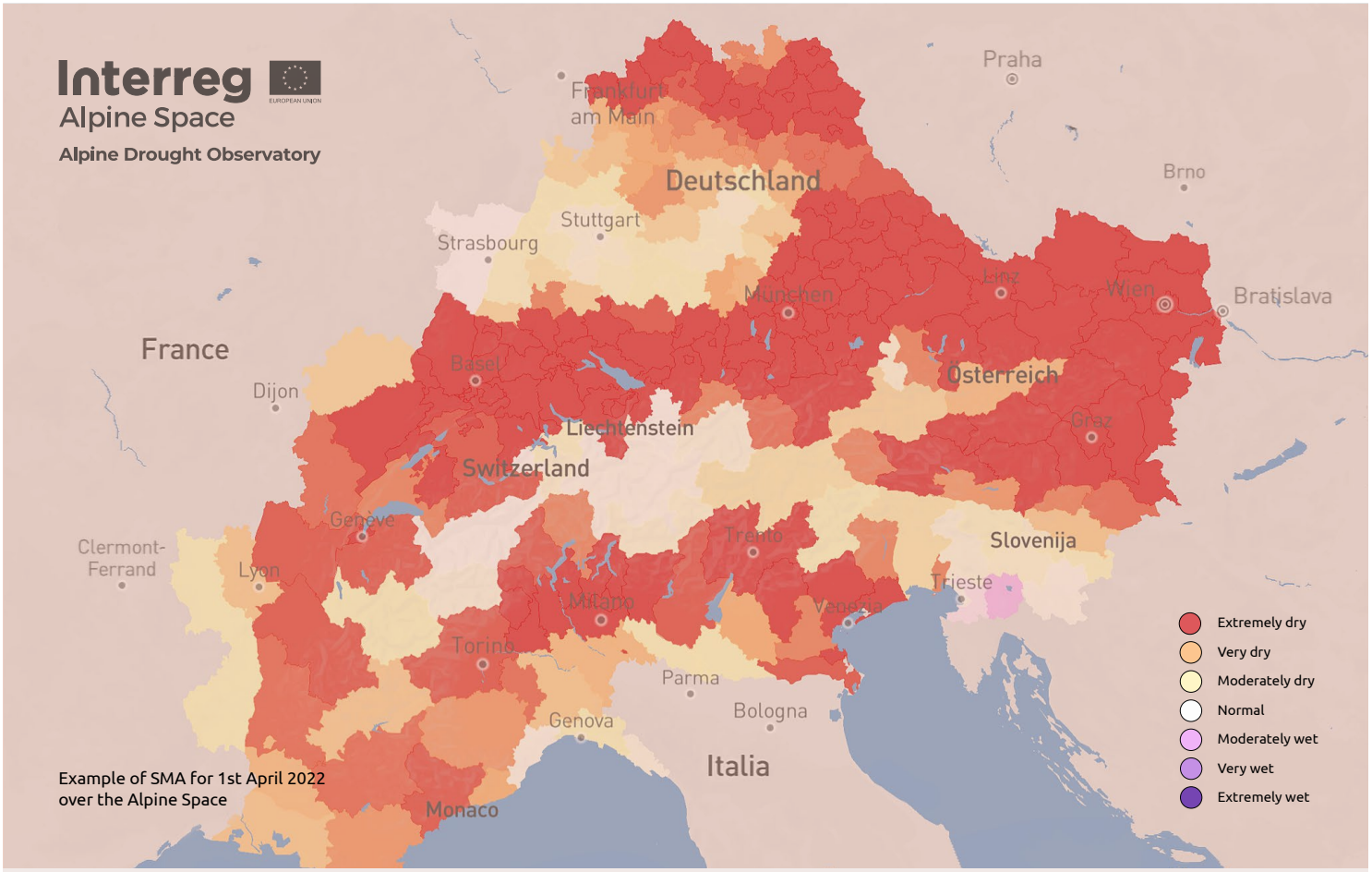


Example of SMA for 1st April 2022 over the Alpine Space

SMA

Soil Moisture Anomalies

This factsheet provides a detailed technical description of the indicator Soil Moisture Anomaly (SMA), which is implemented in the Alpine Drought Observatory (ADO), and used for detecting and monitoring agricultural drought conditions (JRC EDO, 2020).

Input variable	Type of drought	Temporal resolution	Spatial resolution	Temporal coverage	Time scale (aggregation period)	Unit
Soil moisture content	Agricultural	Daily	5 km	1979–present	10 days	Unitless / SMA unit (unit of standard deviation from the long-term mean)

Definition

The Soil Moisture Anomaly (SMA) indicator that is implemented in the ADO platform is used for determining the start and duration of agricultural drought conditions, which arise when soil moisture availability to plants drops to such a level that it adversely affects crop yield, and hence, agricultural production. The SMA indicator is computed daily with respect to the average conditions of the preceding 10 days (dekad) as anomalies of soil moisture content derived from ERA5 reanalysis (Hersbach et al., 2018).

Methodology

Data source	Index provider	Metadata
ERA5 reanalysis (Copernicus)	Eurac	Soil Moisture Anomalies

CALCULATION

For each location (grid-cell), the dekadal soil moisture anomaly (SMA) is calculated as follows:

$$SMA = \frac{SM_t - \overline{SM}}{\sigma_{SM}}$$

where SM_t is the dekadal average soil moisture (for the date t), $\overline{SM}$ is the long-term mean and σ_{SM} is the standard deviation, which are both calculated for each day of the year from a smoothed time-series (running mean on a 10 day window) for a baseline period of 1981–2020. According to this definition, the anomaly values are expressed as units of standard deviation.

