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JRC MARS Bulletin

Crop monitoring in Europe

January 2023

2023 gets off to a fair start for winter crops

Unusually warm weather can store up trouble for the coming months

Whilst winter crops in most of Europe remain in fair to good condition, recent warmer-than-usual weather, and yo-yoing between temperature extremes are concerns.

An unusually warm autumn was followed by relatively cold conditions in large parts of Europe, which lasted until 18 December 2022. This was followed by an abrupt transition to much warmer weather, with the New Year period even seeing record-breaking temperatures. Because of the shift, much of the cold tolerance previously built up in winter crops was lost. Called de-hardening, this leads to increased frost damage vulnerability should cold spells subsequently occur. Moreover, alternating freeze/thaw cycles can damage plants, thus reducing their vigour and negatively affecting spring regrowth.

Warm temperatures also saw snowpacks in the Alps reach historic lows. If not restored, water availability for irrigation downstream will be problematic come spring. Mild winter conditions are also associated with high pest and disease survival rates.

On the positive side, frost damage has been limited. A severe cold spell in Russia's Volga okrug (around 10 January) is likely to have caused damage, as crops were hardened but insufficiently protected by snow. Weather forecasts to 28 January do not foresee additional frost damage in Europe.

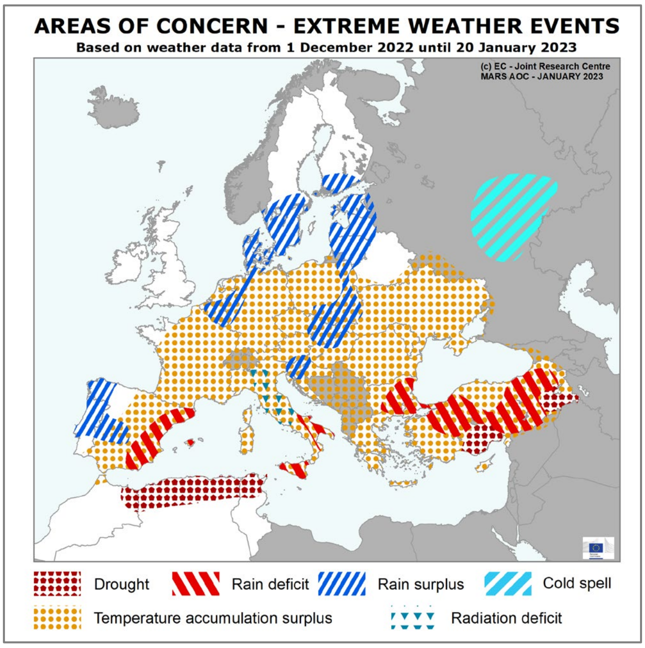
Contents:

Covers the period from 1 December until 16 January 2023

Surplus precipitation is seen in northern and central Europe, the Benelux countries, and the west Iberian Peninsula. This is welcomed where soil moisture and ground water were depleted in summer 2022, but not for slowly draining soils, which are subject to anoxia when temperatures remain above 0°C, and to mechanical damage to crops when the water-logged soils freeze.

The rainfall deficit in south-eastern Spain, southern Italy, and Bulgaria is of no immediate concern for winter crops, but caused further delays to sowing in Türkiye. In Algeria and Tunisia, where drought conditions continued, rainfall is urgently needed to avoid severe losses to crop yields.

A distinct radiation deficit since the beginning of December is noted in parts of Italy, but any impact on crops is unlikely.



Joint Research Centre

1. Agrometeorological overview

1.1 Meteorological review (1 December 2022– 16 January 2023)

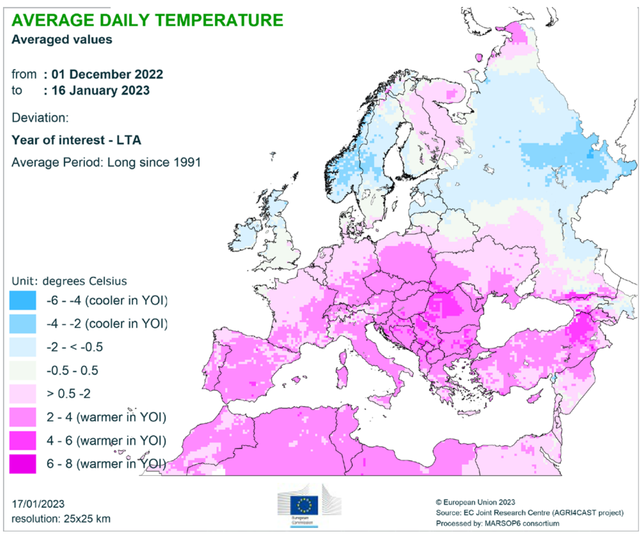
Warmer-than-usual winter conditions occurred in most of Europe south of 55°N latitude. Wetter-than-usual conditions developed mainly in the Iberian Peninsula and in the North Sea and Baltic Sea region, as well as along a latitudinal band extending from southern France and most of Italy north-east through the western Balkans and East European Plain to the Ural Mountains.

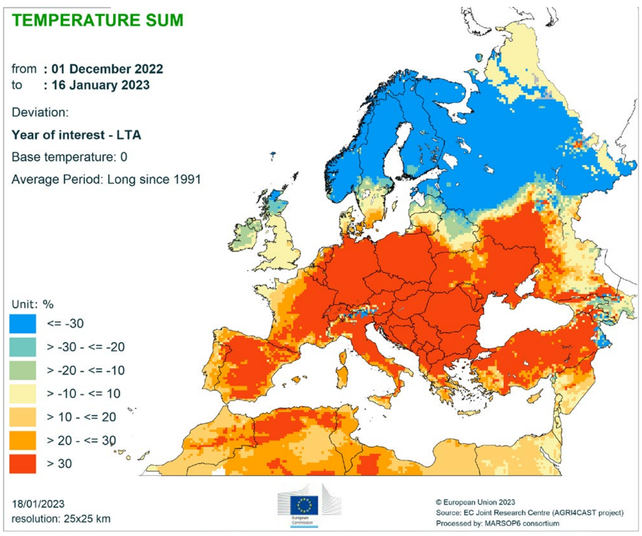
Warmer-than-usual conditions with daily mean temperatures between 2 °C and 4 °C above the 1991–2022 long-term average (LTA) were observed in the Iberian Peninsula, southern and eastern France, most of central Europe, the Balkan Peninsula, south and western Ukraine, and most of Türkiye, as well as the Kara Sea coastal region of northernmost European Russia. More distinct positive temperature anomalies (between 4 °C and 6 °C above the LTA) were observed in eastern Türkiye, north-western Romania and the border region in Ukraine, as well as in several parts of the Balkan Peninsula countries. Warm anomalies were particularly pronounced in the second half of the review period (19 December 2022–16 January 2023) when they occurred almost throughout Europe. Temperature sums (Tbase = 0 °C) exceeded the LTA by 30% and more in most of southern, western and central Europe, as well as in large parts of eastern Europe and Türkiye.

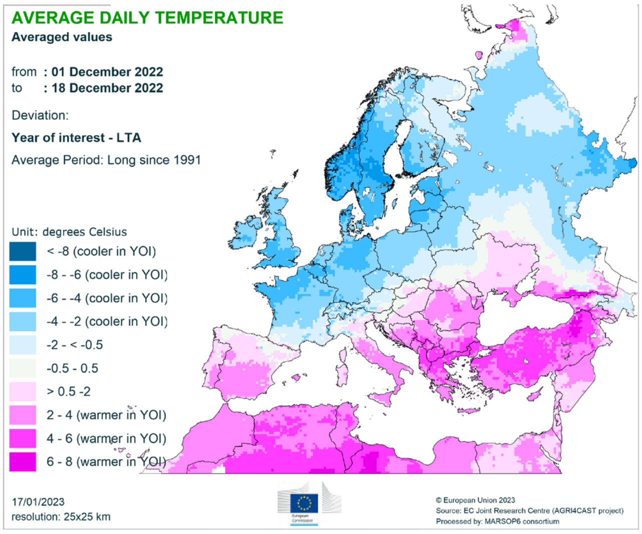
Colder-than-usual conditions with temperature anomalies down to -4 °C to -2 °C below the LTA were observed in parts of Sweden and Norway, as well as in the eastern part of European Russia. In the northern and eastern European plains and Scandinavia, temperatures were lower than the LTA by up to 8 °C during the first part of the review period (1–18 December 2022). This is reflected in temperature sums by 30% and more below the LTA.

