



# Mediterranean Seasonal Climate Update

Workshop on objective seasonal forecasts (OSF) production over MedCOF region

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02/07/2024

## Introduction

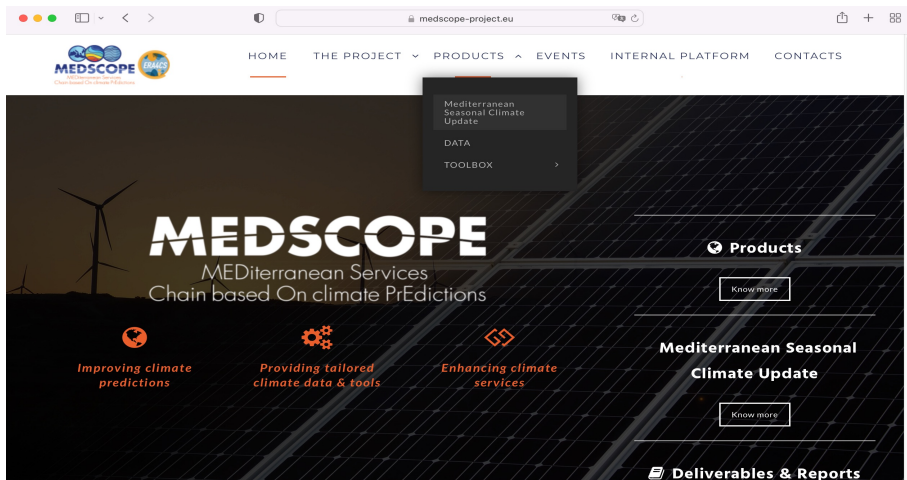
The **Mediterranean Seasonal Climate Update (MSCU)** is a monthly Seasonal Forecast update for a large region encompassing the Mediterranean basin, which presents forecasts of Precipitation and Temperature, for the upcoming season, using:

- The **North American Multi-Model Ensemble (NMME)** seasonal prediction system (Kirtman et al, 2014, Becker et al, 2014),
- The **Copernicus Climate Change (C3S)** seasonal prediction system (<https://climate.copernicus.eu/seasonalforecasts>) and,
- The **AEMET empirical model** developed within the MEDSCOPE framework (Rodriguez-Guisado et al, 2019).

The MSCU is principally addressed to the MedCOF community and more generally, to users and stakeholders who may benefit from having at hands a summary, in graphical homogeneous form, of the seasonal predictions produced by some of the main international and well–documented multi–model systems.

# Introduction

Available at the MEDSCOPE website: [www.medscope-project.eu](http://www.medscope-project.eu)



The screenshot shows the MEDSCOPE website homepage. At the top, there is a navigation bar with the following links: HOME, THE PROJECT, PRODUCTS, EVENTS, INTERNAL PLATFORM, and CONTACTS. The 'PRODUCTS' link is highlighted with a dropdown menu showing 'Mediterranean Seasonal Climate Update', 'DATA', and 'TOOLBOX'. The main header features the MEDSCOPE logo and the tagline 'MEDiterranean Services Chain based On climate PrEdictions'. Below this, there are three main sections: 'Improving climate predictions' (with a globe icon), 'Providing tailored climate data & tools' (with a gear icon), and 'Enhancing climate services' (with a network icon). On the right side, there is a 'Products' section with a 'Know more' button, and a 'Mediterranean Seasonal Climate Update' section with another 'Know more' button. At the bottom right, there is a 'Deliverables & Reports' section with a document icon.

**MEDSCOPE**  
MEDiterranean Services  
Chain based On climate PrEdictions

**Products**  
Know more

**Mediterranean Seasonal Climate Update**  
Know more

**Deliverables & Reports**

Improving climate predictions

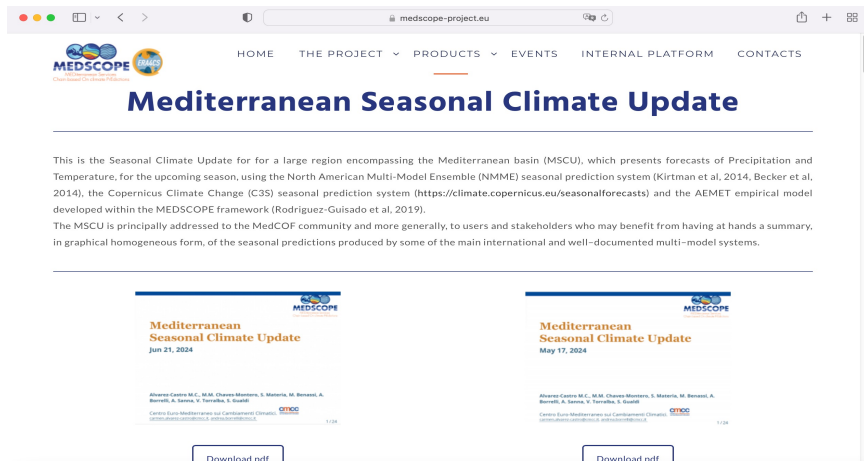
Providing tailored climate data & tools

Enhancing climate services

# Introduction

Available at the MEDSCOPE website:

