# Drought Monitoring in Portugal

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Network of Drought Observatories in the EU
16-17 June 2022

Mainland Portugal is located in south-western Europe, and has a mild Mediterranean climate, susceptible to the occurrence of regular drought episodes.

Fifteen main river basins grouped into
5 River Basin Authorities
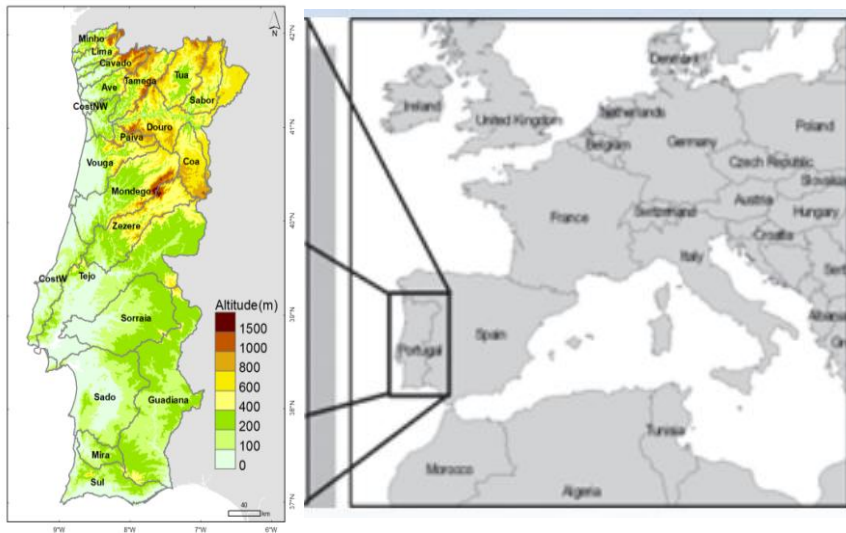
Climate and water availability

Average precipitation: 960 mm/yr (70% between October and March)

Average temperature: 7°C (inner central highlands) to 18°C (southern coast)
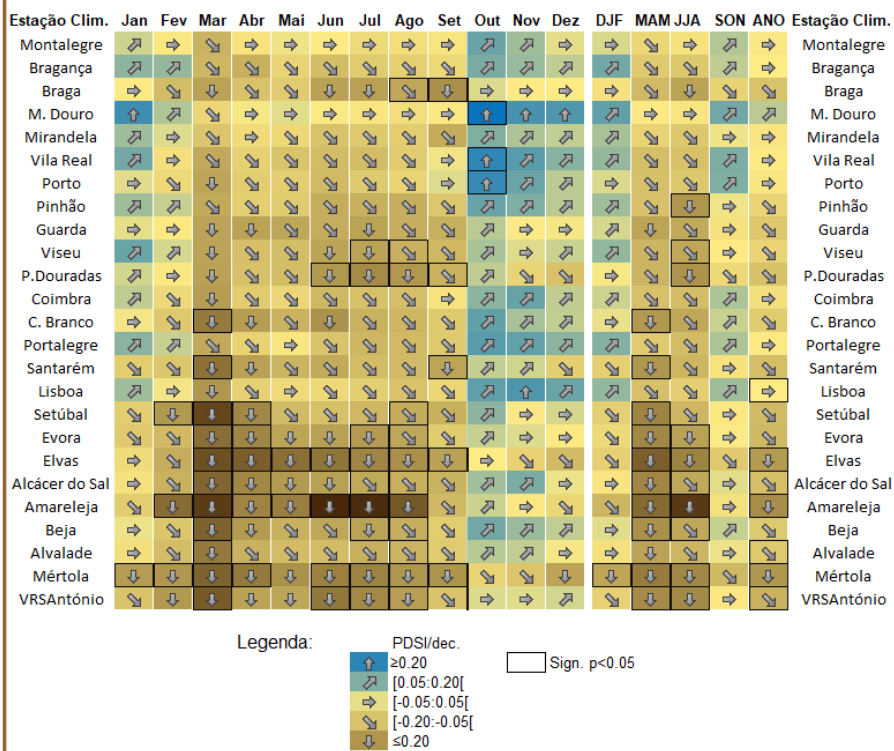
Total run-off: 30,700 hm^3/yr

Infiltration: 6,000 hm^3/yr
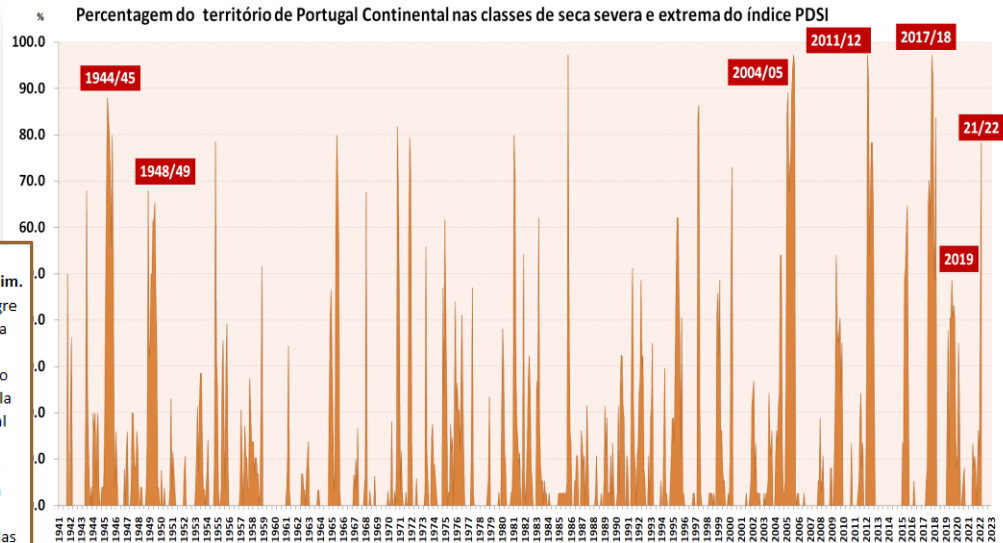
Higher frequency of dry periods in late winter, spring and summer mainly in the southern region of mainland Portugal

Percentage of the territory in severe and extreme drought - meteorological index PDSI

Percentagem do território de Portugal Continental nas classes de seca severa e extrema do índice PDSI

