Rankings of widespread extreme dry and wet events on the Iberian Peninsula using the multiscalar SPEI gridded dataset

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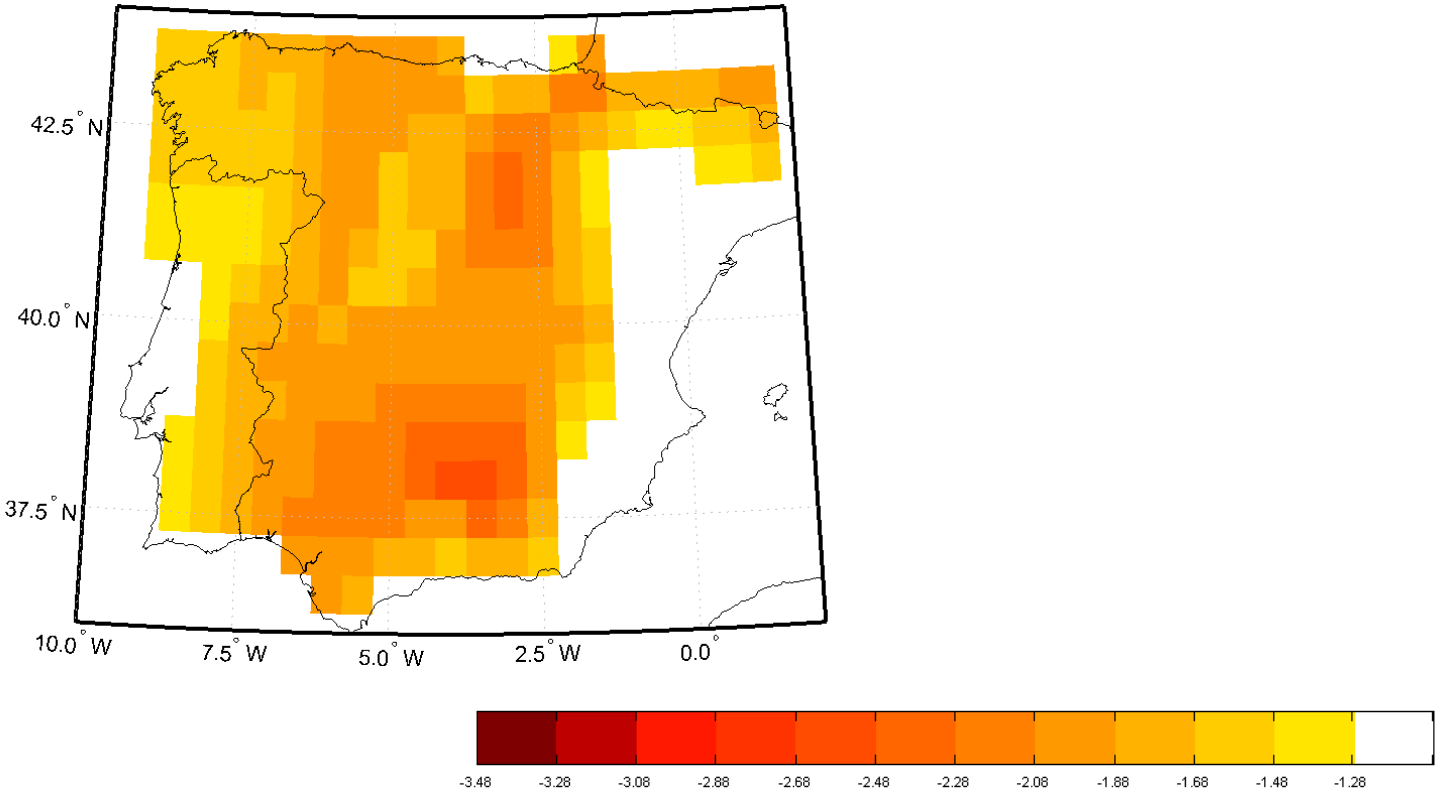
Motivation

How extreme were 2005 and 2012 droughts ?

