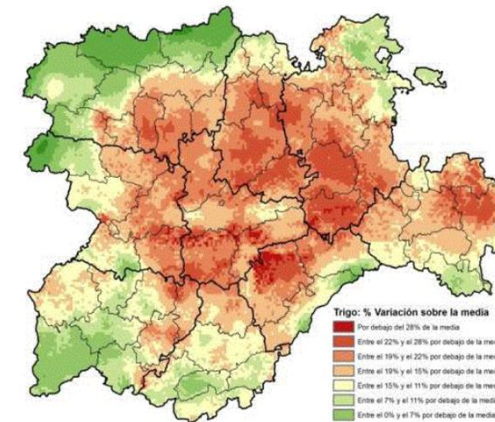
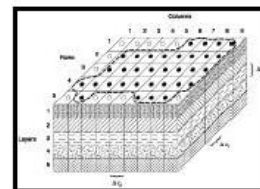
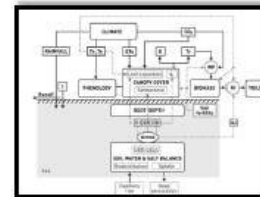
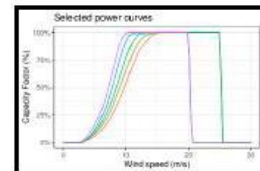
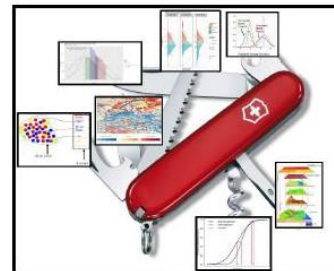


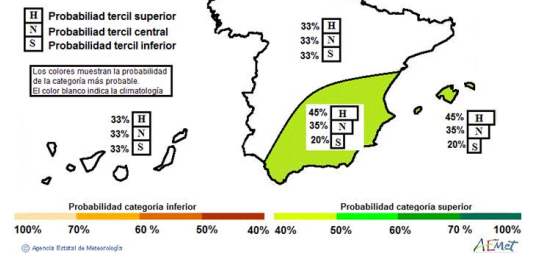
Curso OEP 2019-2020

3.8 Predicción estacional

ECMWF S5



PROBABILIDAD DE LA CATEGORÍA MÁS PROBABLE DE PRECIPITACIÓN
SEPTIEMBRE OCTUBRE NOVIEMBRE 2018



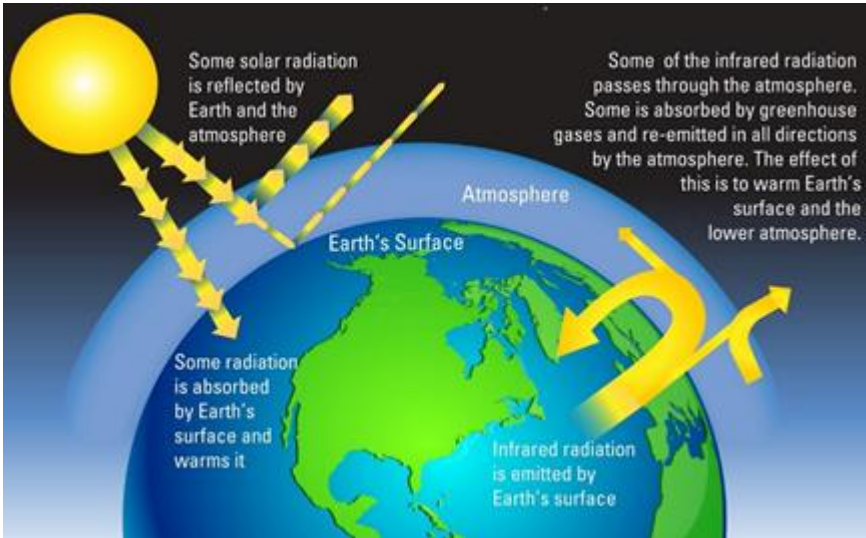
Esteban Rodríguez Guisado
erodriguezg@aemet.es

Sistema Climático

Equilibrio radiativo: radiación entrante vs saliente

Sin atmósfera -> 255K

Con atmósfera -> 288K

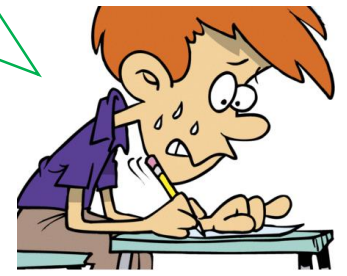
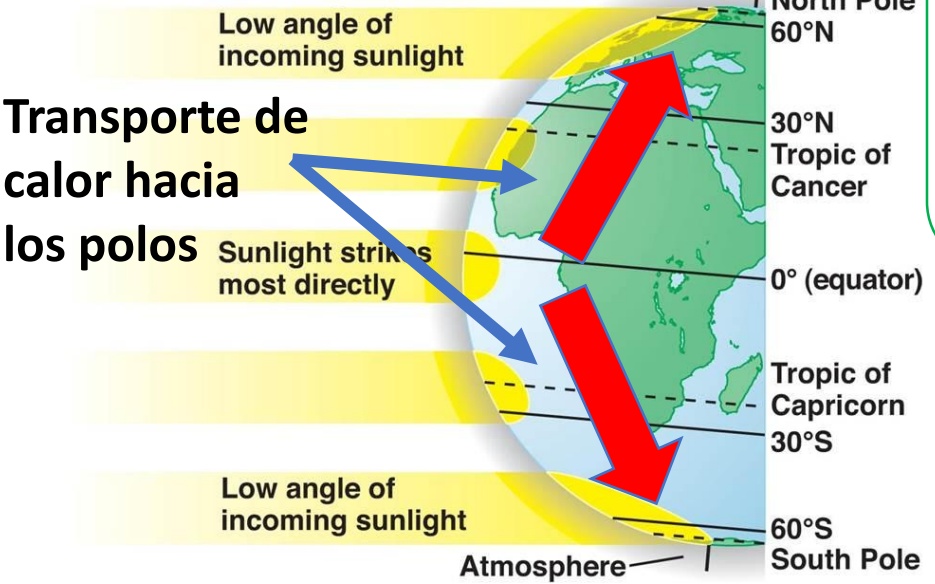
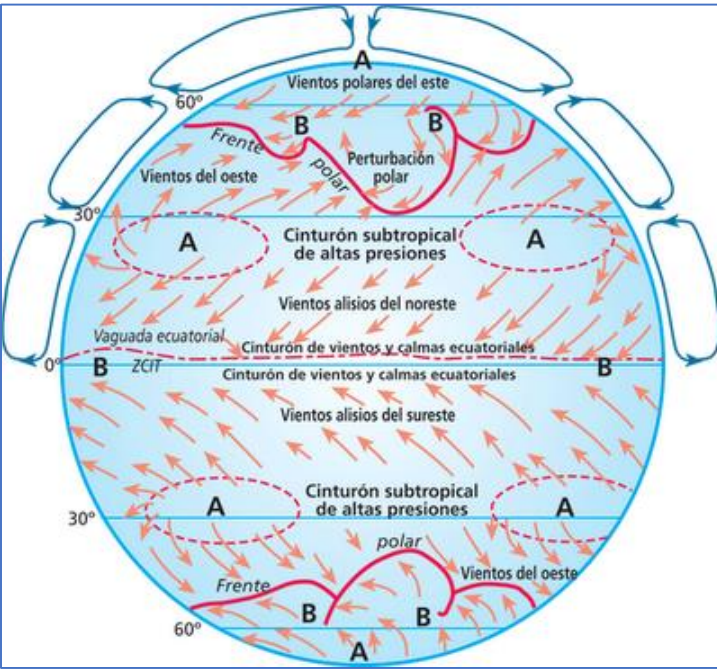


$$\frac{DV}{Dt} + f\mathbf{k} \otimes \mathbf{V} = -\nabla\Phi$$

$$\left(\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y}\right)_p + \frac{\partial \omega}{\partial p} = \nabla \cdot \mathbf{V} + \frac{\partial \omega}{\partial p} = 0$$

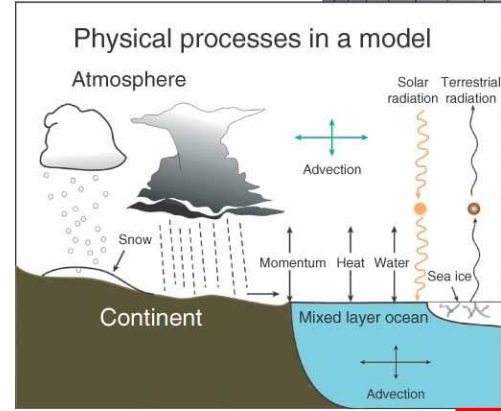
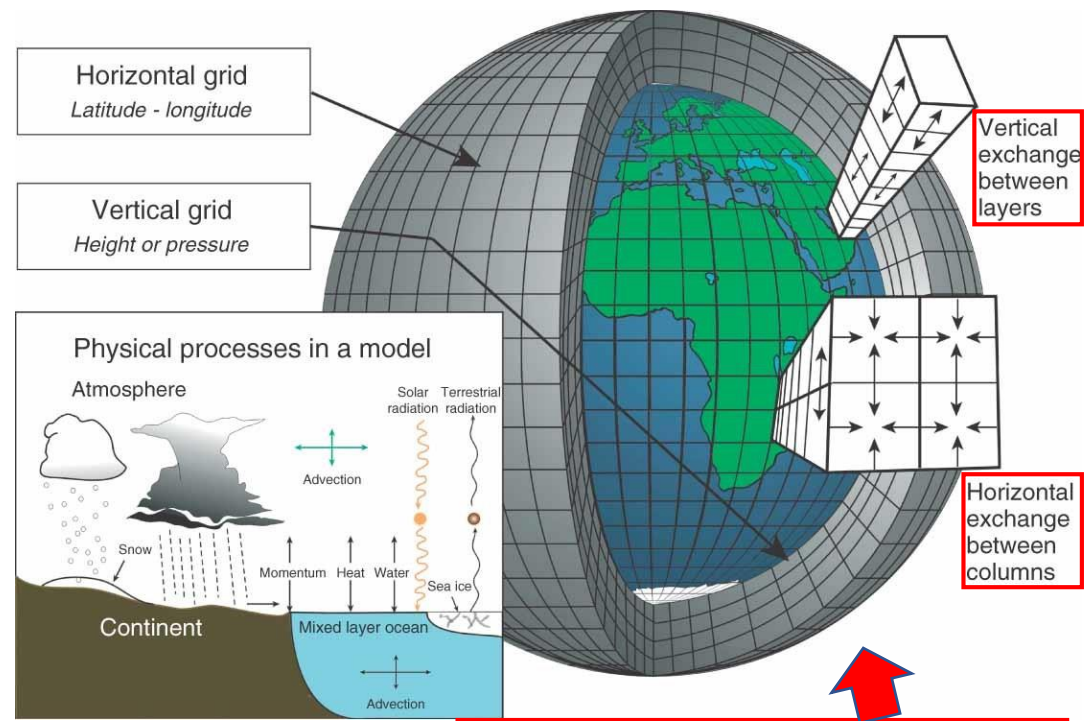
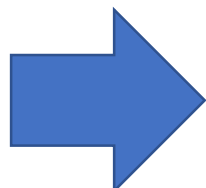
$$\frac{\partial T}{\partial t} + u \frac{\partial T}{\partial x} + v \frac{\partial T}{\partial y} - S_p \omega = \frac{\partial T}{\partial t} + \mathbf{V} \cdot \nabla T - S_p \omega = \frac{J}{c_p}$$

$$\frac{\partial \Phi}{\partial p} = -\alpha = -\frac{RT}{p}; S_p \equiv -T \frac{\partial \ln \theta}{\partial p}$$





Infinity-Imagined.tumblr.com



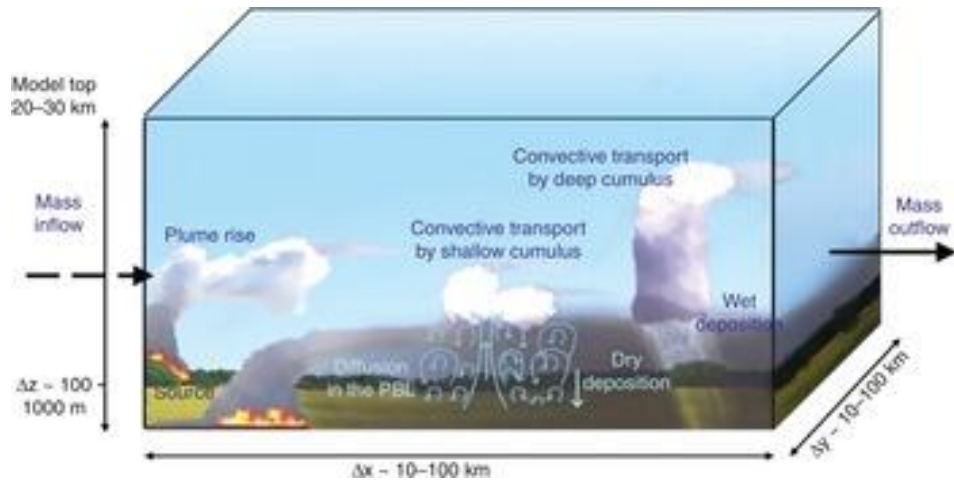
$$\frac{DV}{Dt} + f\mathbf{k} \otimes \mathbf{V} = -\nabla\Phi$$

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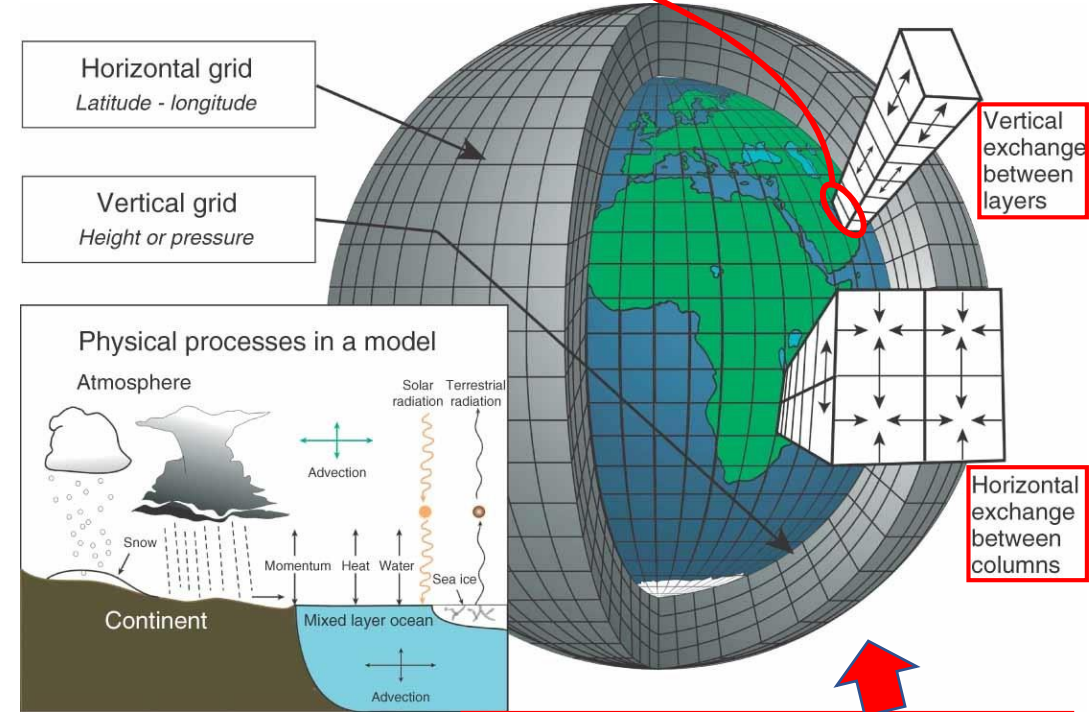
$$\frac{\partial T}{\partial t} + u \frac{\partial T}{\partial x} + v \frac{\partial T}{\partial y} - S_p \omega = \frac{\partial T}{\partial t} + \mathbf{V} \cdot \nabla T - S_p \omega = \frac{J}{c_p}$$

$$\frac{\partial \Phi}{\partial p} = -\alpha = -\frac{RT}{p} \quad ; \quad S_p \equiv -T \frac{\partial \ln \theta}{\partial p}$$

Dificultades: rejilla discreta



Representación de procesos subgrid mediante aproximaciones basadas en relaciones físicas y observación. Se comienzan a integrar técnicas de ML.



$$\frac{DV}{Dt} + \mathbf{f}\mathbf{k} \otimes \mathbf{V} = -\nabla\Phi$$

$$\left(\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y}\right)_p + \frac{\partial \omega}{\partial p} = \nabla \cdot \mathbf{V} + \frac{\partial \omega}{\partial p} = 0$$

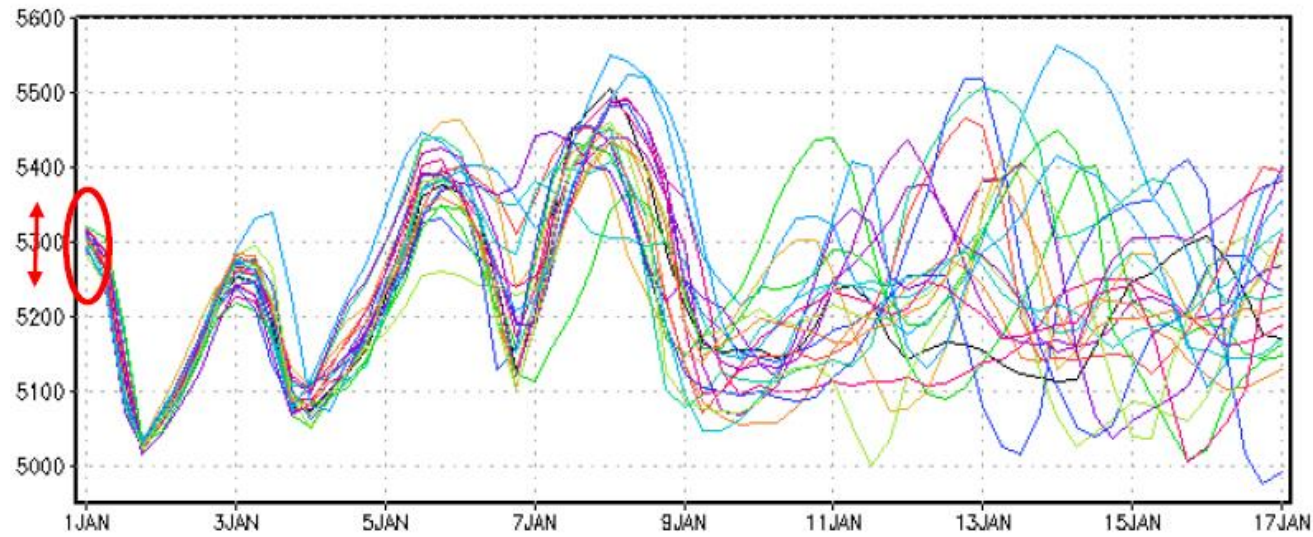
$$\frac{\partial T}{\partial t} + u \frac{\partial T}{\partial x} + v \frac{\partial T}{\partial y} - S_p \omega = \frac{\partial T}{\partial t} + \mathbf{V} \cdot \nabla T - S_p \omega = \frac{J}{c_p}$$

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Limitaciones: la naturaleza caótica de la atmósfera:



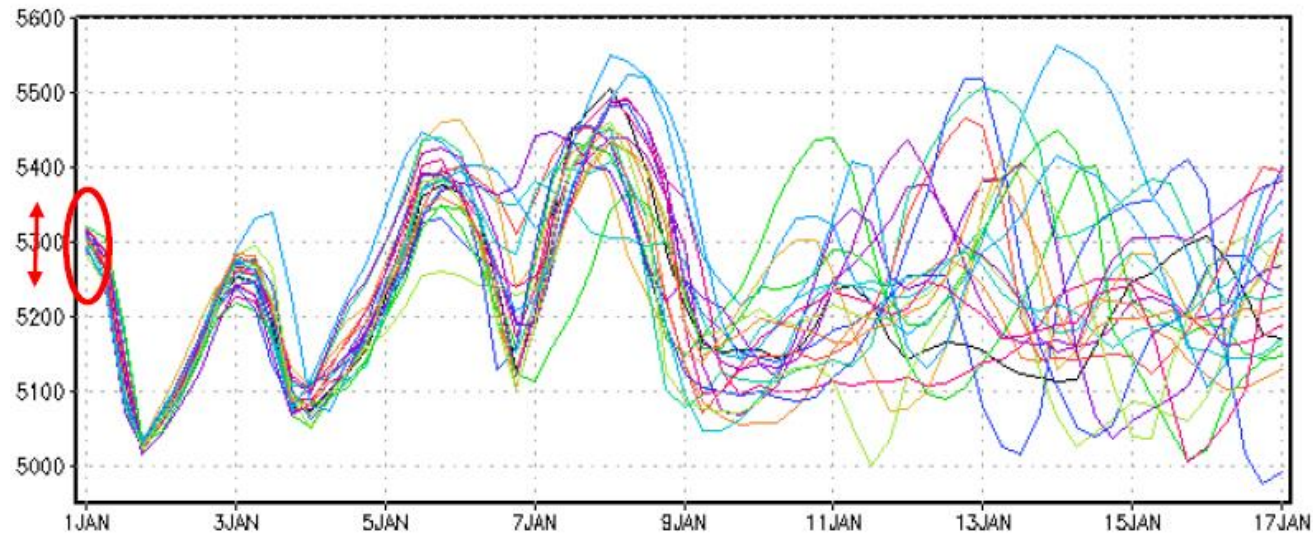
*Lorenz's experiment:
the difference between
the starting values of
these curves is only
.000127*

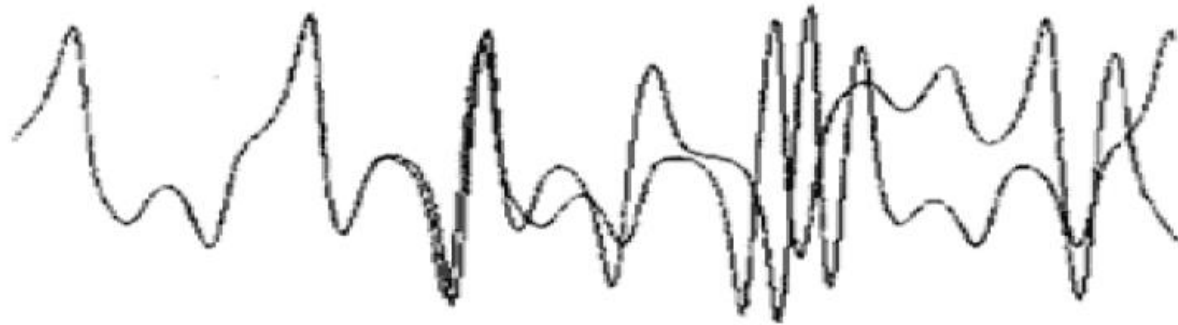


Limitaciones: la naturaleza caótica de la atmósfera:

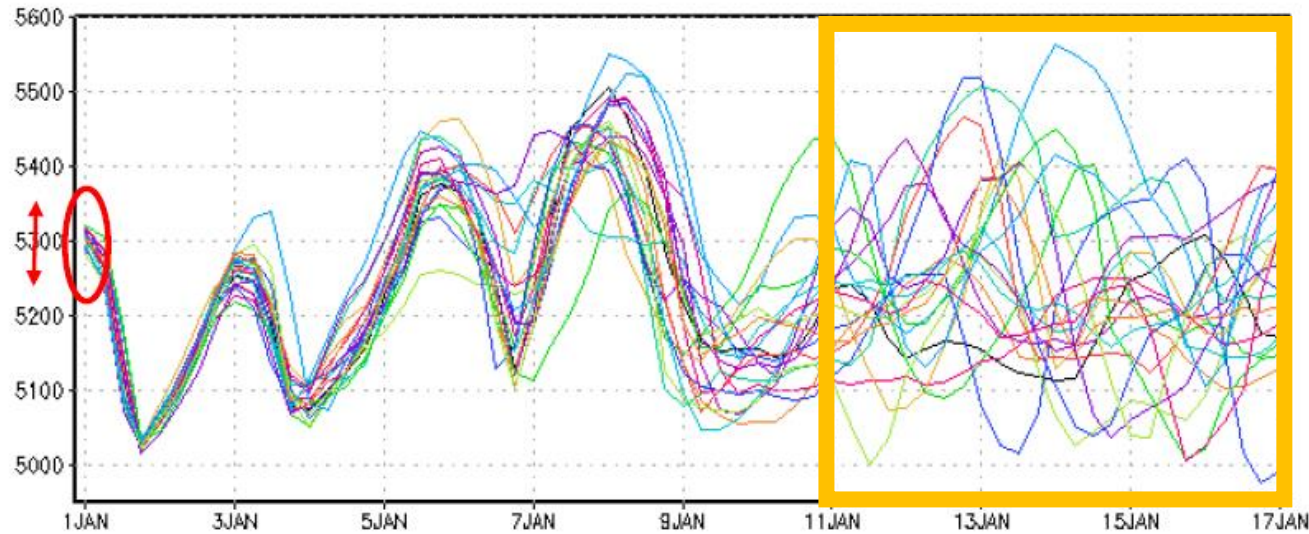


*Lorenz's experiment:
the difference between
the starting values of
these curves is only
.000127*



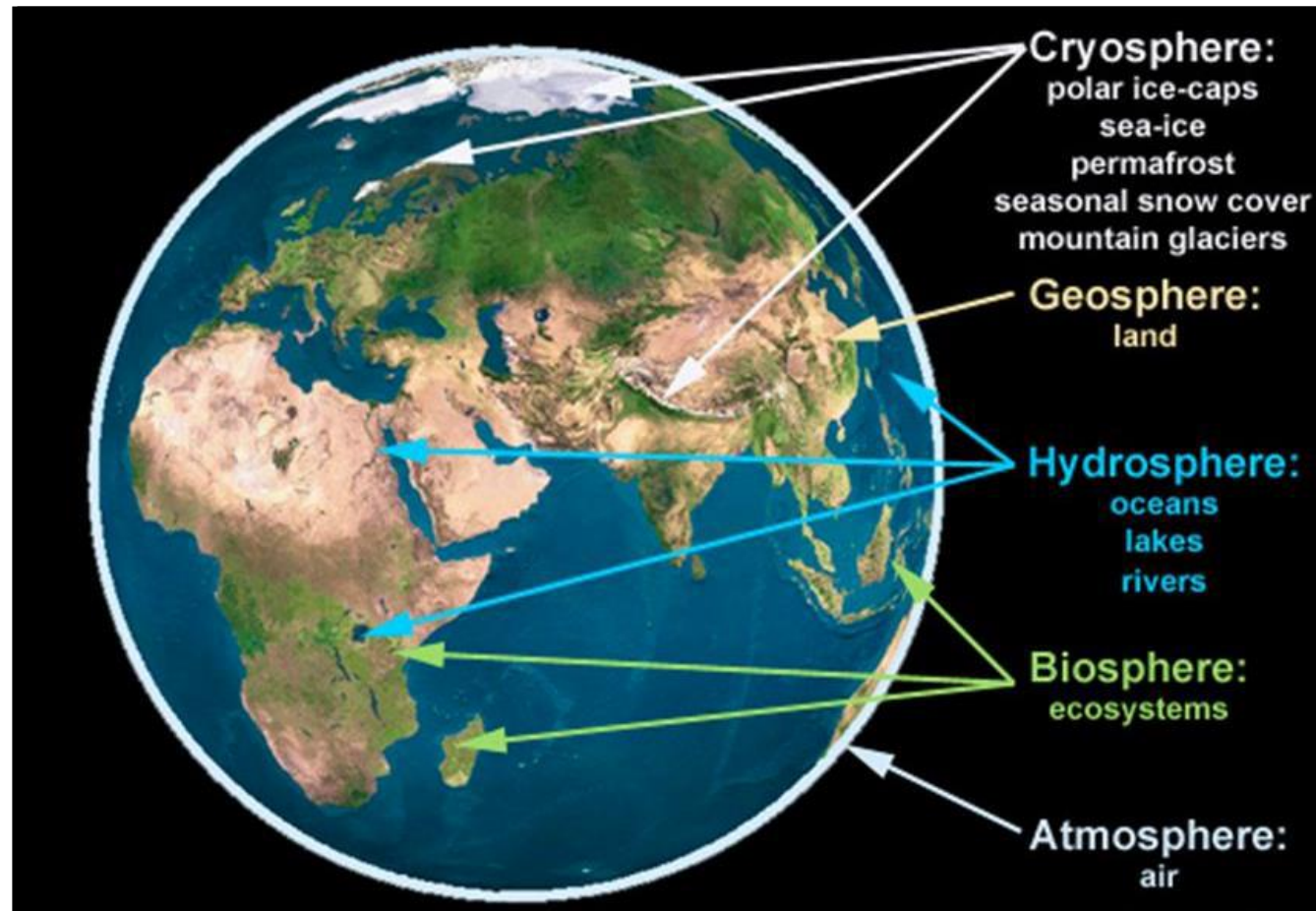


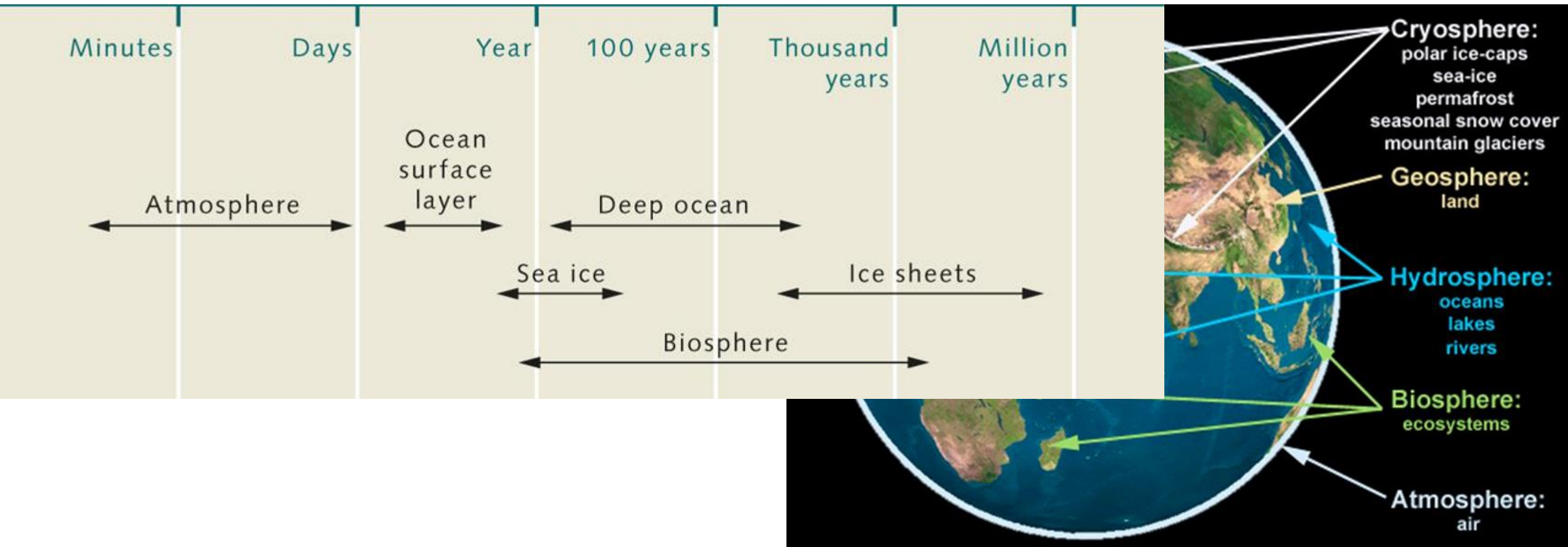
*Lorenz's experiment:
the difference between
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.000127*

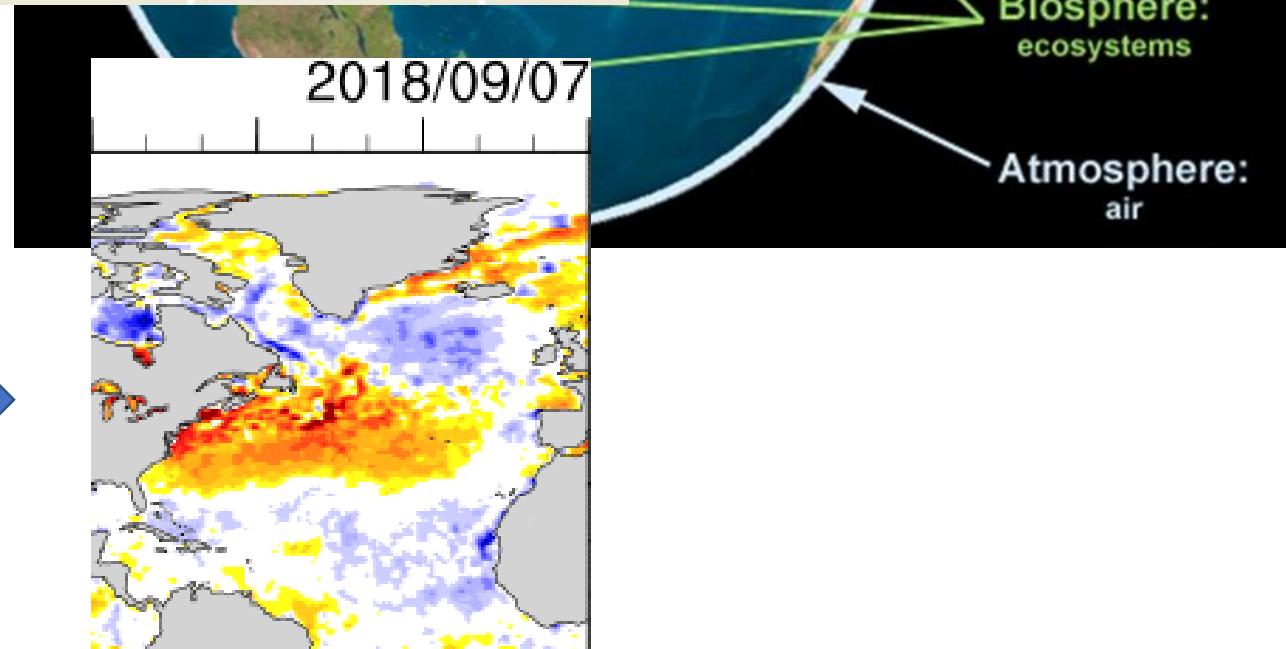
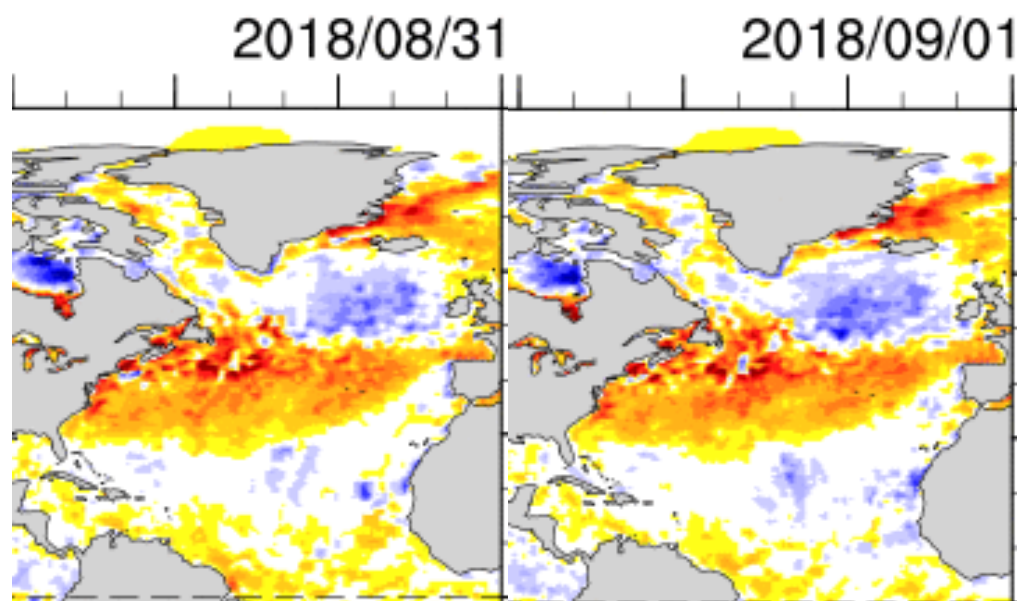
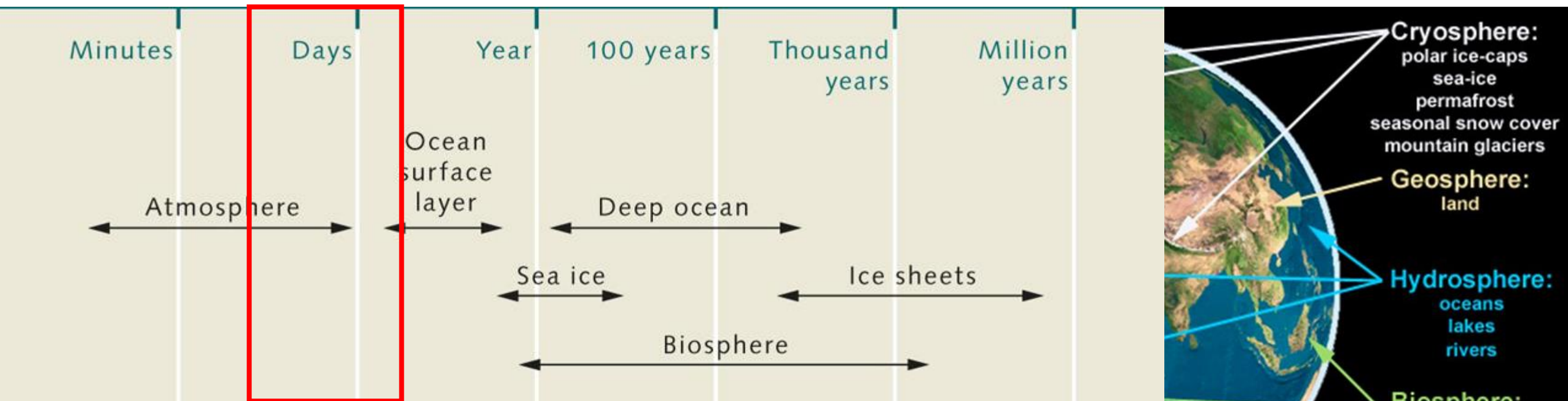


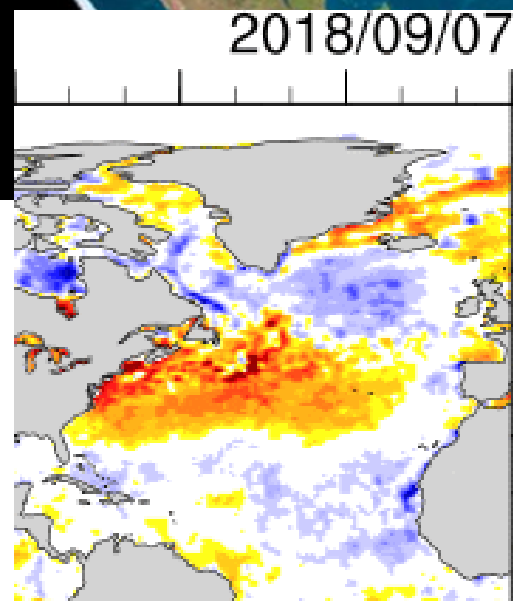
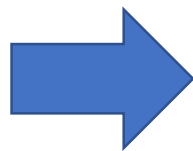
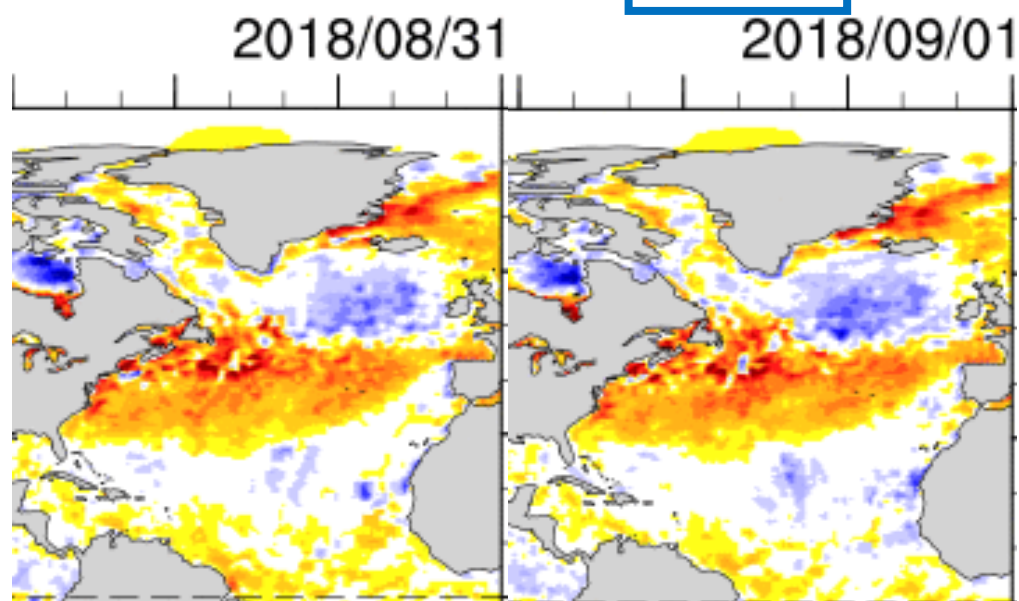
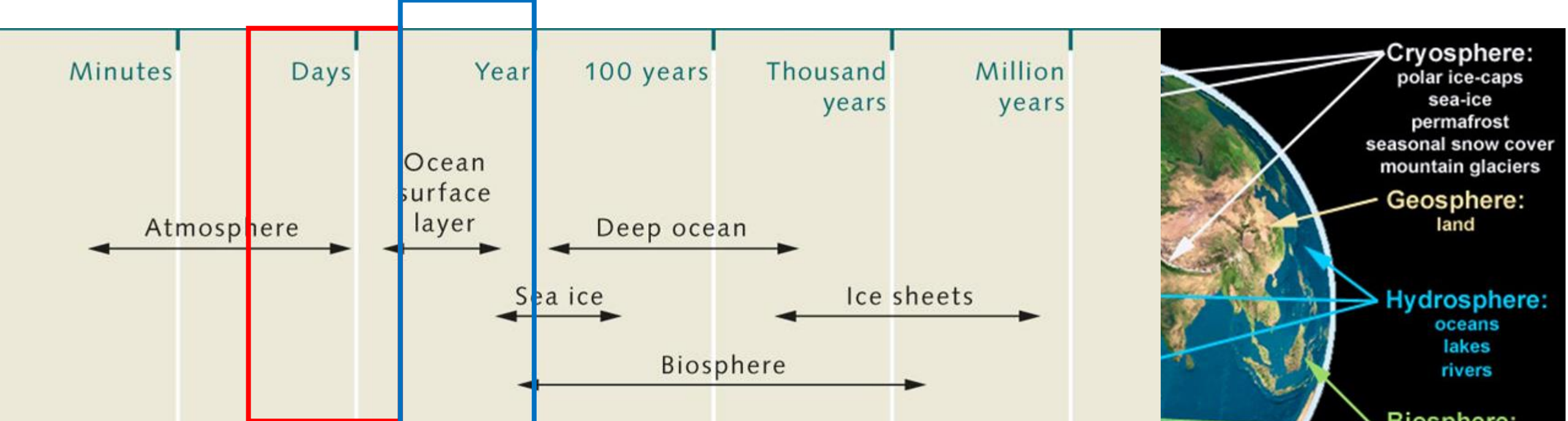
A partir de un umbral de unos 10 días,
no se puede predecir con precisión el
estado de la atmósfera