Trends PDSI 1941-2019

- **5 severe events since 2000**

- **2004/2005 – the most severe: ~40% of the territory with 9 consecutive months in severe and extreme drought.**
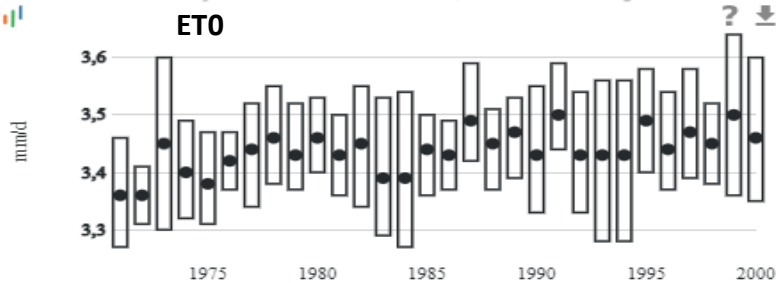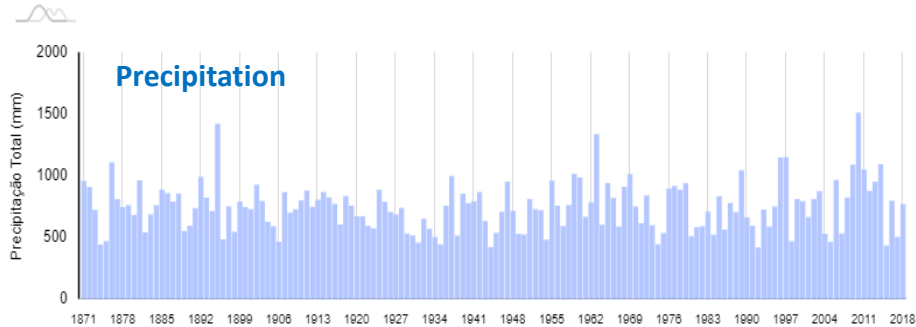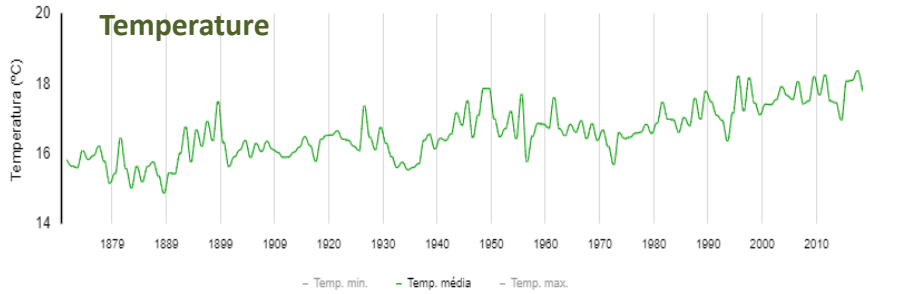
Droughts monitoring using in situ data and models

- **SMI** (Soil Moisture Index)
- **PDSI** (Palmer Drought Severity Index)
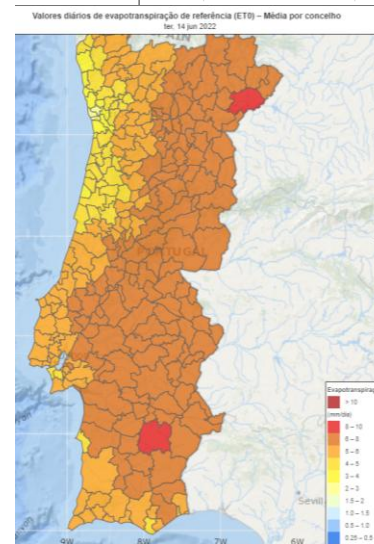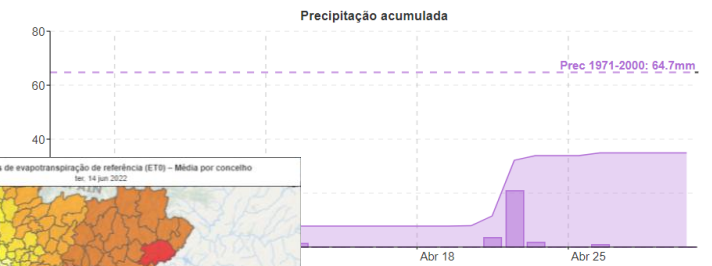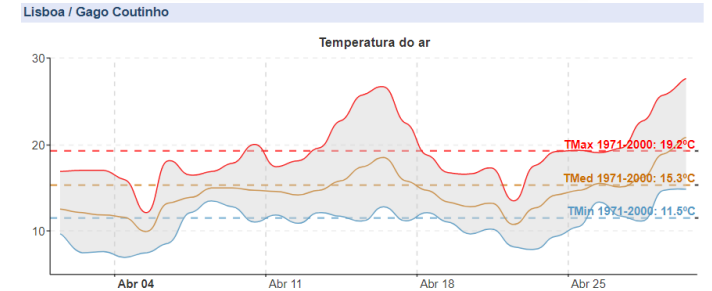- **SPI** (Standardized Precipitation Index)

Droughts monitoring using information from satellites

- **VHI** (Vegetation Health Index)
- **FAPAR** (Fraction of Absorbed Photosynthetically Active Radiation

Drought Monitoring Using in Situ Data

Historical data series

Temperature

Precipitation

ET0

Daily monitoring

Lisboa / Gago Coutinho

Temperatura do ar

TMax 1971-2000: 19.2°C
TMed 1971-2000: 15.3°C
TMin 1971-2000: 11.5°C

Precipitação acumulada

Prec 1971-2000: 64.7mm

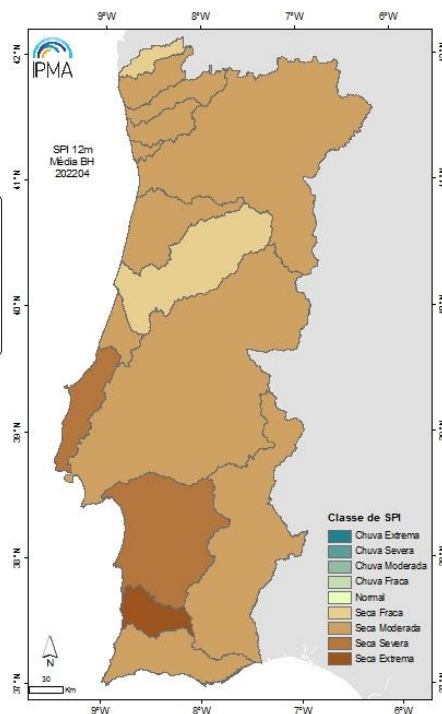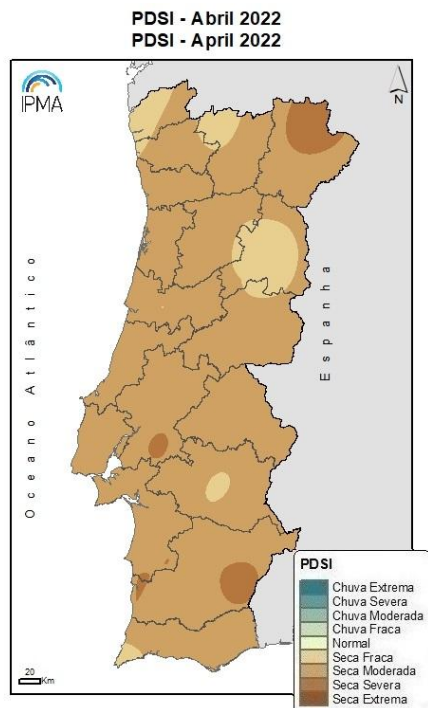Valores diários de evapotranspiração de referência (ET0) – Média por concelho
ter. 14 jun 2022