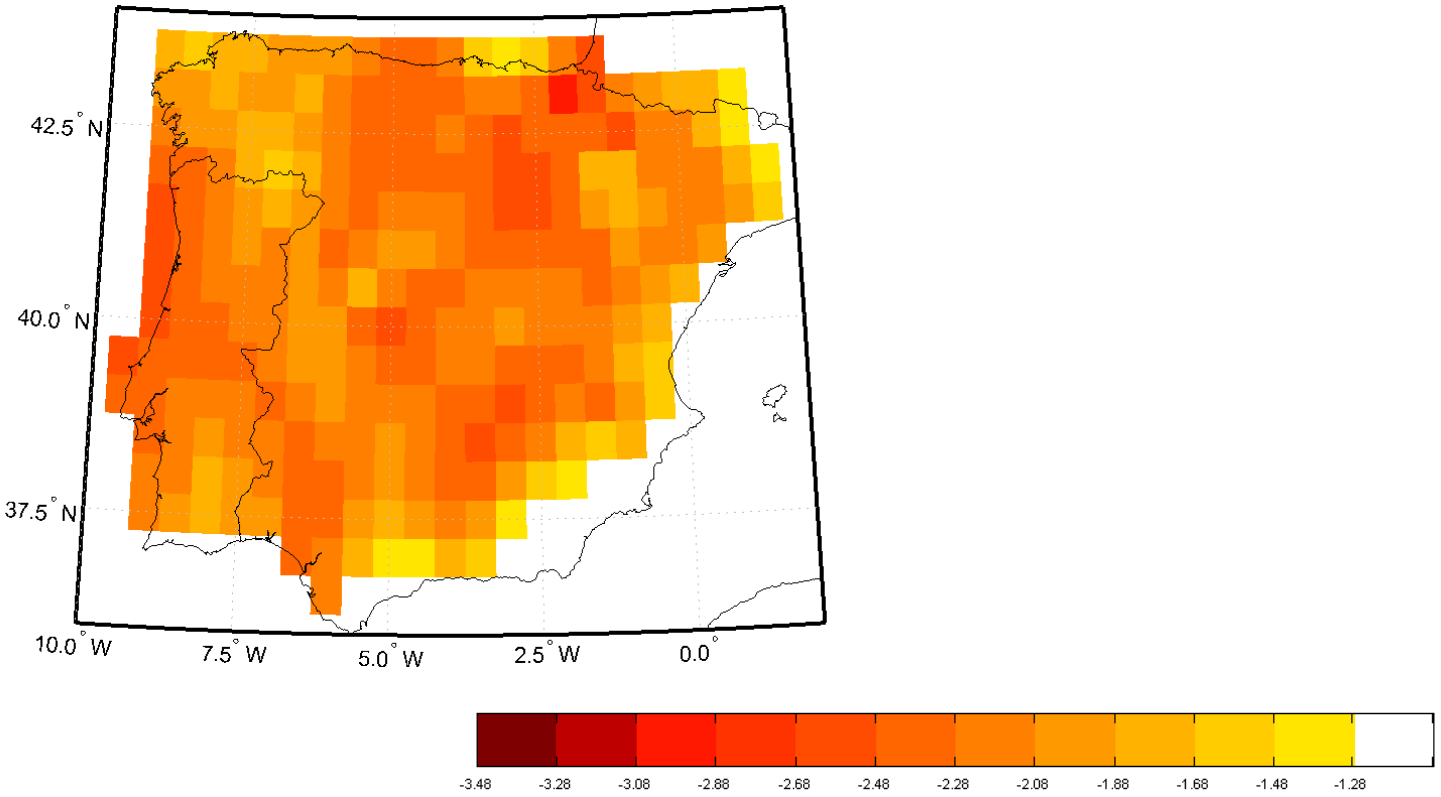
SPEI06 March 2012



Motivation

How extreme were 2005 and 2012 droughts ?

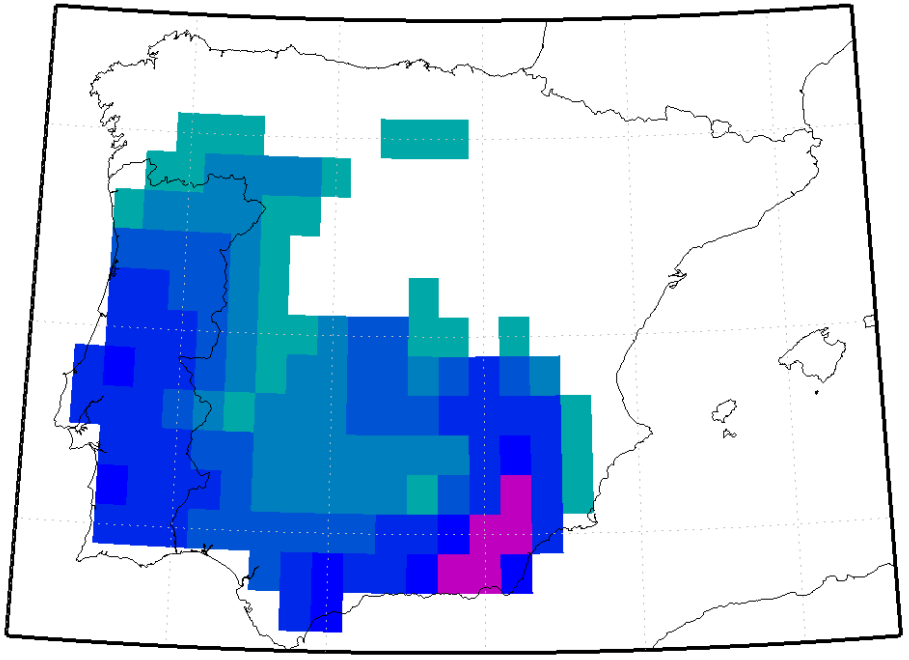
SPEI12 September 2005



Motivation

How extreme were wet episodes?

SPEI06 March 2010



Objectives

- To present **a tool** which allows identifying **regional extremes** of **widespread droughts** and **wet events** at **different time scales**

- To build a **comprehensive dataset of rankings** of the most extreme, widespread dry/wet events on the Iberian Peninsula

  - using the multi-scalar SPEI gridded dataset with a regular resolution of 0.5 degree

  - spanning the period from 1901 to 2012

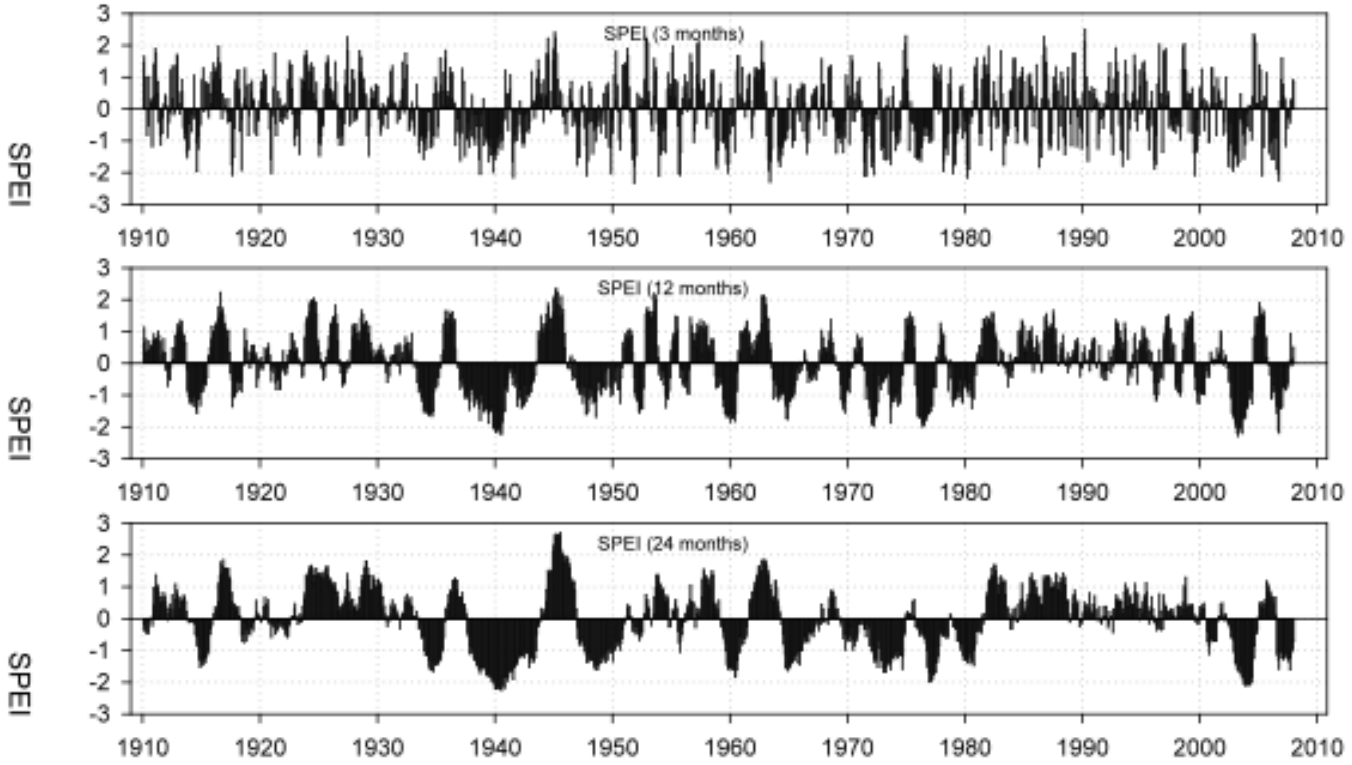
  - for time scales 6, 12, 18 and 24 months

Data and methods

Different systems respond to water scarcity with different temporal scales.

