AEMet
Agencia Estatal de Meteorología

WMO Northern Africa RCC Network

WMO RA VI RCC Network

MedCOF Mediterranean Climate Outlook Forum

WMO OMM

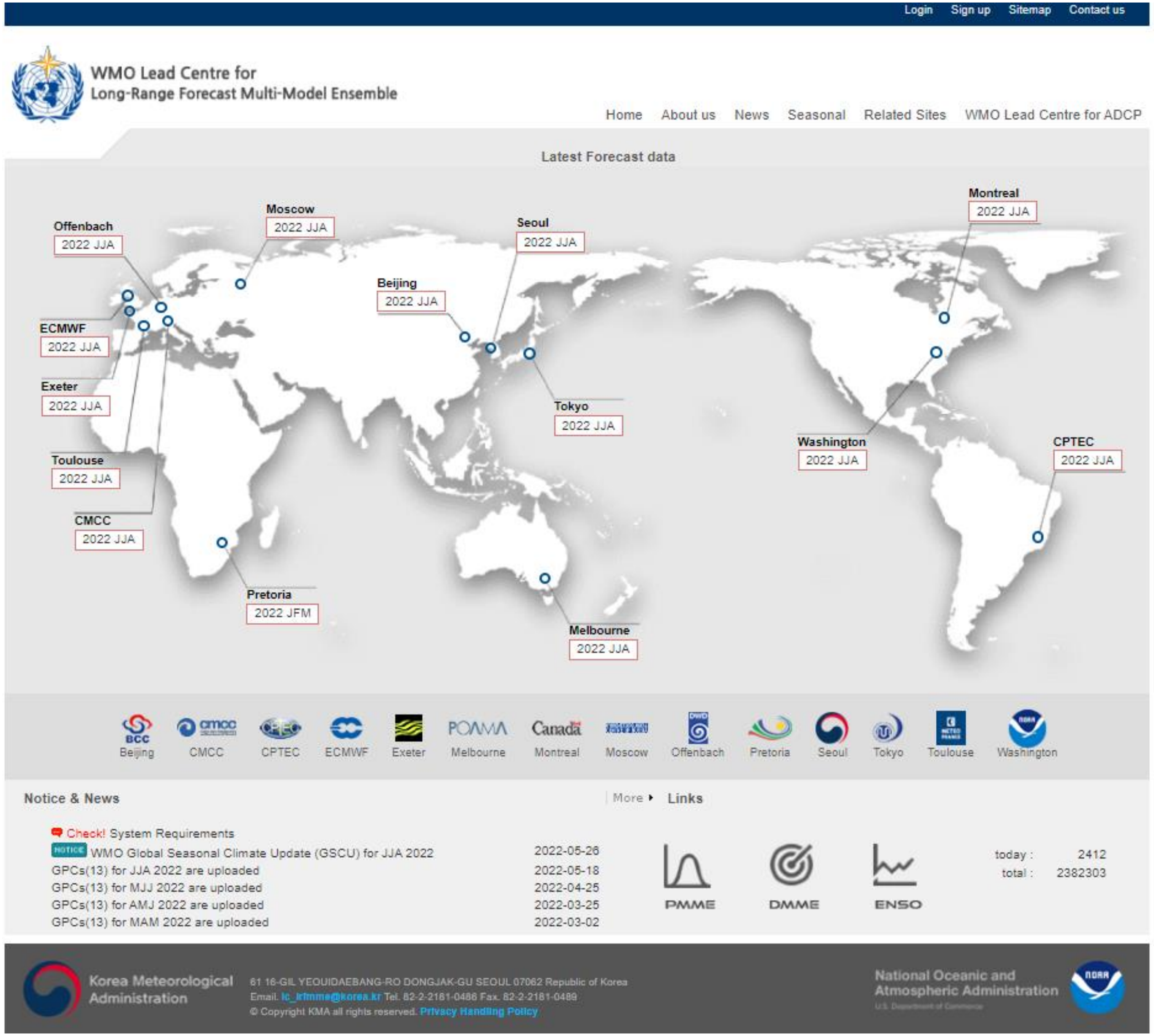
MEDSCOPE

MedCOF training Workshop in OSF:
Additional sources of seasonal climate information

Overview:

-WMO Lead Centre for Long Range forecasting
-Mediterranean Seasonal Climate update
-IRI seasonal forecast resources
-Empirical forecasts

https://wmolc.org/



https://wmolc.org/

https://wmolc.org/

Global Seasonal climate Update

Summary

During February-April 2022, all four Pacific Niño sea-surface temperature (SST) indices in the central and eastern Pacific were below-normal. The observed SST conditions in the equatorial Pacific were characterized by a weak La Niña state. The Indian Ocean Dipole (IOD) over the observed period was weakly negative. The North Tropical Atlantic (NTA) SST index was near-zero, and the South Tropical Atlantic (STA) SST index was positive.

For the June-August 2022 season, below-normal sea-surface temperature anomalies in the Niño 3.4 and Niño 3 regions with values of approximately -0.5° C (Niño 3.4) and -0.5° C (Niño 3) are predicted indicating a return toward near-normal conditions.

Although a tendency towards near-normal ENSO conditions is predicted for the equatorial central and eastern Pacific, negative sea-surface temperature anomalies are still expected through much of this region. The widespread warmer-than-average sea-surface temperatures elsewhere are predicted to dominate the forecast of air temperatures for June-August 2022, although the extent and strength of predicted warming is less than during March-May 2022. Positive temperature anomalies are expected over most of the land areas in the Northern Hemisphere, with the exceptions being a band running from southern Central America and Caribbean, through the Sahelian belt, the southern Arabian Peninsula, and the Indian subcontinent. Of these exceptions, it is only over part of the Indian subcontinent where below normal temperatures are predicted with high probability and model-to-model consistency. The largest land air-temperature anomalies are expected over the far northern and north-eastern parts of Asia at around 90 °E, and in patchy areas at about 40 °N including parts of North America, through much of Europe, and small areas in south-western, central and eastern Asia extending far to the east of Japan. The probabilities for above-normal temperatures are most increased immediately to the northeast of the Indian subcontinent, to the east of Japan, and over much of southeast Asia and the Maritime continent, but model-to-model consistency in predictions of positive temperature anomalies is high over most of the Northern Hemisphere landmasses. Exceptions include the Indian subcontinent, the southern half of the Arabian Peninsula, Africa south of about 20 °N, and the northern part of South America extending along the Pacific coast of North America. In the Southern Hemisphere, positive temperature anomalies are predicted over the southern Maritime continent, extending to the southeast as far as about 90 °W. There is also a fork of predicted positive temperature anomalies that extends over New Zealand and Tasmania. Probability for above-normal

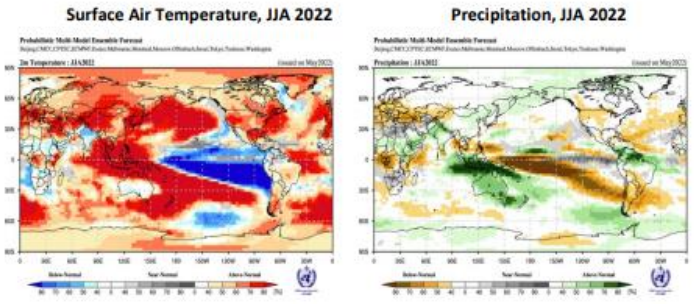


Figure 1. Probabilistic forecasts of surface air temperature and precipitation for the season June-August 2022. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal and near-normal is depicted in blue, red and grey shadings respectively for temperature, and orange, green and grey shadings respectively for precipitation. White areas indicate equal chances for all categories in both cases. The baseline period is 1993-2009.

1. Observations: February-April 2022

In the following sections, observed temperature and precipitation patterns for the previous season are briefly discussed. For more detailed information about regional and local climate anomalies, the reader is referred to the concerned WMO Regional Climate Centres (RCCs) or RCC Networks, listed in Section 5.

1.1 Large-scale sea surface temperature (SST) indices

During February-April 2022, all four Pacific Niño sea-surface temperature (SST) indices in the central and eastern Pacific were below-normal. The observed SST conditions in the equatorial Pacific were characterized by a weak La Niña state. The Indian Ocean Dipole (IOD) over the observed period was weakly negative. The North Tropical Atlantic (NTA) SST index was near-zero, and the South Tropical Atlantic (STA) SST index was positive.

Month	Niño 1+2	Niño 3	Niño 4	Niño 3.4	IOD	NTA	STA
February 2022	-1.4	-1.1	-0.2	-0.7	-0.4	0.5	0.7
March 2022	-0.7	-0.7	-0.7	0.9	-0.1	0.1	0.4
April 2022	-1.4	-0.9	-0.7	-1.0	-0.4	0.1	0.3
February-April 2022	-1.2	-0.9	-0.5	-0.3	-0.3	0.2	0.5

Table 1. Large-scale oceanic indices (°C). Anomalies are with respect to the 1981-2010 average. (Source: U.S. Climate Prediction Center)

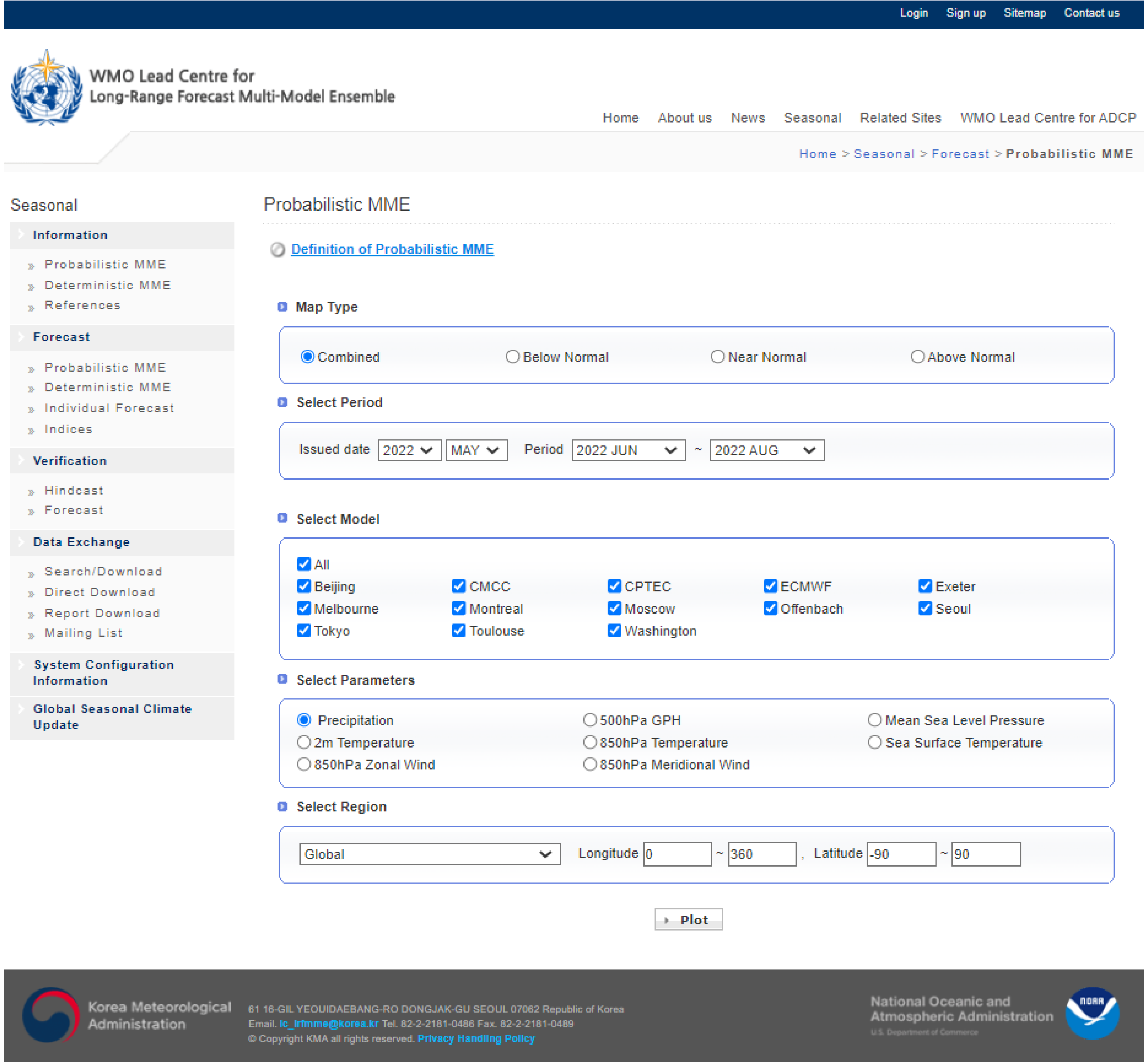
2. Potential evolution of the state of the climate over the next three months (June-August 2022)

2.1 Large-scale SST-based indices, June-August 2022

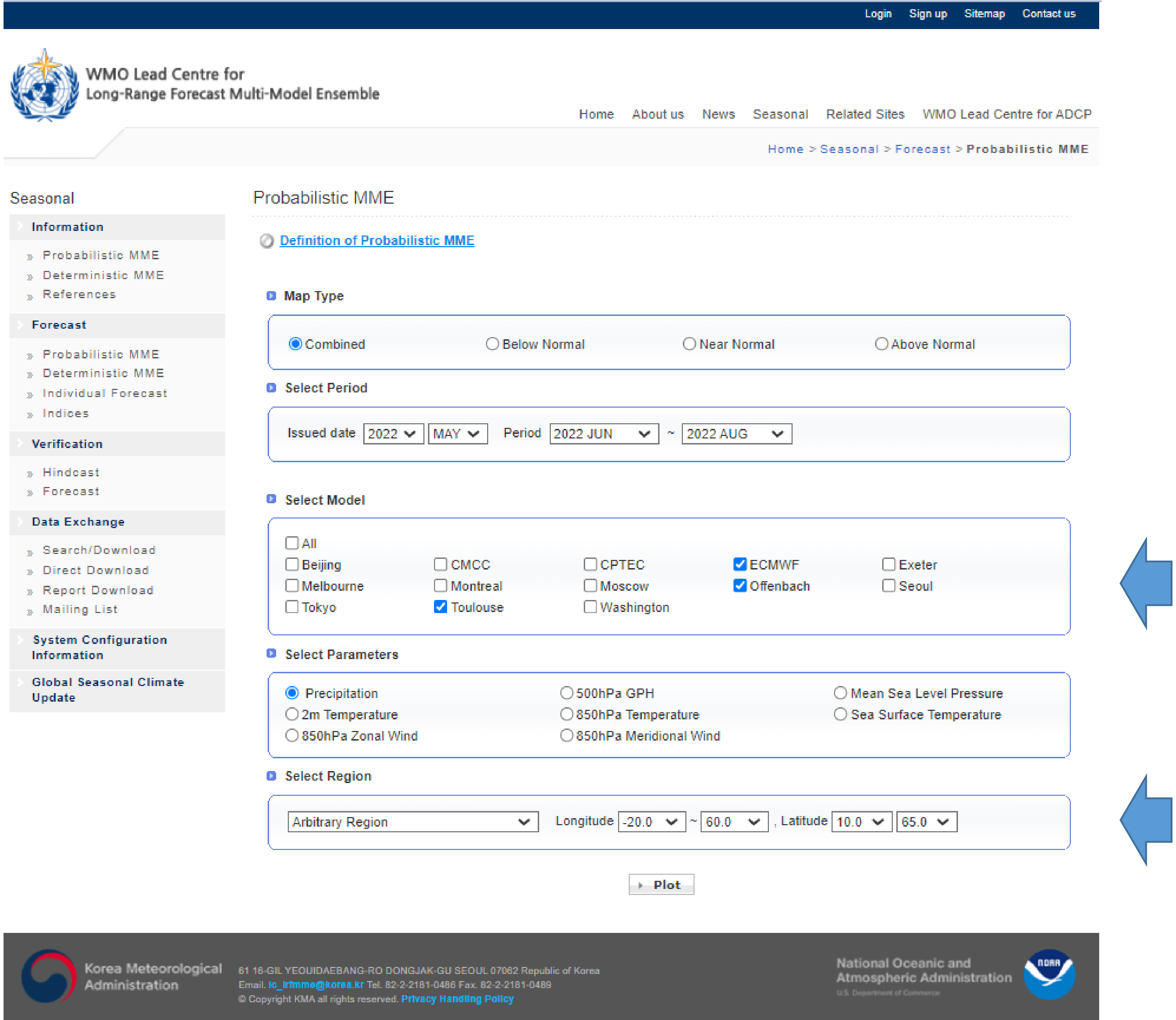
Month	Nino 1+2	Nino 3	Nino 4	Nino3.4	IOD	NTA	STA
June 2022	-0.9±0.3	-0.5±0.2	-0.7±0.3	-0.7±0.2	-0.8±0.2	0.1±0.1	0.0±0.1
July 2022	-0.8±0.3	-0.4±0.2	-0.7±0.3	-0.5±0.2	-1.1±0.3	0.2±0.1	0.0±0.1
August 2022	-0.7±0.3	-0.4±0.2	-0.6±0.3	-0.5±0.3	-1.3±0.4	0.2±0.1	0.0±0.1
June-August 2022	-0.8±0.3	-0.4±0.2	-0.7±0.3	-0.5±0.2	-1.1±0.4	0.2±0.1	0.0±0.1

https://wmolc.org/

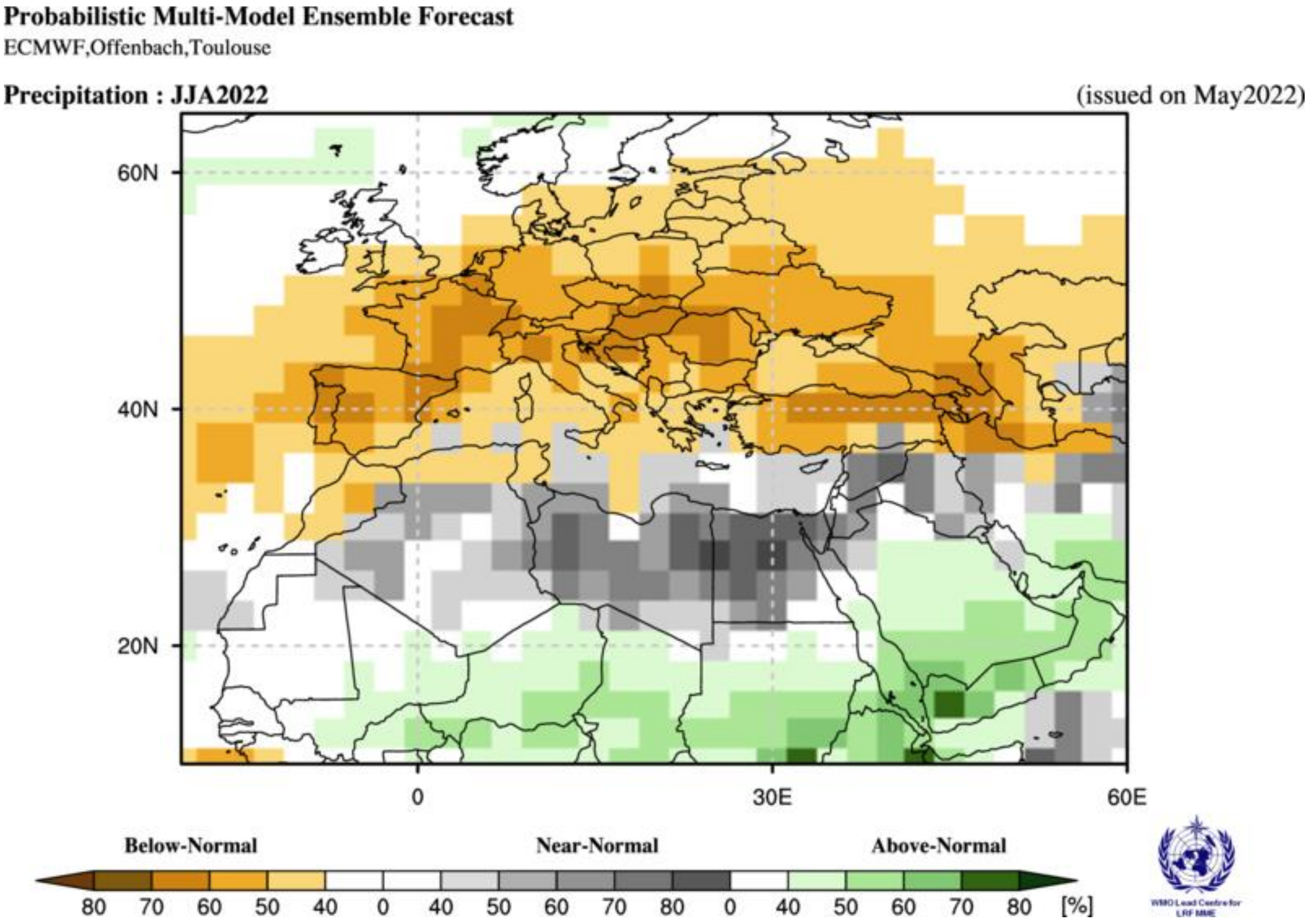
PMME (Probabilistic MultiModel Ensemble)



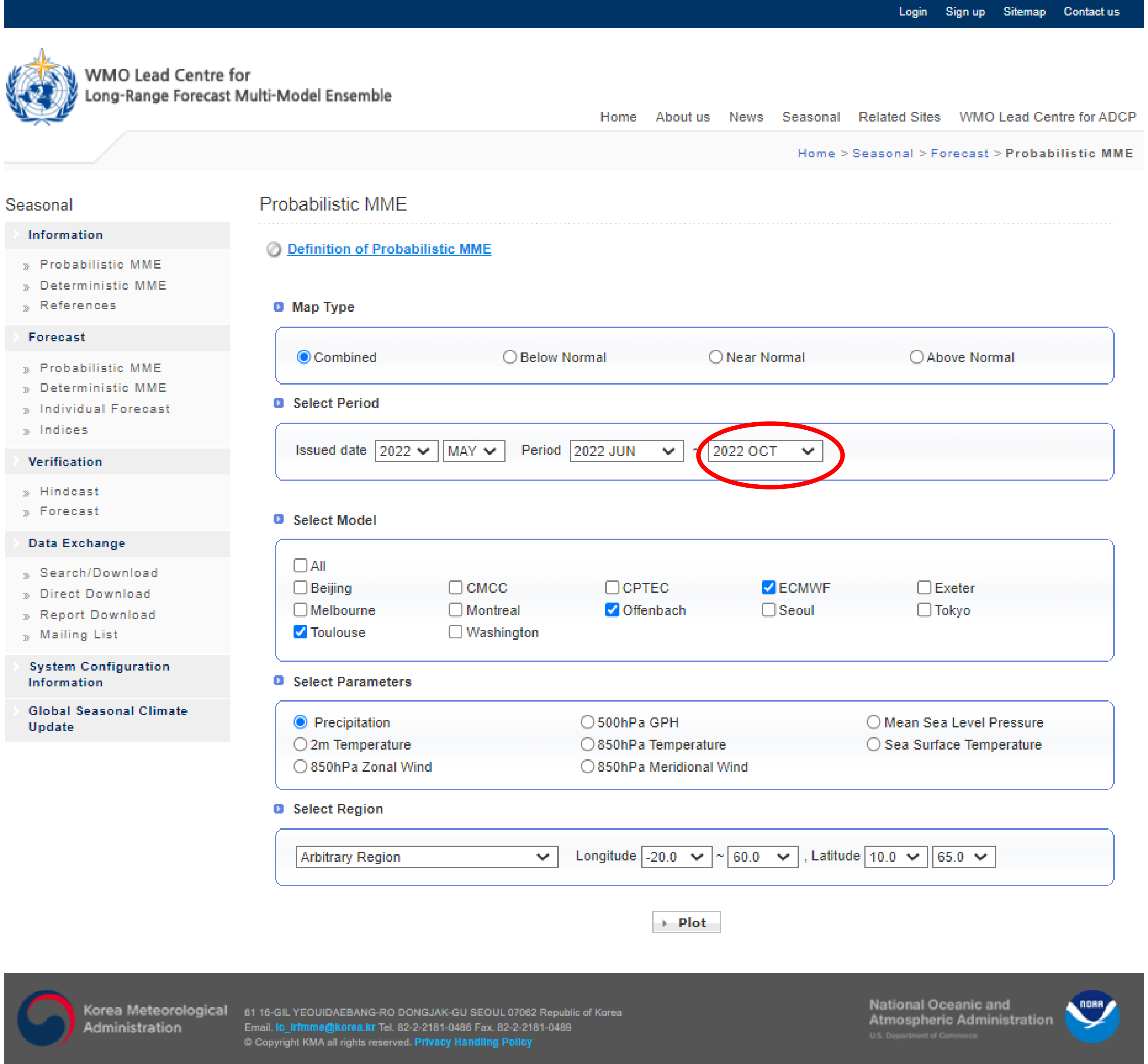
PMME (Probabilistic MultiModel Ensemble)