<https://www.medscope-project.eu/products/mediterranean-seasonal-climate-update/>




The screenshot displays the MEDSCOPE website interface. At the top, the navigation bar includes links for HOME, THE PROJECT, PRODUCTS, EVENTS, INTERNAL PLATFORM, and CONTACTS. The main heading is 'Mediterranean Seasonal Climate Update'. Below this, a paragraph explains that the update provides forecasts for the Mediterranean basin (MSCU) using the North American Multi-Model Ensemble (NMME) and the Copernicus Climate Change (C3S) seasonal prediction system, along with the AEMET empirical model. It states that the MSCU is primarily addressed to the MedCOF community and more generally to users and stakeholders who may benefit from having a summary of seasonal predictions in a homogeneous form. Below the text, there are two download buttons for PDFs: 'Download pdf' for the 'Mediterranean Seasonal Climate Update Jun 21, 2024' and 'Download pdf' for the 'Mediterranean Seasonal Climate Update May 17, 2024'. Both buttons are located at the bottom of the page.

**Mediterranean Seasonal Climate Update**  
Jun 21, 2024

**Mediterranean Seasonal Climate Update**  
May 17, 2024

Alvarez-Castro M.C., M.M. Chaves-Montero, S. Matera, M. Benassi, A. Borrelli, A. Sanna, V. Terralba, S. Guadì

Centro Euro-Mediterraneo sul Cambiamento Climatico. 

1/24

Download pdf





**Example: Last Mediterranean Seasonal  
Climate Update**

# Mediterranean Seasonal Climate Update

**Jun 18, 2024**

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

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# Outline

1. Introduction
2. Data:
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  - b) NMME ensemble
  - c) AEMET empirical model
3. Seasonal Forecast:
  1. Start date and Leadtime
  2. Terciles
  3. ENSO:
  4. Mediterranean Maps:
    - a) Most likely Tercile in the three forecast systems (L1): Precipitation
    - b) Skill (L1): Precipitation
    - c) Most likely Tercile in the three forecast systems (L1): Temperature
    - d) Skill (L1): Temperature
4. References

Supplementary Material

## 1.Introduction

- This is a Seasonal Climate Update for a large region encompassing the Mediterranean basin (hereafter, MSCU) and is principally addressed to the MedCOF community and more generally, to users and stakeholders who may benefit from having at hands a summary, in graphical homogeneous form, of the seasonal predictions produced by some of the main international and well-documented multi-model systems.
- Seasonal forecasts are essential to offer data and information for the development of early-warning decision support systems (Troccoli et al,2008), which can help to reduce the socio-economics related risk associated with anomalous events.
- Characteristics of the climate system and links among remote regions make seasonal prediction systems capable of forecasting the probability of occurrence of future anomalies. The skill of these forecasts depends on the considered meteo-climatic variable, on the lead time and on the target area (Balmaseda et al, 2009). The evolution of anomalous conditions over the oceans and in tropical regions is, in general, more predictable than over continental areas in mid-latitudes. Thus, the models' predictive skill is generally higher in the Tropics. Also, variables like precipitation, featured by a more stochastic nature, are less predictable than temperature, and thus forecasts show higher predictive skill for temperature than for rainfall (Becker et al, 2014).

- The MSCU presents forecasts of Precipitation and Temperature, for the upcoming season, using the North American Multi-Model Ensemble (NMME) seasonal prediction system (Kirtman et al, 2014, Becker et al, 2014), the Copernicus Climate Change (C3S) seasonal prediction system (<https://climate.copernicus.eu/seasonalforecasts>) and the AEMET empirical model developed within the MEDSCOPE framework (Rodriguez-Guisado et al, 2019). These systems have been chosen as they include large super-ensembles produced with well-documented state-of-the-art seasonal prediction systems. The different reference hindcast periods considered by the different multi-model systems (see Tables 1 and 2), may have some influence on both their predictions and predicting skills.
- The MSCU will be continuously updated and improved through interactions with users and collected feedback and, progressively, more systems will be considered and included in the Update.

## 2. Data

### a) C3S models

C3S Models	Members	Model horizontal/vertical resolution (atmosphere)*
CMCC	50	0.5° x 0.5° / 46 levels
DWD	50	T127 / 95 levels
ECCC3	10	1.1° / 85 levels
ECCC2	10	T63 / 35 levels
ECMWF	51	TCO319 / 91 levels
JMA	78	TL159 / 60 levels
MF	51	TL359 / 91 levels
NCEP	120	T128 / 64 levels
UKMO	60	N216 / 85 levels
<b>TOTAL*</b>	<b>460</b>	
<b>Hindcast period**</b>	<b>1993-2016</b>	

Table 1: C3S Models, number of members and Hindcast reference period in the ensemble.

\* C3S models are provided in 1°x1° grid and interpolated here to 0.5°x0.5° grid.

\*\* Number of Members of the Forecast. The total number of members vary among start dates due to NCEP, JMA and UKMO models.