The **Standardized Precipitation and Evapotranspiration Index (SPEI)** is a new index (Vicente-Serrano et al. 2010) that allows the analysis of the drought at different temporal scales.

SPEI is based on precipitation and temperature data, corresponding to a very adjustable index, extremely useful for drought monitoring and assessing impacts (Vicente-Serrano et al. 2013).

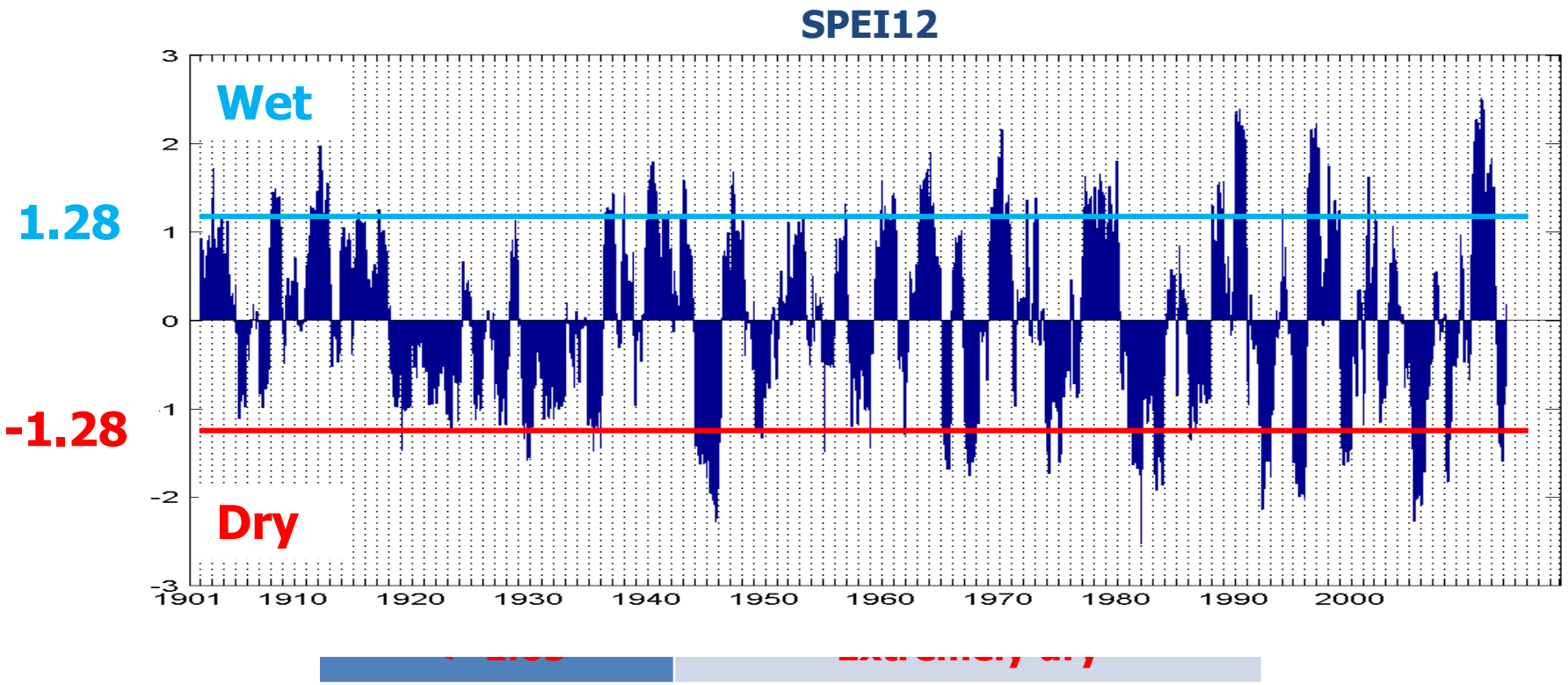


Data and methods

- The multi-scalar SPEI was computed using
  - the monthly Climatic Research Unit (CRU) TS3.21
  - High Resolution Gridded Data (0.5 degree)
  - spanning the period from 1901 to 2012
  - for all time scales
- The CRU Potential Evapotranspiration (PET) was used, through the **Penmann-Monteith equation**