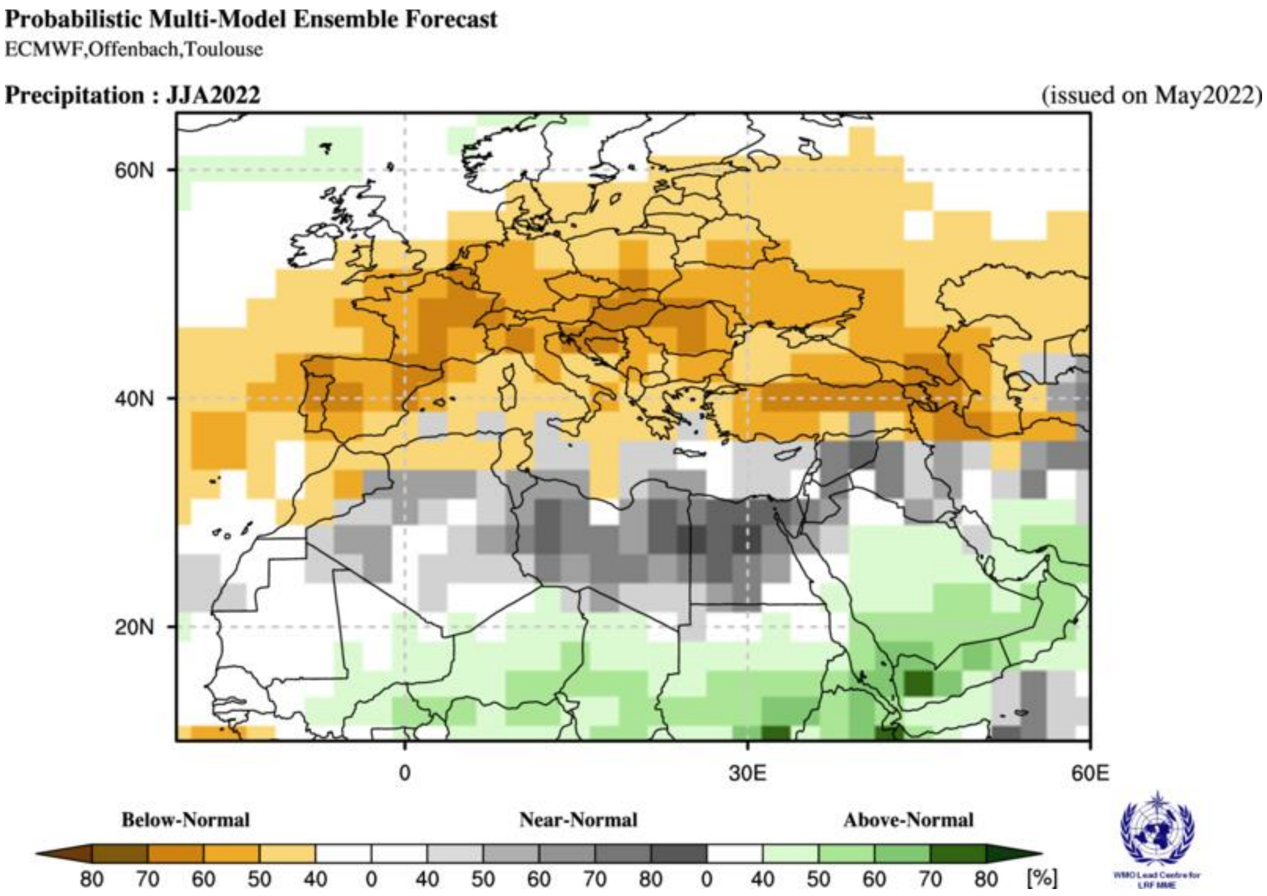
PMME (Probabilistic MultiModel Ensemble)

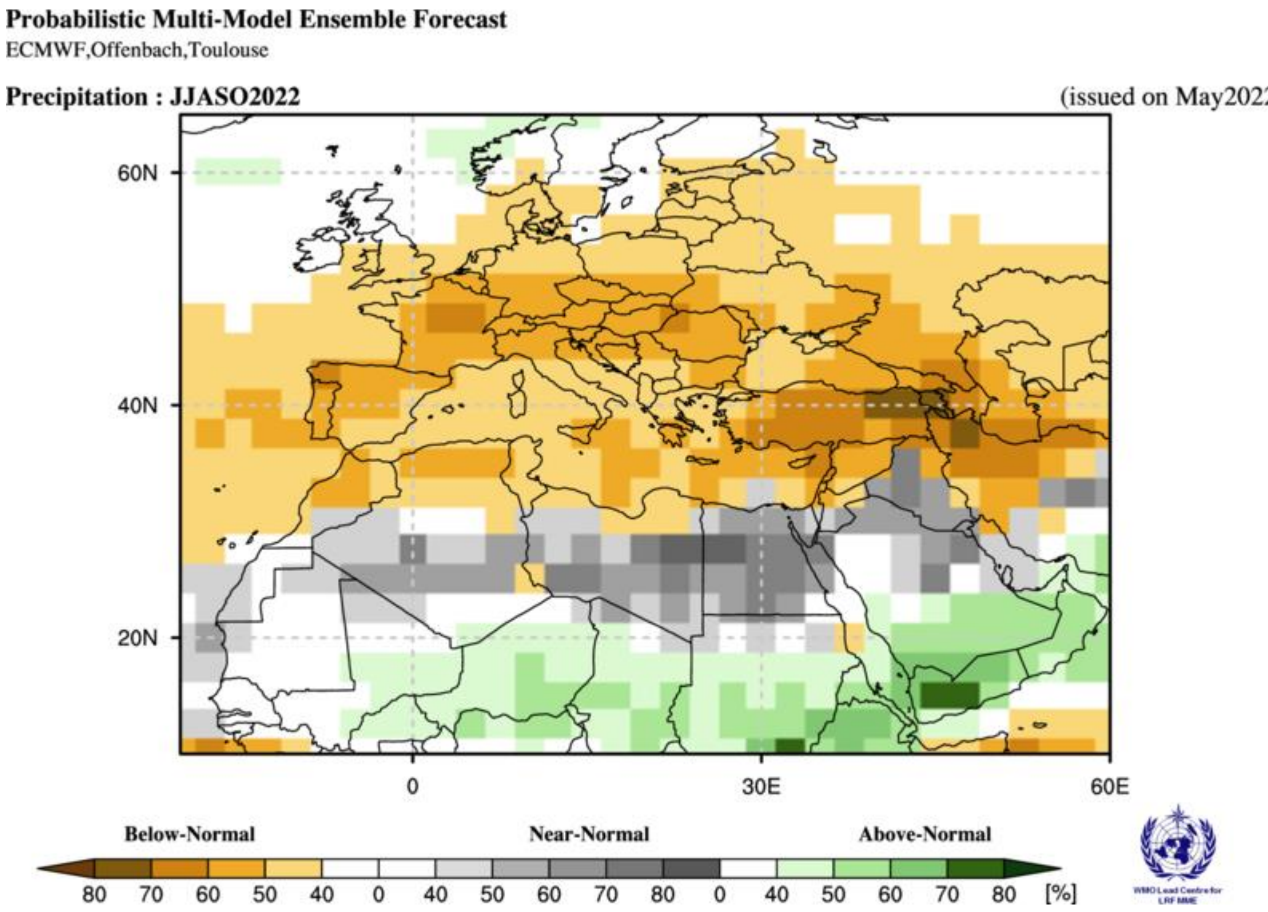


PMME (Probabilistic MultiModel Ensemble)

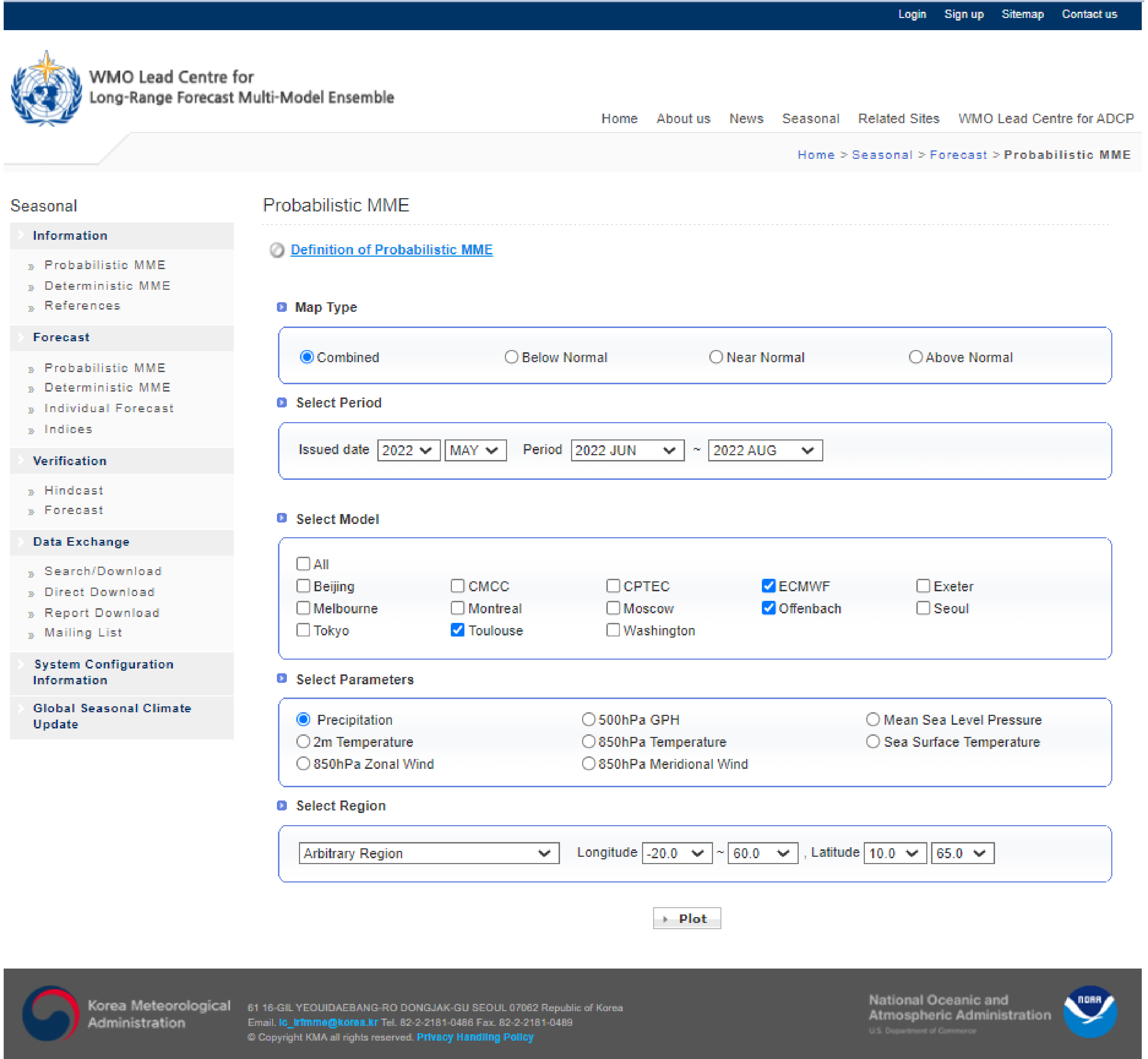


PMME (Probabilistic MultiModel Ensemble)

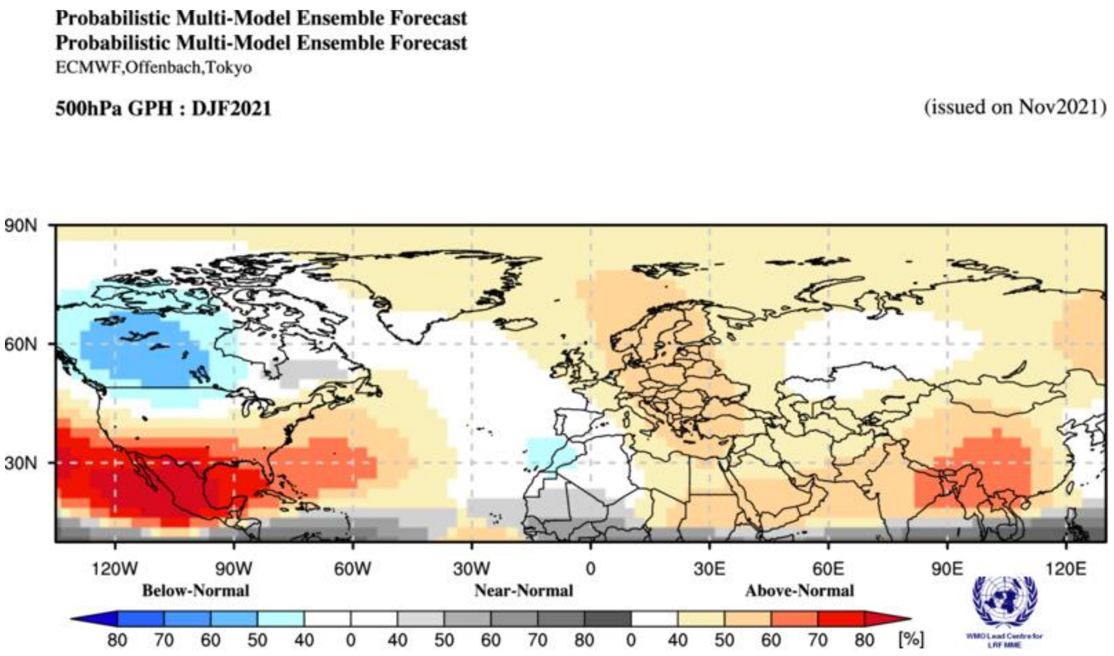


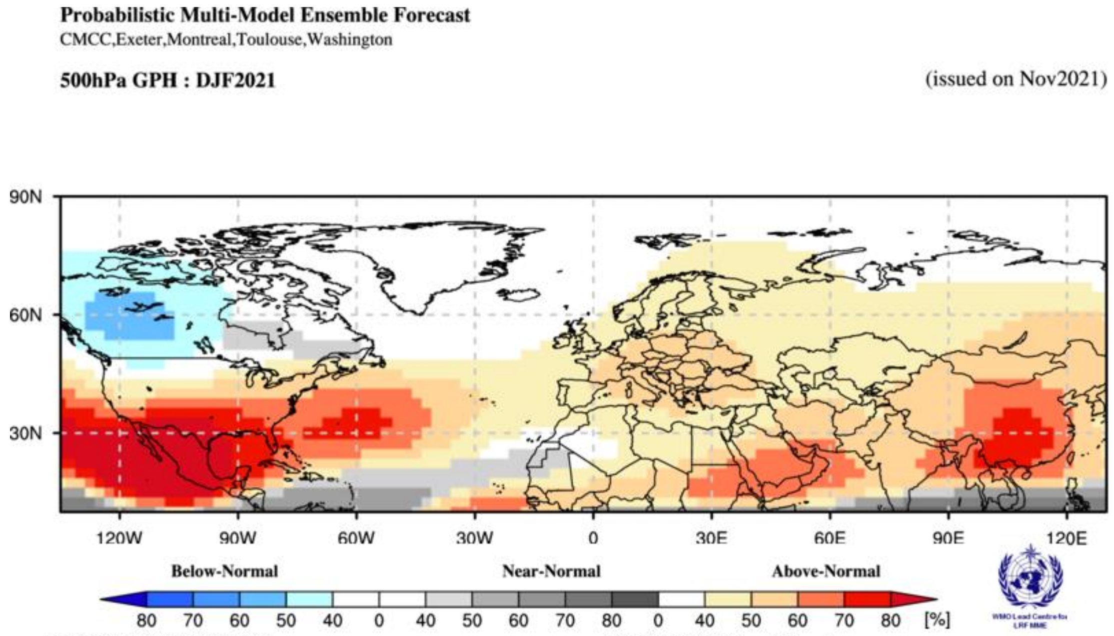


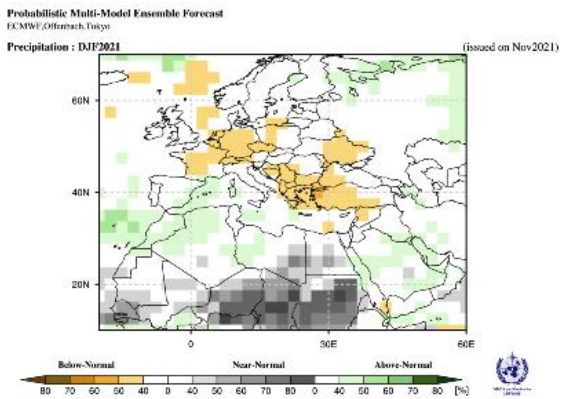
PMME (Probabilistic MultiModel Ensemble)

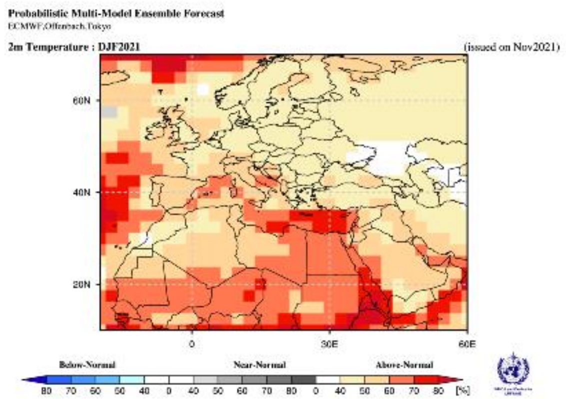


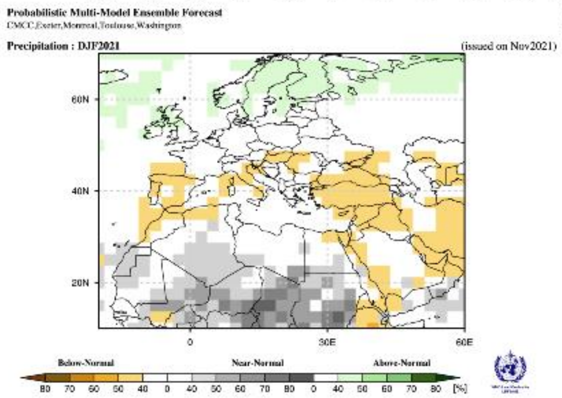
Grouping models by two different scenarios

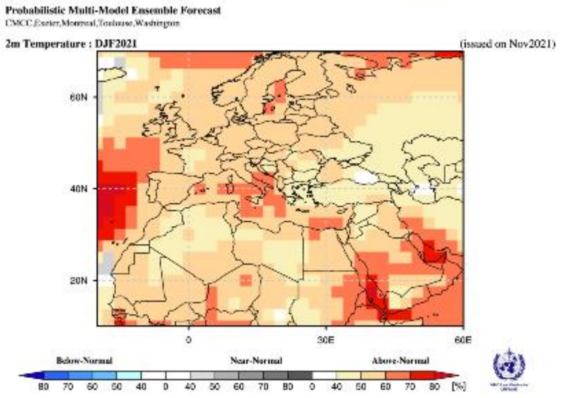




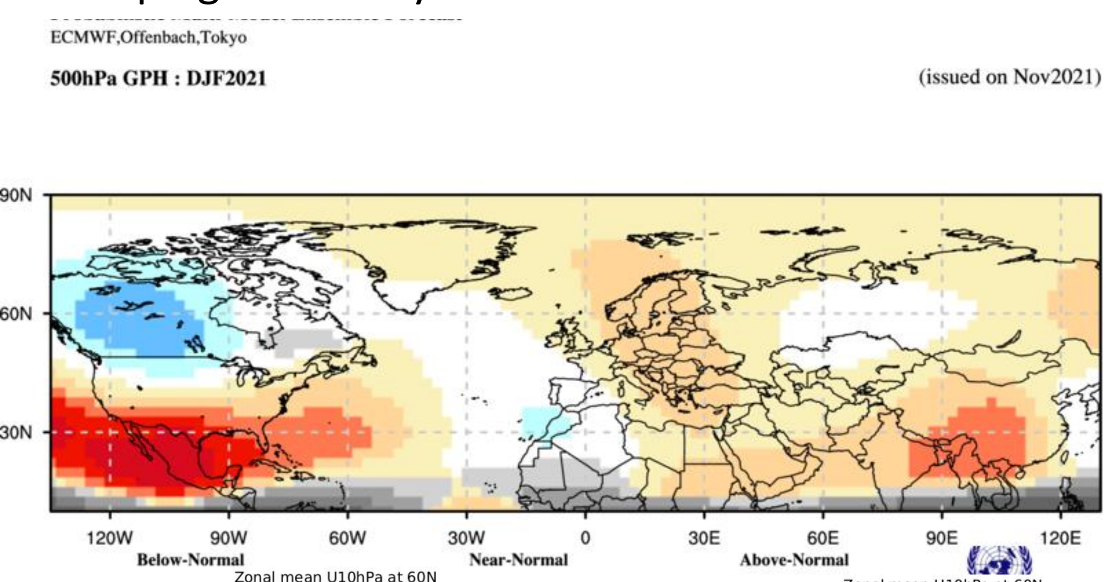


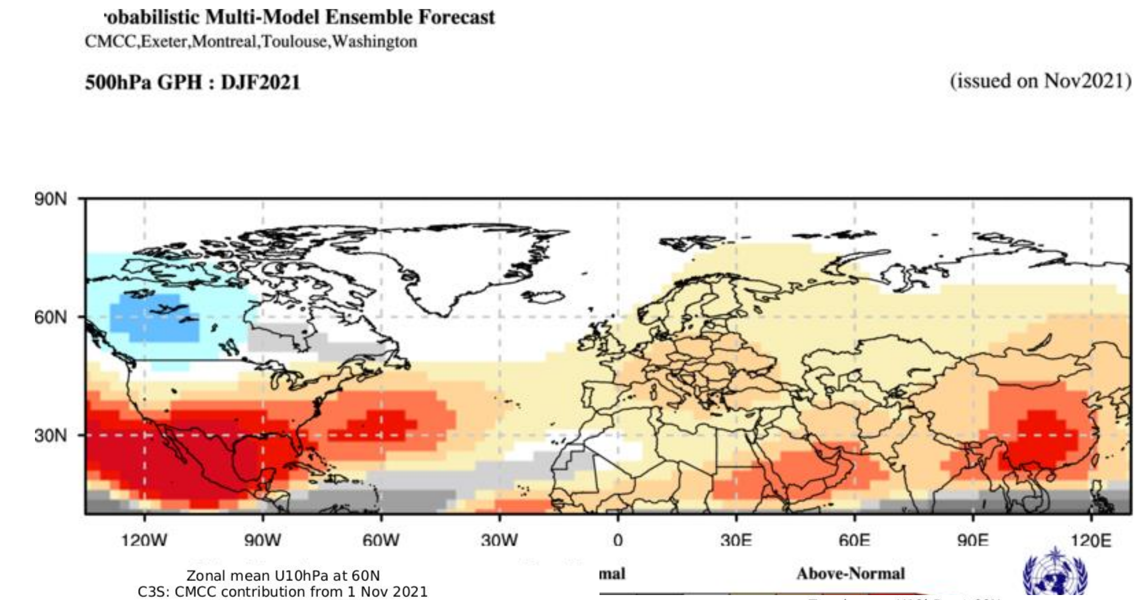


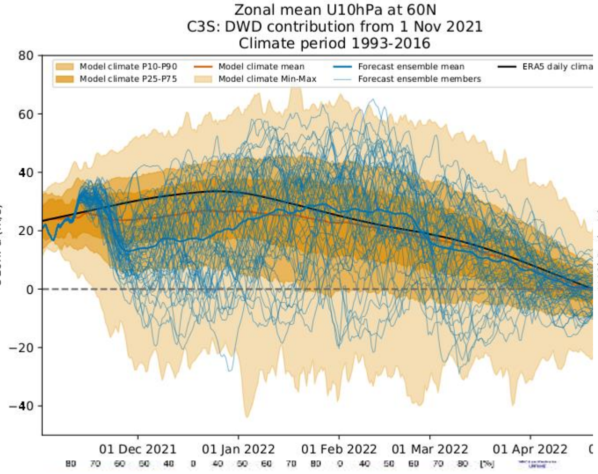


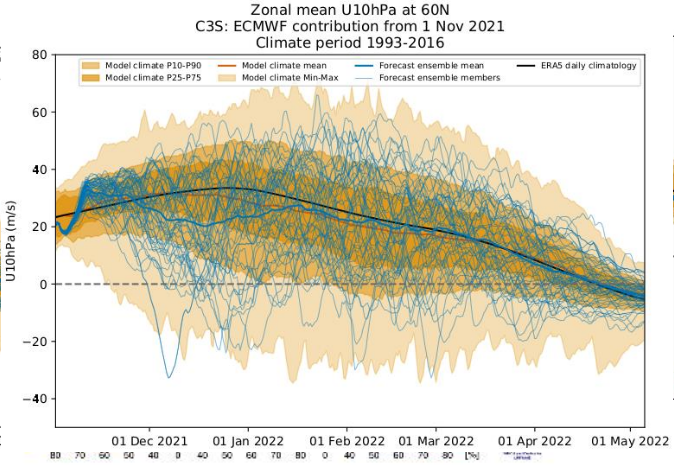


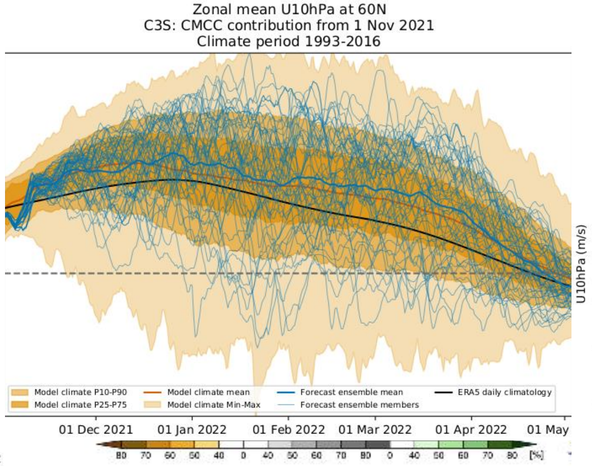
Grouping models by two different scenarios

