WMO Workshop on Operational Long-Range Forecasting : GPCs and RCCs, in support of NMHSs and RCOFs

Session 3 – GPC systems and products

GPC Toulouse

J.P. Céron - Climatology Department

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GPCs / RCCs / RCOFs workshop
Brasilia – 25-27/11/2013

WMO

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GPC Toulouse

Operationnal Forecasting Suite (System 4)

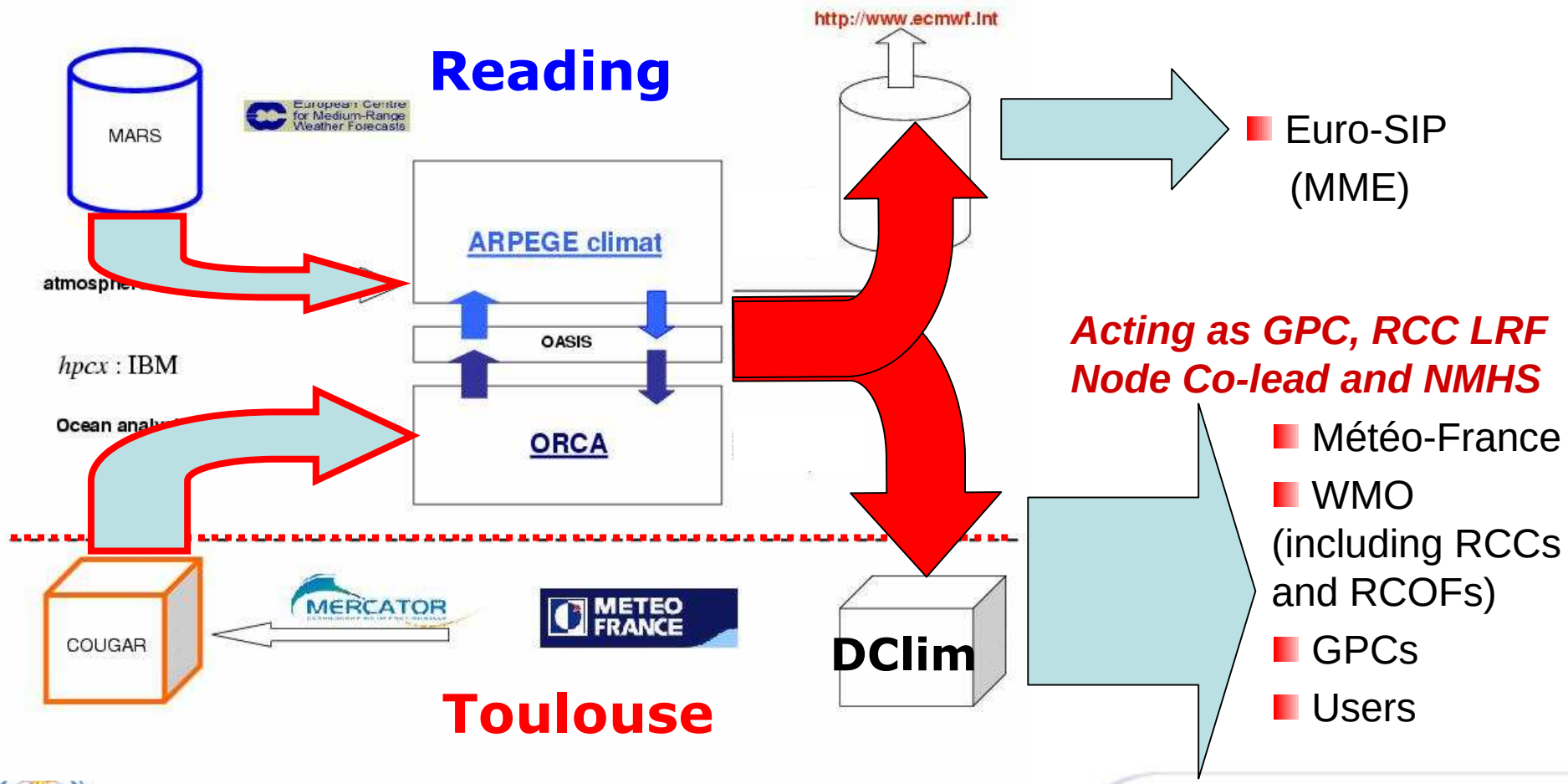
- Distributed Forecasting suite, coupled model (Arpège *T127L31*) for atmosphere and *NEMO 1°* grid for the ocean)
- ECMWF atmospheric (and surface) analysis – Mercator oceanic analysis
- Hindcast *1991-2010 – 15 members*
- Operations : 7 month range forecast - 51 members
  10 atmospheric * 5 oceanic Initial Conditions (+ 1 member)

Products

- Issuance at the beginning of the current month (commitment for the 8th at the latest)
- Dedicated Web site (password protected – access granted on request under the WMO umbrella)

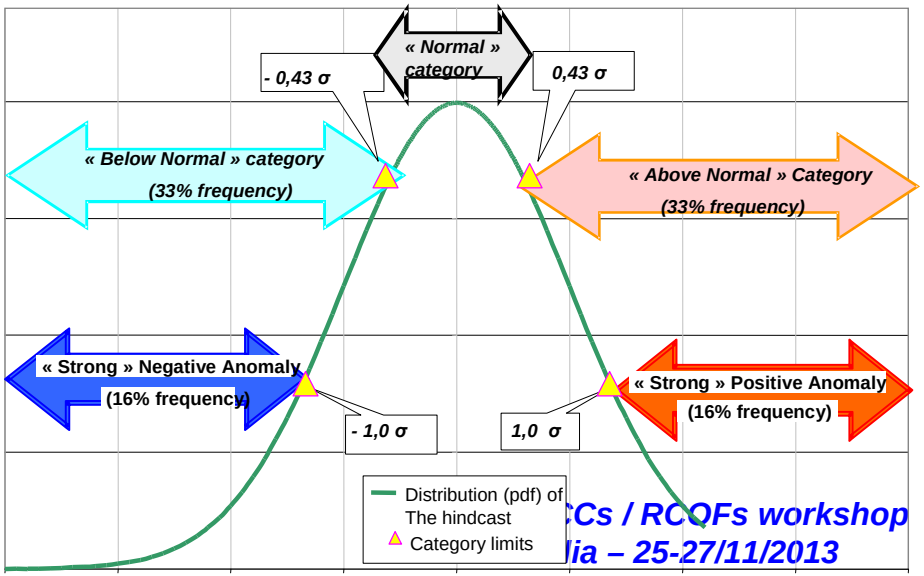
Operationnal Forecasting Suite

- **Arpège model (v 5) - Mercator initialisation (Ocean) :**



Products

- **Deterministic products :**
  - Ensemble mean : Anomalies, **Indices (Standardized anomalies)** and **recalibrated Anomalies**
  - Significance **Test** (T test)
- **Probabilistic products :**
  - Ensemble Member frequency into the **tercile** categories,
  - Ensemble Member frequency into « **extreme** » categories
  - **Probabilistic forecast synthesis** (most likely category)



Category boundaries computed under gaussian assumption

Frequency computed using standardized anomalies

Products

- **Coupled model :**
  - Precipitation, Temperature at 2m and 850hPa, Geopotential Height at 500hPa, Mean Sea Level Pressure, **U and V at 850 hPa and 200hPa**
  - SST
  - Niño plumes for Niño 4, Niño 3.4, Niño 3 and Niño 1+2 boxes,
  - **Oceanic plumes for TNA, TSA, TASI, WTIO, SETIO, DMI (OOPC boxes)**
  - Global fields (2.5 by 2.5)
  - Format by default gif files
    - On request postscript, Grib, ascii files,
  - **Circulation regimes (North Atlantic sector) : Post-processing of daily values**
  - **Velocity Potential and Stream Function at 200 hPa : idem**
- **Expertised product :**
  - Global Climate Bulletin (GCB)
    - Collaboration with the RA VI RCC LRF Node
    - Monthly update,
    - Expected lead-time of 1 month for forecasts ,
    - Edited by the end of the current month (for next 3 month forecasts)

Dissemination

External :

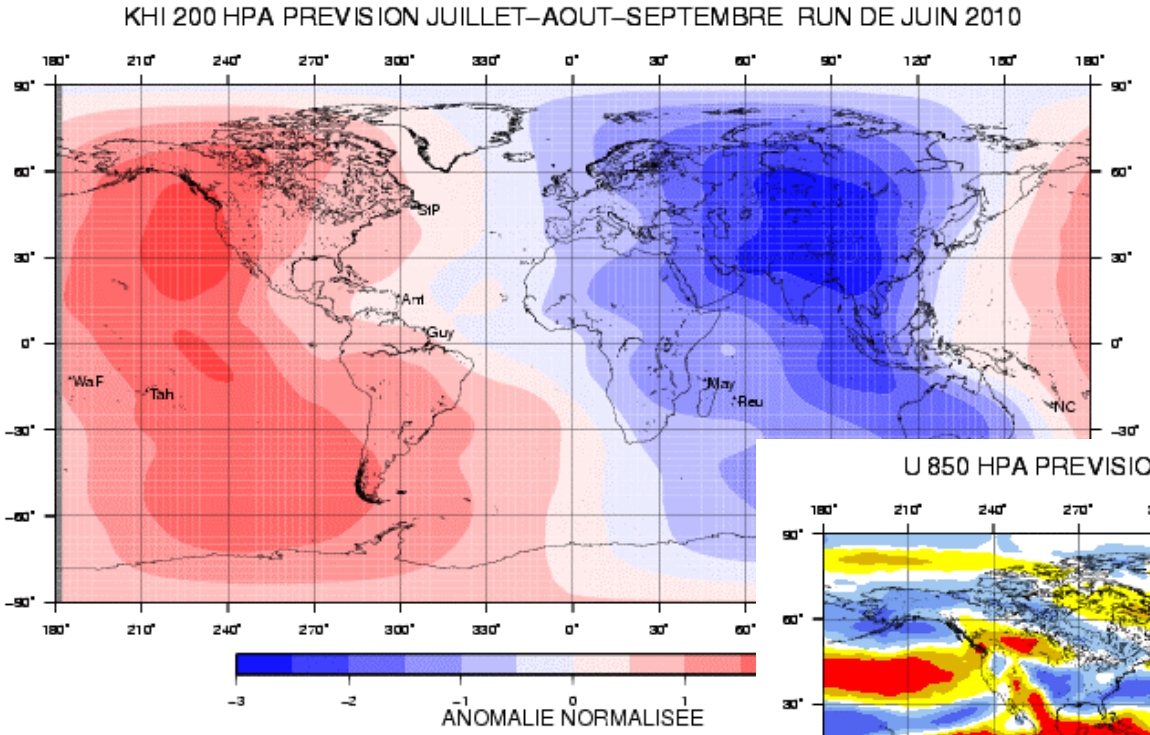
- Password protected ftp site http://elaboration.seasonal.meteo.fr (on request under the WMO umbrella),
- ECMWF facilities (Euro-Sip MME, RCCs),

Availability dates :

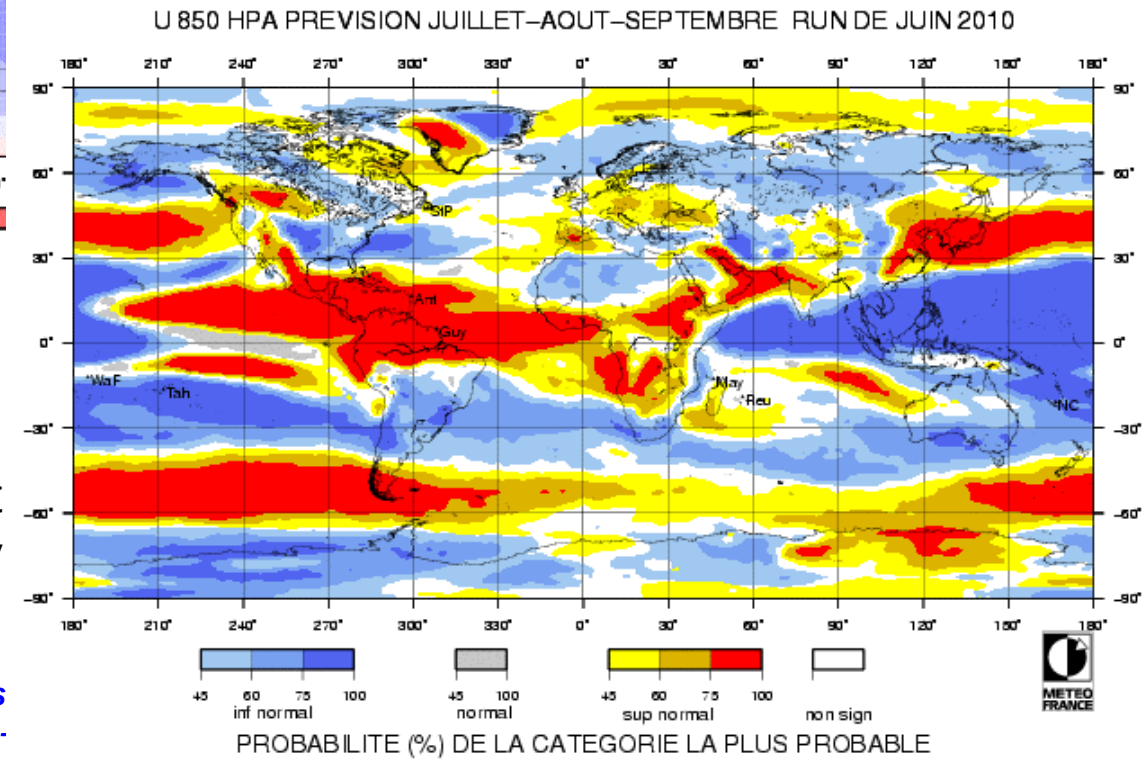
- Begining of the month in Toulouse,
- 15th of the month at ECMWF (Coupled model within the Euro-Sip MME),
- GCB provided at the end (~25th) of the month,