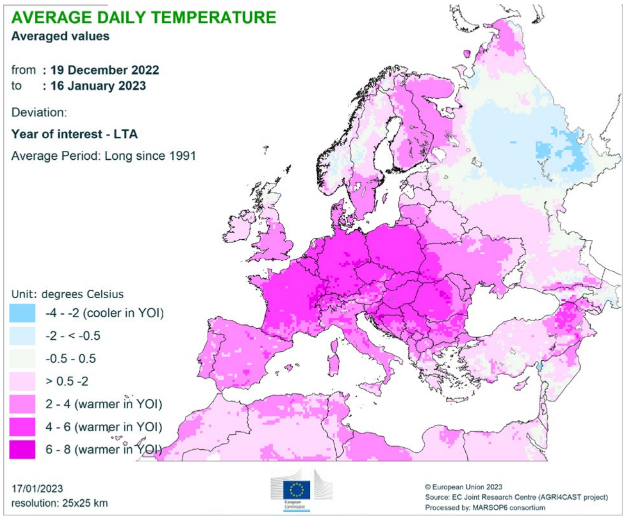
Drier-than-usual conditions with precipitation anomalies of -50% or more with respect to the LTA were observed in parts of Mediterranean Spain, the southern Adriatic coast of Italy, parts of Greece and Bulgaria, and most of Türkiye, as well as in southernmost European Russia and along the Norwegian Sea coast of Scandinavia. This is reflected in the climatic water balance, which in parts of southern Türkiye and coastal Norway was 100 mm and more below the LTA.

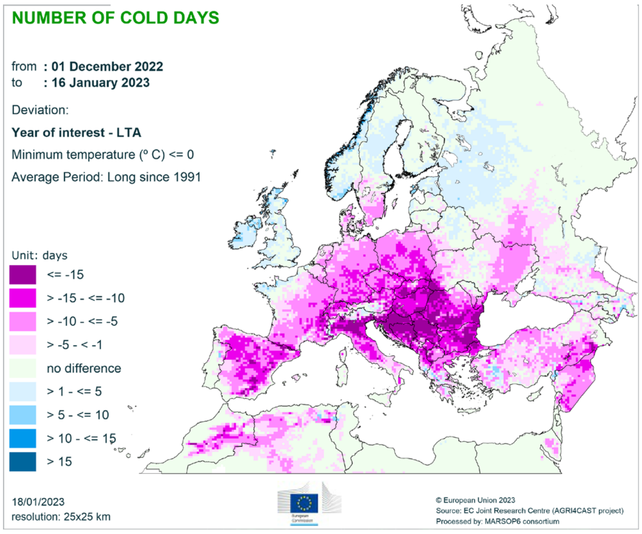
Wetter-than-usual conditions (50% or more with respect to the LTA) were observed in most of the Iberian Peninsula, parts of France and the United Kingdom, the Netherlands, northern Germany, Denmark, southern Norway, most of Sweden and Finland, as well as along a swath extending from Slovenia and Croatia north-east through Hungary, Slovakia, south-eastern Poland and Belarus into central European Russia. In north-western Spain and Portugal, the western British Isles, south-western Norway, and along the Adriatic coast of the western Balkans, 8 or more days with rainfall above 15 mm were observed. This is reflected in the climatic water balance, which in these regions exceeded the LTA by 150 mm and more.

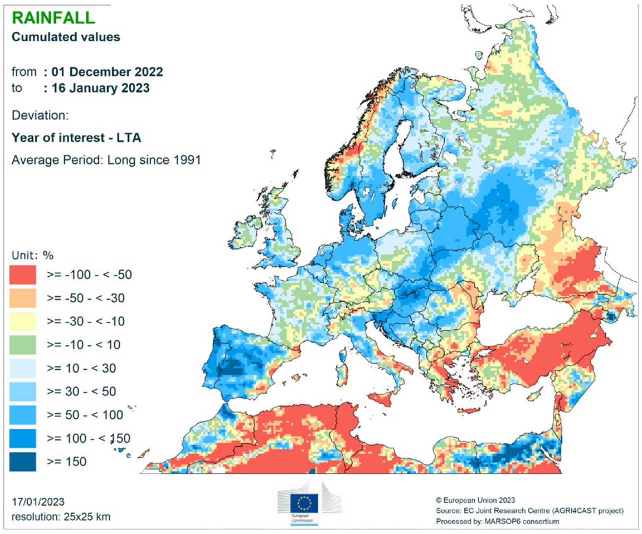


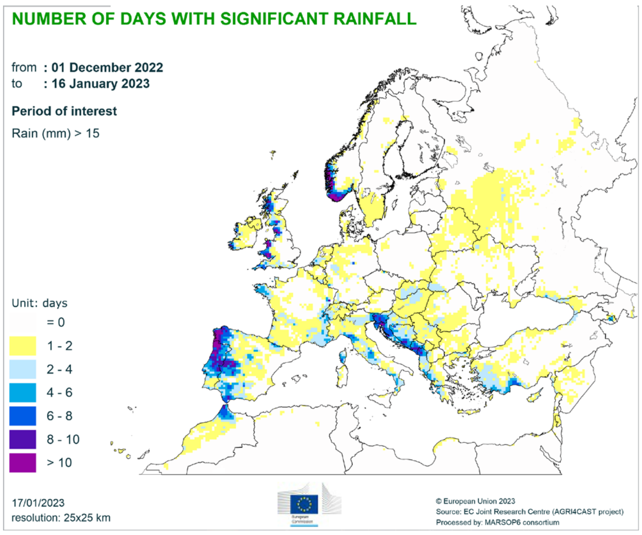


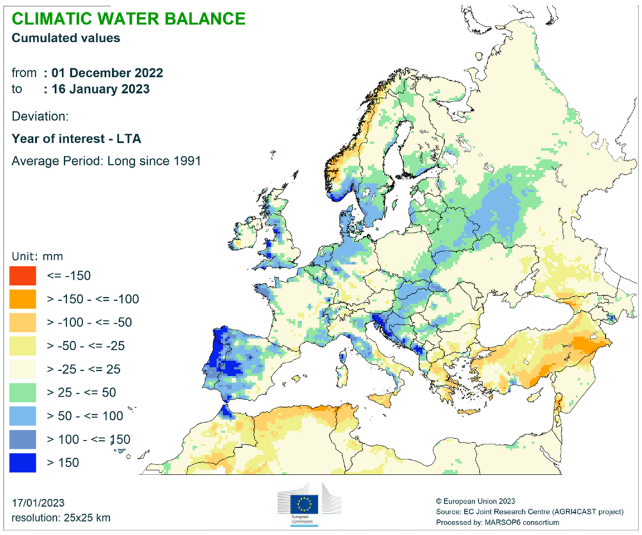

AVERAGE DAILY TEMPERATURE
Averaged values
from : 01 December 2022
to : 18 December 2022
Deviation:
Year of interest - LTA
Average Period: Long since 1991
Unit: degrees Celsius
< -8 (cooler in YOI)
-8 - -6 (cooler in YOI)
-6 - -4 (cooler in YOI)
-4 - -2 (cooler in YOI)
-2 - < -0.5
-0.5 - 0.5
> 0.5 -2
2 - 4 (warmer in YOI)
4 - 6 (warmer in YOI)
6 - 8 (warmer in YOI)
17/01/2023
resolution: 25x25 km
© European Union 2023
Source: EC Joint Research Centre (AGRI4CAST project)
Processed by: MARSOP6 consortium