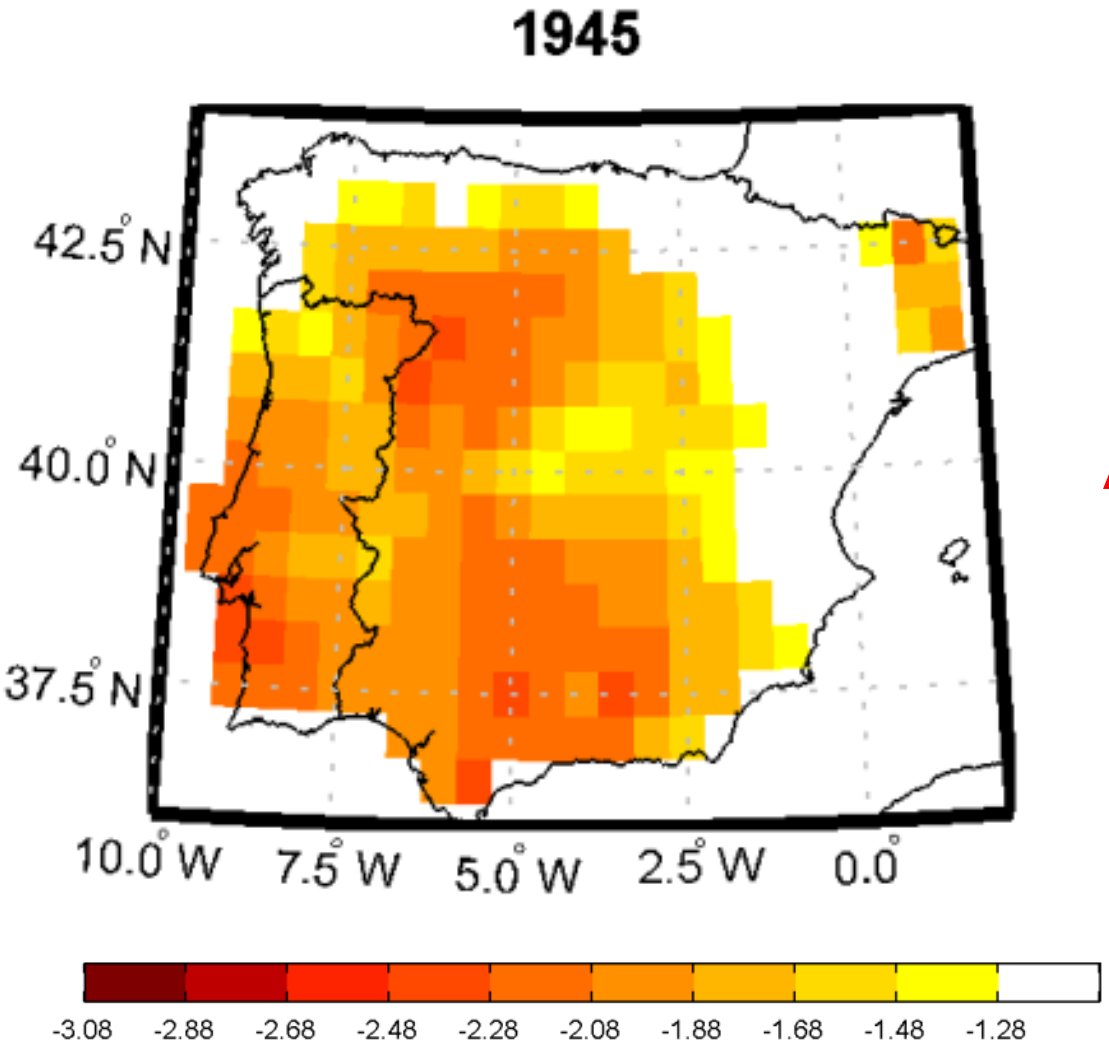
Data and methods

Using the SPEI drought categories for the **period 1901-2012** we may select only the **severely** (very) or **extremely dry (wet) events** for **each grid point** over the Iberian Peninsula.



Data and methods

SPEI12
September



$A \times \overline{SPEI}$

Data and methods

Ranking of widespread severe event

The magnitude of an event (**R**) is given by an index that is obtained after **multiplying:**

1) the **area** (**A**, in percentage) that has SPEI index above/below a certain **threshold** (**±1.28**) by

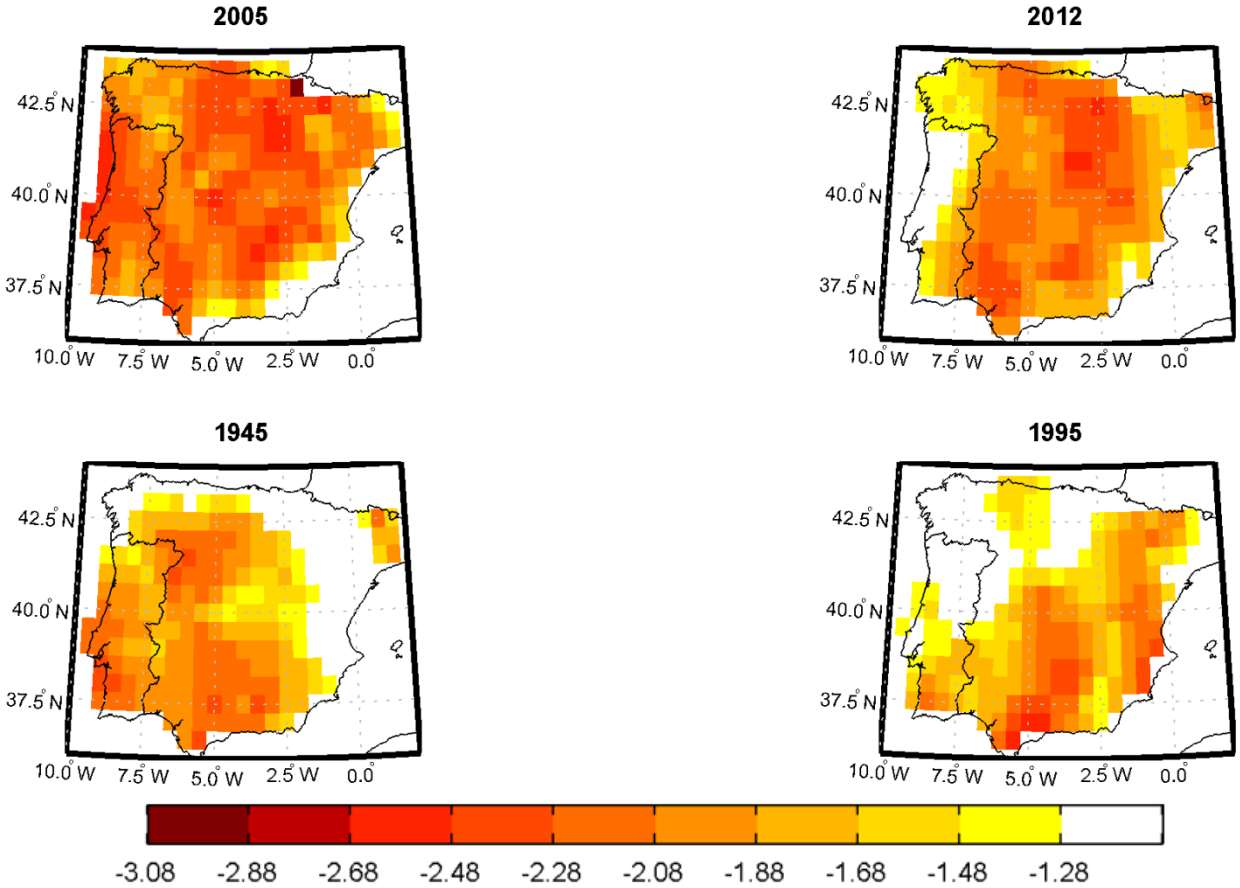
2) the **mean values** (**M**) of the SPEI values over this area A (**>1.28** or **< -1.28**).