La atmósfera evoluciona condicionada por el estado del resto de componentes del sistema climático (e interaccionando todos entre sí), cada uno con procesos que evolucionan en diferentes escalas temporales





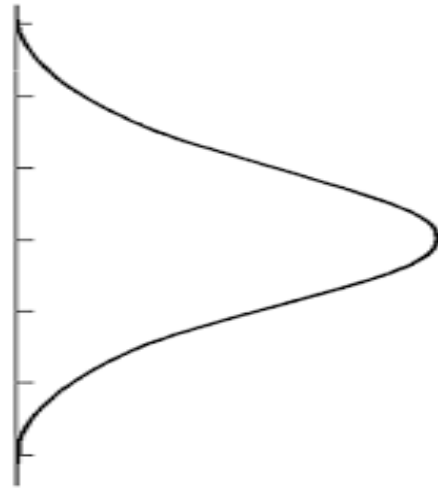
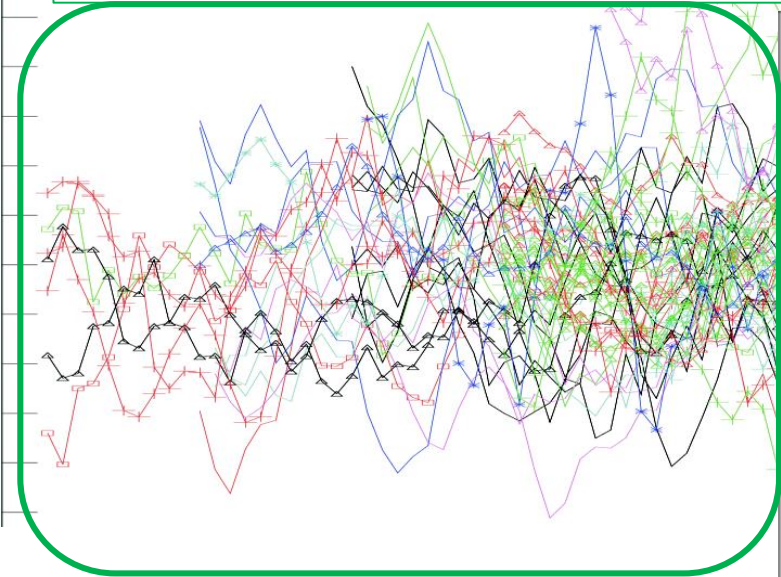




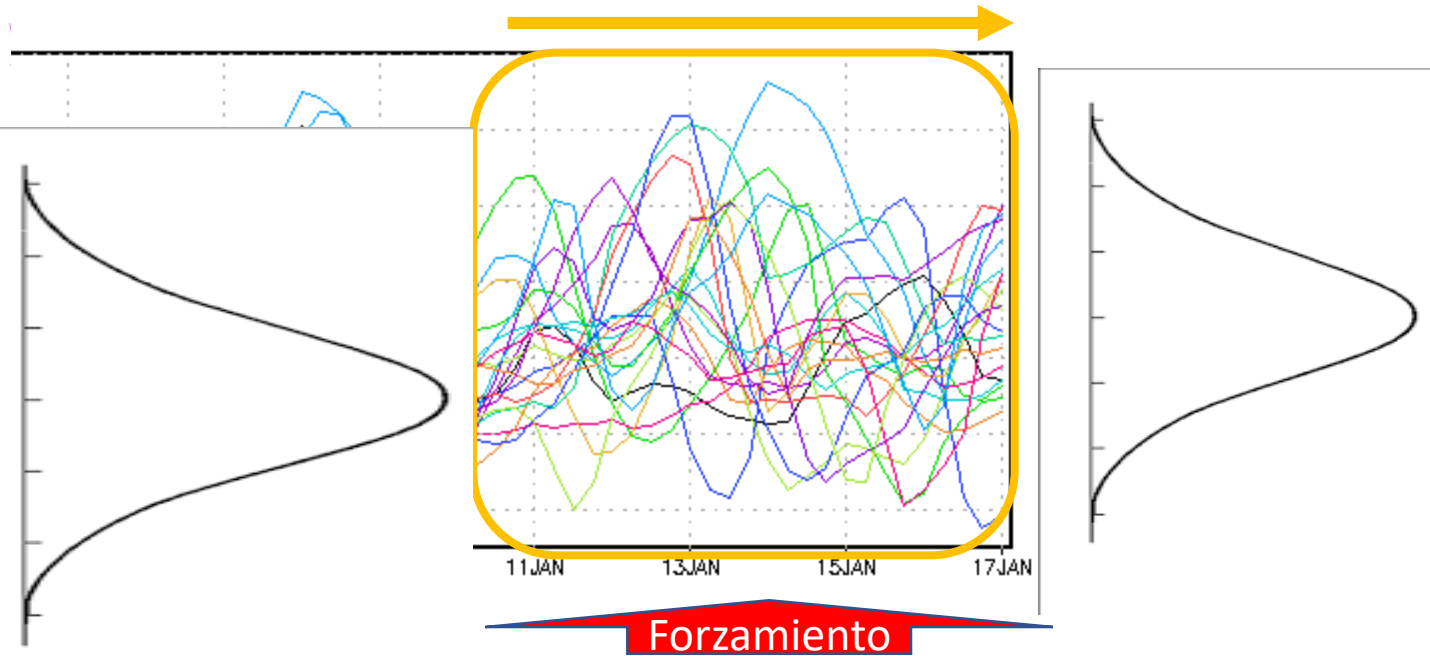
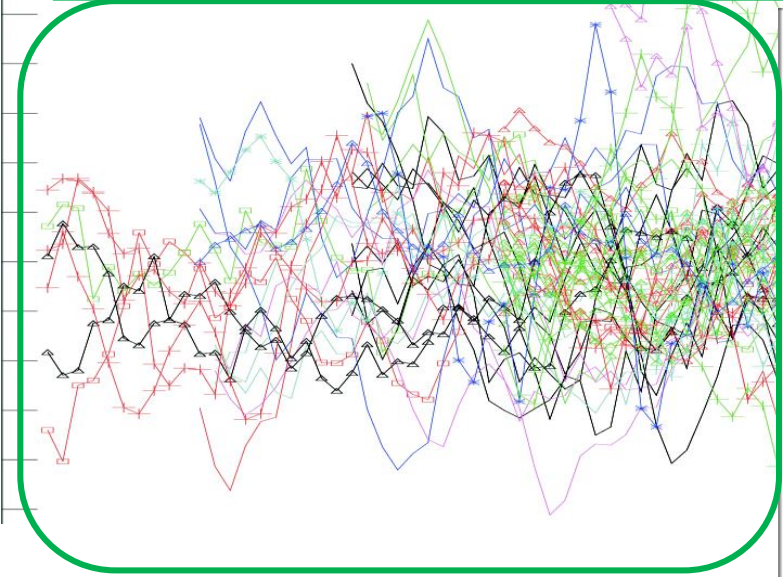
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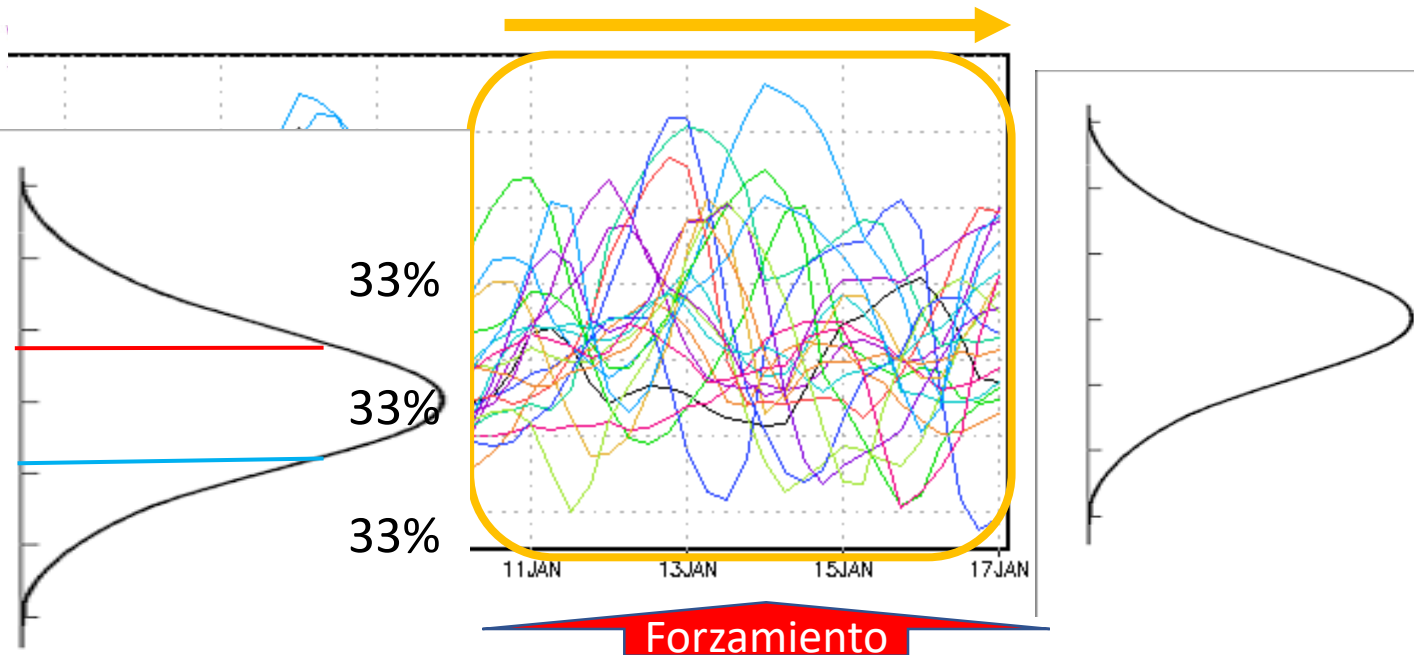
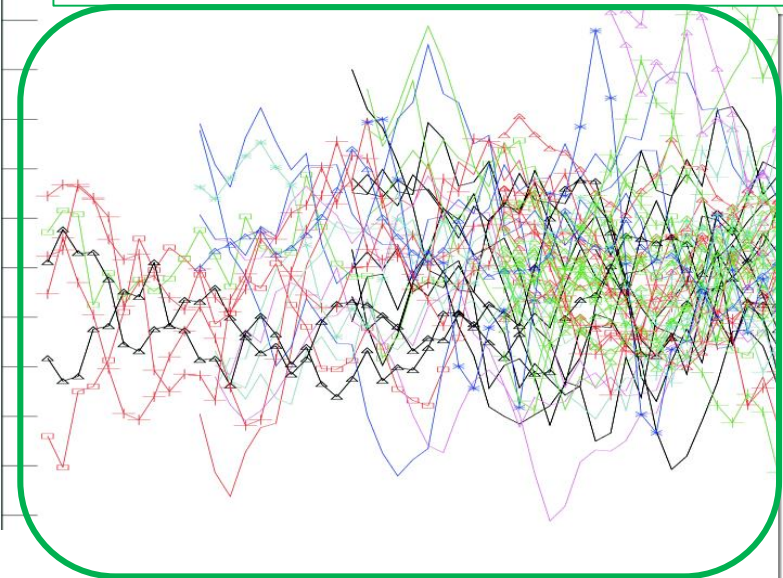
Climatología



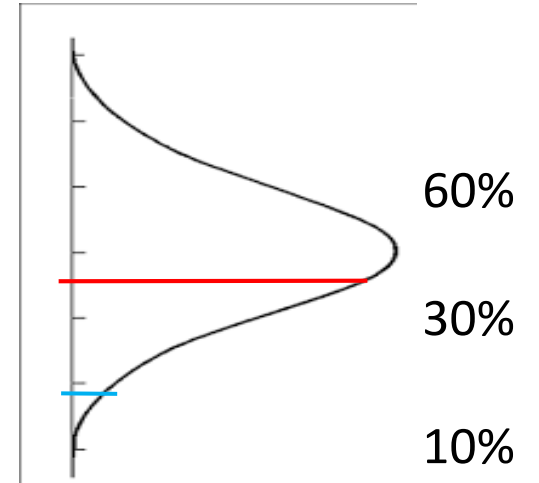
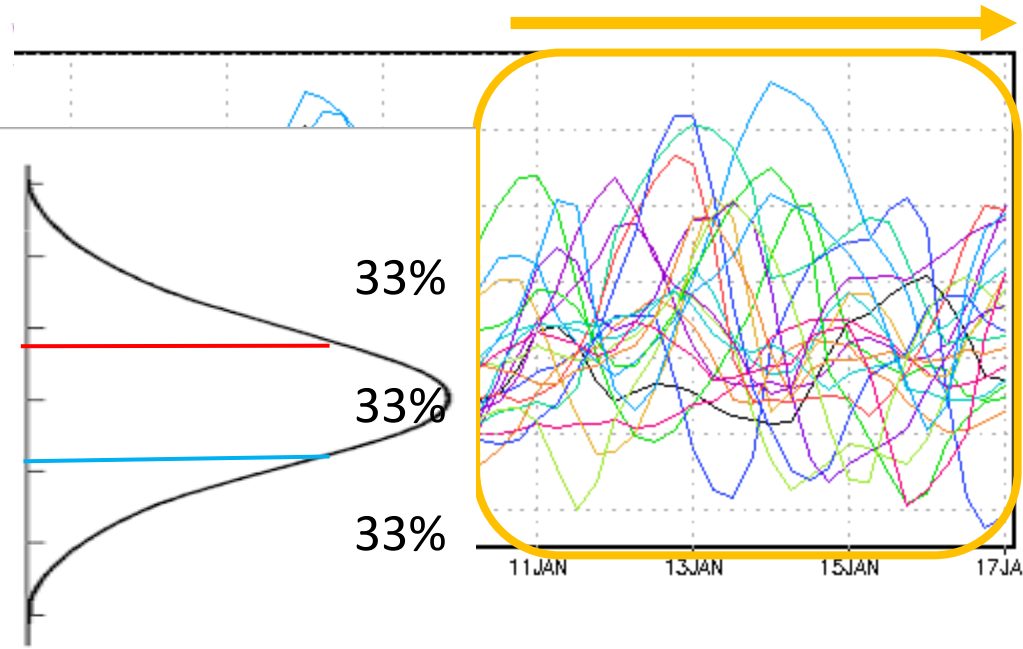
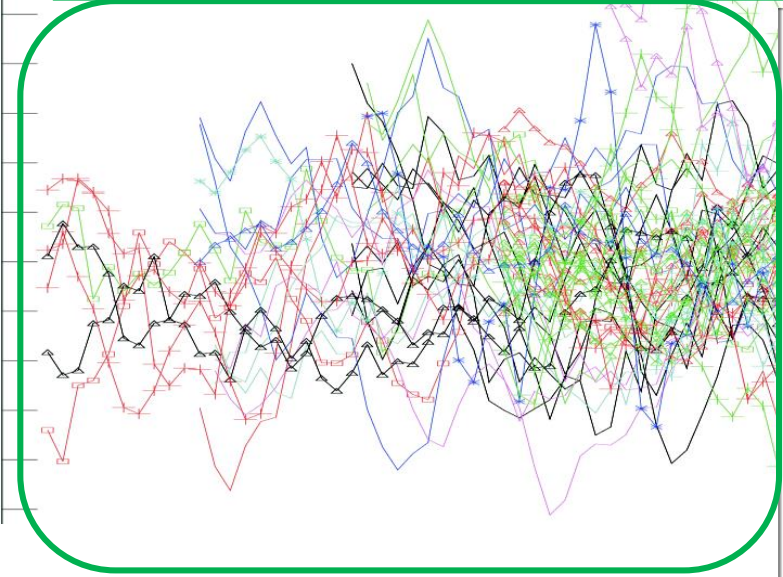
Climatología



Climatología



Climatología



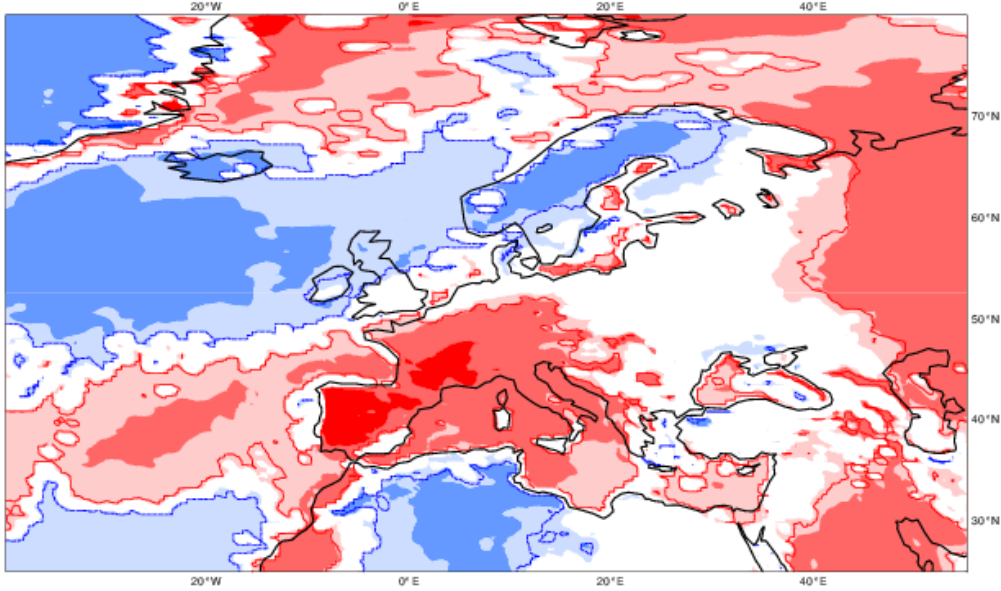
Predicción de naturaleza probabilista. Normalmente se da en forma de probabilidades para los terciles.

ECMWF EPS-Monthly Forecasting System
 Soil Temp. Lev. 1/SST anomaly
 Forecast start reference is 17-09-2018
 ensemble size = 51 ,climate size = 660

24-09-2018/TO/3/
 Shaded areas significant
 Contour

ECMWF Seasonal Forecast
 Prob(most likely category of 2m temperature)
 Forecast start is 01/09/18, climate period is 1993-2016
 Ensemble size = 51, climate size = 600

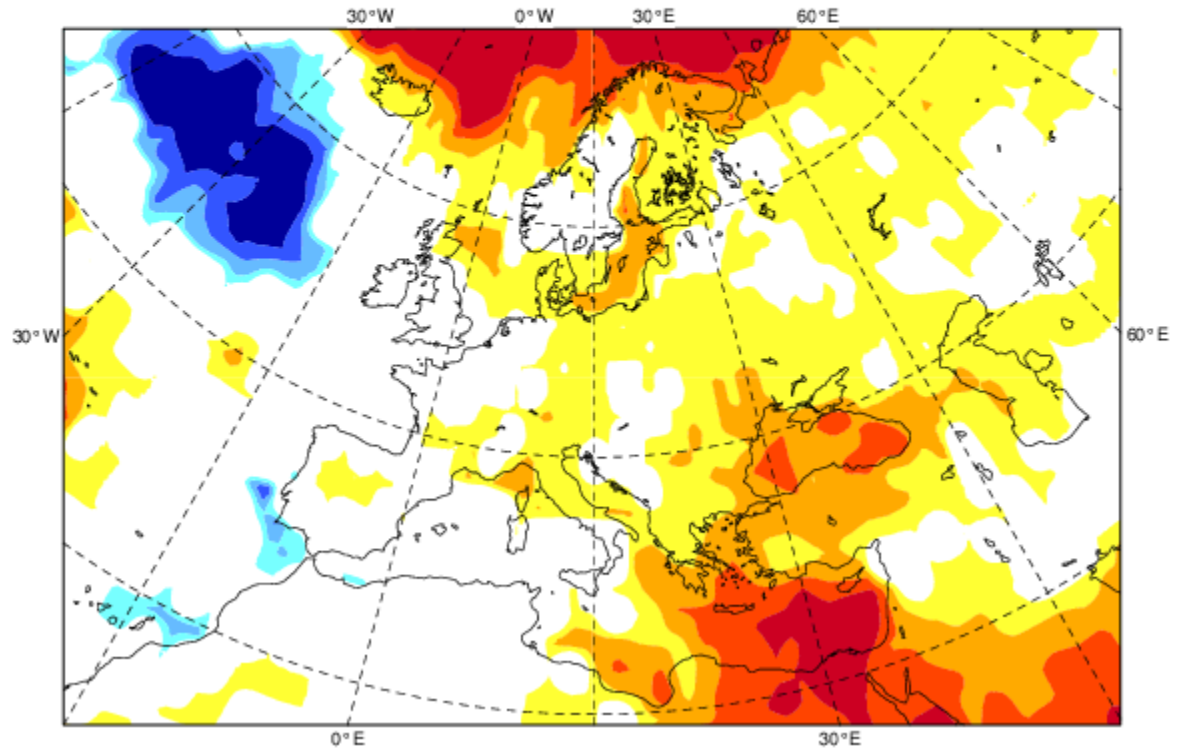
█ <-10deg
 █ -10.. -6
 █ -6.. -3
 █ -3.. -1
 █ -1.. 0
 █ 0.. 1
 █ 1.. 3
 █ 3.. 6
 █ 6.. 10
 █ > 10deg



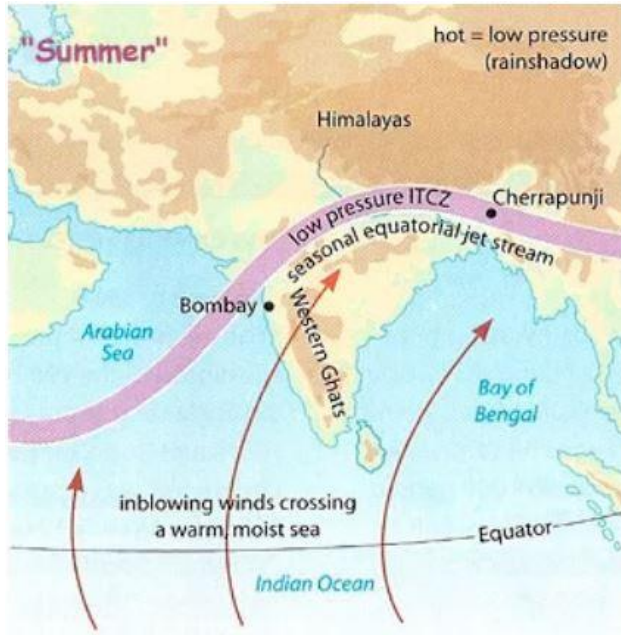
<---- Prob(below lower tercile)

Prob(above upper tercile) ---->

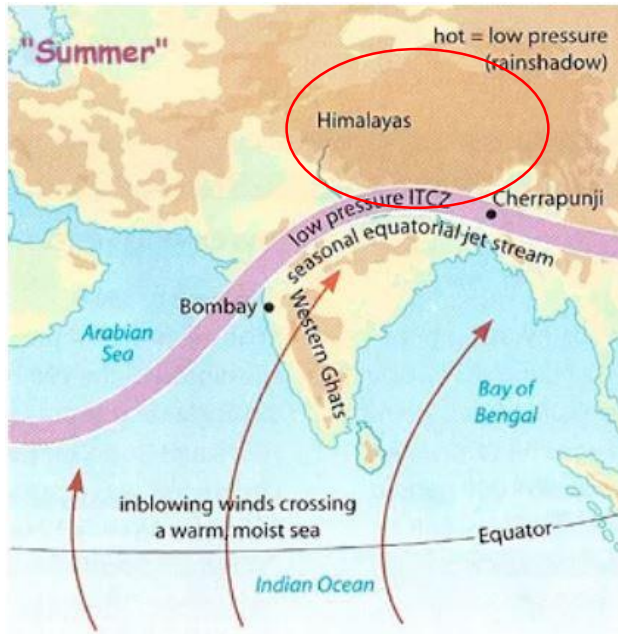
█ 70..100%
 █ 60..70%
 █ 50..60%
 █ 40..50%
 █ other
 █ 40..50%
 █ 50..60%
 █ 60..70%
 █ 70..100%



Los primeros intentos de predicción estacional se hicieron en la India, tratando de predecir la intensidad del monzón.

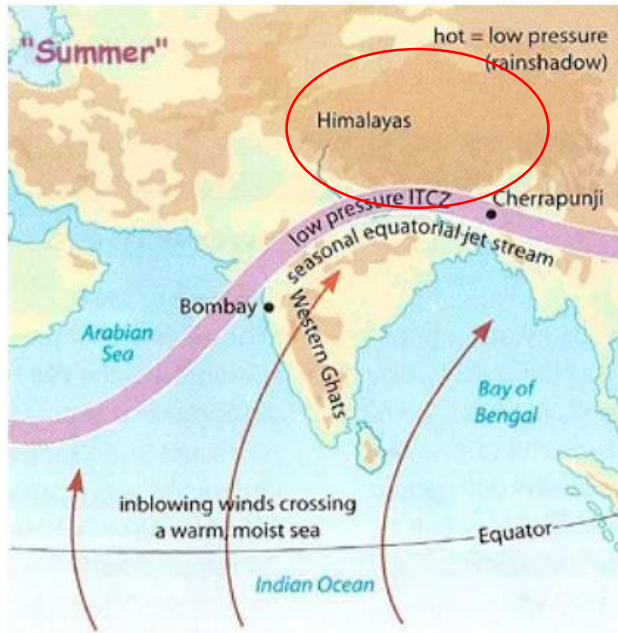


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Se trató de elaborar una predicción basada en la variabilidad en el espesor de nieve del Himalaya.

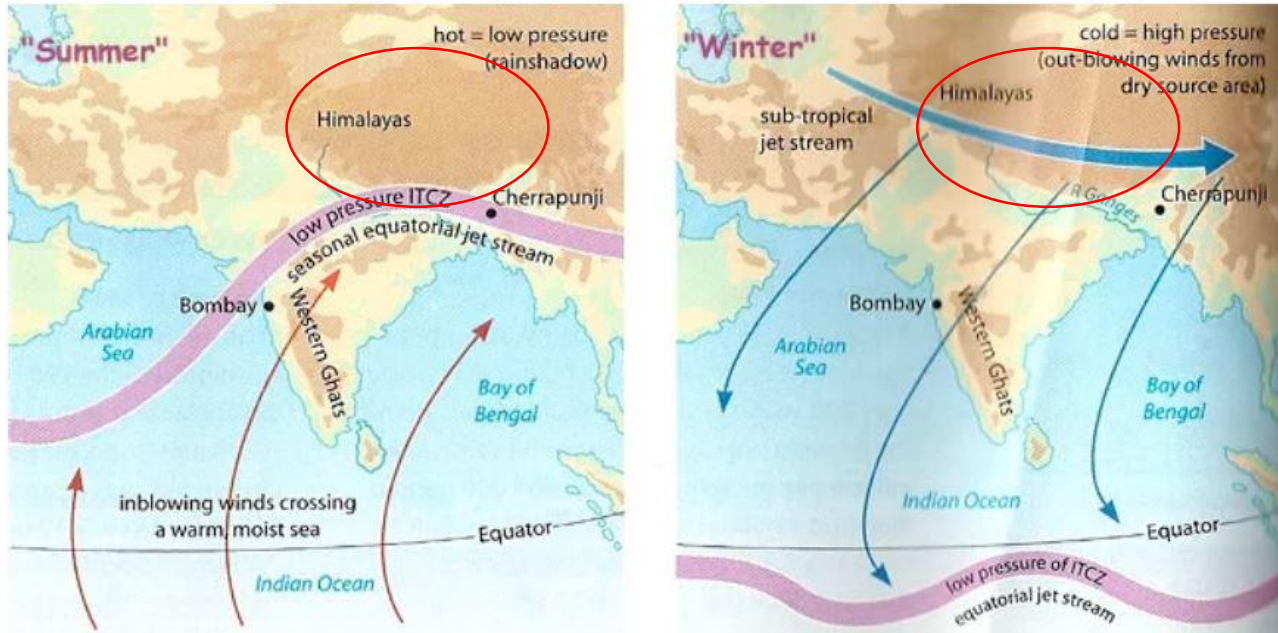
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Se exploraron técnicas de análogos y se trataron de desarrollar metodologías objetivas, buscando relación con la variabilidad de otros parámetros meteorológicos (T,P, p...)

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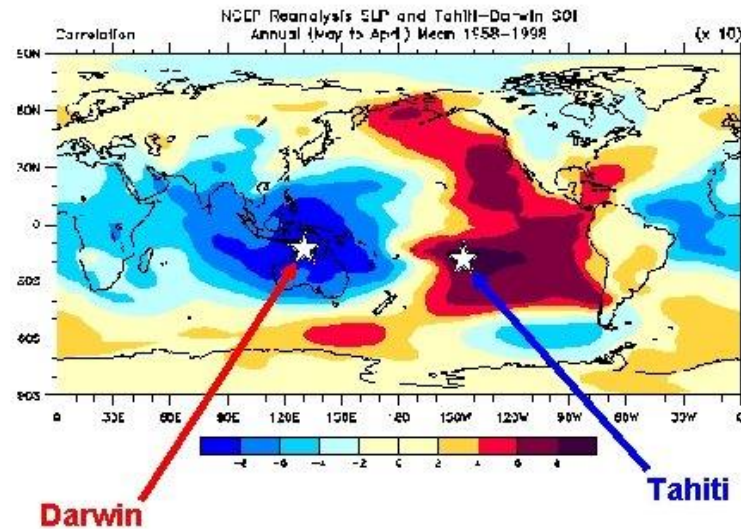
Ello llevó a Sir Gilber T. Walker a descubrir tres patrones de fluctuación a gran escala de presión: Oscilación del Atlántico Norte (NAO), Oscilación del Pacífico Norte (NPO) y la oscilación del sur (SO)

Posteriormente, se relacionó la oscilación del sur con anomalías en la temperatura superficial del mar. Estudios sucesivos han llevado a identificar dicho fenómeno como ENSO, uno de los fenómenos de acoplamiento Océano Atmósfera más relevantes.

The Southern Oscillation



Sir Gilbert Walker
(1868-1958)

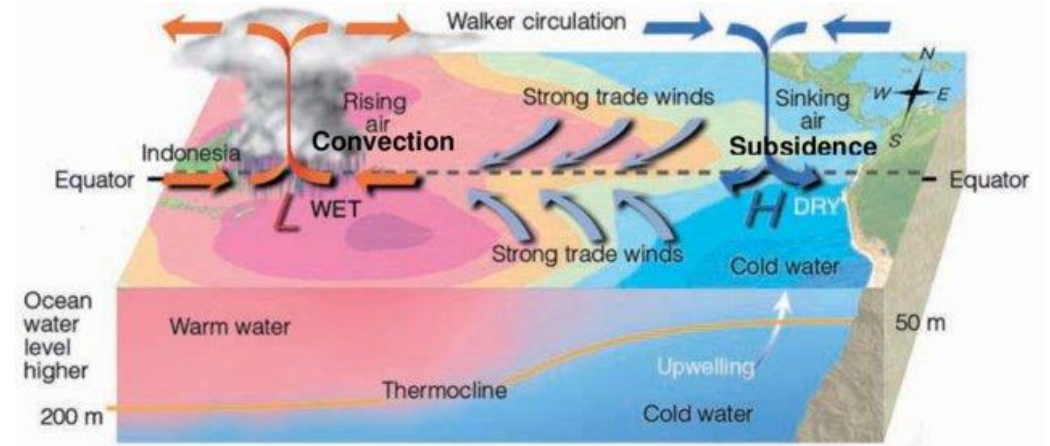
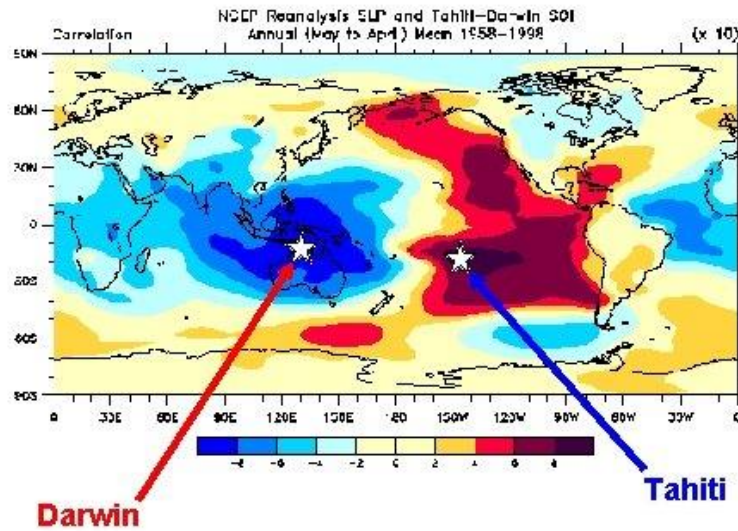


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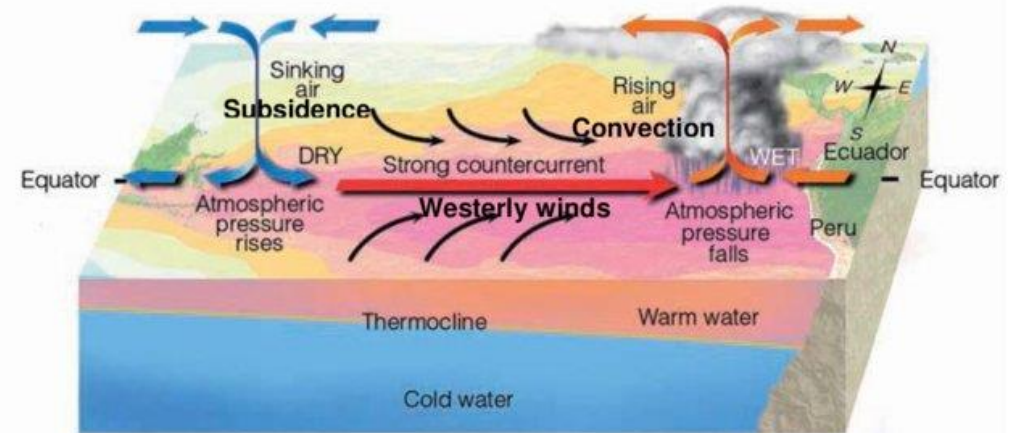
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(a) Neutral ENSO

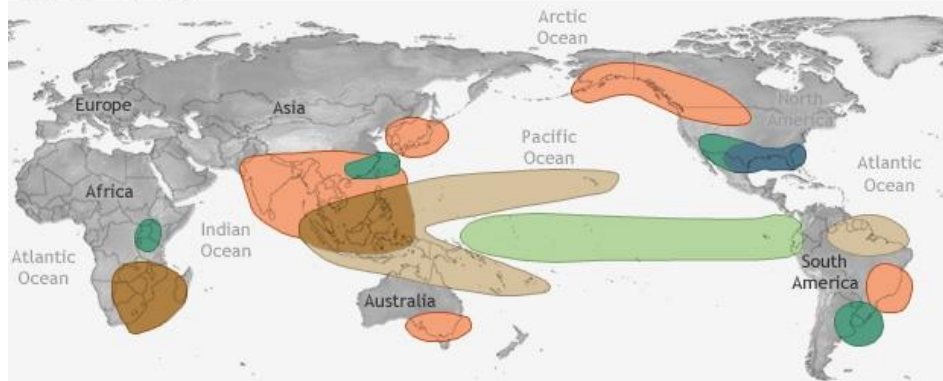


(b) El Niño phase

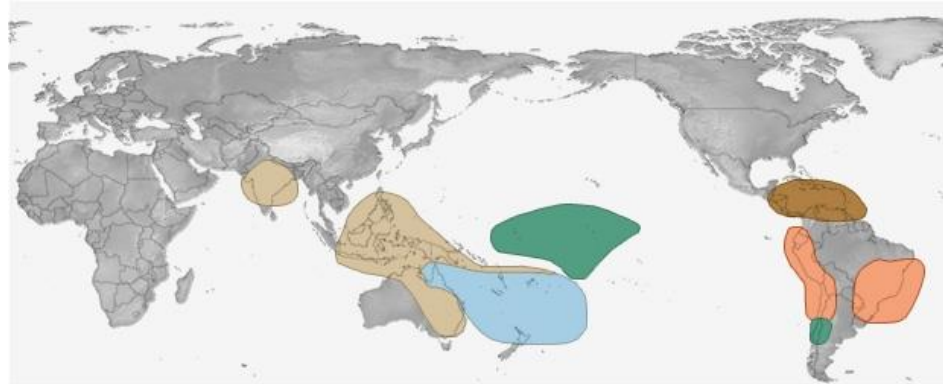
El estado del sistema climático condiciona las anomalías que podemos esperar en el estado la atmósfera.
 Desarrollo de modelos empíricos objetivos