PDSI - Palmer Drought Severity Index

- Implemented and calibrated for the climate conditions of Mainland Portugal.

- Input: Temperature Precipitation from IPMA's weather stations

- Historical data series > 40 years

- Time step : monthly

- Results: meteorological station ; municipality

PDSI - Abril 2022
PDSI - April 2022

PDSI
- Chuva Extrema
- Chuva Severa
- Chuva Moderada
- Chuva Fraca
- Normal
- Seca Fraca
- Seca Moderada
- Seca Severa
- Seca Extrema

SPI 12m
Média BH
202204

Classe de SPI
- Chuva Extrema
- Chuva Severa
- Chuva Moderada
- Chuva Fraca
- Normal
- Seca Fraca
- Seca Moderada
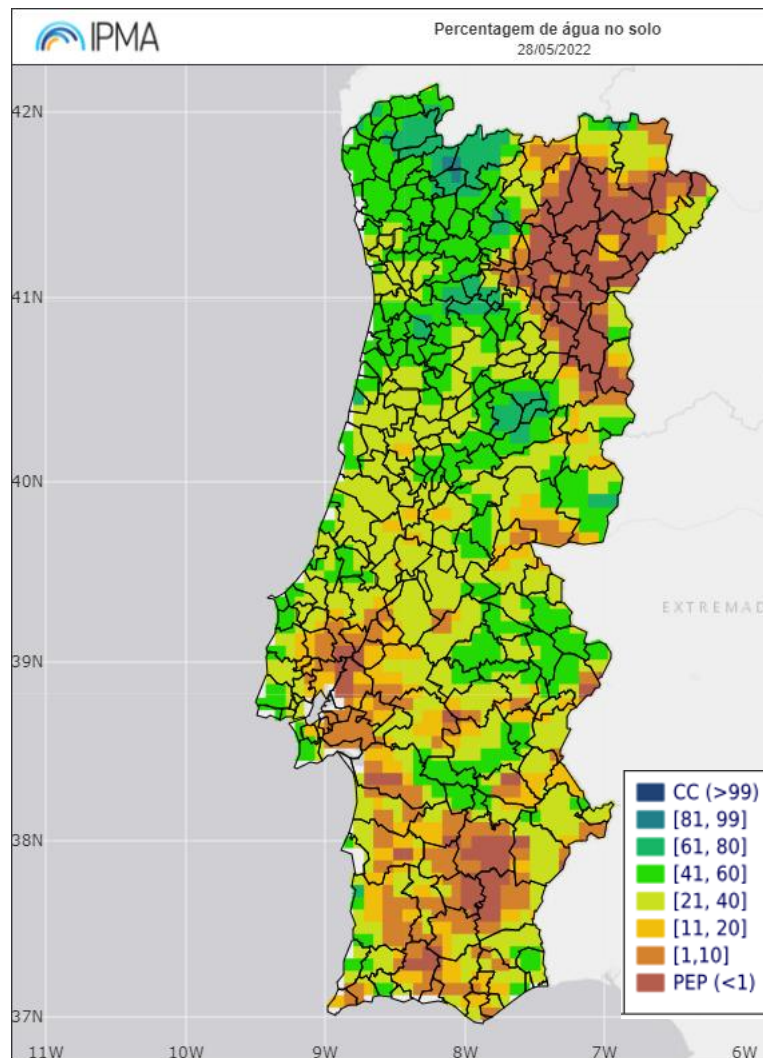- Seca Severa
- Seca Extrema

SPI – Standardized Precipitation Index

- Input: Precipitation from IPMA's weather stations

- Historical data series > 40 years

- Time step : monthly

- Output: SPI 1, 3, 6, 9, 12, 18, 24 m

- Results: meteorological station, hydrological basins

Main Drought Indexes
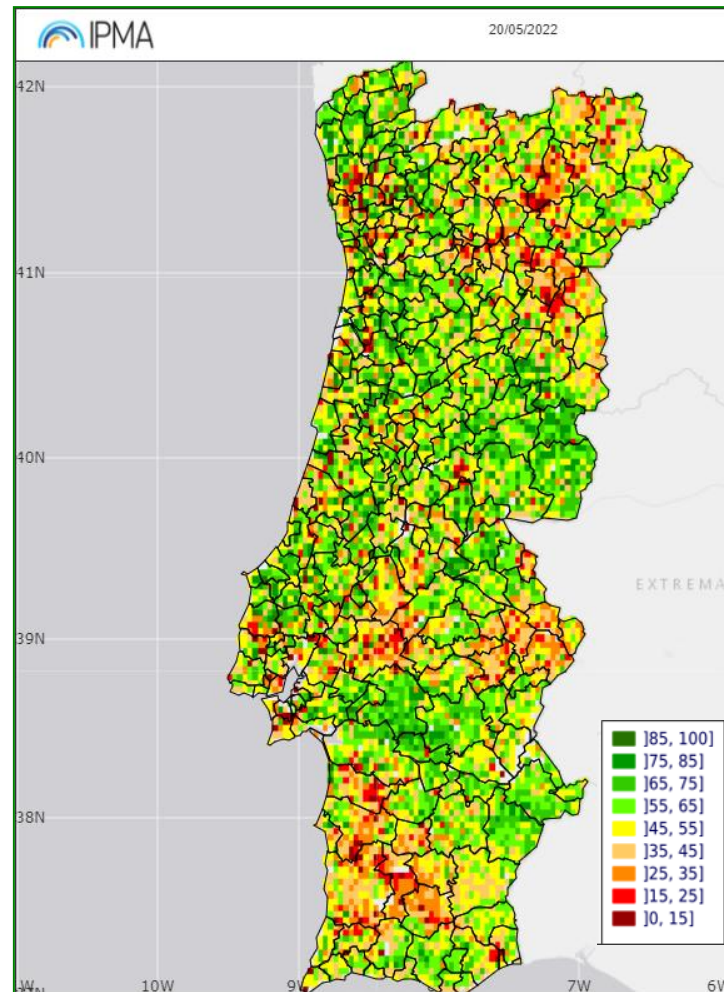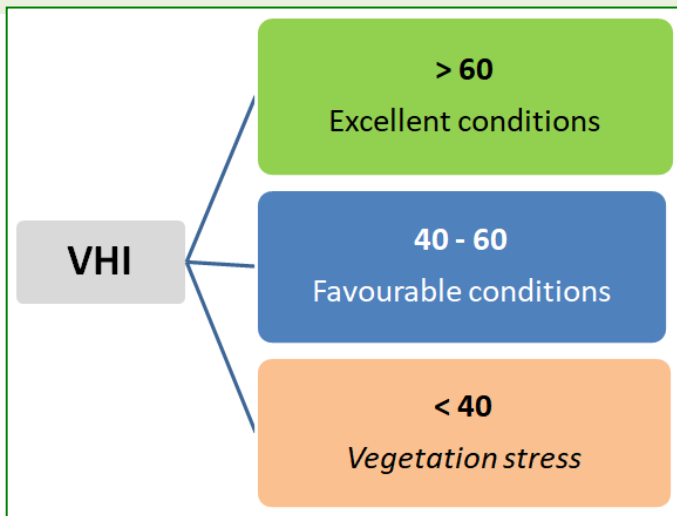
Soil Moisture Index (SMI)
ECMWF product available in graphical format