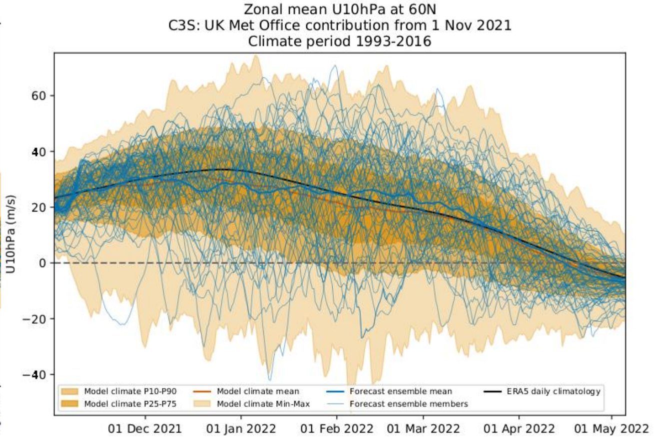




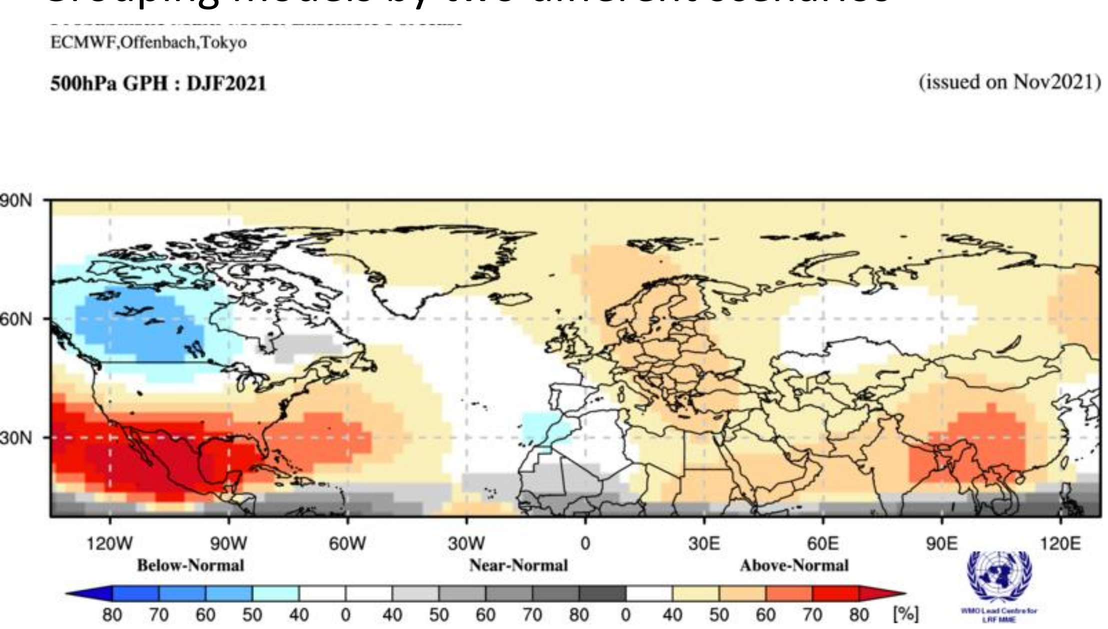


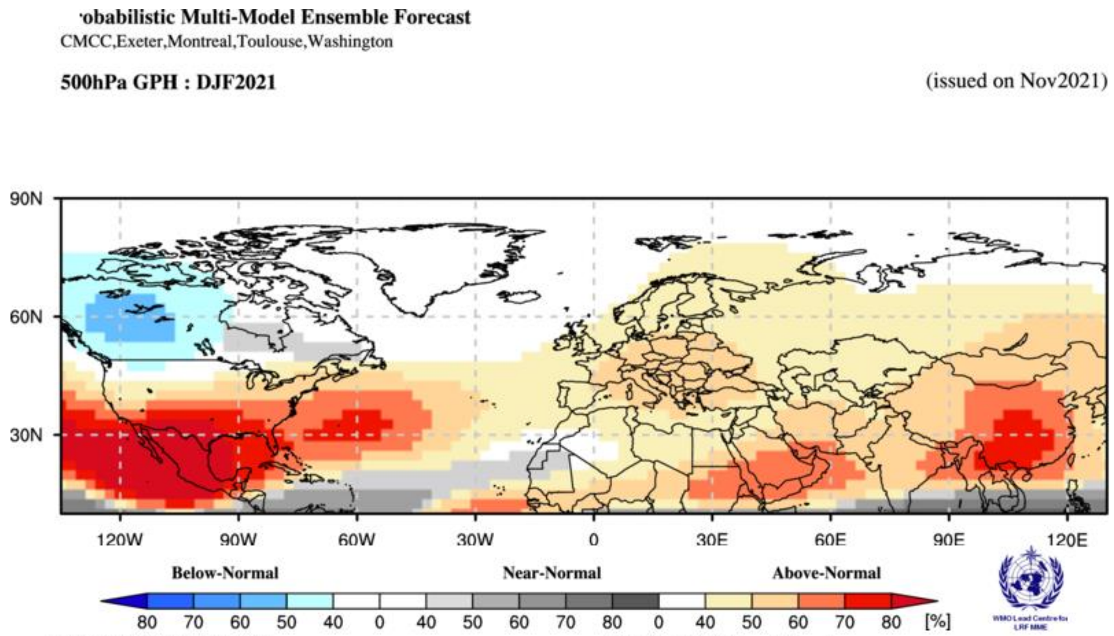


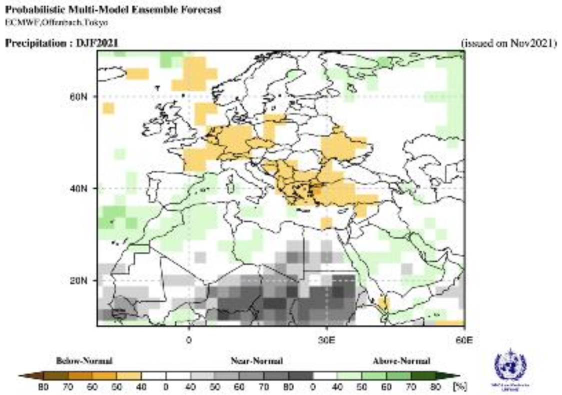


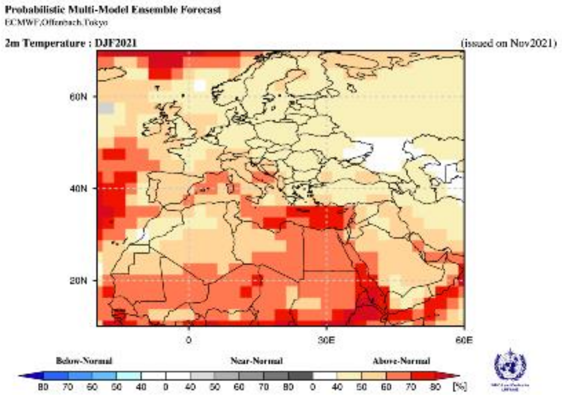


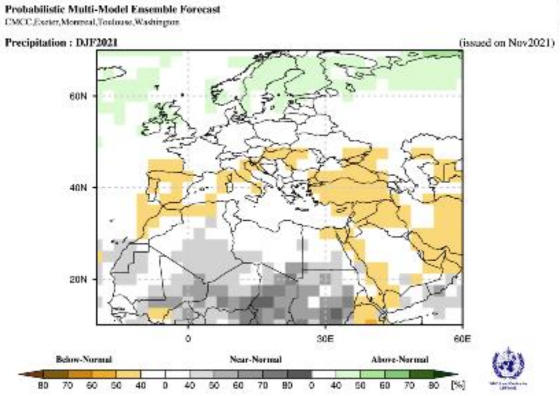
Grouping models by two different scenarios

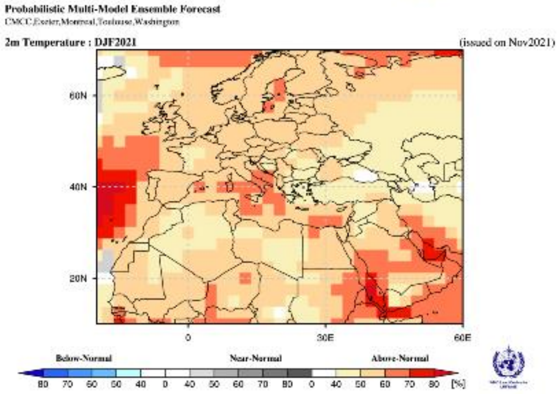




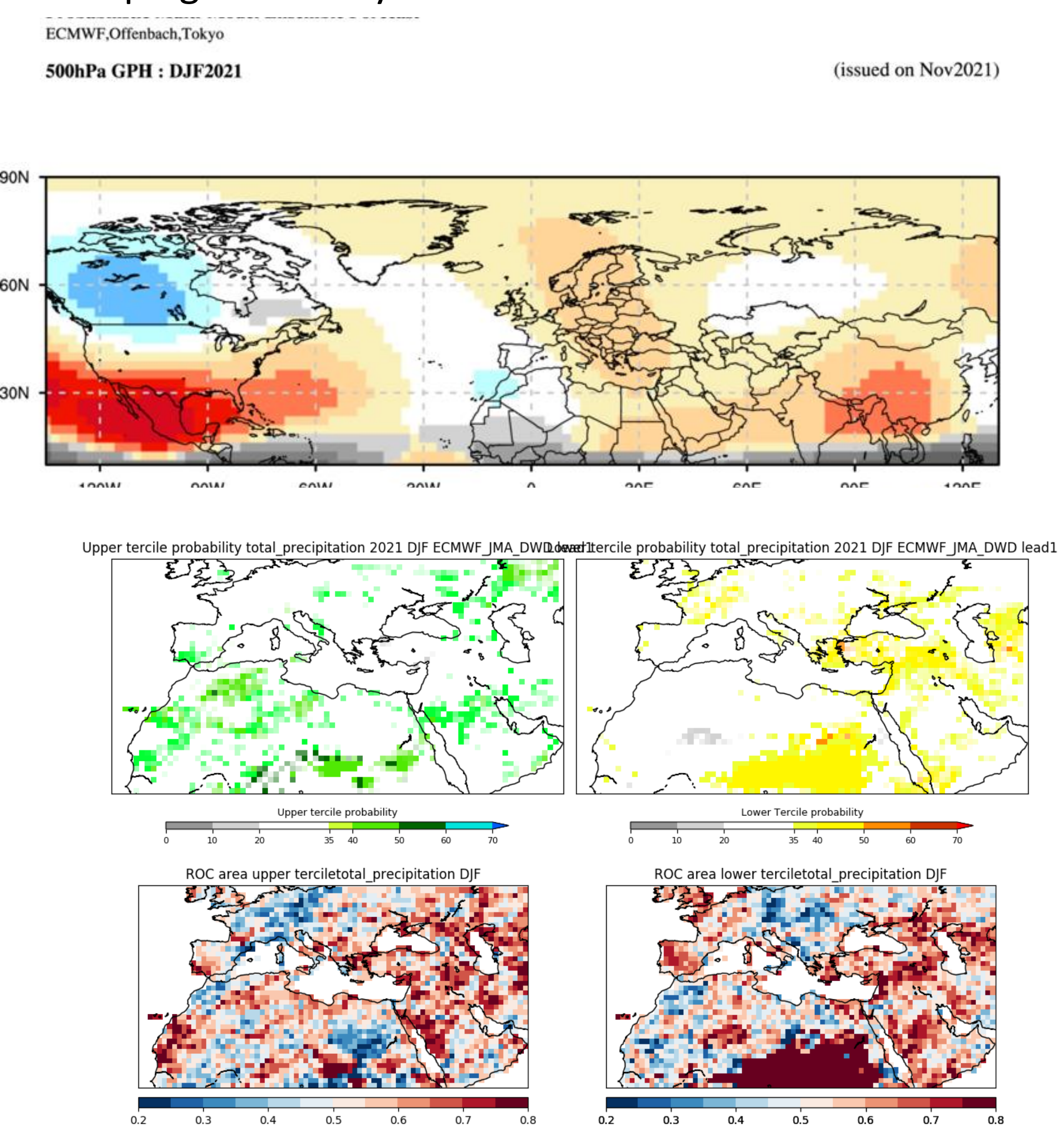


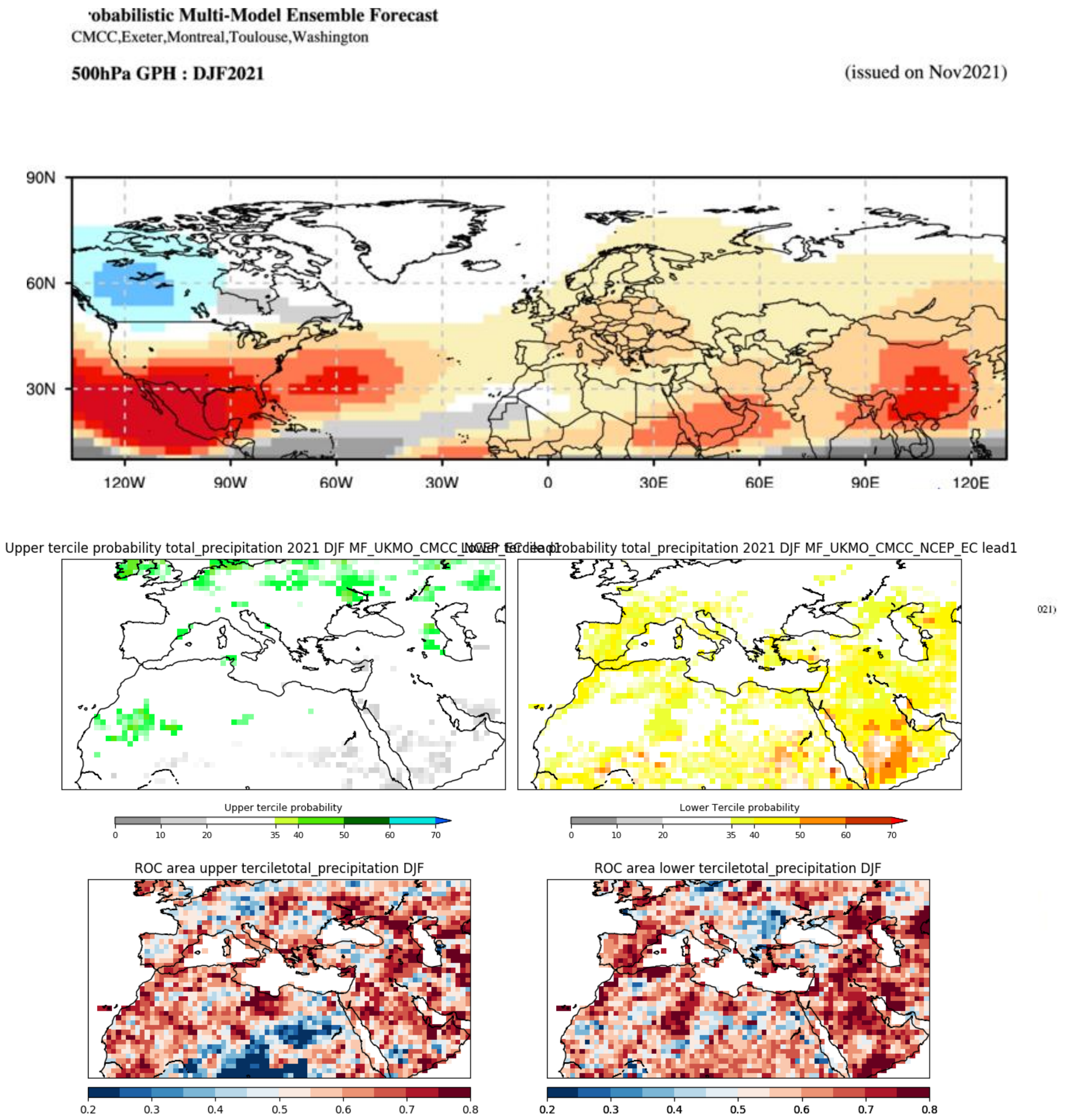






Grouping models by two different scenarios

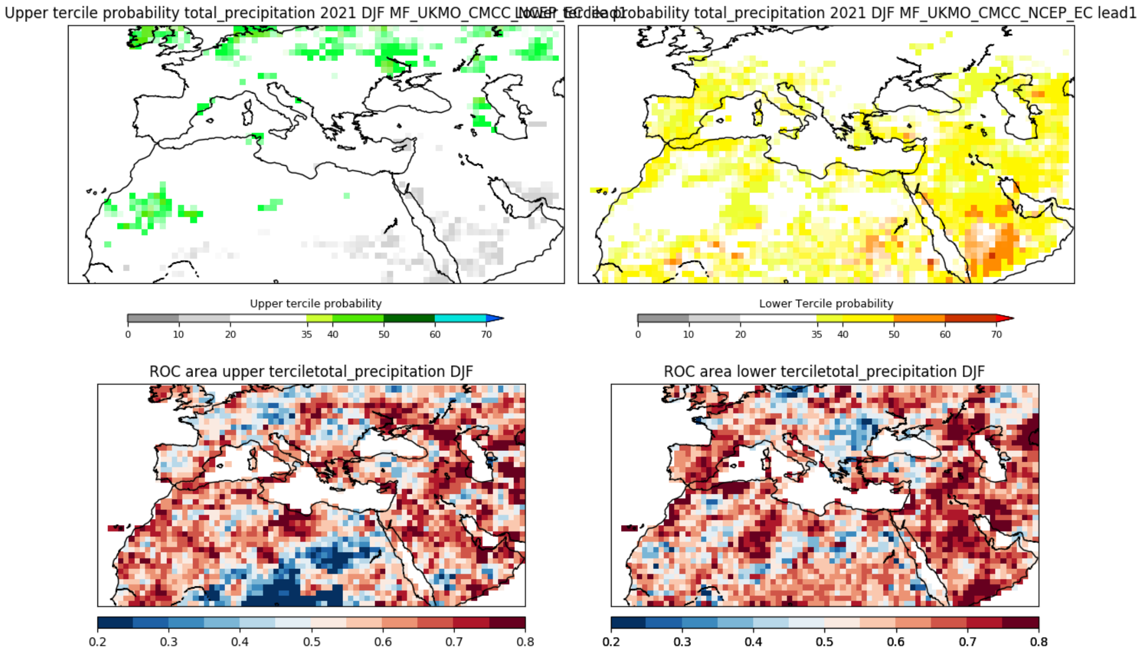




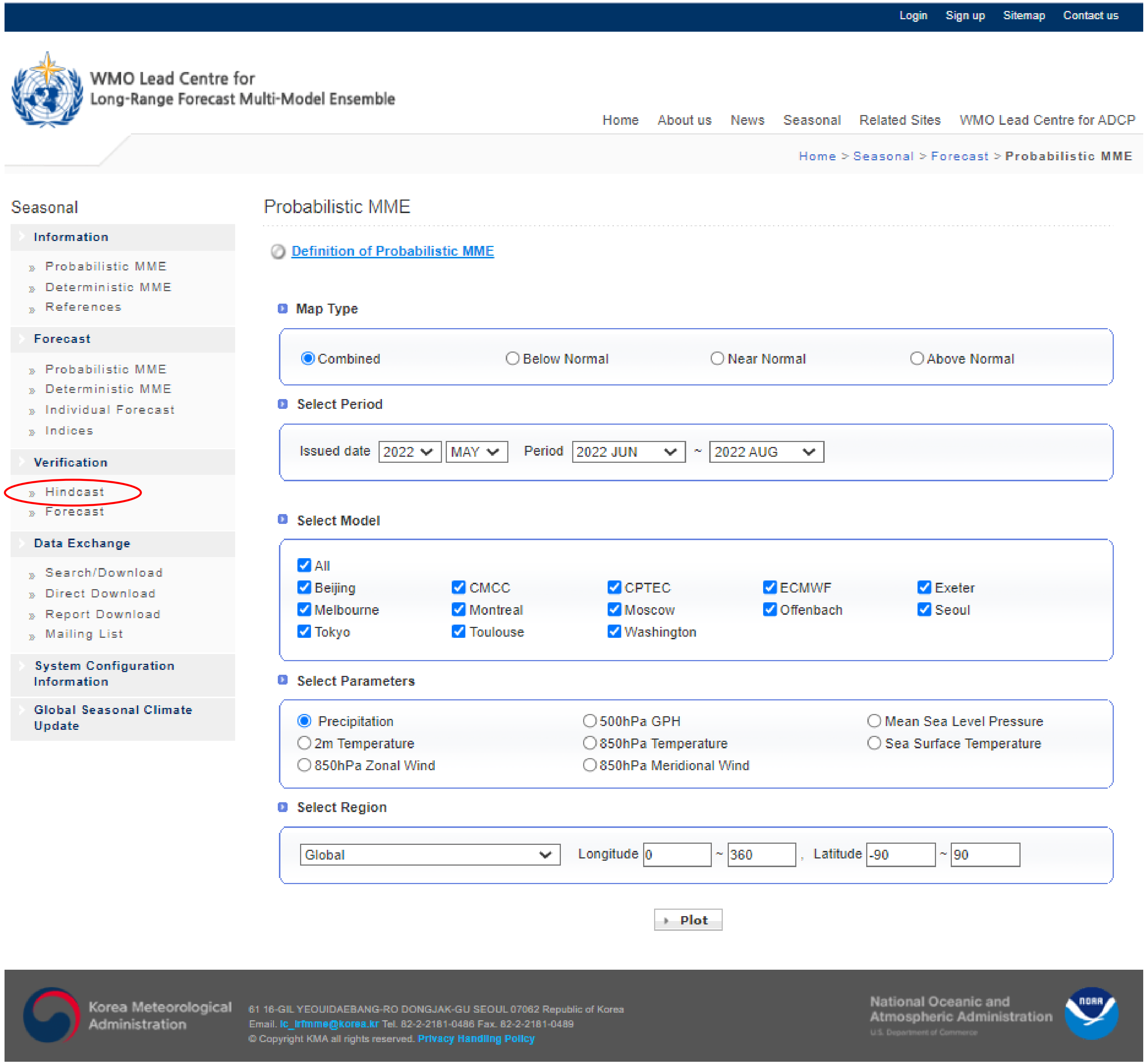
Importance of verification:

Guidance on Operational Practices
for Objective Seasonal Forecasting, chapter 4.9:

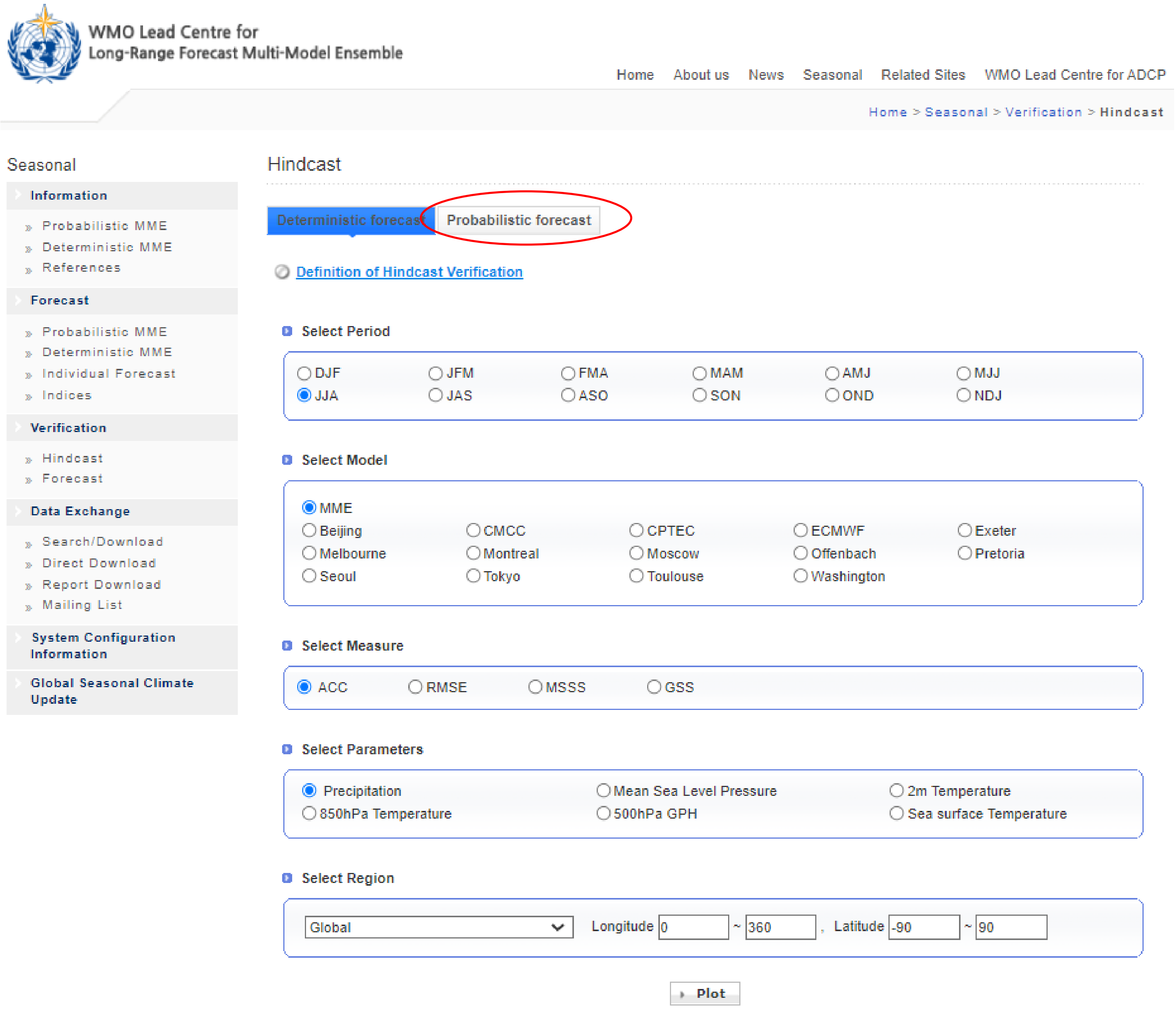
“In summary, hindcast and real-time forecast quality should be published, regularly reported and made available alongside operational forecasts so that this information can be used when preparing seasonal forecasts”



PMME (Probabilistic MultiModel Ensemble)



Verification (hindcast)



PMME (Probabilistic MultiModel Ensemble

Login Sign up Sitemap Contact us

WMO Lead Centre for
Long-Range Forecast Multi-Model Ensemble

Home About us News Seasonal Related Sites WMO Lead Centre for ADCP

Home > Seasonal > Verification > Hindcast

Seasonal

- **Information**
  - Probabilistic MME
  - Deterministic MME
  - References
- **Forecast**
  - Probabilistic MME
  - Deterministic MME
  - Individual Forecast
  - Indices
- **Verification**
  - Hindcast
  - Forecast
- **Data Exchange**
  - Search/Download
  - Direct Download
  - Report Download
  - Mailing List
- **System Configuration Information**
- **Global Seasonal Climate Update**

Hindcast

Deterministic forecast | Probabilistic forecast

Definition of Hindcast Verification

Select Period

DJF JFM FMA MAM AMJ MJJ
JJA JAS ASO SON OND NDJ

Select Model

MME
Beijing CMCC CPTEC ECMWF Exeter
Melbourne Montreal Moscow Offenbach Pretoria
Seoul Tokyo Toulouse Washington

Select Measure

ROC Score ROC Map Reliability diagram

Select Parameters

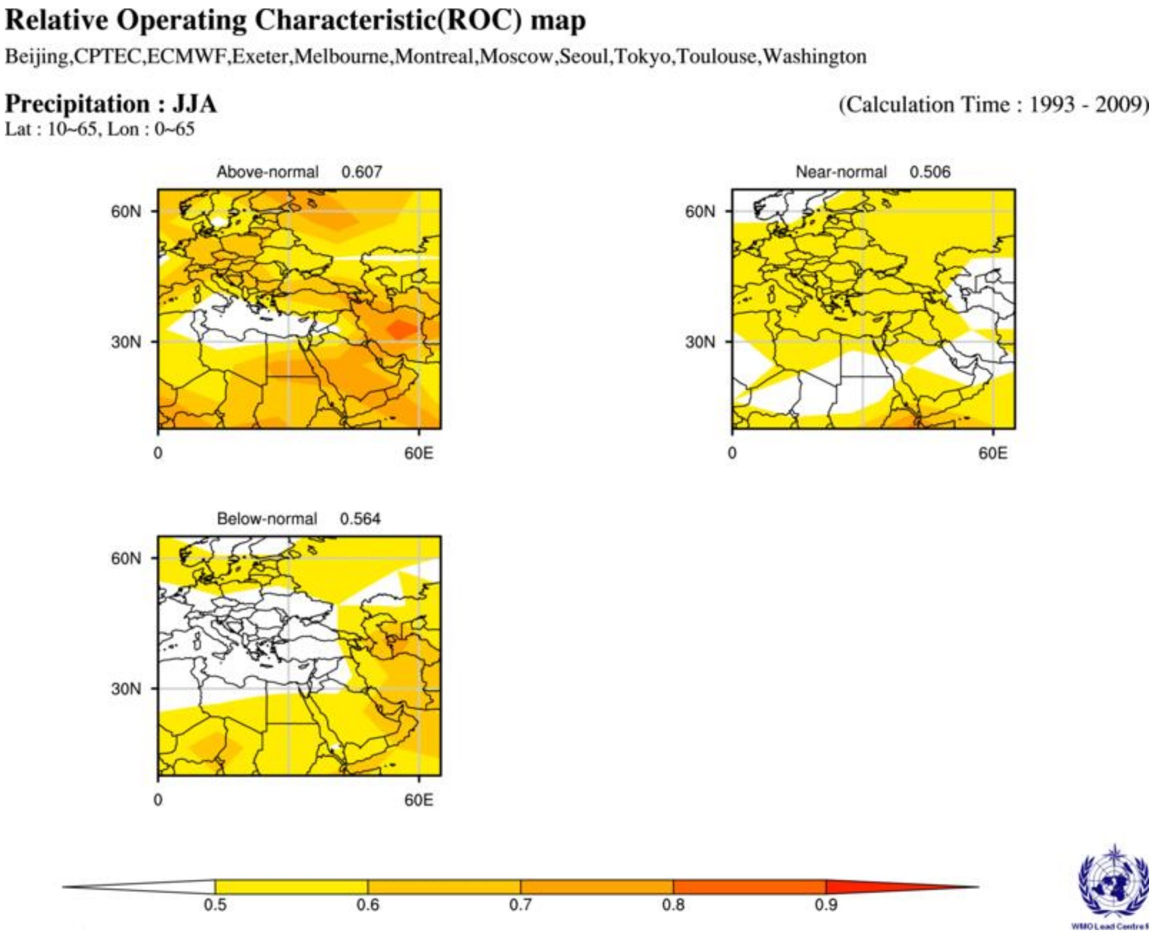
Precipitation Mean Sea Level Pressure 2m Temperature
850hPa Temperature 500hPa GPH Sea surface Temperature

Select Region

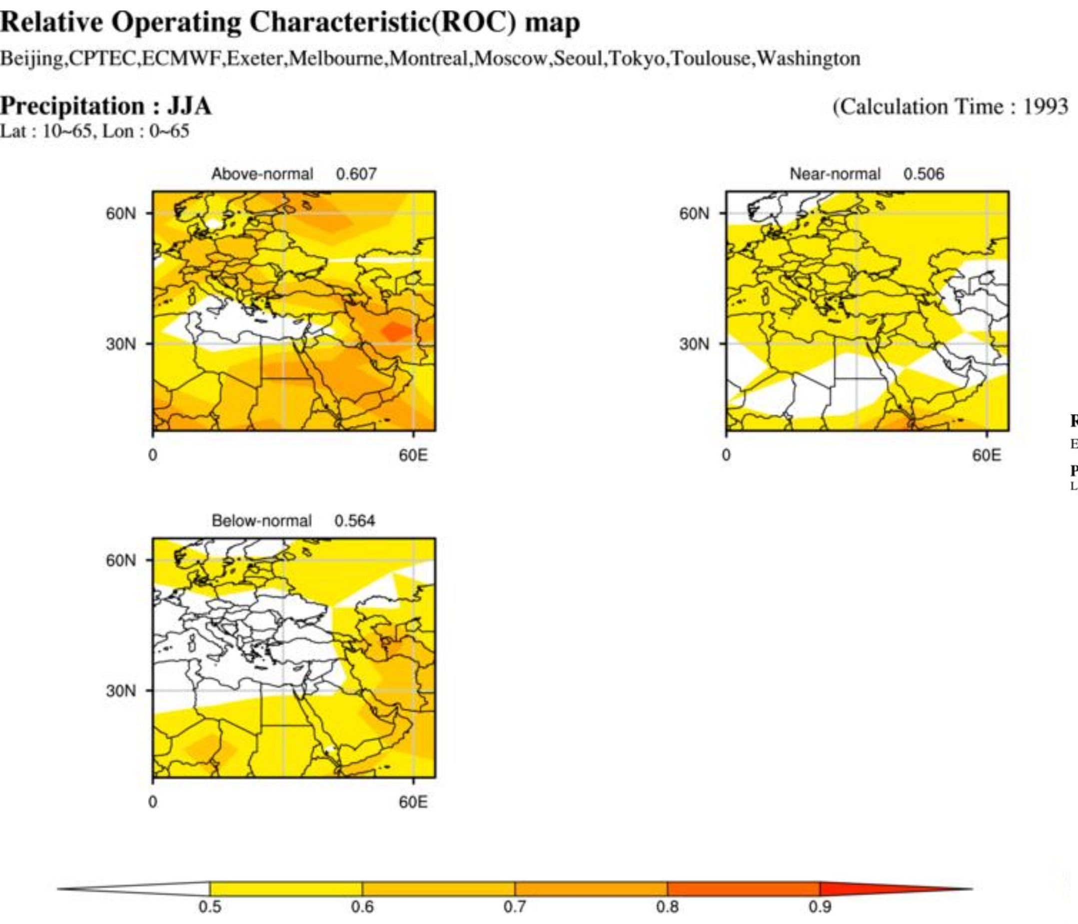
Global Longitude 0 ~ 360 , Latitude -90 ~ 90

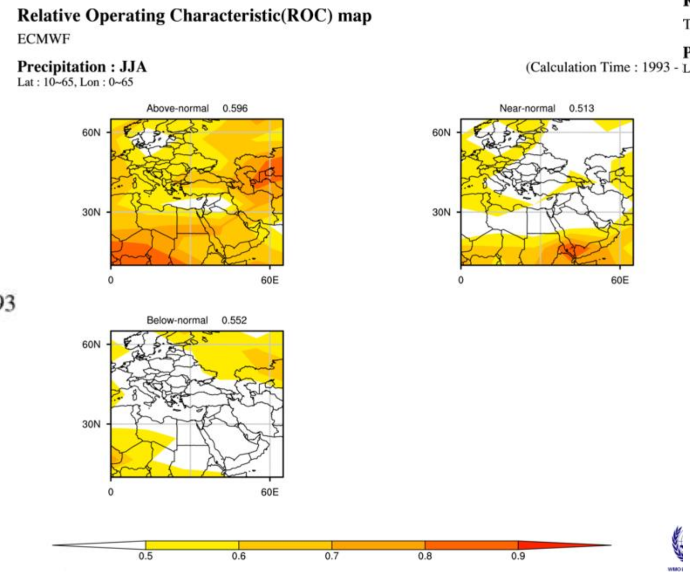
Plot

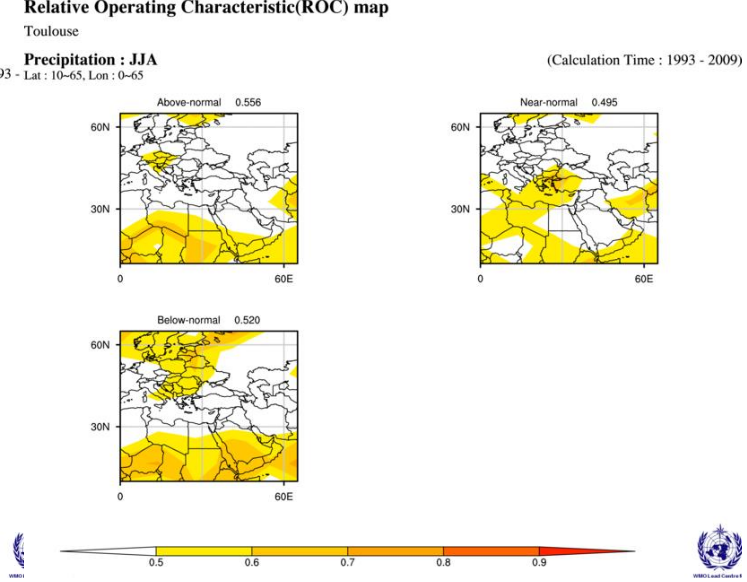
PMME (Probabilistic MultiModel Ensemble)

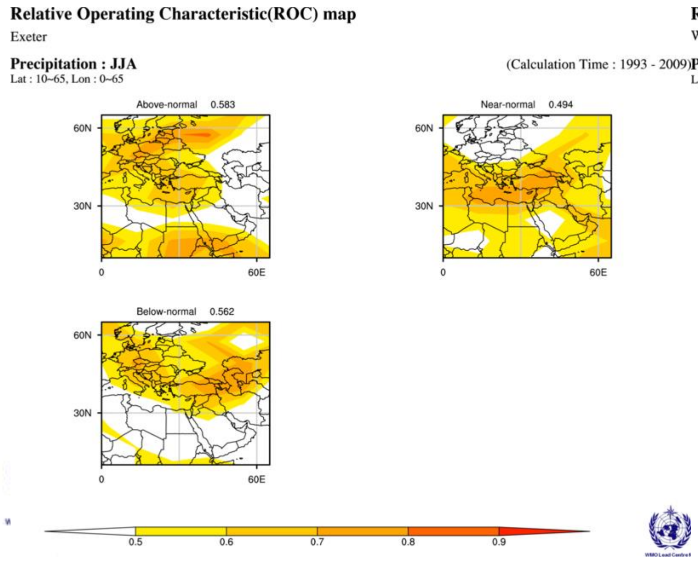


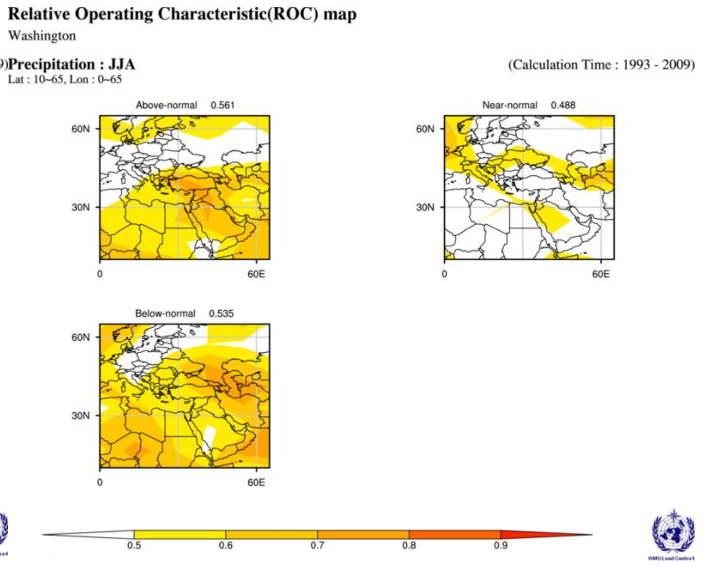
PMME (Probabilistic MultiModel Ensemble)