EL NIÑO CLIMATE IMPACTS

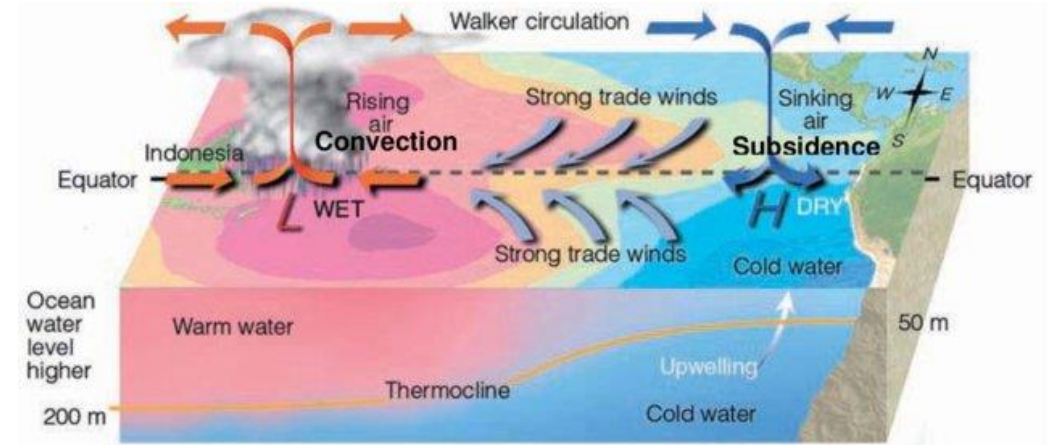
December-February



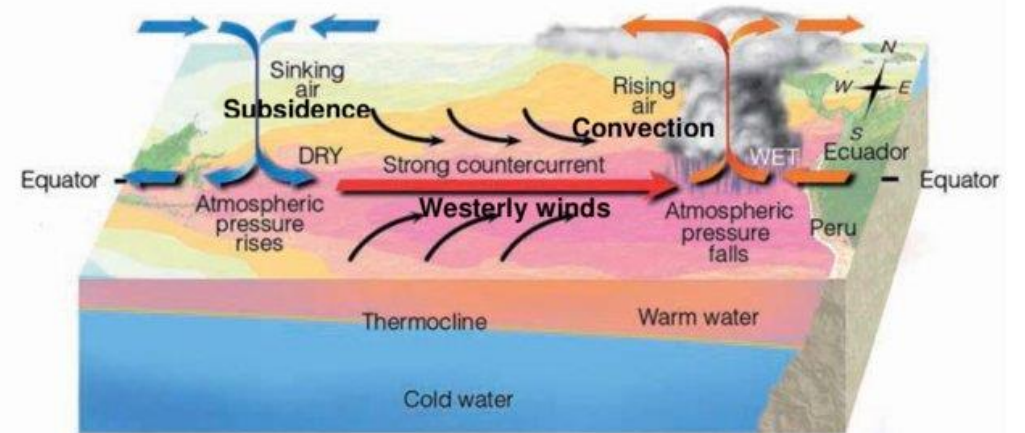
June-August



NOAA Climate.gov



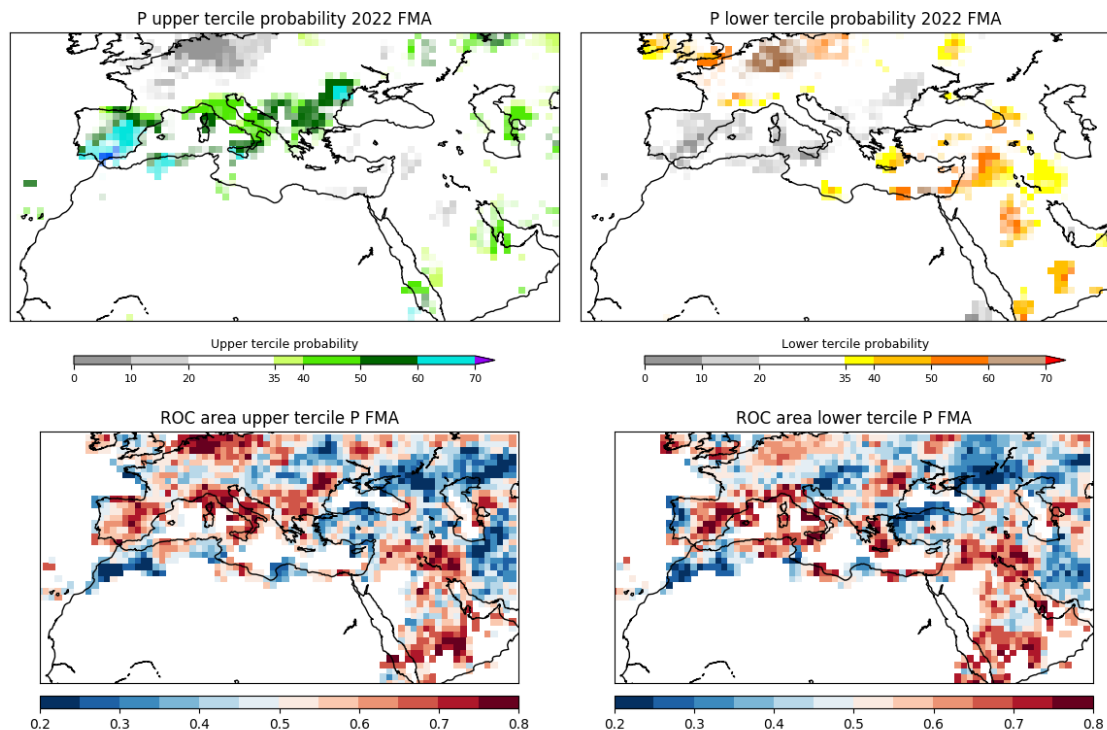
(a) Neutral ENSO



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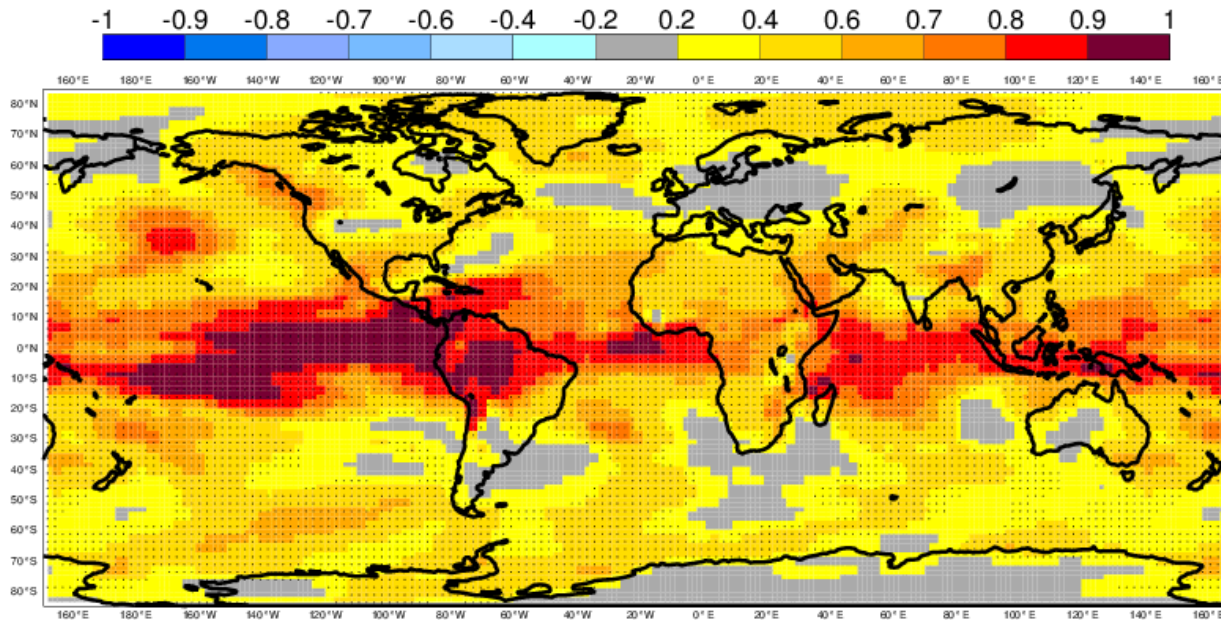
El estado del sistema climático condiciona las anomalías que podemos esperar en el estado la atmósfera.
Desarrollo de modelos empíricos objetivos

- Predictores basados en:
- temperatura superficial y contenido de calor del mar
- anomalías de presión y geopotencial
- extensión de la cubierta de nieve y el hielo
- humedad del suelo

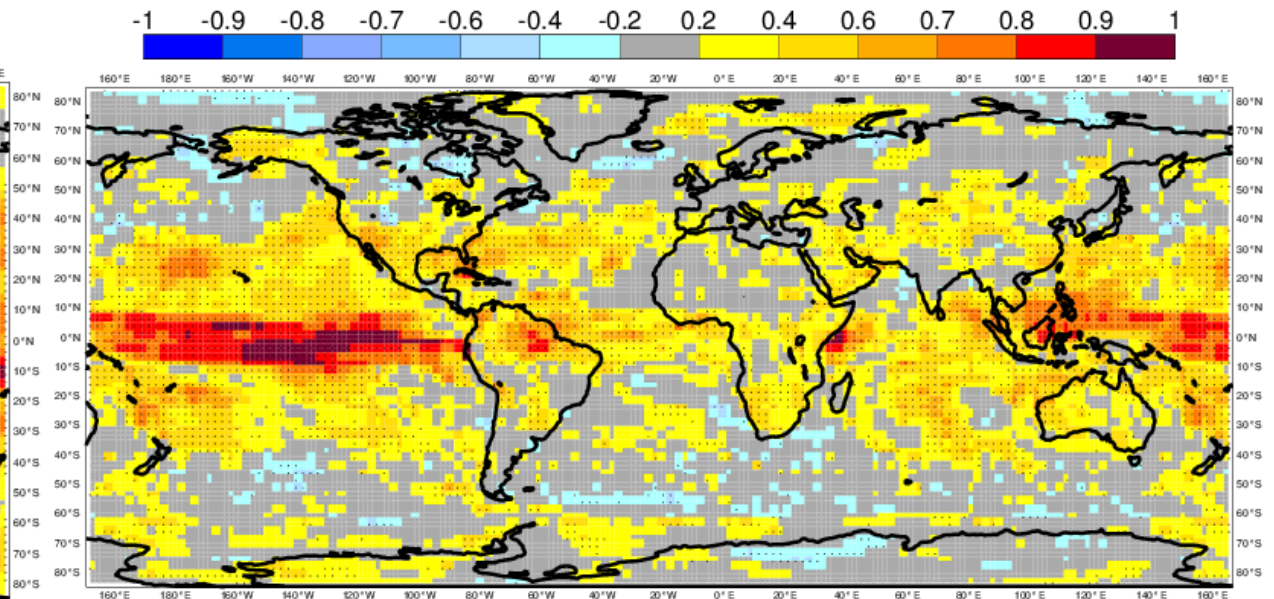


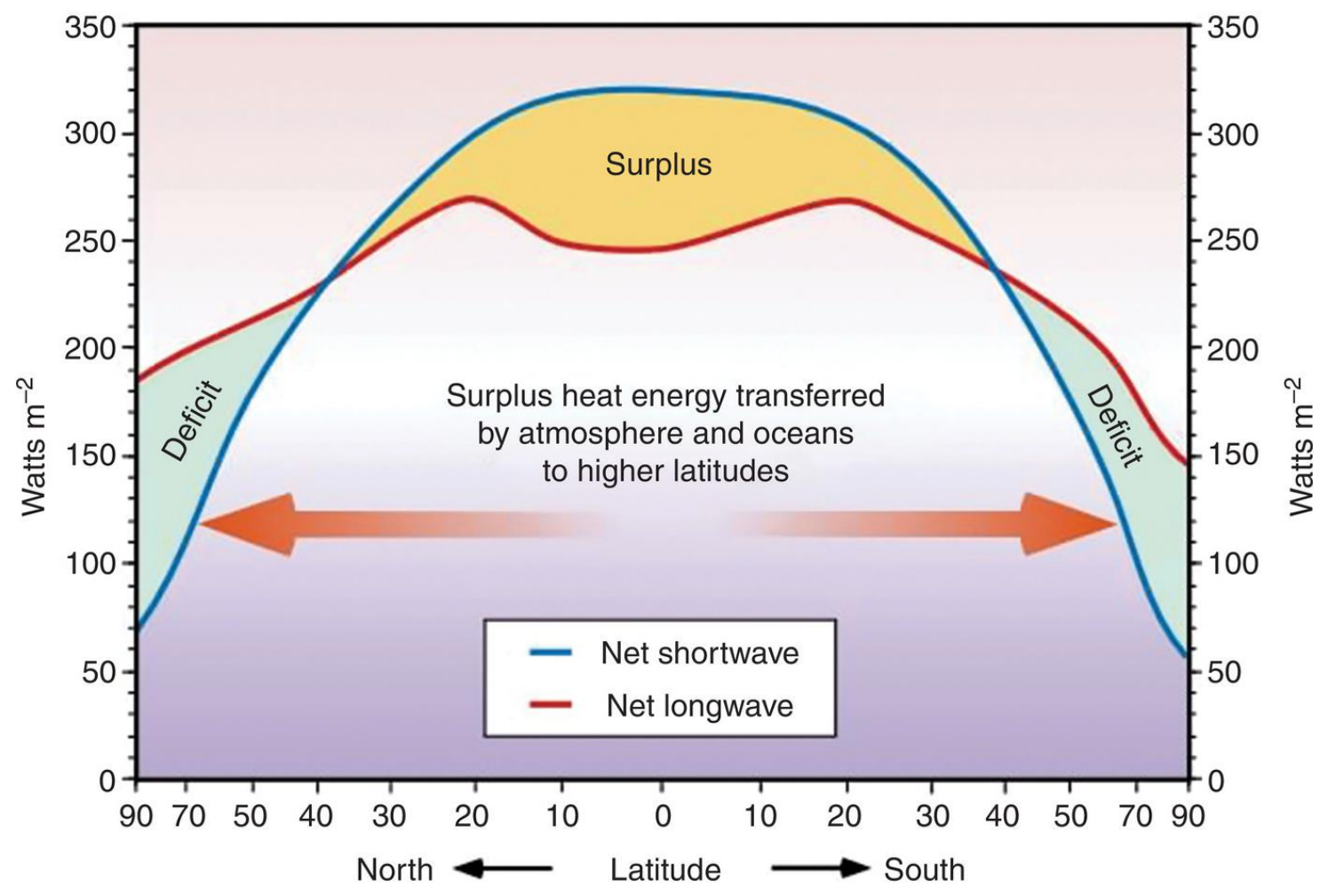
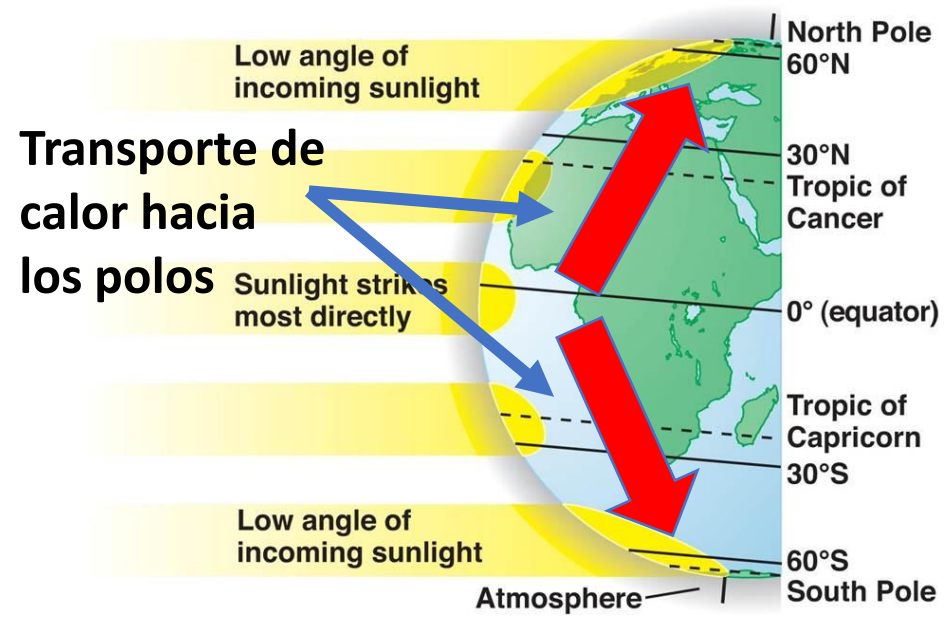
Funcionan bien los modelos de predicción climática?

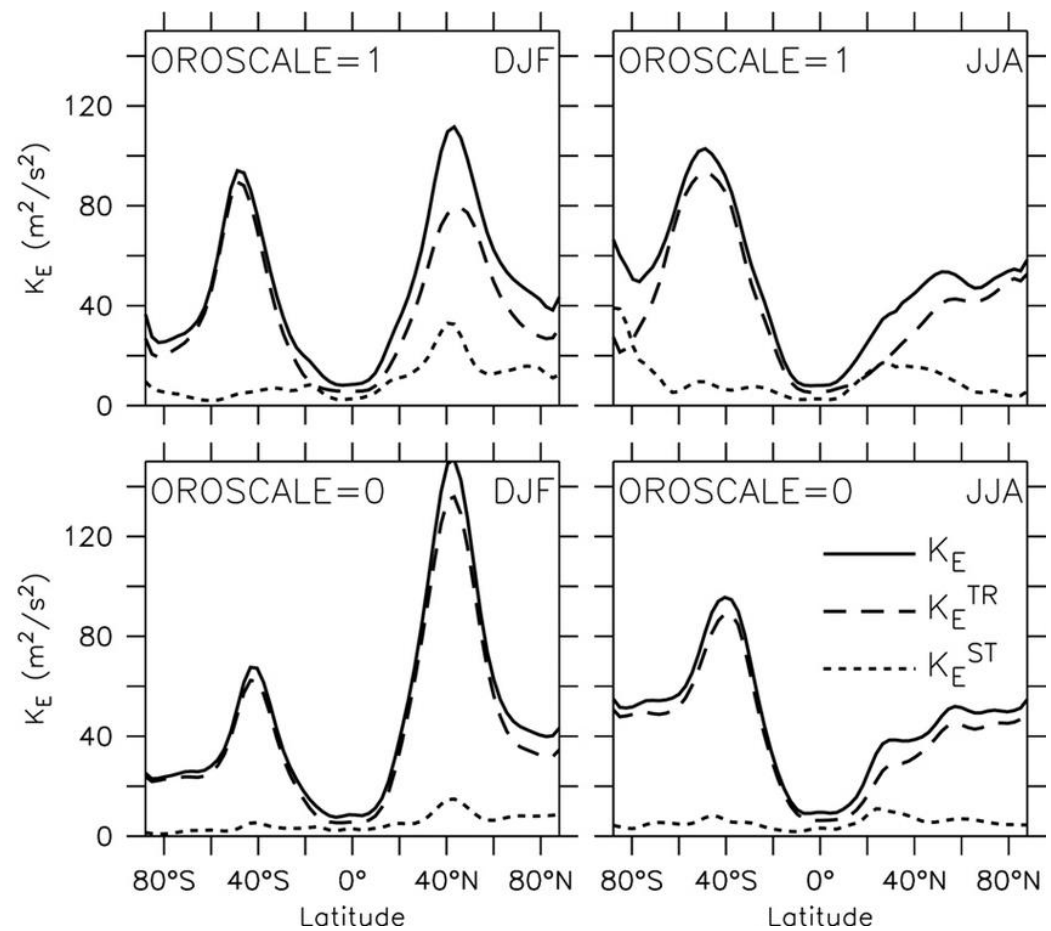
Anomaly Correlation Coefficient for 0001 with 25 ensemble members
850 hPa temperature
Hindcast period 1981-2016 with start in December average over months 2 to 4
Black dots for values significantly different from zero with 95% confidence (1000 samples)



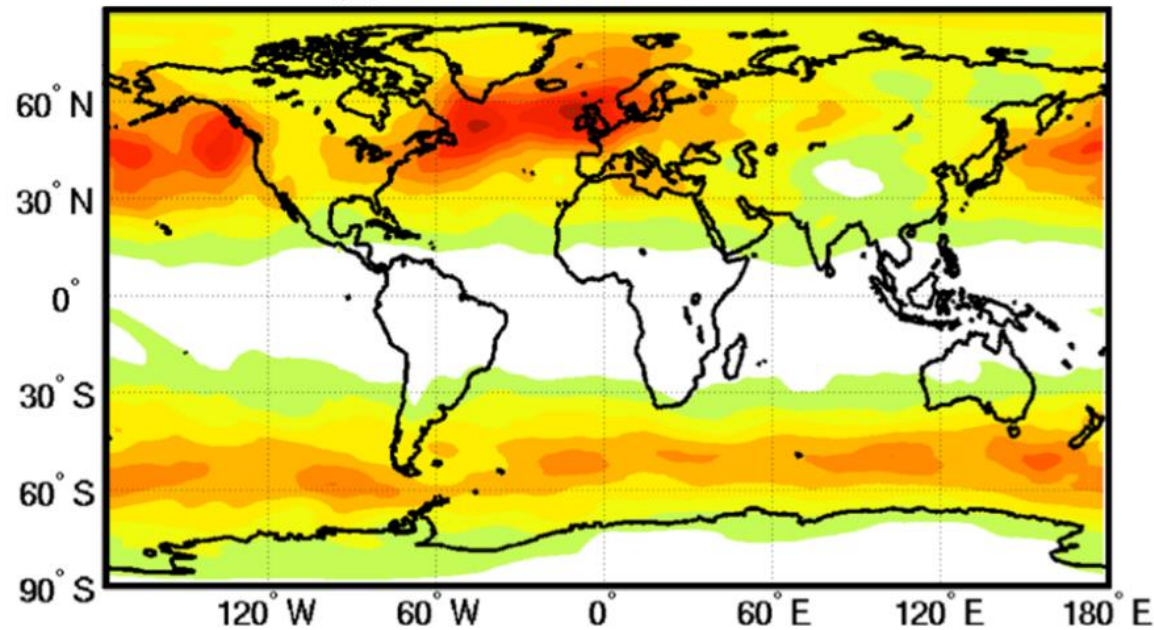
Anomaly Correlation Coefficient for 0001 with 25 ensemble members
Precipitation
Hindcast period 1981-2014 with start in December average over months 2 to 4
Black dots for values significantly different from zero with 95% confidence (1000 samples)







(a) Era-Interim: K_{TV} in DJF

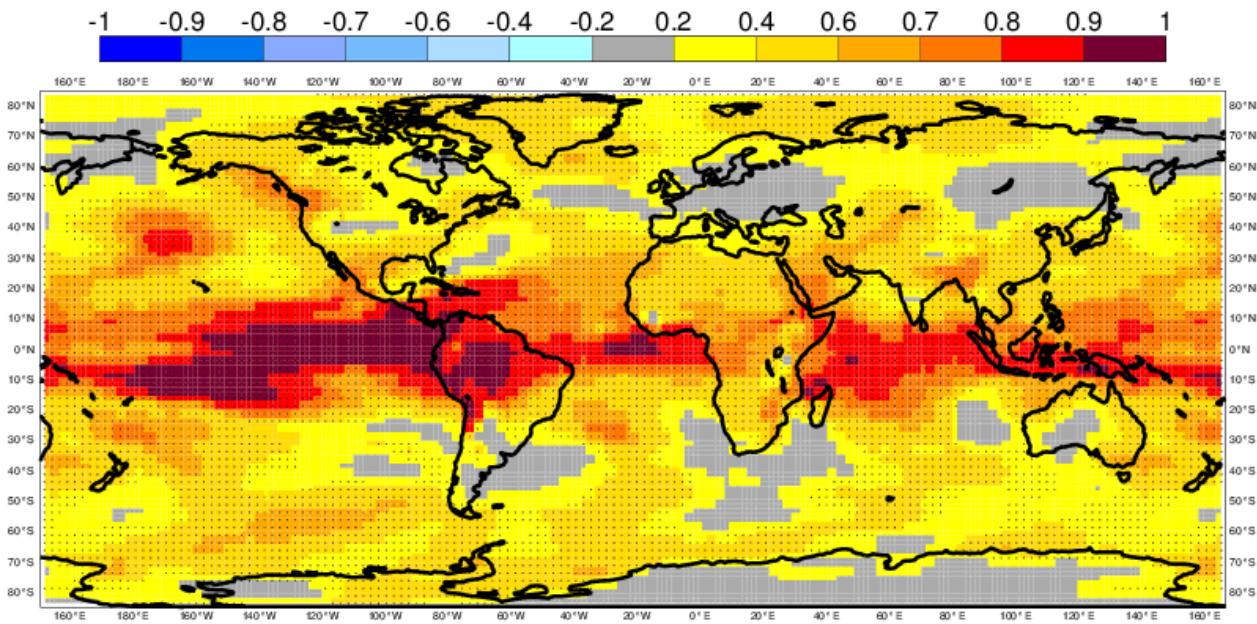


Anomaly Correlation Coefficient for 0001 with 25 ensemble members

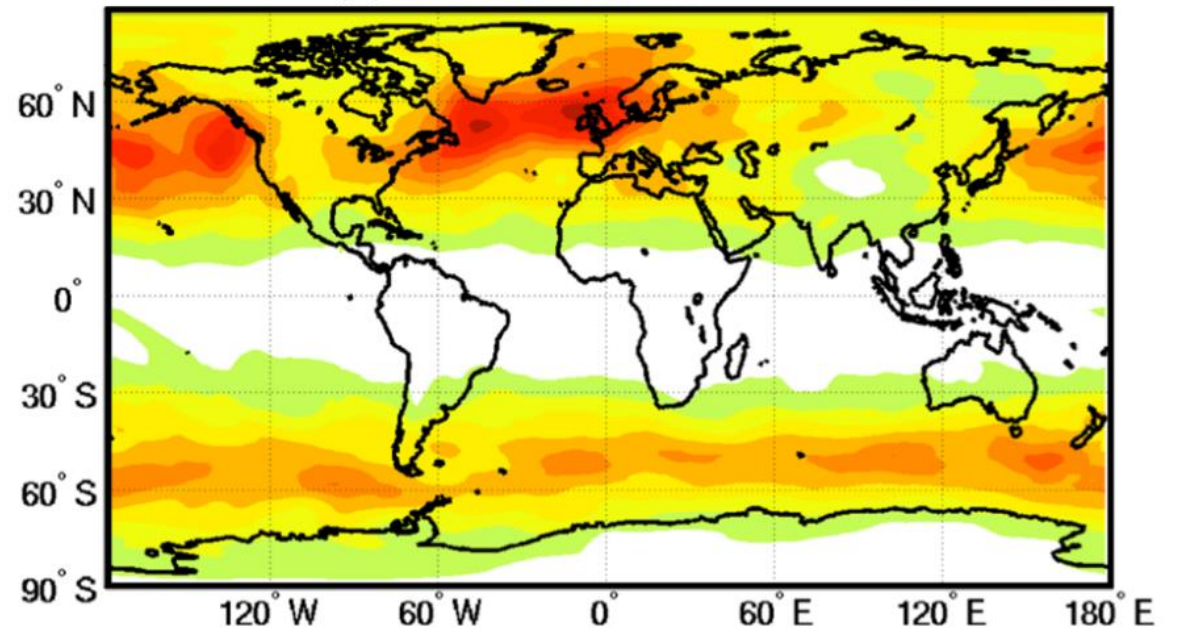
850 hPa temperature

Hindcast period 1981-2016 with start in December average over months 2 to 4

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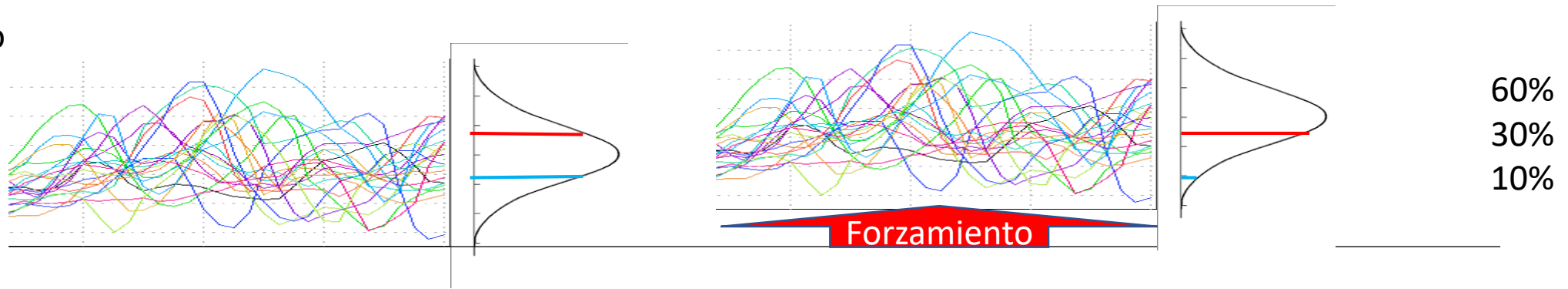
(a) Era-Interim: K_{TV} in DJF



Trópico



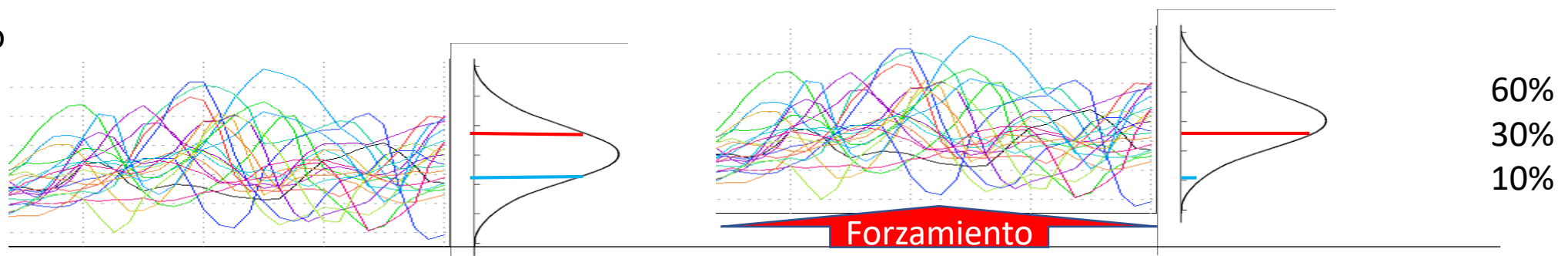
Trópico



60%
30%
10%

Forzamiento

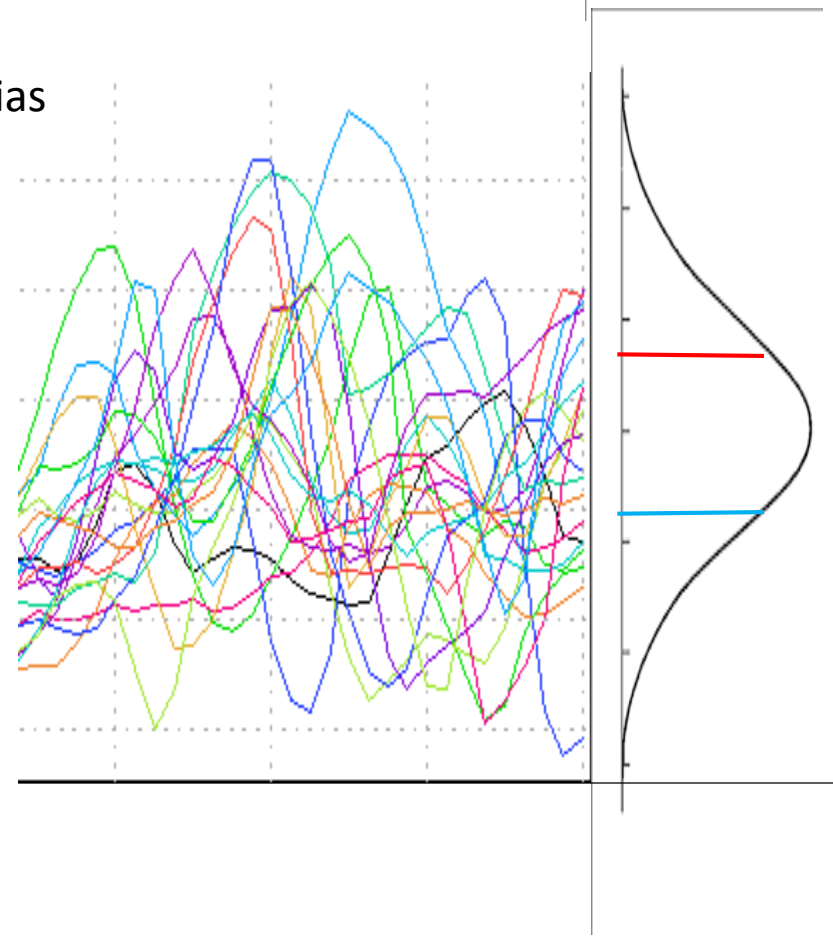
Trópico



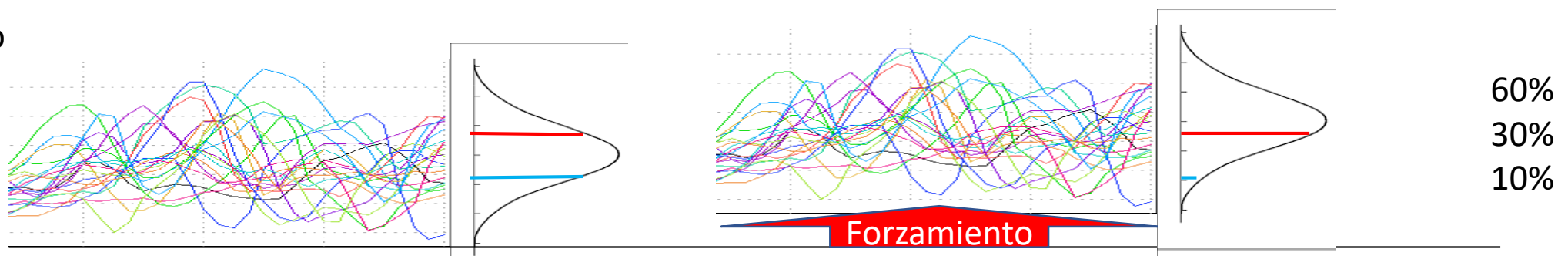
60%
30%
10%

Forzamiento

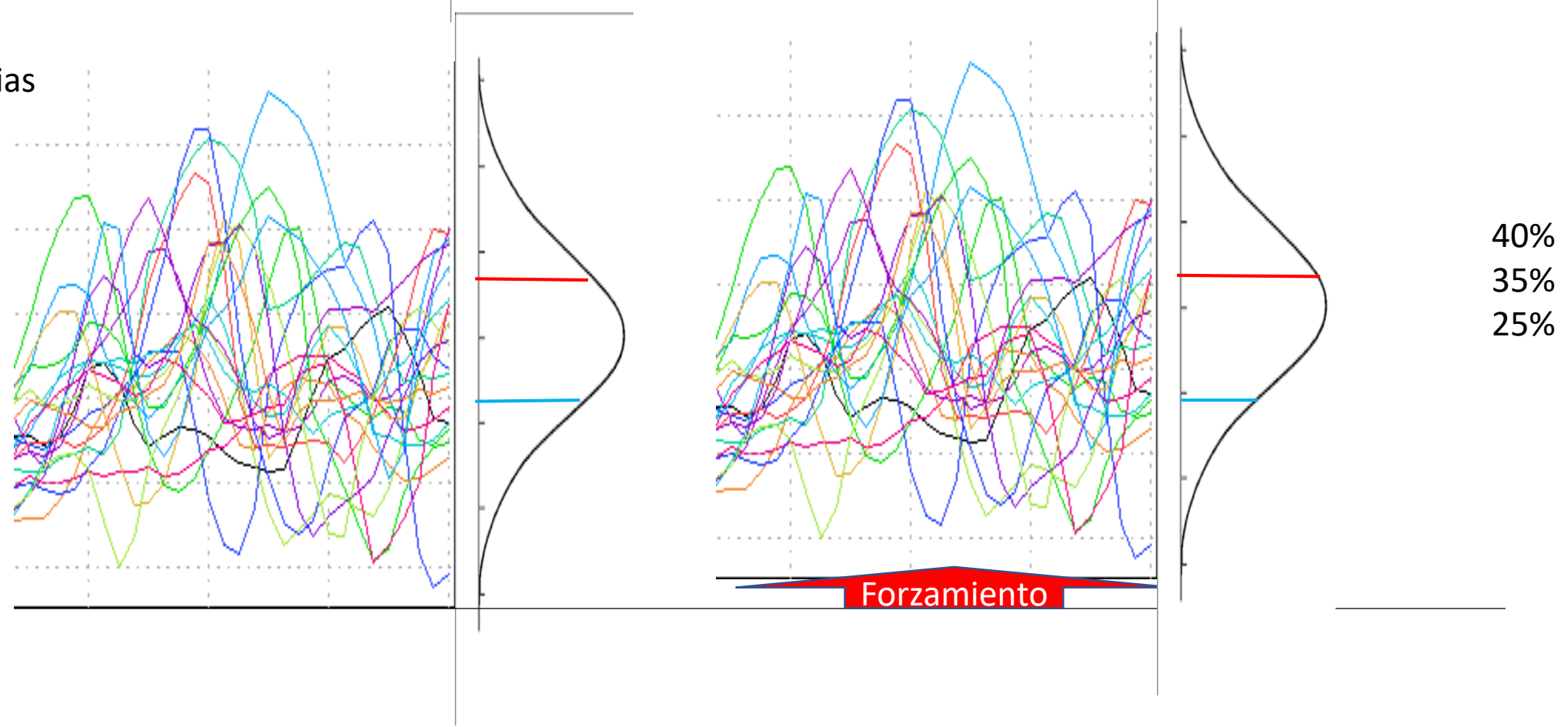
Lat. medias



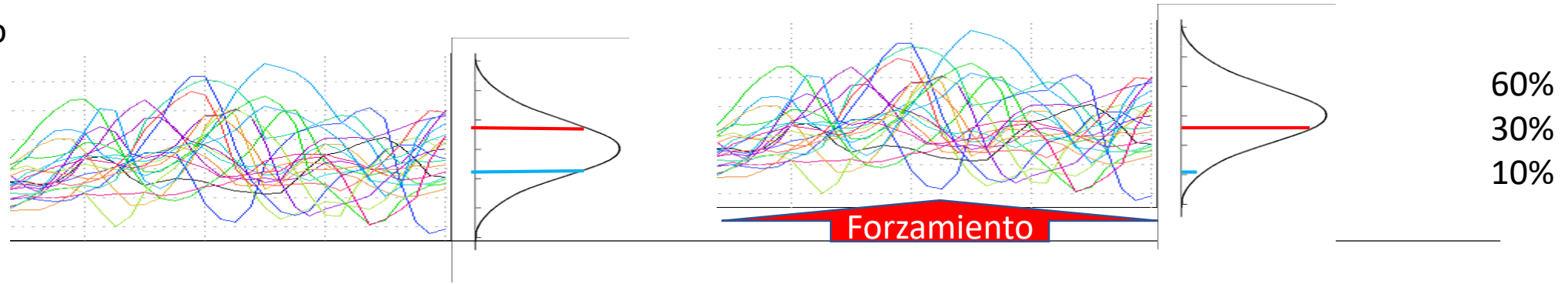
Trópico



Lat. medias

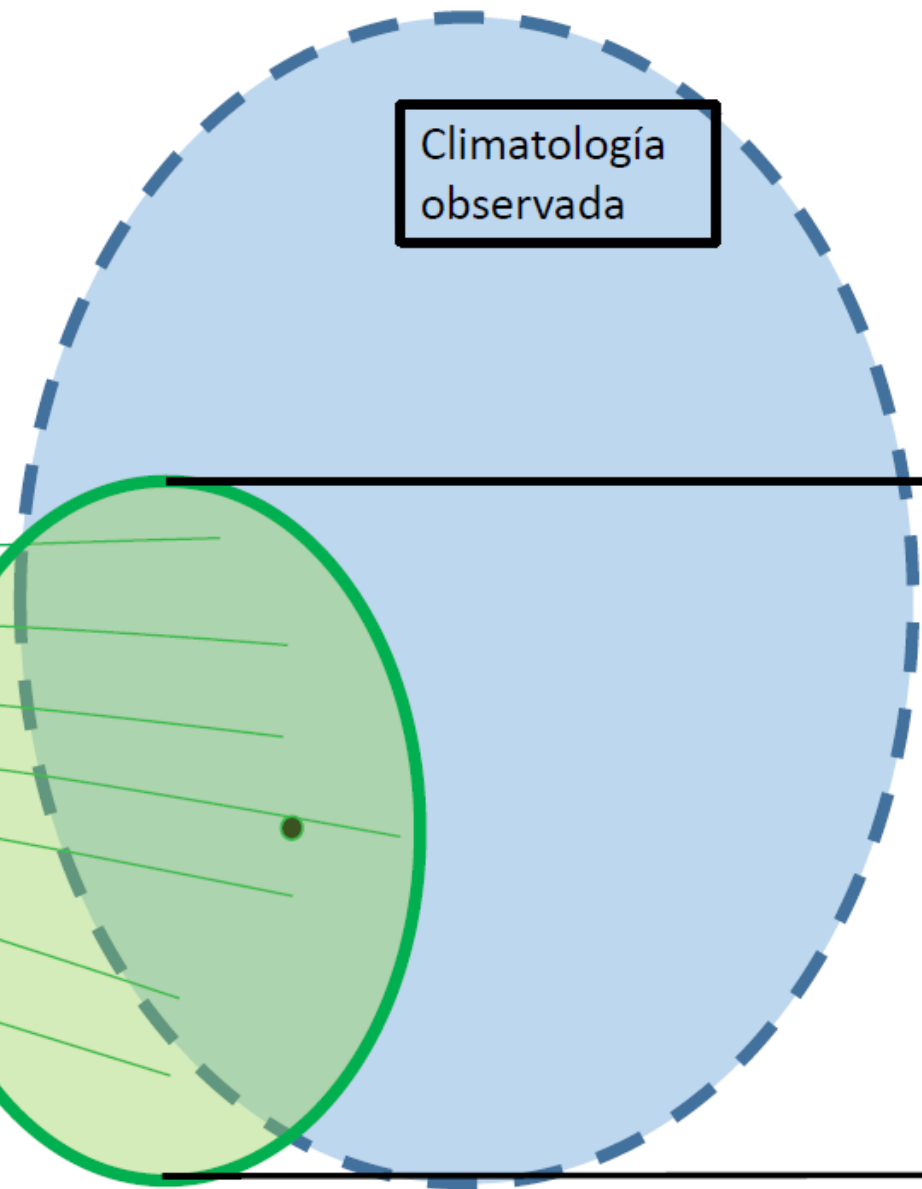
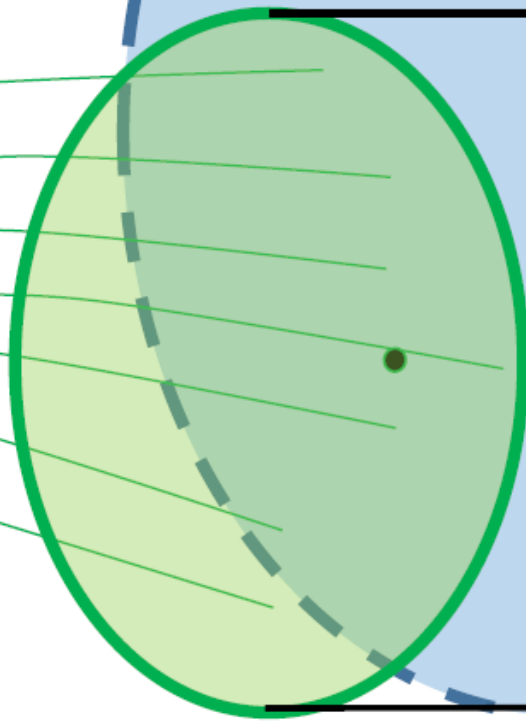
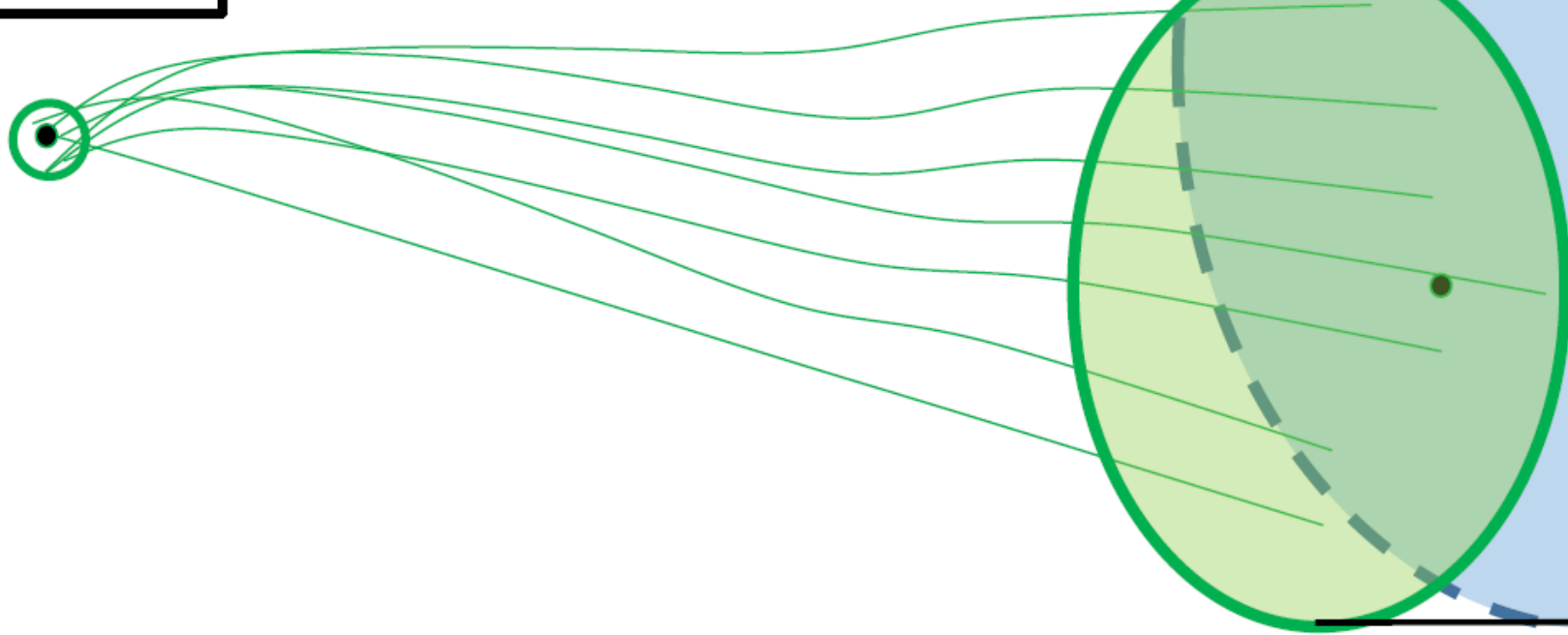