Similar to methodology used for precipitation extremes on Iberia Ramos et al. 2014 (ASL)

Widespread Severe Drought – SPEI12

SPEI12 Sept TOP 6 Iberian Peninsula

year	month	A (Area)	M (Mean)	|A*M|	#
2005	9	93.46	-2.14	199.68	1
2012	9	88.08	-1.97	173.61	2
1945	9	75.00	-1.88	140.98	3
1995	9	69.23	-1.79	123.78	4

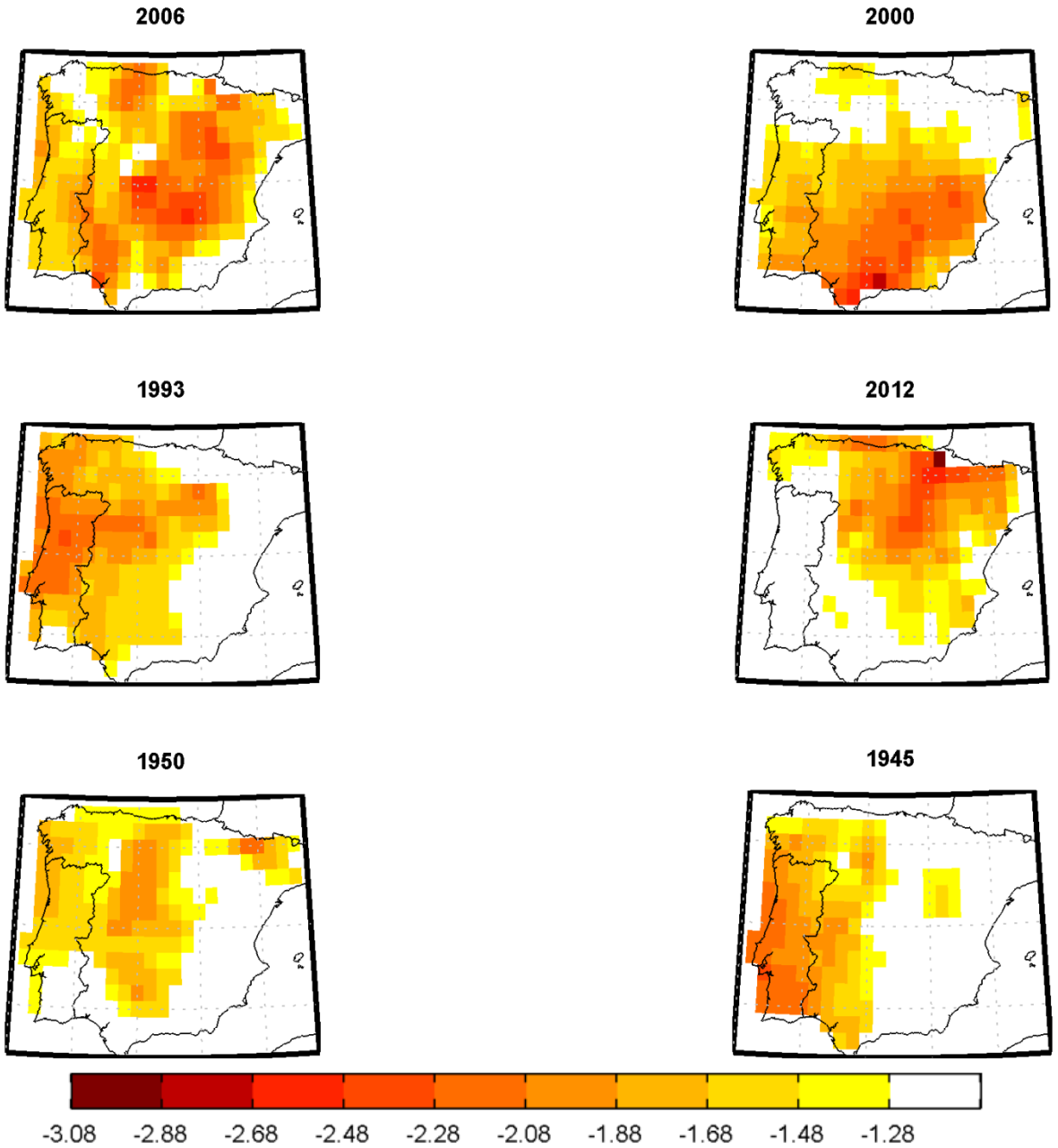


Widespread Severe Drought – SPEI18

SPEI18 March TOP 6 Iberian Peninsula

year	month	A (Area)	M (Mean)	|A*M|	#
2006	3	83.85	-1.82	152.81	1
2000	3	70.00	-1.83	128.35	2
1993	3	65.00	-1.80	117.14	3
2012	3	58.85	-1.80	105.82	4
1950	3	63.08	-1.62	102.38	5
1945	3	50.00	-1.76	87.98	6

Widespread Severe Drought – SPEI18

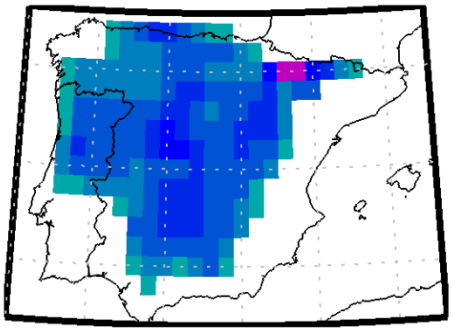


Widespread Severe Wet – SPEI06

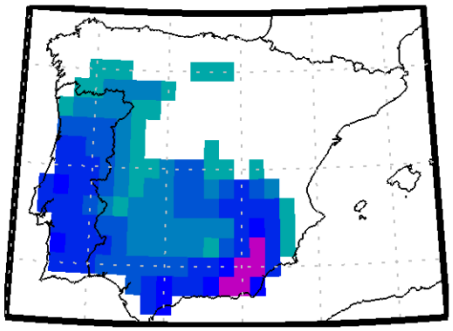
SPEI06 March TOP 6 Iberian Peninsula

year	month	A (Area)	M (Mean)	|A*M|	#
1936	3	72.73	1.97	142.97	1
2010	3	67.53	1.96	132.40	2
1960	3	56.71	1.70	96.15	3
2001	3	50.22	1.82	91.63	4

