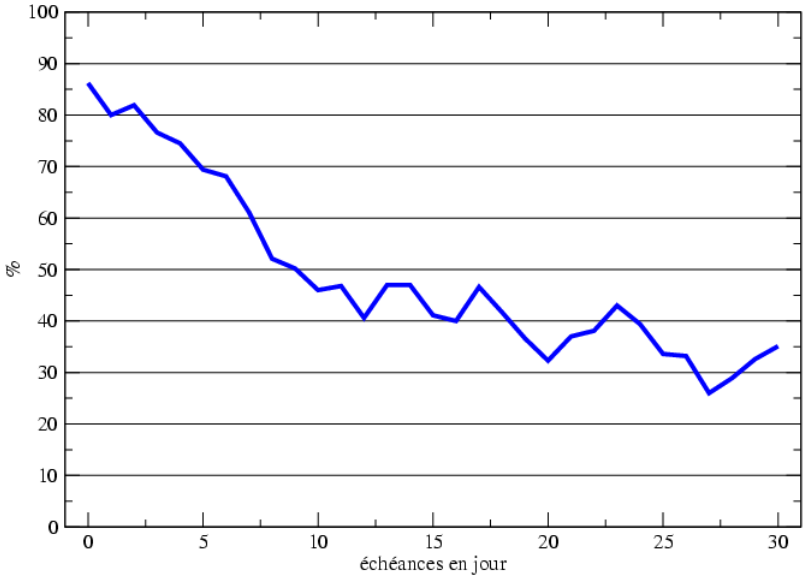
	Hit rate (%)			
5 winters	NAO- 79	BLOC 59	Atl Ridge 70	NAO+ 78
2004-2005	83	66 (-)	88 (++)	94 (--)
2005-2006	83	61 (+)	66 (+)	88 (--)
2006-2007	83	44	66 (-)	72 (+)
2007-2008	89 (--)	73	63	68 (+)
2008-2009	57	52	68 (+)	68 (-)

Weather regimes
monthly forecasts : regimes chronology

- For every lead time :

good forecast (hit) = the most likely regime is observed

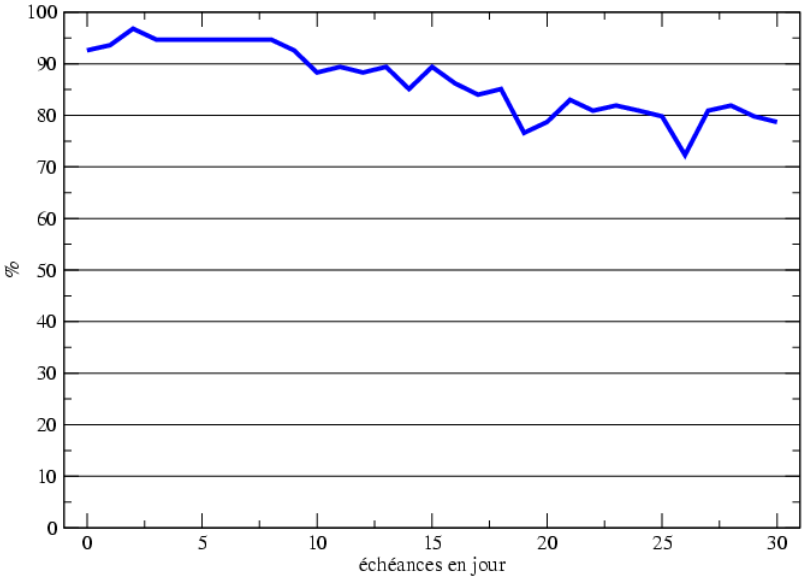
Hit rate (%)



- For every lead time :

good forecast (hit) = the less likely regime is not observed

Hit rate (%)

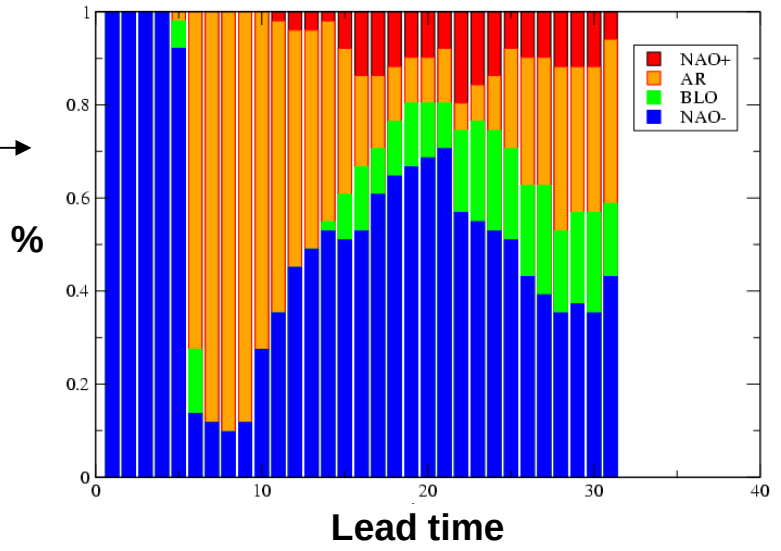


Weather regimes
monthly forecasts : preliminary results

- First results are interesting, but deeper assessment must be done
- At this time we are testing products with the medium-range forecasters and also with seasonal forecast community
- Perspective : try to improve the precipitations forecast by using the weather regime informations