AVERAGE DAILY TEMPERATURE
Averaged values
from : 19 December 2022
to : 16 January 2023
Deviation:
Year of interest - LTA
Average Period: Long since 1991
Unit: degrees Celsius
-4 - -2 (cooler in YOI)
-2 - < -0.5
-0.5 - 0.5
> 0.5 -2
2 - 4 (warmer in YOI)
4 - 6 (warmer in YOI)
6 - 8 (warmer in YOI)
17/01/2023
resolution: 25x25 km
© European Union 2023
Source: EC Joint Research Centre (AGRI4CAST project)
Processed by: MARSOP6 consortium


NUMBER OF COLD DAYS
from : 01 December 2022
to : 16 January 2023
Deviation:
Year of interest - LTA
Minimum temperature (° C) <= 0
Average Period: Long since 1991
Unit: days
<= -15
> -15 - <= -10
> -10 - <= -5
> -5 - < -1
no difference
> 1 - <= 5
> 5 - <= 10
> 10 - <= 15
> 15
18/01/2023
resolution: 25x25 km
© European Union 2023
Source: EC Joint Research Centre (AGRI4CAST project)
Processed by: MARSOP6 consortium


RAINFALL
Cumulated values
from : 01 December 2022
to : 16 January 2023
Deviation:
Year of interest - LTA
Average Period: Long since 1991
Unit: %
>= -100 - < -50
>= -50 - < -30
>= -30 - < -10
>= -10 - < 10
>= 10 - < 30
>= 30 - < 50
>= 50 - < 100
>= 100 - < 150
>= 150
17/01/2023
resolution: 25x25 km
© European Union 2023
Source: EC Joint Research Centre (AGRI4CAST project)
Processed by: MARSOP6 consortium


NUMBER OF DAYS WITH SIGNIFICANT RAINFALL
from : 01 December 2022
to : 16 January 2023
Period of interest
Rain (mm) > 15
Unit: days
= 0
1 - 2
2 - 4
4 - 6
6 - 8
8 - 10
> 10
17/01/2023
resolution: 25x25 km
© European Union 2023
Source: EC Joint Research Centre (AGRI4CAST project)
Processed by: MARSOP6 consortium


CLIMATIC WATER BALANCE
Cumulated values
from : 01 December 2022
to : 16 January 2023
Deviation:
Year of interest - LTA
Average Period: Long since 1991
Unit: mm
<= -150
> -150 - <= -100
> -100 - <= -50
> -50 - <= -25
> -25 - <= 25
> 25 - <= 50
> 50 - <= 100
> 100 - <= 150
> 150
17/01/2023
resolution: 25x25 km
© European Union 2023
Source: EC Joint Research Centre (AGRI4CAST project)
Processed by: MARSOP6 consortium

1.2 Weather forecast (19-28 January)

Weather conditions will be mainly influenced by transitioning large-scale atmospheric processes and a weakening La Niña. Much warmer-than-usual air temperatures are forecast for most of Scandinavia, Eastern Europe and the Balkan Peninsula, as well as for Türkiye, while colder-than-usual daily air temperatures are expected in large parts of France.

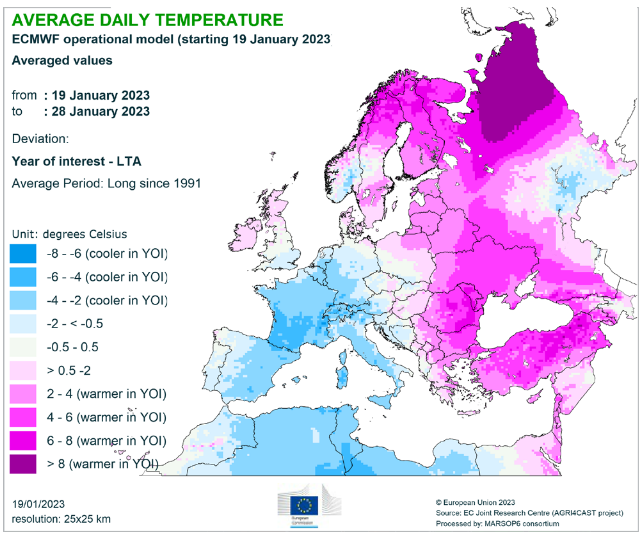
Much warmer-than-usual conditions with average daily temperatures up to 8 °C above the 1991–2022 long-term average (LTA) are forecast in northern Scandinavia, most of European Russia, the Baltic countries, north-eastern Poland, Belarus, Ukraine, Moldova, Romania, Bulgaria, north-eastern Greece, and Türkiye. Even more distinct anomalies, with average daily temperatures of 8 °C or higher than the LTA are forecast for northernmost European Russia in the Barents Sea region. Minimum daily temperatures will remain above 0 °C in the western coastal region of the Iberian Peninsula and most of the United Kingdom and Ireland, as well as in parts of the Balkans and western Türkiye; and even on the coldest days, minimum temperatures are expected to remain above -10 °C in most arable land areas of western, central and south-eastern Europe, as well as in Denmark, Sweden, Belarus, Ukraine and Türkiye.

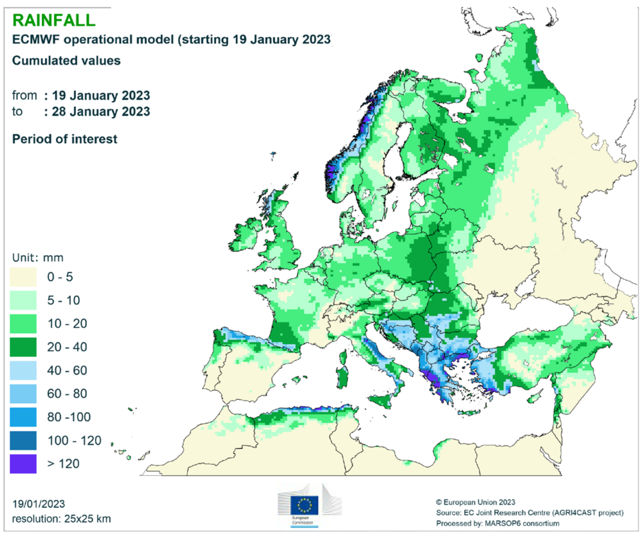
Colder-than-usual conditions with temperature anomalies down to 4 °C below the LTA are forecast for south-eastern United Kingdom, eastern Spain, most of France, parts of the Netherlands and Belgium, parts of western and southern Germany, the Alps region, most of Italy, and parts of the western Balkans. A more distinct negative temperature anomaly is expected for southern France where temperatures down to 6 °C below the LTA are forecast. Minimum daily temperatures below 0 °C are expected in most of Europe with a drop to -10 °C and below in the Pyrenees, Alps, southern part of Norway, and the eastern part of central European Russia.

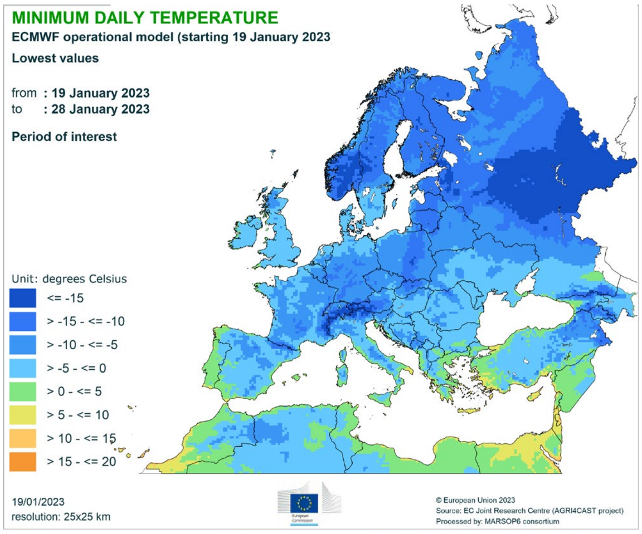
Dry conditions (less than 5 mm precipitation) are expected in most of the Iberian Peninsula, parts of France and Italy, south-eastern United Kingdom and parts of Scandinavia, as well as in eastern Ukraine and southern and eastern central European Russia.

