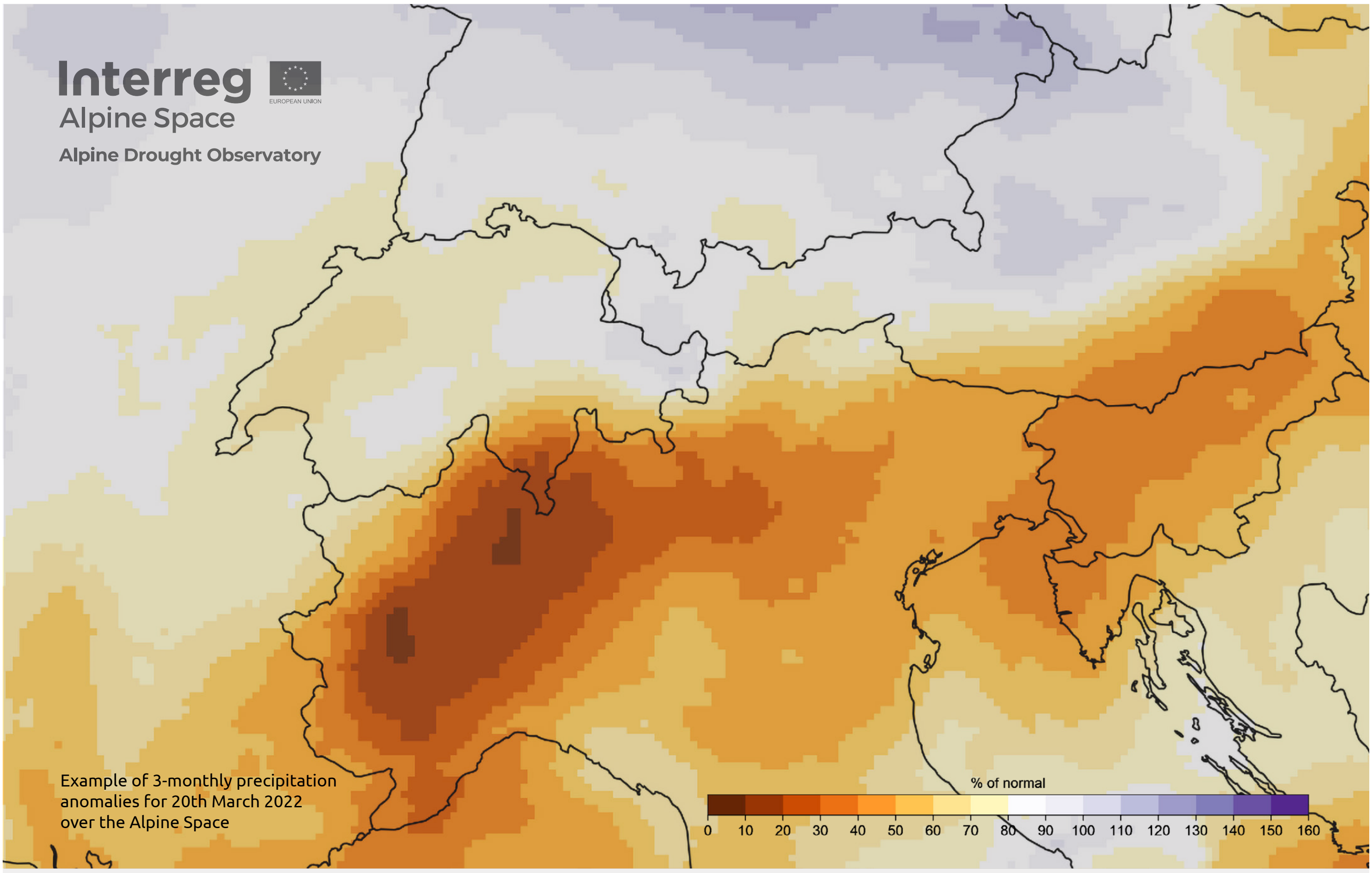
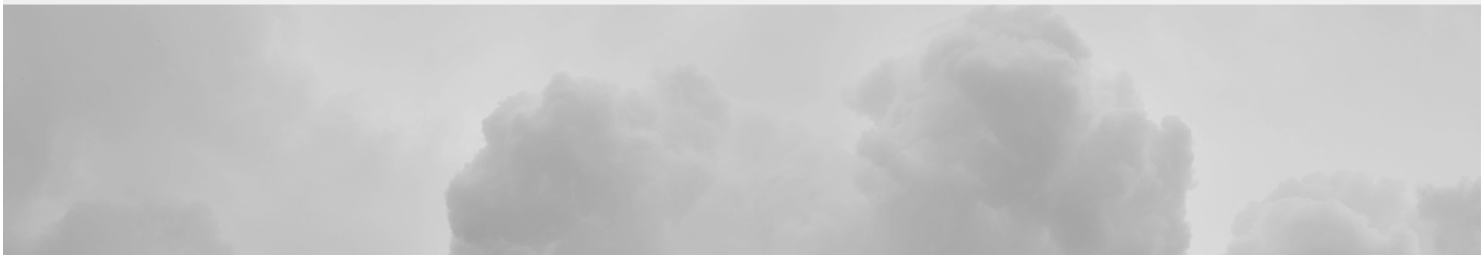


