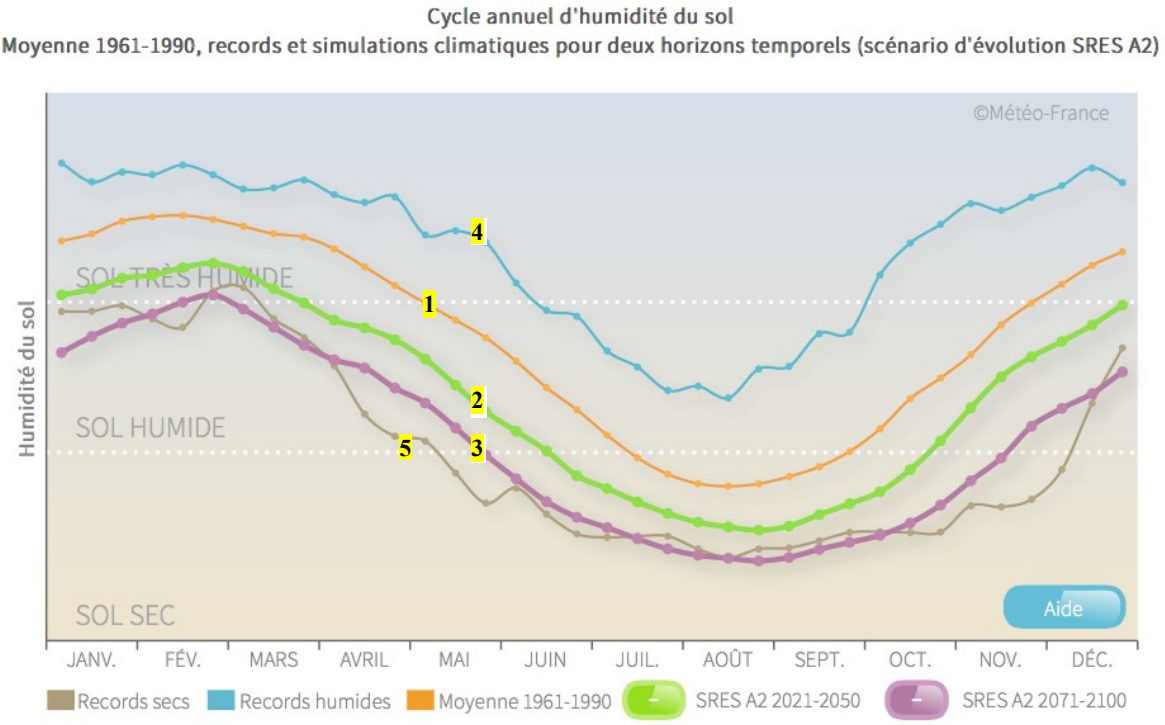
Evolution of annual cycle of soil moisture
Past and future climate

1. Graph reading aid



5 data sequences are shown in the graph:

Sequence 1 'orange curve':
Soil moisture average per decade in France (or a region) over the period 1961-1990

Sequence 2 'green curve':
Soil moisture average per decade in France (or a region) over the period 2021-2050 according to the Arpège Climat model and the emission scenario of greenhouse effect gas SRES A2.

Sequence 3 'purple curve':
Soil moisture average per decade in France (or a region) over the period 2071-2100 according to the Arpège Climat model and the emission scenario of greenhouse effect gas SRES A2.

Sequence 4 'blue curve':
Record soil moisture per decade in France (or a region) over the period 1959-2014 (occurrence date available in tooltip)

Sequence 5 'brown curve':
Record soil dryness per decade in France (or a region) over the period 1959-2014 (occurrence date available in tooltip)

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2. Definitions

Soil moisture: Soil moisture is expressed through the Soil Wetness Index or SWI representing for a plant the ratio between the water content available in the soil on any given day and its maximum value.

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

where W is the integrated water content of the soil, W_{wilt} the water content at wilting point and W_{fc} the water content of the soil at the field capacity.
The SWI varies mainly between the values 0 (extremely dry soil) and 1 (extremely moist soil). Below 0,5 soil is considered as dry and above 0,8 as very moist.

3. Data and methods

The soil moisture values are issued from a digital simulation tool, called Safran Isba Modcou (SIM), widely tried and tested in the domain of research and of operational applications. It allows the calculation, with daily time-step, of the water content of soils from a water balance model at a resolution of 8 km across France.
This tool is used in real time for the national hydrological follow-up, has been the object of a re-analysis since 1958 and has been forced by different climatic projections for the 21st century in the context of the project ClimSec (2008-2011).

Climatic projections used in forcing of the model SIM:
Climatic simulations issued from the model Arpège-Climat (Météo-France) have been used in this case. The climate models are general circulation models, which take into account different reference scenarios of the evolution of the chemical composition of the atmosphere (greenhouse gases and aerosols).

Evolution scenario SRES/RCP: Until the 4th exercise of the GIEC (2007), the different evolution possibilities of the GHG (Greenhouse gas) were developed from social-economic scenarios called SRES (Special Report on Emissions Scenarios). We therefore used an optimistic scenario B1, an intermediary scenario A1B and a pessimistic scenario A2; this last describing a very heterogeneous world where economic development continues on the current scheme, with no real climate policy aimed at the reduction of GHG emissions. This approach has been replaced as of 2013 by that of scenarios called RCP (which stands for Representative Concentration Pathway). The SRES A2 scenario is quite similar to the present RCP 8.5 scenario.

4. References

Drias – Emission scenarios SRES
http://www.drias-climat.fr/accompagnement/section/174

Drias – Drought values
http://www.drias-climat.fr/accompagnement/section/183

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

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

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