## 2. Data

### b) NMME models

NMME Models	Members	Model horizontal/vertical resolution (atmosphere)*
CFSv2	24	T126 / 24 levels
CanCM4i	10	T63 / 31 levels
GEM-NEMO	10	1.1° x 1.4° / 85 levels
GFDL-SPEAR	30	C18 / 32 levels
NCAR-CCSM4	10	0.9° x 1.25° / 26 levels
NCAR-GEOS5v2	12	0.5° / 72 levels
<b>TOTAL **</b>	<b>96</b>	
<b>Hindcast period</b>	<b>1982-2010</b>	

Table 2: NMME Models, number of members and Hindcast reference period in the ensemble.

\* NMME are provided in 1°x1° grid and interpolated here to 0.5°x0.5° grid.

\*\* Number of Members of the Forecast. The total number of members vary among start dates due to NASA and CFSv2 models.

## 2. Data

### c) AEMET Empirical model

The AEMET empirical model (Rodriguez–Guisado et al, 2019) is based on multiple linear regression, using global climate indices (mainly global teleconnection patterns and indices based on sea surface temperatures, as well as sea-ice and snow cover) as predictors. The model is implemented in a way that allows easy modifications to include new information from other predictors that will come as result of the ongoing sensitivity experiments within the MEDSCOPE project.

The AEMET empirical model makes use of different sets of predictors for every season and every sub region. Starting from a collection of 25 global climate indices, a few predictors are selected for every season and every sub region, checking linear correlation between predictands (temperature and precipitation) and global indices up to one year in advance and using moving averages from two to six months. Special attention has also been paid to the selection of predictors in order to guaranty smooth transitions between neighbor sub regions and consecutive seasons. The model runs a three–month forecast every month with a one–month lead time.

AEMET Empirical Model	Horizontal Resolution
AEMET	1° x 1°



### 3. Seasonal Forecast:

#### 3.1 Start date and Leadtime:

Start date M0	Jun
Leadtime L1	JAS

Table 3: Mediterranean figures for Precipitation and Temperature Figures at leadtime 1 (L1)

##### Notes:

There is a mask in the forecasts in regions that have climatologically very little precipitation in the target months. These regions correspond to the **white** areas in precipitation maps. Forecast of the temperature maps are not affected by this mask.

ECMWF and JMA data were interpolated to common C3S 1x1 grid.

### 3. Seasonal Forecast:

#### 3.2 Terciles:

Seasonal forecasts for precipitation and temperature are expressed in form of probability (Doblas-Reyes et al, 2005, Palmer et al, 2008), meaning that the areas of interest are assigned a likelihood of being wetter (warmer), drier (colder) or within the norm:

- The probability of being above the norm is given by the percentage of ensemble members predicting an anomaly higher than the 66th percentile,
- The probability of being below the norm is given by the percentage of ensemble members predicting an anomaly lower than the 33rd percentile.
- The forecast representing predicted anomalies within the norm (between 33rd and 66th percentile) is displayed as well.

## 3. Seasonal Forecast:

### 3.3 ENSO:

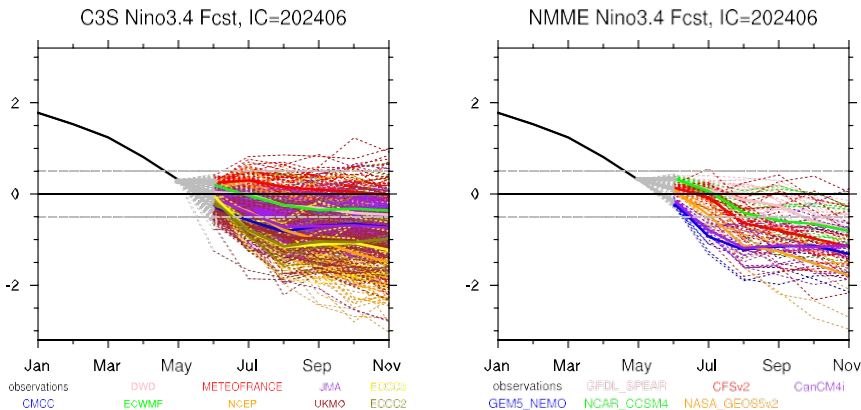


Figure 1: Niño3.4 prediction from all the ensemble members of the C3S multi-system (a) and the NMME multi-system (b), for the start-date of Jun.

### 3. Seasonal Forecast:

#### 3.4 Mediterranean Maps:

Mediterranean temperature and precipitation (forecast and skill) in Leadtime  
L1: **JAS**

- a ) Precipitation Forecast
- b ) Precipitation Skill
- c ) Temperature Forecast
- d ) Temperature Skill

**Models:** C3S models (CMCC, DWD, ECCC3, ECCC2, ECMWF, JMA, NCEP, MF, UKMO), NMME ensemble and Empirical Model AEMET

**Note:** Figures 2 (Precipitation Forecast) and 4 (Temperature Forecast), can be reproduced using 'PlotMostLikelyQuantileMap' function within the CStools R package (Perez-Zanon et al, 2021)