Ensemble members distribution onto winter weather regimes

Monthly forecast from 20090212



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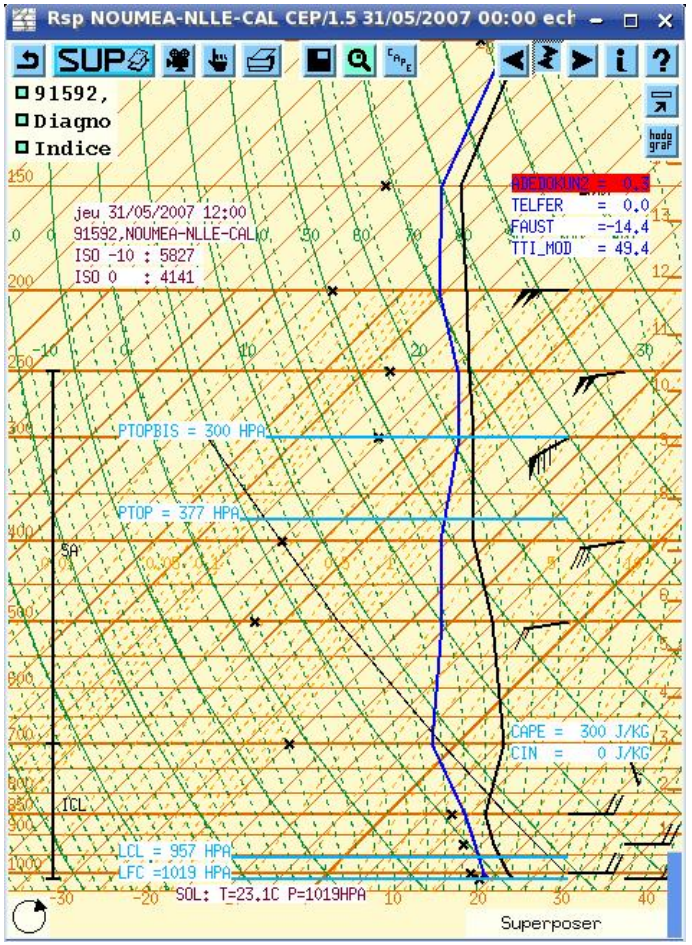
Experimental products
vertical profiles with T799

Work from Nadine Aniort (MF - DPrévi/COMPAS/DOP)

- **Present situation :**
  - Vertical profile on synergie (forecaster workstation) →
  - Very few vertical levels

- **goal :**
  - Provide vertical profile with a good vertical resolution (of ECMWF deterministic model)



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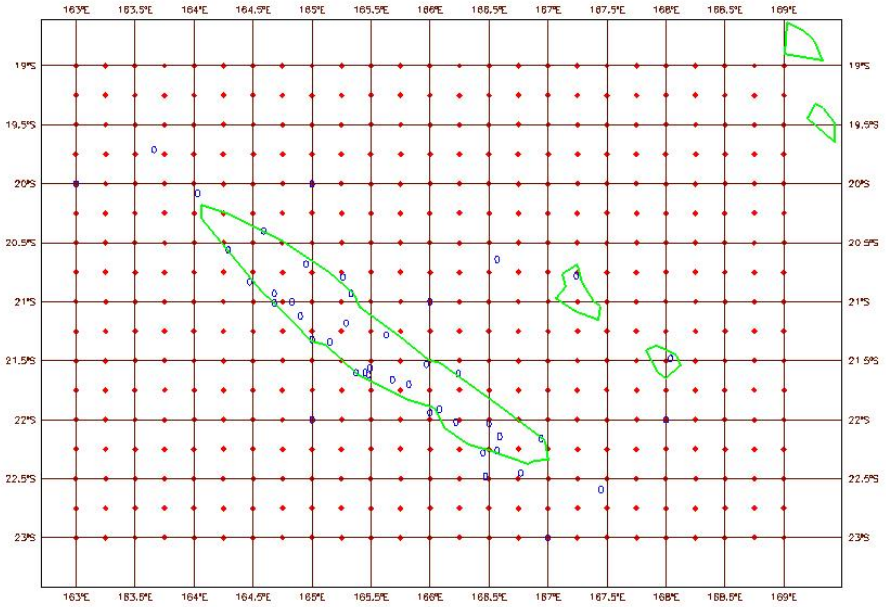
Experimental products
vertical profiles with T799

parameters :