Trópico

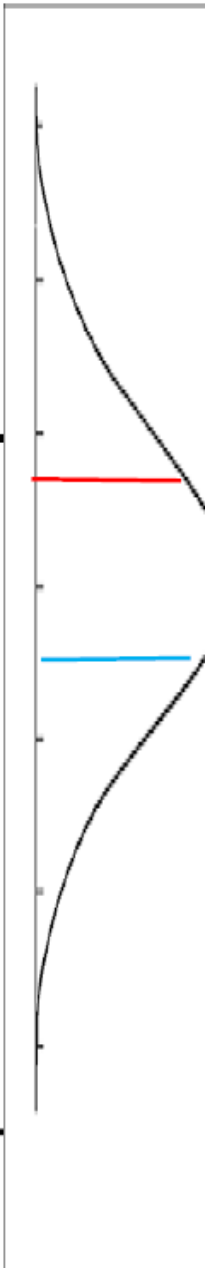


Pero cuando hablamos de comparar las ejecuciones del modelo, hay que tener en cuenta que los modelos climáticos tienen sesgos significativos

Incertidumbre
CIs



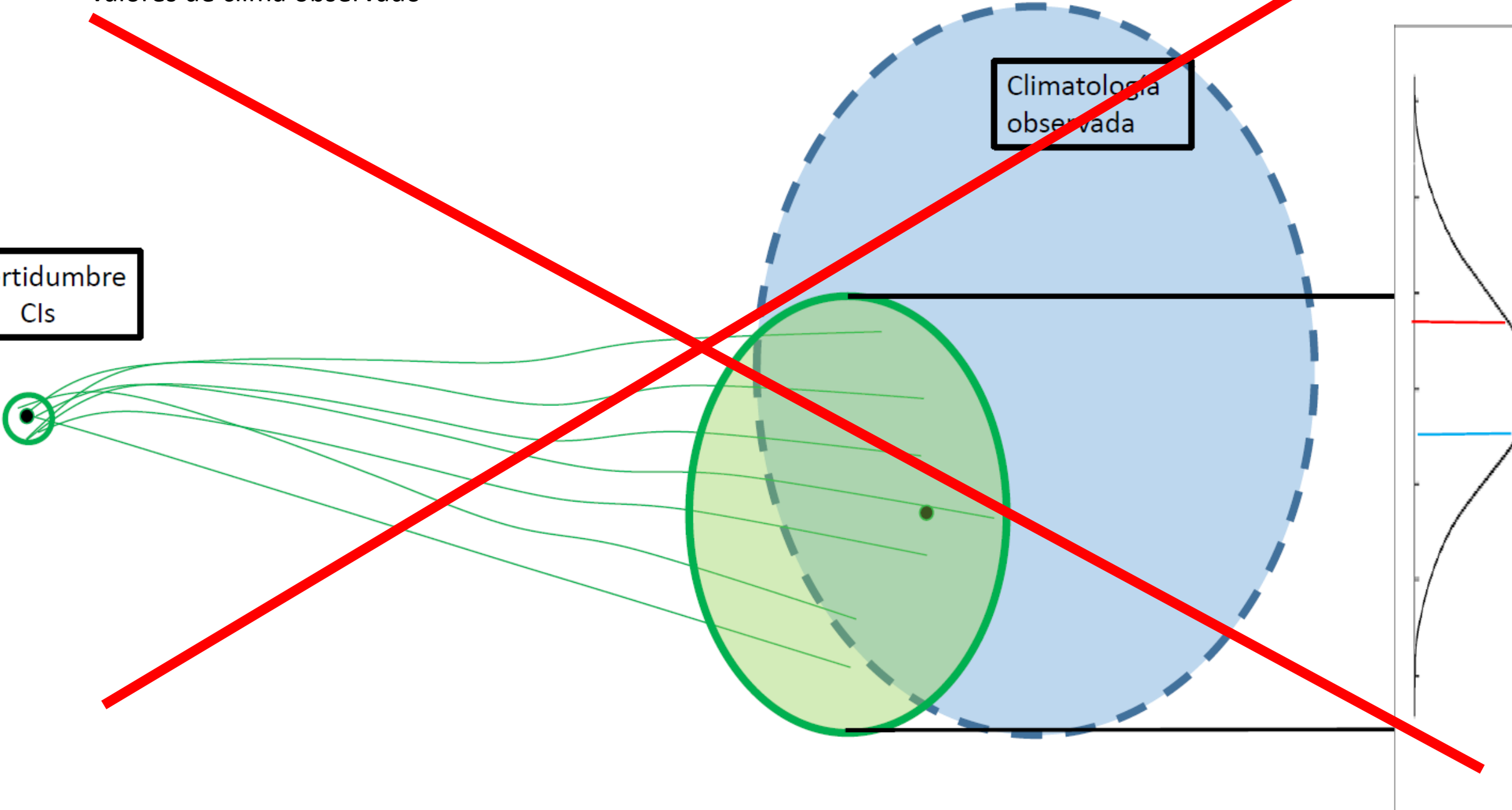
Climatología
observada



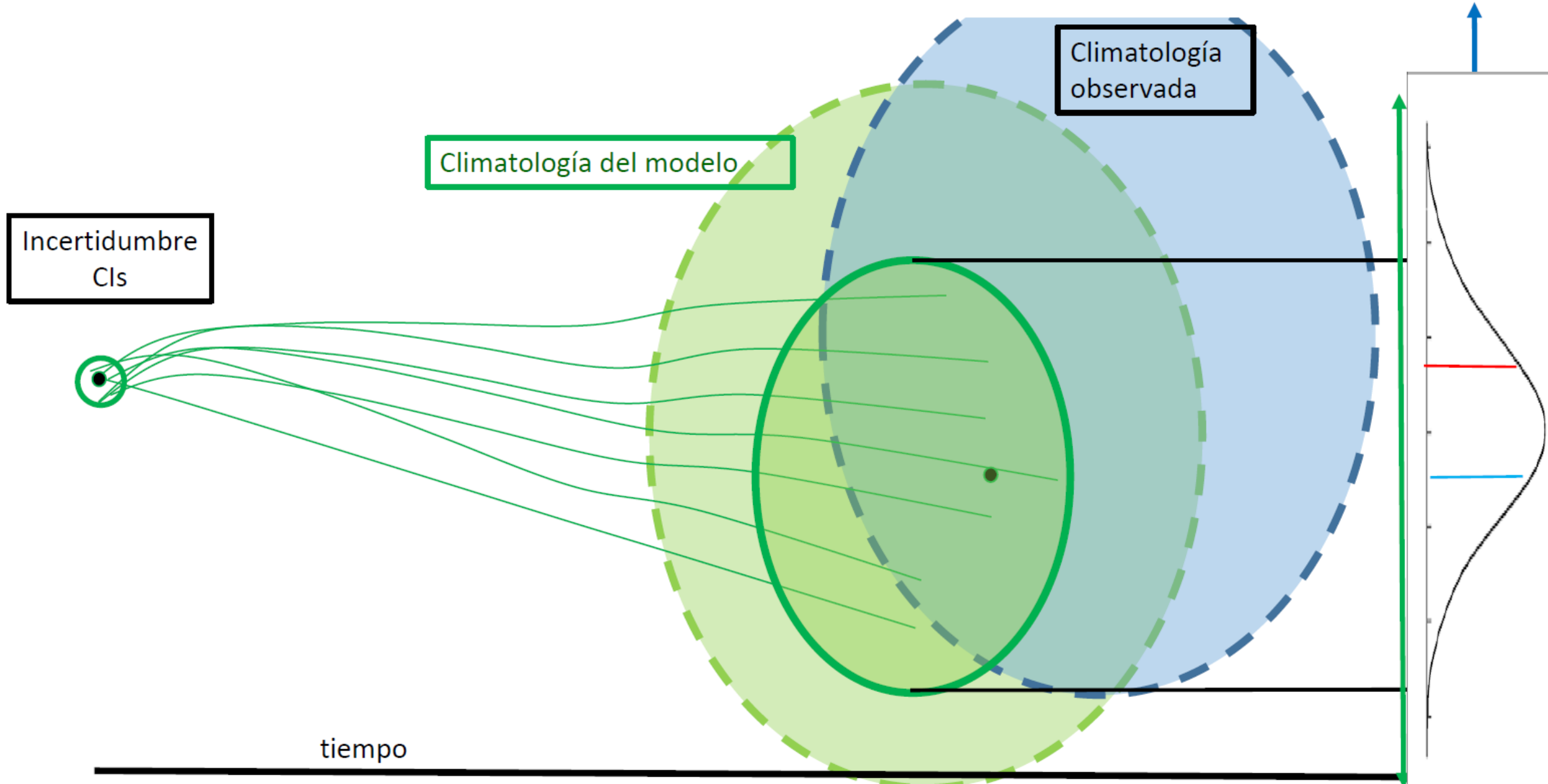
No podemos comparar directamente la salida de las predicciones de un modelo de predicción estacional con los valores de clima observado

Incertidumbre
CIs

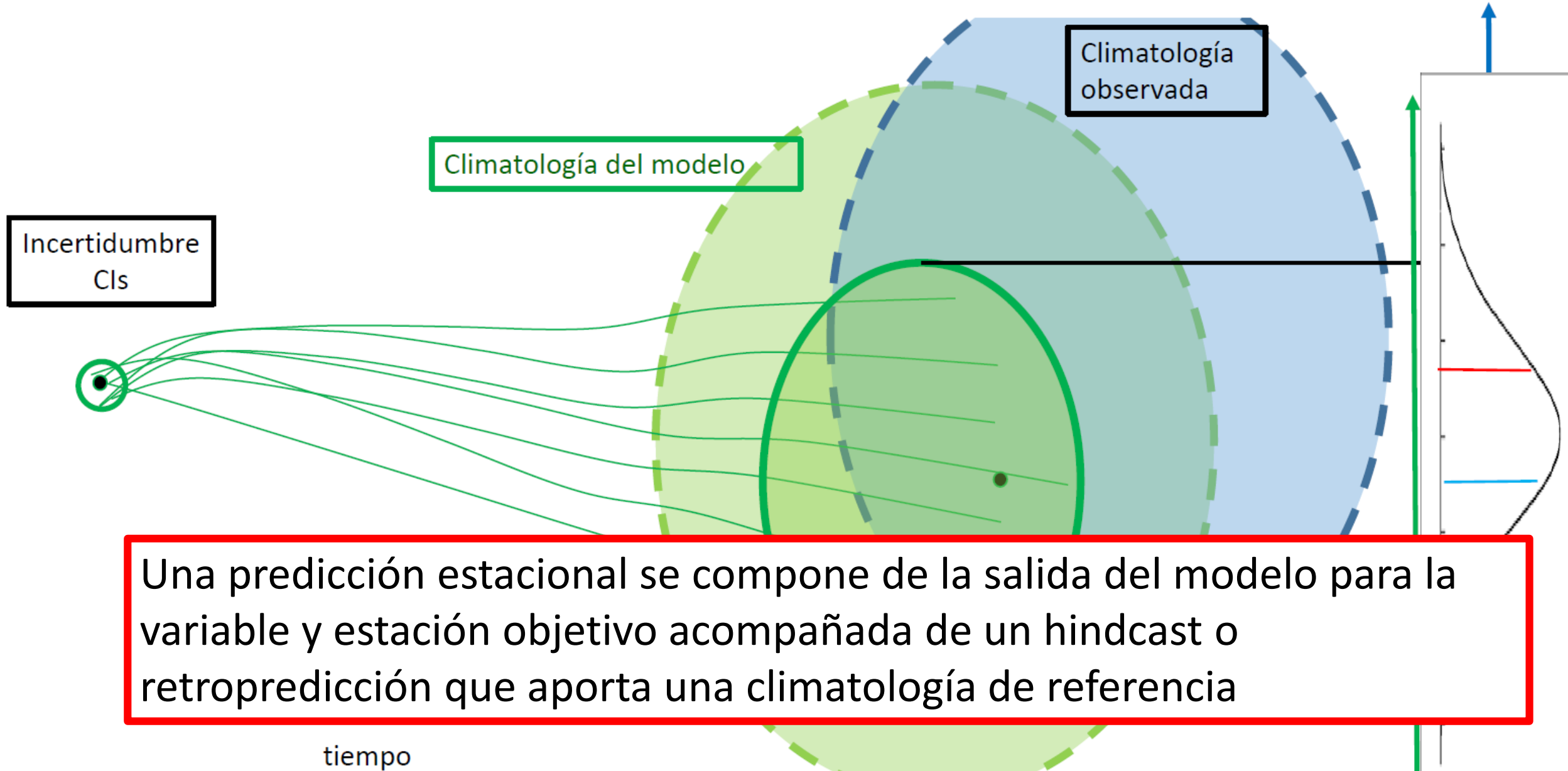
Climatología
observada



LOS MODELOS CLIMÁTICOS TIENEN SESGO: SU CLIMATOLOGÍA NO COINCIDE PERFECTAMENTE CON LA OBSERVADA



LOS MODELOS CLIMÁTICOS TIENEN SESGO: SU CLIMATOLOGÍA NO COINCIDE PERFECTAMENTE CON LA OBSERVADA

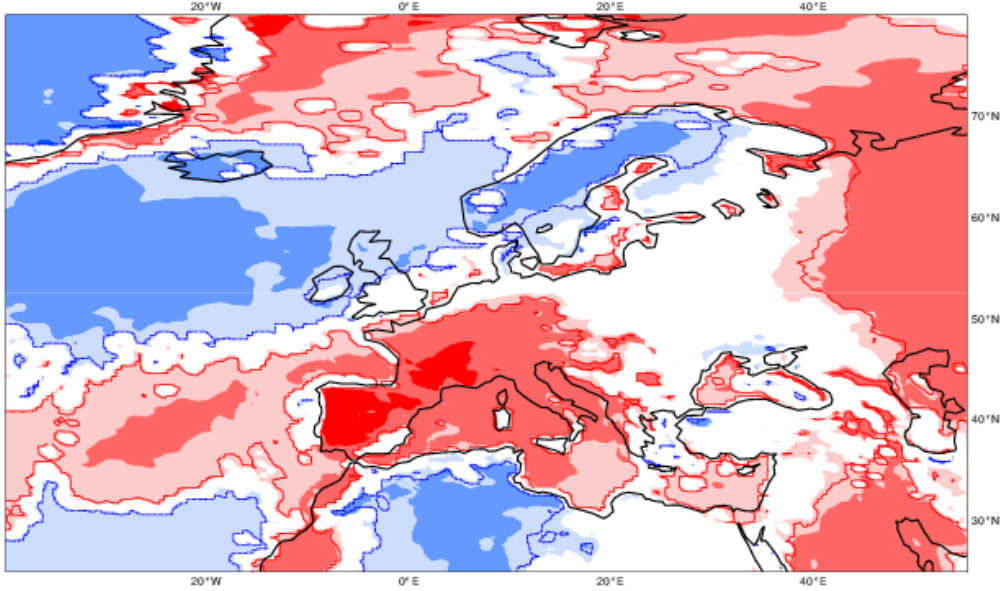


ECMWF EPS-Monthly Forecasting System
 Soil Temp. Lev. 1/SST anomaly
 Forecast start reference is 17-09-2018
 ensemble size = 51 ,climate size = 660

24-09-2018/TO/3/
 Shaded areas significant
 Contour

ECMWF Seasonal Forecast
 Prob(most likely category of 2m temperature)
 Forecast start is 01/09/18, climate period is 1993-2016
 Ensemble size = 51, climate size = 600

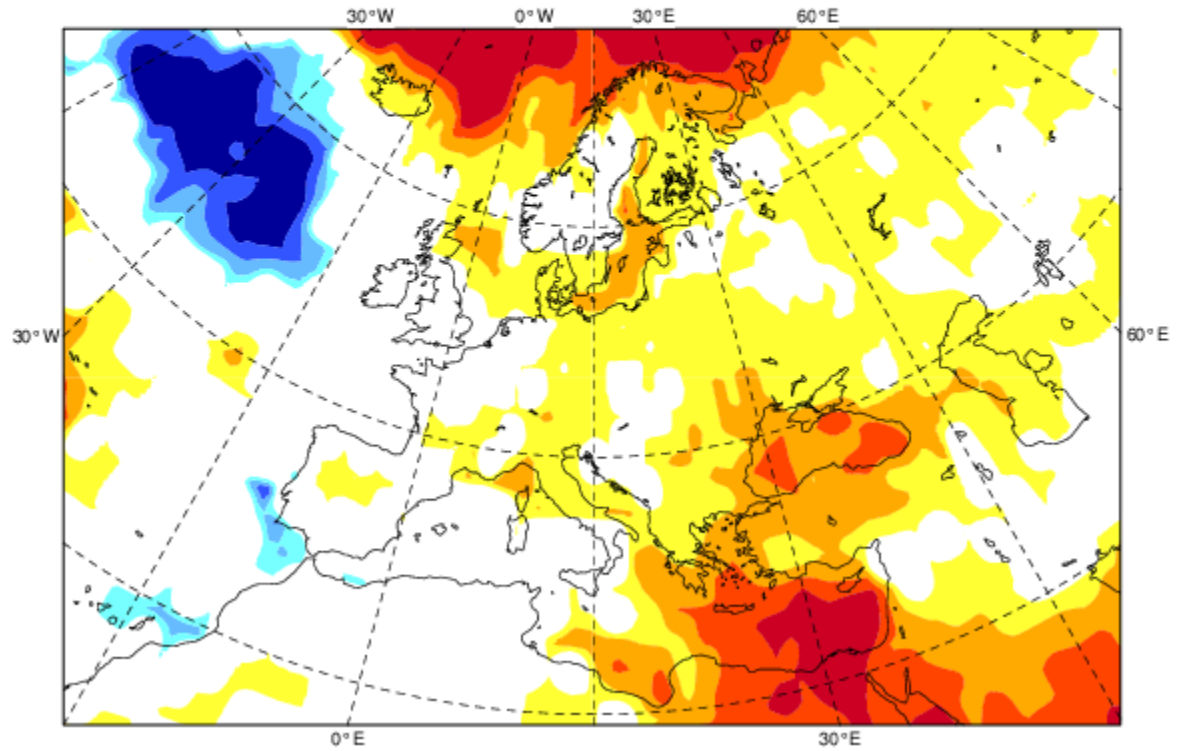
<-10deg -10.. -6 -6.. -3 -3.. -1 -1.. 0 0.. 1 1.. 3 3.. 6 6.. 10 > 10deg



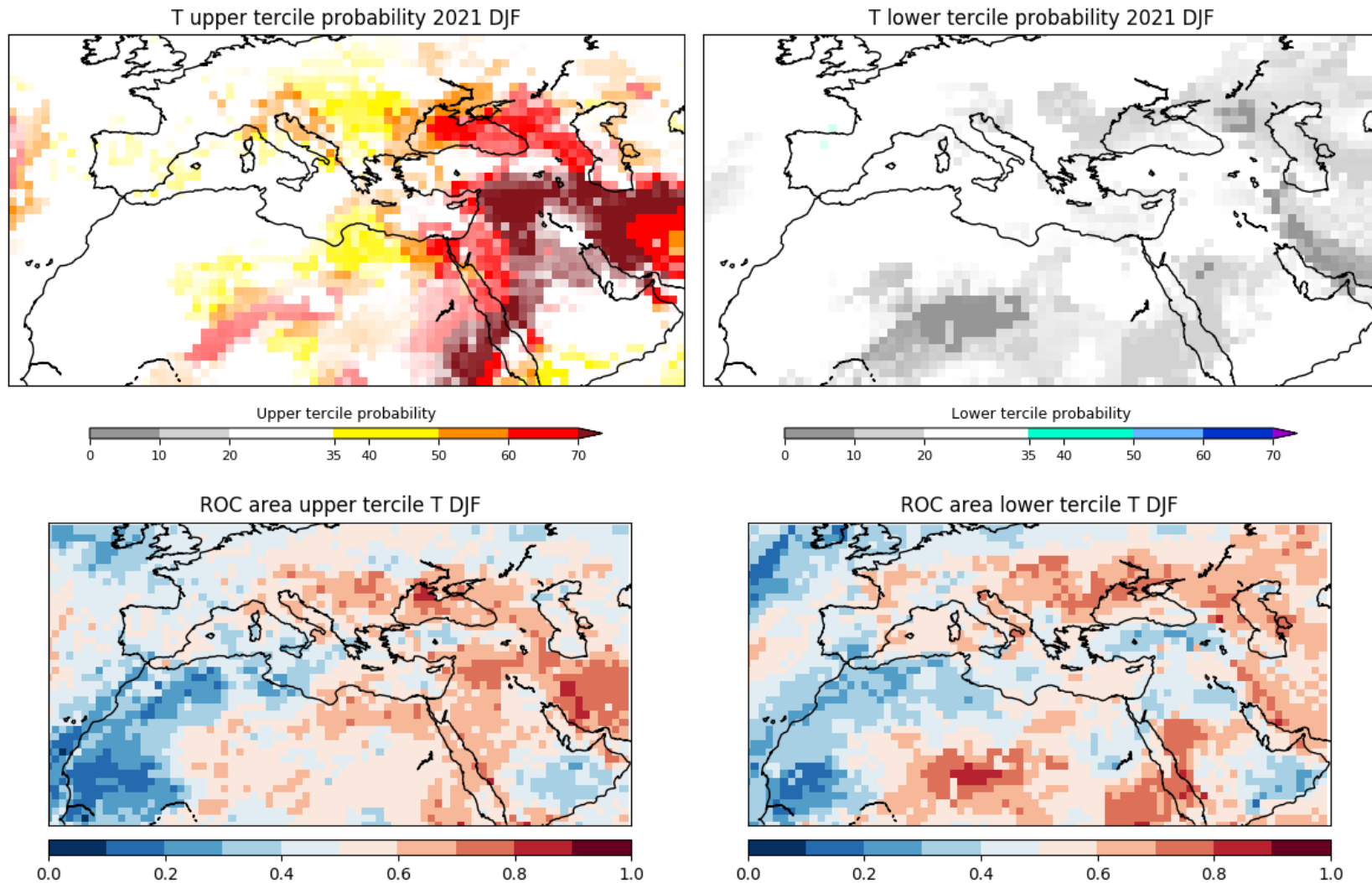
<---- Prob(below lower tercile)

Prob(above upper tercile) ---->

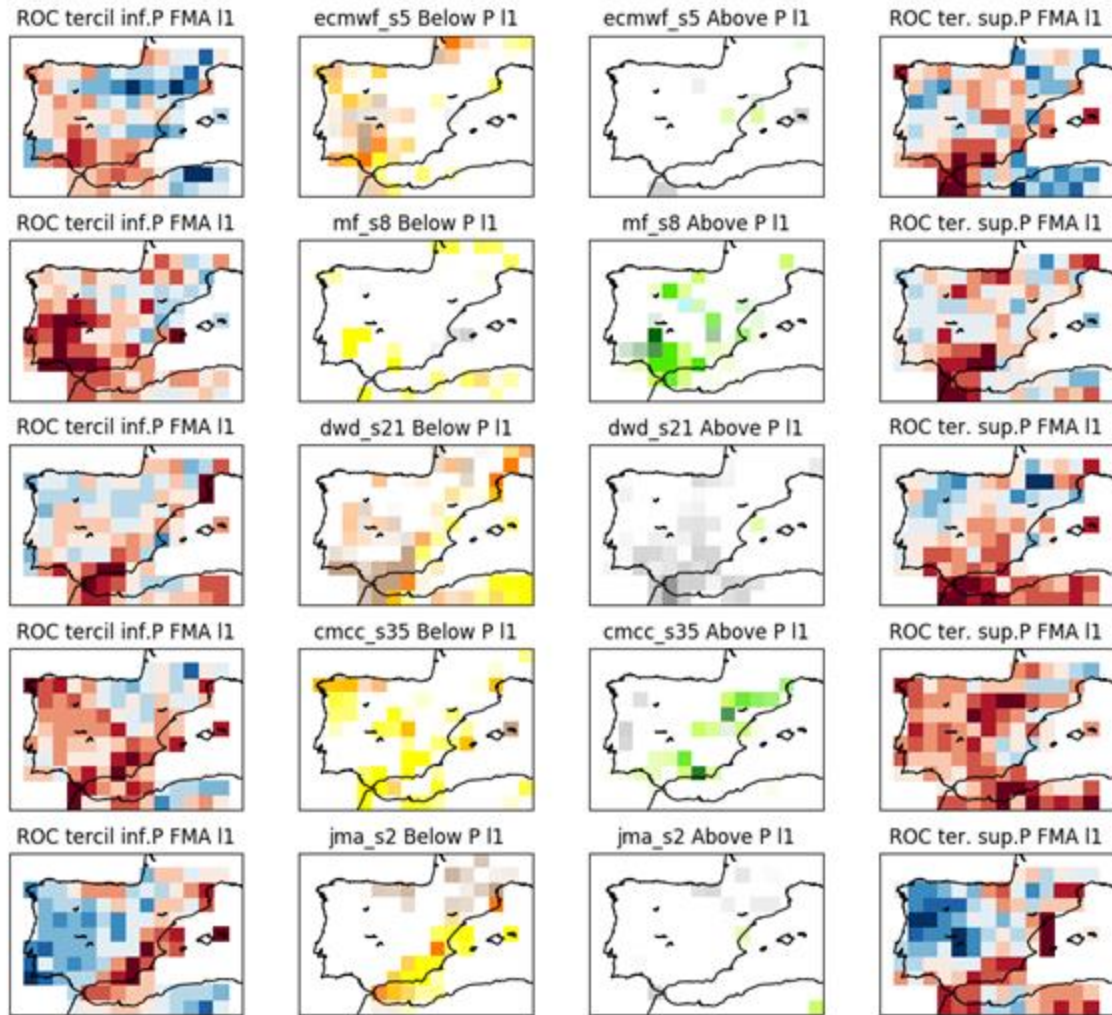
70..100% 60..70% 50..60% 40..50% other 40..50% 50..60% 60..70% 70..100%



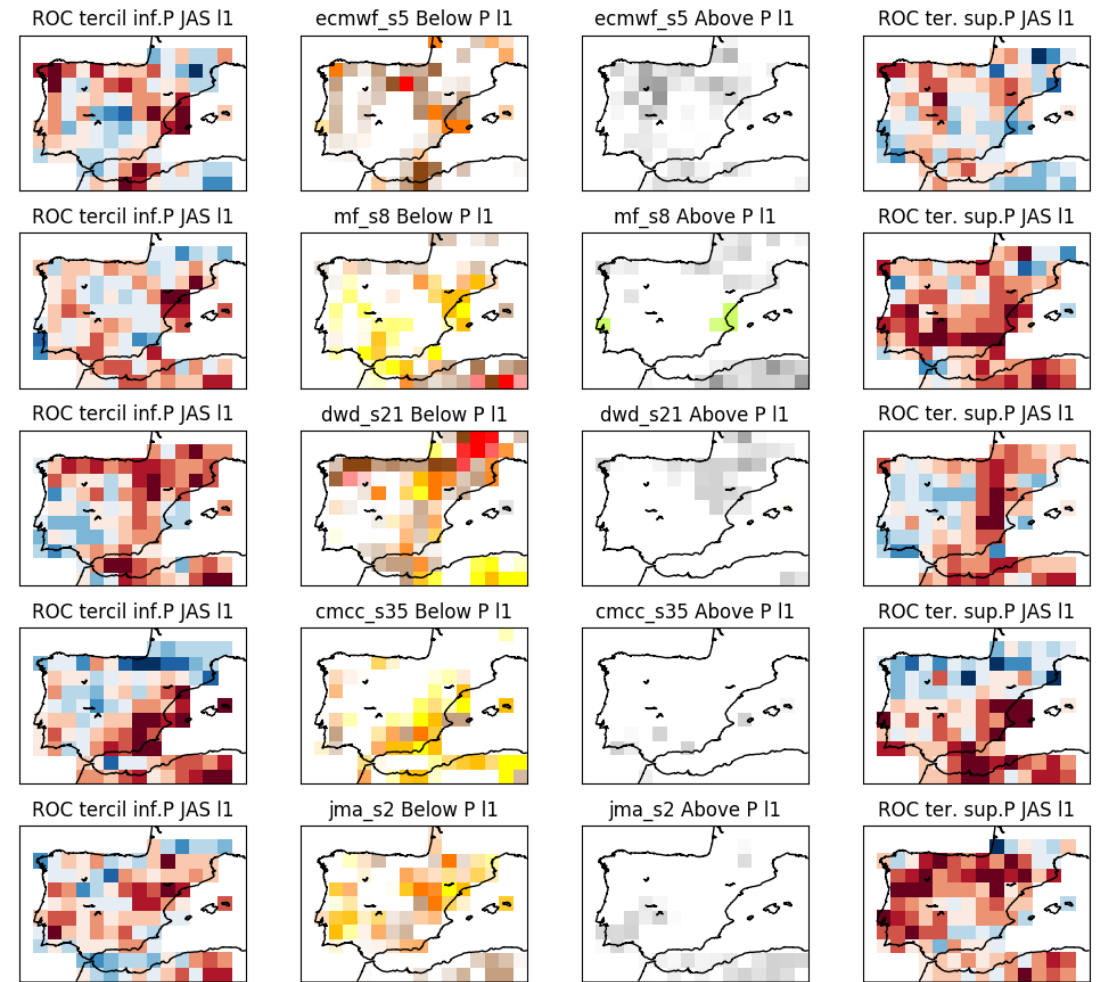
El hindcast no sólo es necesario como referencia, sino que se utiliza para evaluar el funcionamiento del modelo, y elaborar mapas de “skill”, que ayudan a interpretar la información. La WMO recomienda proporcionar dicha información junto con la de pronóstico.



La habilidad o skill de los modelos cambia según la región, estación, modelo y estado del sistema climático.



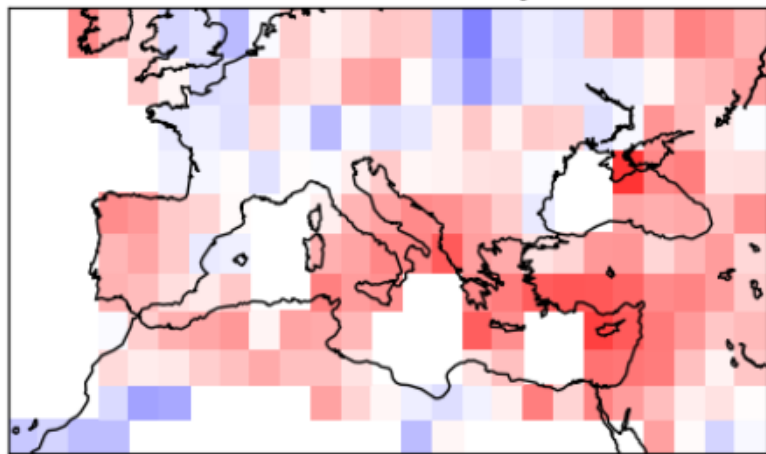
Predicción y skill Febrero-Abril



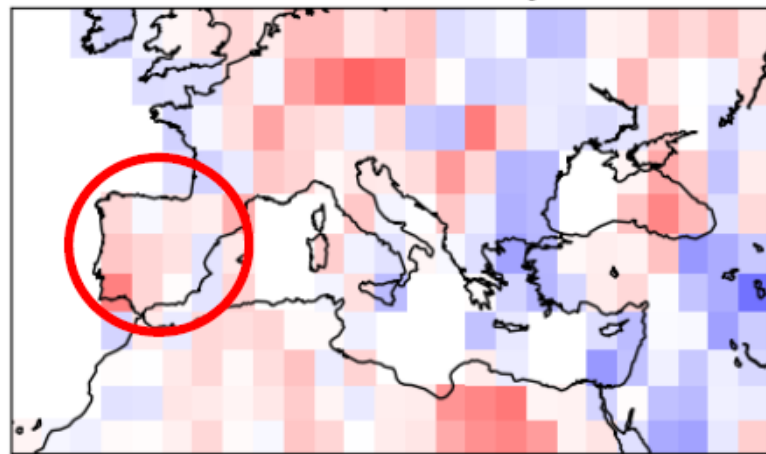
Predicción y skill Julio-Septiembre

Verificación precipitación invierno (JFM). Azul= áreas con skill

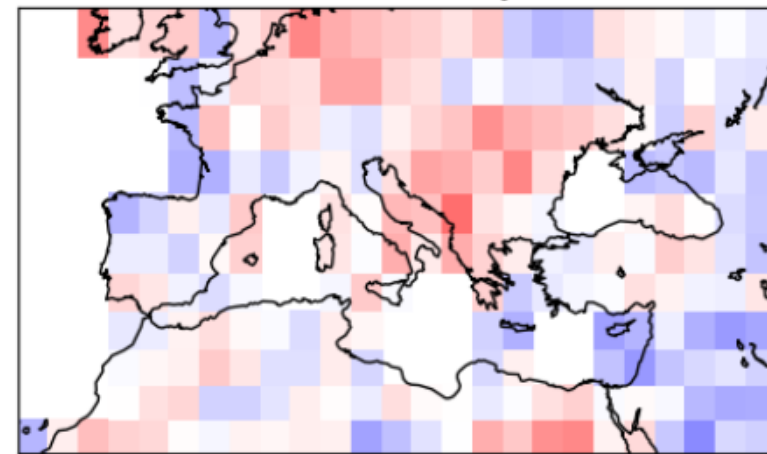
RPSS P AEMET-S2 DJF



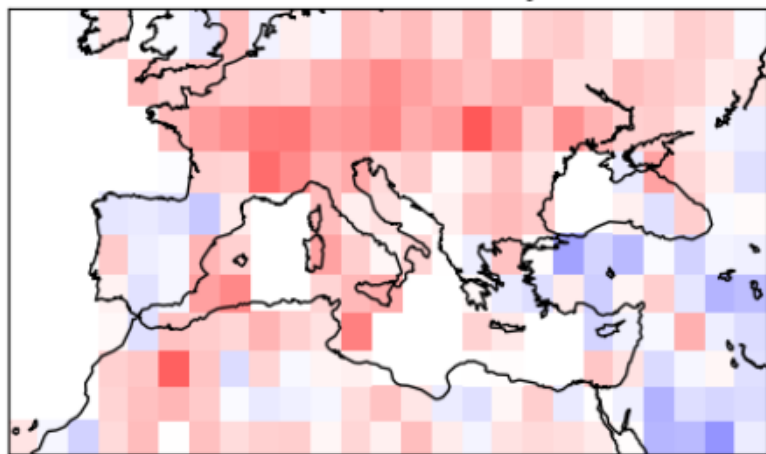
RPSS P UKMO-S13 DJF



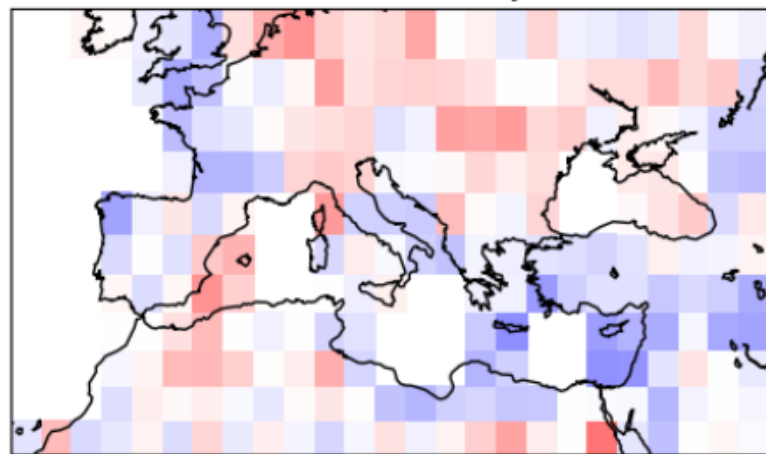
RPSS P MF-S6 DJF



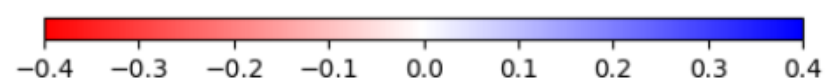
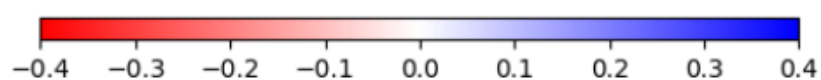
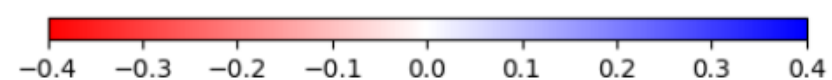
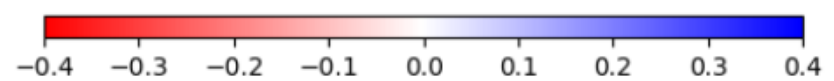
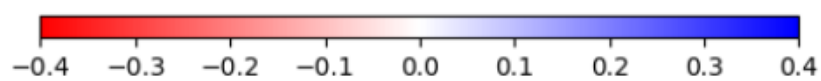
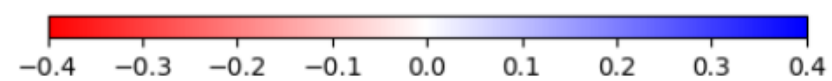
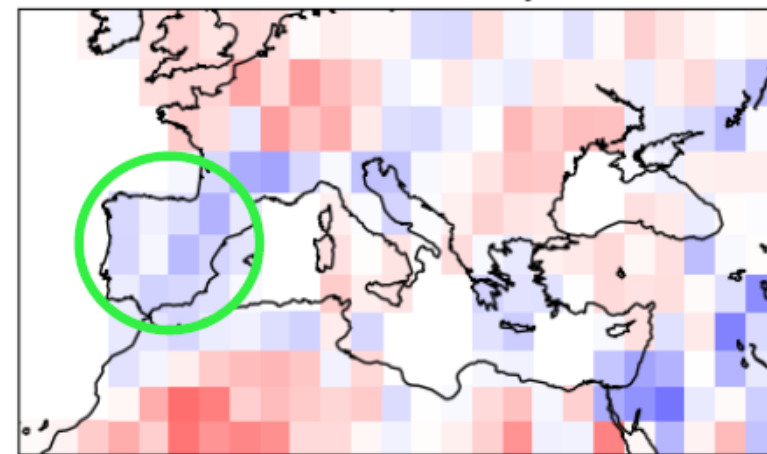
RPSS P ECMWF-S5 DJF