- The graphical information comes from the High Resolution Model (HRES),

- SMI varies between the **permanent wilting point (PWP)** and the **field capacity (CAP)**

- Data series since 2010

- Resolution 0.15 ° for Europe.

- Time step: Daily *(at 12-hour intervals up to T + 24 and then 24 hours up to T + 240)*

Percentagem de água no solo
28/05/2022

Legend:
- CC (>99)
- [81, 99]
- [61, 80]
- [41, 60]
- [21, 40]
- [11, 20]
- [1,10]
- PEP (<1)

https://www.ecmwf.int/en/forecasts/charts/catalogue/w_soil_moisture

Vegetation Health Index – VHI

- Designed to be a proxy of vegetation response
  - soil moisture conditions (VCI)
  - thermal conditions (TCI)

- Data series since

- Time step : weekly

- Range from 0 to 100 characterizing changes in vegetation conditions from extremely poor to excellent

VHI

> 60
Excellent conditions

40 - 60
Favourable conditions

< 40
Vegetation stress

20/05/2022

Legend:
-]85, 100]
-]75, 85]
-]65, 75]
-]55, 65]
-]45, 55]
-]35, 45]
-]25, 35]
-]15, 25]
-]0, 15]

Based on: Kogan *et al*,
NOAA NESDIS

FAPAR
Fraction of Absorbed Photosynthetically Active Radiation

- Indicator of the health of vegetation

- Defines the fraction absorbed by the green parts of the canopy, and thus expresses the canopy's energy absorption capacity

Sensor: SEVIRI
Temporal Frequency: 1 day
Spatial resolution: SEVIRI

https://landsaf.ipma.pt/en/

Valores da fração da radiação fotossinteticamente ativa absorvida (FAPAR)
28/05/2022

Legend: [90, 100], [80, 90[, [70, 80[, [60, 70[, [50, 60[, [40, 50[, [30, 40[, [20, 30[, [10, 20[, [0, 10[

Drought Monitoring
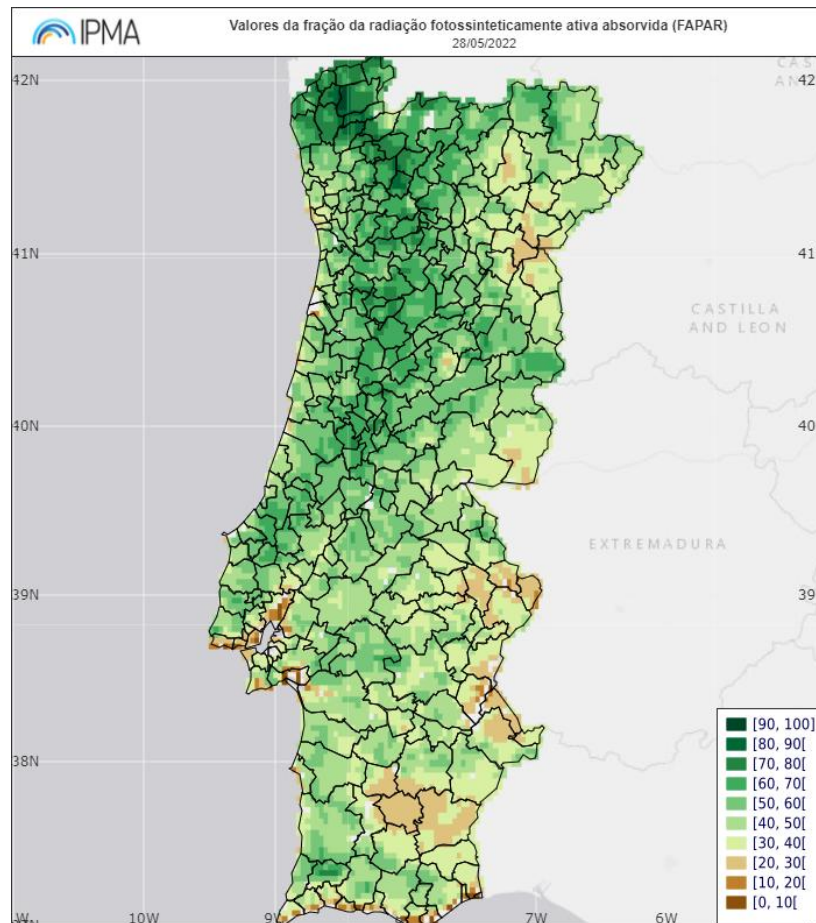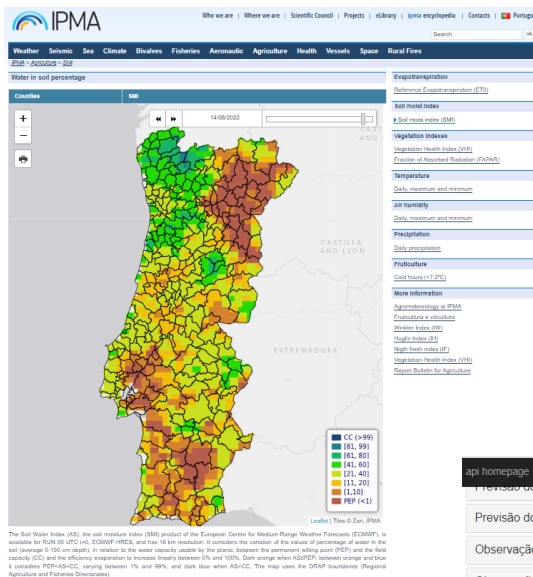
IPMA Website