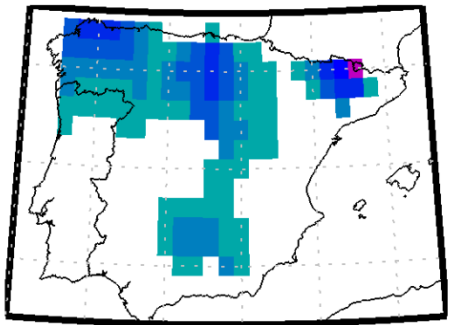
1936



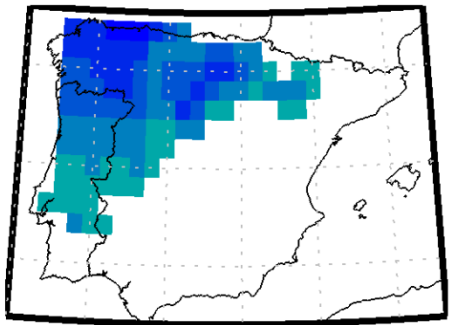
2010



1960



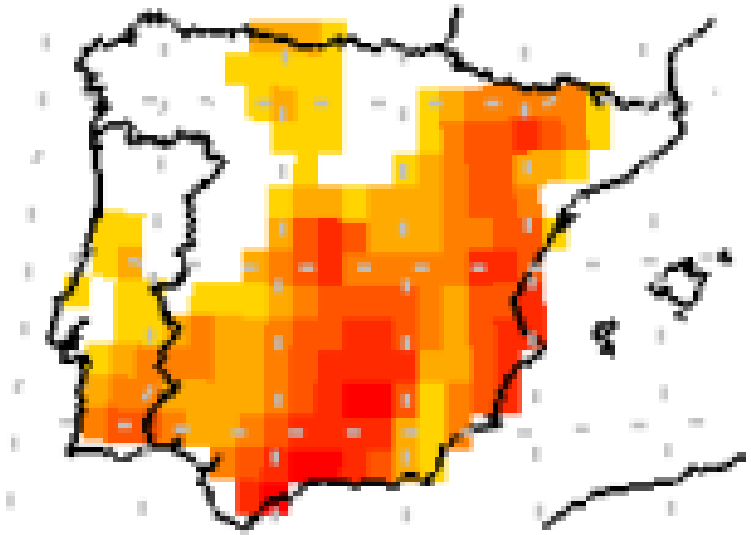
2001



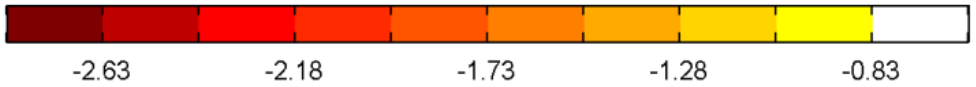
Ranking sensitivity to threshold

SPEI12
September

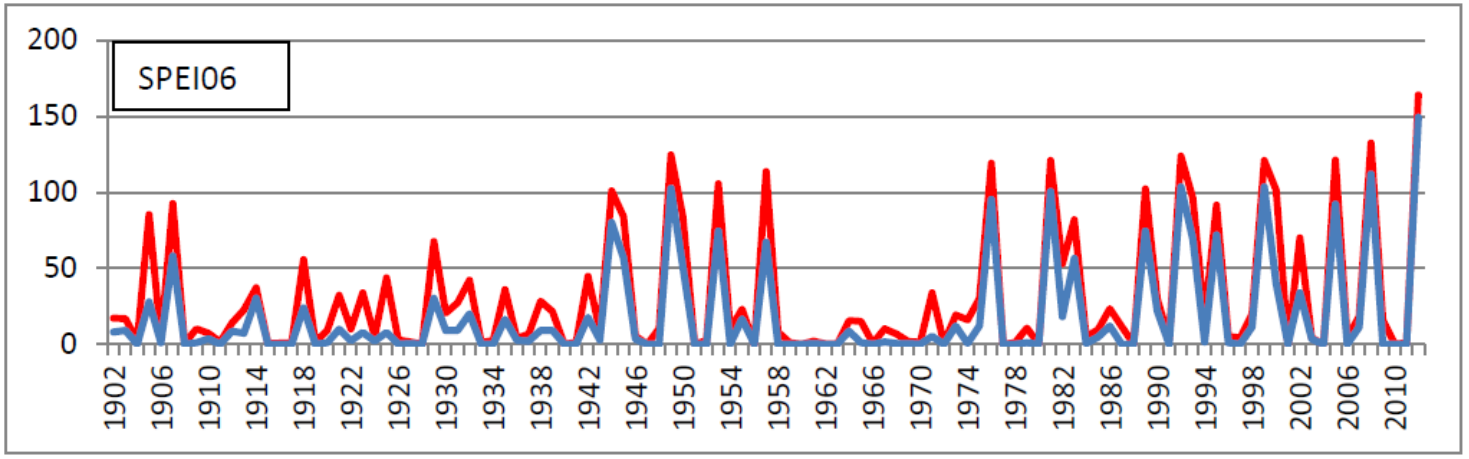