## a) Precipitation Forecast L1:

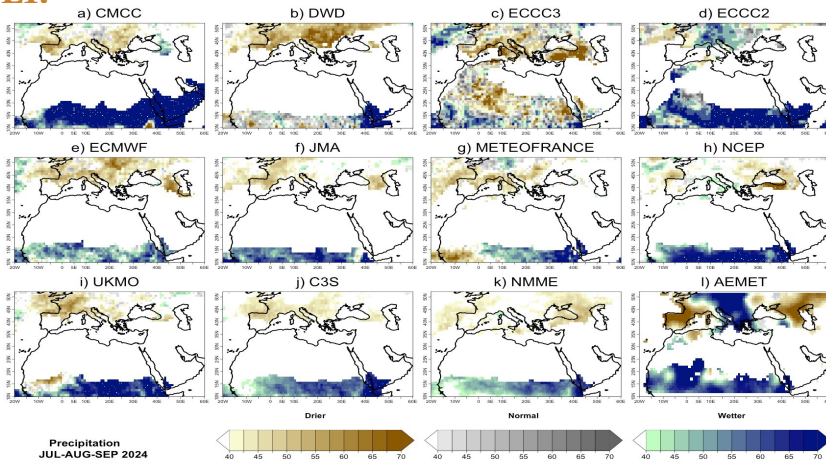


Figure 2: Most likely tercile of Precipitation in the three seasonal forecast systems C3S (j), NMME (k) and AEMET(l) in L1 forecast. From (a) to (i) models of the C3S ensemble.

## b) Precipitation Skill (RPSS) L1:

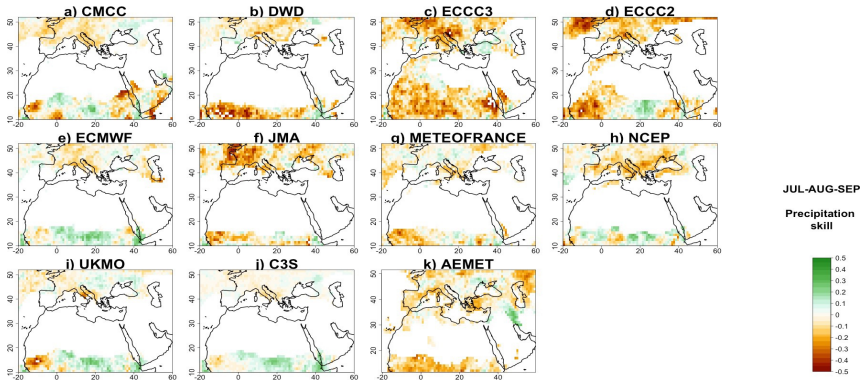


Figure 3: Ranked Probability Skill Score (RPSS) in JAS Precipitation forecast for the seasonal forecast systems. Higher values indicate better model predictive skill. From (a) to (i) models of the C3S ensemble. (j) for AEMET.

## c) Temperature Forecast, L1: JAS

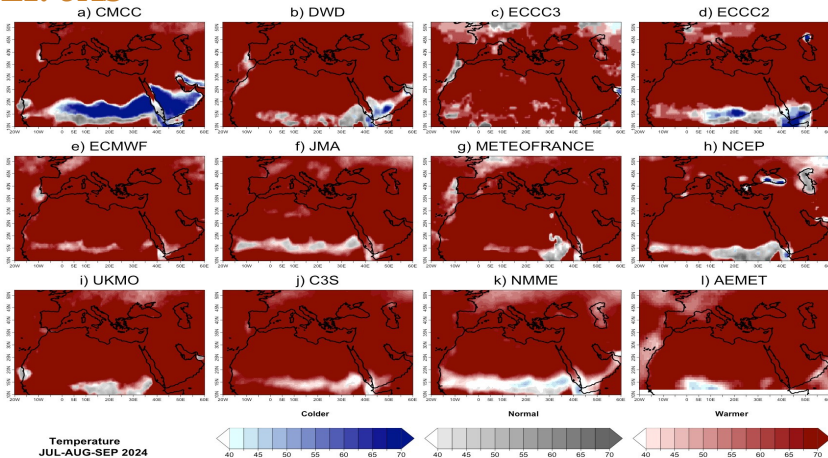


Figure 4: Most likely tercile of Temperature in the three seasonal forecast systems C3S (j), NMME (k) and AEMET(l) in L1 forecast. From (a) to (i) models of the C3S ensemble

## d) Temperature Skill (RPSS) L1:

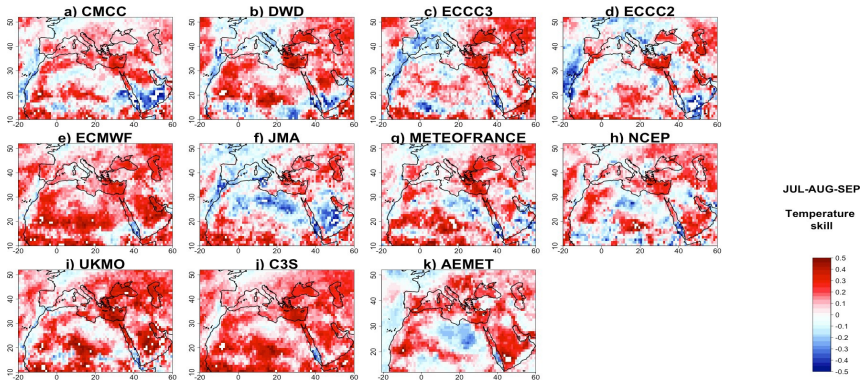


Figure 5: Ranked Probability Skill Score (RPSS) in JAS Temperature forecast for the seasonal forecast systems. Higher values indicate better model predictive skill. From (a) to (i) models of the C3S ensemble. (j) for AEMET.