Drought Reports
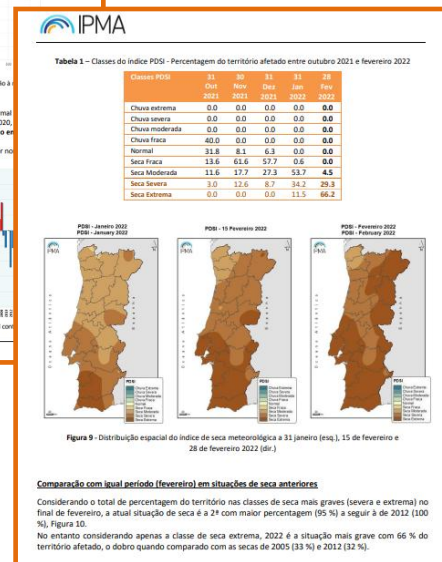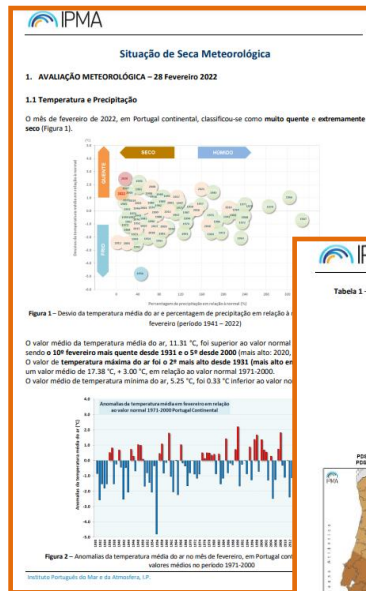
Platform online download services

National Drought Plan
PREVENTION, MONITORING AND CONTINGENCY PLAN FOR DROUGHT SITUATIONS

PLANO DE PREVENÇÃO,
MONITORIZAÇÃO E CONTINGÊNCIA
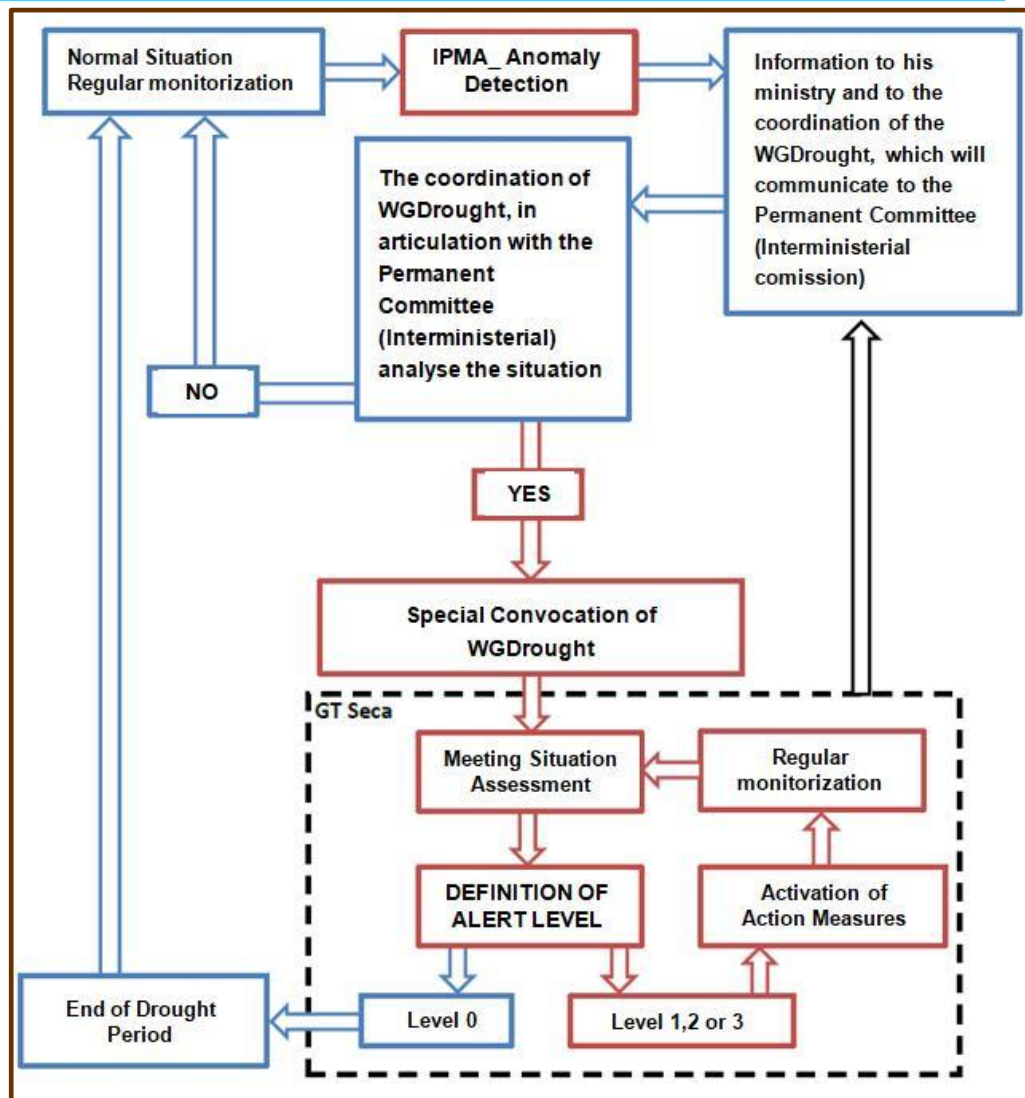PARA SITUAÇÕES DE SECA

REPÚBLICA
PORTUGUESA
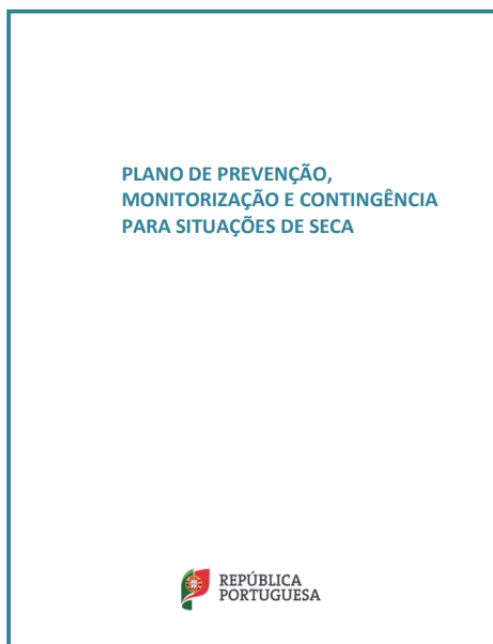
Structured in three axes of action
1. Prevention
2. Monitoring
3. Contingency