1995



-1.28

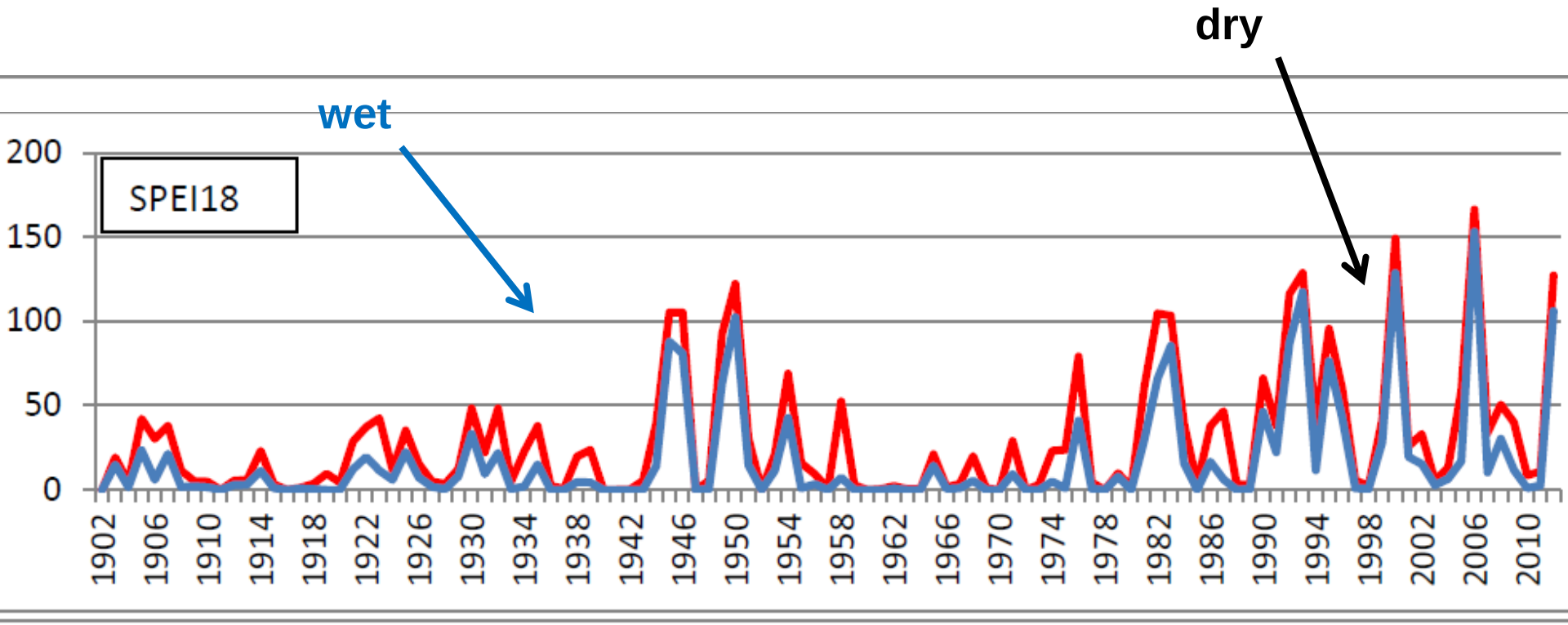


Time evolution of droughts



Ranking Index

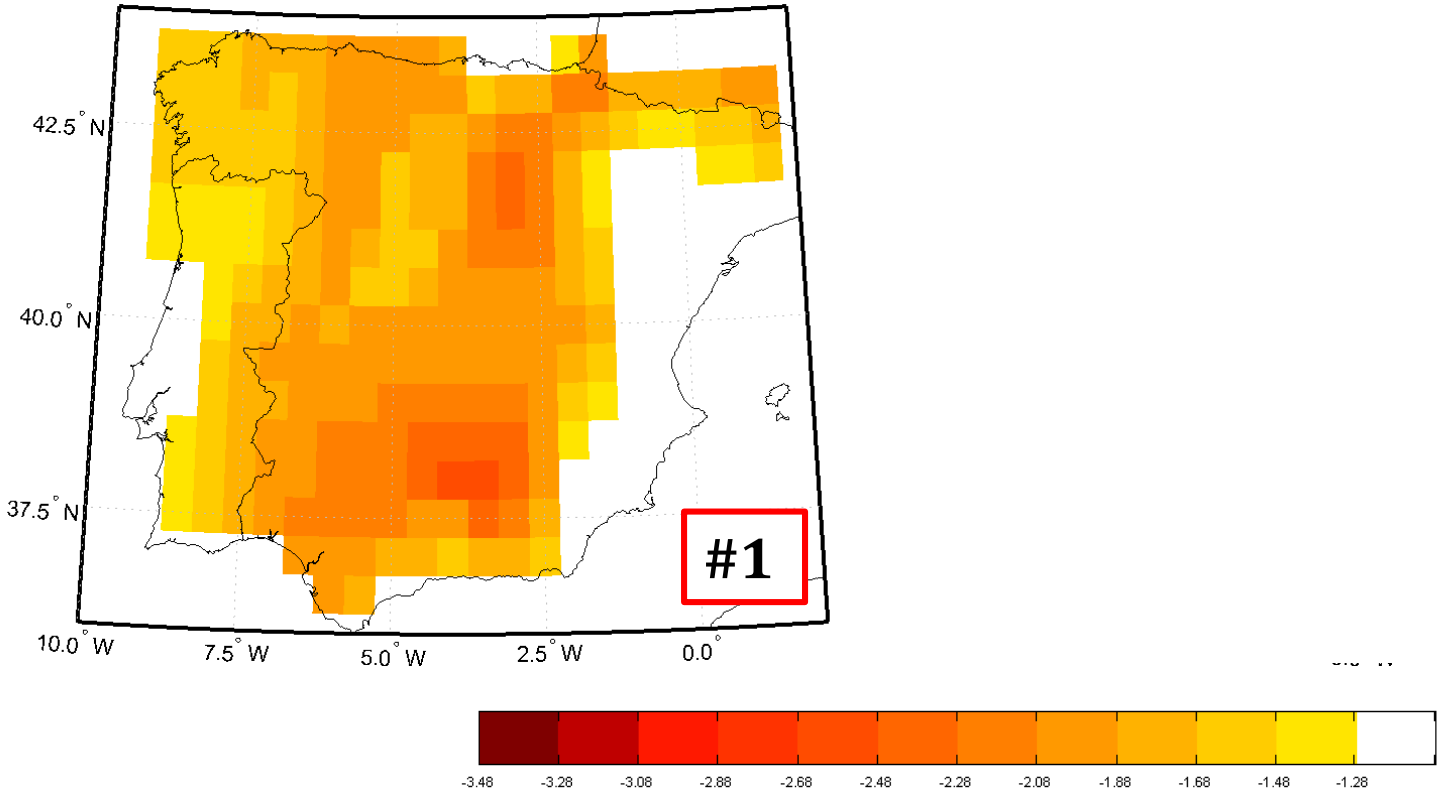
Time evolution of wet/dry periods



Widespread Severe Drought – SPEI06

How extreme were 2005 and 2012 droughts ?