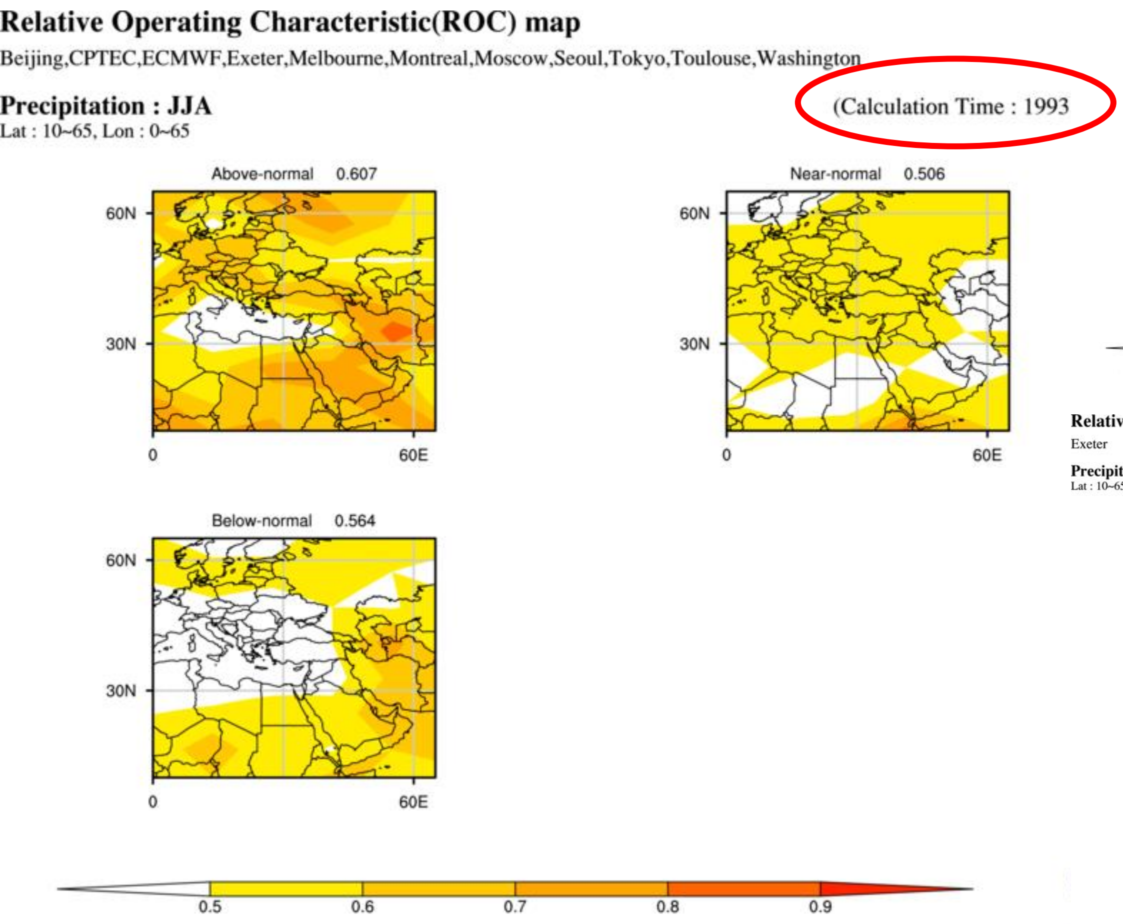


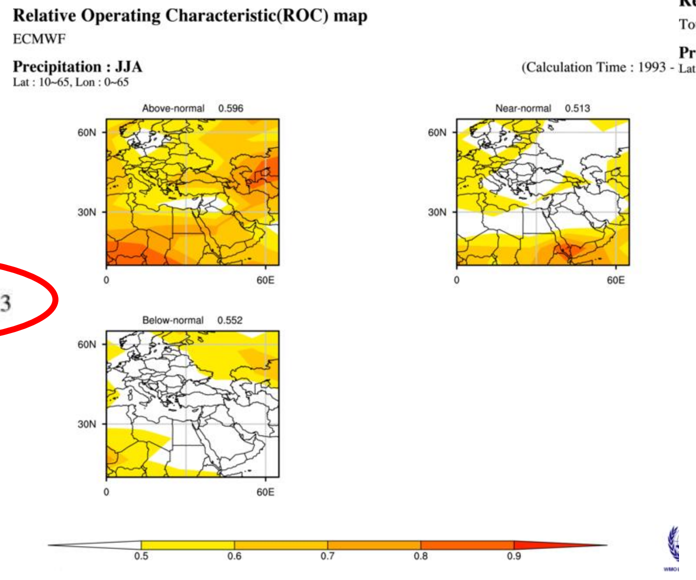


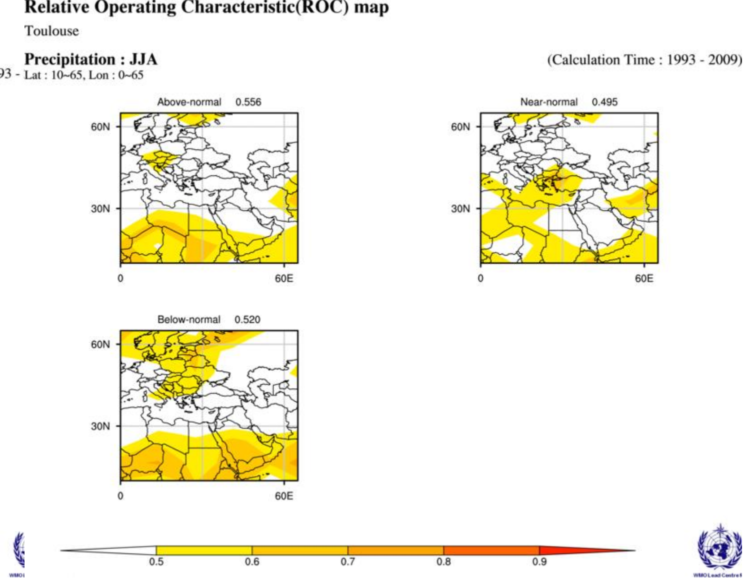


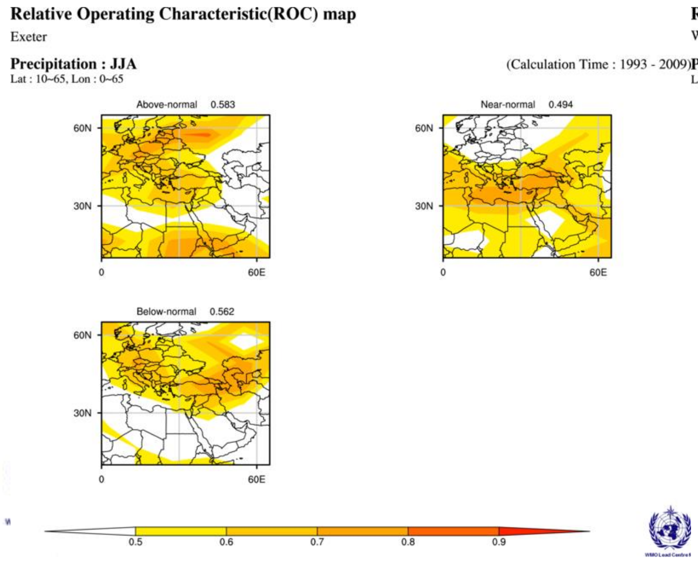


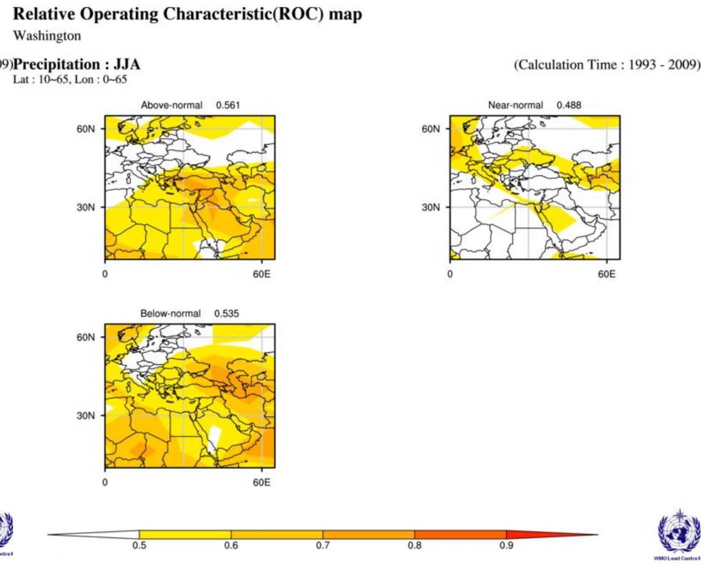
PMME (Probabilistic MultiModel Ensemble)











Caution interpreting these maps: short hindcast implies high uncertainty in skill-scores

MEDSCOPE
MEDiterranean Services
Chain based On climate PrEdictions

Mediterranean Seasonal Climate Update

May 17, 2022

Alvarez-Castro M.C., M.M. Chaves-Montero, S. Materia, M. Benassi, A. Borrelli, A. Sanna, V. Torralba, Z. Yang, S. Gualdi

Centro Euro-Mediterraneo sui Cambiamenti Climatici.
carmen.alvarez-castro@cmcc.it, andrea.borrelli@cmcc.it

Mediterranean Seasonal Climate Update

MEDSCOPE
MEDiterranean Services Chain based On climate PrEdictions

Mediterranean Seasonal Climate Update

May 17, 2022

Alvarez-Castro M.C., M.M. Chaves-Montero, S. Materia, M. Benassi, A. Borrelli, A. Sanna, V. Torralba, Z. Yang, S. Gualdi

Centro Euro-Mediterraneo sui Cambiamenti Climatici.
carmen.alvarez-castro@cmcc.it, andrea.borrelli@cmcc.it

1 / 24

-Focused on Mediterranean Basin (aimed at MedCOF community)

-Seasonal predictions from C3S, NMME and AEMET empirical model presented in graphical homogeneous form

-Skill information available to help interpreting forecast maps

-More prediction systems and features to be incorporated.

3.3 ENSO:

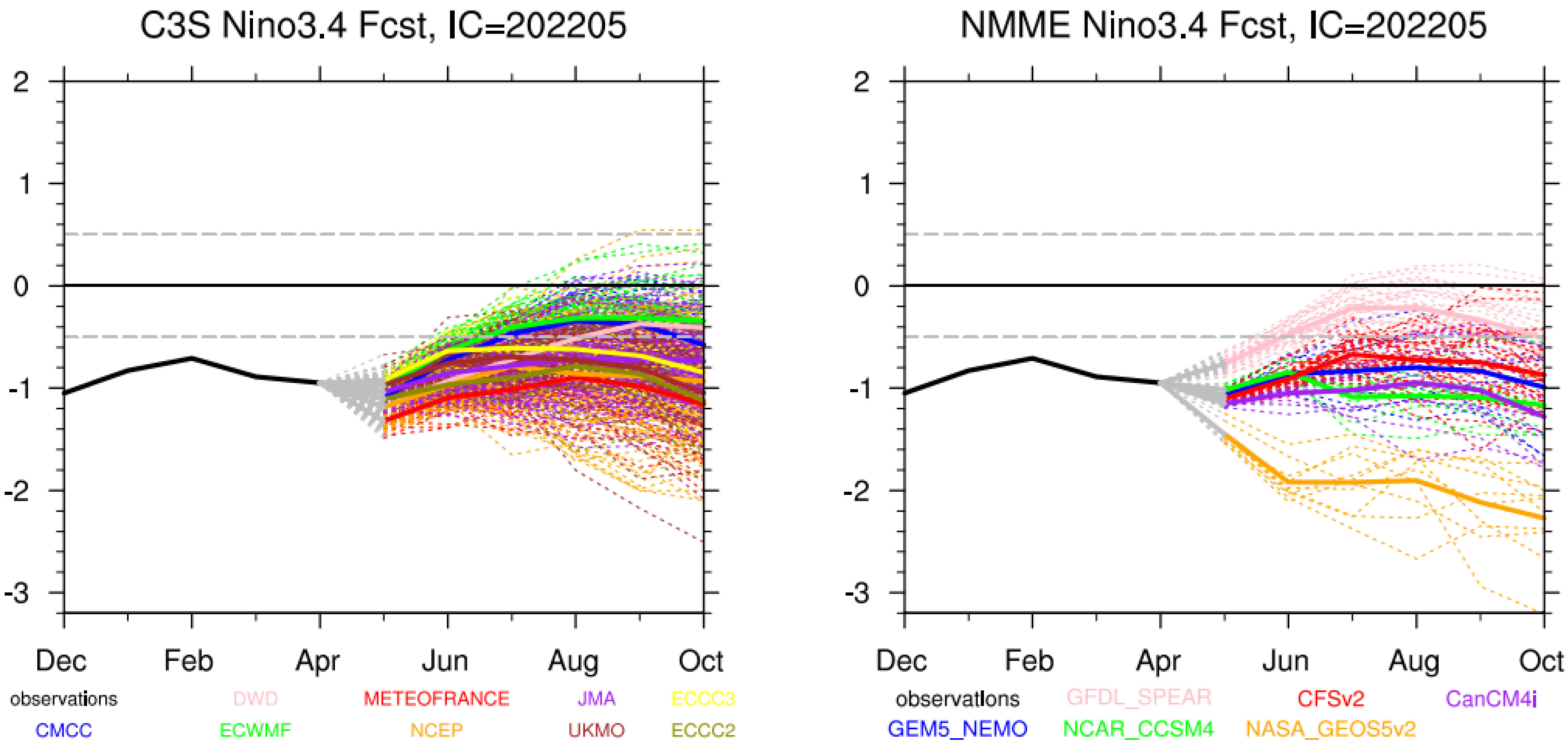
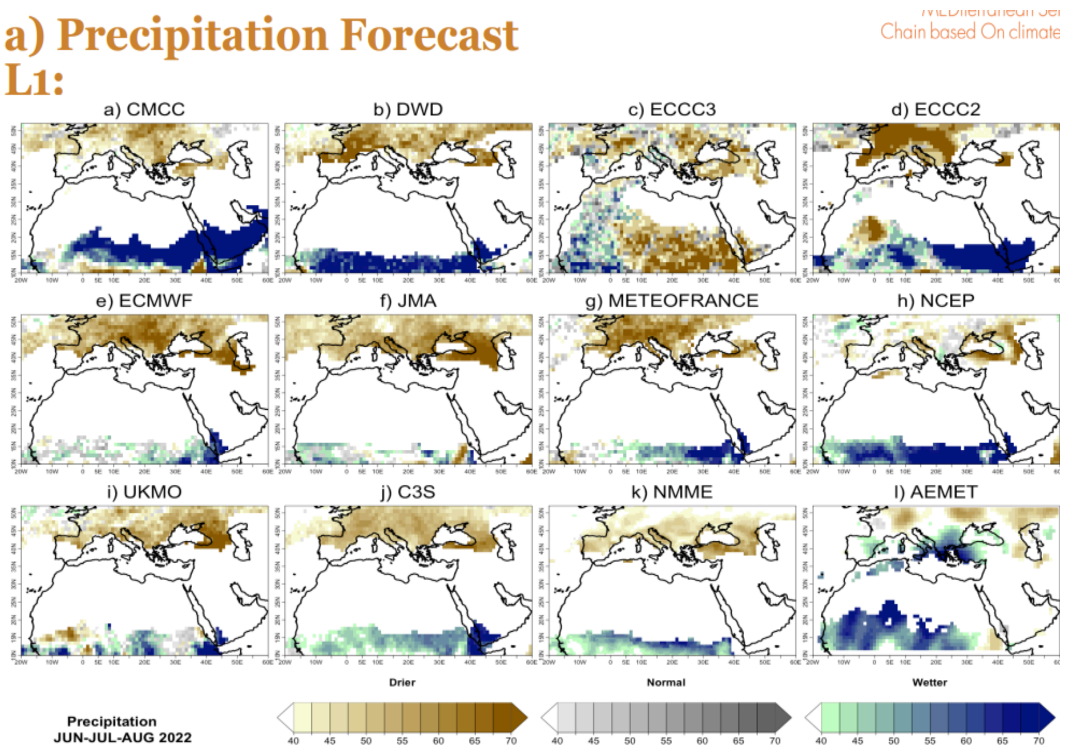


Figure 1: Niño3.4 prediction from all the ensemble members of the C3S multi-system



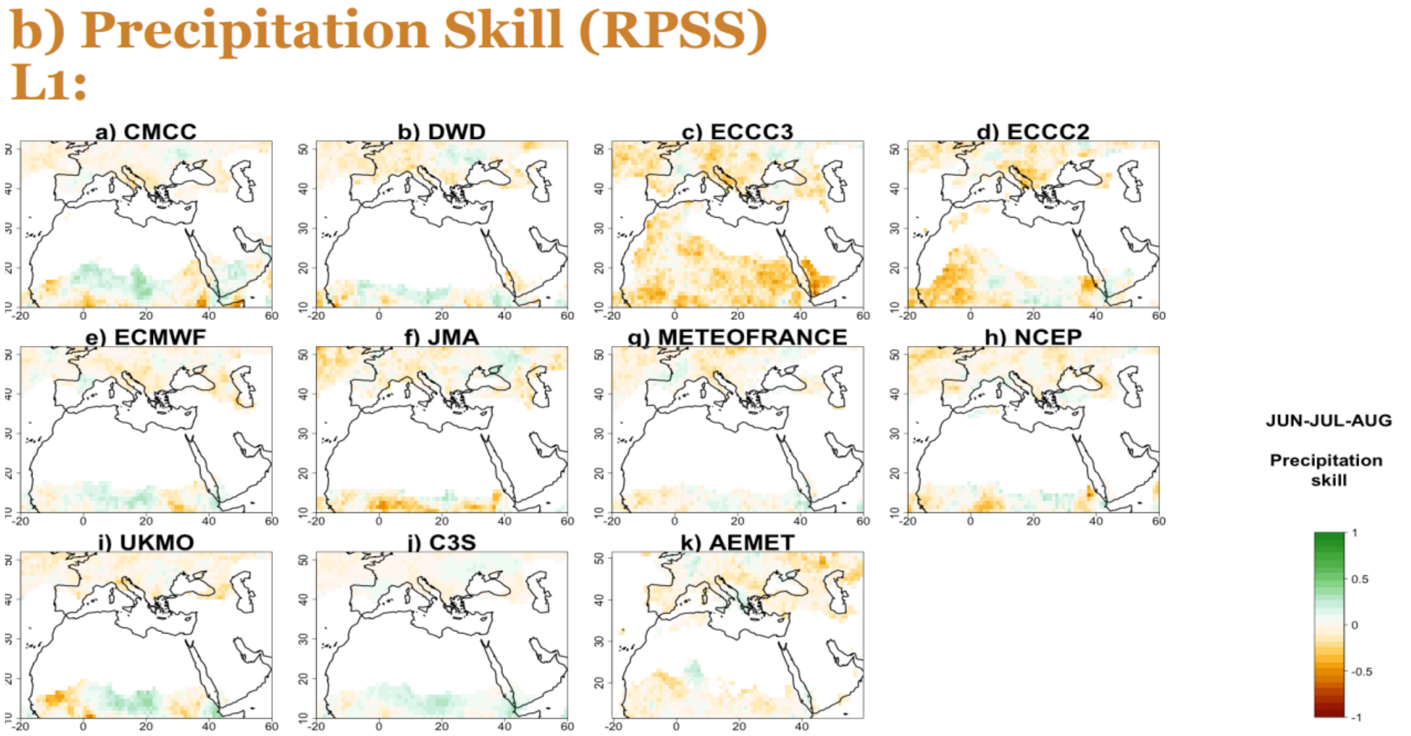
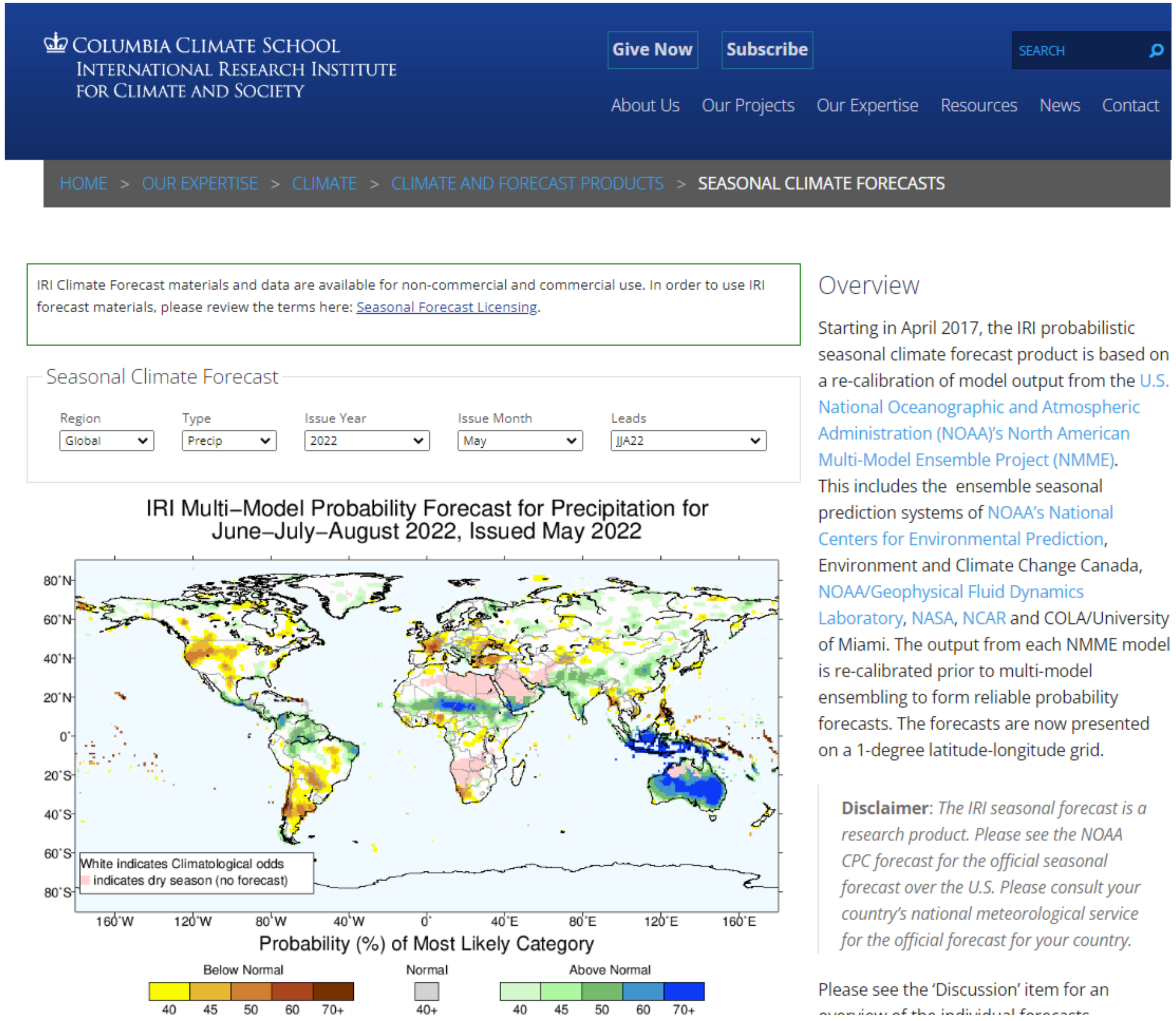


Figure 3: Ranked Probability Skill Score (RPSS) in Precipitation forecast for the seasonal forecast systems. Higher values indicate better model predictive skill. From (a) to (i) models of the C3S ensemble. (j) for AEMET.

https://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/


COLUMBIA CLIMATE SCHOOL
INTERNATIONAL RESEARCH INSTITUTE FOR CLIMATE AND SOCIETY

Give Now | Subscribe | SEARCH

About Us | Our Projects | Our Expertise | Resources | News | Contact

HOME > OUR EXPERTISE > CLIMATE > CLIMATE AND FORECAST PRODUCTS > SEASONAL CLIMATE FORECASTS

IRI Climate Forecast materials and data are available for non-commercial and commercial use. In order to use IRI forecast materials, please review the terms here: Seasonal Forecast Licensing.

Seasonal Climate Forecast

Region: Global | Type: Precip | Issue Year: 2022 | Issue Month: May | Leads: JJA22

Overview

Starting in April 2017, the IRI probabilistic seasonal climate forecast product is based on a re-calibration of model output from the U.S. National Oceanographic and Atmospheric Administration (NOAA)'s North American Multi-Model Ensemble Project (NMME). This includes the ensemble seasonal prediction systems of NOAA's National Centers for Environmental Prediction, Environment and Climate Change Canada, NOAA/Geophysical Fluid Dynamics Laboratory, NASA, NCAR and COLA/University of Miami. The output from each NMME model is re-calibrated prior to multi-model ensembling to form reliable probability forecasts. The forecasts are now presented on a 1-degree latitude-longitude grid.

Disclaimer: *The IRI seasonal forecast is a research product. Please see the NOAA CPC forecast for the official seasonal forecast over the U.S. Please consult your country's national meteorological service for the official forecast for your country.*

Please see the 'Discussion' item for an

Based on NMME models. Probabilities for every model are calculated training logistic regression using observations (1990-2020).
Probabilities then are averaged to built the multimodel.

https://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/

COLUMBIA CLIMATE SCHOOL
INTERNATIONAL RESEARCH INSTITUTE FOR CLIMATE AND SOCIETY

Give Now | Subscribe | SEARCH

About Us | Our Projects | Our Expertise | Resources | News | Contact

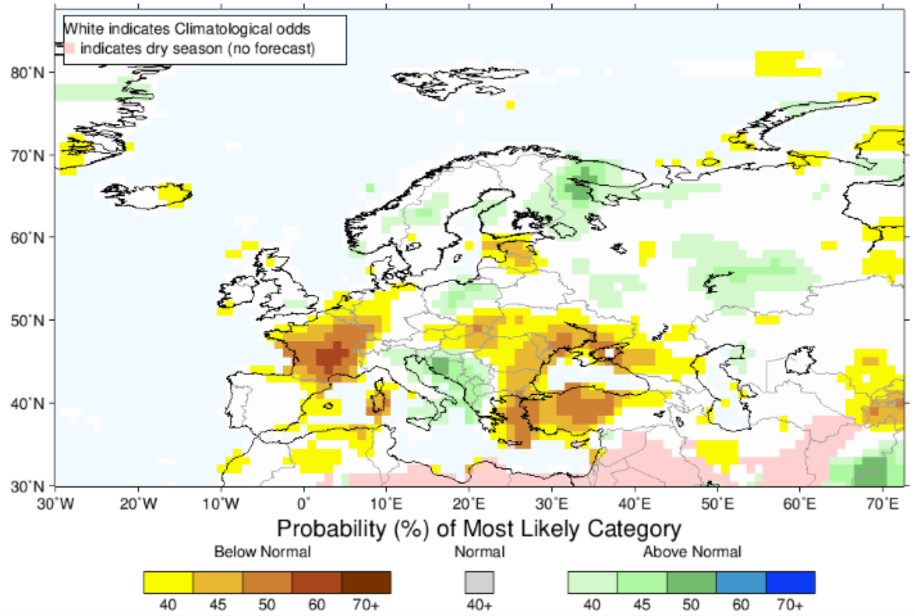
HOME > OUR EXPERTISE > CLIMATE > CLIMATE AND FORECAST PRODUCTS > SEASONAL CLIMATE FORECASTS

IRI Climate Forecast materials and data are available for non-commercial and commercial use. In order to use IRI forecast materials, please review the terms here: Seasonal Forecast Licensing.