Conceptual scheme to monitor drought in Portugal

Involve several ministerial bodies in the fields of meteorology, water resources, agriculture, livestock, environment, forestry and agricultural regions, as well as the paying agency.

Detection of agrometeorological drought involve:

Drought indicators through in situ data	Drought indicators through model and satellite

PDSI   **SPI**   **+**   **SMI**   **VHI**
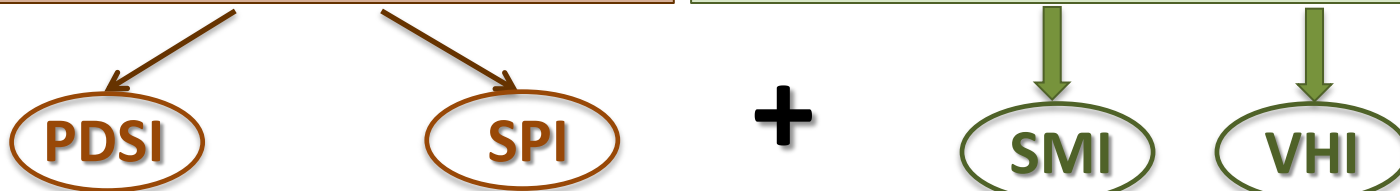
Level of Intervention	Alert Level	Drought Category
A.0	Normal	Normal
A.1	Pré-Alert	Moderate drought
A.2	Alert	Severe drought
A.3	Emergency	Extreme drought

Level A.0 – *Proactive prevention measures*

Level A.1 – *Voluntary Measures for the agricultural sector*

Level A.2 – *Restrictive measures for the agricultural sector and environmental character*

Level A.3 – *Exceptional measures for the agricultural sector and environmental character*

**2017/2018 Drought
Mainland Portugal**

2018 Drought in Angola

2017/2018 Drought

ECMWF Model - SMI
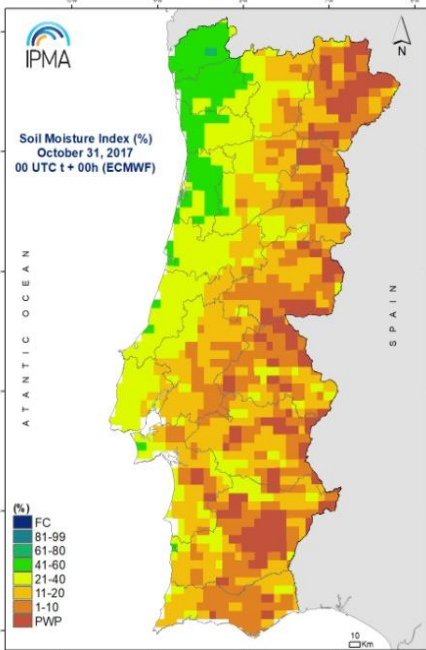
Surface obs. - PDSI
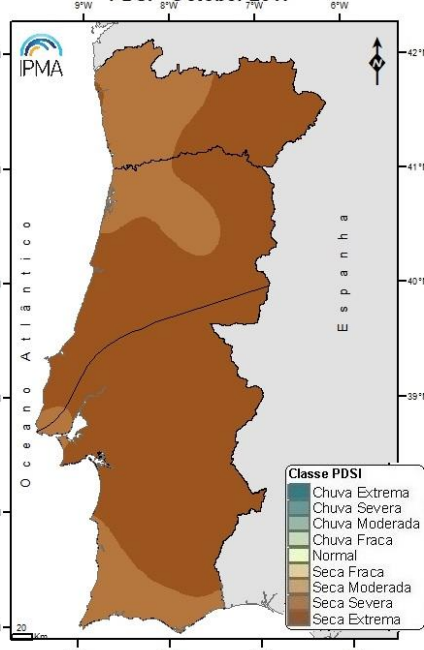
Surface obs. – SPI 6m
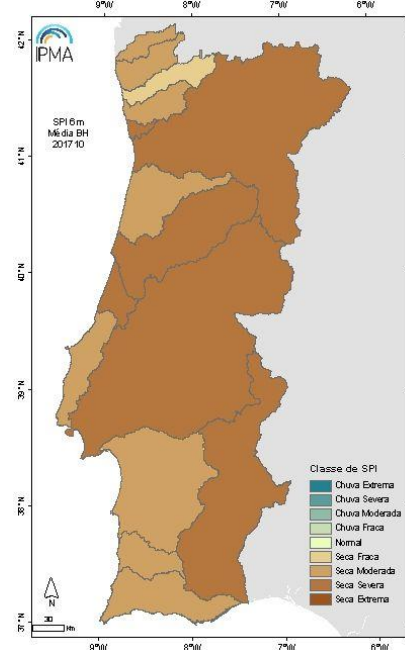
Satellite data - VHI
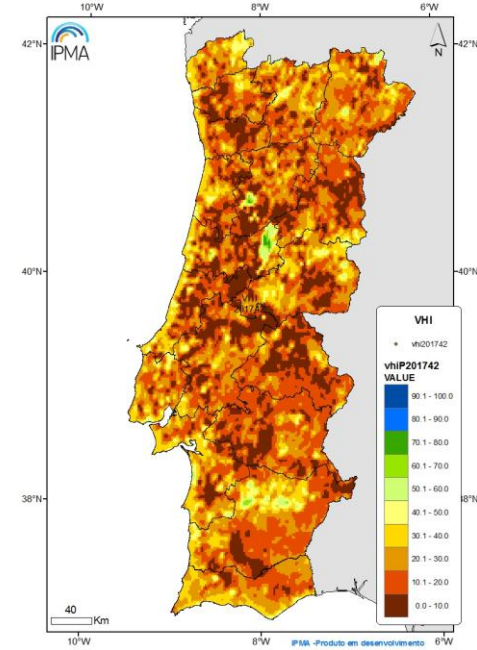
OCTOBER 2017
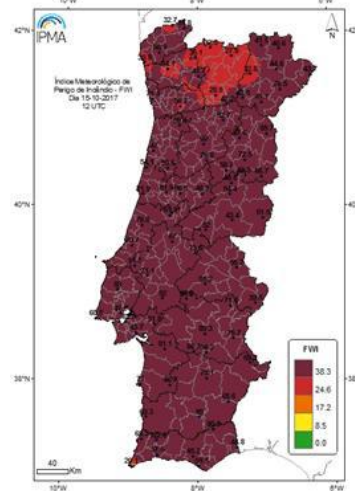## SEVERE TO EXTREME DROUGHT

Drought Impacts

- Crop yield reduction;
- Pasture and biomass reduction;
- Reduction of water level in reservoirs;
- Reductions of soil moisture;

Intensive fire season.