## 4. References:

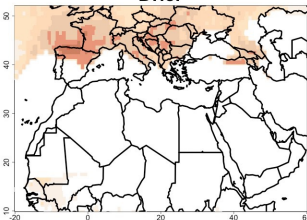
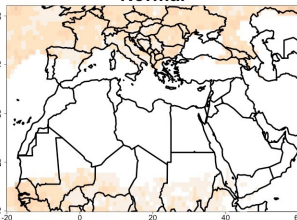
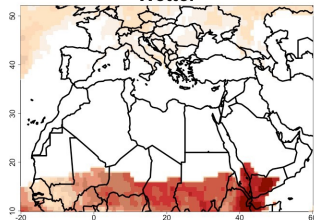
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## S1. C3S Precipitation Forecast L1: JAS

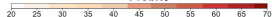
**Wetter**

**Normal**

**Drier**



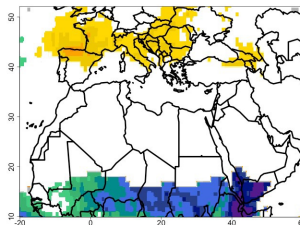
Prob. %



**Precipitation Mediterranean**

**JUL-AUG-SEP 2024**

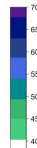
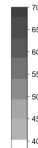
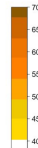
**Probability of occurrence  
for the most likely  
category of events**



**Drier  
Prob. %**

**Normal  
Prob. %**

**Wetter  
Prob. %**

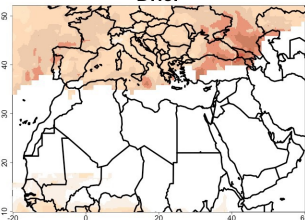
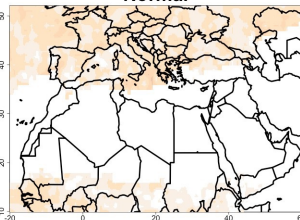
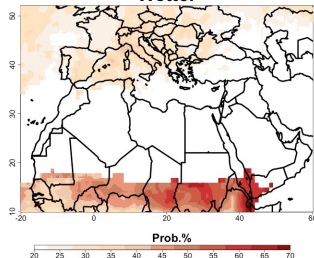


# S2. NMME Precipitation Forecast L1: JAS

**Wetter**

**Normal**

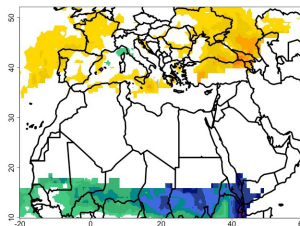
**Drier**



**Precipitation Mediterranean**

**JUL-AUG-SEP 2024**

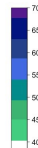
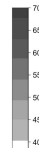
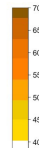
**Probability of occurrence  
for the most likely  
category of events**



**Drier  
Prob. %**

**Normal  
Prob. %**

**Wetter  
Prob. %**



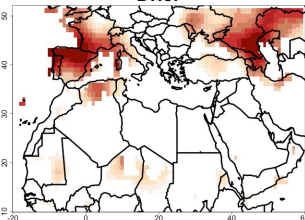
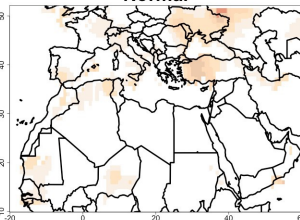
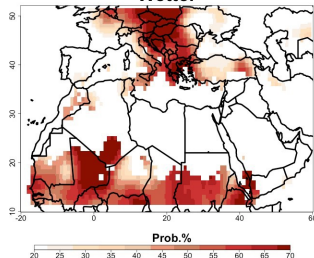
# S3. AEMET Precipitation Forecast

## L1: JAS

**Wetter**

**Normal**

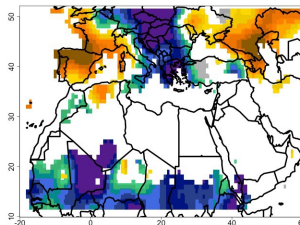
**Drier**



**Precipitation Mediterranean**

**JUL-AUG-SEP 2024**

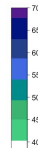
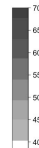
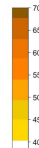
**Probability of occurrence  
for the most likely  
category of events**