The issuance date of GPC products is critical for the operations of the RCCs and RCOFs

Products : General Circulation
Velocity Potential 200 & U 850



Velocity Potential at 200 hPa
- Standardized Anomaly



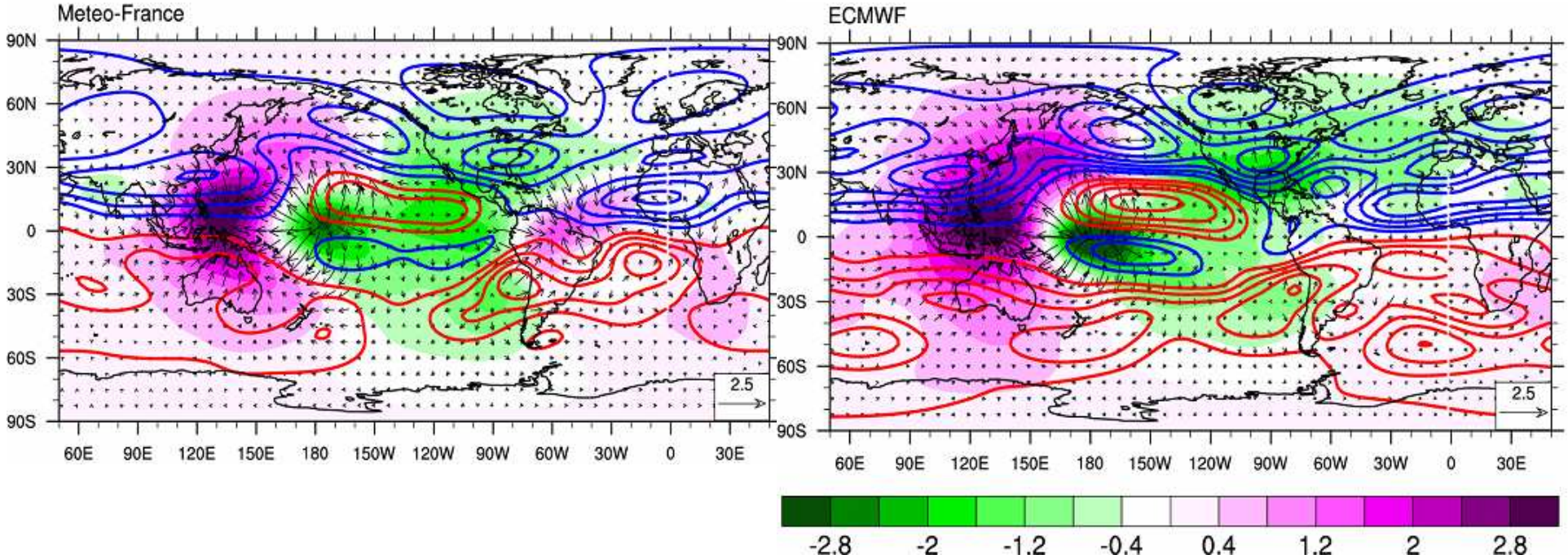
U 850 hPa – Most Likely Category

GPCs / RCCs Brasilia -

Other Large Scale Parameters

New Model Diagnosis and associated evaluations (Stream function and Velocity Potential in the high troposphere)

JFM 2010 forecasts

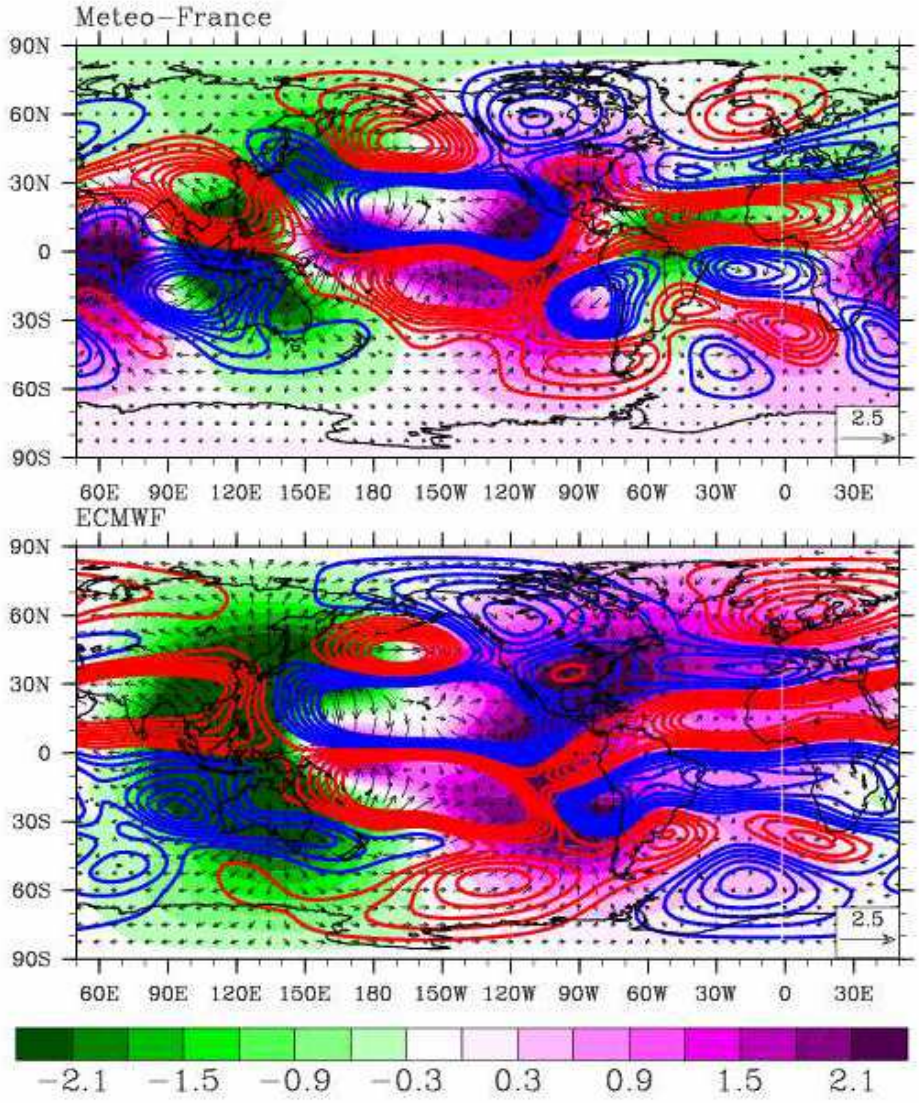


Velocity Potential gives insight into the atmospheric response in terms of Hadley-Walker circulation anomalies while the Stream Function gives complementary insight into the atmospheric response to tropical forcing (especially in terms of teleconnections with mid-latitudes)

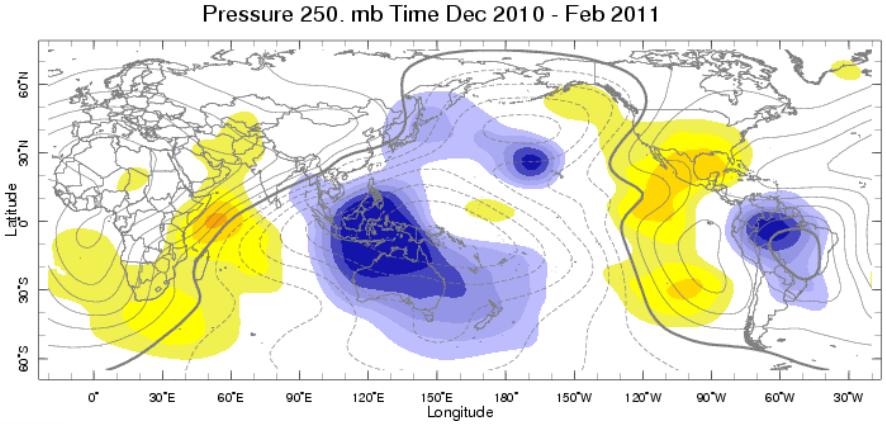
Other Large Scale Parameters - DJF 2010-2011

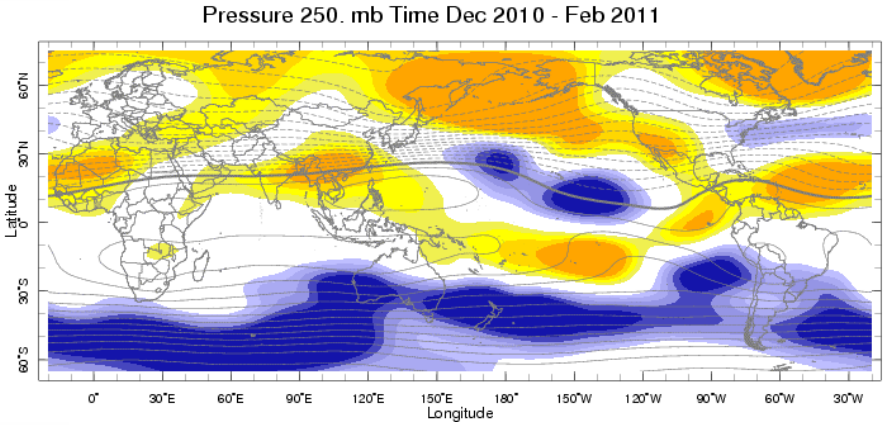
Seasonal Forecasts MF/ CEP (M+1) :

- Velocity Potential and Stream Function (High Troposphere)



Verification (Analyse) :

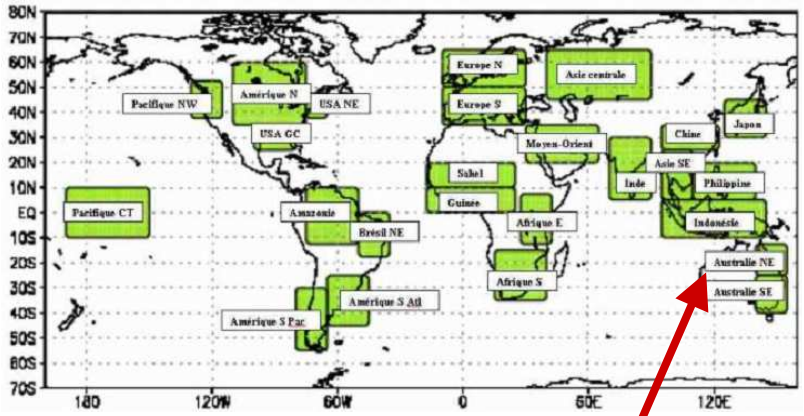




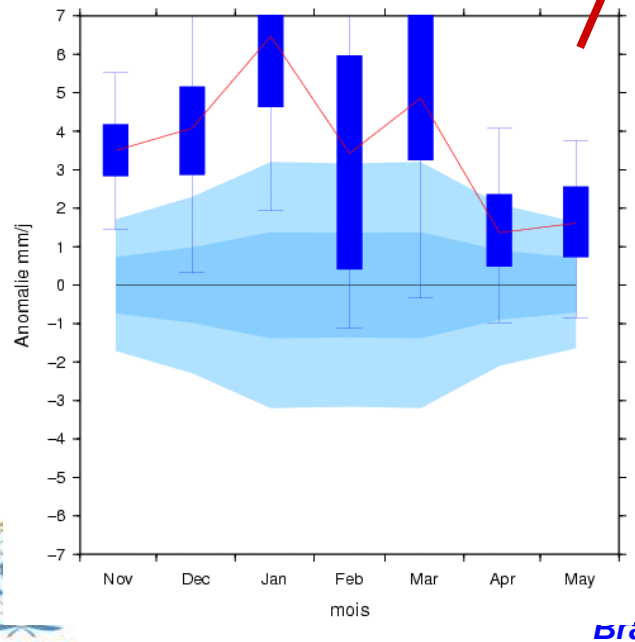
Take care with scales!