RPSS P DWD-S2 DJF

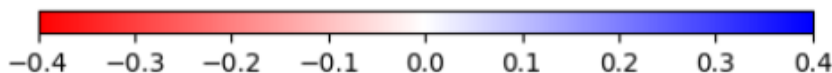
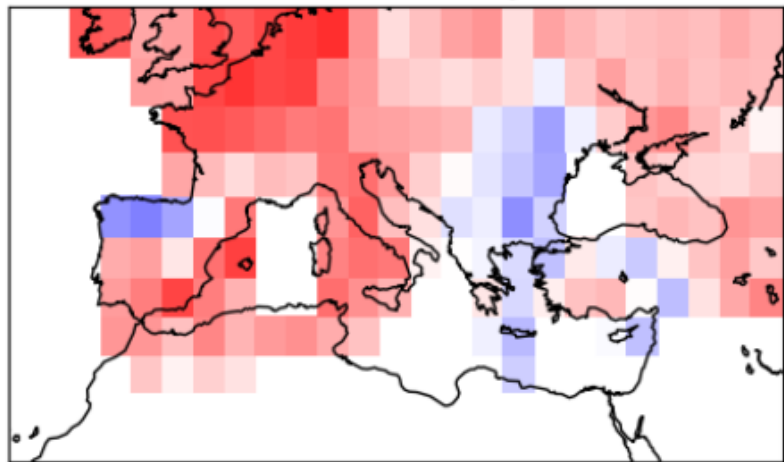


RPSS P CMCC-S3 DJF

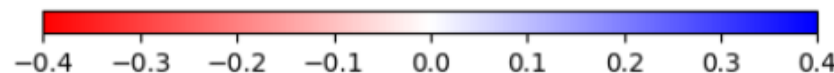
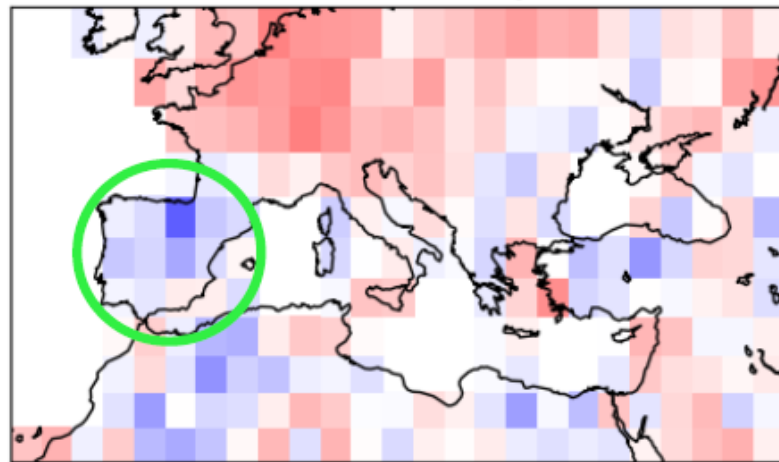


Verificación precipitación verano (JAS). Azul= áreas con skill

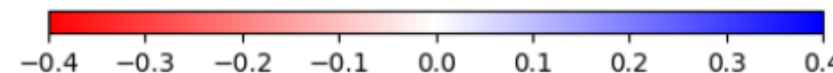
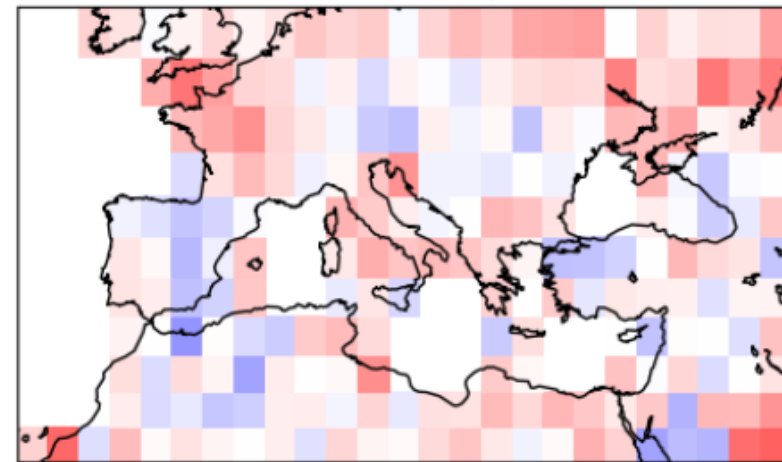
RPSS P AEMET-S2 JAS



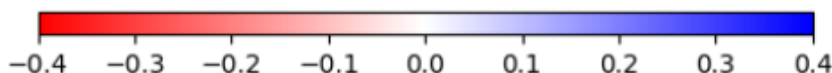
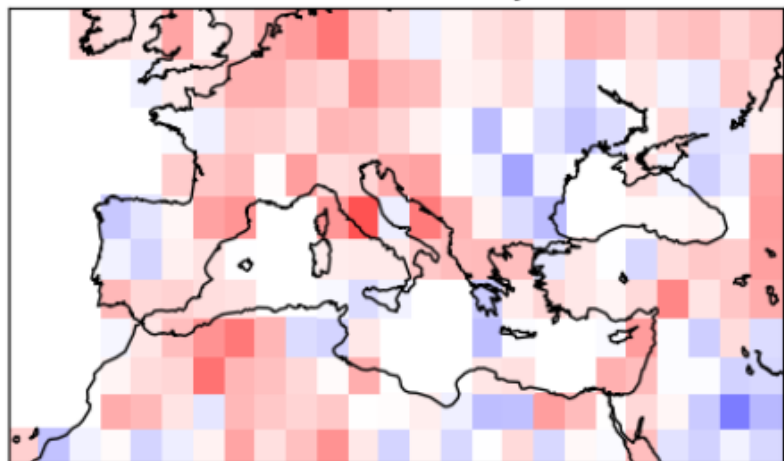
RPSS P UKMO-S13 JAS



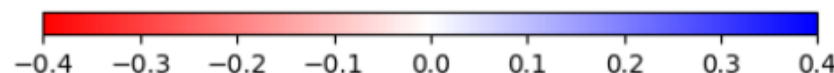
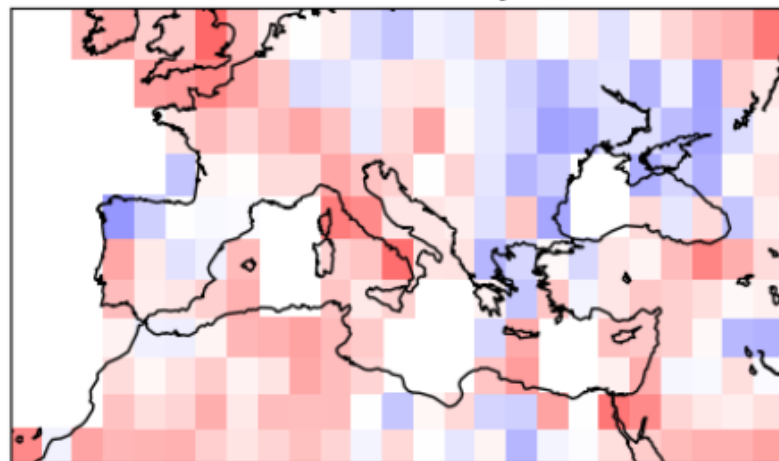
RPSS P MF-S6 JAS



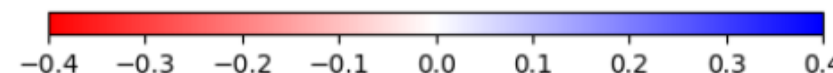
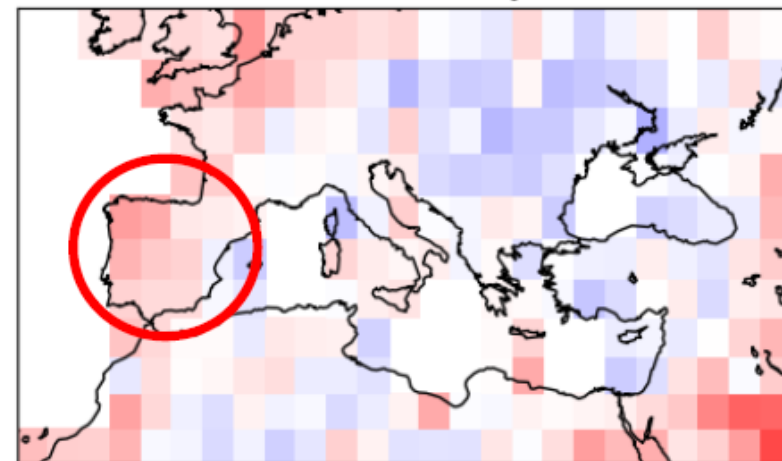
RPSS P ECMWF-S5 JAS



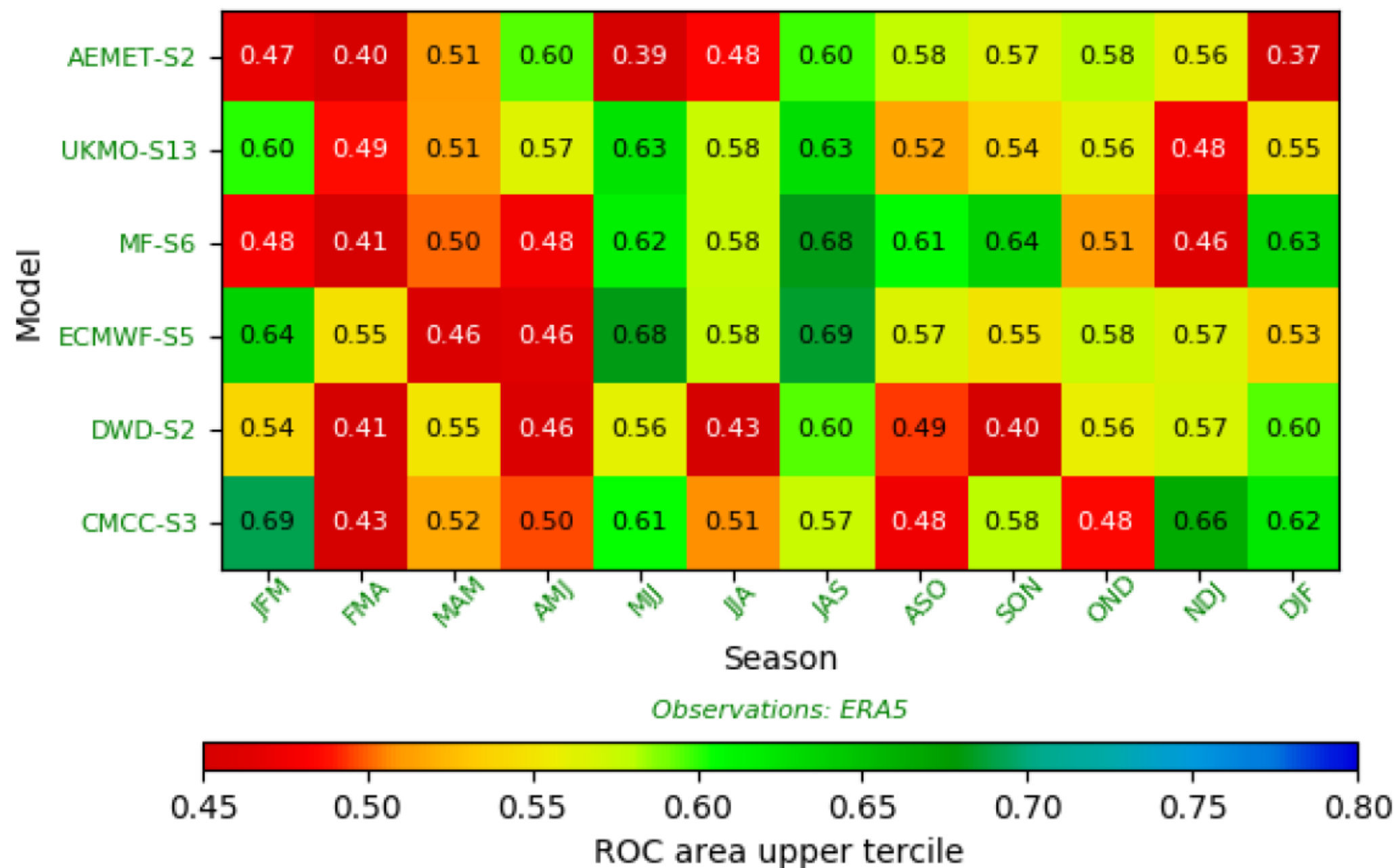
RPSS P DWD-S2 JAS



RPSS P CMCC-S3 JAS



ROC area (upper tercile) for IBERIA 2m_temperature



¿Cómo abordar el problema?

¿Cómo abordar el problema?

**Centros Productores
Globales para Predicción a
Largo Plazo (GPC-LRF):**
Generación de ensembles
de predicción mensuales,
hasta 6 meses - 1 año

Predicción estacional: centros productores



Links to 13 designated GPCs: **Target audience: NMHSs, RCCs and RCOFs**



Latest Forecast data



Notice & News

More > Links

Check! System Requirements

NOTICE WMO Global Seasonal Climate Update (GSCU) for JJA 2022

- GPCs(13) for JJA 2022 are uploaded
- GPCs(13) for MJJ 2022 are uploaded
- GPCs(13) for AMJ 2022 are uploaded
- GPCs(13) for MAM 2022 are uploaded

- 2022-05-26
- 2022-05-18
- 2022-04-25
- 2022-03-25
- 2022-03-02



PMME



DMME



ENSO

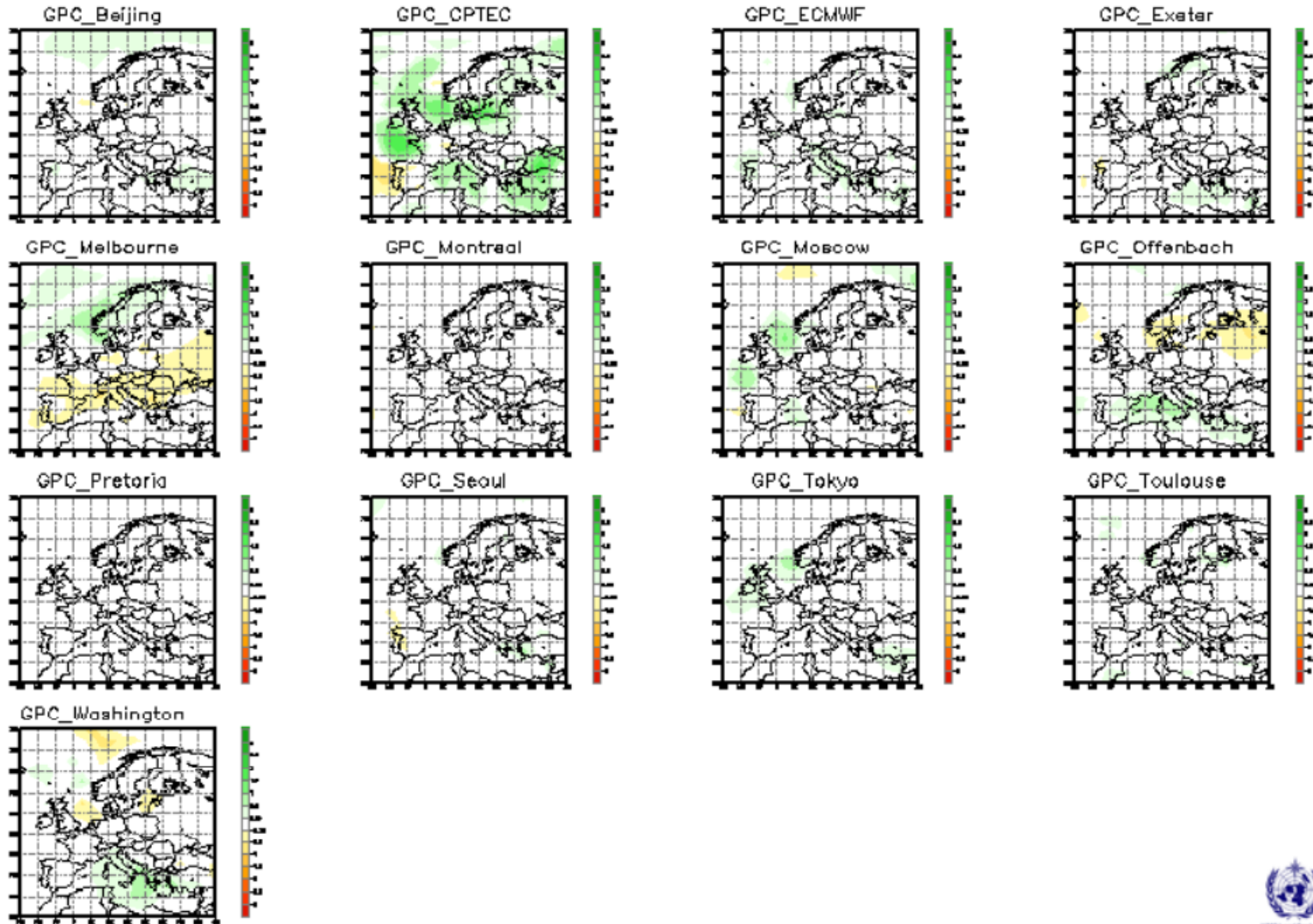
today : 2412
total : 2382303



lat=30 75
lon=345 400

Precipitation : SON2018

(issued on Aug2018) [Unit: mm/day]

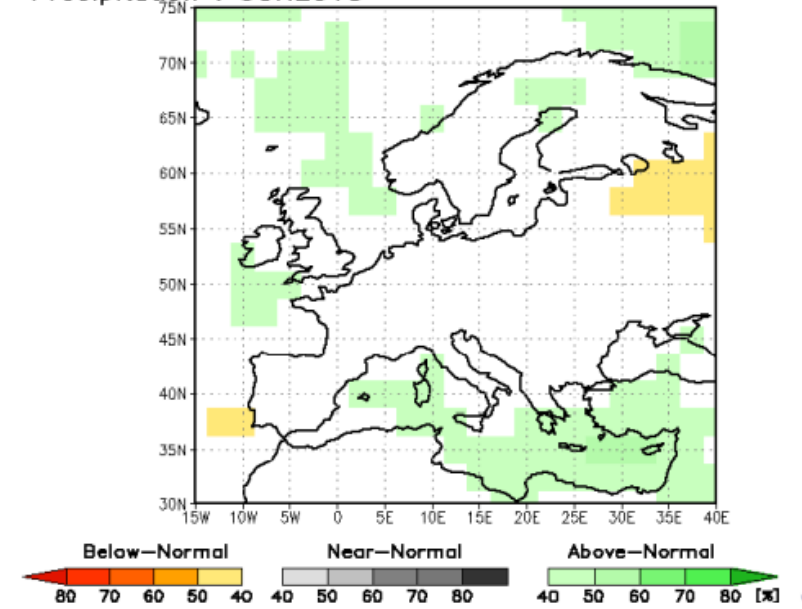


Probabilistic Multi-Model Ensemble Forecast

/GPC_seoul/GPC_washington/GPC_tokyo/GPC_exeter/GPC_moscow/GPC_beijing
/GPC_melbourne/GPC_cpctec/GPC_pretoria/GPC_montreal/GPC_ecmwf/GPC_offenbach

Precipitation : SON2018

(issued on Aug2018)





C3S seasonal predictions – graphical products

Publication schedule:

- monthly updates
- on the 13th of each month

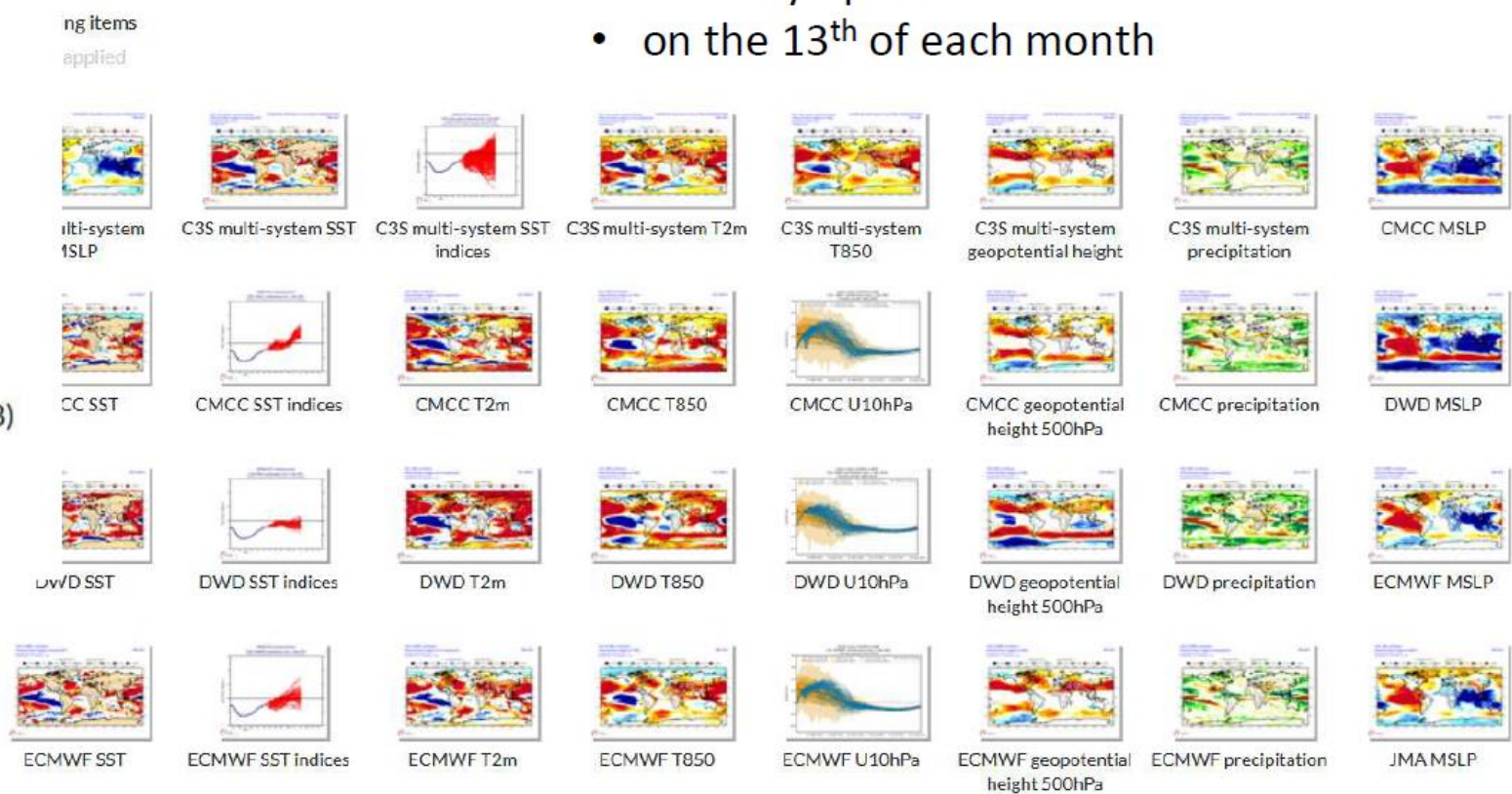
Parameters

- MSLP (8)
- SST (16)
- T2m (8)
- T850 (8)
- geopotential height 500hPa (8)
- precipitation (8)
- zonal wind 10hPa (6)

Plot type

- Maps (48)
- Time series (14)

Centres



C3S:

- Actualmente 8 modelos
- Repredicciones para el período 1993-2016
- Ejecución mensual
- Alcance de 6 meses
- Datos diarios y agregaciones 3 meses disponibles en el CDS

Seasonal products

Module:

Series

each month

SST (16)

T2m (8)

T850 (8)

geopotential height 500hPa (8)

precipitation (8)

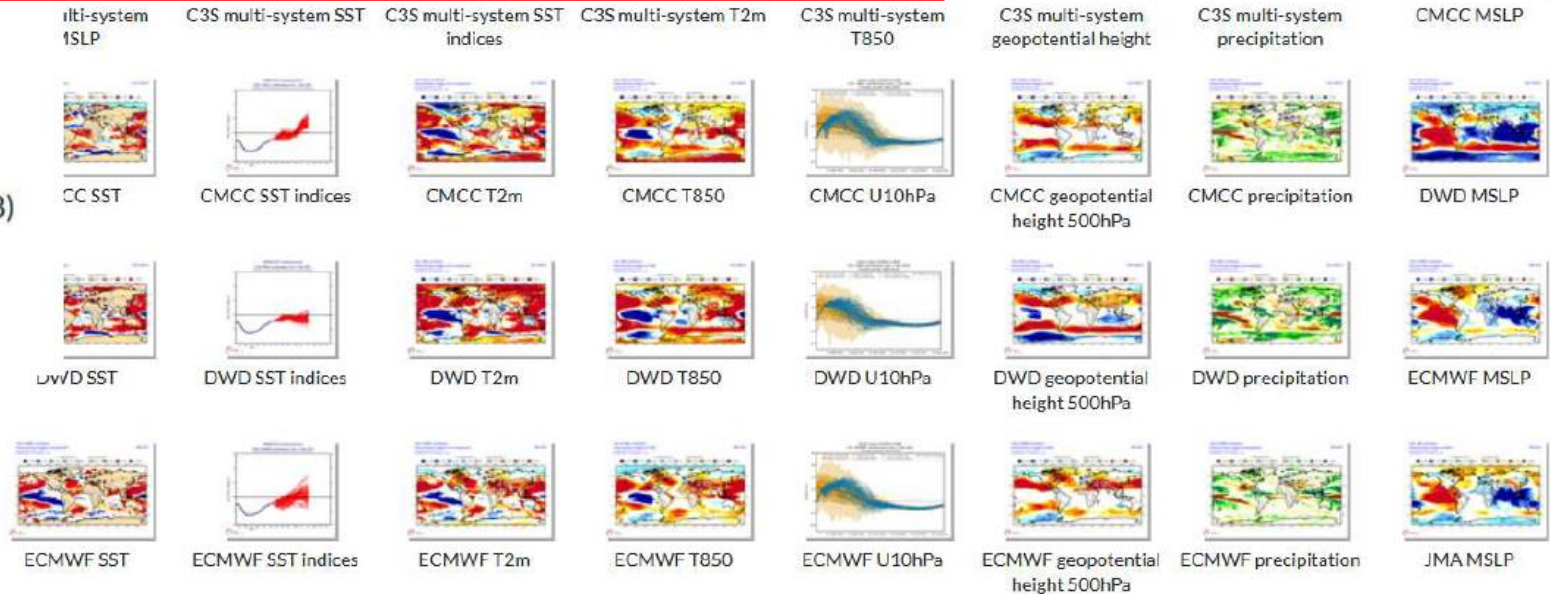
zonal wind 10hPa (6)

Plot type

Maps (48)

Time series (14)

Centres



PROGRAMME OF
THE EUROPEAN UNION

Europe's eyes on Earth

IMPLEMENTED BY
ECMWF

http://climate.copernicus.eu/charts/c3s_seasonal/

¿Cómo abordar el problema?

Centros Productores Globales para Predicción a Largo Plazo (GPC-LRF):

Generación de ensembles
de predicción mensuales,
hasta 6 meses - 1 año

Centros Regionales de Clima(RCC):

Interpretación de salidas de
modelos, postprocesos,
elaboración de boletines y
predicciones.



Legend

- designated RCC
- RCC in demonstration phase
- RCC proposed
- ▲ designated RCC-Network
- ▲ RCC-Network in demonstration phase
- ▲ RCC-Network proposed

¿Cómo abordar el problema?

Global Producing Centers – Long Range Forecast (GPC-LRF):

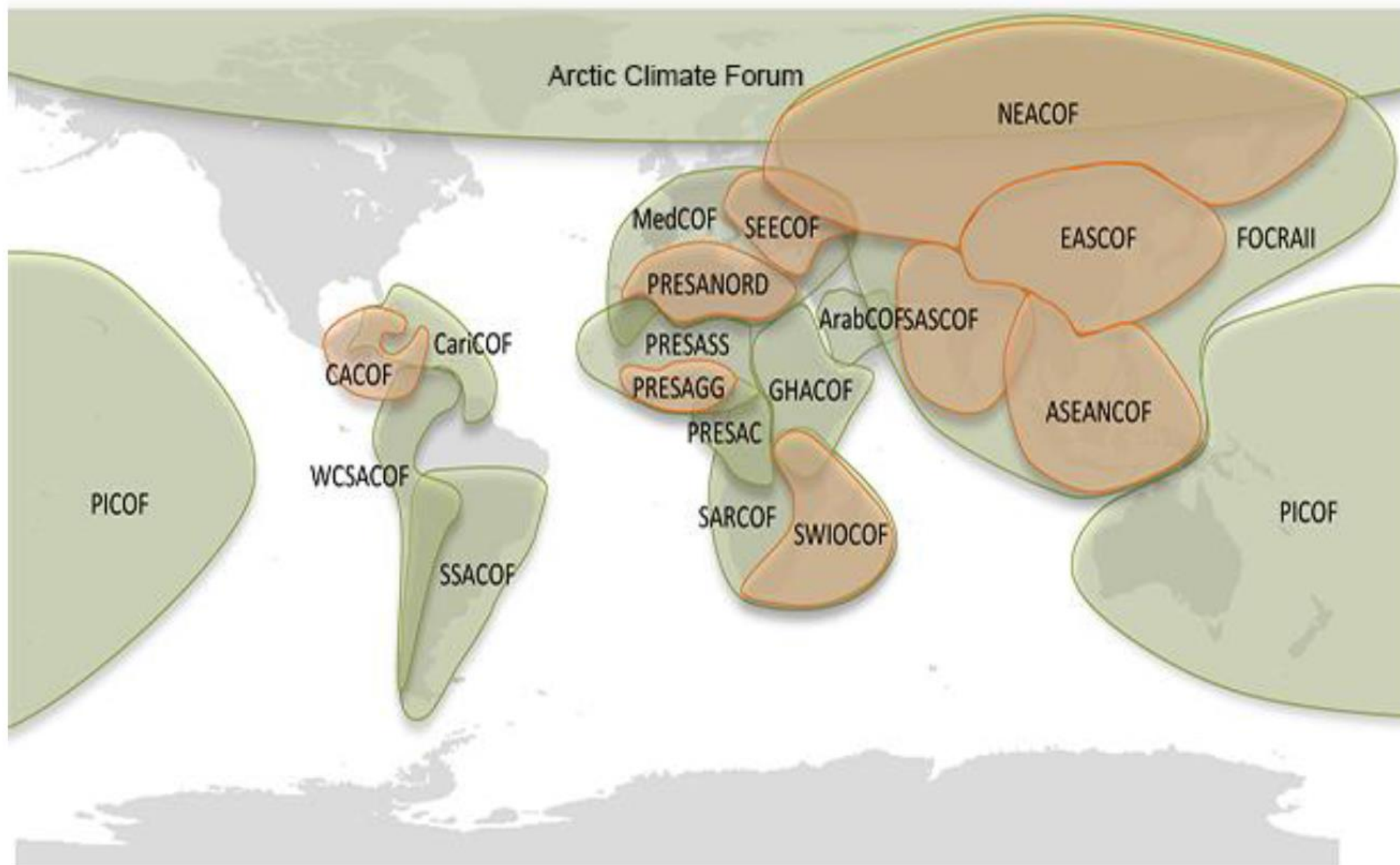
Generación de ensembles de predicción mensuales, hasta 6 meses - 1 año

Regional Climate Centers (RCCs):

Interpretación de salidas de modelos, postprocesos, elaboración de boletines y predicciones.

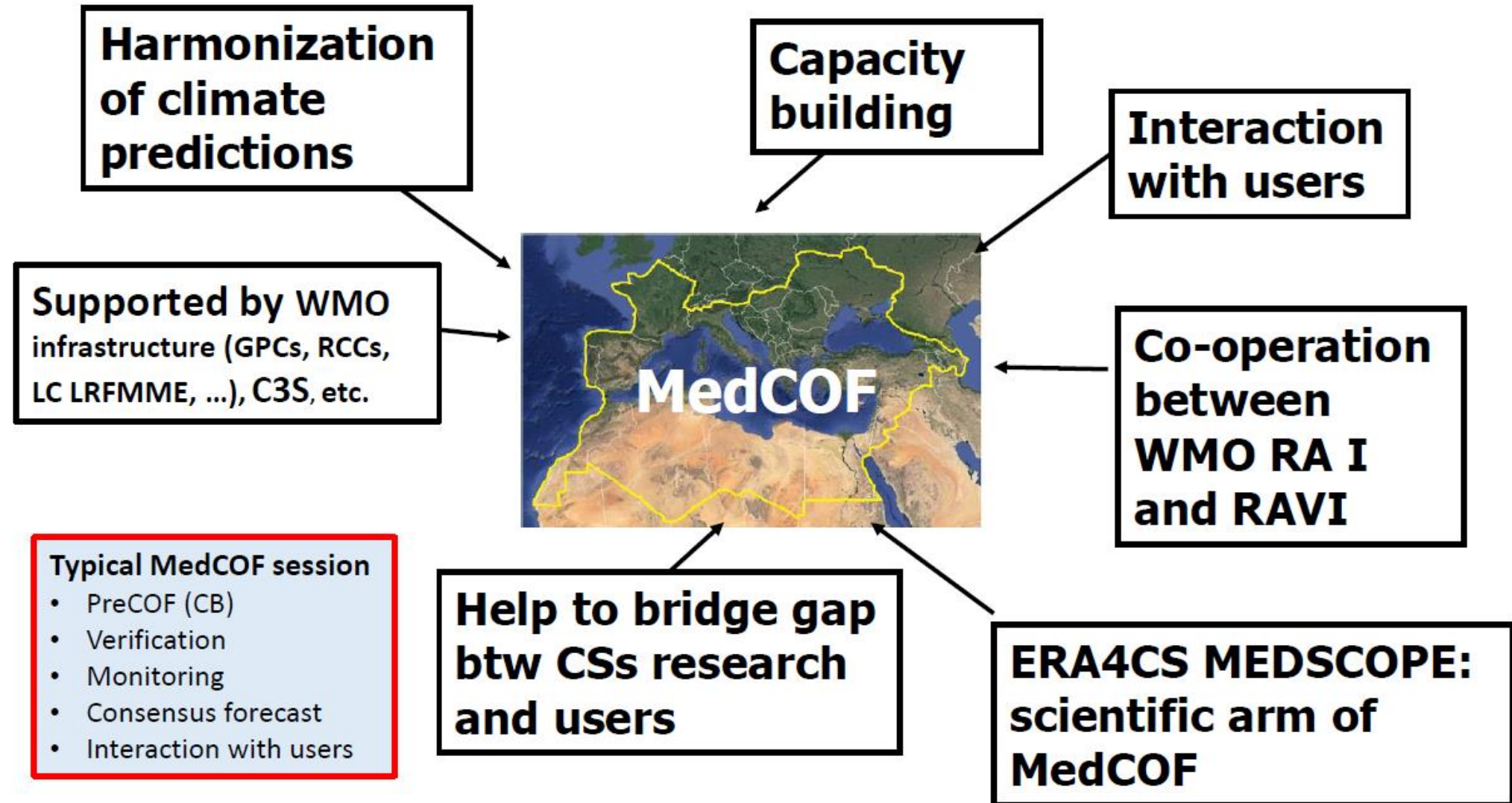
Regional Climate Outlook Forums (RCOFs):

Elaboración de predicciones y productos relevantes para usuarios por consenso entre expertos de países de zonas climáticas homogéneas



MedCOF

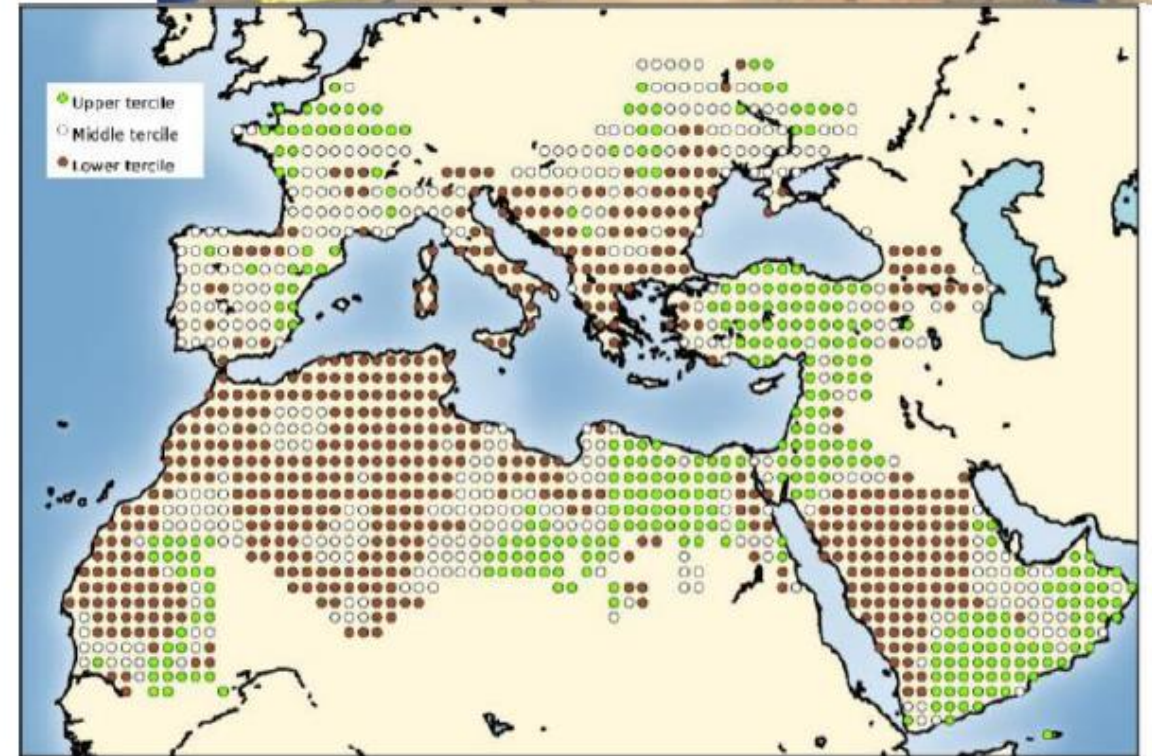
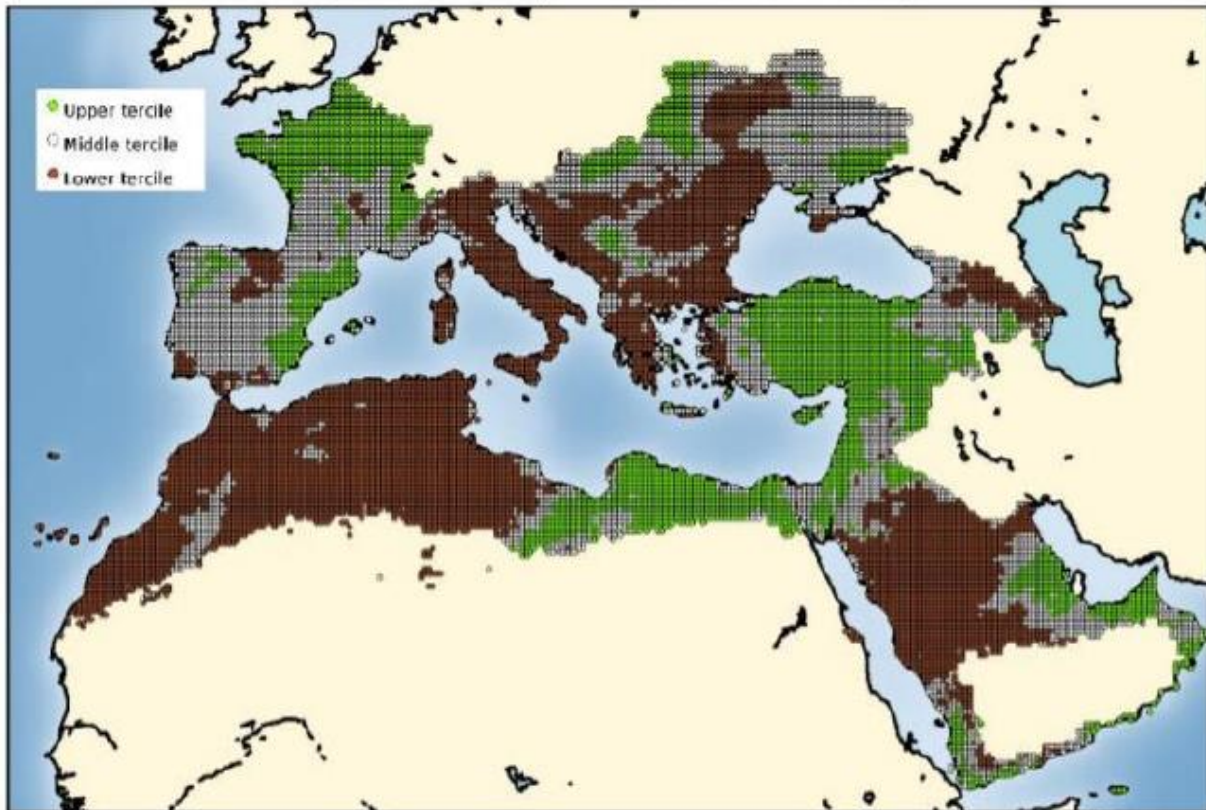
Mediterranean Climate Outlook Forum



Typical MedCOF session

- PreCOF (CB)
- Verification
- Monitoring
- Consensus forecast
- Interaction with users

PRECIPITATION DJF 2019-2020 (ERA-Interim data)
(reference period 1981-2010)



Typical MedCOF session

- PreCOF (CB)
- Verification
- **Monitoring**
- Consensus forecast
- Interaction with users

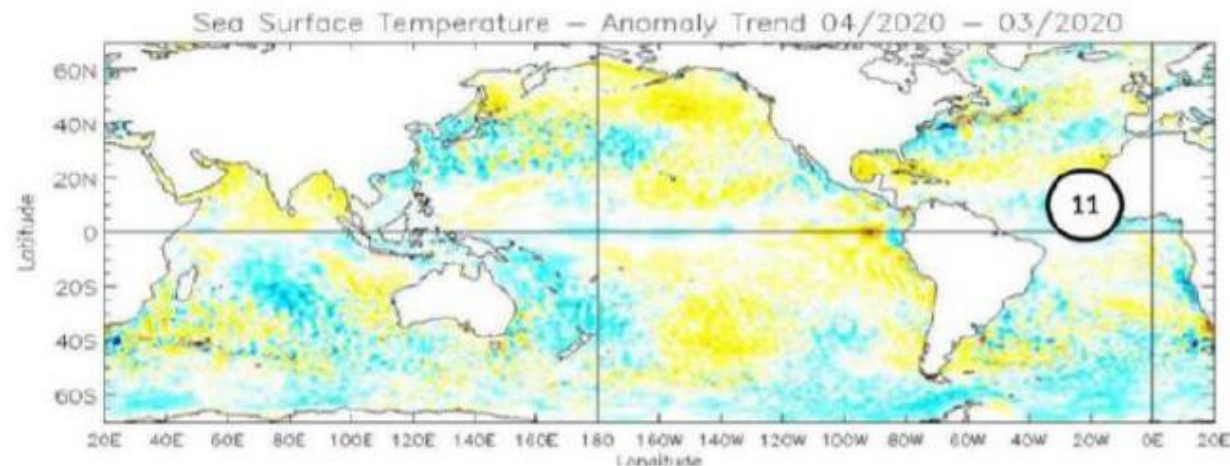
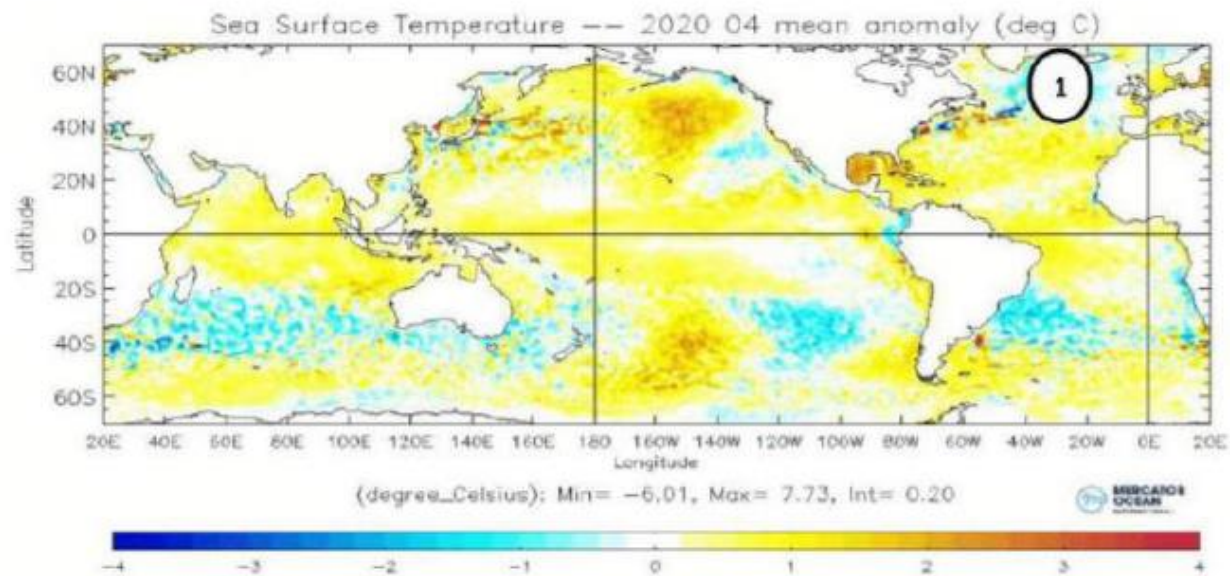
5. Soil moisture

In those parts of the domain, where precipitation was very low, the upper layers of soil dried out considerably during April 2020. In early May 2020, soil moisture was below normal particularly in parts of Italy, the northern Balkans and parts of Eastern Europe (Fig. 5). A dry soil has less potential evaporation, which causes a lower latent heat flux into the atmosphere, and therefore less cooling of the soil and near surface air by evaporation. This means that low soil moisture can amplify positive surface air temperature anomalies, even in the following summer, causing increased risk of heatwaves.