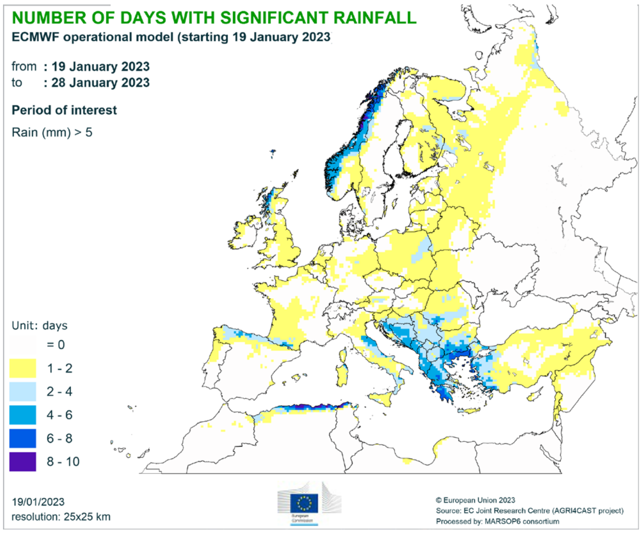
Wet conditions (60 mm or more rainfall) are forecast along the Norwegian Sea coast of Scandinavia, the north-western coastal region of Spain, southernmost Italy, south-western Romania and large parts of the Balkan Peninsula. In most of these regions between 4 and 7 days with rainfall above 5 mm are forecast.

The **seasonal forecast** is for likely warmer-than-usual conditions in most of Europe in February, and a slowly decreasing likelihood of warmer-than-usual conditions in March and April in parts of the Iberian Peninsula, the North European Plain, and parts of Scandinavia. Rainfall is expected to stay close to median values in most of Europe in February, March and April with only slightly increased likelihood of exceeding median values in Italy and the western Balkans in March, and in the Carpathian Mountains region in April.

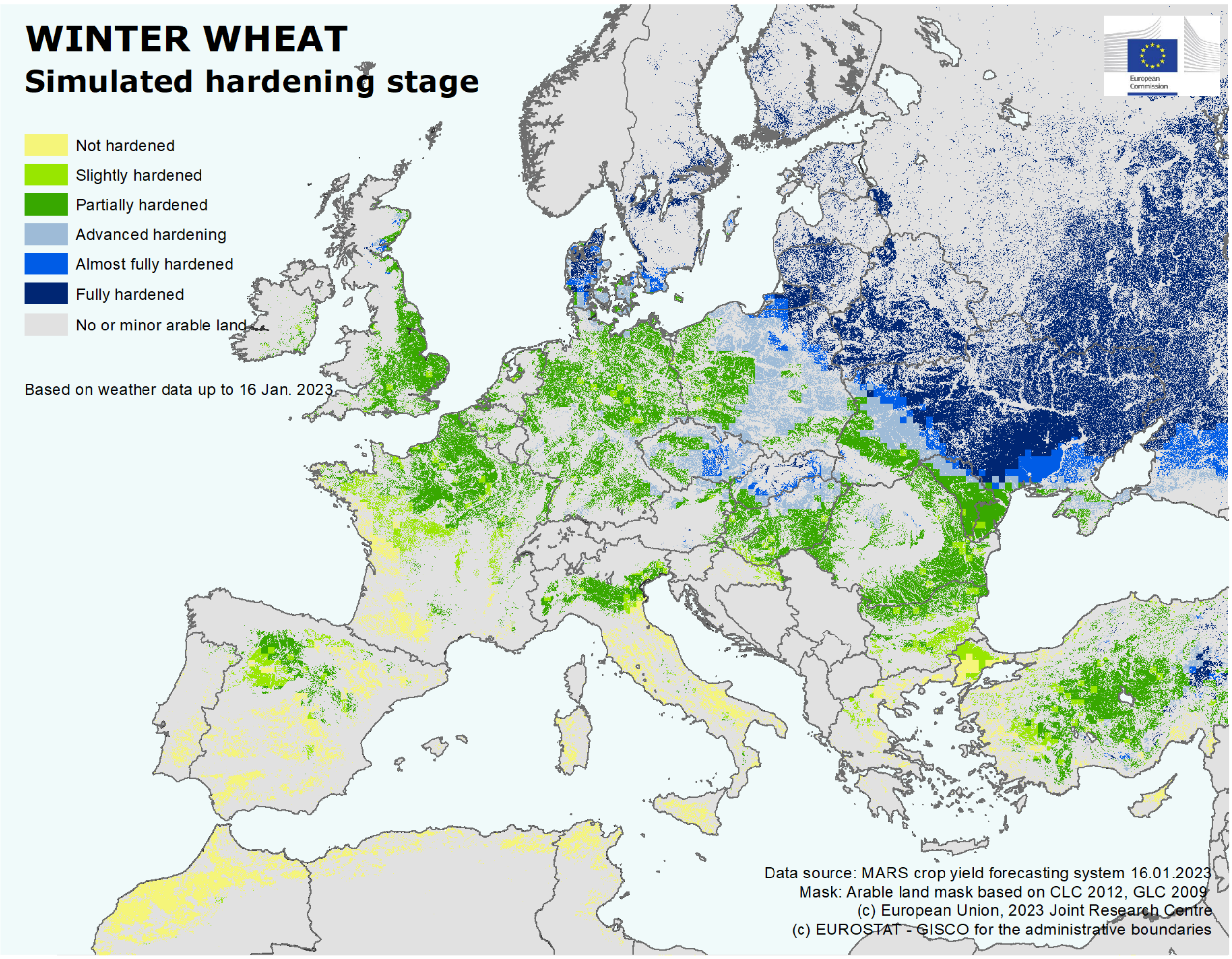





MINIMUM DAILY TEMPERATURE
ECMWF operational model (starting 19 January 2023
Lowest values
from : 19 January 2023
to : 28 January 2023
Period of interest
Unit: degrees Celsius
<= -15
> -15 - <= -10
> -10 - <= -5
> -5 - <= 0
> 0 - <= 5
> 5 - <= 10
> 10 - <= 15
> 15 - <= 20
19/01/2023
resolution: 25x25 km
© European Union 2023
Source: EC Joint Research Centre (AGRI4CAST project)
Processed by: MARSOP6 consortium


NUMBER OF DAYS WITH SIGNIFICANT RAINFALL
ECMWF operational model (starting 19 January 2023
from : 19 January 2023
to : 28 January 2023
Period of interest
Rain (mm) > 5
Unit: days
= 0
1 - 2
2 - 4
4 - 6
6 - 8
8 - 10
19/01/2023
resolution: 25x25 km
© European Union 2023
Source: EC Joint Research Centre (AGRI4CAST project)
Processed by: MARSOP6 consortium