Additionnal Products

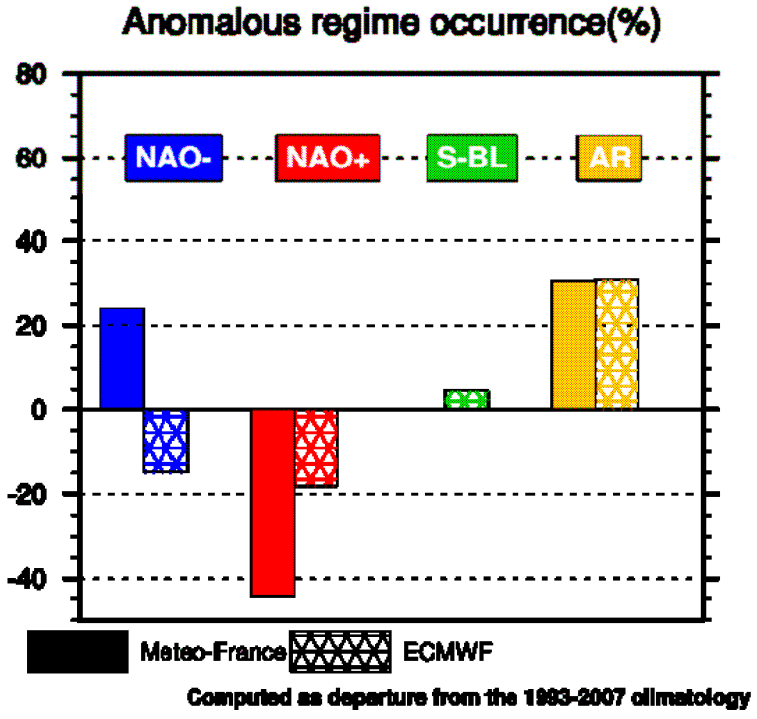
- **climagrams**



PRET Australie_NE 2010 11



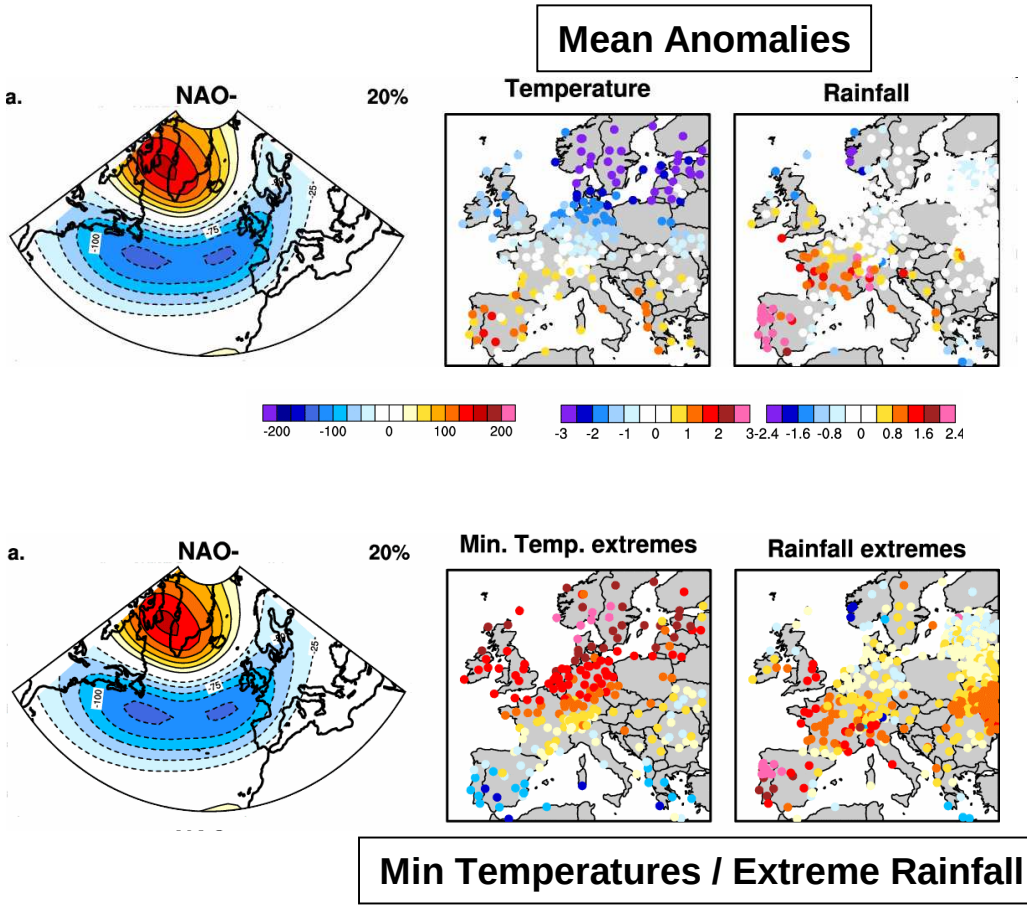
Circulation Regimes over the North-Atlantic sector



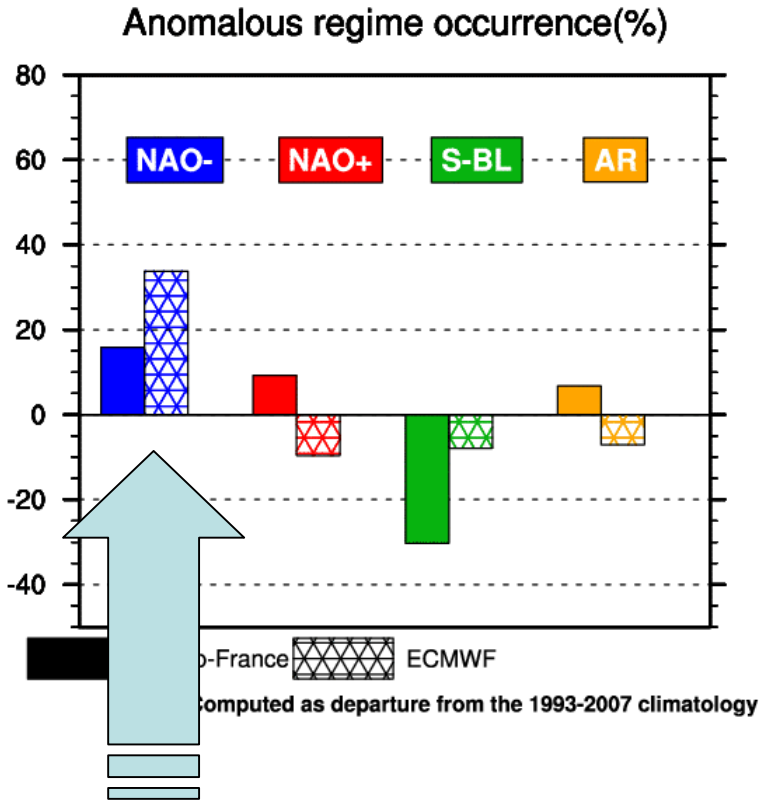
DJF 2010-2011 – Very Strong Niña

Products : Circulation Regimes

- **Forecast Mode and use – Winter 2009 forecasts**

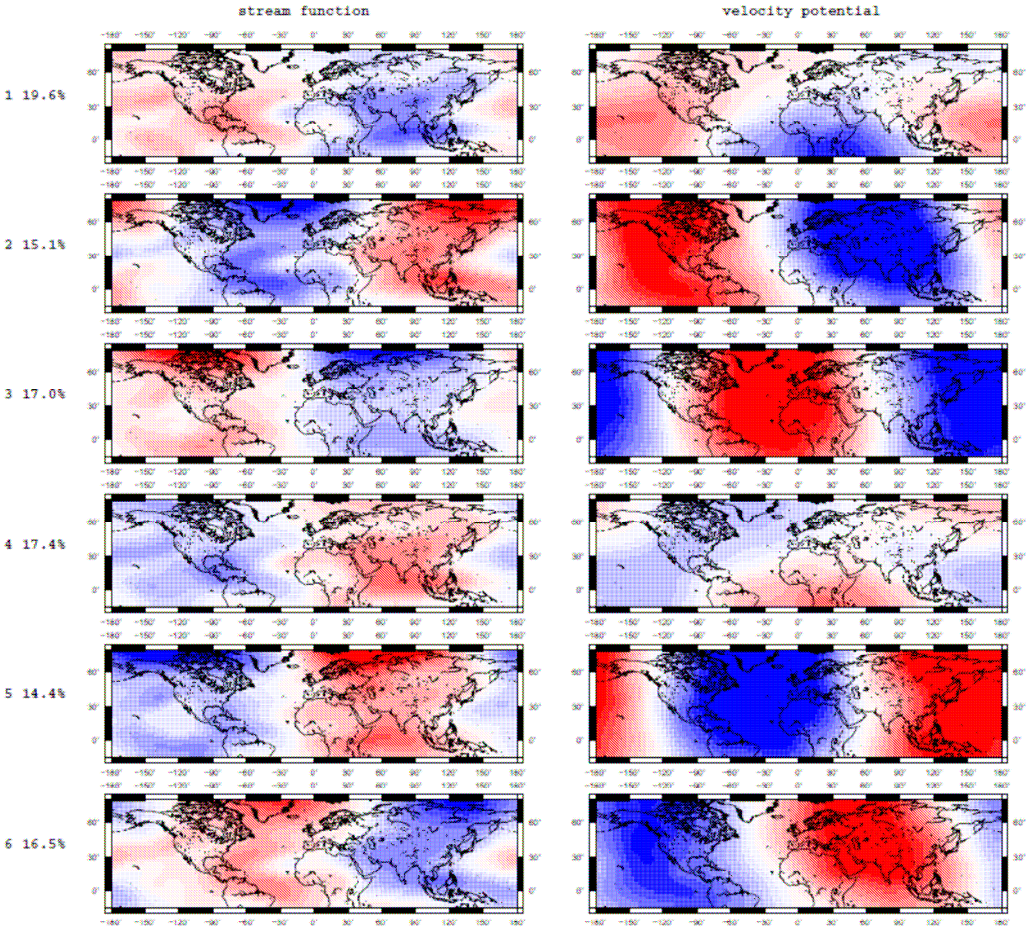


Min Temperatures / Extreme Rainfall

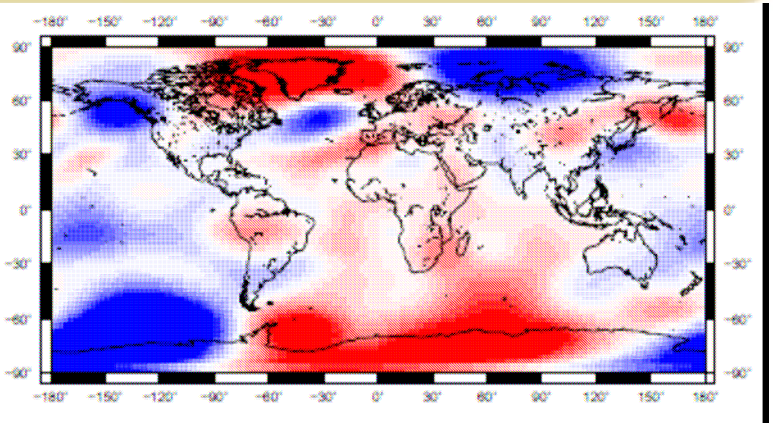


Increased Occurrence of NAO – regimes

GPC Perspectives



Psi and Khi 200 Circulation Regimes in SON



Psi 200 Composite for years with a high number of HPE

	MF	EC	MED	NPIR
ROC (area)	0.62	0.71	0.68	0.77
95% Boostrap	*(0.37, 0.83)*	*(0.48, 0.90)*	*(0.41, 0.92)*	*(0.56, 0.94)*

ROC area for years with a high number of HPE

New Circulation regimes to be prepared

GPC evolutions

Coupled Model version 6 (System 5)

- Version close to the IPCC-AR5 version (consistency with Decadal Forecasts)
- Atmosphere : Arpege version 6.i,
- Ocean : NEMO (free elevation at the surface),
- Mercator Ocean analysis and Reanalysis: **1979 – 2010**,
- Availability for operations : targetted for **2015** (possibly end of 2014 - developements in progress)

- Development of the **post-processing at the full resolution**

Scores System 5 (development in progress)

- Hindcast over 1979 - 2011 (**DJF and JJA**), 15 and 30 members
- Different options tested (DSM, Ajc, Ecume, Resolution, Time Step)
- Anomaly correlations for T2m

mACC DJF TSUR 1979-2011 (15 et 30 membres)