Seasonal Climate Forecast

Region	Type	Issue Year	Issue Month	Leads
Europe	Precip	2022	May	JJA22

IRI Multi–Model Probability Forecast for Precipitation for June–July–August 2022, Issued May 2022



Overview

Starting in April 2017, the IRI probabilistic seasonal climate forecast product is based on a re-calibration of model output from the U.S. National Oceanographic and Atmospheric Administration (NOAA)'s North American Multi-Model Ensemble Project (NMME). This includes the ensemble seasonal prediction systems of NOAA's National Centers for Environmental Prediction, Environment and Climate Change Canada, NOAA/Geophysical Fluid Dynamics Laboratory, NASA, NCAR and COLA/University of Miami. The output from each NMME model is re-calibrated prior to multi-model ensembling to form reliable probability forecasts. The forecasts are now presented on a 1-degree latitude-longitude grid.

> **Disclaimer**: *The IRI seasonal forecast is a research product. Please see the NOAA CPC forecast for the official seasonal forecast over the U.S. Please consult your country's national meteorological service for the official forecast for your country.*

Please see the 'Discussion' item for an overview of the individual forecasts.

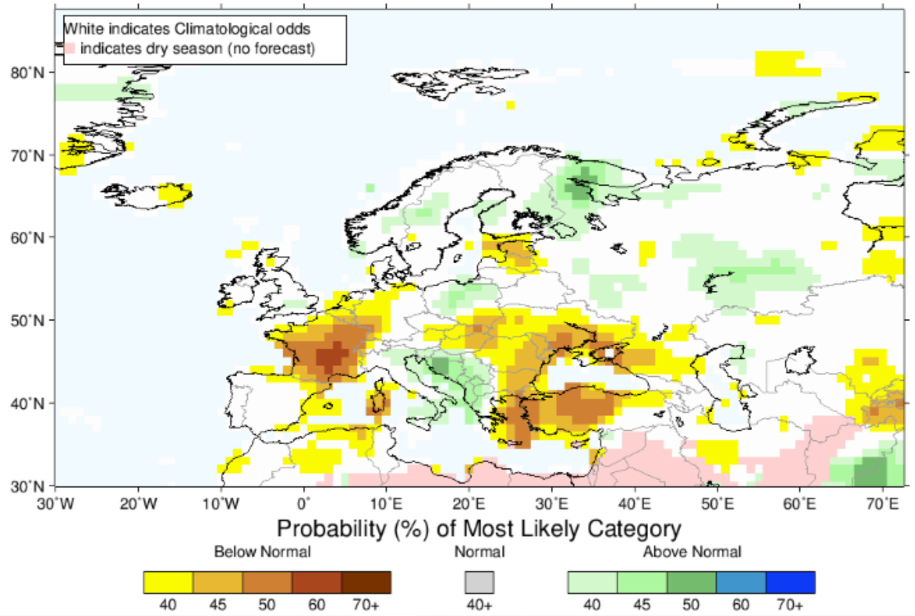
https://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/

IRI Climate Forecast materials and data are available for non-commercial and commercial use. In order to use IRI forecast materials, please review the terms here: Seasonal Forecast Licensing.

Seasonal Climate Forecast

Region	Type	Issue Year	Issue Month	Leads
Europe	Precip	2022	May	JJA22

IRI Multi–Model Probability Forecast for Precipitation for June–July–August 2022, Issued May 2022



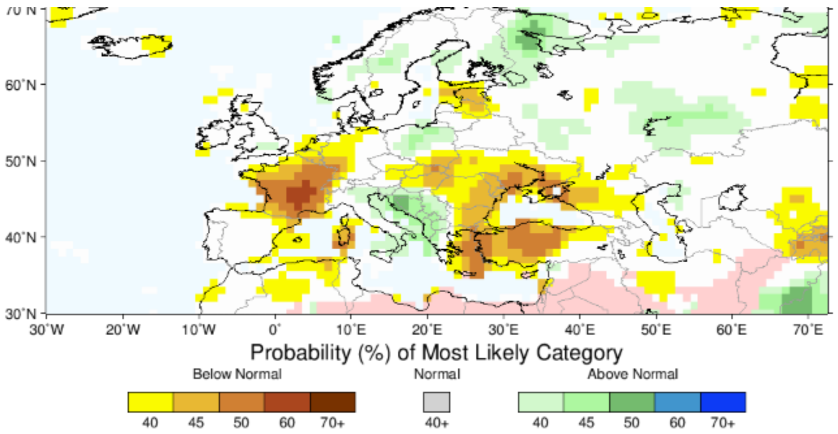
Overview

Starting in April 2017, the IRI probabilistic seasonal climate forecast product is based on a re-calibration of model output from the U.S. National Oceanographic and Atmospheric Administration (NOAA)'s North American Multi-Model Ensemble Project (NMME). This includes the ensemble seasonal prediction systems of NOAA's National Centers for Environmental Prediction, Environment and Climate Change Canada, NOAA/Geophysical Fluid Dynamics Laboratory, NASA, NCAR and COLA/University of Miami. The output from each NMME model is re-calibrated prior to multi-model ensembling to form reliable probability forecasts. The forecasts are now presented on a 1-degree latitude-longitude grid.

> **Disclaimer**: *The IRI seasonal forecast is a research product. Please see the NOAA CPC forecast for the official seasonal forecast over the U.S. Please consult your country's national meteorological service for the official forecast for your country.*

Please see the 'Discussion' item for an overview of the individual forecasts.

https://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/



Discussion

May 2022 Climate forecast Discussion for Jun-Aug through Sep-Nov 2022

Note: The IRI seasonal forecasts of precipitation and temperature issued this month are based on an objective calibration procedure that combines the NCEP-CFSv2, CanSIPS-IC3, COLA-RSMAS-CCSM4, and GFDL-SPEAR, and NASA-GEOSS2S models. The climatological base period for normal is 1991-2020.

In April 2022, the equatorial sea surface temperatures (SSTs) in the central-eastern tropical Pacific Ocean were below average, and tropical Pacific atmosphere remained consistent with La Niña conditions. The CPC/IRI ENSO forecast from early-May indicates that La Niña is likely to persist during summer and fall in the Northern Hemisphere with 69% chance in Jun-Aug 2022, weakening during Jul-Sep and Aug-Oct, while strengthening slightly thereafter. Four out of the five models used in IRI's seasonal climate forecast, predict cooler than average SSTs over the eastern tropical Pacific and a continuation of the current La Niña episode. GFDL-SPEAR, one of the five models used here, indicates ENSO-neutral conditions for the next few months, before reverting back to La Niña later in the forecast. This has significant impacts on the seasonal forecasts of precipitation and temperature across the globe. The tropical Atlantic Ocean does not exhibit significant SST anomalies, while a gradually strengthening negative dipole in the Indian Ocean is evident during the forecast period.

The forecasts show moderate probabilities of below-normal precipitation in the Northwest United States, southern South America, and Turkey in Jun-Aug, weakening during rest of the forecast period. Increasing probabilities of below-average precipitation are forecast for the

ensembling to form reliable probability forecasts. The forecasts are now presented on a 1-degree latitude-longitude grid.

> **Disclaimer**: *The IRI seasonal forecast is a research product. Please see the NOAA CPC forecast for the official seasonal forecast over the U.S. Please consult your country's national meteorological service for the official forecast for your country.*

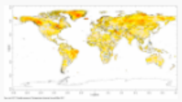
Please see the 'Discussion' item for an overview of the individual forecasts.

The climatological base period currently used is 1991-2020. Details of the forecast system, post-processing, and recommended references for citation can be found here. Forecasts from the individual NMME models are shown on NOAA CPC's website. Verifications of IRI's real-time forecasts issued since 1998 can be found on the Seasonal Climate Verifications pages.

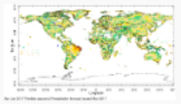
To aid in interpretation of the forecast probabilities, maps of the observed precipitation and temperature percentiles are plotted in physical units here: Climatological Percentiles Maproom.

The IRI forecasts are also available as a flexible probabilistic format, providing the probability of exceedance (or non-exceedance) of a user-specified percentile of the climatological distribution: Go to IRI Flexible Forecasts

Temperature



Precipitation



https://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/

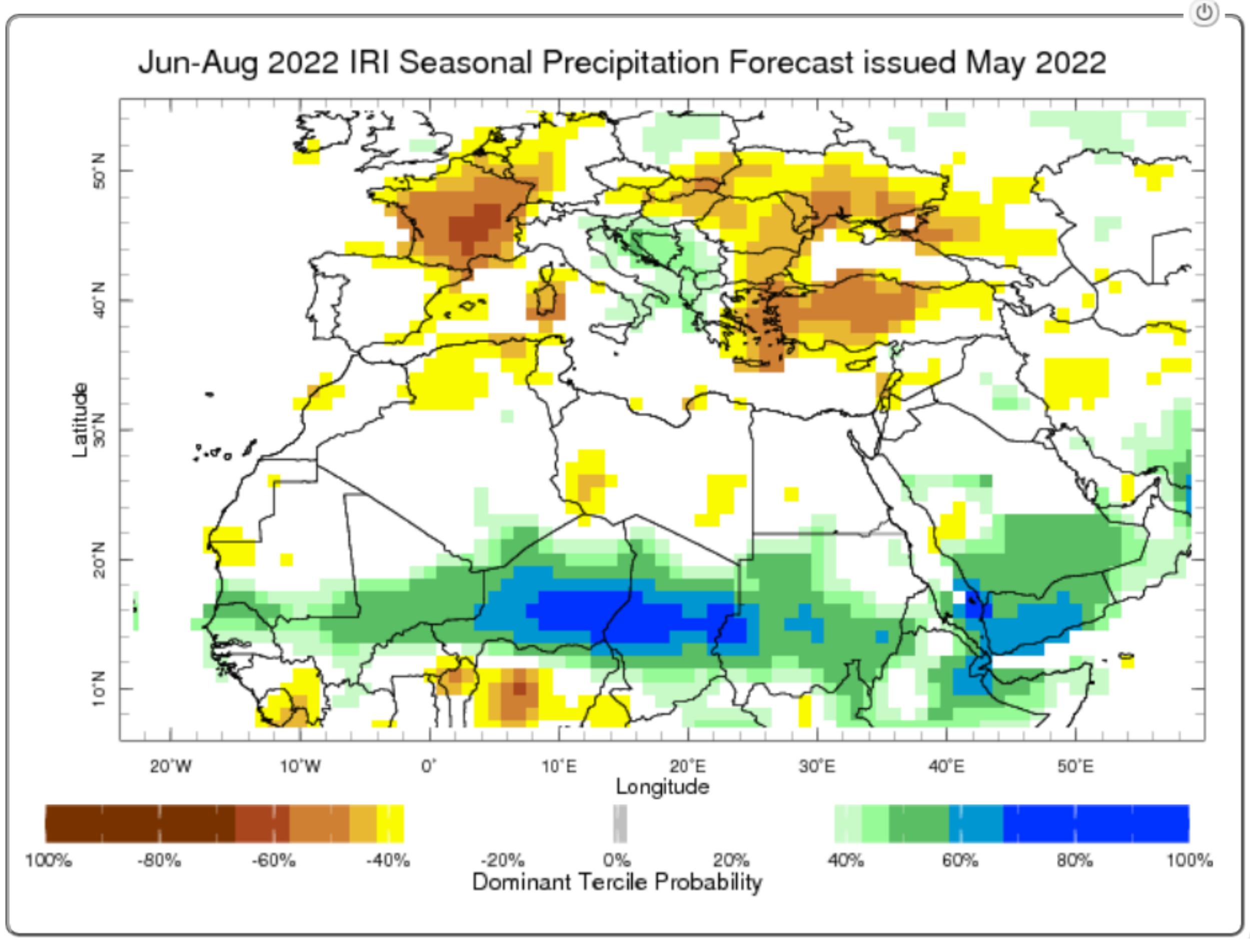
Climate Forecasts | Forecasts: Precipitation Terciles Seasonal Forecast | Region | Target Time: Jun-Aug 2022

Description | Dataset Documentation | Dataset | Contact Us

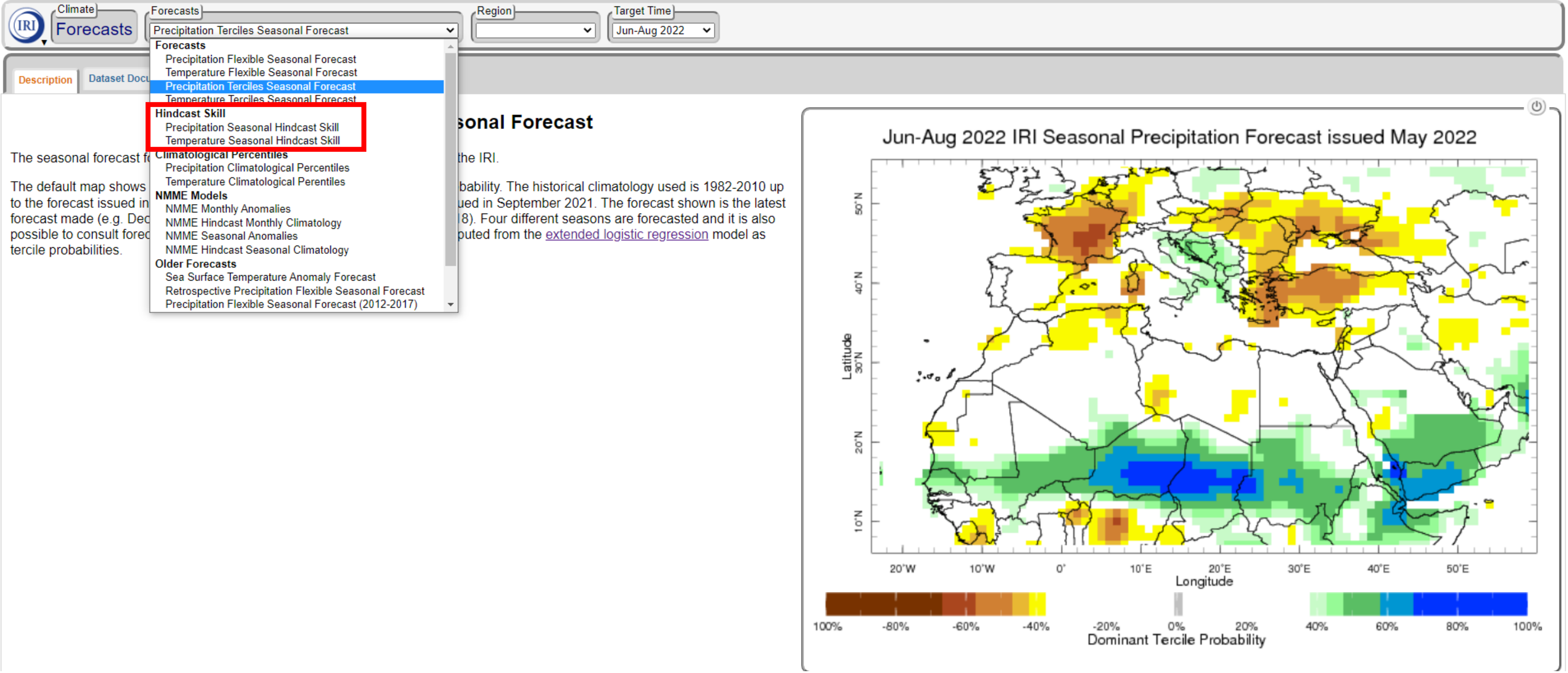
Precipitation Terciles Seasonal Forecast

The seasonal forecast for above-, below- and near-normal precipitation from the IRI.

The default map shows globally the seasonal precipitation forecast tercile probability. The historical climatology used is 1982-2010 up to the forecast issued in August 2021, and is 1991-2020 from the forecast issued in September 2021. The forecast shown is the latest forecast made (e.g. Dec 2017) for the next season to come (e.g. Jan-Mar 2018). Four different seasons are forecasted and it is also possible to consult forecasts made previously. The forecasts are directly computed from the extended logistic regression model as tercile probabilities.



https://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/



https://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/

Climate
Seasonal Forecasts
Hindcast Skill: Precipitation Seasonal Hindcast Skill
Region
Lead Time: Lead 1 [Months 2-4]
Skill Score: RPSS

Description | Dataset Documentation | Instructions | Contact Us

Precipitation Seasonal Hindcast Skill

Seasonal skill score based on the historical performance of each calibrated NMME model and their multimodel ensemble (1982-2010).

Skill is mapped by calendar month for seasonal lead times. Lead 1 = months 2-4, Lead 2 = months 3-5, Lead 3 = months 4-6, Lead 4 = months 5-7 after the forecast is issued. Forecasts skill scores combine start times by calendar month and across years 1982 to 2010. The observational reference datasets are CMAP-URD for precipitation and GHCN-CAMS for temperature. The models included in the assessment are: the Center for Ocean-Land-Atmosphere Studies/University of Miami (COLA-RSMAS-CCSM4), one from the National Aeronautics and Space Administration (NASA-GMAO-062012), three from the Geophysical Fluid Dynamics Laboratory (GFDL-CM2p1-ae04, GFDL-CM2p5-FLOR-A06, GFDL-CM2p5-FLOR-B01), two from the Canadian Meteorological Center (CMC1- CanCM3, CMC2-CanCM4), one from NOAA's Centers for Environmental Prediction (NCEP- CFSv2) and one from the National Center for Atmospheric Research (NCAR-CESM1).

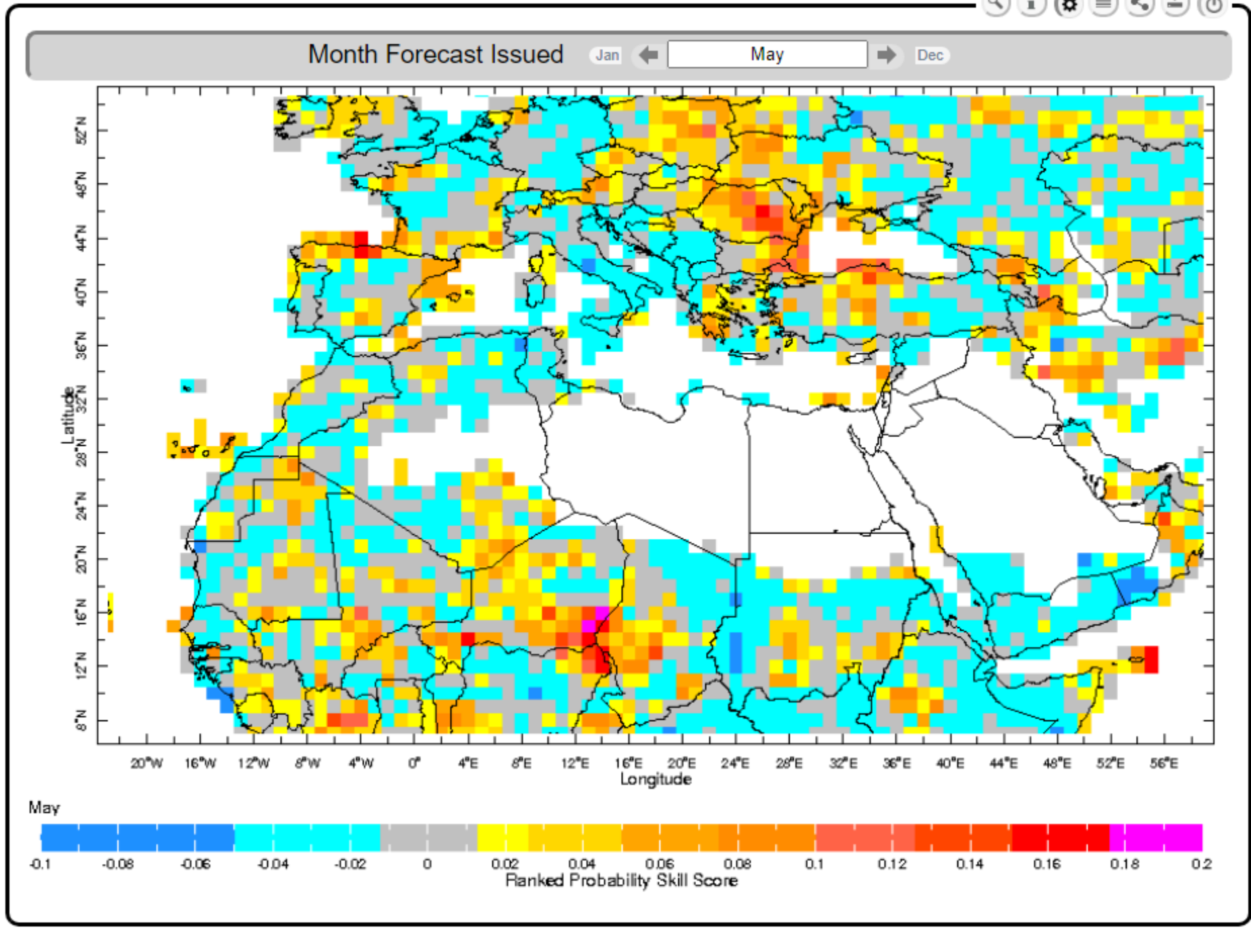
These skill scores diagnostics maps give a sense of where and when (issued which months of the year and for which seasonal lead times) the probabilistic seasonal forecasts have the potential to provide useful information, based on hindcasting.

Skill scores definitions:

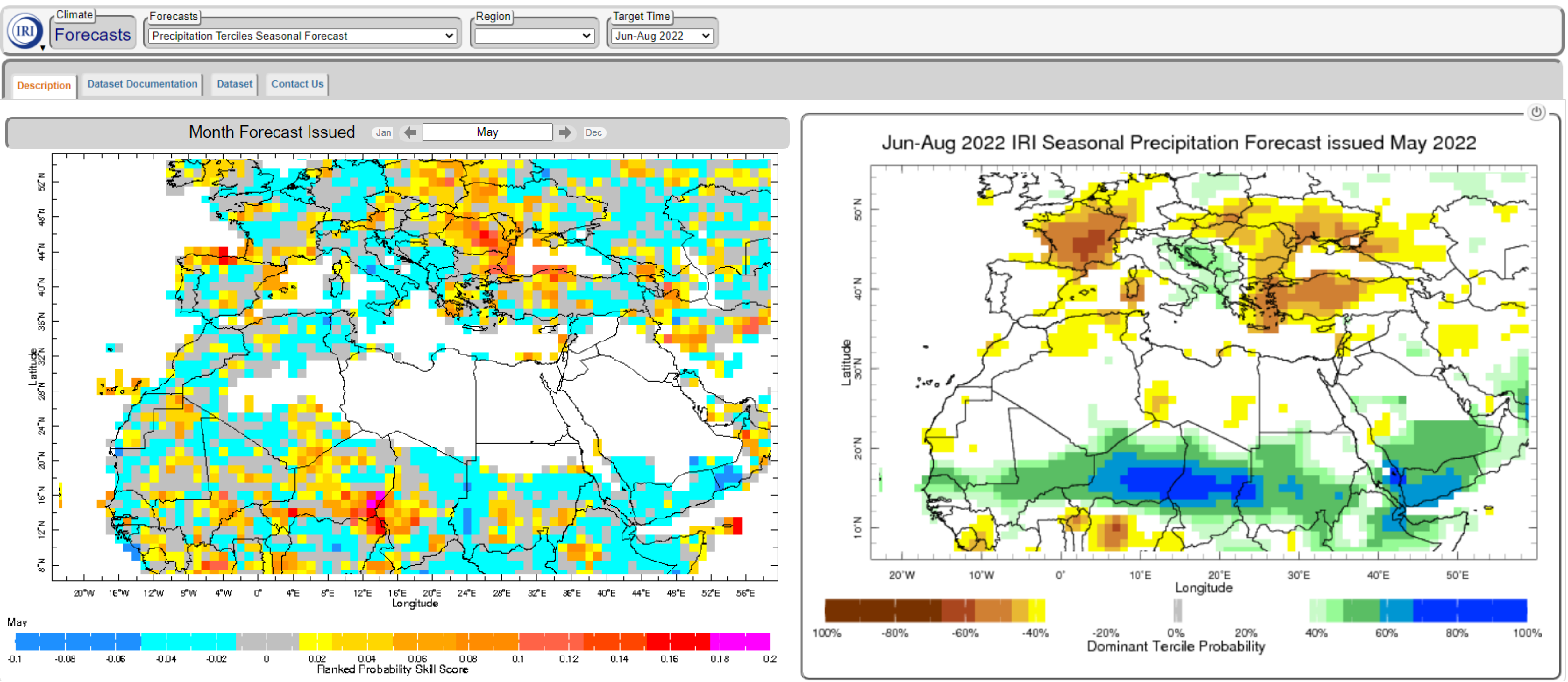
- **RPSS**: Ranked Probability Skill Scores (RPSS; Epstein (1969); Murphy (1969, 1971); Weigel et al. (2007)) are used to quantify the extent to which the calibrated tercile-category predictions are improved compared to climatological frequencies. RPSS values tend to be small, even for skillful forecasts. The approximate relationship between RPSS and correlation being such that a RPSS value of 0.1 corresponds to a correlation of about 0.44 (Tippett et al. 2010).