**Drier  
Prob. %**

**Normal  
Prob. %**

**Wetter  
Prob. %**



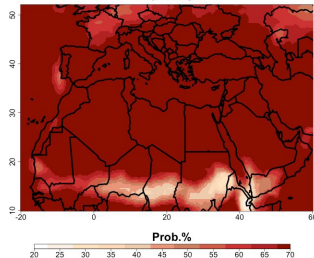
# S4. C3S Temperature Forecast

## L1: JAS

**Warmer**

**Normal**

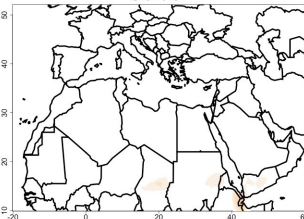
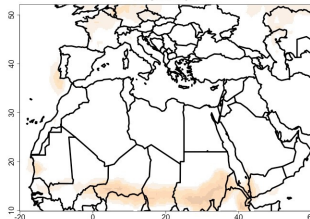
**Colder**



Temperature (2m) Mediterranean

**JUL-AUG-SEP 2024**

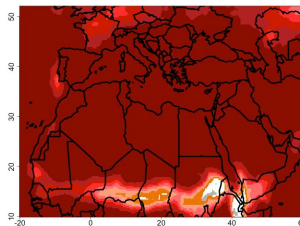
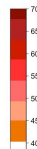
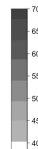
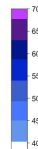
Probability of occurrence  
for the most likely  
category of events



**Colder  
Prob. %**

**Normal  
Prob. %**

**Warmer  
Prob. %**

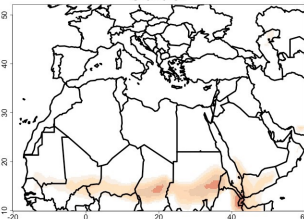
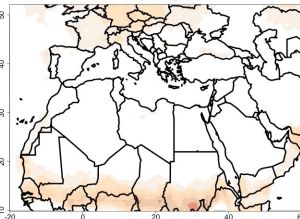
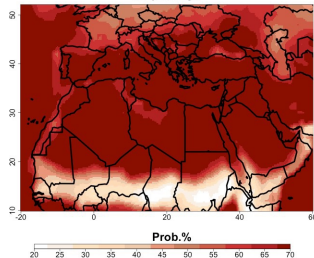


# S5. NMME Temperature Forecast L1: JAS

**Warmer**

**Normal**

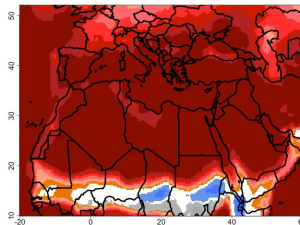
**Colder**



Temperature (2m) Mediterranean

**JUL-AUG-SEP 2024**

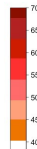
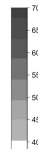
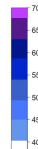
Probability of occurrence  
for the most likely  
category of events



**Colder  
Prob. %**

**Normal  
Prob. %**

**Warmer  
Prob. %**



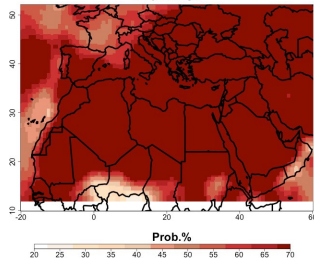
# S6. AEMET Temperature Forecast

## L1: JAS

**Warmer**

**Normal**

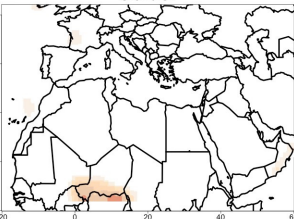
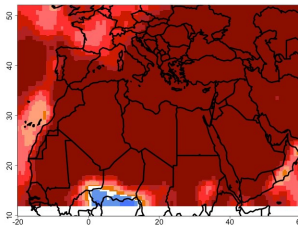
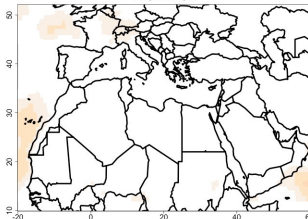
**Colder**



Temperature (2m) Mediterranean

**JUL-AUG-SEP 2024**

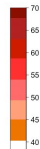
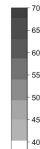
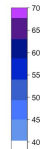
Probability of occurrence  
for the most likely  
category of events



**Colder  
Prob. %**

**Normal  
Prob. %**

**Warmer  
Prob. %**



## S7.) Precipitation Skill (ACC) L1:

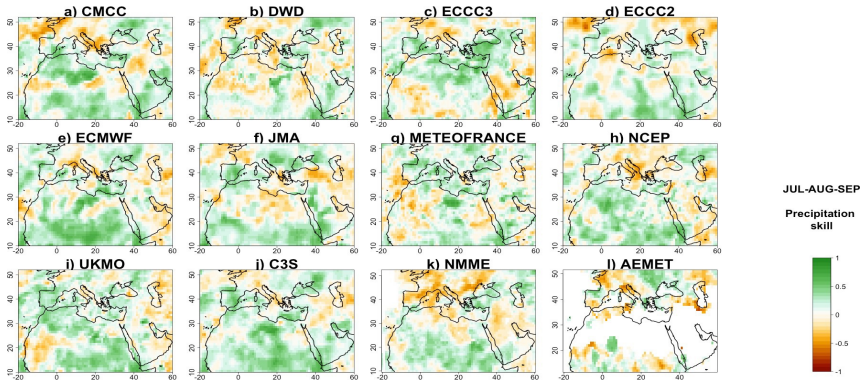


Figure 6: Precipitation correlations in JAS forecast, compared to observations, for the three seasonal forecast systems C3S (j), NMME (k) and AEMET(l). Higher values indicate better model predictive skill. From (a) to (i) models of the C3S ensemble.