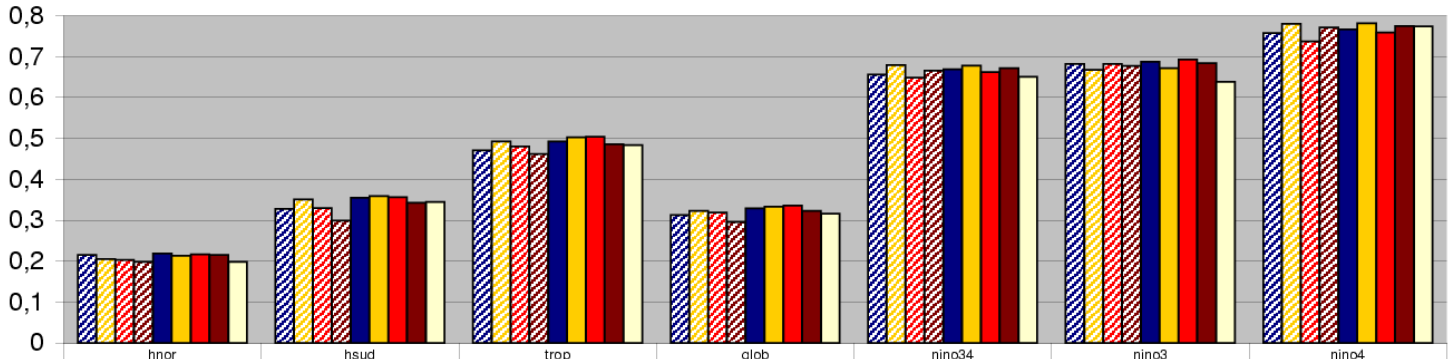
N8 : tl127l91r DSM+ajc+noec, pdt=20mn

N10 : t159l71r DSM+noec, pdt=30mn

N11 : tl159l91r DSM+ajc+noec, pdt=30mn

N12 : tl127l91r DSM +noec, pdt=10mn

N13 : tl127l31r +noec, pdt=30mn



	hnor	hsud	trop	glob	nino34	nino3	nino4
SYS5_N8(15)	0,215	0,328	0,471	0,313	0,656	0,682	0,758
SYS5_N10(15)	0,205	0,351	0,493	0,323	0,679	0,668	0,78
SYS5_N11(15)	0,203	0,33	0,48	0,319	0,649	0,682	0,737
SYS5_N12(15)	0,198	0,299	0,462	0,296	0,666	0,677	0,771
SYS5_N8(30)	0,219	0,355	0,493	0,329	0,669	0,687	0,767
SYS5_N10(30)	0,213	0,359	0,503	0,333	0,678	0,672	0,781
SYS5_N11(30)	0,216	0,356	0,504	0,336	0,662	0,693	0,759
SYS5_N12(30)	0,215	0,343	0,486	0,323	0,672	0,684	0,775
SYS5_N13(30)	0,198	0,345	0,484	0,316	0,651	0,638	0,774

GPC evolutions

- **Coupled Model version 6 (System 5)**
  - Atmosphere : Arpege 6.i,
    - T127 L**91 (configuration close to N12)**,
  - Ocean : NEMO (1° resolution, free elevation at the surf ace),
  - Still to be added (already tested)
    - **Stochastic Dynamic**,
    - **Sea-Ice** : Gelato model,
    - **Surface** : Surfex model,
  - Some options remain open,
    - Hindcast using both NemoVar and Mercator
    - …

GPC / RCC linkage

- **Important point from the GPC side**
  - Securisation of operations,
    - QMF-like approach and integration within the operational system at Meteo-France (supervision, post-processing, …)
  - Provision of relevant data for RCC sub-regional products,
  - Provision of verifications associated to all provided products
    - Climagrams, Monthly values, …
  - Flexibility of MME combination,
  - Post-processing of daily values (and associated operations),
  - New parameters to assess the current predictability,
  - Verification of the current forecasts
    - Tropics vs mid or high latitudes
  - Climate trend vs Seasonal anomaly

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Thank you for attention

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Perspective in Seasonal Forecasting at Météo-France

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Operations in GPC Toulouse

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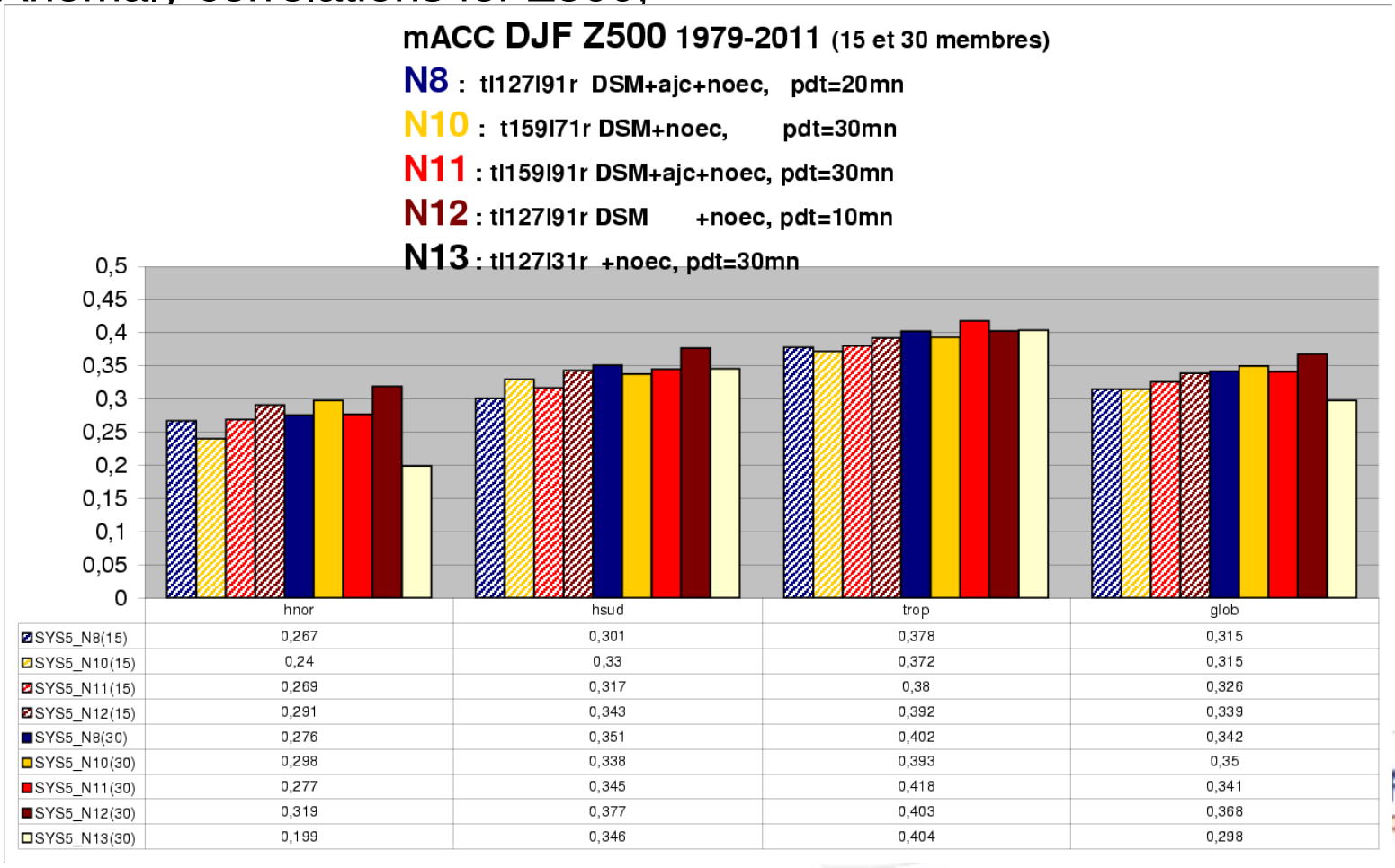
Scores System 5 (development in progress)

- Hindcast over 1979 - 2011 (DJF and JJA), 15 and 30 members
- Different options tested (DSM, Ajc, Ecume, Resolution, Time Step)
- Anomaly correlations for Z500,



	hnor	hsud	trop	glob
SYS5_N8(15)	0,267	0,301	0,378	0,315
SYS5_N10(15)	0,24	0,33	0,372	0,315
SYS5_N11(15)	0,269	0,317	0,38	0,326
SYS5_N12(15)	0,291	0,343	0,392	0,339
SYS5_N8(30)	0,276	0,351	0,402	0,342
SYS5_N10(30)	0,298	0,338	0,393	0,35
SYS5_N11(30)	0,277	0,345	0,418	0,341
SYS5_N12(30)	0,319	0,377	0,403	0,368
SYS5_N13(30)	0,199	0,346	0,404	0,298

Scores System 5 (development in progress)

- Hindcast over 1979 - 2011 (DJF and JJA), 15 and 30 members
- Different options tested
- Anomaly correlation for Rainfall

mACC DJF PREC 1979-2011 (15 et 30 membres)

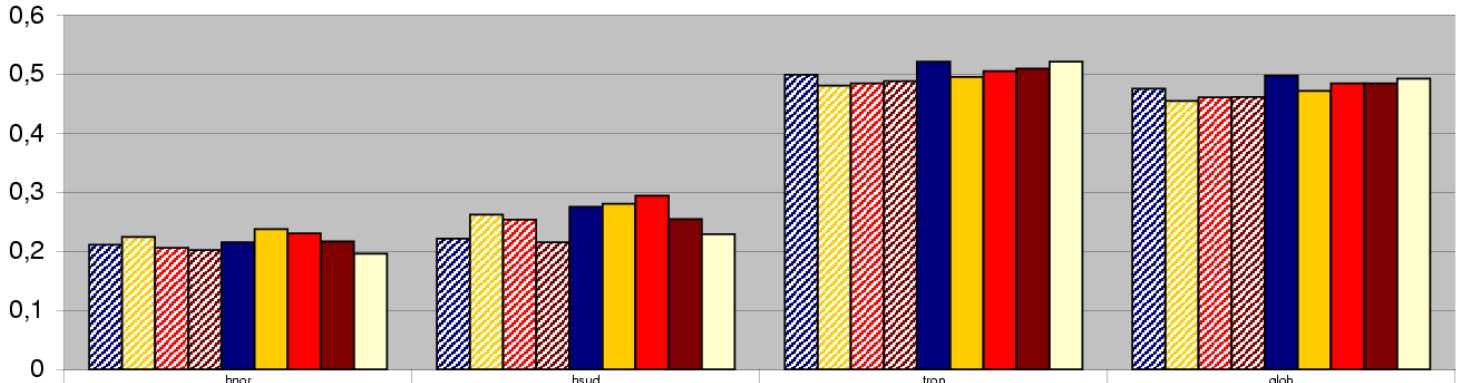
N8 : tl127l91r DSM+ajc+noec, pdt=20mn

N10 : t159l71r DSM+noec, pdt=30mn

N11 : tl159l91r DSM+ajc+noec, pdt=30mn

N12 : tl127l91r DSM +noec, pdt=10mn

N13 : tl127l31r +noec, pdt=30mn



	hnor	hsud	trop	glob
SYS5_N8(15)	0,211	0,221	0,499	0,475
SYS5_N10(15)	0,224	0,262	0,48	0,454
SYS5_N11(15)	0,206	0,253	0,484	0,46
SYS5_N12(15)	0,202	0,215	0,488	0,461
SYS5_N8(30)	0,215	0,275	0,521	0,497
SYS5_N10(30)	0,237	0,28	0,495	0,471
SYS5_N11(30)	0,23	0,294	0,505	0,484
SYS5_N12(30)	0,216	0,254	0,509	0,484
SYS5_N13(30)	0,196	0,229	0,521	0,492

Perspectives

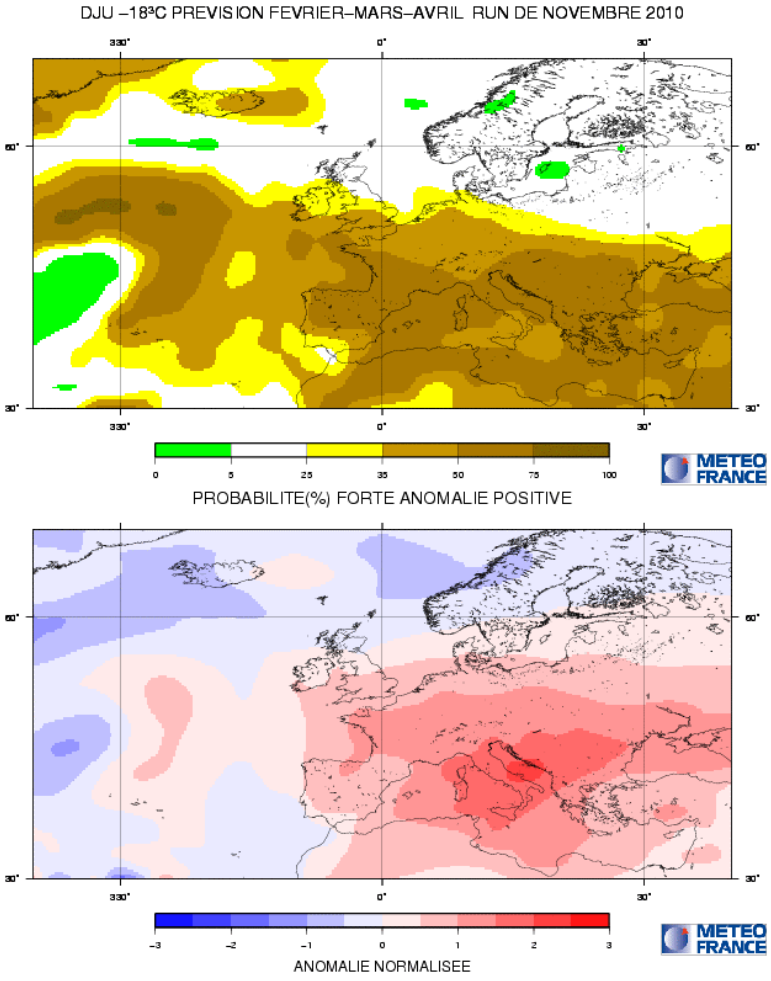
- **Experimental Products at Météo-France**
  - Daily time series post-processing (preparation of products dedicated to Energy, Agriculture, …),