References:

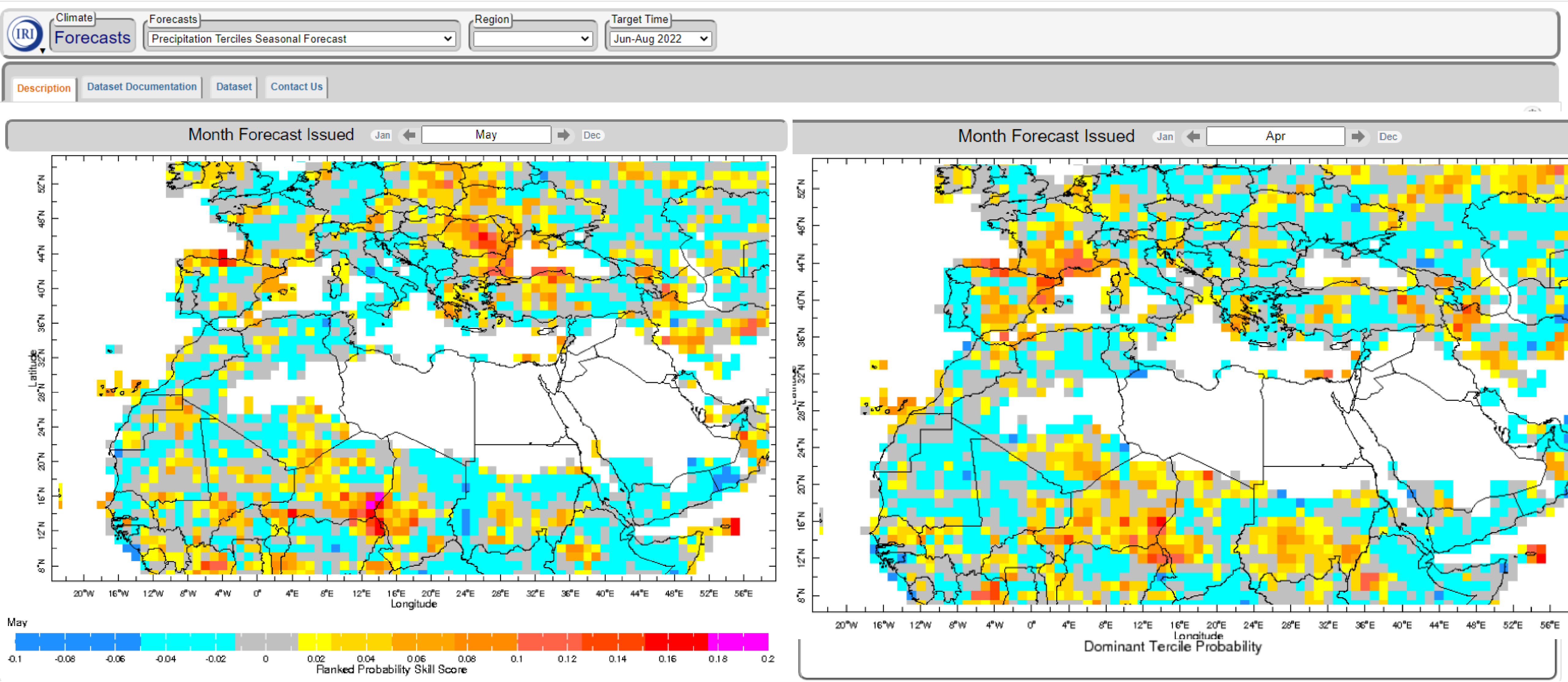
- Epstein, E.S., 1969: A Scoring System for Probability Forecasts of Ranked Categories. J. Appl. Meteor., 8, 985–987
- Murphy, A.H., 1969: On the "Ranked Probability Score". J. Appl. Meteor., 8, 988–989
- Murphy, A.H., 1971: A Note on the Ranked Probability Score. J. Appl. Meteor., 10, 155–156
- Tippett, M.K., A.G. Barnston, and T. DelSole, 2010: Comments on "Finite Samples and Uncertainty Estimates for Skill Measures for Seasonal Prediction". Mon. Wea. Rev., 138, 1487–1493
- Weigel, A.P., M.A. Liniger, and C. Appenzeller, 2007: The Discrete Brier and Ranked Probability Skill Scores. Mon. Wea. Rev., 135, 118–124



https://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/

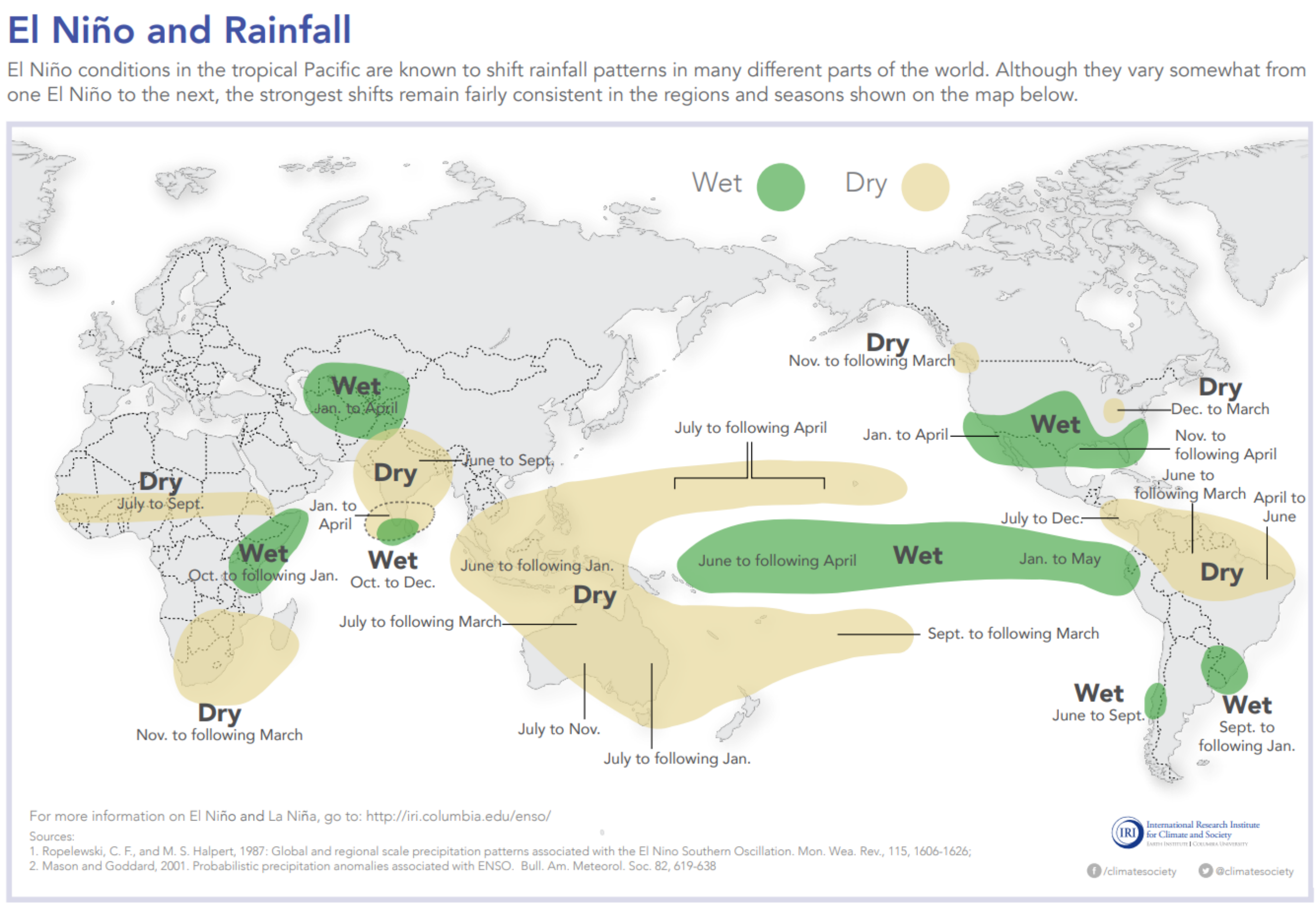


https://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/



Empirical models

-Based on relationships among different elements of the climate system.

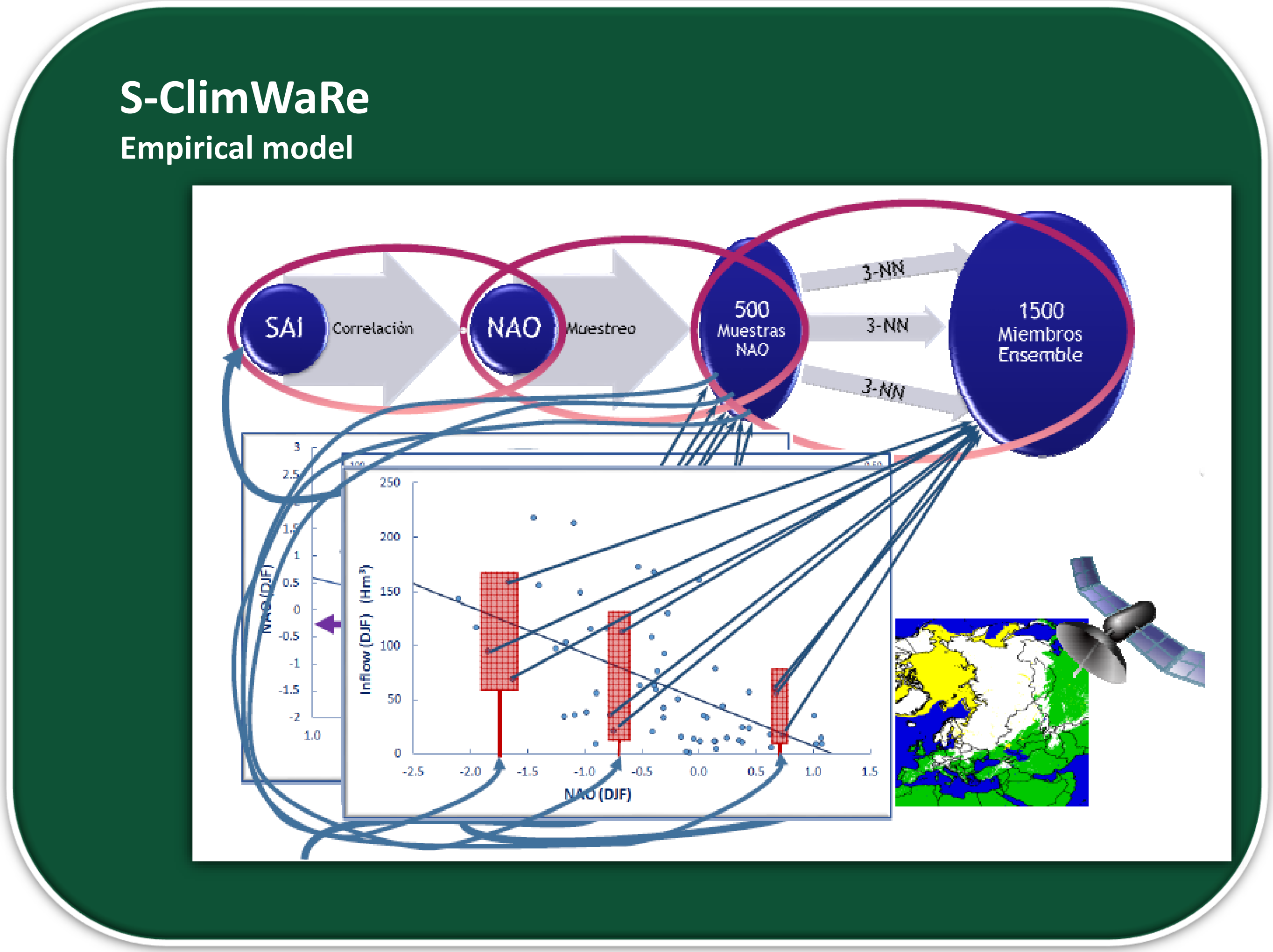


-Assume statinary relationship among driver and target

-Usually linear methodologies

Empirical models

-Based on relationships among different elements of the climate system.



-Assume stationary relationship among driver and target
-Usually linear methodologies

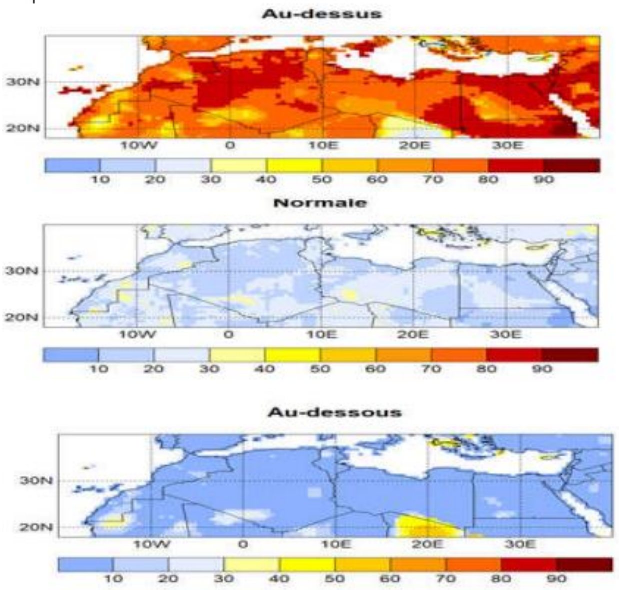
-Example of snow cover-NAO linear regression

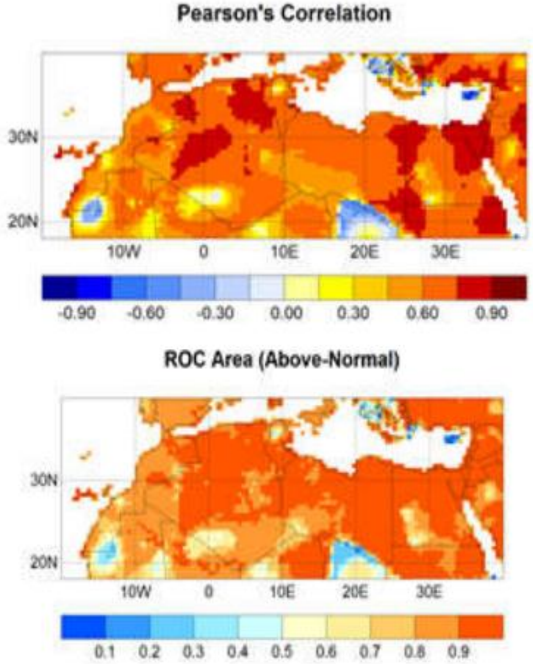
Empirical models

II. Statistical Forecast

Statistical forecasts of 2m temperature anomalies are produced by Canonical Correlation Analysis method using as predictors North Atlantic April SST (NOAA NCDC ERSST version4) and as predictand North Africa T2m(CPC /GHCN_CAMS).

Statistical forecast is represented by probabilities of 3 categories above normal, normal and below normal.





-Assume stationary relationship among driver and target
-Usually linear methodologies

-Use of spatial information (CCA) in empirical model for temperatura in RA I RCC-LRF

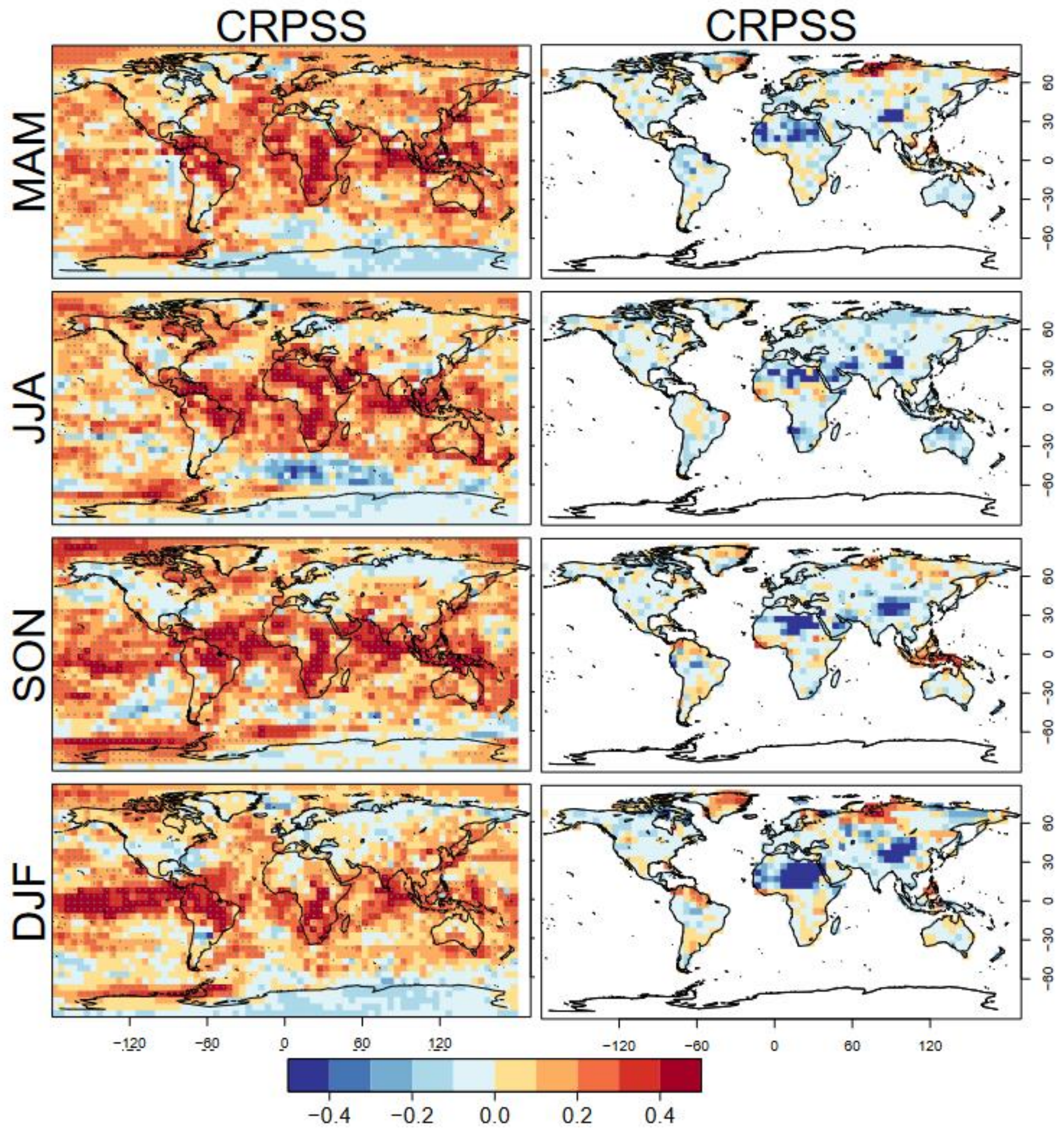
Empirical models

A global empirical system for probabilistic seasonal climate prediction

J. M. Eden[1], G. J. van Oldenborgh[1], E. Hawkins[2], and E. B. Suckling[2]

[1]Royal Netherlands Meteorological Institute (KNMI), De Bilt, the Netherlands
[2]NCAS-Climate, Department of Meteorology, University of Reading, Reading, UK

Predictor	Source
CO2EQV	CO_2-equivalent concentrations (Meinshausen et al., 2011)
NINO3.4	Calculated from SST fields from HadISST (Rayner et al., 2003)
PDO	University of Washington (http://research.jisao.washington.edu/pdo/)
QBO	At 30 hPa from the reconstruction of Brönnimann et al. (2007)
AMO	Calculated by van Oldenborgh et al. (2009); based on HadSST (Kennedy et al., 2011a, b)
IOD	Calculated from SST fields from HadISST (Rayner et al., 2003)
LSST	HadSST3 (Kennedy et al., 2011a, b)
CPREC	GPCC Full Data Reanalysis version 6 (Schneider et al., 2011)



Empirical models

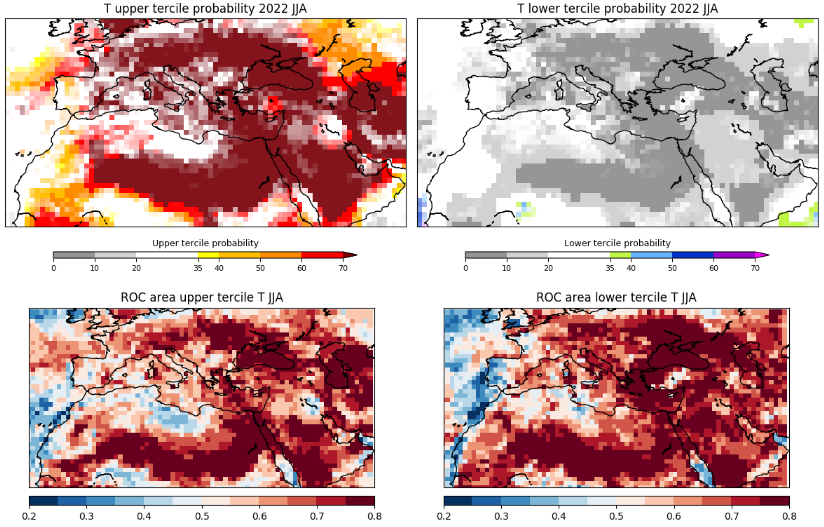
MEDSCOPE
MEDiterranean Services
Chain based On climate PrEdictions