- Temperature and specific humidity on 56 model levels
- Geopotential, U and V at 1000, 925, 850, 700, 500, 400, 300 and 200hPa.
- Surface parameters : Temperature, dew-point temperature, wind direction and speed …

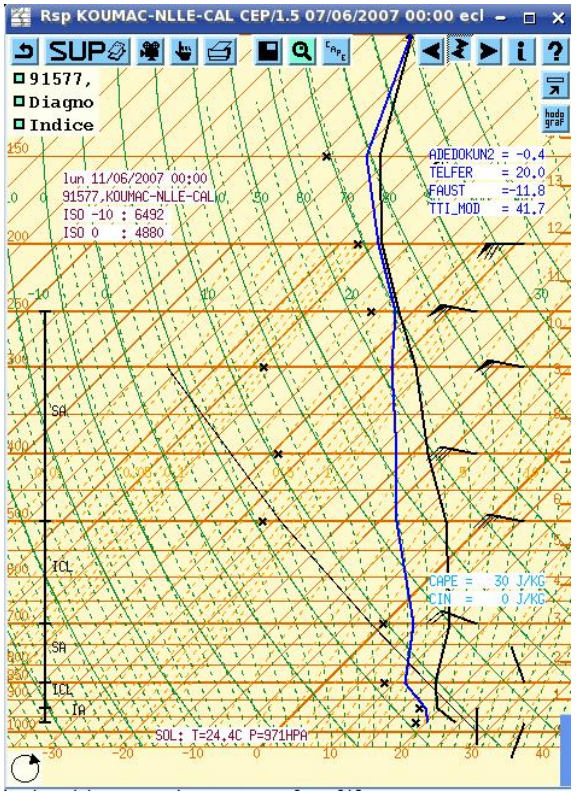
⟶ Necessary to run on ecgate

- **First tests on New-Caledonia**

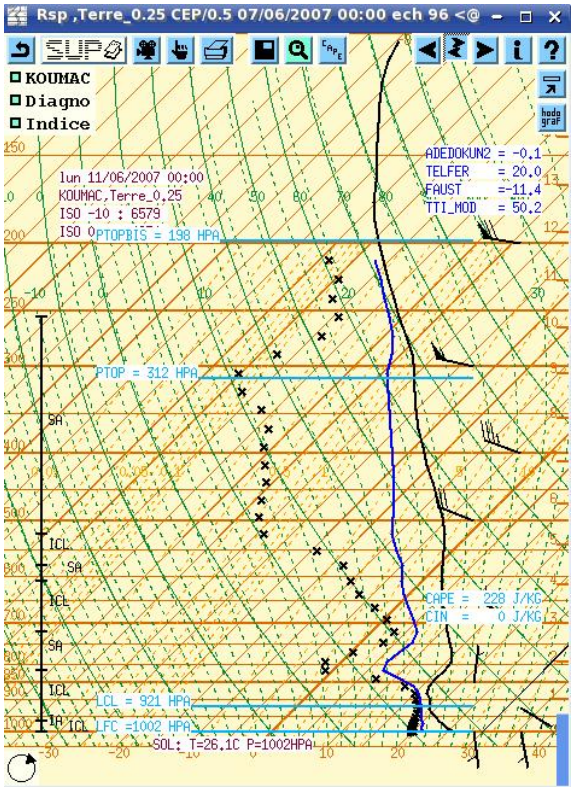


METEO FRANCE
Toujours un temps d'avance

Experimental products
vertical profiles with T799



OLD



NEW

→ Better estimation of isotherm levels and instability indices

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Toujours un temps d'avance

Experimental products
vertical profiles with T799 : perspectives

- Over all tropical areas : 200 points
- Over metropolitan France : 200 points (or more…)

→ PROBLEM : very large volume of data leads to long computation time !
how can we produce this in operations ?