Perspectives

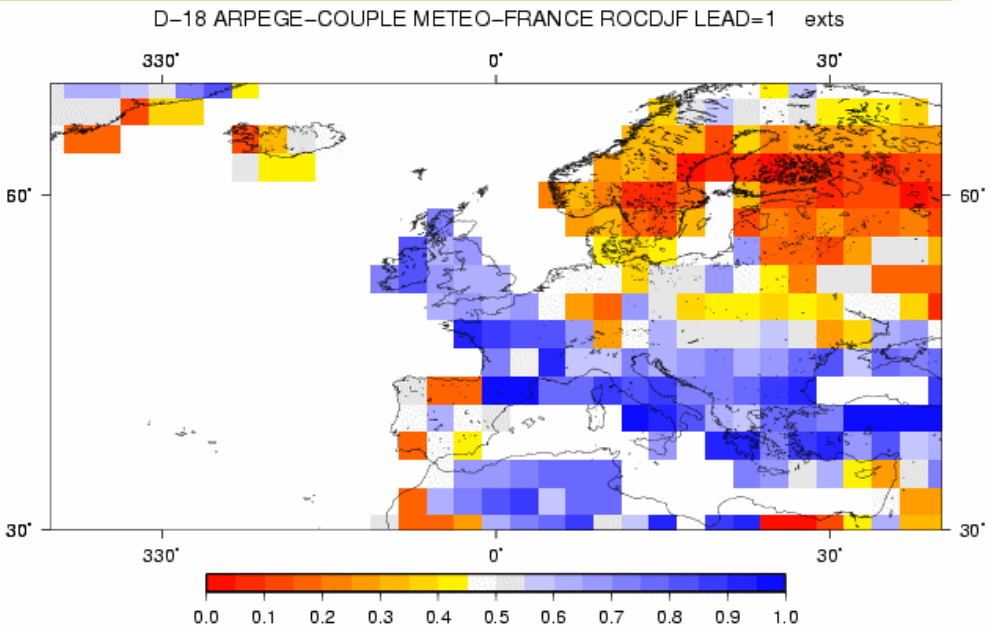
M-F Production

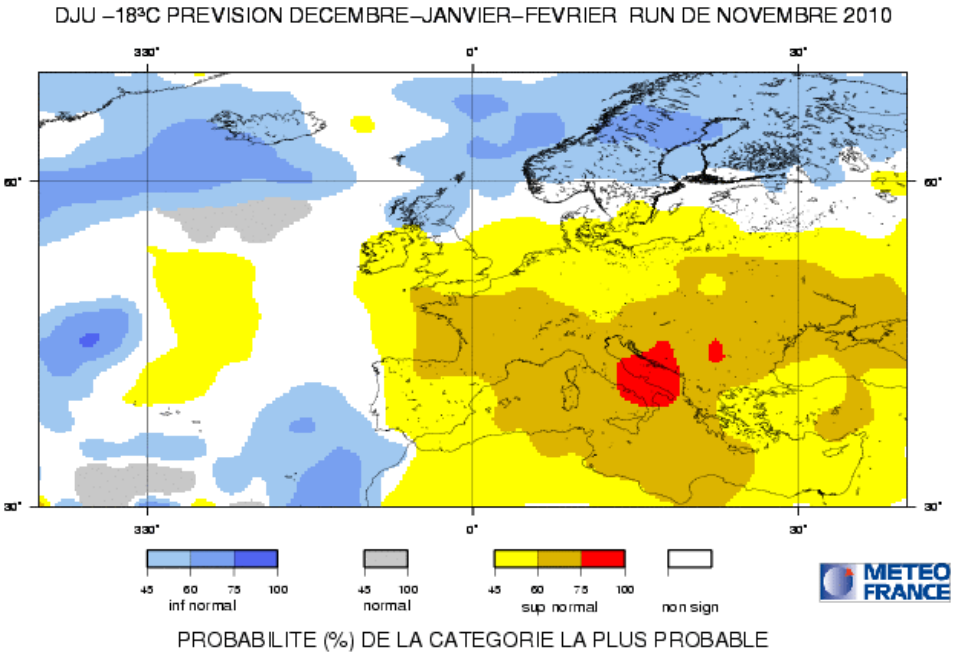
- Atmosphere : DJF 2010-2011

Heating Degres days (18℃)



ROC Score for DJF





Perspectives

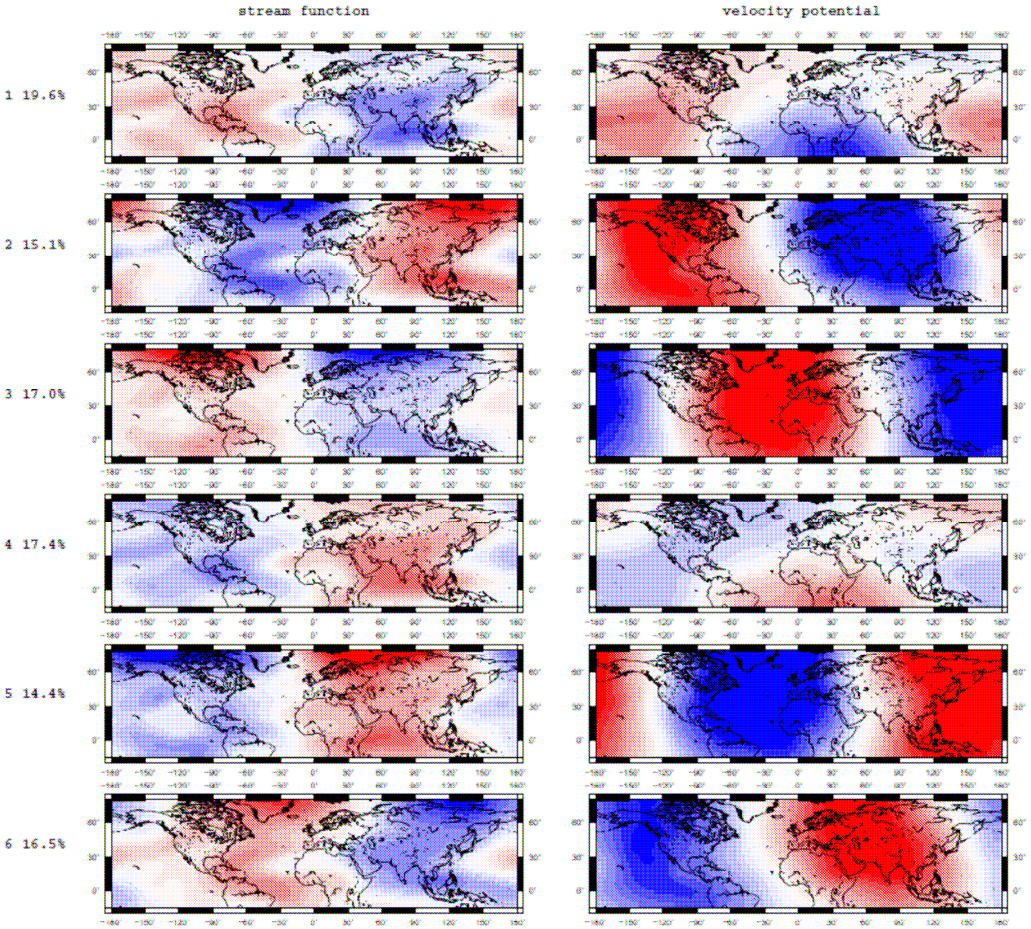
- **Experimental Products at Météo-France**
  - *Daily time series post-processing (preparation of products dedicated to Energy, Agriculture, …),*
  - Hydrological Seasonal Forecasts (Impact models, management models, …),
    - Over France – Hydrological model (SIM),

Perspectives

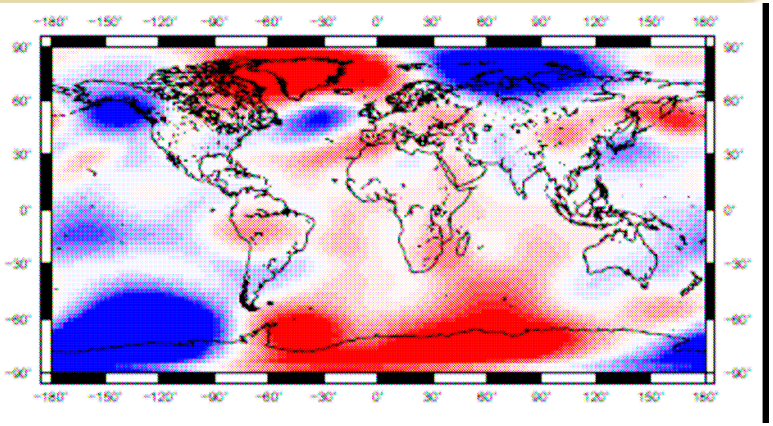
Experimental Products at Météo-France

- *Daily time series post-processing (preparation of products dedicated to Energy, Agriculture, …),*
- *Hydrological Seasonal Forecasts (Impact models, management models, …),*
  - *Over France – Hydrological model (SIM),*
- Extreme events
  - Over the French Mediterranean area – High Precipitation Events (Cevenoles Events) at Fall (SON).

HPE predictability (SON)



Psi and Khi 200 Circulation Regimes in SON



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ROC area for years with a high number of HPE

Guérémy, J.-F., Laanaia, N., and Céron, J.-P.: Seasonal forecast of French Mediterranean heavy precipitating events linked to weather regimes, Nat. Hazards Earth Syst. Sci., 12, 2389-2398, doi:10.5194/nhess-12-2389-2012, 2012

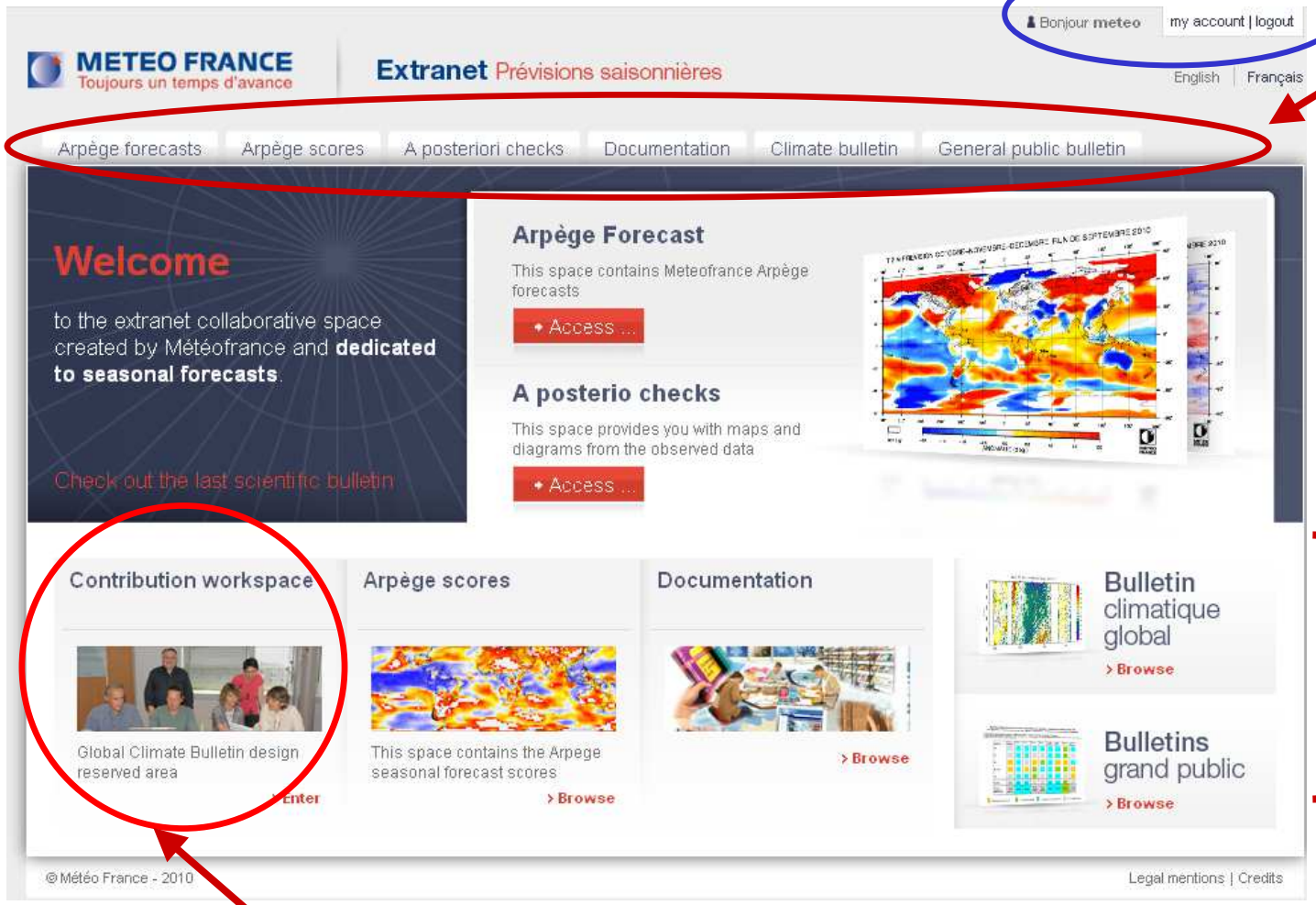
Perspectives

- **Experimental Products at Météo-France**
  - *Daily time series post-processing (preparation of products dedicated to Energy, Agriculture, …),*
  - *Hydrological Seasonal Forecasts (Impact models, management models, …),*
    - *Over France – Hydrological model (SIM),*
  - *Extreme events*
    - *Over the French Mediterranean area – High Precipitation Events (Cevenoles Events) at Fall (SON).*
- **Modeling Improvment**
  - GPC Evolution
    - Toward System 5,