SPEI06 March 2012



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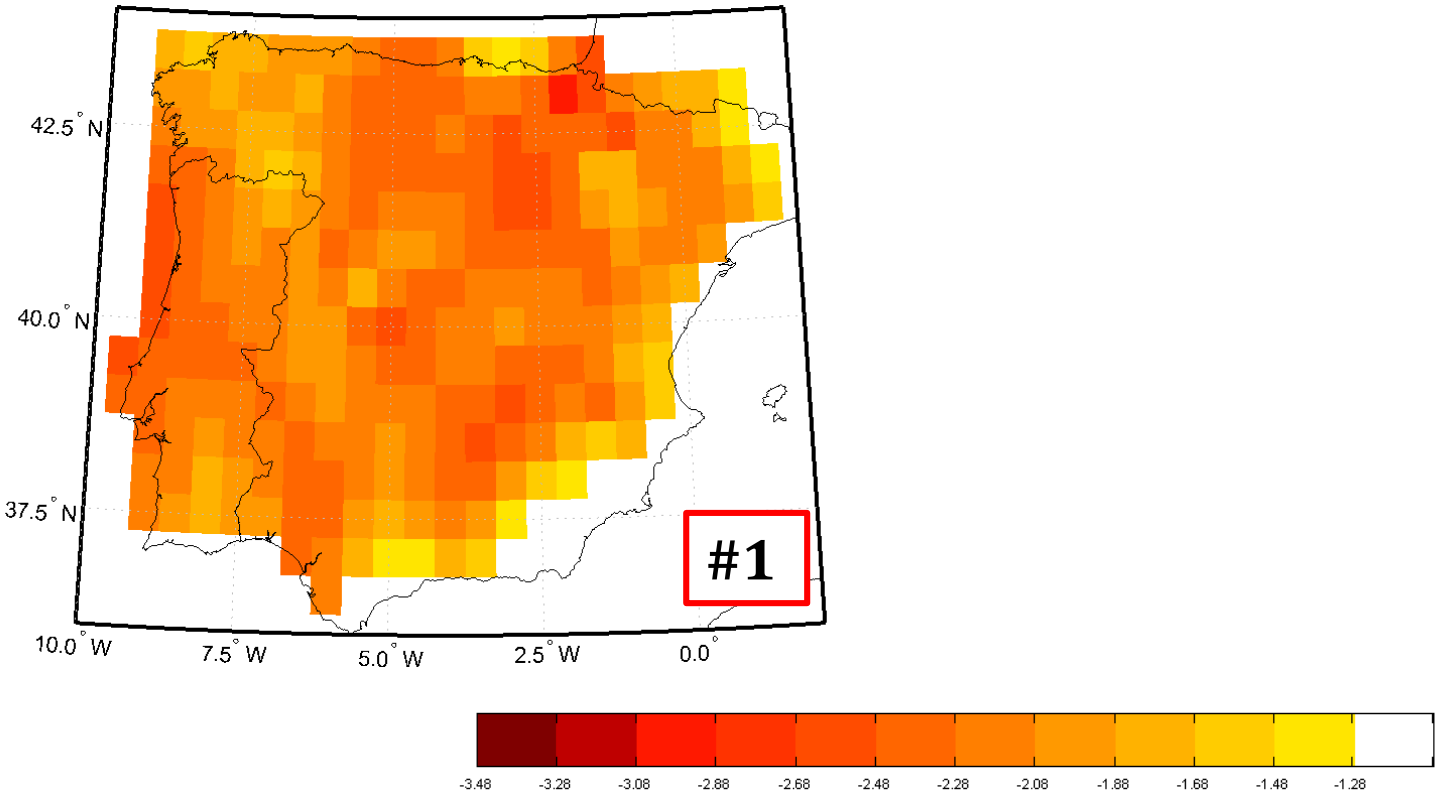
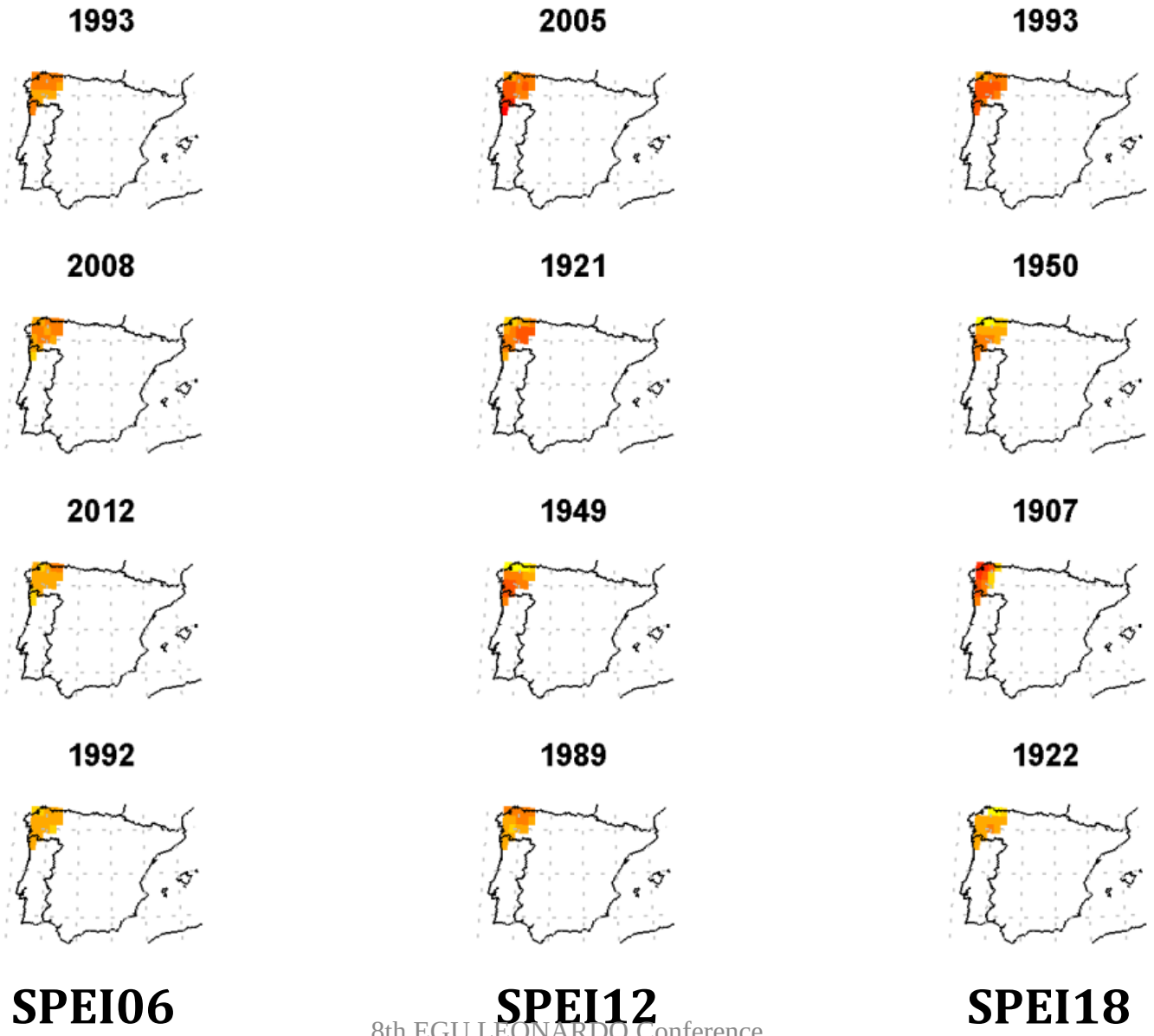


Regional rankings



Summary and Future Work

- A methodology is presented using drought indexes, in particular SPEI, which reveals to be useful in order to identify and rank severe, widespread dry and wet events at several timescales for different applications.

Acknowledgments

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