INPUT DATA

Input data for the calculation of the SMA is ERA5 reanalysis dataset at 0.25° resolution (Hersbach et al. 2018), regridded (bilinear interpolation) to 5 km.

REFERENCE PERIOD

It is important to define a reference period long enough to realistically capture climate variability in considered regions. ADO project consortium has recommended to use period 1981–2020 as reference where possible (depends on data availability). The reference period for calculating SMA is 1981–2020.

Index values and thresholds

In the ADO platform, the SMA values range from –5 to 5. For any given location and accumulation period, they are classified into seven different categories (from dry to wet), as shown in the table. These also represent the commonly used thresholds for identifying drought through SMA.

SMA value thresholds	Classification	Probability of event [%]
SPEI < –2.00	extremely dry	2.3
–1.99 < SMA < –1.5	very dry	4.4
–1.49 < SMA < –1	moderately dry	9.2
–0.99 SMA < 0.99	normal	68.2
1. < SMA < 1.49	moderately wet	9.2
1.5 < SMA < 1.99	very wet	4.4
SMA > 2.00	extremely wet	2.3

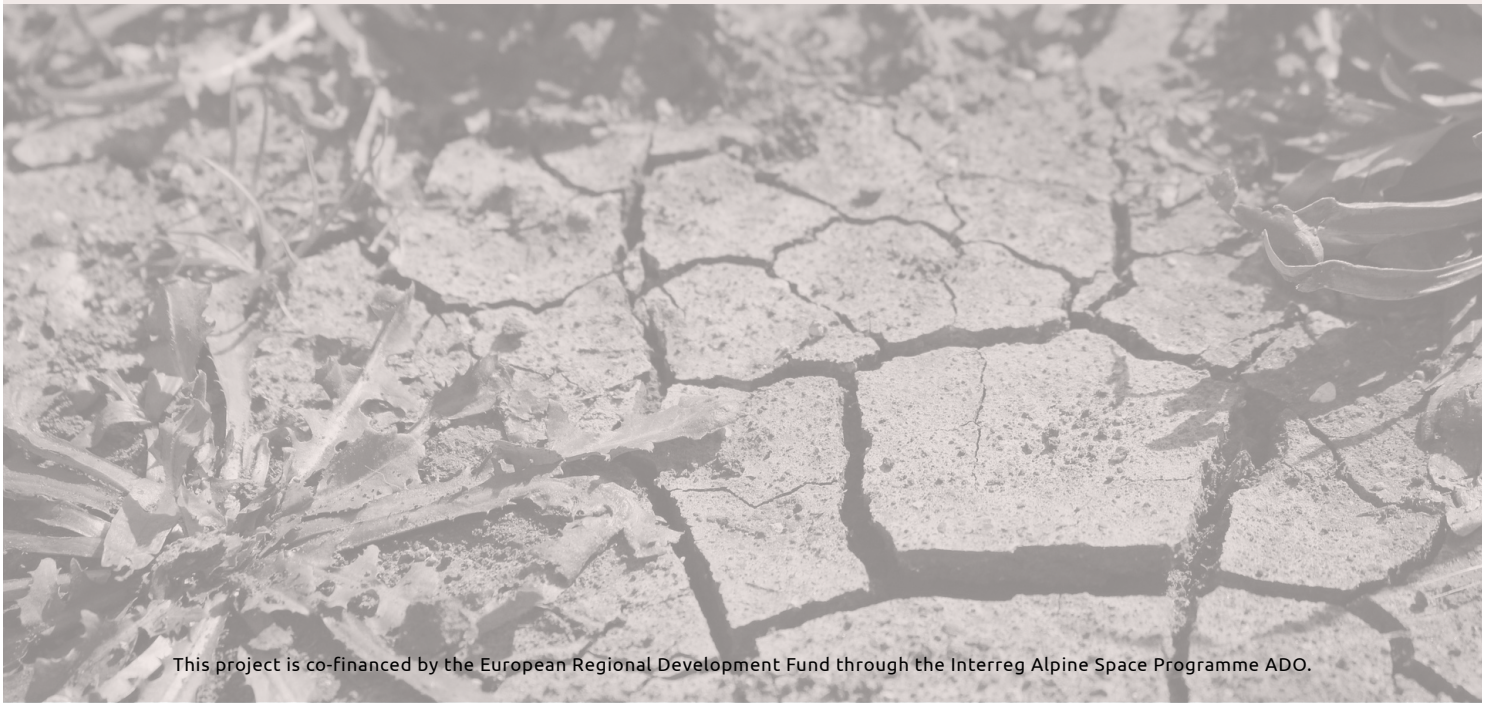
Source: JRC EDO, 2020.

References

Greifeneder, F. (2022). Soil Moisture Anomalies - ERA5_QM (Version v1) [Data set]. Institute for Earth Observation. https://doi.org/10.48784/ea665ca2-0ceb-11ed-86c5-02000a08f4e5

JRC EDO (Joint research Centre, Copernicus European Drought Observatory). (2020). Soil Moisture Anomaly - factsheet. URL: https://edo.jrc.ec.europa.eu/documents/factsheets/factsheet_soilmoisture.pdf.

Hersbach, H., Bell, B., Berrisford, P., Biavati, G., Horányi, A., Muñoz Sabater, J., Nicolas, J., Peubey, C., Radu, R., Rozum, I., Schepers, D., Simmons, A., Soci, C., Dee, D., Thépaut, J-N. (2018). ERA5 hourly data on single levels from 1979 to present. Copernicus Climate Change Service (C3S) Climate Data Store (CDS). https://doi.org/10.24381/cds.adbb2d47 (download dates are indicated in the dataset metadata).



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