Extranet dedicated to Seasonal Forecasts

Login and password on request

6 Menus



Bulletins

Working Space

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Products : Bulletins

GLOBAL CLIMATE BULLETIN
n°173 - NOVEMBER 2013

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(issued end of October)

September 2013 observations

Use of Global monitoring products

Use of Regional Monitoring Products

kshop
!3

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Products : Bulletins

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Global Climate Bulletin n°173

(issued end of October)
September 2013 observations
NDJ 2013 forecasts

Use of SST forecasts from ECMWF, Meteo-France and Euro-SIP (including Oceanic boxes in the 3 oceans)

Use of General Circulation Forecasts from ECMWF and Meteo-France (Velocity Potential, Stream Function and Z500)

Use of Temperature and Rainfall forecasts from 5 GPCs and MMEs (LC-MME and Euro-SIP)

Use of Model's consistency map (LC-MME)

Use of Regional Land Boxes from ECMWF and Meteo-France

kshop
!3

Preparation of Sub-Regional Outlook

- Helping our users for the best decision,

WMO RA VI Pilot RCC-Network

Synthesis of Temperature forecasts for September-October-November 2013 for European regions

Results are expressed with respect of 3 possible scenarios : « Above normal », « close to normal » and « Below normal ». The limits between each category is given by the corresponding tercile such that each scenario have the same climatological probability of occurrence (33,3%). If the forecast shows no specific signal (because of low predictability and/or divergent scenarios between several models), the cell is filled in grey and "No privileged scenario" is indicated.

MODELS	Northern Europe	Southern Europe	Central Europe	Eastern Europe	SEE Region
CEP					
MF					
Met Office					
CPC					
JMA					
synthesis					
LC-MME					
Eurosip					
privileged scenario by RCC-LRF node	no privileged scenario	no privileged scenario	no privileged scenario	above normal	above normal

T Below normal (Cold) | T close to normal | T Above normal (Warm) | No privileged scenario

RA VI RCC-LRF Node GLOBAL CLIMATE BULLETIN n°171 SEPTEMBER 2013 36/39

Guiding the user choice : Trying to give some insight into the uncertainty and adding the expert judgment

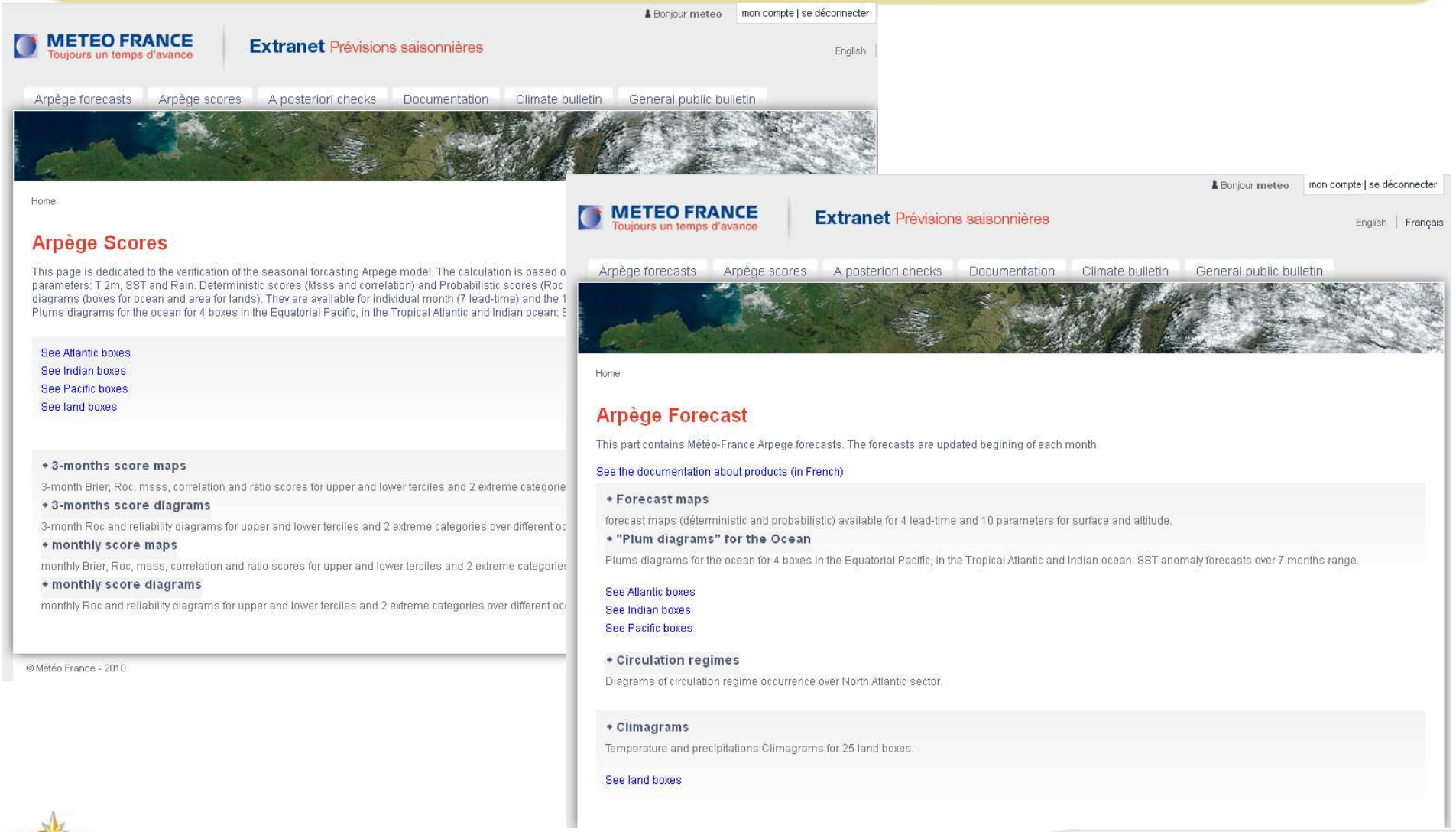
insight into individual model scenarios (most likely) dispersion

Synthesis of individual models

insight into most likely multi model scenarios dispersion

Proposed guidance using additionnal expert judgment

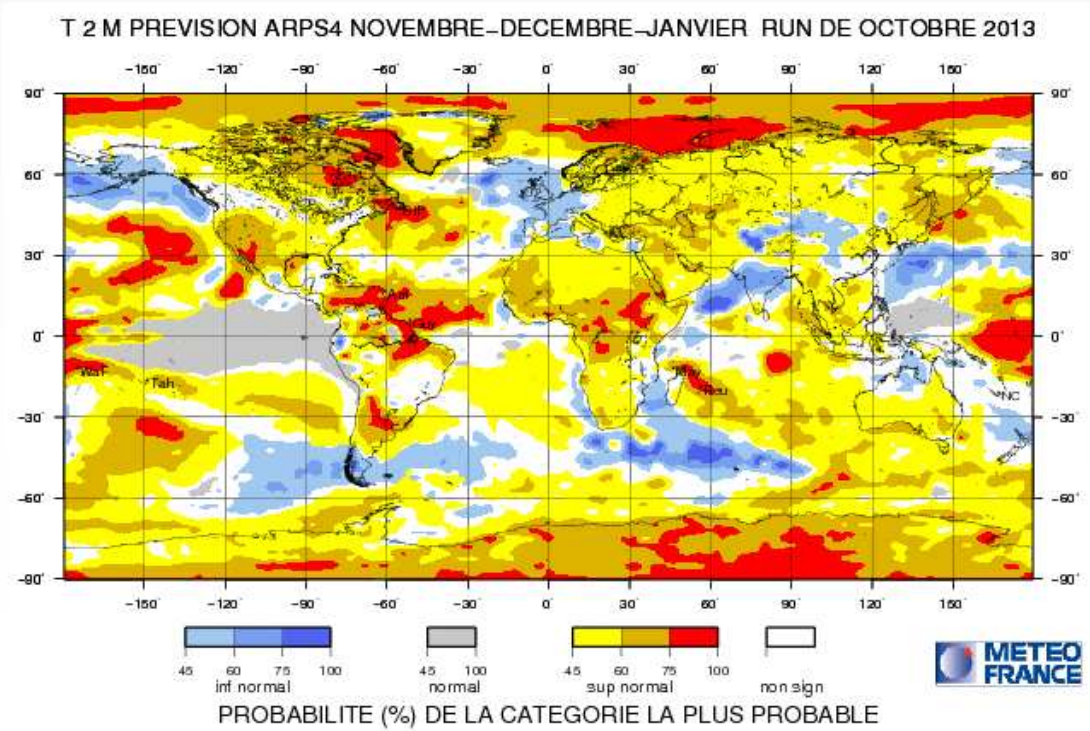
Extranet : Forecast access



Extranet : Forecast access

Arpège forcasts - choose your map

Zone	Forecast type	Parameter	Initial month	Lead-time
Globe	tercile summa	T 2m	201310	1



GPC/LRF Node RCC Toulouse

Additional contribution

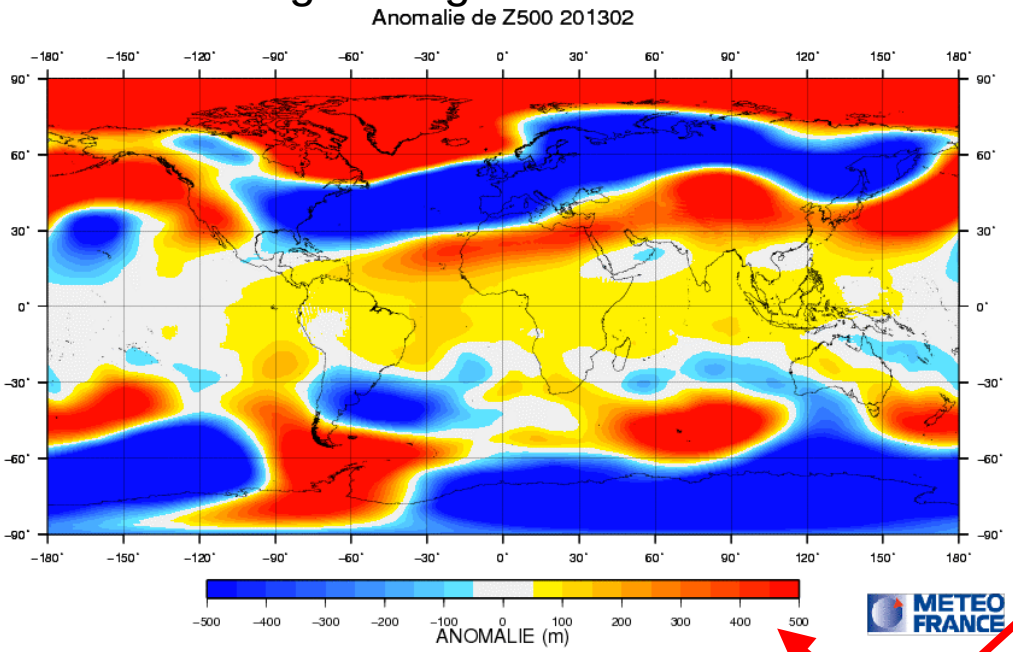
- MEDCOF
  - ✓ Promotion and participation to the dedicated scoping meeting (June 2013 – Madrid)
  - ✓ Participation to the Interim Management Team
  - ✓ Participation to the first MEDCOF (Belgrade – mid-November)
- COFs participation
- Guide on downscaling of Seasonal Forecasts for RCOFs (Preliminary version based on the SWIOCOF experience)