Over the Mediterranean and Black Sea:

- The western Mediterranean had above-normal temperatures in April, while the eastern Mediterranean temperatures were around normal. The Black Sea was warmer than normal.

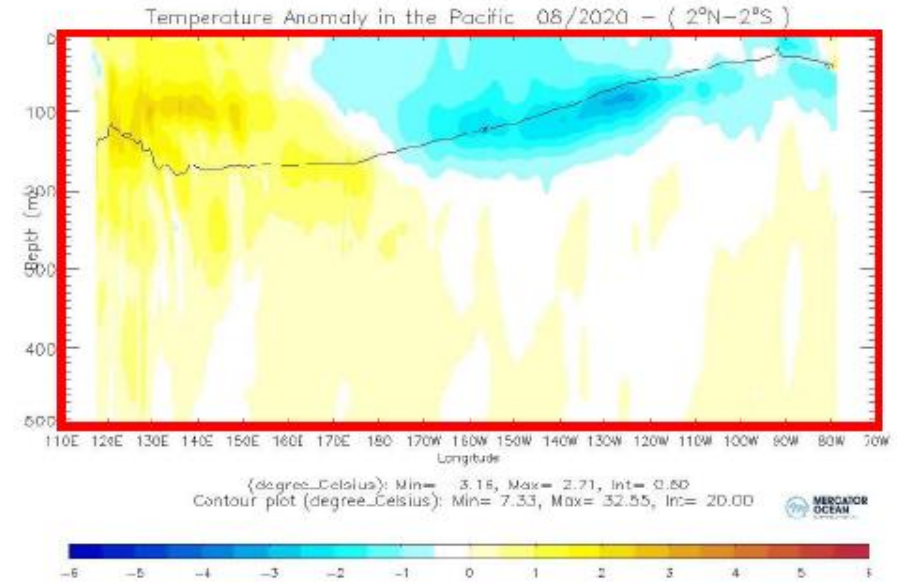
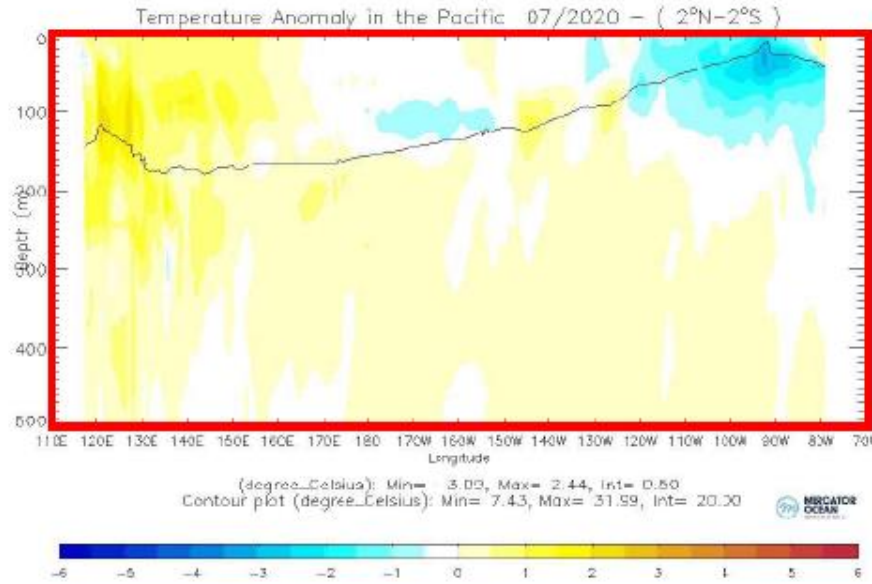
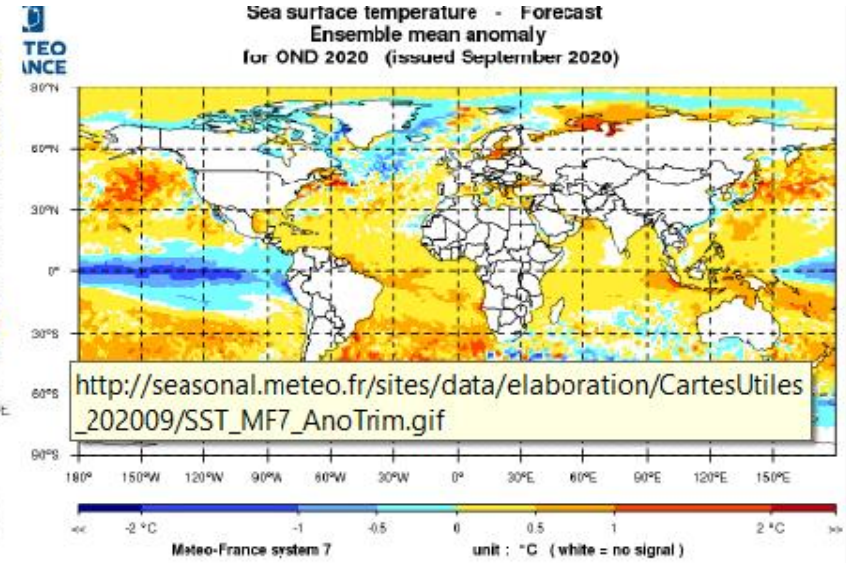
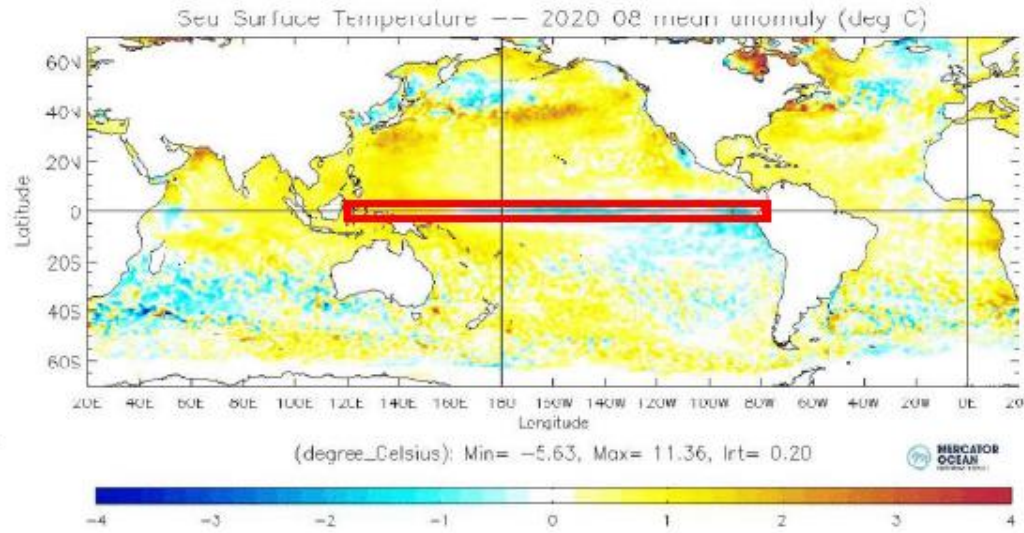


Typical MedCOF session

- PreCOF (CB)
- Verification
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- Consensus forecast
- Interaction with users

Análisis de estado de clima, drivers y modos de variabilidad relevantes

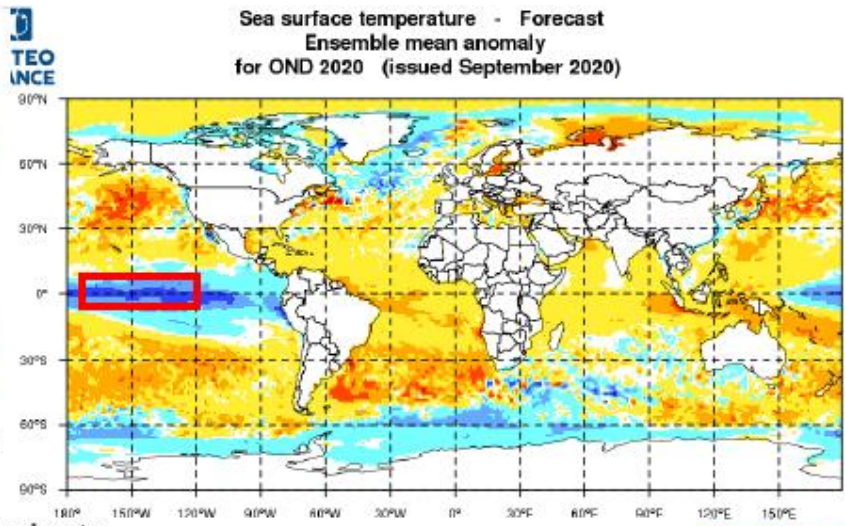
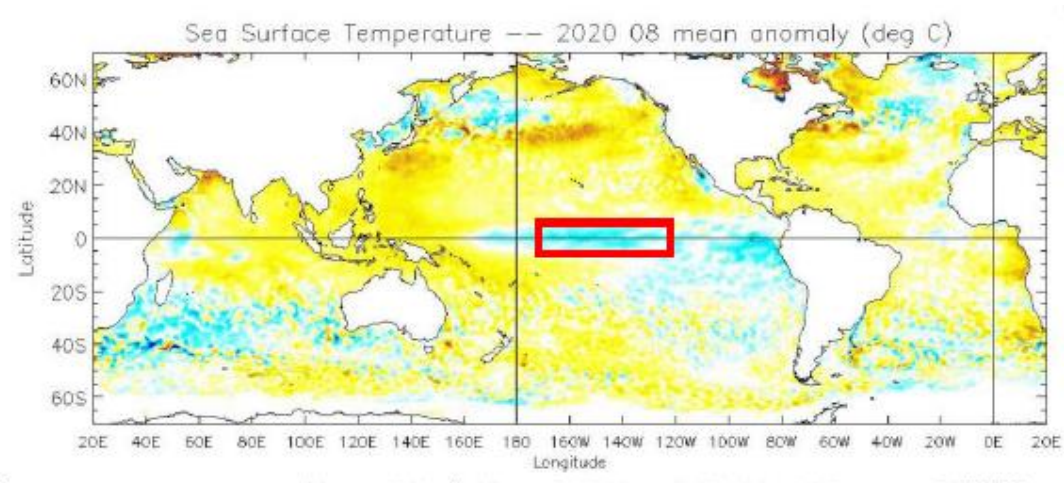
Análisis capa superficial
Pacífico Ecuatorial



- Typical MedCOF session**
- PreCOF (CB)
 - Verification
 - Monitoring
 - Consensus forecast
 - Interaction with users

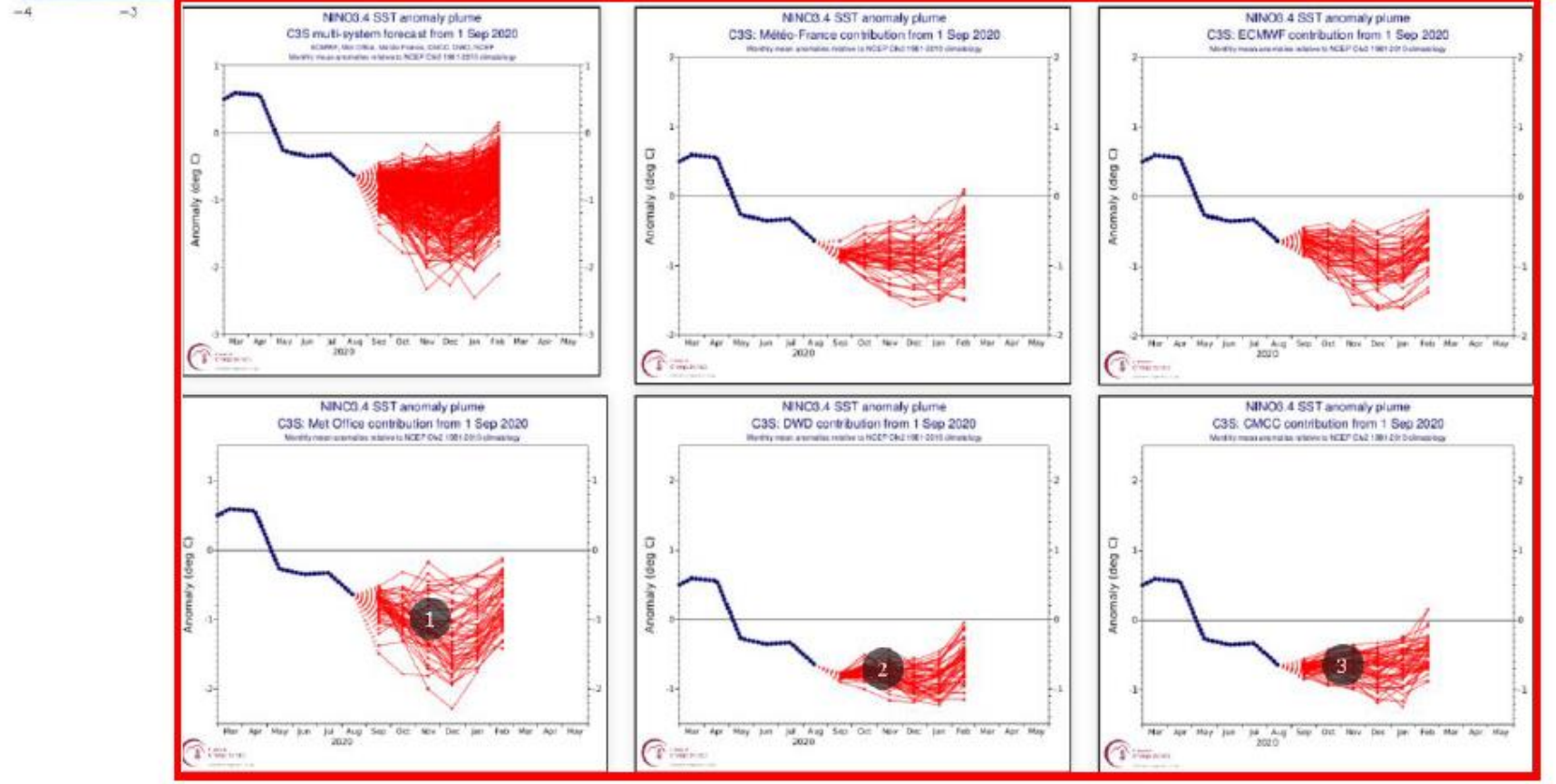
Análisis de estado de clima, drivers y modos de variabilidad relevantes

Análisis estado y pronóstico ENSO



(degree_Celsius): Min= -5.63, Max= 11.36, Int= 0.20

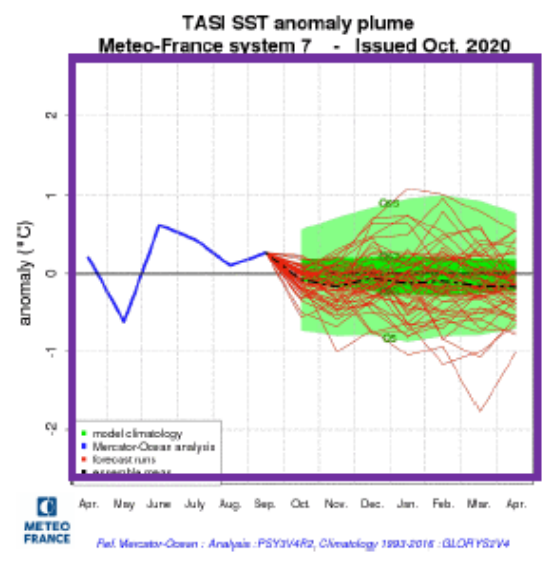
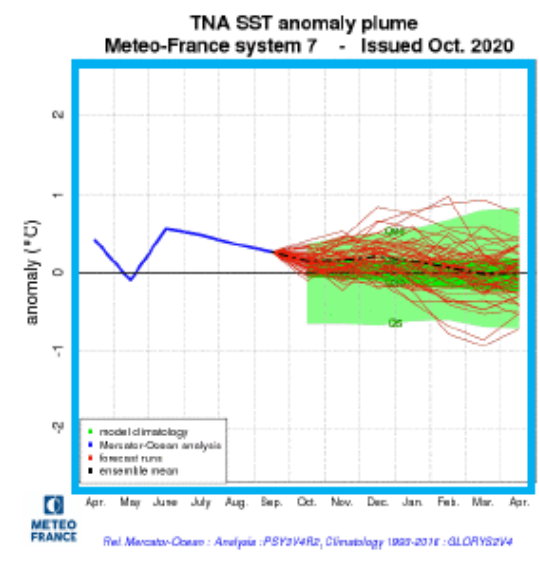
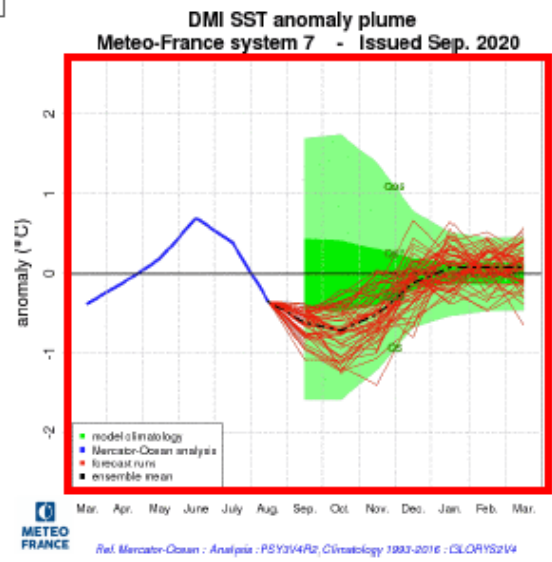
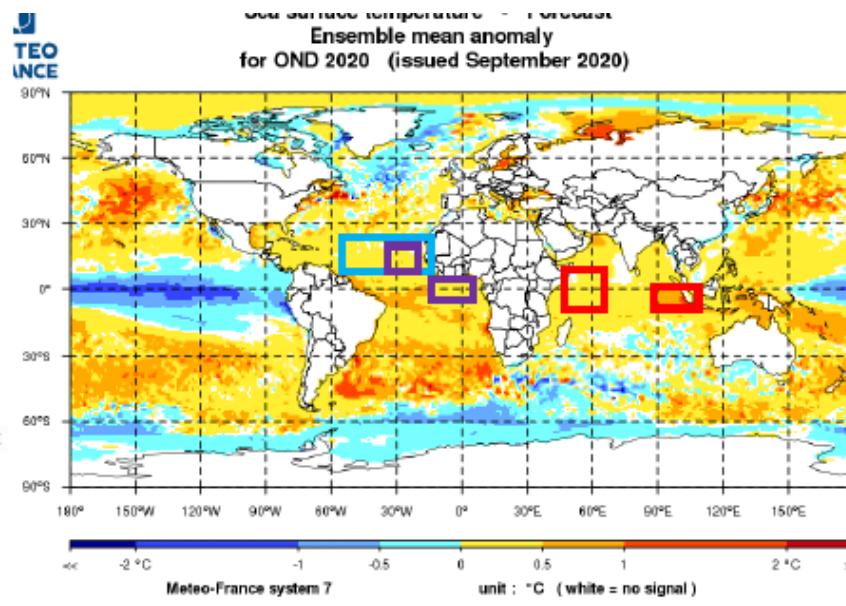
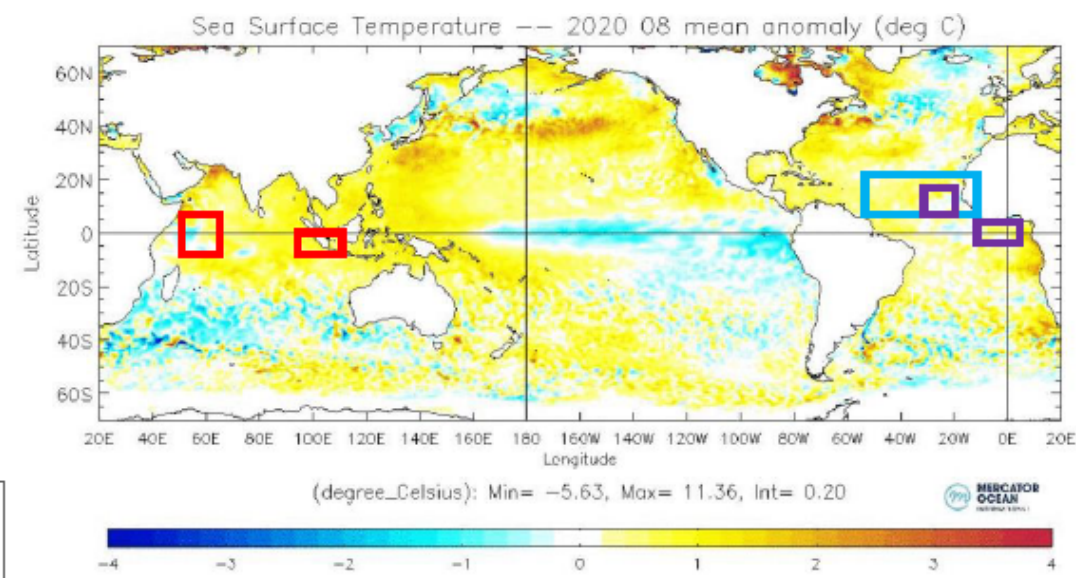
Expected Phase for the next three months : La Niña weak to moderate



- Typical MedCOF session**
- PreCOF (CB)
 - Verification
 - Monitoring
 - Consensus forecast
 - Interaction with users

Análisis de estado de clima, drivers y modos de variabilidad relevantes

Análisis estado y pronóstico otros drivers relevantes en el Atlántico y el Índico

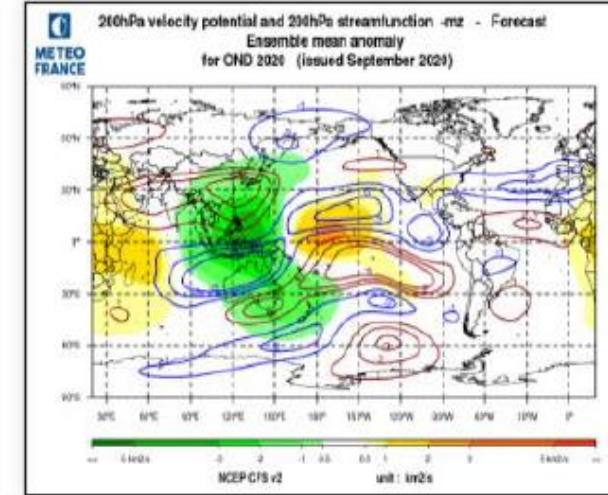
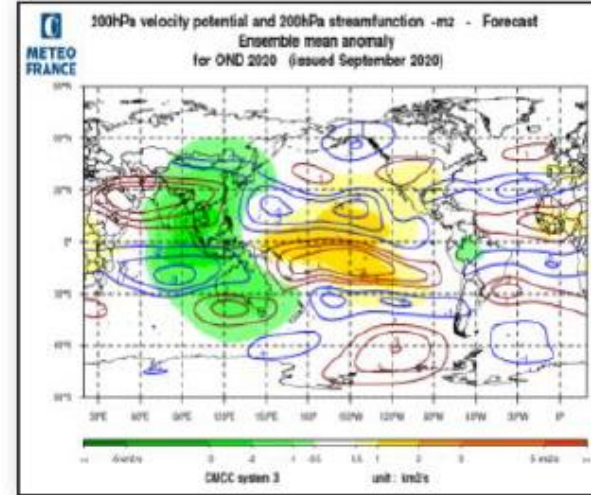
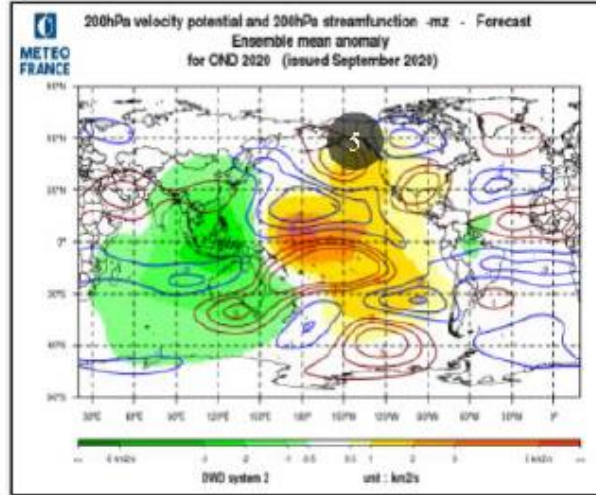
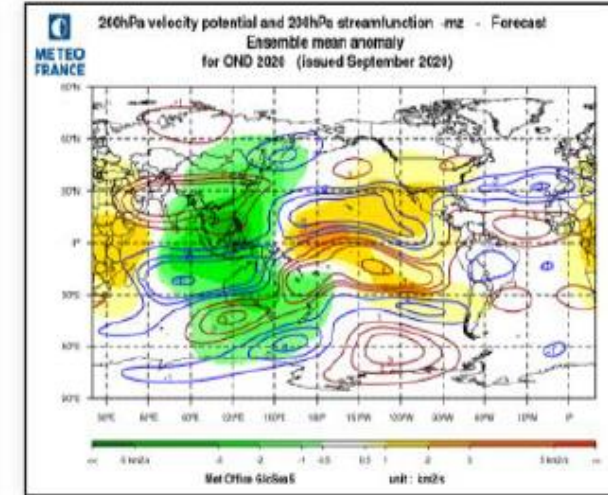
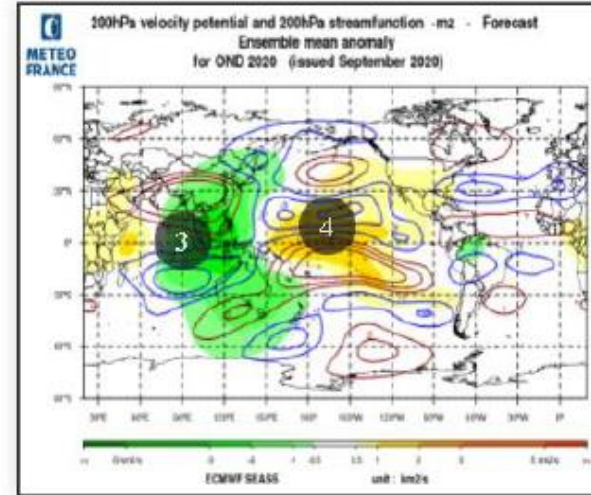
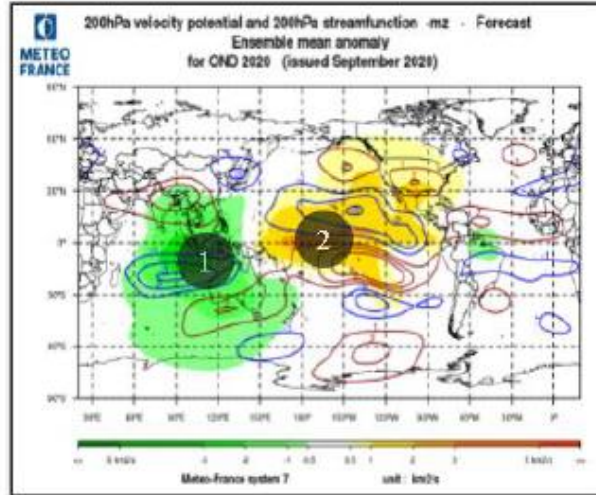


Typical MedCOF session

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Análisis de estado de clima, drivers y modos de variabilidad relevantes

Análisis respuesta atmosférica a anomalías SST y teleconexiones

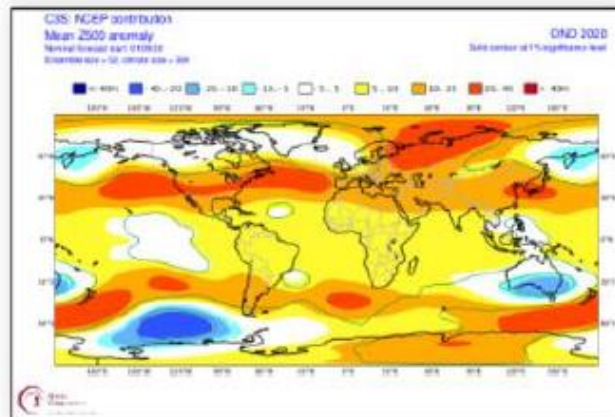
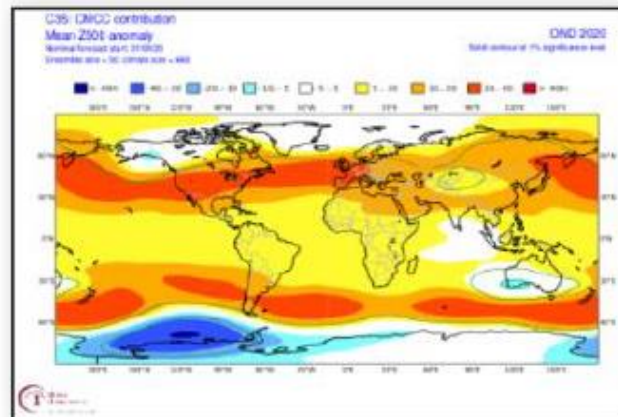
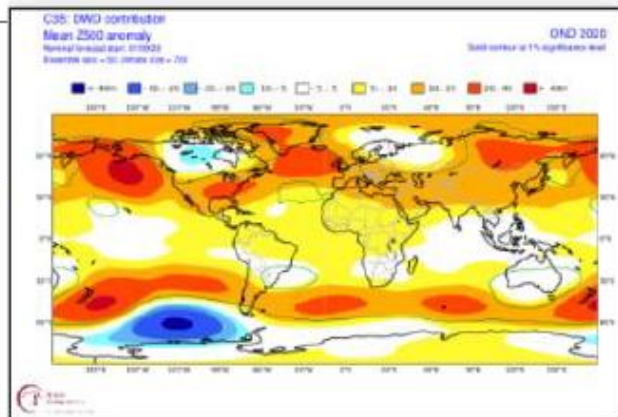
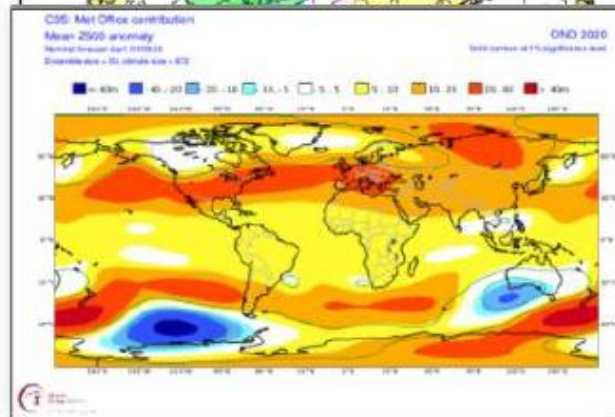
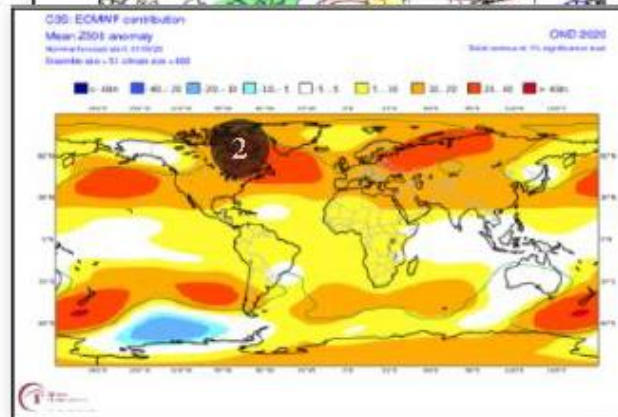
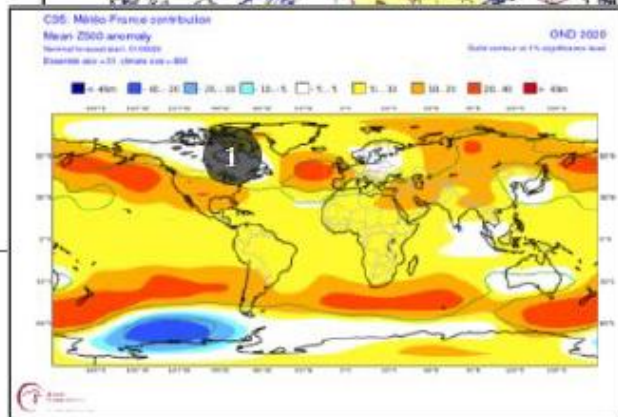
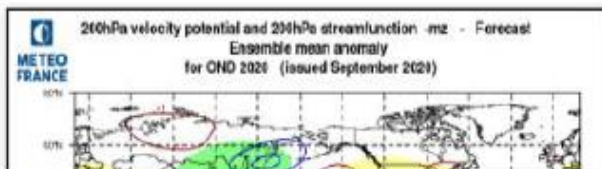
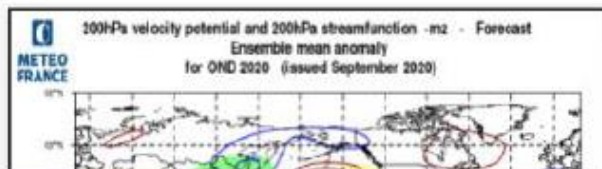
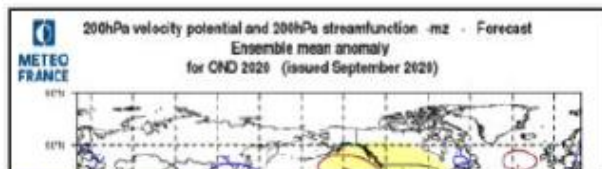


Typical MedCOF session

- PreCOF (CB)
- Verification
- Monitoring
- Consensus forecast
- Interaction with users

Análisis de estado de clima, drivers y modos de variabilidad relevantes

Análisis respuesta atmosférica a anomalías SST y teleconexiones



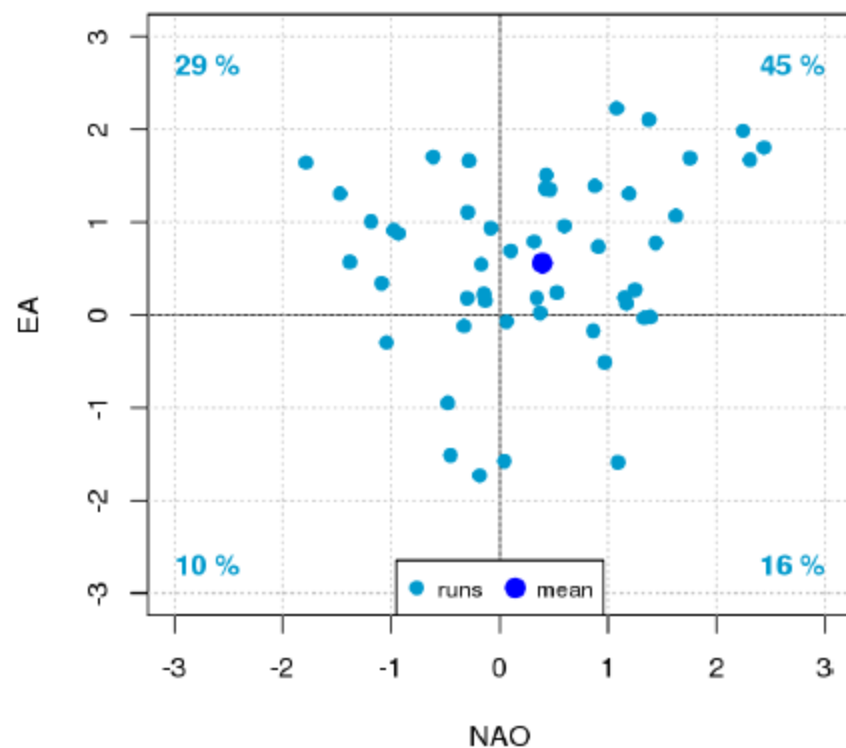
Typical MedCOF session

- PreCOF (CB)
- Verification
- Monitoring
- **Consensus forecast**
- Interaction with users

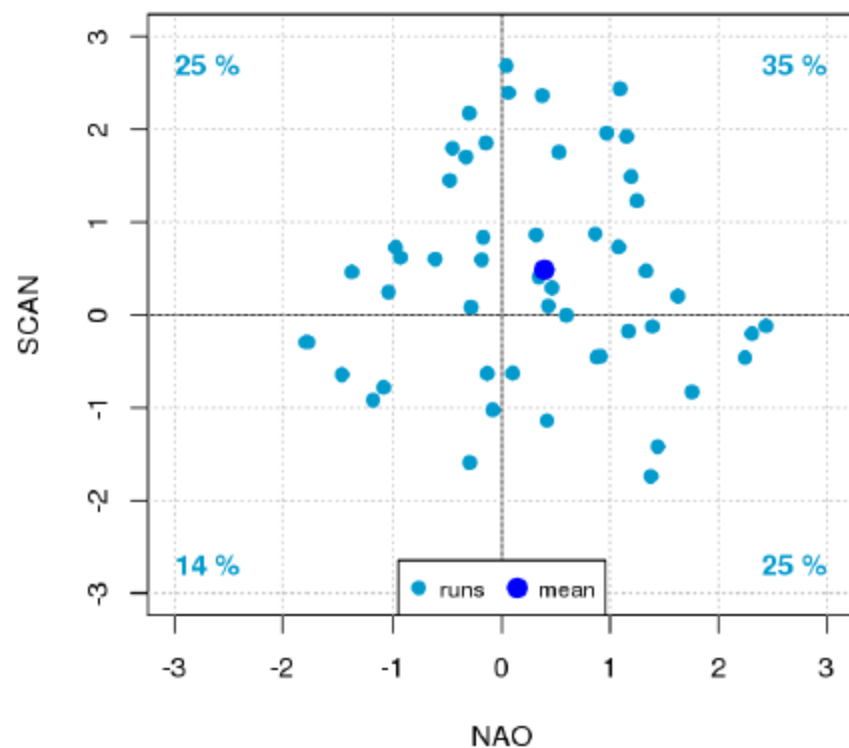
Análisis de estado de clima, drivers y modos de variabilidad relevantes

Análisis respuesta atmosférica. Modos de variabilidad.