## S8.) Temperature Skill (ACC) L1:

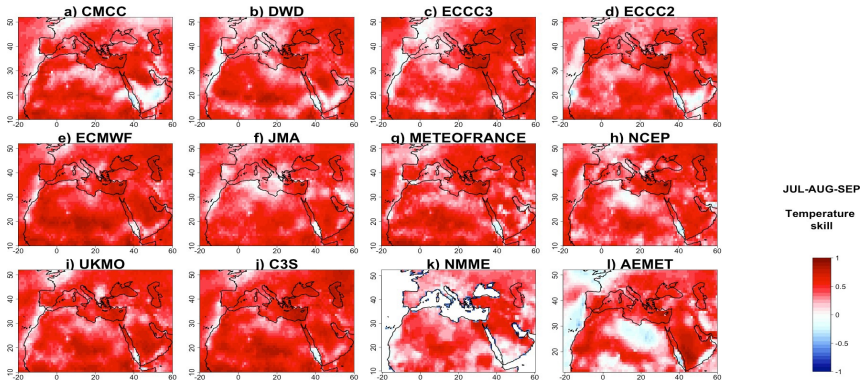
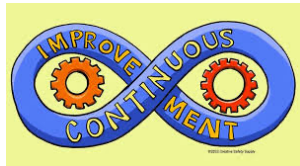


Figure 7: Temperature correlations in JAS forecast, compared to observations, for the three seasonal forecast systems C3S (j) and NMME (k) and AEMET (l). Higher values indicate better model predictive skill. From (a) to (i) models of the C3S ensemble



# Improving the Mediterranean Seasonal Climate Update



## Improving the MSCU: New



- Improvements in the operational chain to **release the update each 15th of the month.**
- **ASC: Andalusian Seasonal Climate Update** (with info for Andalusia/Spain) -> available from September in vareclim website (within [www.upo.es](http://www.upo.es))
- Increase the horizontal resolution with a **Downscaling available by January 2025** (at least 25 km, but exploring the possibility to reach up to 1 km)

# Improving the MSCU: Feedback



- Specific region of interest for an update?
- Additional variables? SST, SLP, z500?
- Include another leadtime?
- Verification?
- Changes in design/format/content???
- Changes in observation dataset for skill scores??

# <https://www.cost.eu/actions/CA23108/#tabs+Name:Description>

## CA23108 - Seasonal-to-decadal climate predictability in the Mediterranean: process understanding and services (MEDUSSE)

 Downloads

[Home](#) > [Browse Actions](#) > Seasonal-to-decadal climate predictability in the Mediterranean: process understanding and services (MEDUSSE)

Description

Management Committee

Main Contacts and Leadership

Working Groups and Membership

## Description

Climate forecasting has enormous potential influence in different socio-economic sectors, such as agriculture, health, water management, and energy. Actionable climate information is particularly relevant at seasonal-to-decadal timescales, where predictability is linked to slow fluctuations of the system such as those in the ocean, sea-ice and land-surface, thus bridging weather/sub-seasonal predictions (mainly relying on atmospheric initial condition) with future projections (mainly based on atmospheric radiative forcing). Seasonal-to-decadal climate forecasting has progressed considerably in recent years, but prediction skill over the Mediterranean is still limited. Better understanding the drivers of regional climate anomalies as well as exploring untapped sources of predictability constitute a much-needed and timely effort.

### Action Details

 MoU - 021/24

 CSO Approval date - 17/05/2024

### How can I participate?

- Read the Action Description [MoU](#)
- Inform the Main Proposer/Chair of your

# CA23108 - Seasonal-to-decadal climate predictability in the Mediterranean: process understanding and services (MEDUSSE)

 Downloads

Description

Management Committee

Main Contacts and Leadership

Working Groups and Membership

## Working Groups

Number	Title	Leader
1	Climate Variability and Predictability	TBA
2	Climate Prediction	TBA
3	Climate Services	TBA


Express your interest to join any of the working groups by applying below.