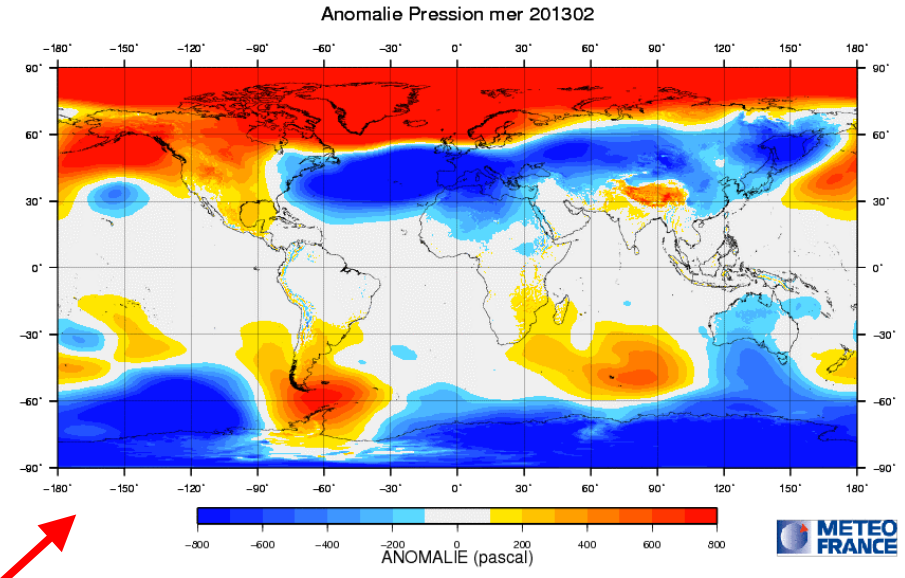
News

- Model change for operations in January 2013 (System 4)
- Activation of the Wiki page on the dedicated Web site (password protected – access granted on request under the WMO umbrella)

Some Perspectives

Monitoring : using model anomalies





- Which parameters ?
- Which baseline ?
- Which periods (month, season, …) ?
- …

Revisit of Model anomaly products

- ECMWF Operationnal analysis and ERA-Interim climatology

How to improve products and services ?

Large Scale information to work on

- MME issues
- Circulation regimes vs Variability modes
- Climate trend and Seasonal forecast
- Intraseasonal information (including MJO, monthly desegregation of LRF, …)
- Other parameters to be investigated (extreme events, Psi and Khi parameters, …)
- Prediction of the current predictability

RCC perspectives

METEO-FRANCE

WMO

METEO FRANCE
Toujours un temps d'avance

RCC Perspectives

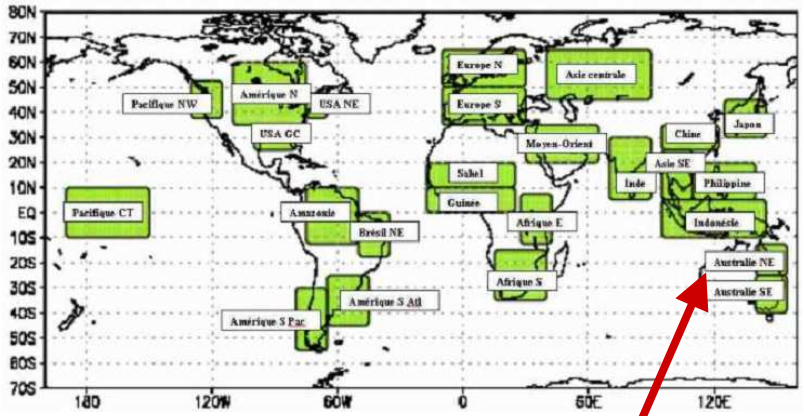
- **Monitoring and Forecast consistency**
  - Sharing analysis and possible evolutions of the climate system (monitoring and forecasts)
  - *General Circulation Indices*
  - *Extreme events*
  - *Sub-regional products*
  - *Predictability Diagnosis*
  - *Monitoring products*

RCC Perspectives

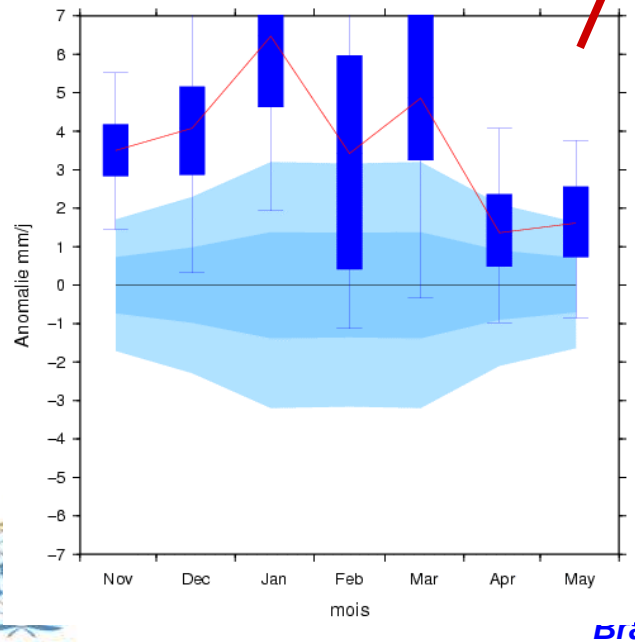
- **Monitoring and Forecast consistency**
  - *Sharing analysis of the climate system (monitoring and forecasts)*
  - General Circulation Indices and Circulation Regimes
  - *Extreme events*
  - *Sub-regional products*
  - *Predictability Diagnosis*
  - *Monitoring products*