Fire Weather Index (FWI)
October 15th 2017 12 UTC

**October 15th
burnt area > 200 000 ha**

**Highest value of the
last ten years**

In 2017 burnt area was 4x more than normal value

Drought Impacts

- Crop yield reduction;
- Pasture and biomass re
- Reduction of water lev
- Reductions of soil mois

Intensive fire sea
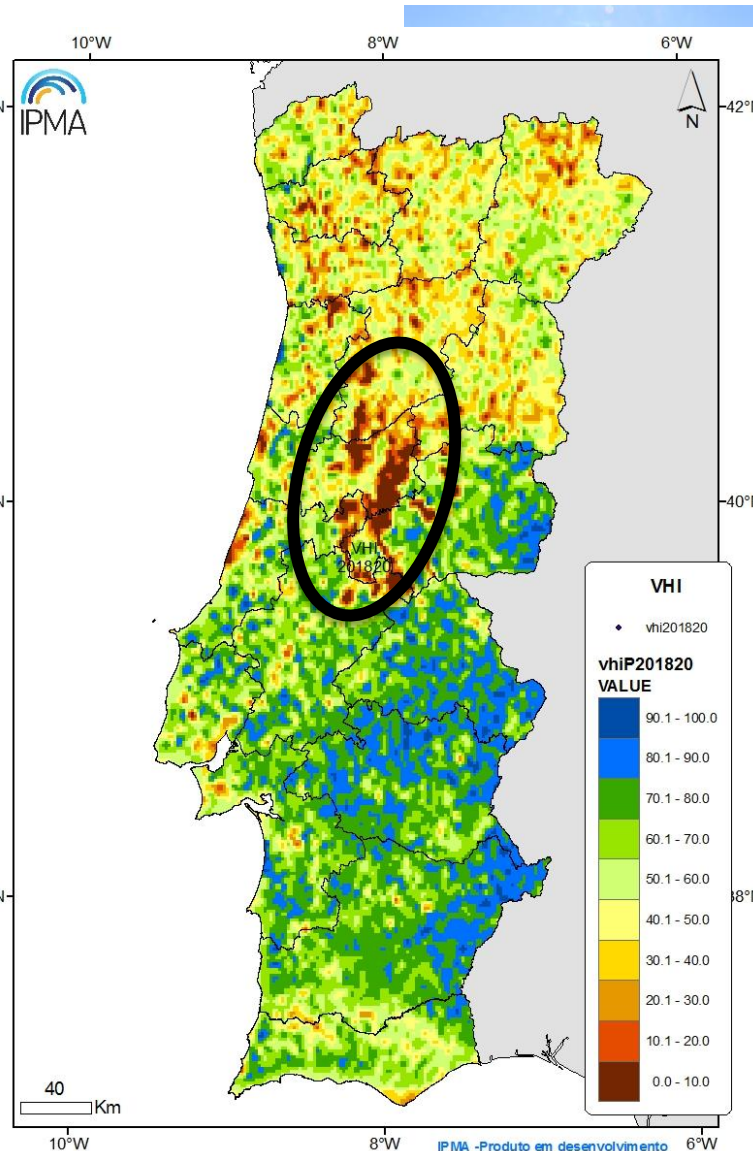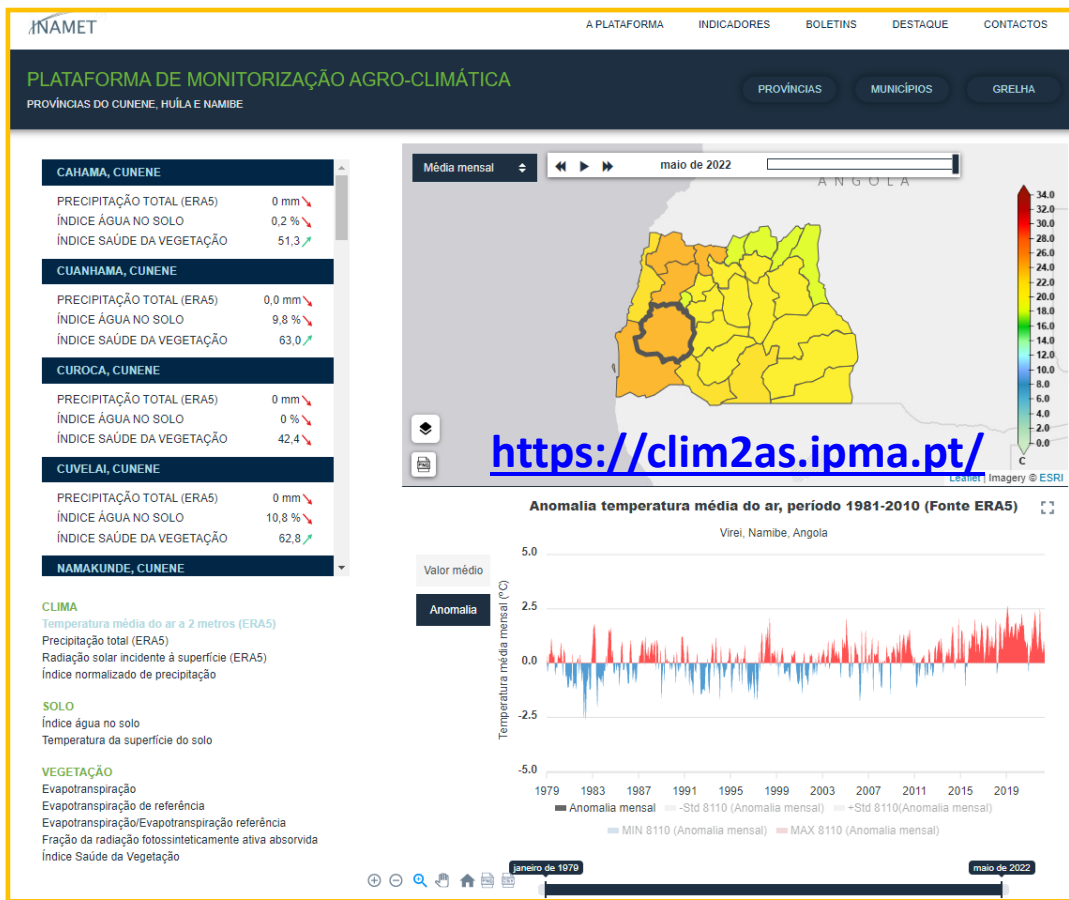
...ober 15th
...ea > 200 000 ha