ECMWF SEAS5 - Modes of variability
Init. : Sep. 2020 - Forecast for OND

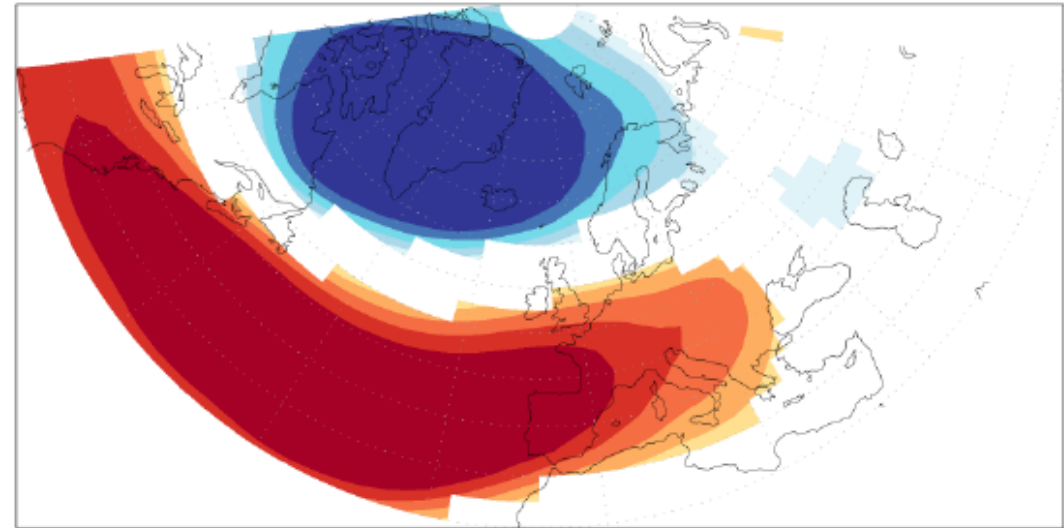


ECMWF SEAS5 - Modes of variability
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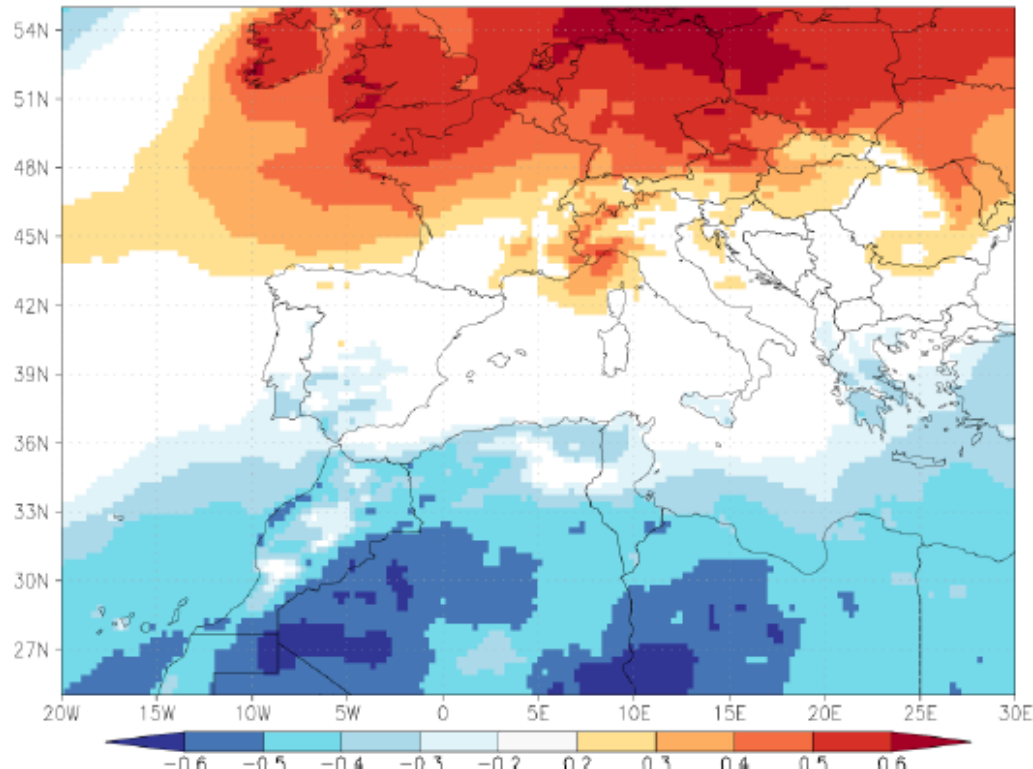


North Atlantic Oscillation

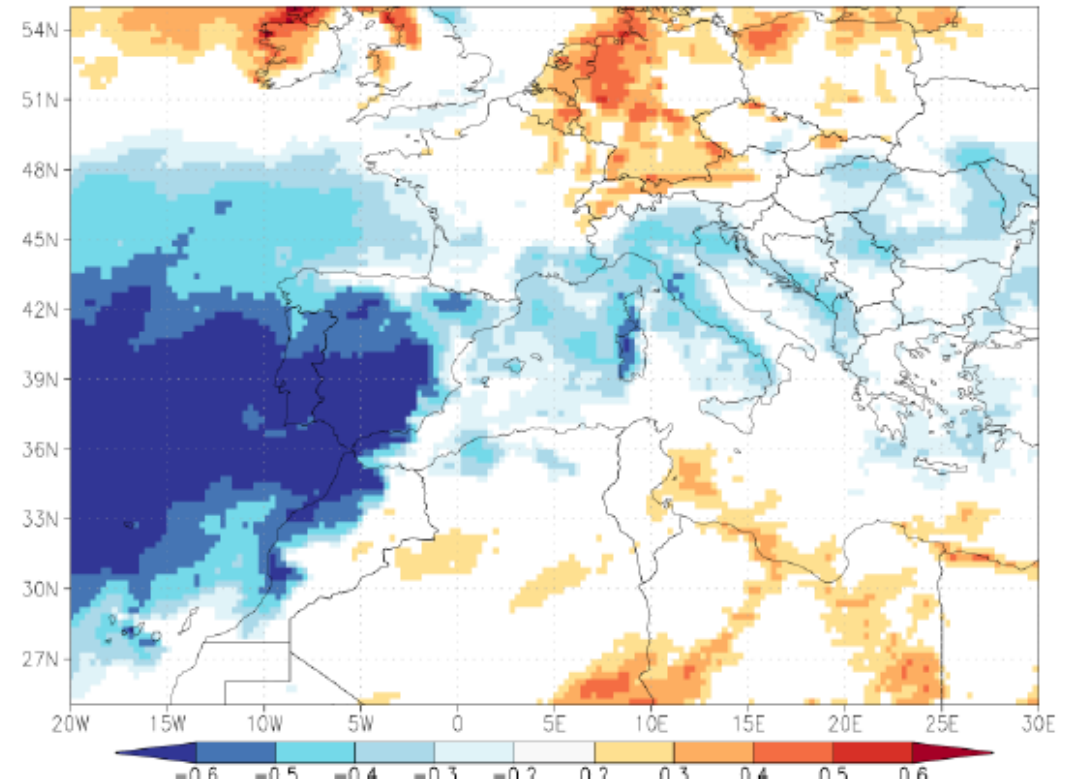
corr Nov-Feb averaged CPC NAO anomalies
Nov-Feb averaged NCEP/NCAR 500mb height anomalies (detrend) 1979:2018



corr Nov-Feb averaged CPC NAO anomalies
with Nov-Feb averaged ERA5 T2m anomalies (detrend) 1979:2018 $p < 20\%$

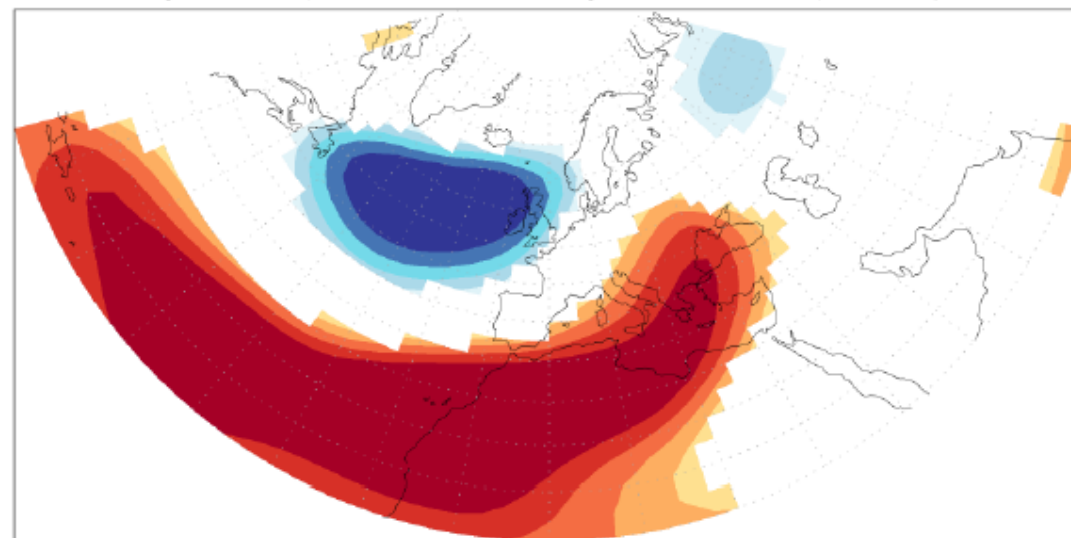


corr Nov-Feb averaged CPC NAO anomalies
with Nov-Feb averaged ERA5 precipitation anomalies (detrend) 1979:2018 $p < 20\%$

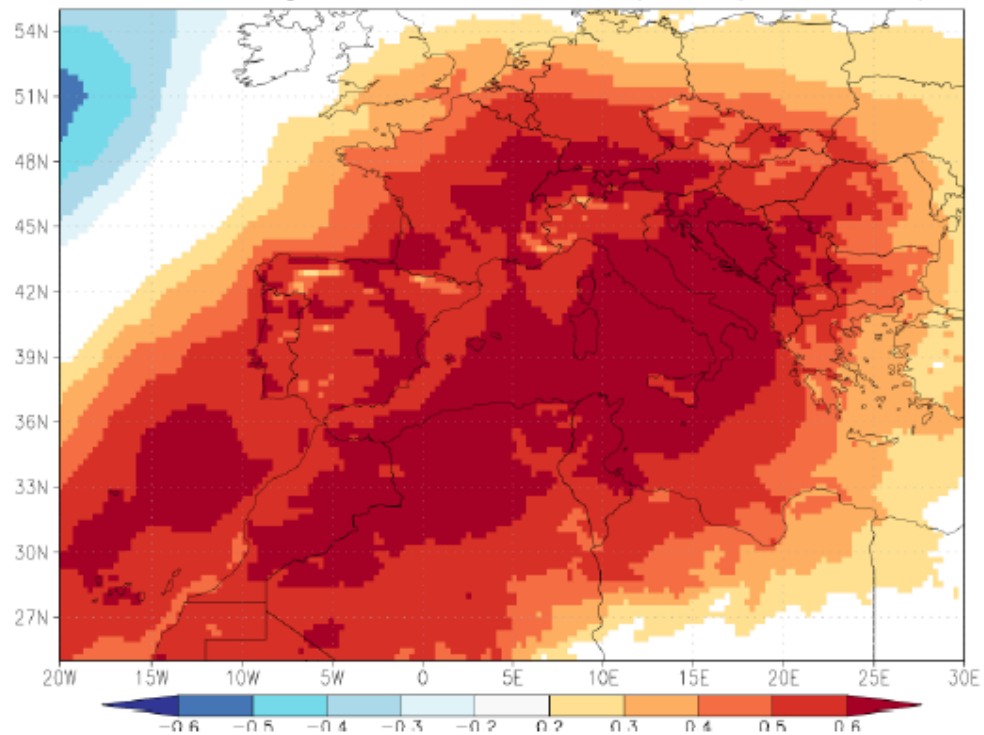


East Atlantic

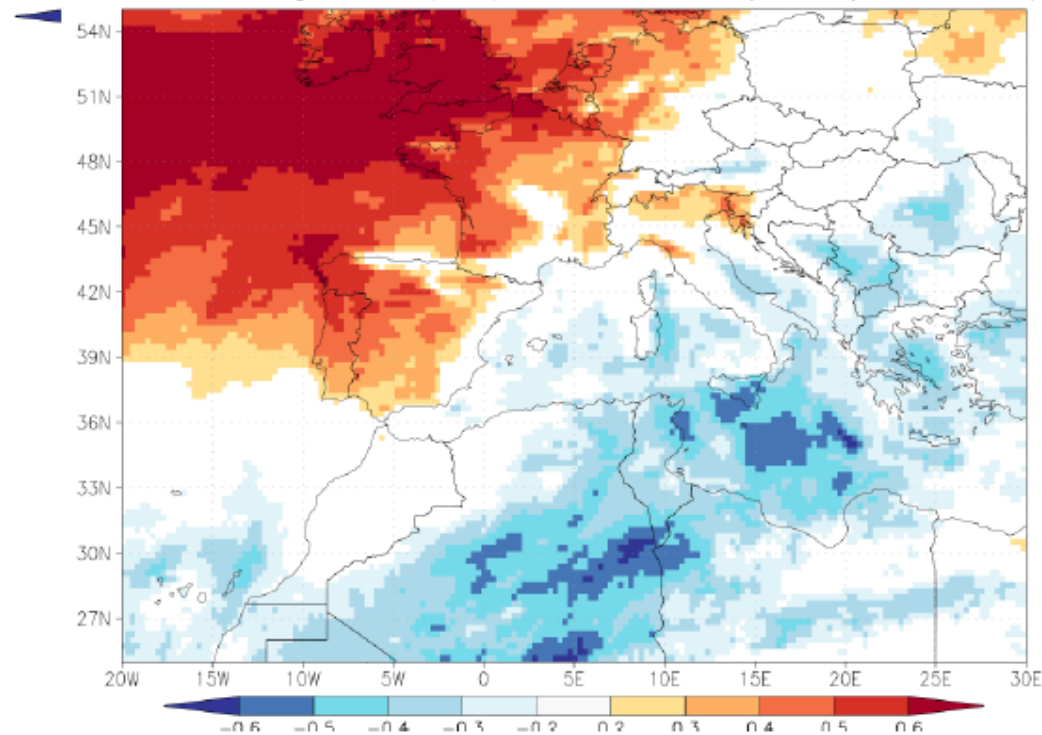
Nov-Feb averaged NCEP/NCAR 500mb height anomalies (detrend) 1979:2018



corr Nov-Feb averaged CPC_EA anomalies with Nov-Feb averaged ERA5 T2m anomalies (detrend) 1979:2018 $p < 20\%$



corr Nov-Feb averaged CPC_EA anomalies with Nov-Feb averaged ERA5 precipitation anomalies (detrend) 1979:2018 $p < 20\%$



Typical MedCOF session

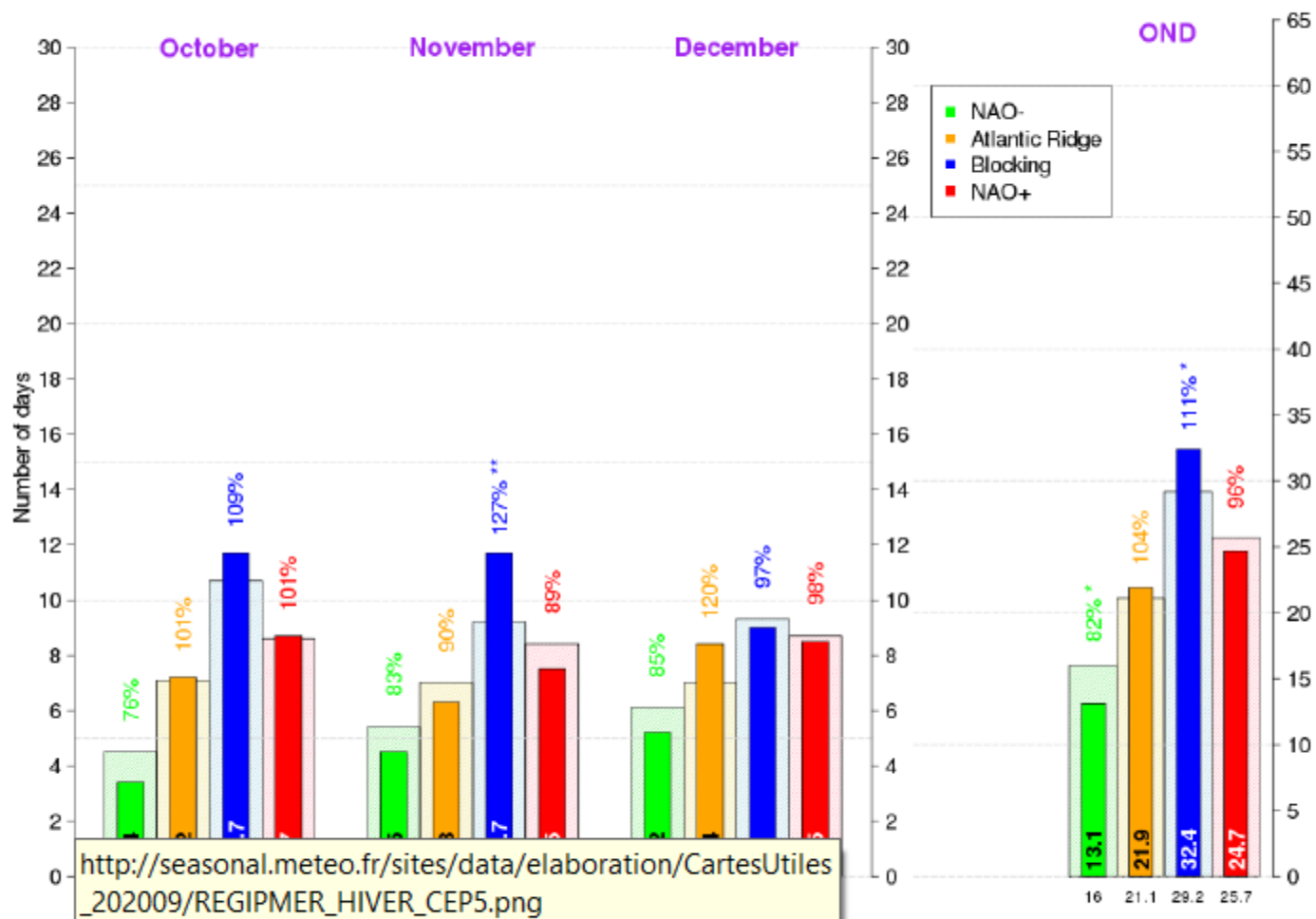
- PreCOF (CB)
- Verification
- Monitoring
- **Consensus forecast**
- Interaction with users

Análisis de estado de clima, drivers y modos de variabilidad relevantes

Análisis respuesta atmosférica. Tipos de tiempo



Winter Weather Regimes (based on PMER) - Forecast and climatology ECMWF SEAS5 - Issued September 2020

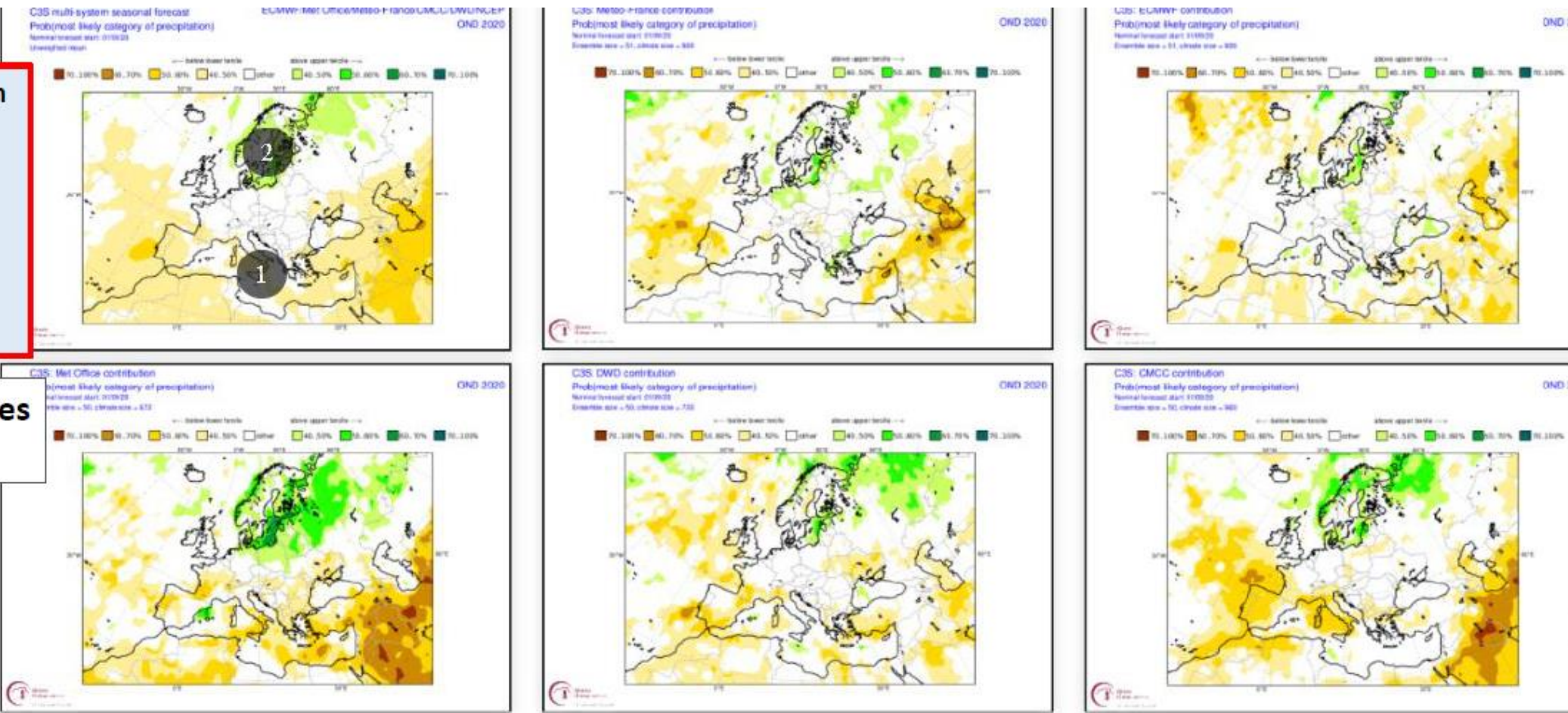


Typical MedCOF session

- PreCOF (CB)
- Verification
- Monitoring
- Consensus forecast
- Interaction with users

Análisis de predicciones de modelos

Predicción temperatura y precipitación



ROC area (lower tercile) for IBERIA total_precipitation

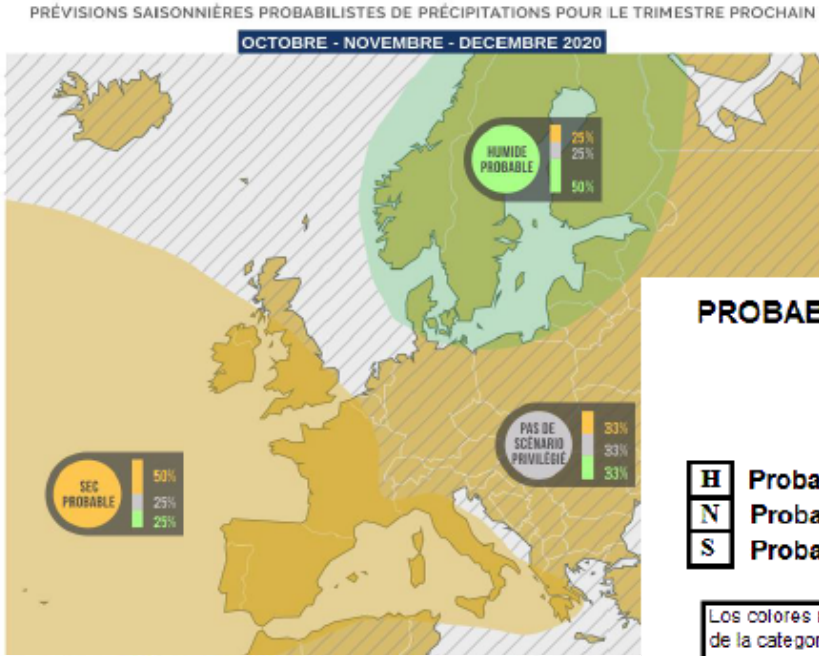
AEMET-S2	0.42	0.55	0.56	0.38	0.50	0.59	0.51	0.47	0.55	0.48	0.48	0.33
UKMO-S13	0.57	0.47	0.52	0.58	0.62	0.54	0.59	0.54	0.52	0.59	0.57	0.50
MF-S6	0.56	0.51	0.56	0.52	0.56	0.52	0.54	0.52	0.50	0.64	0.55	0.56
ECMWF-S5	0.59	0.48	0.59	0.65	0.63	0.62	0.49	0.48	0.49	0.46	0.59	0.56
DWD-S2	0.56	0.54	0.59	0.58	0.53	0.53	0.57	0.56	0.53	0.50	0.65	0.58
CMCC-S3	0.51	0.55	0.59	0.57	0.57	0.49	0.46	0.54	0.54	0.58	0.60	0.65
	FJI	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ	DF

ROC area (upper tercile) for IBERIA total_precipitation

AEMET-S2	0.45	0.61	0.56	0.47	0.42	0.53	0.56	0.48	0.56	0.48	0.51	0.42
UKMO-S13	0.54	0.44	0.54	0.58	0.59	0.62	0.66	0.53	0.55	0.56	0.52	0.51
MF-S6	0.51	0.52	0.47	0.58	0.59	0.56	0.61	0.52	0.54	0.57	0.59	0.58
ECMWF-S5	0.54	0.54	0.57	0.61	0.65	0.63	0.58	0.52	0.53	0.55	0.52	0.55
DWD-S2	0.59	0.56	0.59	0.54	0.56	0.60	0.51	0.54	0.52	0.51	0.53	0.51
CMCC-S3	0.55	0.57	0.63	0.61	0.60	0.60	0.51	0.53	0.59	0.64	0.58	0.61
	FJI	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ	DF

- Typical MedCOF session**
- PreCOF (CB)
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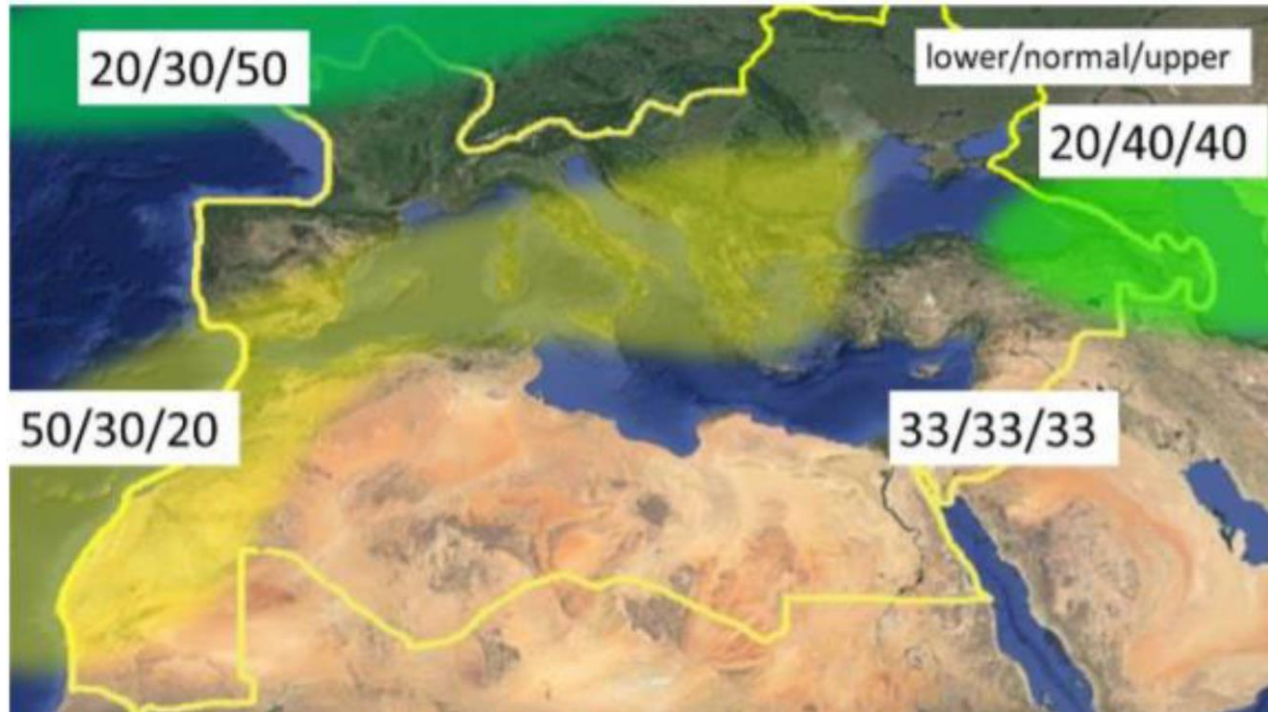
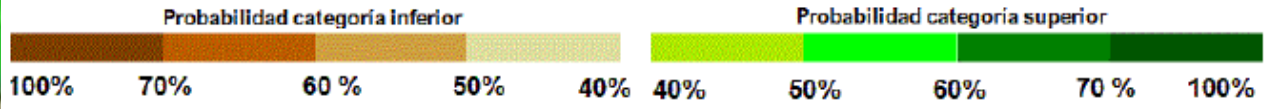
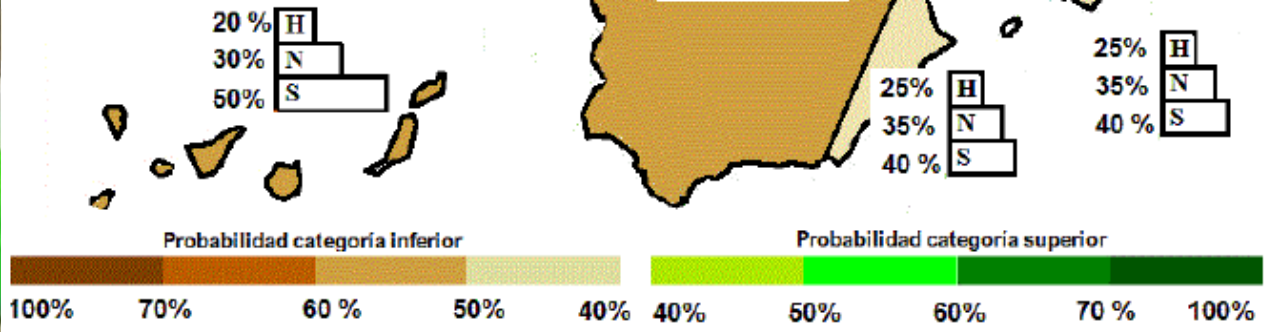
Predicción por consenso



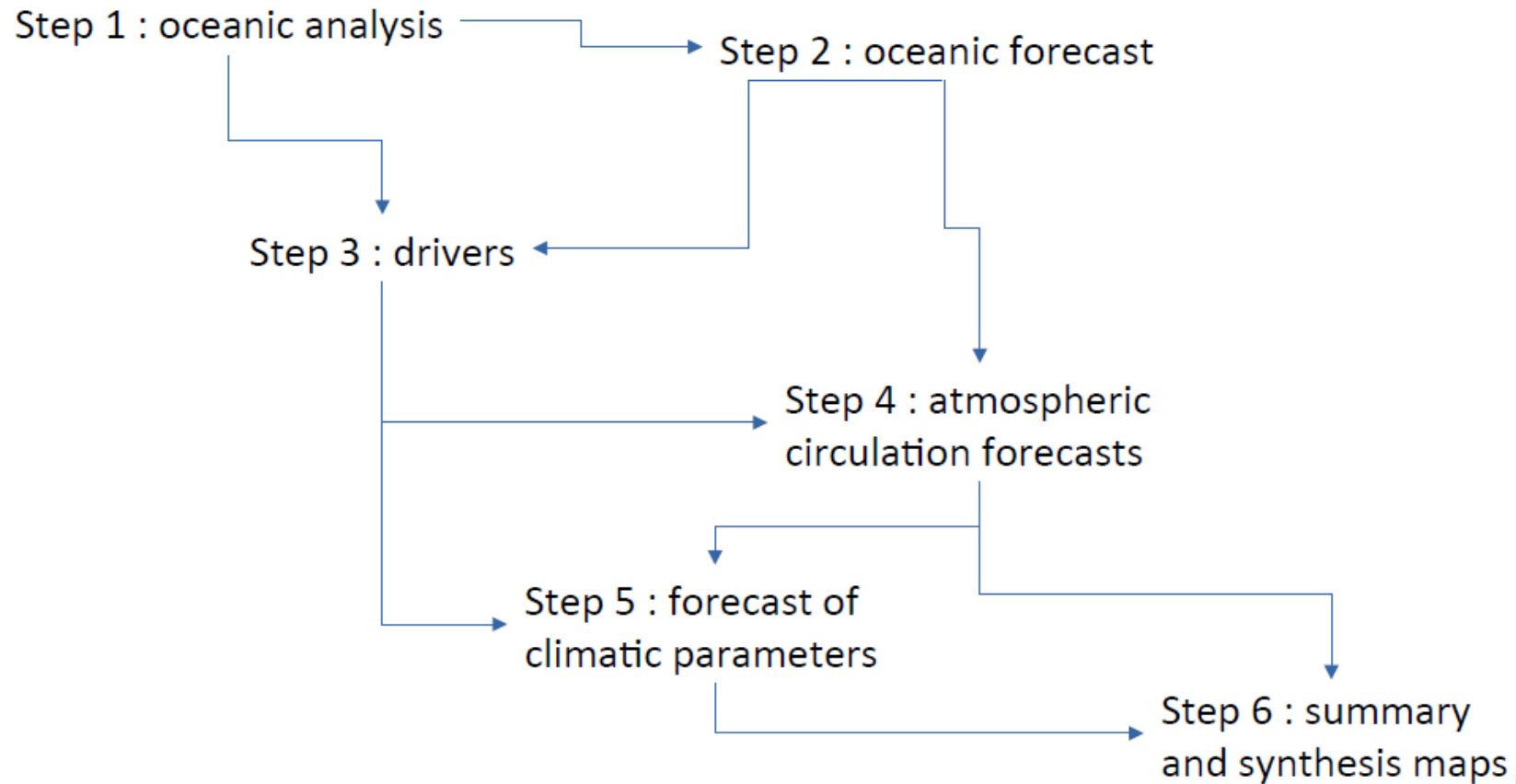
**PROBABILIDAD DE LA CATEGORÍA MÁS PROBABLE DE PRECIPITACIÓN
OCTUBRE - NOVIEMBRE - DICIEMBRE 2020**

- H** Probabilidad tercil superior
- N** Probabilidad tercil central
- S** Probabilidad tercil inferior

Los colores muestran la probabilidad de la categoría más probable. El color blanco indica la climatología

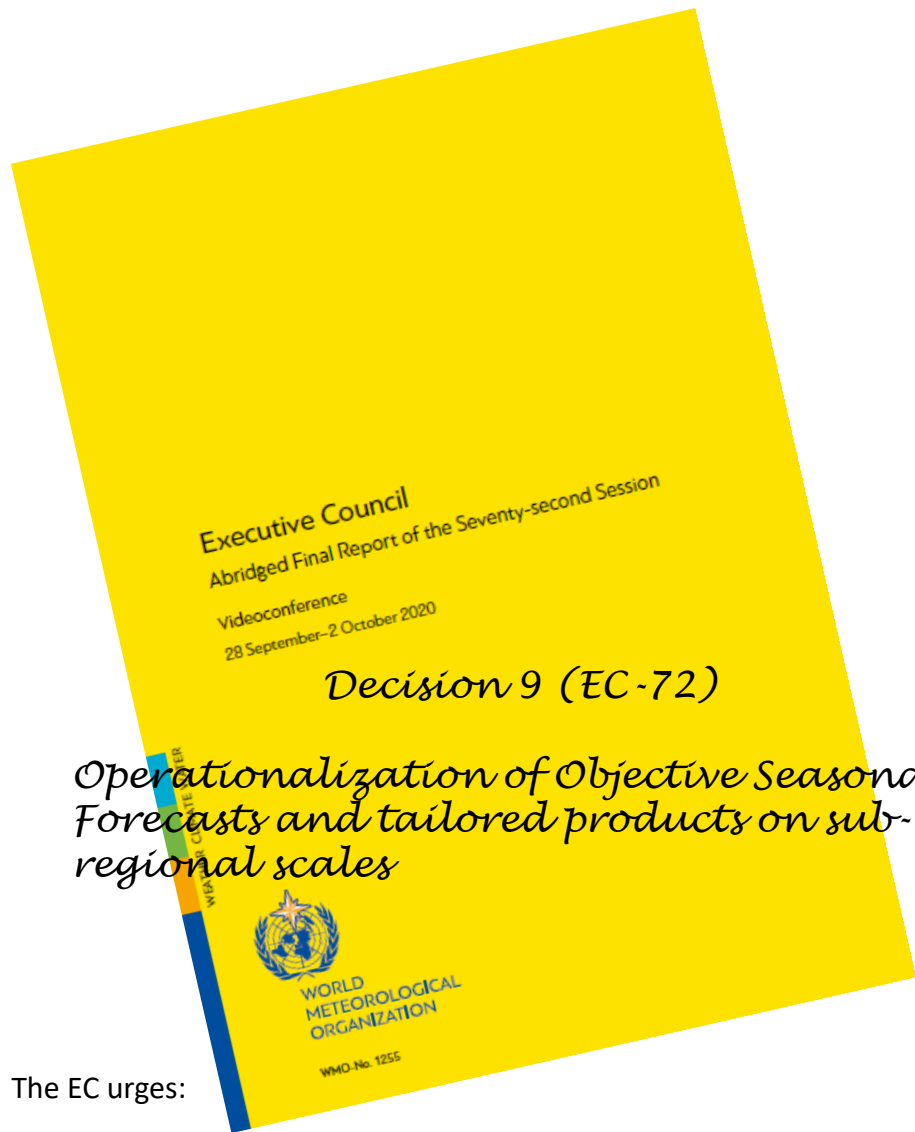


Current MedCOF procedure



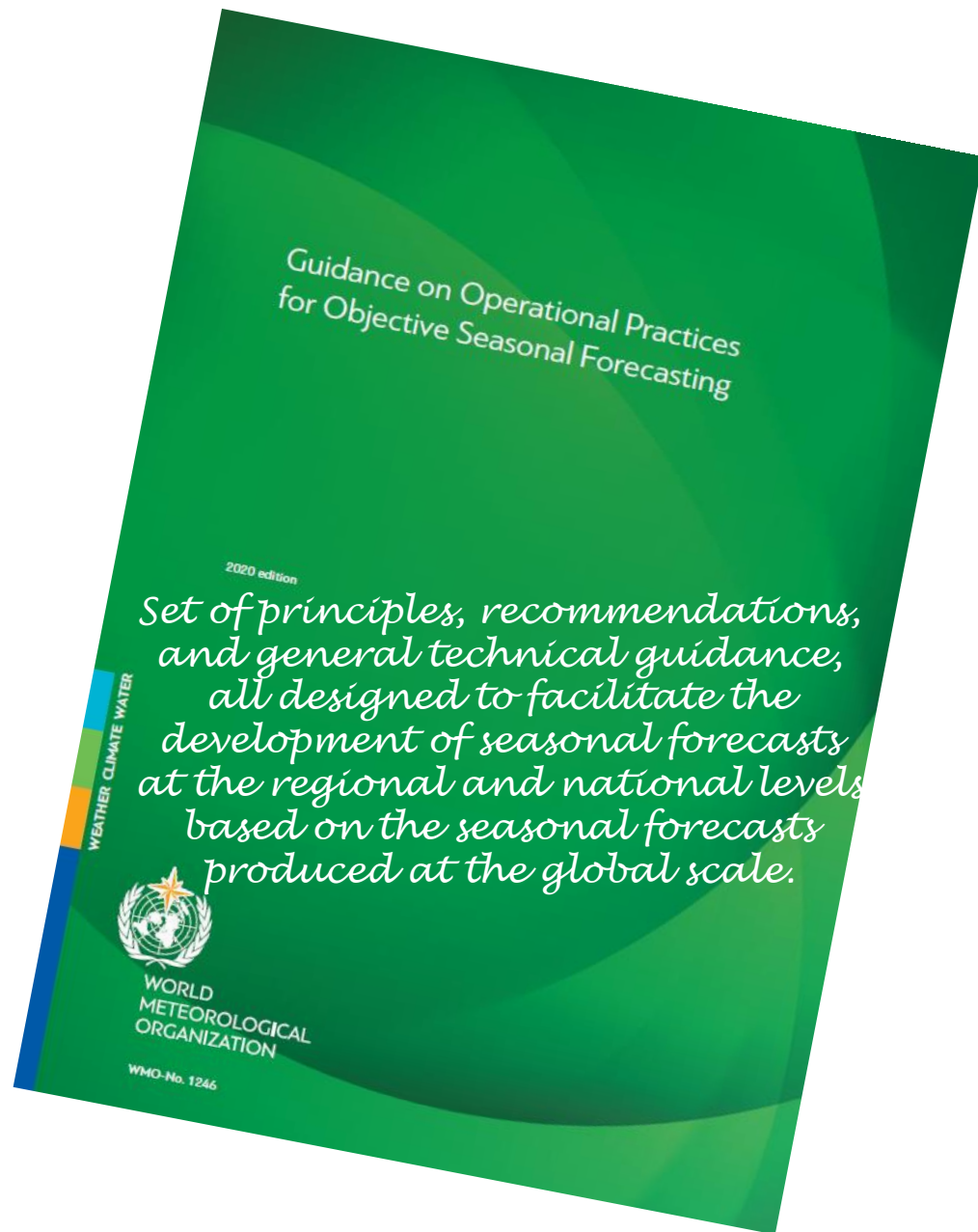
Drawbacks of current practices in many RCOFs

- a subjective, consensus-based forecast process that is **neither traceable nor reproducible**;
- forecasts are packaged in a **fixed, one size-fits-all tercile probability format** that seldom addresses the requirements of specific applications;
- forecasts are generally **unavailable in digitized form**, and therefore, if needed, cannot be used in terms of quantitative inputs feeding into application models or decision support tools;
- forecasts are **not amenable to standardized verification** and skill assessments, thereby making forecast quality ambiguous, and also making future improvements difficult;
- forecast preparation requires a **high degree of manual activity**, which limits the frequency of forecast updates and the diversity of products.