2. Winter hardening and frost kill



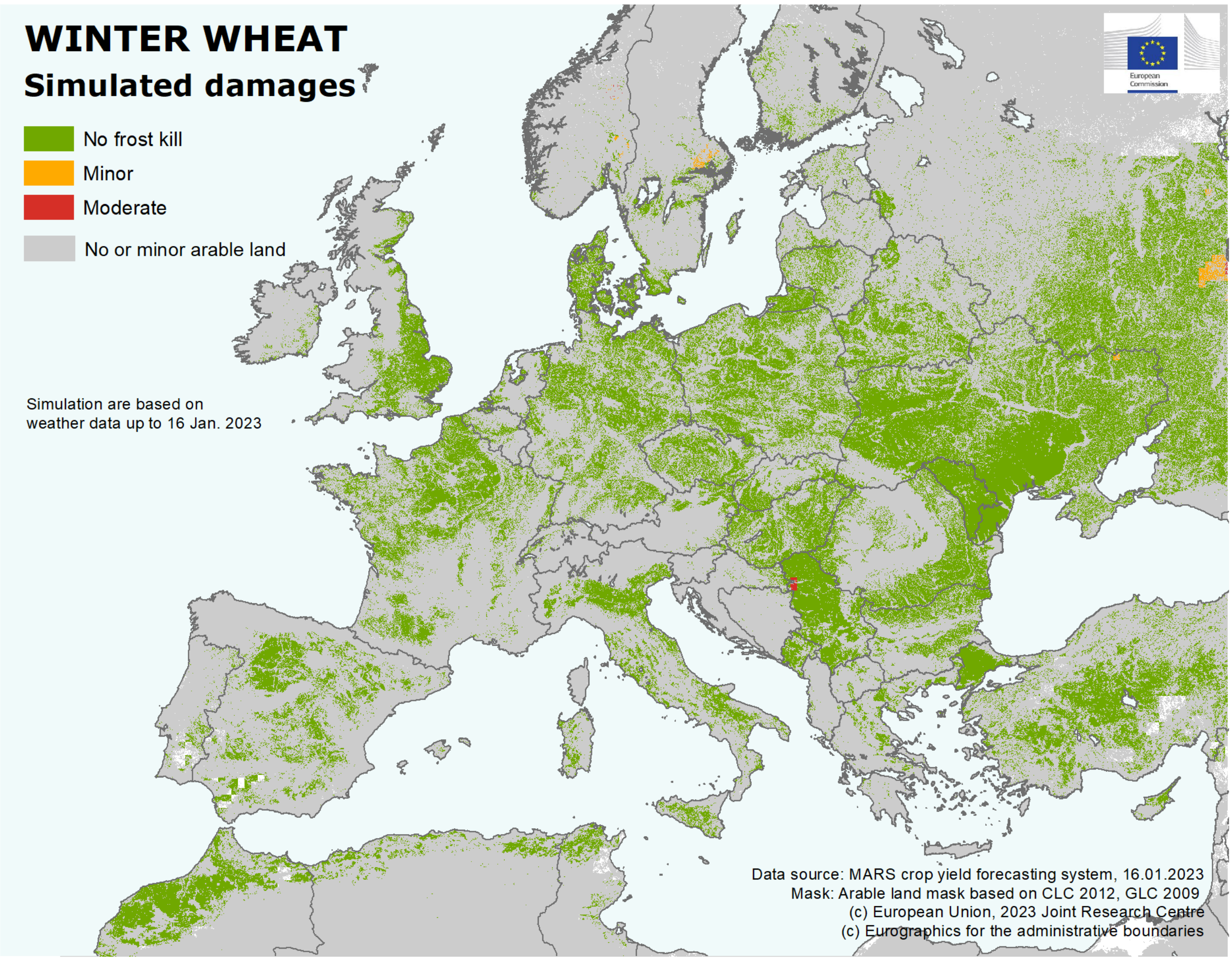
Hardening is the bio-physiological process whereby winter cereals gain low-temperature tolerance to withstand freezing conditions that occur during the winter dormancy period.

Colder-than-usual temperatures in the first half of December were followed by a distinct cold spell in central and eastern Europe, which lasted until 18 December. Temperatures during this period locally dropped to as low as -20 °C, thus leading to very advanced hardening stages. A rapid increase of temperatures toward the end of the year with record-breaking New Year's Eve temperatures (locally surpassing +20 °C) in eastern France, Germany, Poland and the alpine regions initiated a de-hardening period and melt snowpack over agricultural areas. While winter cereals in Russia, the Baltic countries and Scandinavia are still fully to almost fully hardened, those in most other parts of Europe are currently only partially hardened. This de-hardening process leads to a higher vulnerability in case of new cold spells.

So far, frost damage has been limited. The cold spell of mid-December is likely to have caused no damage, due to the (at that time) advanced hardening stage and the presence of a snow layer in the most affected areas. A severe cold spell in the eastern parts of European Russia around 10 January, with observed daily minima below -30 °C for four consecutive nights, is expected to have caused minor frost-kill damages in the Volga okrug, where crops were fully hardened, but not or insufficiently protected by snow.

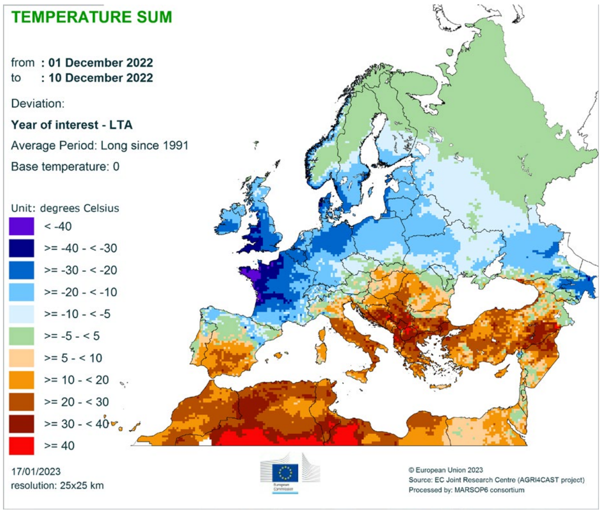
Compared to last year the hardening in mid-December has been more advanced, followed by an atypical de-hardening phase. The current status in mid-January shows winter crops in a less advanced hardening stage compared to the same period in 2022.

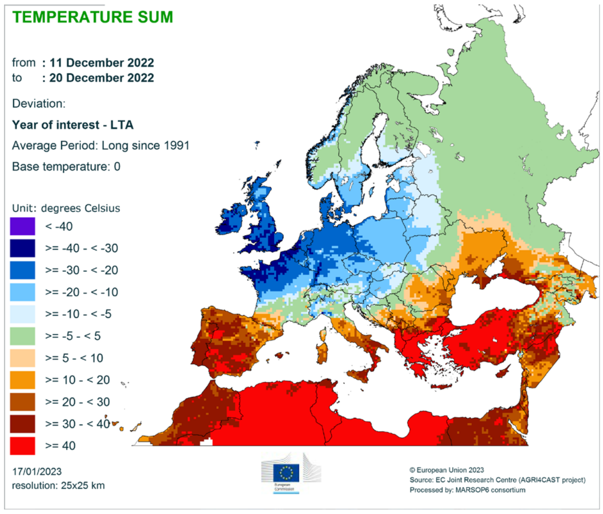
Nevertheless, according to our model simulations, based on the current weather forecast (until 28 January), no additional frost damage is expected in the coming days.