...value of the
...ten years

In 2017 burr ...normal value

2018 Drought - Angola

Monitor the variability of agro-climatic indicators in the provinces of Cunene, Huíla and Namibe, and respective municipalities – FRESAN project
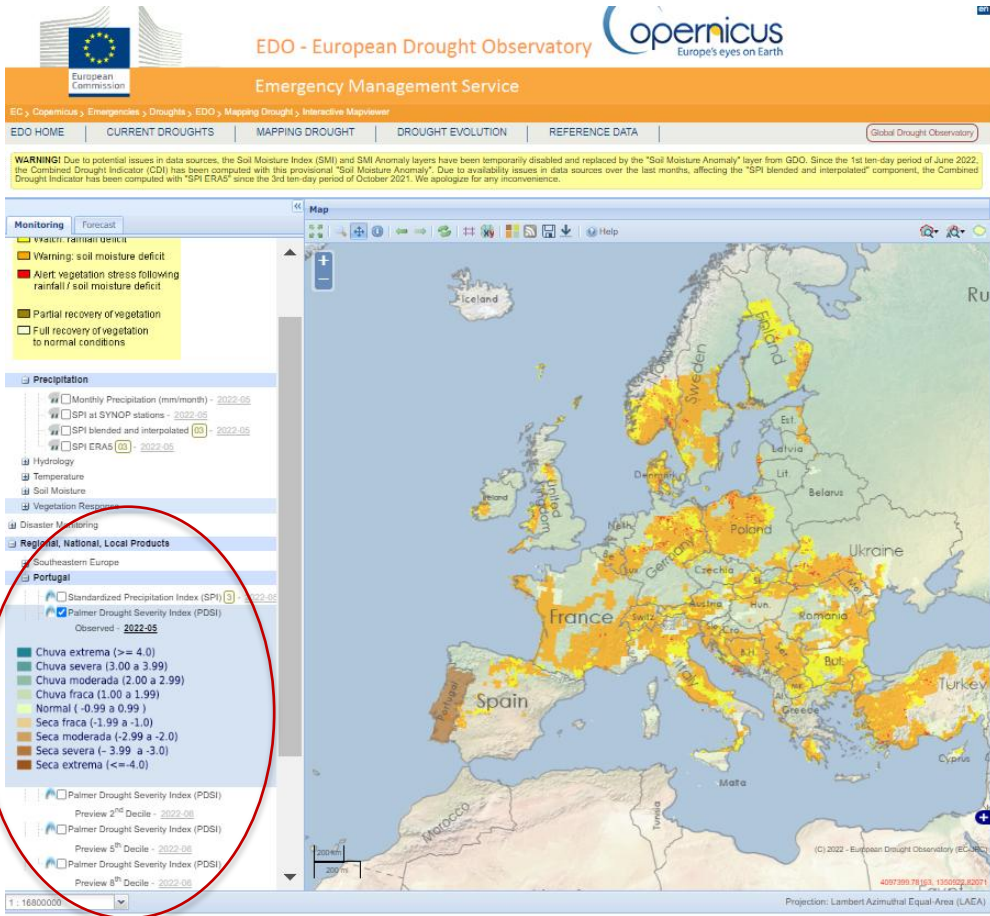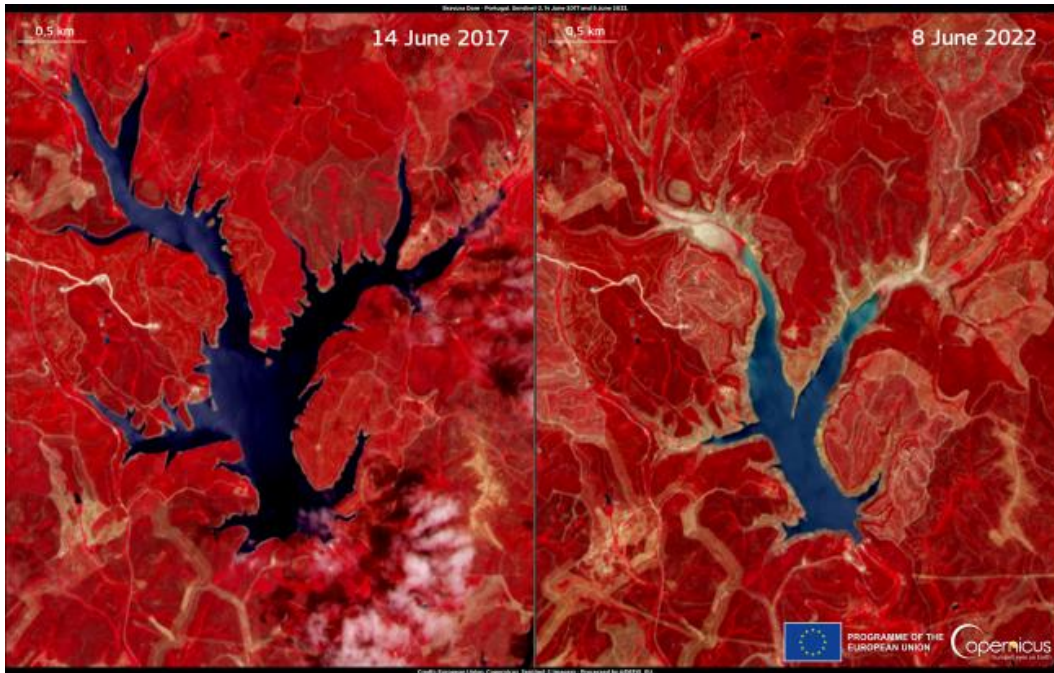
Exchanging data
Web map inclusion in EDO

- SPI

- PDSI
Monthly data

Next steps…

Development web-based integrated drought monitoring platform

Drought Indicators
Seasonal forecast/Drought forecast
Drought Impacts
Regional reports

Thank you!

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