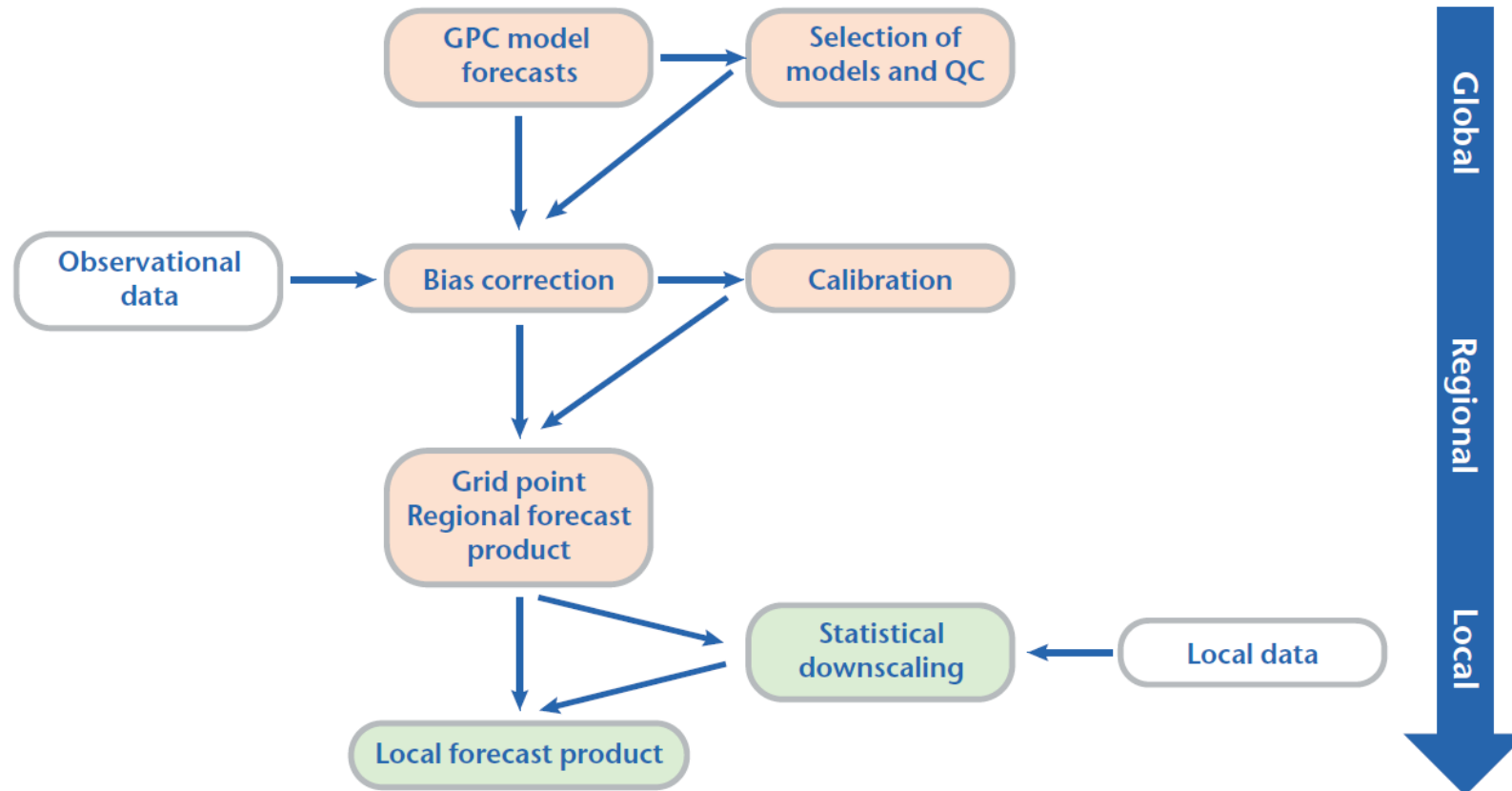


The EC urges:

- (a) **RCCs, RCC networks and other relevant organizations** cooperating on RCFs worldwide to actively contribute to the implementation of the proposal in the respective regions;
- (b) **WMO GPCs for LRF and the LC for MME LRF to facilitate access** to required data sets and ensure timely and regular provision of objective sub-seasonal and seasonal forecast products, in suitable formats to RCCs, RCFs, and NMHSs



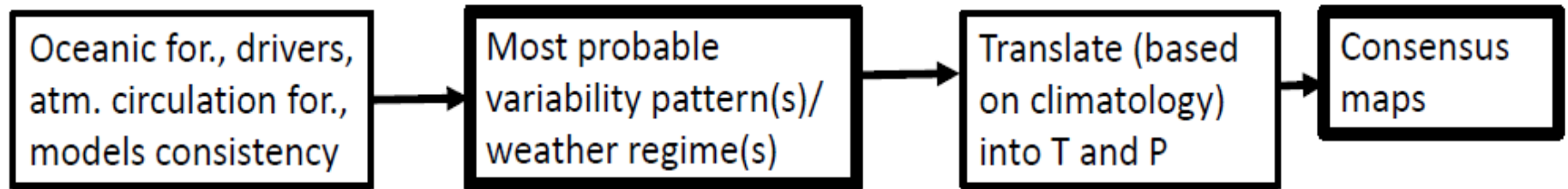
Recommended procedure for developing SFs at the regional and national levels (WMO 2020)



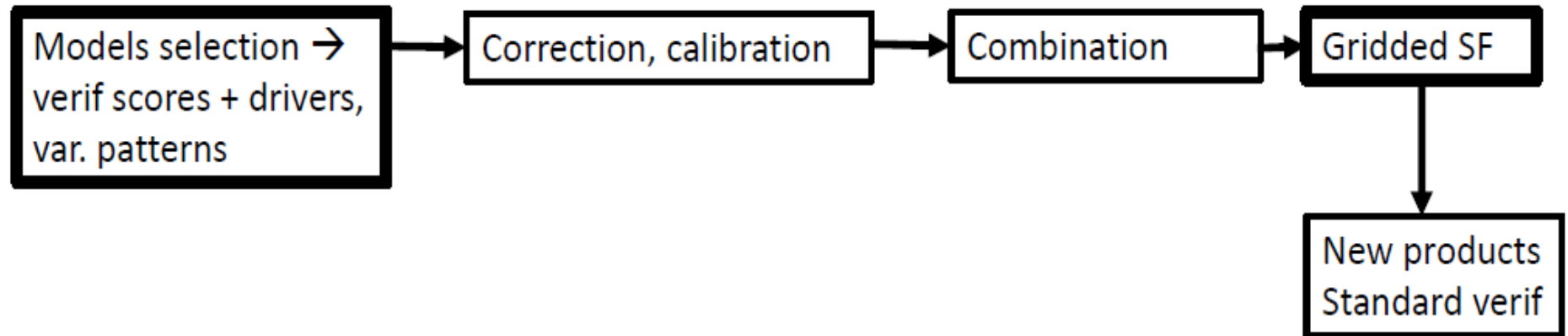
An outline of the recommended procedure for developing seasonal forecasts at the regional and national levels starting from the forecasts from GPCs-LRF (WMO 2020)

Current versus new approaches to SF

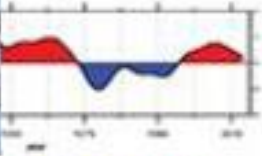
Current



New



ERA4CS MEDSCOPE: designed as the scientific arm of MedCOF



WMO Northern Africa
WMO EA VI
MedCOF Mediterranean Climate Outlook Forum

Home About Events FAQ Links Online forum Contact

The Ninth MedCOF
MedCOF 9
Zagreb, Croatia, November 20-24, 2011

Latest Consensus Outlook

MedCOF community and national users



Copernicus Climate Change Service

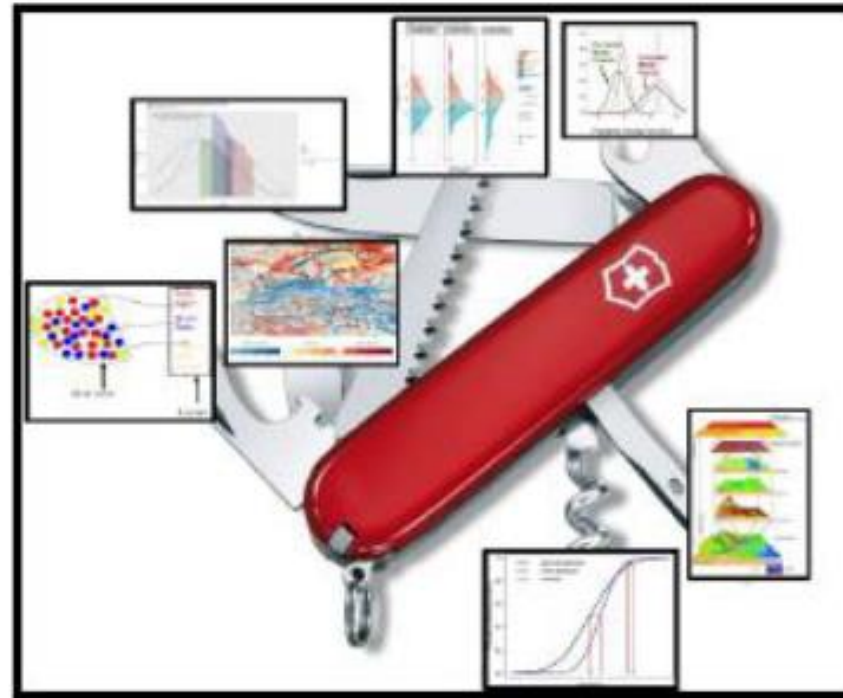
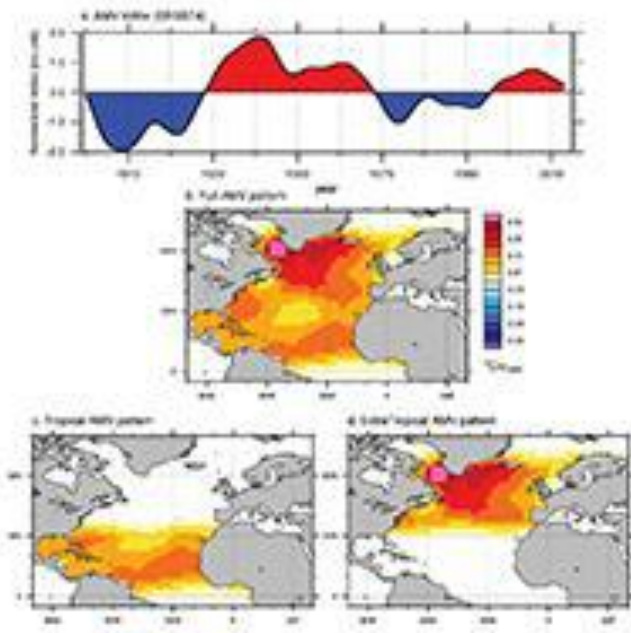
Seasonal forecasts

Research community and seasonal forecast producers (e.g. Copernicus)



(Thanks to S. Gualdi, CMCC)

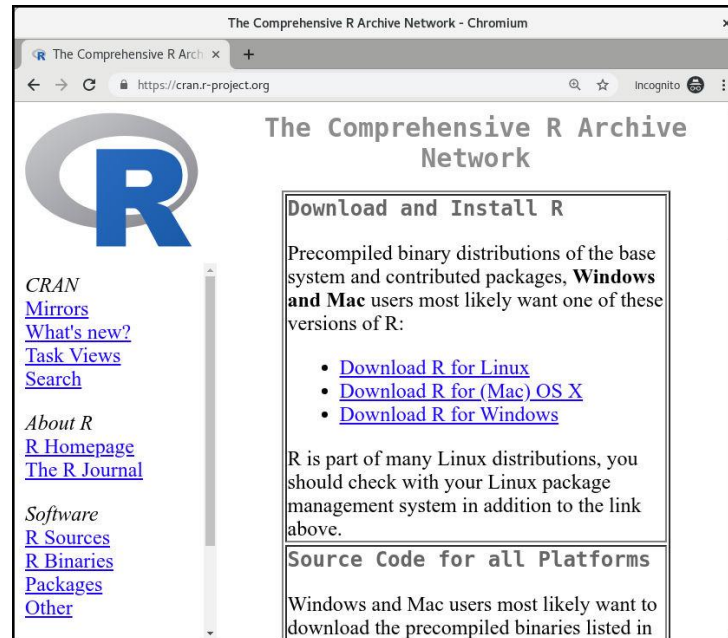
ERA4CS MEDSCOPE Project: main objectives



ERA4CS MEDSCOPE Project: output



MEDSCOPE Special Issue: advancing the understanding of variability and predictability over the Mediterranean region at seasonal to decadal time scales



Climate Services Toolbox (CSTools) primarily designed to merge all the required steps on seasonal forecast post-processing



Climate Services developed and evaluated for 3 sectors: renewable energy, water and agroforestry

The CStools Toolbox

Retrieval and transformation	CST_Load, CST_Anomaly, CST_SaveExp, CST_MergeDims, CST_SplitDims, as.s2dv_cube, s2dv_cube
Classification	CST_MultiEOFS, CST_WeatherRegimes, CST_RegimesAssign, CST_CategoricalEnsCombination
Downscaling	CST_Analogs, CST_RainFarm, CST_RFTemp, CST_AdamontAnalogs, CST_AnalogsPredictors
Correction	CST_BEI_Weighting, CST_BiasCorrection, CST_Calibration, CST_QuantileMapping, CST_DynBiasCorrection
Assessment	CST_MultiMetric, CST_MultivarRMSE
Visualization	PlotCombinedMap, PlotForecastPDF, PlotMostLikelyQuantileMap, PlotPDFsOLE, PlotTriangles4Categories

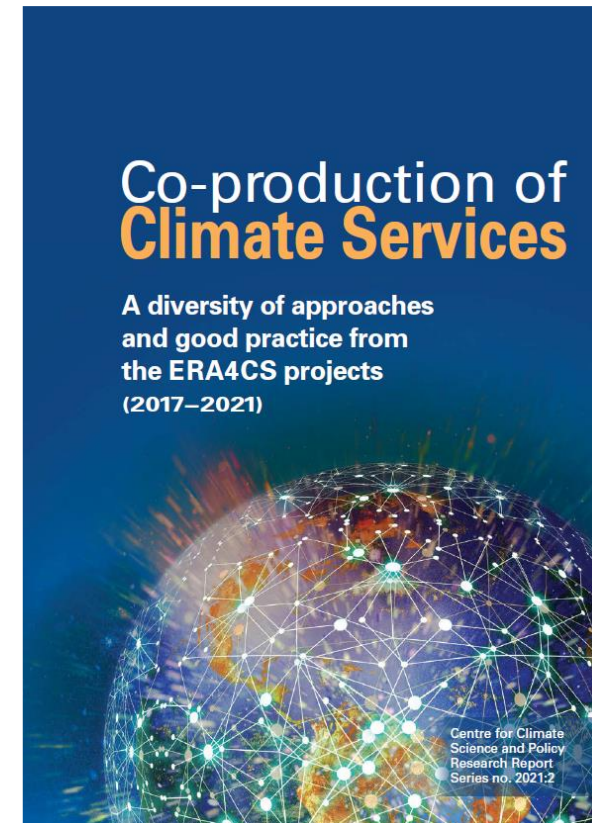
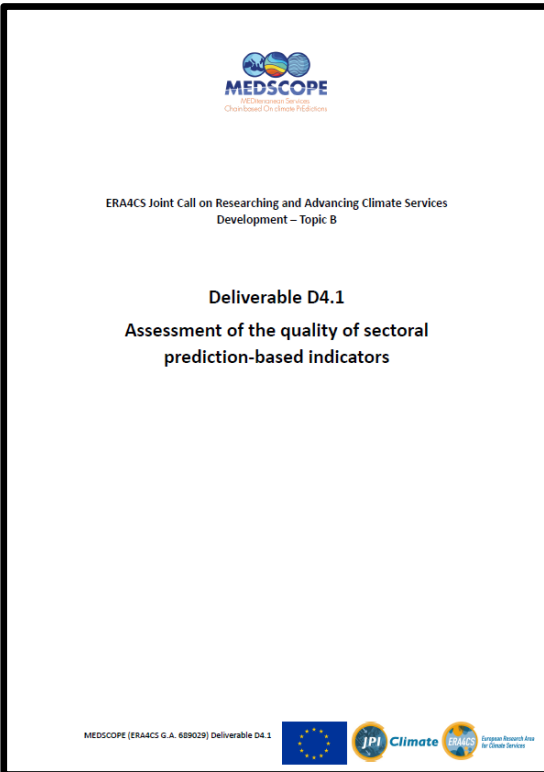
Table 1.-. Summary of the functions and methods by category. Prefix CST refers to functions working on a specific object class called s2dv_cube (from Perez-Zanón et al. 2021a).

- The package contains process-based state-of-the-art methods for loading and transformation requirements, forecast calibration, bias correction, statistical and stochastic downscaling, optimal forecast combination and multivariate verification, as well as basic and advanced tools to obtain tailored products.
- All functions are documented in a standard reference manual on the CRAN website (<https://CRAN.R-project.org/package=CStools>).
- The documentation also includes vignettes describing some of the methodologies included in CStools, as well as information on how to use the package to conduct specific analysis.
- Thanks to the toolbox design in individual functions, users can develop their own post-processing chain.

Climate services based on seasonal predictions for the Mediterranean

- A detailed description of all services developed during the project -including their evaluation is provided in deliverable D4.1 (available from <https://www.medscope-project.eu>)

- Co-production of Climate Services: A diversity of approaches and good practice from the ERA4CS projects (2017–2021). <https://doi.org/10.3384/9789179291990>



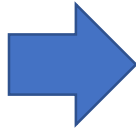
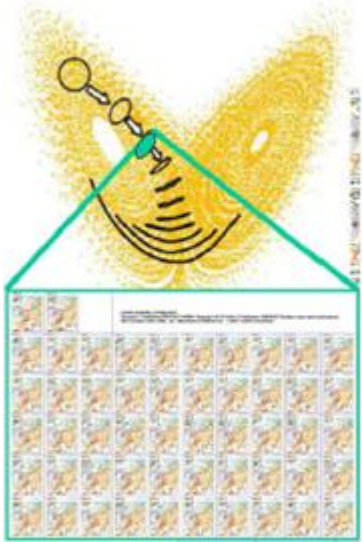
Pero el verdadero valor de la predicción estacional está en las aplicaciones sectoriales

Sectores como el energético, agrícola, hidrológico...trabajan en escalas de tiempo donde las informaciones respecto a probabilidades de determinados eventos pueden influenciar el proceso de toma de decisiones

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ECMWF S5

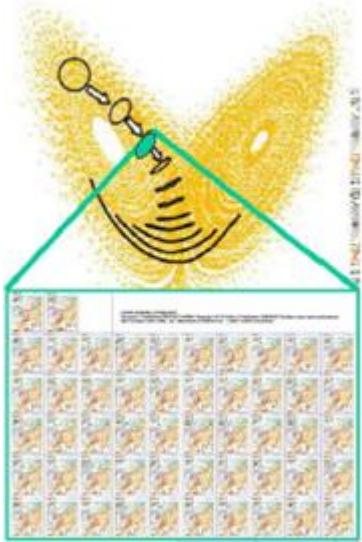


Partimos de modelos de predicción estacional

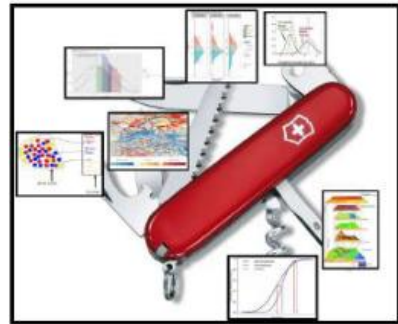
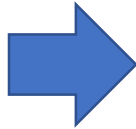
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ECMWF S5



Postproceso de las variables de interés (calibración, corrección, downscaling...)



Partimos de modelos de predicción estacional

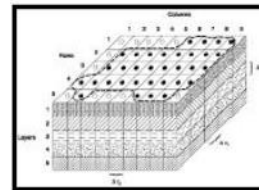
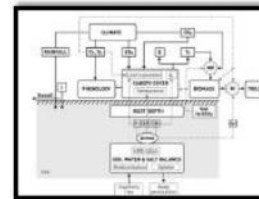
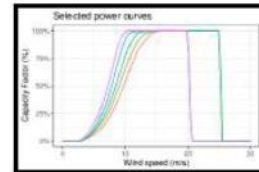
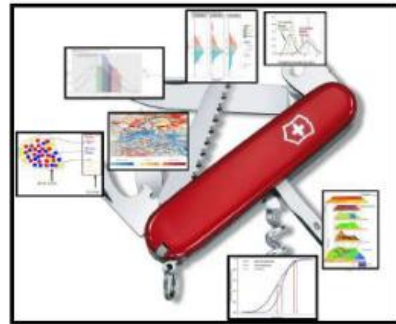
Pero el verdadero valor de la predicción estacional está en las aplicaciones sectoriales

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ECMWF S5



Postproceso de las variables de interés (calibración, corrección, downscaling...)



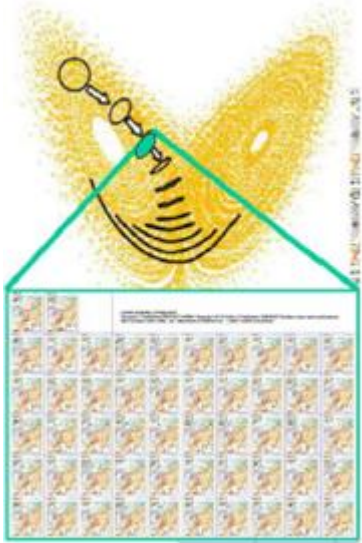
Partimos de modelos de predicción estacional

La información postprocesada de cada ejecución el modelo se introduce en un modelo de aplicación

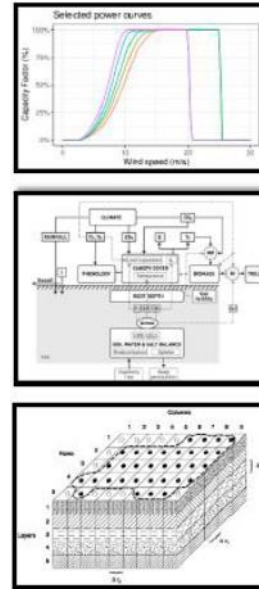
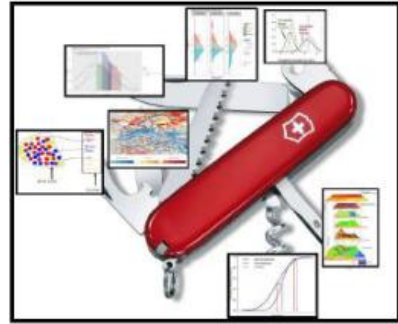
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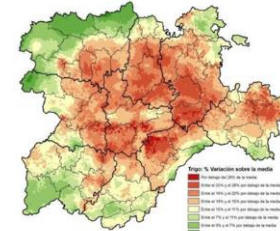
ECMWF S5



Postproceso de las variables de interés (calibración, corrección, downscaling...)



La salida del modelo de aplicación permite construir pronósticos probabilistas sobre variables sectoriales: rendimiento de un cultivo, aportaciones a un embalse...



Partimos de modelos de predicción estacional

La información postprocesada de cada ejecución el modelo se introduce en un modelo de aplicación

VIEWER



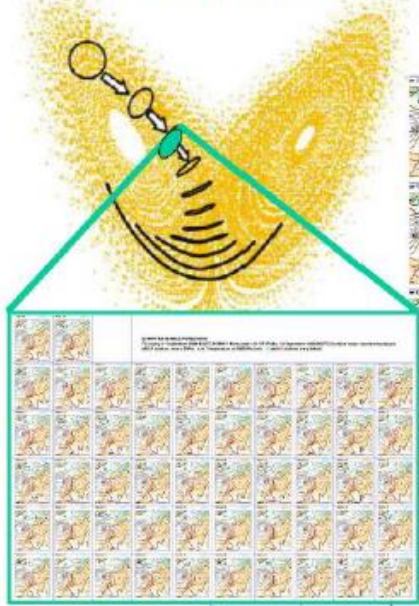
EVALUATION AT BELESAR RESERVOIR



BEST NAO weighting and combination

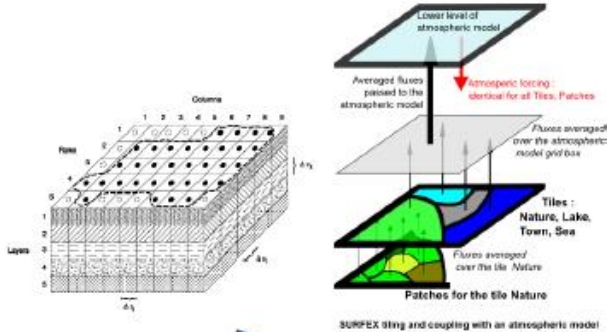
SIMPA SURFEX

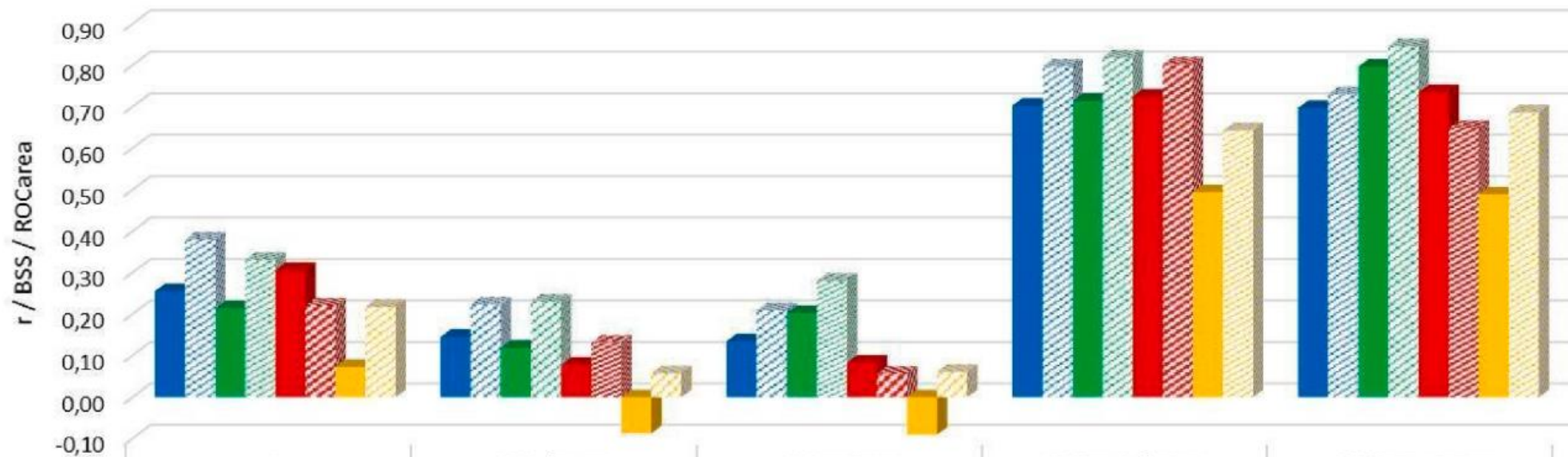
ECMWF S5



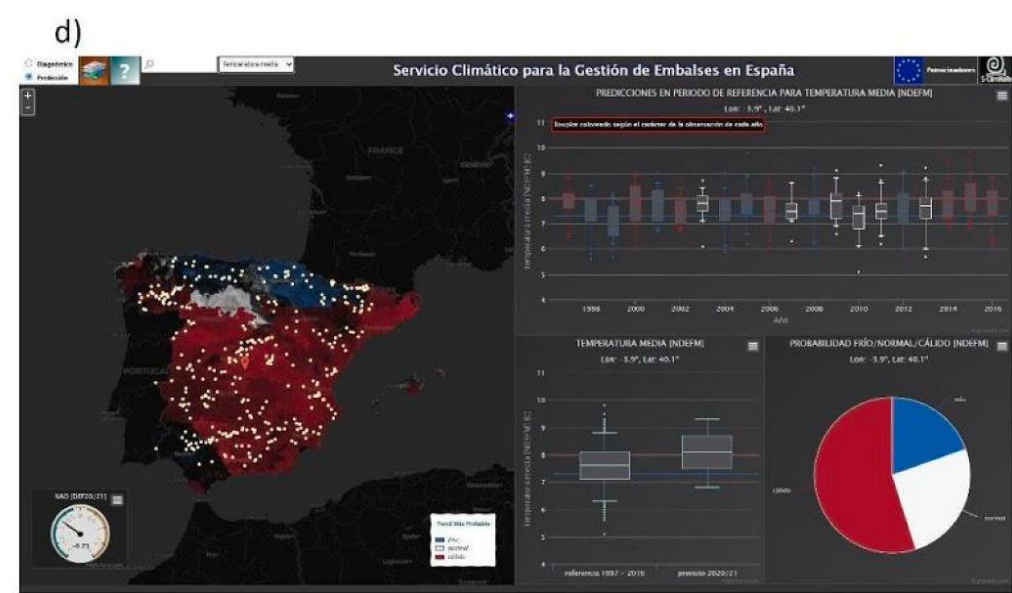
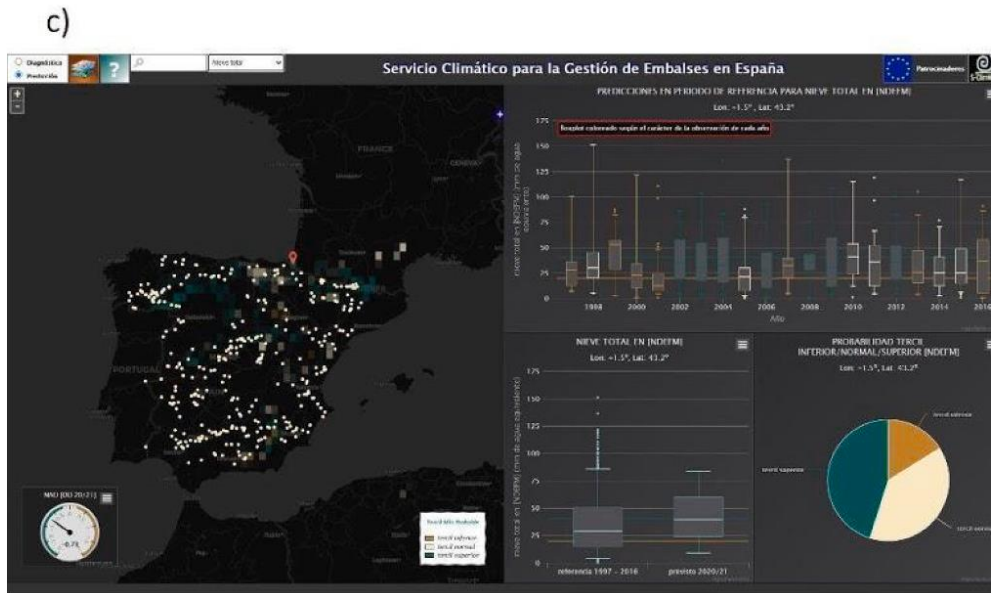
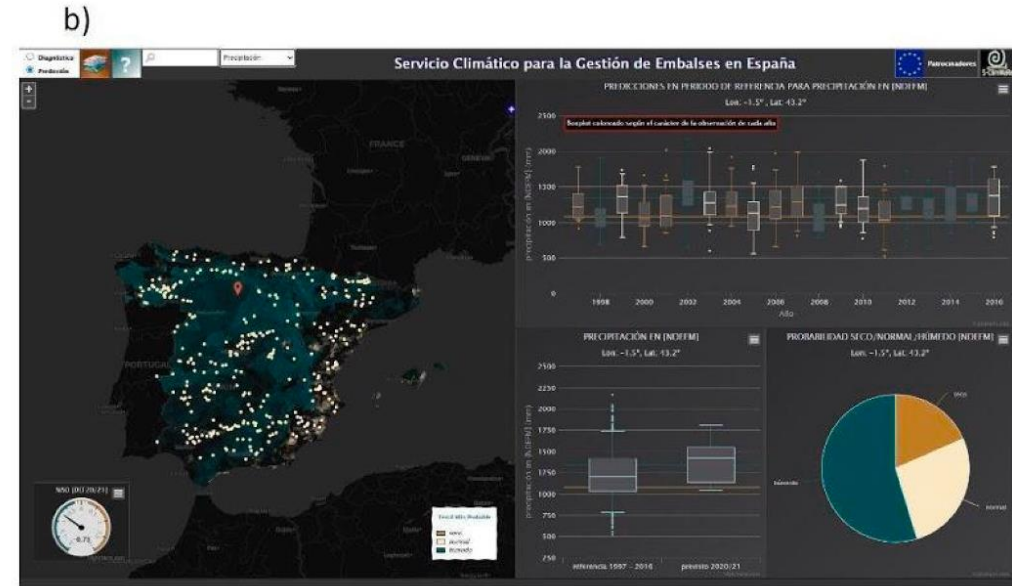
- **Domain of application:** All water reservoirs in Spain
- **Potential user(s):** dam managers
- **Decision making process:** Partition of water resources among main users: agriculture, energy, public supply

Downscaling based on ANALOGS





	r	BSS_lower	BSS_upper	ROCarea_lower	ROCarea_upper
■ SIMPA-EQ	0,26	0,15	0,13	0,70	0,70
▨ SIMPA-W	0,38	0,22	0,21	0,80	0,73
■ SURFEX-EQ	0,21	0,12	0,20	0,71	0,80
▨ SURFEX-W	0,33	0,23	0,28	0,82	0,85
■ SCLimWaRe	0,31	0,08	0,08	0,73	0,74
▨ SCLimWaRe-H	0,22	0,13	0,06	0,80	0,65
■ SEAS5-EQ	0,07	-0,09	-0,09	0,49	0,49
▨ SEAS5-W	0,22	0,06	0,06	0,64	0,69



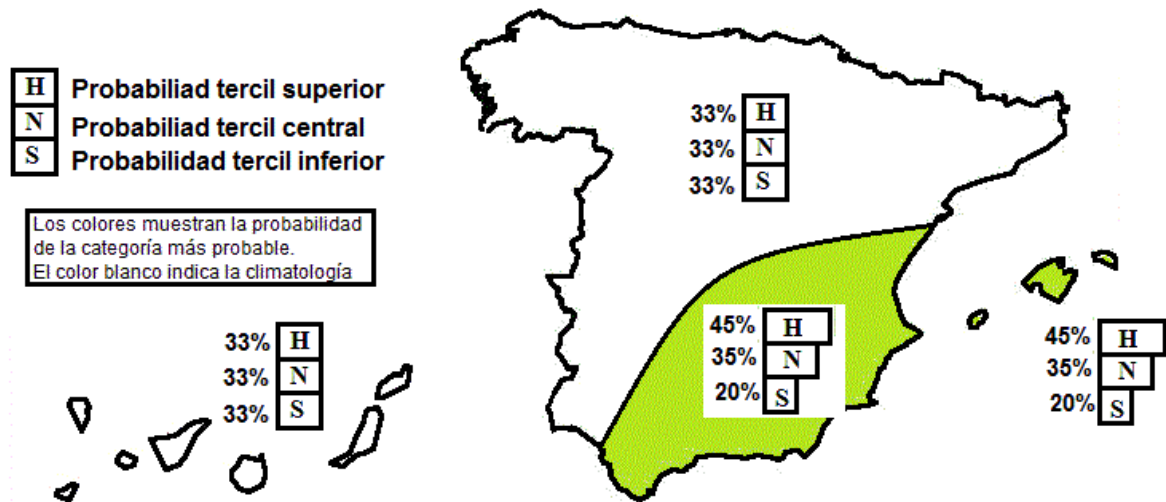
Overview of the forecasting displaying panels showing seasonal forecasts for November to March of accumulated water inflow (a), accumulated precipitation (b), accumulated snowfall (c) and mean temperature (d).

Co-design, co-develop, co-evaluacion

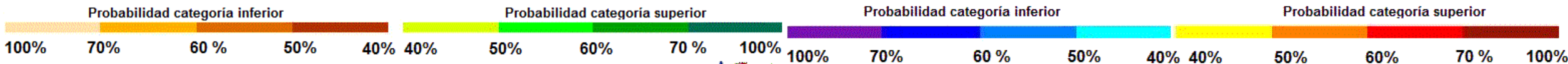
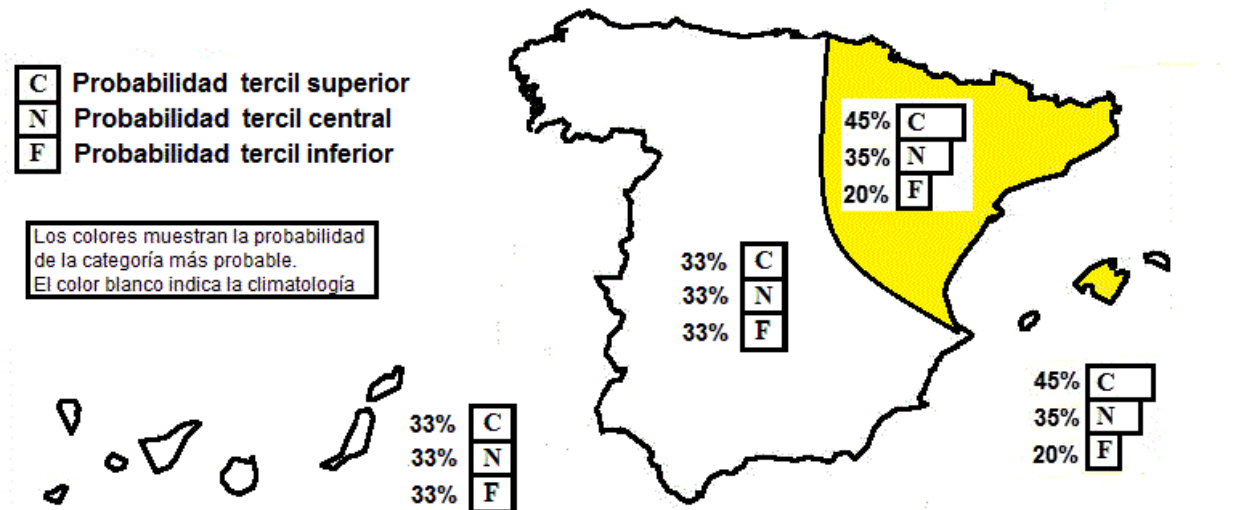


Recopilación de toda la información en boletines, discusión y elaboración de mapas de consenso

PROBABILIDAD DE LA CATEGORÍA MÁS PROBABLE DE PRECIPITACIÓN
SEPTIEMBRE OCTUBRE NOVIEMBRE 2018



PROBABILIDAD DE LA CATEGORÍA MÁS PROBABLE DE TEMPERATURA
SEPTIEMBRE OCTUBRE NOVIEMBRE 2018



Resumen

- La predicción estacional tiene necesariamente carácter probabilista, dándose en forma de probabilidades de ocurrencia de un determinado evento o anomalías frente a la climatología
- Los errores o BIAS de los modelos climáticos hacen necesaria la generación de repredicciones o hindcast para elaborar una climatología de referencia y evaluar la pericia de los modelos
- La información de predicción estacional tiene especial interés en determinados sectores, en los que puede condicionar la estrategia o toma de decisiones. Incluso predicciones poco definidas pueden tener valor económico si la relación entre el coste de prevención y el de pérdida es razonable.
- Tradicionalmente la predicción estacional se elabora mediante un proceso de consenso, en el que se analiza y se discute información de todas las fuentes disponibles. La WMO está liderando un proceso por el que se pretende cambiar a una metodología objetiva, que permita generar índices objetivos de verificación y acoplar aplicaciones y modelos de impacto, permitiendo producir productos sectoriales a partir de una predicción que incorpora la información de los modelos y el conocimiento experto.