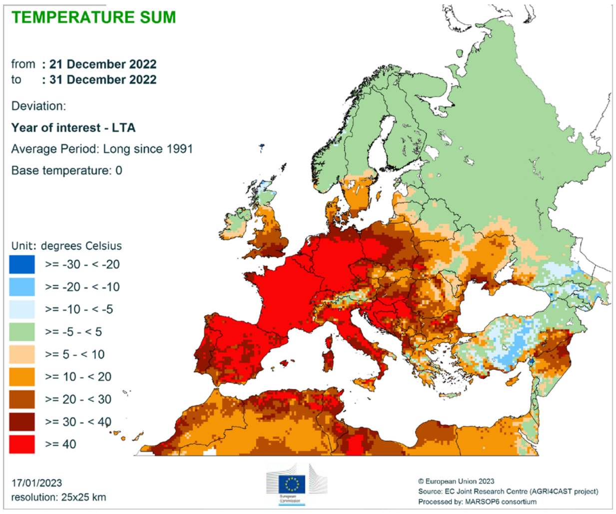

WINTER WHEAT
Simulated damages
No frost kill
Minor
Moderate
No or minor arable land
Simulation are based on weather data up to 16 Jan. 2023
Data source: MARS crop yield forecasting system, 16.01.2023
Mask: Arable land mask based on CLC 2012, GLC 2009
(c) European Union, 2023 Joint Research Centre
(c) Eurographics for the administrative boundaries
European Commission