Example of 3-monthly precipitation anomalies for 20th March 2022 over the Alpine Space

PRCPA

Precipitation Anomalies

Precipitation anomalies are defined as deviations of accumulated precipitation over a selected time period from long-term averages. They are used to detect and characterize meteorological droughts. A meteorological drought is defined as a period with abnormal precipitation deficit, in relation to normal conditions for a region, represented as a long-term average. Precipitation anomalies are expressed in % of normal.



Input variable	Type of drought	Temporal resolution	Spatial resolution	Temporal coverage	Time scale (aggregation period)	Unit
Precipitation	Meteorological	Daily	5 km	1979–present	1 month 2 months 3 months 6 months 12 months	% of normal precipitation (long-term average)

Definition

Precipitation anomalies are a simple indicator used to describe drought conditions from a climatological perspective. They are defined as deviations of accumulated precipitation over a selected time period from normal conditions, which are represented as an average of a historical reference period. They can be computed for any time scale of interest and are expressed in relative or absolute values, thus giving a direct information on the precipitation deficit or surplus. The amount of cumulative precipitation relative to the long-term average is a relatively good and simple early warning indicator of drought.

Methodology

Data source	Data provider	Index provider	Metadata
ERA5 reanalysis (Copernicus)	ZAMG	ARSO	Precipitation anomalies

CALCULATION

In the ADO platform, relative precipitation anomalies are calculated daily on five different time scales (1, 2, 3, 6, 12 months). The time scale corresponds to the length of the rolling time window (accumulation period) over which the sum of precipitation is calculated: 30, 60, 90, 180 and 365 days respectively. The anomalies are given in percentage of normal precipitation, where normal is defined as the long-term average accumulation of precipitation for a selected time scale in the period 1981–2020.

The equation below shows the calculation of precipitation anomaly in percentage of normal:

$$P'_{ikdy} = \frac{P_{ikdy}}{\overline{P_{ikd}}} \times 100$$

where P'_{ikdy} is the precipitation anomaly for the grid cell i over time scale k for day d and year y, P_{ikdy} is the precipitation value for grid cell i over time scale k for day d and year y, and $\overline{P_{ikd}}$ is the mean for grid cell i over time scale k for day d over the 40-year reference period.

INPUT DATA

Precipitation data used as input data for the calculation of precipitation anomalies is downscaled directly from ERA5 reanalysis dataset at 0.25° resolution (Hersbach et al., 2018) to 5.5 km resolution using a quantile mapping approach. Quantile mapping is performed using the UERRA reanalysis dataset (Bazile et al., 2017) as reference data.

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 precipitation anomalies is 1981–2020.

Index thresholds

Relative precipitation anomaly thresholds may vary depending on the regional climatology and use case. For example, in Slovenia, a threshold of 70 % of normal (long-term) precipitation was recognised as an indicative threshold for periods of agricultural drought, based on drought years in the period 1961-2013 (Sušnik, 2014).

Key strengths and weaknesses

+ Index is simple to calculate and requires only one meteorological variable as an input.
+ It can be used to compare any time period for any location (WMO, 2016).
+ Index is easy to understand for the general user.

— Not comparable between different regions as the thresholds may vary depending on the regional climatology and use case.

— Only considers one meteorological variable and thus does not address the effects of evapotranspiration (driven by radiation, temperature, wind, humidity) on drought conditions and water stress.

— A long enough reference period data record is needed to sample the natural variability.

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