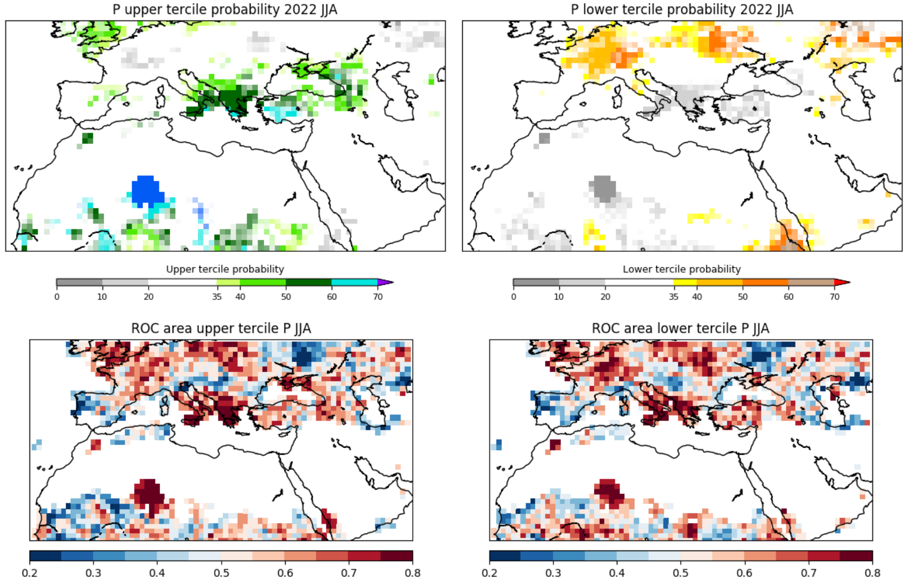
Deliverable D2.3

Final version of the empirical forecasting system

	Acronym	Index name	Source
Teleconnections (z500 patterns)	AAO	Antartic Oscillation	https://psl.noaa.gov/data/correlation/aao.data
	AO	Artic Oscillation	https://psl.noaa.gov/data/correlation/ao.data
	EA	East Atlantic	ftp://ftp.cpc.ncep.noaa.gov/wd52dg/data/indices/ea_index.tim
	EA/WR	East Asia/West Russia	https://psl.noaa.gov/data/correlation/ea.data
	EP/NP	East Pacific/North Pacific	https://psl.noaa.gov/data/correlation/epo.data
	NAO	North Atlantic Oscillation	https://psl.noaa.gov/data/correlation/nao.data
	NP	North Pacific	https://psl.noaa.gov/data/correlation/np.data
	PNA	Pacific North American	https://psl.noaa.gov/data/correlation/pna.data
	SCAND	Scandinavian	ftp://ftp.cpc.ncep.noaa.gov/wd52dg/data/indices/scand_index.tim
	WP	West Pacific	https://psl.noaa.gov/data/correlation/wp.data
Stratosphere	QBO	Quasi Biennial Oscillation	Averaged u wind (10S-10N at 10hPa)
	u10n	Northern u at 10hPa	Averaged u wind (60N-85N at 10 hPa)
	u10s	Southern u at10hPa	Averaged u wind (85S-60S at 10 hPa)
ENSO	MEIv2	Multivariate ENSO index	https://psl.noaa.gov/enso/mei/data/meiv2.data
	SOI	Southern Oscillation index	https://psl.noaa.gov/data/correlation/soi.data
Indian Ocean SST and Tave200m	WTIO	Western Tropical Indian Ocean	Averaged (50E-70E,10S-10N)
	SWIO	South Western Indian Ocean	Averaged (31E-45E,32S-25S)
	SETIO	South Eastern Tropical Indian Ocean	Averaged (90E-110E,10S-0)
	DMI	Dipole Mode Index	Calculated (WTIO-SETIO)
Pacific Ocean SST and Tave200m	Nino12	Nino12	Averaged (90W-80W,10S-0)
	Nino3	Nino3	Averaged (150W-90W,5S-5N)
	Nino4	Nino4	Averaged (160E-150W,5S-5N)
	Nino34	Nino34	Averaged (170E-120W,5S-5N)
	Nino34-Nino12	Nino34 - Nino12	Calculated
Atlantic+Mediterranean Oceans SST and Tave200m	TNA	Tropical Northern Atlantic	Averaged (57.5W-15W, 5.5N-23.5N)
	TSA	Tropical Southern Atlantic	Averaged (30W-10E, 20S-0)
	NAT	North Atlantic Tropical	Averaged (40W-20W, 5N-20N)
	SAT	South Tropical Atlantic	Averaged (15W-5E, 20S-5N)
	TASI	NAT - SAT	Calculated
	Atl1	Locally derived	Averaged (40W-10W, 50N-60N)
	Med1	Locally derived	Averaged (0-8E, 33N-46N)
	Med2	Locally derived	Averaged (10E-22E, 33N-46N)
	Med3	Locally derived	Averaged (25E-40E,30N-40N)
	WHWP	Western Hemisphere Warm Pool	https://psl.noaa.gov/data/correlation/whwp.data
Snow extent	SnNH	Snow extent (N. Hemisphere)	https://climexp.knmi.nl/getindices.cgi?WMO=RutgersData/nh_snow&STATION=NH_snow_cover&TYPE=i&id=someone@somewhere
	SnNA	Snow extent(North America)	https://climexp.knmi.nl/getindices.cgi?WMO=RutgersData/namerica_snow&STATION=North_America_snow_cover&TYPE=i&id=someone@somewhere
	SnEA	Snow extent (Eurasia)	https://climexp.knmi.nl/getindices.cgi?WMO=RutgersData/eurasia_snow&STATION=Eurasia_snow_cover&TYPE=i&id=someone@somewhere
	Snow1	Locally derived	Averaged (10E-20E, 58N-67N)
	Snow2	Locally derived	Averaged (110W-85W, 38N-50N)
	Snow3	Locally derived	Averaged (38E-67E, 38N-54N)
	Snow4	Locally derived	Averaged(75E-145E, 25N-55N)
	Snow3-Snow4	Locally derived	Calculated locally (Snow3-Snow4)
	Soil_wetness	Variability modes	Rotated PCA from monthly anomalies (calculated 10W-40E, 30N-60N box)

- Comprehensive list of global and regional predictors
- Use of PLS regression
- Multiple runs with different configurations to try to isolate signal
- Generation of hindcast to evaluate skill with a particular configuration





Empirical models

MEDSCOPE

MEDiterranean Services Chain based On climate PrEdictions

Deliverable D2.3

Final version of the empirical forecasting system

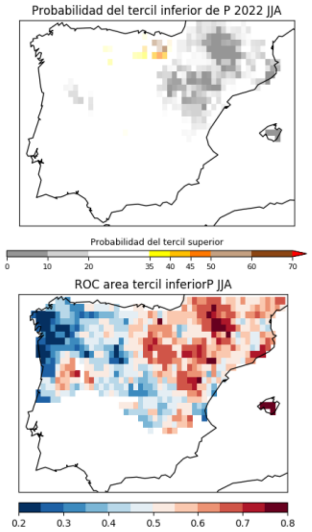
	Acronym	Index name	Source
Teleconnections (z500 patterns)	AAO	Antartic Oscillation	https://psl.noaa.gov/data/correlation/aao.data
	AO	Artic Oscillation	https://psl.noaa.gov/data/correlation/ao.data
	EA	East Atlantic	ftp://ftp.cpc.ncep.noaa.gov/wd52dg/data/indices/ea_index.tim
	EA/WR	East Asia/West Russia	https://psl.noaa.gov/data/correlation/ea.data
	EP/NP	East Pacific/North Pacific	https://psl.noaa.gov/data/correlation/epo.data
	NAO	North Atlantic Oscillation	https://psl.noaa.gov/data/correlation/nao.data
	NP	North Pacific	https://psl.noaa.gov/data/correlation/np.data
	PNA	Pacific North American	https://psl.noaa.gov/data/correlation/pna.data
	SCAND	Scandinavian	ftp://ftp.cpc.ncep.noaa.gov/wd52dg/data/indices/scand_index.tim
	WP	West Pacific	https://psl.noaa.gov/data/correlation/wp.data
Stratosphere	QBO	Quasi Biennial Oscillation	Averaged u wind (10S-10N at 10hPa)
	u10n	Northern u at 10hPa	Averaged u wind (60N-85N at 10 hPa)
	u10s	Southern u at10hPa	Averaged u wind (85S-60S at 10 hPa)
ENSO	MEIv2	Multivariate ENSO index	https://psl.noaa.gov/enso/mei/data/meiv2.data
	SOI	Southern Oscillation index	https://psl.noaa.gov/data/correlation/soi.data
Indian Ocean SST and Tave200m	WTIO	Western Tropical Indian Ocean	Averaged (50E-70E,10S-10N)
	SWIO	South Western Indian Ocean	Averaged (31E-45E,32S-25S)
	SETIO	South Eastern Tropical Indian Ocean	Averaged (90E-110E,10S-0)
	DMI	Dipole Mode Index	Calculated (WTIO-SETIO)
Pacific Ocean SST and Tave200m	Nino12	Nino12	Averaged (90W-80W,10S-0)
	Nino3	Nino3	Averaged (150W-90W,5S-5N)
	Nino4	Nino4	Averaged (160E-150W,5S-5N)
	Nino34	Nino34	Averaged (170E-120W,5S-5N)
	Nino34-Nino12	Nino34 - Nino12	Calculated
Atlantic+Mediterranean Oceans SST and Tave200m	TNA	Tropical Northern Atlantic	Averaged (57.5W-15W, 5.5N-23.5N)
	TSA	Tropical Southern Atlantic	Averaged (30W-10E, 20S-0)
	NAT	North Atlantic Tropical	Averaged (40W-20W, 5N-20N)
	SAT	South Tropical Atlantic	Averaged (15W-5E, 20S-5N)
	TASI	NAT - SAT	Calculated
	Atl1	Locally derived	Averaged (40W-10W, 50N-60N)
	Med1	Locally derived	Averaged (0-8E, 33N-46N)
	Med2	Locally derived	Averaged (10E-22E, 33N-46N)
	Med3	Locally derived	Averaged (25E-40E,30N-40N)
	WHWP	Western Hemisphere Warm Pool	https://psl.noaa.gov/data/correlation/whwp.data
Snow extent	SnNH	Snow extent (N. Hemisphere)	https://climexp.knmi.nl/getindices.cgi?WMO=RutgersData/nh_snow&STATION=NH_snow_cover&TYPE=i&id=someone@somewhere
	SnNA	Snow extent(North America)	https://climexp.knmi.nl/getindices.cgi?WMO=RutgersData/namerica_snow&STATION=North_America_snow_cover&TYPE=i&id=someone@somewhere
	SnEA	Snow extent (Eurasia)	https://climexp.knmi.nl/getindices.cgi?WMO=RutgersData/eurasia_snow&STATION=Eurasia_snow_cover&TYPE=i&id=someone@somewhere
	Snow1	Locally derived	Averaged (10E-20E, 58N-67N)
	Snow2	Locally derived	Averaged (110W-85W, 38N-50N)
	Snow3	Locally derived	Averaged (38E-67E, 38N-54N)
	Snow4	Locally derived	Averaged(75E-145E, 25N-55N)
	Snow3-Snow4	Locally derived	Calculated locally (Snow3-Snow4)
	Soil_wetness	Variability modes	Rotated PCA from monthly anomalies (calculated 10W-40E, 30N-60N box)

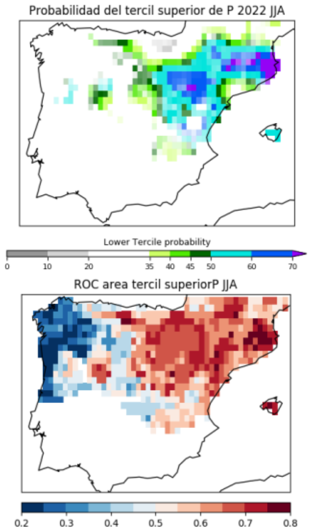
-Comprehensive list of global and regional predictors

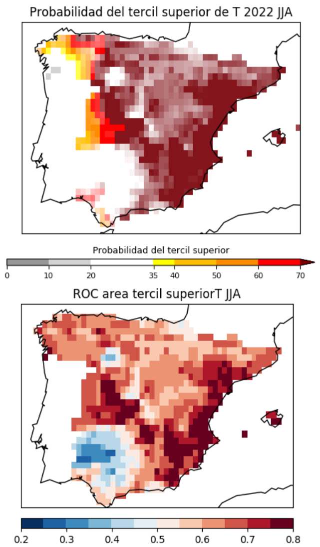
-Use of PLS regression

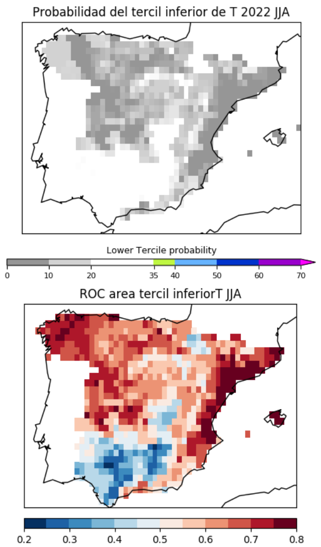
-Multiple runs with different configurations to try to isolate signal

-Generation of hindcast to evaluate skill with a particular configuration









Empirical models

MEDSCOPE

MEDiterranean Services Chain based On climate PrEdictions

Deliverable D2.3

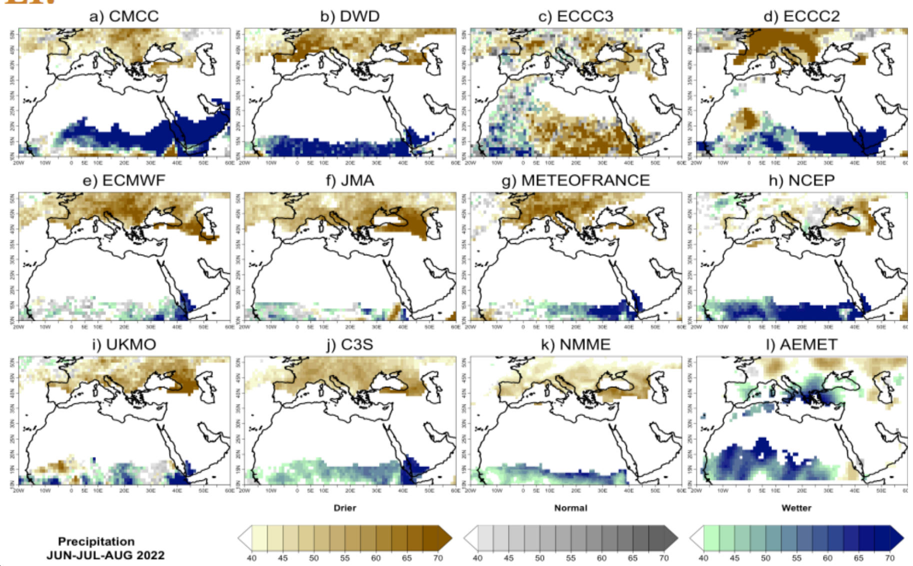
Final version of the empirical forecasting system

	Acronym	Index name	Source
Teleconnections (z500 patterns)	AAO	Antartic Oscillation	https://psl.noaa.gov/data/correlation/aao.data
	AO	Artic Oscillation	https://psl.noaa.gov/data/correlation/ao.data
	EA	East Atlantic	ftp://ftp.cpc.ncep.noaa.gov/wd52dg/data/indices/ea_index.tim
	EA/WR	East Asia/West Russia	https://psl.noaa.gov/data/correlation/ea.data
	EP/NP	East Pacific/North Pacific	https://psl.noaa.gov/data/correlation/epo.data
	NAO	North Atlantic Oscillation	https://psl.noaa.gov/data/correlation/nao.data
	NP	North Pacific	https://psl.noaa.gov/data/correlation/np.data
	PNA	Pacific North American	https://psl.noaa.gov/data/correlation/pna.data
	SCAND	Scandinavian	ftp://ftp.cpc.ncep.noaa.gov/wd52dg/data/indices/scand_index.tim
	WP	West Pacific	https://psl.noaa.gov/data/correlation/wp.data
Stratosphere	QBO	Quasi Biennial Oscillation	Averaged u wind (10S-10N at 10hPa)
	u10n	Northern u at 10hPa	Averaged u wind (60N-85N at 10 hPa)
	u10s	Southern u at10hPa	Averaged u wind (85S-60S at 10 hPa)
ENSO	MEIv2	Multivariate ENSO index	https://psl.noaa.gov/enso/mei/data/meiv2.data
	SOI	Southern Oscillation index	https://psl.noaa.gov/data/correlation/soi.data
Indian Ocean SST and Tave200m	WTIO	Western Tropical Indian Ocean	Averaged (50E-70E,10S-10N)
	SWIO	South Western Indian Ocean	Averaged (31E-45E,32S-25S)
	SETIO	South Eastern Tropical Indian Ocean	Averaged (90E-110E,10S-0)
	DMI	Dipole Mode Index	Calculated (WTIO-SETIO)
Pacific Ocean SST and Tave200m	Nino12	Nino12	Averaged (90W-80W,10S-0)
	Nino3	Nino3	Averaged (150W-90W,5S-5N)
	Nino4	Nino4	Averaged (160E-150W,5S-5N)
	Nino34	Nino34	Averaged (170E-120W,5S-5N)
	Nino34-Nino12	Nino34 - Nino12	Calculated
Atlantic+Mediterranean Oceans SST and Tave200m	TNA	Tropical Northern Atlantic	Averaged (57.5W-15W, 5.5N-23.5N)
	TSA	Tropical Southern Atlantic	Averaged (30W-10E, 20S-0)
	NAT	North Atlantic Tropical	Averaged (40W-20W, 5N-20N)
	SAT	South Tropical Atlantic	Averaged (15W-5E, 20S-5N)
	TASI	NAT - SAT	Calculated
	Atl1	Locally derived	Averaged (40W-10W, 50N-60N)
	Med1	Locally derived	Averaged (0-8E, 33N-46N)
	Med2	Locally derived	Averaged (10E-22E, 33N-46N)
	Med3	Locally derived	Averaged (25E-40E,30N-40N)
	WHWP	Western Hemisphere Warm Pool	https://psl.noaa.gov/data/correlation/whwp.data
Snow extent	SnNH	Snow extent (N. Hemisphere)	https://climexp.knmi.nl/getindices.cgi?WMO=RutgersData/nh_snow&STATION=NH_snow_cover&TYPE=i&id=someone@somewhere
	SnNA	Snow extent(North America)	https://climexp.knmi.nl/getindices.cgi?WMO=RutgersData/namerica_snow&STATION=North_America_snow_cover&TYPE=i&id=someone@somewhere
	SnEA	Snow extent (Eurasia)	https://climexp.knmi.nl/getindices.cgi?WMO=RutgersData/eurasia_snow&STATION=Eurasia_snow_cover&TYPE=i&id=someone@somewhere
	Snow1	Locally derived	Averaged (10E-20E, 58N-67N)
	Snow2	Locally derived	Averaged (110W-85W, 38N-50N)
	Snow3	Locally derived	Averaged (38E-67E, 38N-54N)
	Snow4	Locally derived	Averaged(75E-145E, 25N-55N)
	Snow3-Snow4	Locally derived	Calculated locally (Snow3-Snow4)
	Soil_wetness	Variability modes	Rotated PCA from monthly anomalies (calculated 10W-40E, 30N-60N box)

- -Comprehensive list of global and regional predictors
- -Use of PLS regression
- -Multiple runs with different configurations to try to isolate signal
- -Generation of hindcast to evaluate skill with a particular configuration

Monthly delivered as part of MSCU:

a) Precipitation Forecast L1:



b) Precipitation Skill (RPSS) L1:

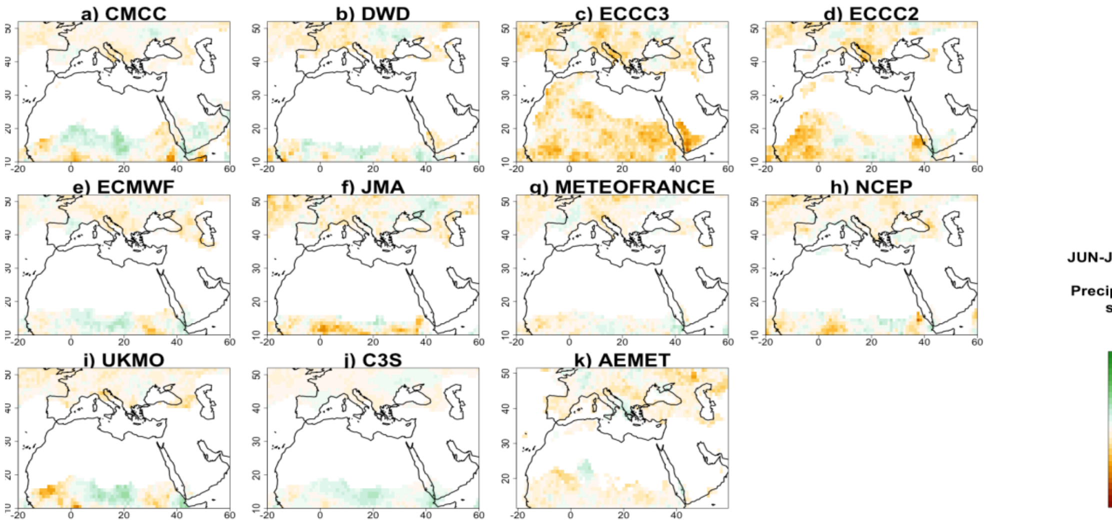
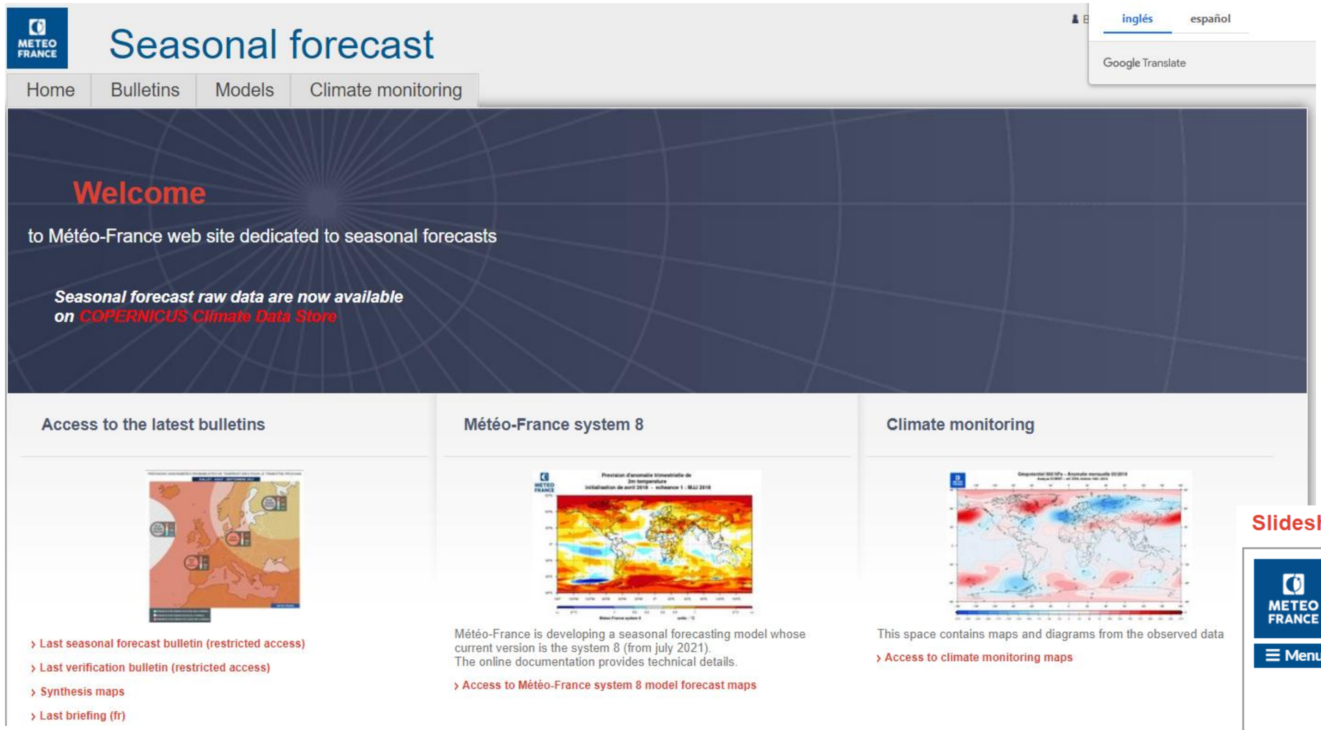


Figure 3: Ranked Probability Skill Score (RPSS) in Precipitation forecast for the seasonal for
systems. Higher values indicate better model predictive skill. From (a) to (i) models of the C3
ensemble. (j) for AEMET.

http://seasonal.meteo.fr/content/bienvenue



Final remarks:

-Several sources of seasonal climate information have been presented
-Importance of verification, both for dynamical and empirical models

Future steps:
-Diagnosis products (variability patterns, weather regimes..). Some of them already available at RAVI RCC-LRF.
-Dore analysis representation of sources of predictability in the models
-Exploring ways of combining information.