Additional Products

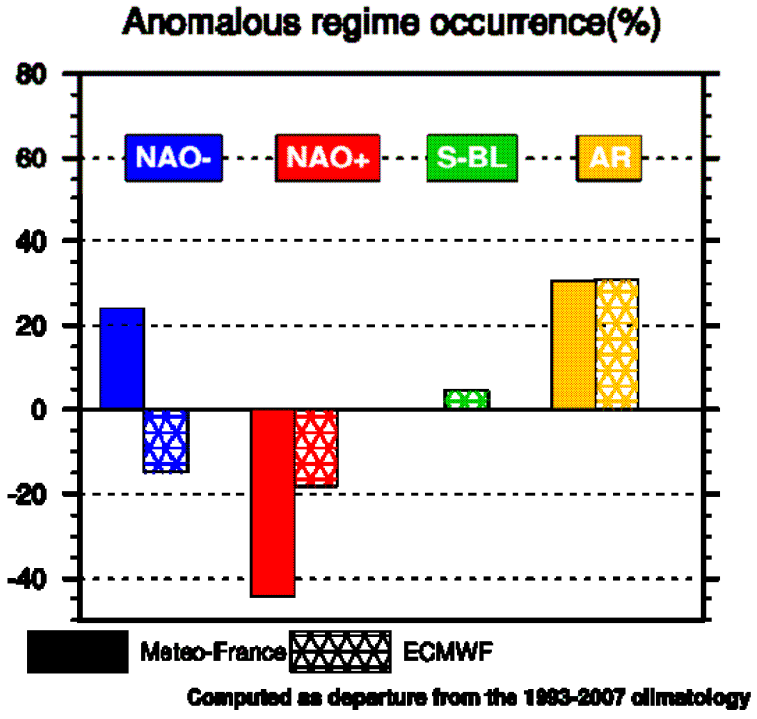
- **climagrams**



PRET Australie_NE 2010 11



Circulation Regimes over the North-Atlantic sector



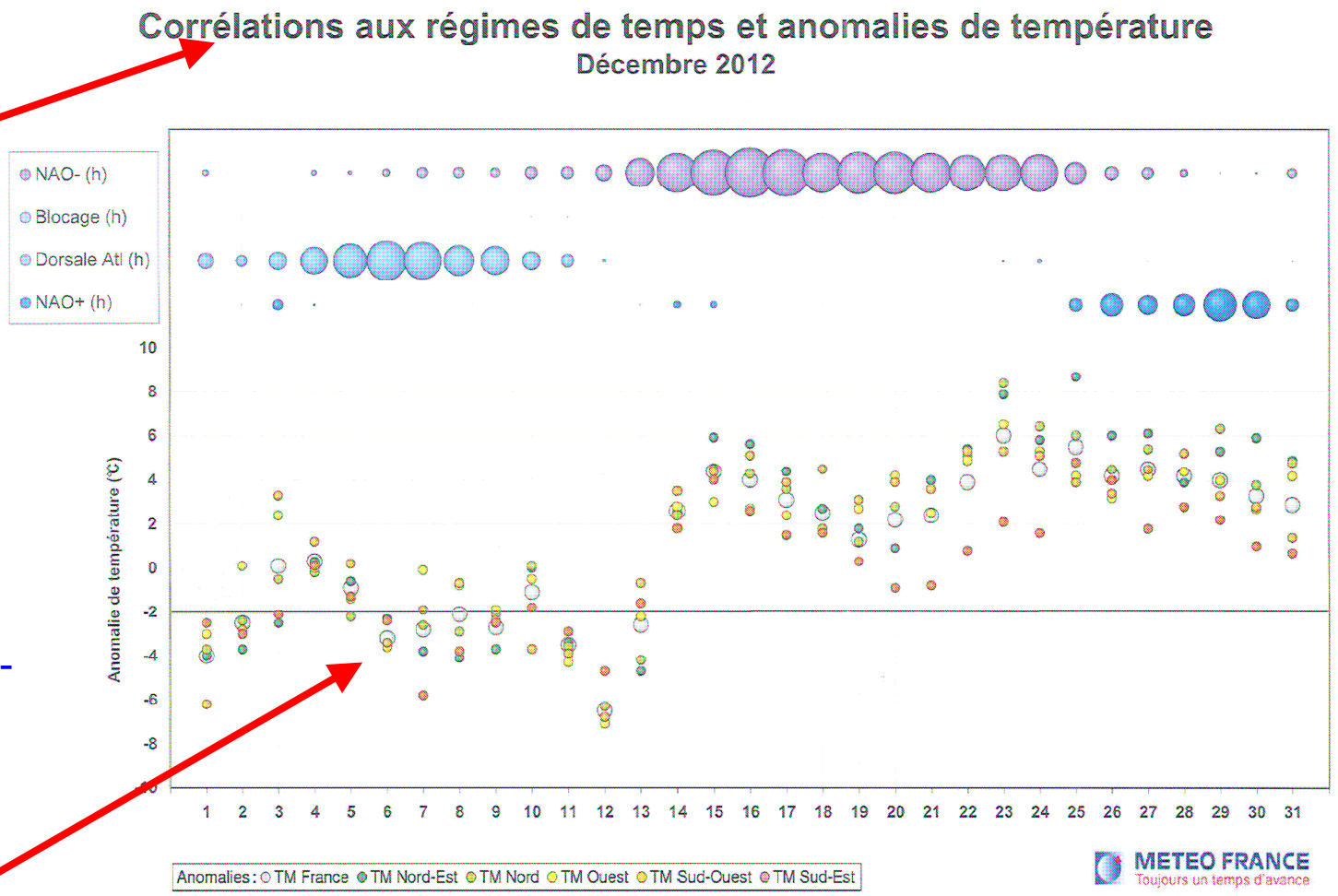
DJF 2010-2011 – Very Strong Niña

RCC Perspectives

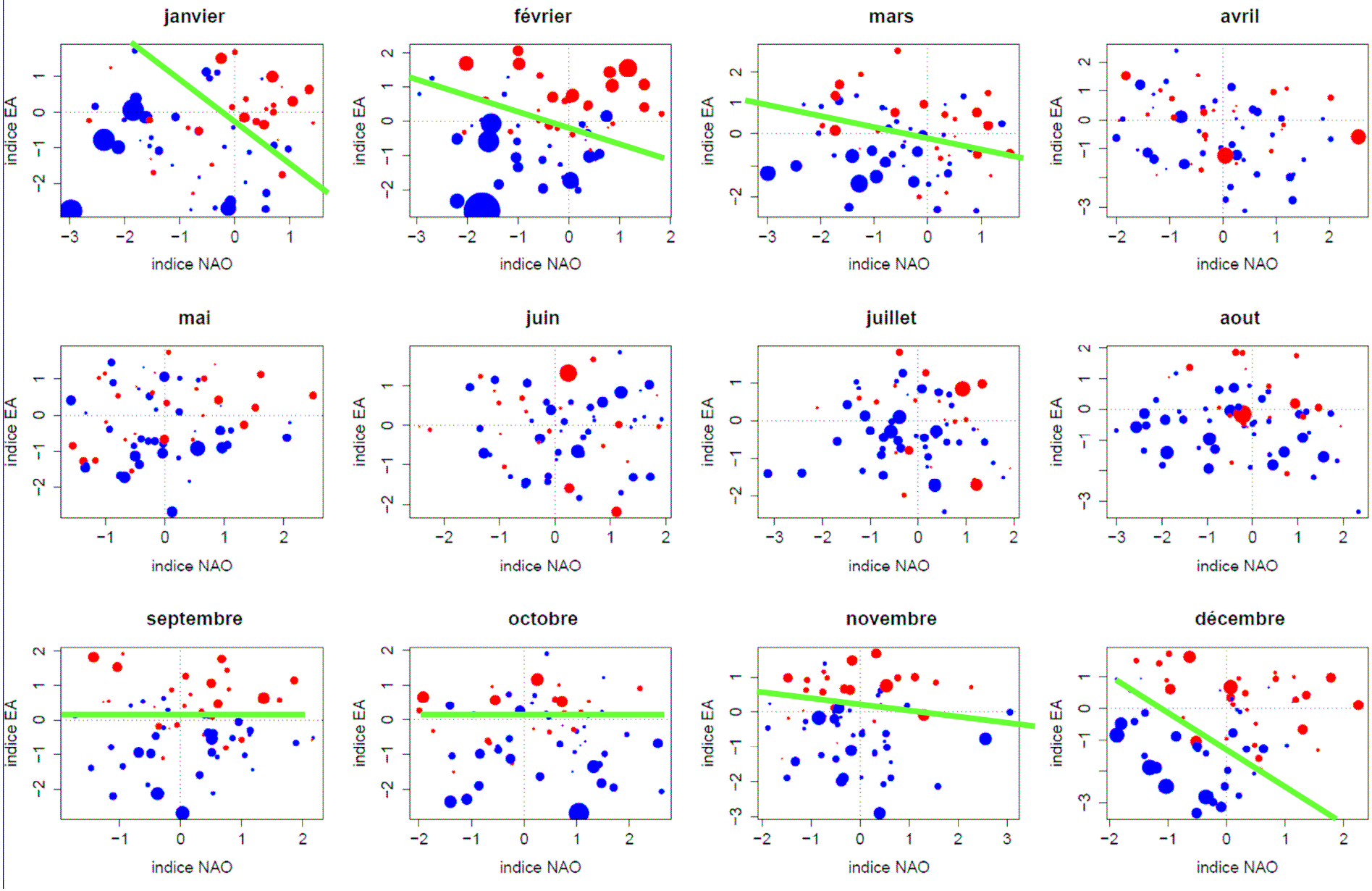
Better use of the distance :

- Correlation
- Bias
- Amplitude

Common regional and sub-regional indices to look at both in Monitoring and Forecasting modes



Use of GC Indices



RCC Perspectives

- **Monitoring and Forecast consistency**
  - *Sharing analysis of the climate system (monitoring and forecasts)*
  - *General Circulation Indices*
  - Extreme events
  - *Sub-regional products*
  - *Predictability Diagnosis*
  - *Monitoring products*

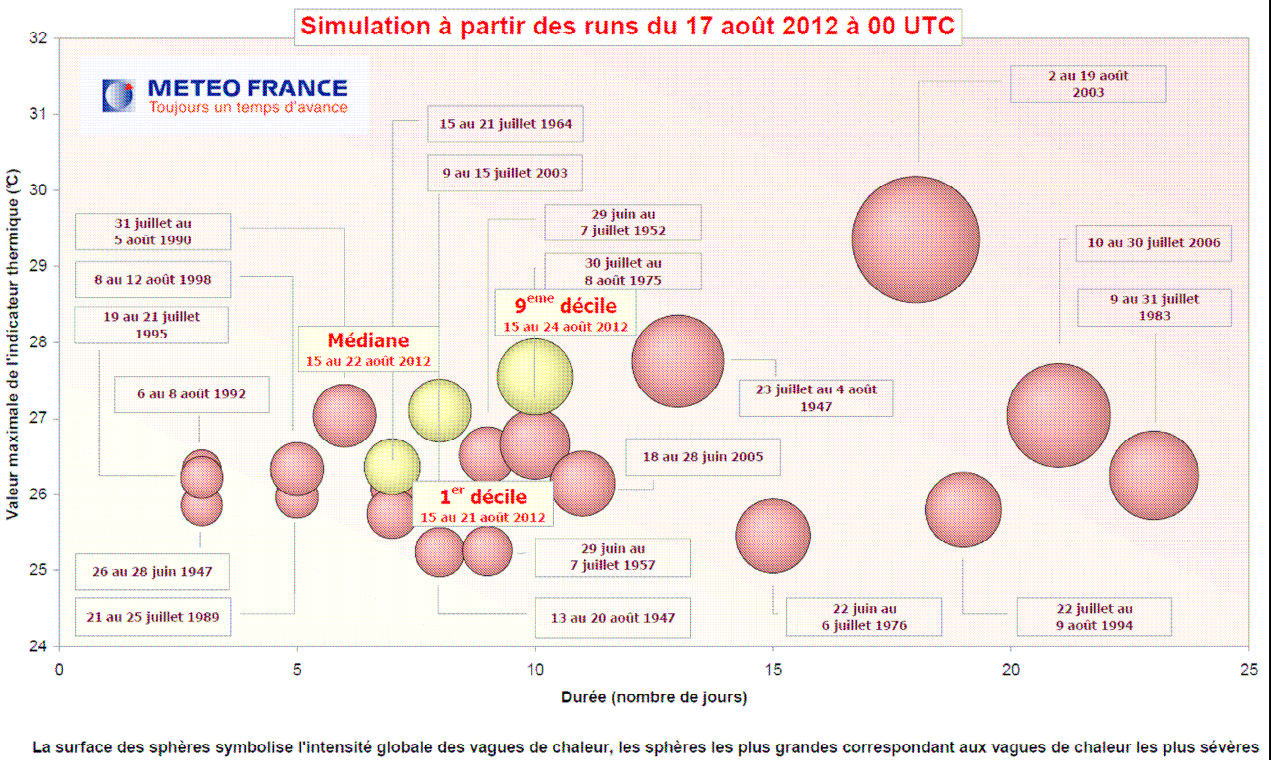
RCC Perspectives

Merging monitoring and forecasting information

- Better coordination
- Which forecast ?
- Which baseline ?
- Useful for CW ?
- …

Heat Waves in France

(1947-2012)



La surface des sphères symbolise l'intensité globale des vagues de chaleur, les sphères les plus grandes correspondant aux vagues de chaleur les plus sévères

RCC Perspectives

- **Monitoring and Forecast consistency**
  - *Sharing analysis of the climate system (monitoring and forecasts)*
  - *General Circulation Indices*
  - *Extreme events*
  - Sub-regional products
  - *Predictability Diagnosis*
  - *Monitoring products*

RCC Perspectives

- **Monitoring and Forecast consistency**
  - *Sharing analysis of the climate system (monitoring and forecasts)*
  - *General Circulation Indices*
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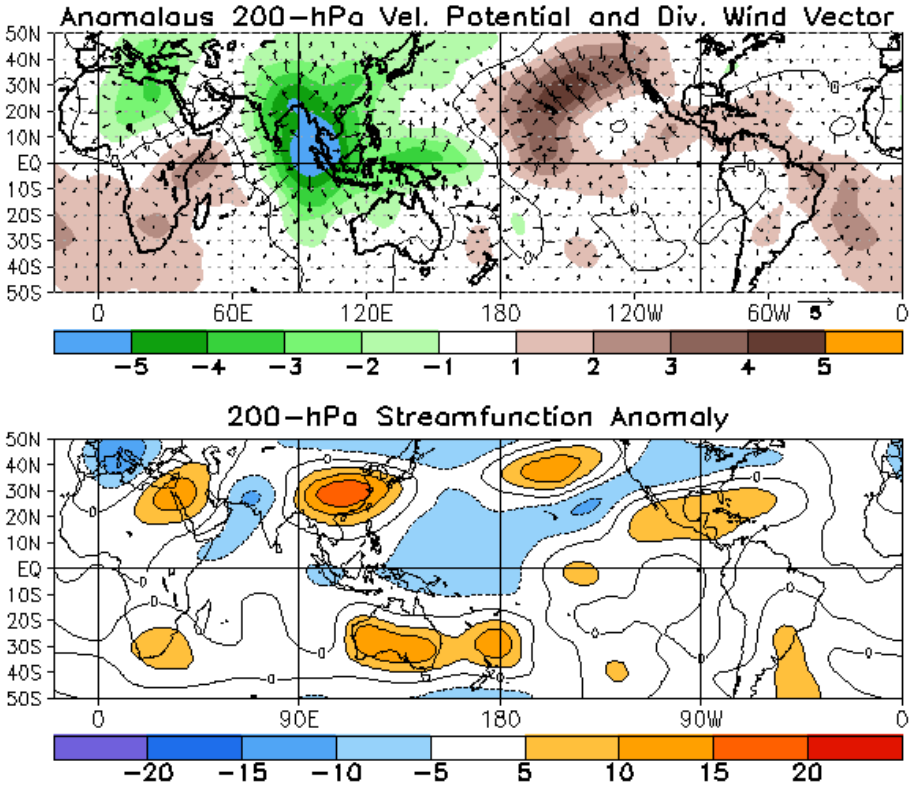
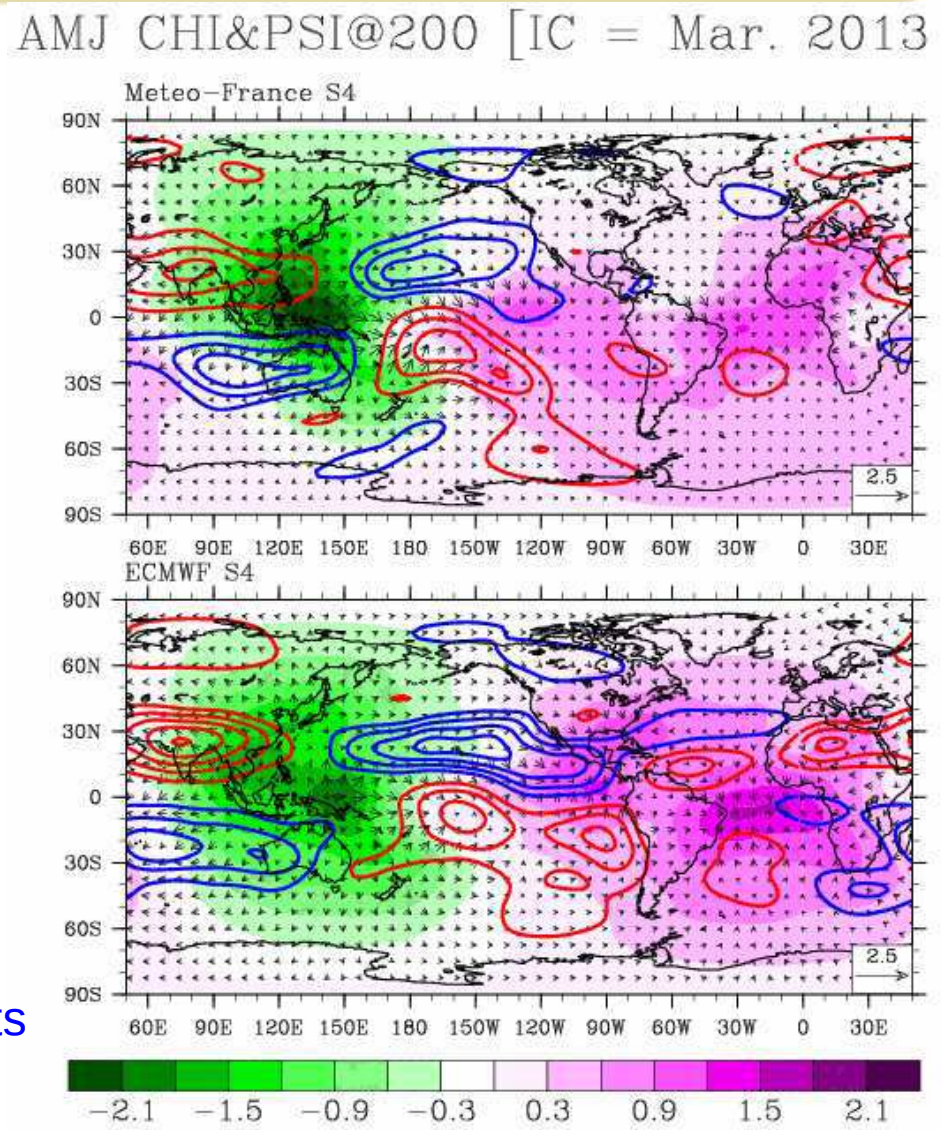
  - Predictability Diagnosis
  - *Monitoring products*

RCC Perspectives



February 2013 – NCEP analysis



AMJ 2013 forecasts

RCC Perspectives

- **Monitoring and Forecast consistency**
  - *Sharing analysis of the climate system (monitoring and forecasts)*
  - *General Circulation Indices*
  - *Extreme events*
  - *Sub-regional products*
  - *Predictability Diagnosis*
  - Monitoring products