*It is required to have an e-COST profile to submit your application. If needed, [create it first](#) and then click 'Apply'.*

Apply

### Action Details

 MoU - 021/24

 CSO Approval date - 17/05/2024

### How can I participate?

- Read the Action Description [MoU](#)
- Inform the Main Proposer/Chair of your interest ([email](#))
- [Apply](#) to join your Working Groups of interest
- Please note, Management Committee nominations are carried out through the [COST National Coordinators](#)

# CA23108 - Seasonal-to-decadal climate predictability in the Mediterranean: process understanding and services (MEDUSSE)

 Downloads











Description

**Management Committee**

Main Contacts and Leadership

Working Groups and Membership

## Management Committee

Country	MC Member
Croatia	Dr Ivana HERCEG BULIC 
Croatia	Ms Petra SVILICIC 
Cyprus	Dr Georgios ZITTIS 
Greece	Prof Panagiotis NASTOS 
Italy	Dr Silvio GUALDI 
Slovakia	Dr Anna KRAKOVSKA 
Spain	Dr Carmen ALVAREZ-CASTRO 
Spain	Prof Javier GARCÍA-SERRANO 
Switzerland	Prof Angela MEYER 
Türkiye	Dr Hudaverdi GURKAN 

### Action Details

 MoU - 021/24

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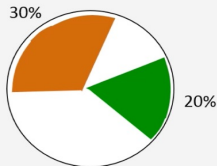
# Improving the MSCU: Feedback



- Specific region of interest for an update?
- Additional variables?
- Include another leadtime?
- Verification?
- Changes in current format???



# SEASONAL FORECAST



**Thanks for your attention!!**

**Thanks to:**

**Esteban Rodriguez-Guisado, Verónica Torralba, Andrea Borrelli, Antonella Sanna, Silvio Gualdi, Marianna Benassi, Maria Chaves-Montero, Stefano Materia, David Gallego, Cristina Peña-Ortiz.**

## Forecast Skill: RPSS

The **ranked probability skill score (RPSS)**, also computed with a CStools function, is based on the comparison of the cumulative squared probability and the reference cumulative probability:

$$\text{RPSS} = 1 - \text{RPS}_{\text{forecast}} / \text{RPS}_{\text{reference}}$$

where RPS is the sum of the squared difference between cumulative forecast and reference probabilities.

**RPSS = 1** the forecast has perfect skill compared to the reference (observations, analyses or climatology) - **forecast beneficial**;

**RPSS = 0** the forecast has no skill compared to the reference (observations, analyses or climatology) - **forecast has no benefit over climatology**;

**RPSS = a negative value** the forecast is less accurate than the reference (observations, analyses or climatology) - **forecast misleading**.

# Andalusian Seasonal Climate Update

September 15, 2024



UNIVERSIDAD  
**PABLO  
OLAVIDE**  
SEVILLA

**AEmet**  
Agencia Estatal de Meteorología



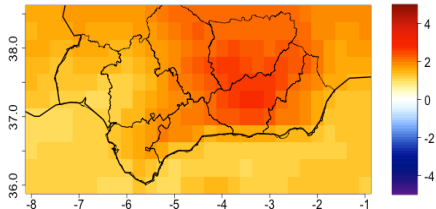
**cmcc**  
Centro Euro-Mediterraneo  
sui Cambiamenti Climatici



**Barcelona  
Supercomputing  
Center**  
Centro Nacional de Supercomputación

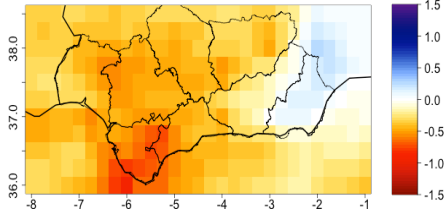
## Temperature

anom (T°C)



## Precipitation

anom (mm)



# Downscaling

- Increase the horizontal resolution with a **Downscaling available by January 2025** (at least 25 km)
- Exploring the possibility to reach up to 1 km with MSWX dataset



Climate Change  
Service

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## ERA5 hourly data on single levels from 1940 to present

A new CDS soon to be launched - expect some disruptions and watch this page for latest.

[Overview](#)

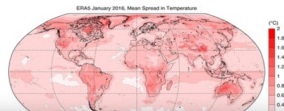
[Download data](#)

[Quality assessment](#)

[Documentation](#)

ERA5 is the fifth generation ECMWF reanalysis for the global climate and weather for the past 8 decades. Data is available from 1940 onwards. ERA5 replaces the ERA-Interim reanalysis.

Reanalysis combines model data with observations from across the world into a globally complete and consistent dataset using the laws of physics. This principle, called data assimilation, is based on the method used by numerical weather prediction



## MSWX

Multi-Source Weather

### Overview

Multi-Source Weather (MSWX) is an operational, high-resolution (3-hourly 0.1°), bias-corrected meteorological product with global coverage from 1979 to 7 months from now.

Other meteorological products, such as ERA5, HydroGFD, PGF, and WFDES, are not available in near real-time, lack freely available forecasts, and have a coarse spatial resolution ( $\geq 0.25^\circ$ ). MSWX combines the best data sources for each time-scale and eliminates systematic biases to provide an effective and readily available solution for use in operational modeling applications. In addition, MSWX is compatible with GloH2O's Multi-Source Weighted-Ensemble Precipitation (MSWEP) product, which merges gauge, satellite, and reanalysis data to obtain the highest quality precipitation estimates.