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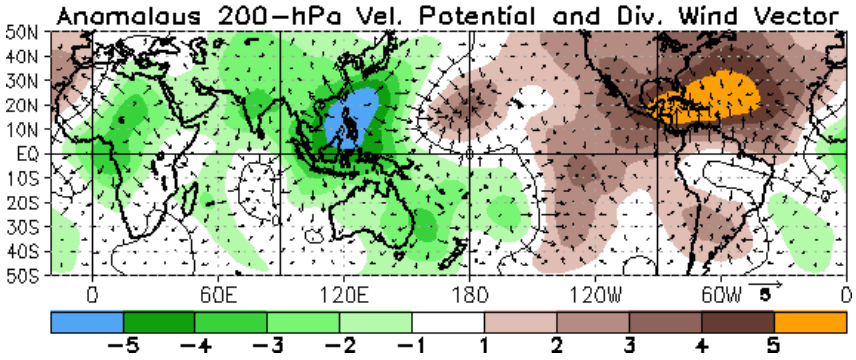
Experimental products
chi and psi plots with seasonal forecasts

Analysis of 200hPa velocity potentiel anomaly

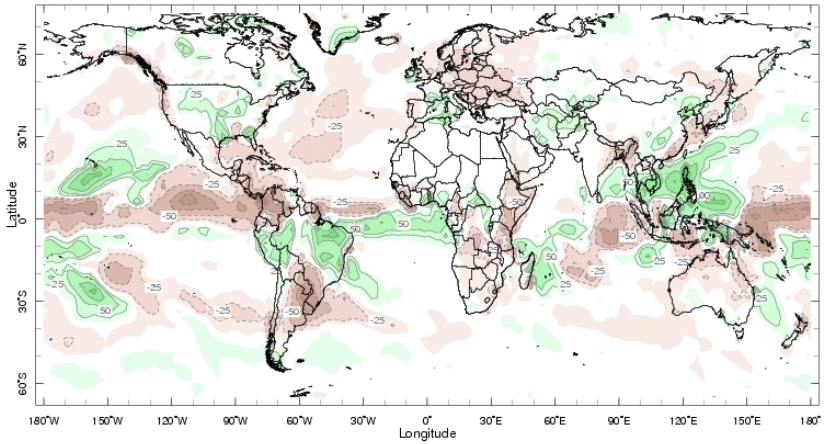
April 2009



http://www.cpc.ncep.noaa.gov/products/CDB/Tropics/figt24.shtml

Observed precipitation anomaly

April 2009



http://iridl.ldeo.columbia.edu/maproom/.Global/.Precipitation/

→ Pertinent parameter for tropical areas

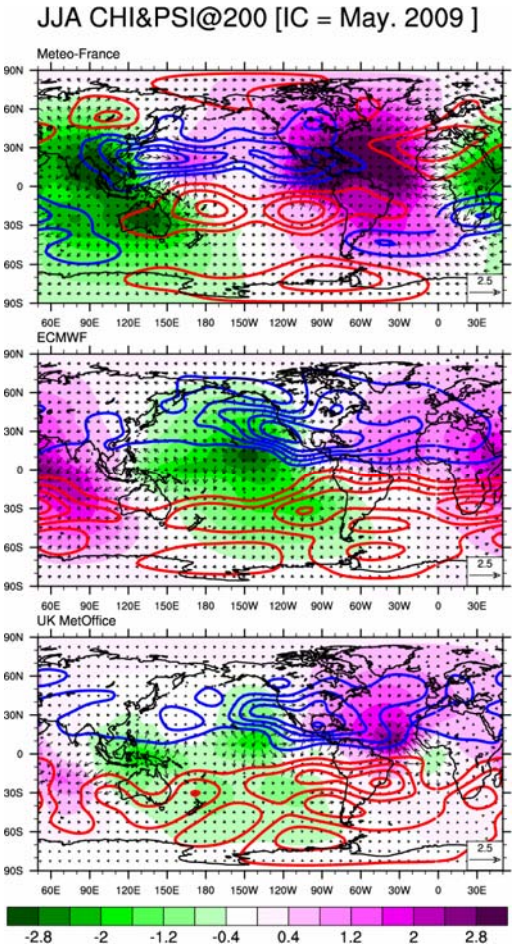
Experimental products
chi and psi plots with seasonal forecasts

Forecast version,plottted by Christophe Cassou and tested in the frame of the GCB :

MF

ECMWF

UKMO



- Negative Velocity potential anomalies show the areas of enforced convective activity (green areas)
- Stream function can show the teleconnexions between tropics and extra-tropics.

NB : it is useful to see the three EUROSIP model separatly → better understanding of the behavior and consistency of every one of them.

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Statement : large needs concerning fields on height or isotherm levels and concerning vertical profiles

- Wind energy
- aeronautics (computation of isotherm levels and diagnostics)
- environmental crisis
- statistical post-processing (wind, humidity, visibility)
- …

Requirements/Proposition

new service with dissemination :

- computation of height level fields on regular lat/lon grid
- computation of isotherm level fields on regular lat/lon grid
- computation of vertical profile in BUFR format on model levels

Requirements and suggestions

Other Suggestions

- Eurosip plots separatly
- European seasonal report
- Access to the diagnostic explorer

Summary

- **Large use of ECMWF products (for all time ranges)**

- **Good performance of ECMWF model**

- **Technical problems to deal with large amount of data**

- **First steps towards seamless forecasts**

Thank you for your attention !