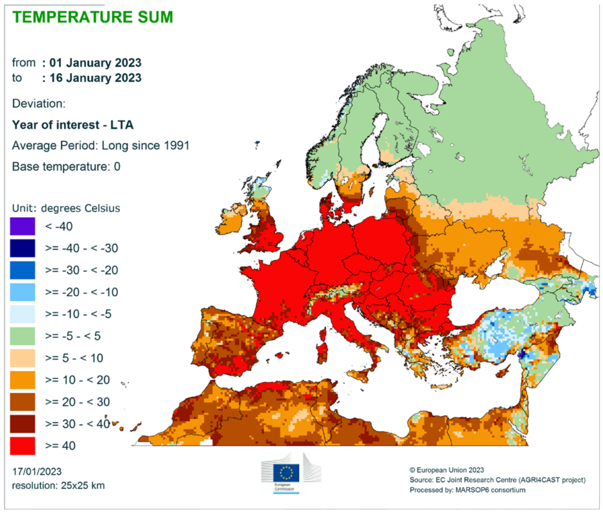
3. Atlas

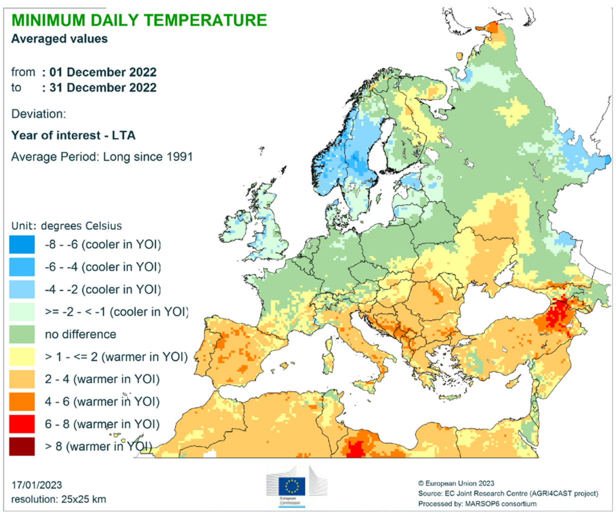
Temperature regime

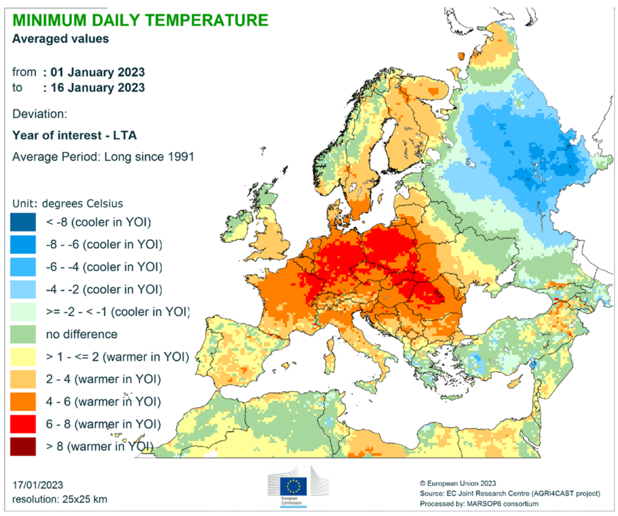


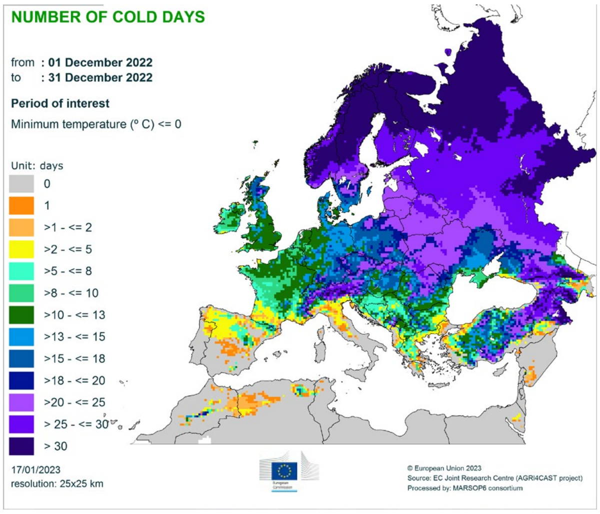


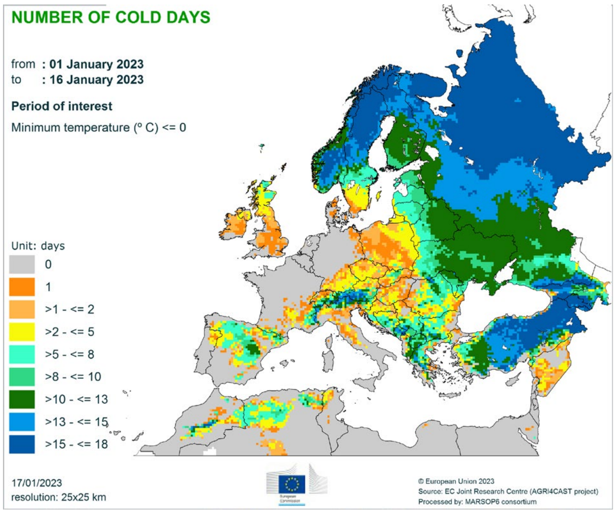




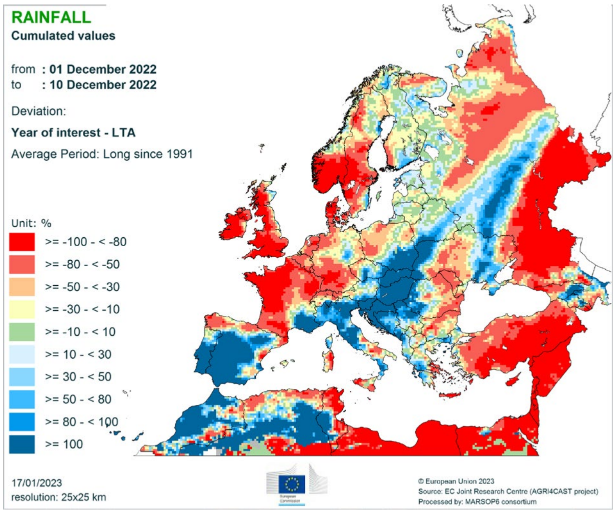


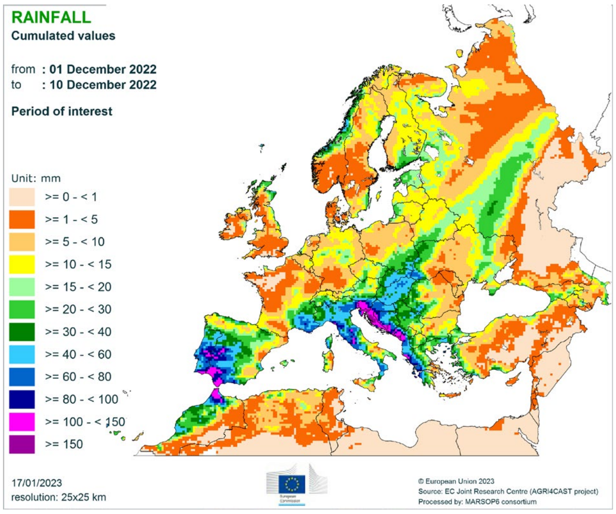


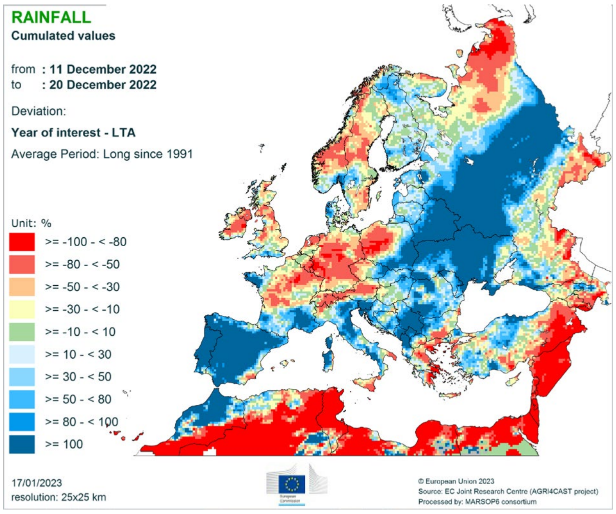


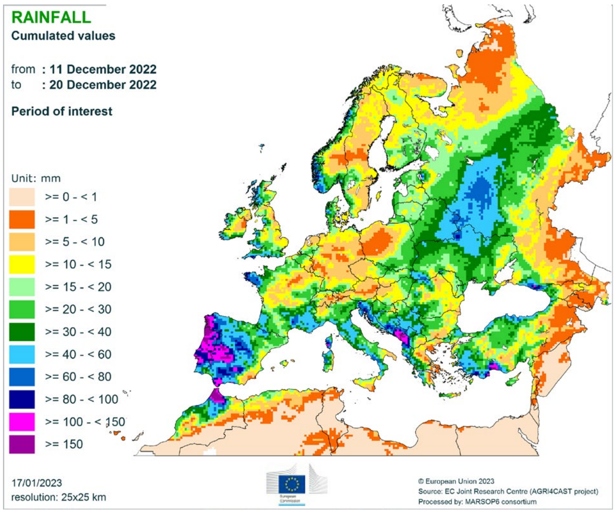


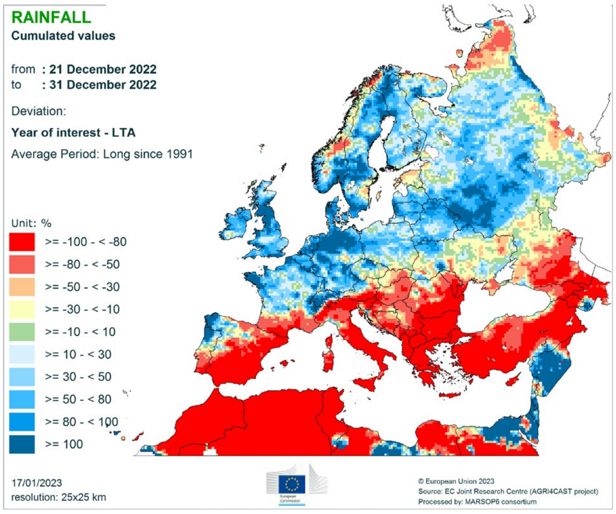
Precipitation

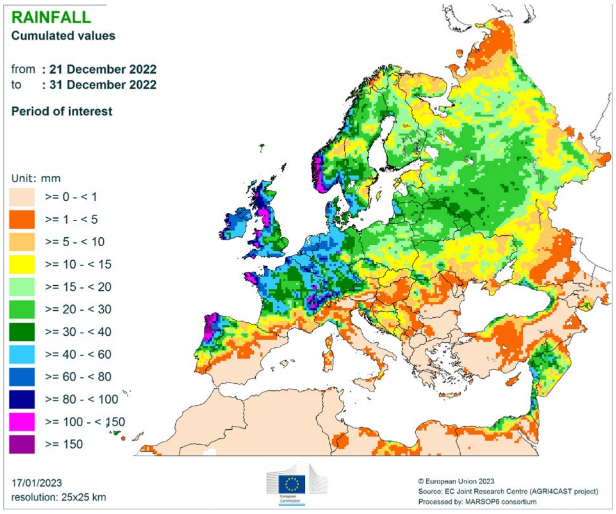


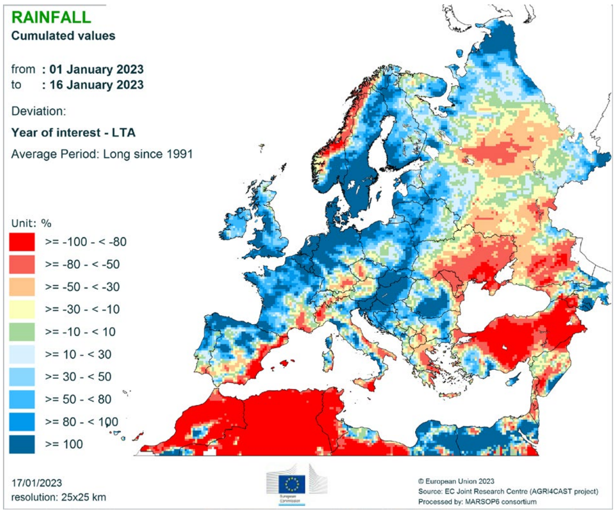


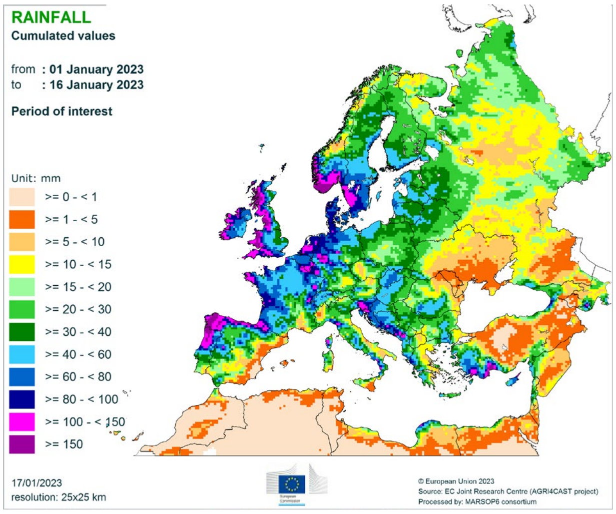


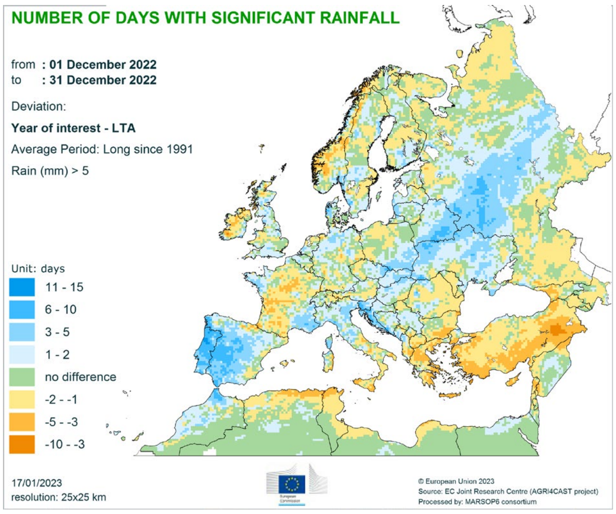


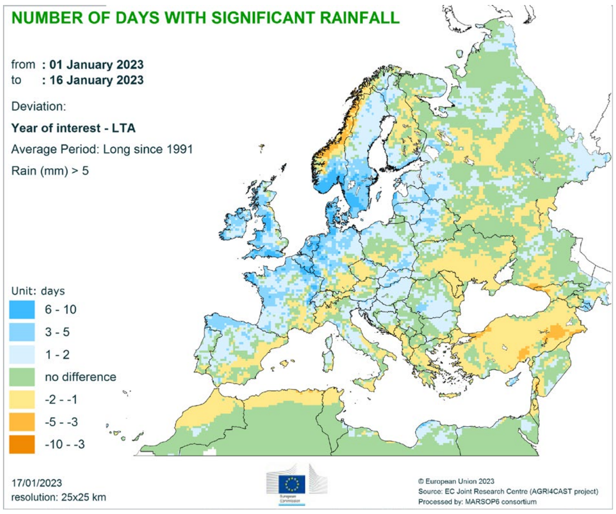

RAINFALL
Cumulated values
from : 21 December 2022
to : 31 December 2022
Deviation:
Year of interest - LTA
Average Period: Long since 1991
Unit: %
>= -100 - < -80
>= -80 - < -50
>= -50 - < -30
>= -30 - < -10
>= -10 - < 10
>= 10 - < 30
>= 30 - < 50
>= 50 - < 80
>= 80 - < 100
>= 100
17/01/2023
resolution: 25x25 km
© European Union 2023
Source: EC Joint Research Centre (AGRI4CAST project)
Processed by: MARSOP6 consortium


