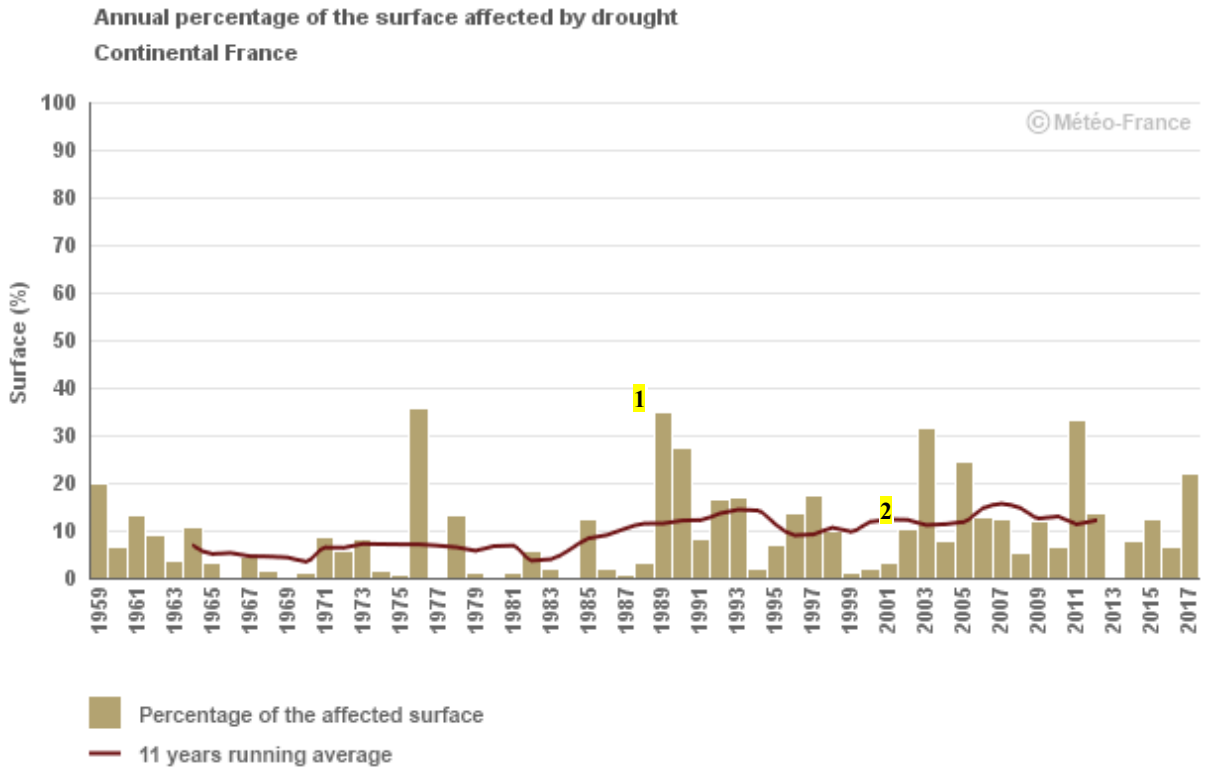
Evolution of droughts
Past climate

1. Graph reading aid



2 data sequences are represented in the graph :

Sequence 1 'histogram in beige':
Annual percentage of the average area of national or regional territory affected by drought.
Values can evolve each year between 0 (no part of the territory is affected by drought at any part of the year) and 100 (the entire territory suffers from drought all year long).

Sequence 2 'curve in ochre':
11 years moving average of the percentage of the territory affected by drought. For example, the value shown for the year 2000 is the average of values between 1995 and 2005. Due to the moving average which is focussed on the year concerned, there is no value for the first 5 years of the sequence, nor for the 5 last.

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2. Definitions

National Drought Index: for each month of the year, the number of meshes whose drought indicator value (SSWI 1 month) exceeds the ten-year value is counted. This number is divided by 12 (number of months of the year) and the number of meshes in the area under consideration is multiplied by 100 to obtain a percentage for the year under consideration.

SSWI 1 month (standardized soil wetness index): obtained by projecting on a 'reduced centred normal' distribution (to obtain standardized values) the monthly SWI distribution for each month of the period 1961-1990 (past reference period in ClimatHD).

Soil moisture: Soil moisture is expressed in terms of the Soil Wetness Index (SWI), which represents the ratio between the available water content in the soil on a given day and its optimal value for a plant.

$$SWI = \frac{W - W_{wilt}}{W_{fc} - W_{wilt}}$$

where W is the integrated soil water content, Wwilt is the water content at the wilting point (the threshold below which a plant can no longer capture water from the soil) and Wfc is the soil water content at the field capacity (the threshold below which water in the soil no longer flows vertically by gravity).

The SWI mainly varies between the values 0 (extremely dry soil) and 1 (extremely wet soil). Below 0.4 a soil is considered dry and above 0.8 it is considered very wet.

Drought:
An agricultural drought can be defined as a soil water deficit.

3. Data and methods

The soil moisture used to characterize the possible state of drought comes from a digital simulation tool, called Safran Isba Modcou (SIM), which has been widely tested in the field of research and operational applications. It enables the soil water content to be calculated at daily time steps based on a water balance model e at 8 km resolution over France. This tool is used in real time for national hydrological monitoring.

The approach adopted for the development of the soil drought indicator is based on the Standardized Precipitation Index (SPI), widely used at the international level and recommended by WMO since December 2009 to characterize a rainfall deficit.
The standardized soil wetness index (SSWI) is thus based on the distribution of the SWI soil moisture index.

The one-grid drought index has been defined as the 1 month SSWI. It is obtained as follows: the SWI is averaged over one month, a density function is then adjusted for each quarter over the period 1991-2020 (reference period in ClimatHD). The distributions are then projected onto a reduced centred normal distribution to obtain the standardised values of the indicator.

The direct correspondence between the value of the indicator and the quantile of return period comes from the distribution of the values of a normal law: for example, an indicator value of -1.28 corresponds to the 10% probability threshold and therefore to the quantile of a 10 years return period.

4. Références

Soubeyroux, J.-M., Kitova, N., Blanchard, M., Vidal, J.-P; Martin, E., Dandin, P. (2012), *Sécheresse des sols en France et changement climatique*, *La Météorologie*, 78, pp 21-30

Internet site ClimSec : http://www.cnrm-game-meteo.fr/spip.php?article605

Portal site ONERC : https://www.ecologie.gouv.fr/politiques-publiques/impacts-du-changement-climatique-eau-biodiversite#summary-target-1

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