RAINFALL
Cumulated values
from : 21 December 2022
to : 31 December 2022
Period of interest
Unit: mm
>= 0 - < 1
>= 1 - < 5
>= 5 - < 10
>= 10 - < 15
>= 15 - < 20
>= 20 - < 30
>= 30 - < 40
>= 40 - < 60
>= 60 - < 80
>= 80 - < 100
>= 100 - < 150
>= 150
17/01/2023
resolution: 25x25 km
© European Union 2023
Source: EC Joint Research Centre (AGRI4CAST project)
Processed by: MARSOP6 consortium


RAINFALL
Cumulated values
from : 01 January 2023
to : 16 January 2023
Deviation:
Year of interest - LTA
Average Period: Long since 1991
Unit: %
>= -100 - < -80
>= -80 - < -50
>= -50 - < -30
>= -30 - < -10
>= -10 - < 10
>= 10 - < 30
>= 30 - < 50
>= 50 - < 80
>= 80 - < 100
>= 100
17/01/2023
resolution: 25x25 km
© European Union 2023
Source: EC Joint Research Centre (AGRI4CAST project)
Processed by: MARSOP6 consortium


RAINFALL
Cumulated values
from : 01 January 2023
to : 16 January 2023
Period of interest
Unit: mm
>= 0 - < 1
>= 1 - < 5
>= 5 - < 10
>= 10 - < 15
>= 15 - < 20
>= 20 - < 30
>= 30 - < 40
>= 40 - < 60
>= 60 - < 80
>= 80 - < 100
>= 100 - < 150
>= 150
17/01/2023
resolution: 25x25 km
© European Union 2023
Source: EC Joint Research Centre (AGRI4CAST project)
Processed by: MARSOP6 consortium


NUMBER OF DAYS WITH SIGNIFICANT RAINFALL
from : 01 December 2022
to : 31 December 2022
Deviation:
Year of interest - LTA
Average Period: Long since 1991
Rain (mm) > 5
Unit: days
11 - 15
6 - 10
3 - 5
1 - 2
no difference
-2 - -1
-5 - -3
-10 - -3
17/01/2023
resolution: 25x25 km
© European Union 2023
Source: EC Joint Research Centre (AGRI4CAST project)
Processed by: MARSOP6 consortium


NUMBER OF DAYS WITH SIGNIFICANT RAINFALL
from : 01 January 2023
to : 16 January 2023
Deviation:
Year of interest - LTA
Average Period: Long since 1991
Rain (mm) > 5
Unit: days
6 - 10
3 - 5
1 - 2
no difference
-2 - -1
-5 - -3
-10 - -3
17/01/2023
resolution: 25x25 km
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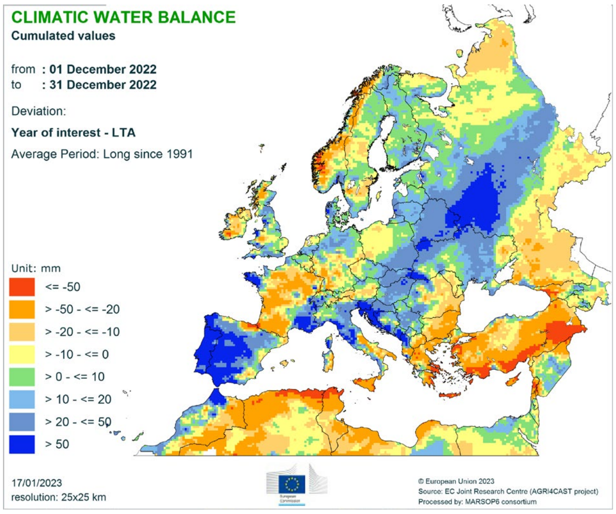
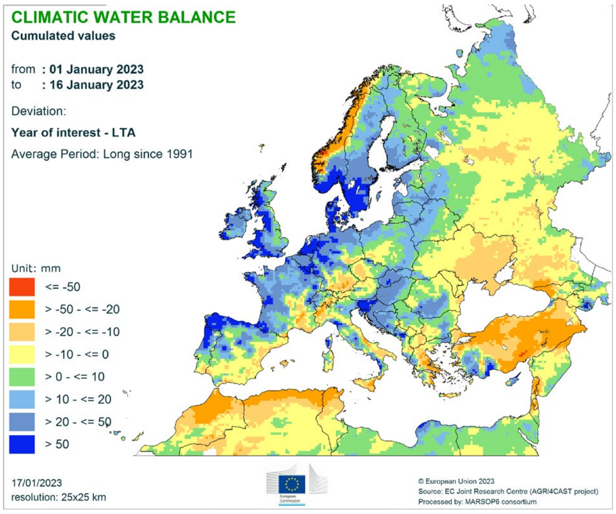
Climatic water balance





JRC MARS Bulletins 2023

Date	Publication	Reference
23 Jan	Agromet analysis	Vol. 31 No 1
20 Feb	Agromet analysis	Vol. 31 No 2
20 Mar	Agromet analysis, yield forecast	Vol. 31 No 3
24 Apr	Agromet analysis, remote sensing, pasture analysis, sowing conditions, yield forecast	Vol. 31 No 4
22 May	Agromet analysis, remote sensing, pasture analysis, sowing update, yield forecast	Vol. 31 No 5
19 Jun	Agromet analysis, remote sensing, pasture analysis, rice analysis, yield forecast	Vol. 31 No 6
24 Jul	Agromet analysis, remote sensing, pasture analysis, harvesting conditions, yield forecast	Vol. 31 No 7
21 Aug	Agromet analysis, remote sensing, pasture update, harvesting update, yield forecast	Vol. 31 No 8
18 Sep	Agromet analysis, remote sensing, pasture analysis, rice analysis, harvesting update, yield forecast	Vol. 31 No 9
23 Oct	Agromet analysis, pasture update, sowing conditions, harvesting update, yield forecast	Vol. 31 No 10
27 Nov	Agromet analysis, sowing update, harvesting update	Vol. 31 No 11
18 Dec	Agromet analysis	Vol. 31 No 12

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Analysis and reports
M. Rossi, L. Seguini, W. Ben Aoun, J. Morel, E. Tarnavsky, M. van den Berg, L. Panarello, B. Baruth, S. Bassu, I. Biavetti, M. Bratu, I. Cerrani, Y. Chemin, M. Claverie, P. De Palma, D. Fumagalli, G. Manfron, L. Nisini, G. Ronchetti, Z. Zajac, A. Zucchini

Reporting support
SeproTec, I. Biavetti, G. Mulhern

Edition
M. van den Berg, A. Belward

Data production
AGRI4CAST (Food Security Unit JRC D5)

Contact
JRC D5/MARS4CAST
JRCMARSBULLETIN@ec.europa.eu

Technical note
The long-term average (LTA) used within this Bulletin as a reference is calculated on the basis of weather data from 1991-2022.

Mission statement
The Joint Research Centre provides independent, evidence-based knowledge and science, supporting EU policies to positively impact society.

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