Agriculture versus climate and environmental change

L'agriculture face aux enjeux climatiques et environnementaux

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION

About

Dr. Serge Zaka

Agro-meteorologist
Agro-climatologist

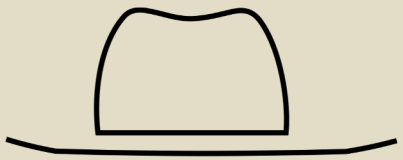
itk
PREDICT AND DECIDE

Also...

- Storm chaser
- Administrator of Infoclimat.fr

www.itk.fr
www.serge-zaka.com

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION



About

Agrometeorology
Agroclimatology

itk
PREDICT AND DECIDE

Forecast of frost damages over the next 7 days
Evolution of drought occurrences over the next 70 years
...

Climate → Agriculture

Agriculture → Climate

Carbone storages
Livestock gas emissions
...

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION

Summary

1. Climate change in Europe (12 minutes)

2. Focus on sorghum (12 minutes)

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION

1. Climate change in Europe

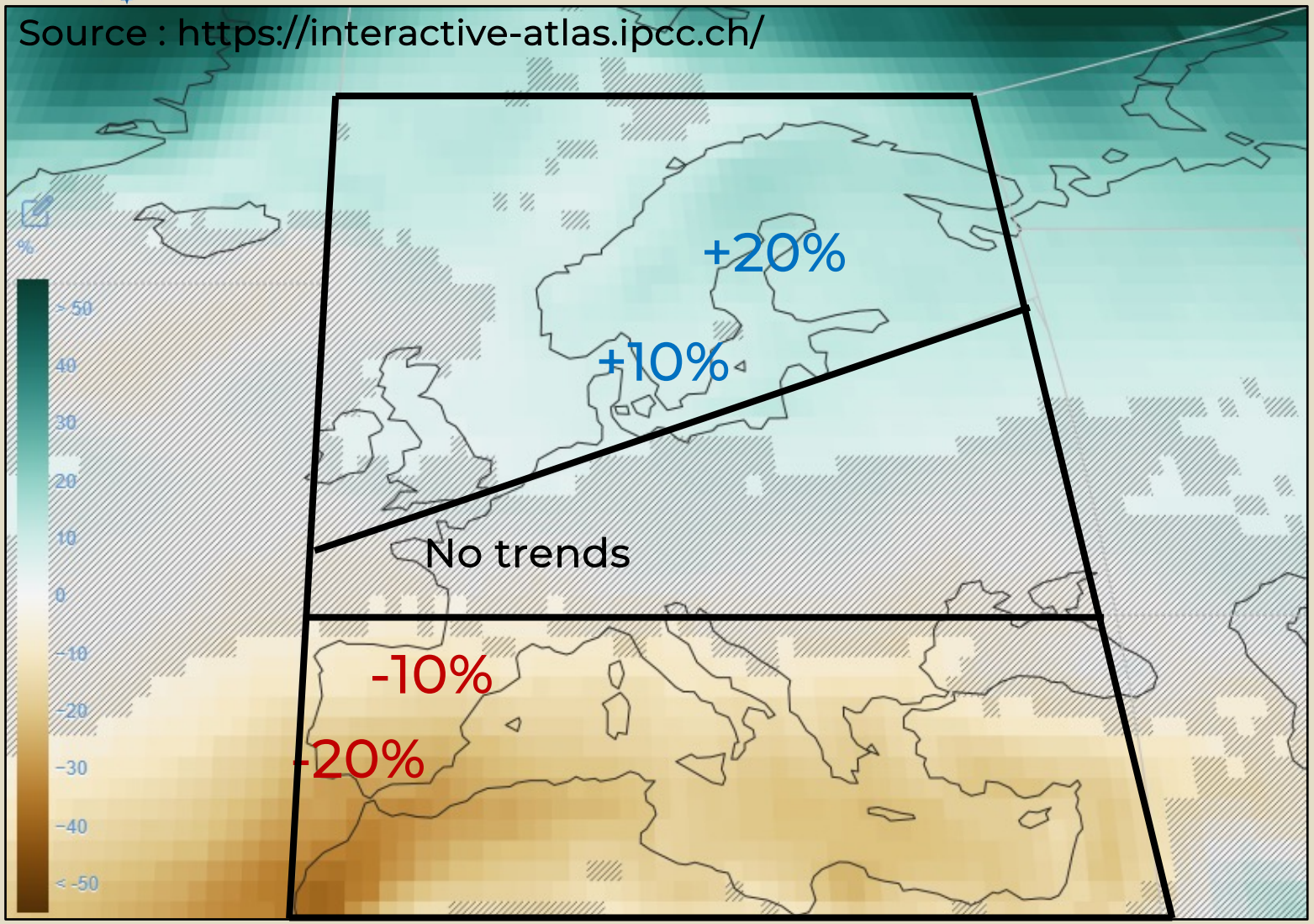
Precipitations

(5 minutes)

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION

Climate change in Europe

Annual precipitation



I.P.C.C. detected 3 zones over Europe

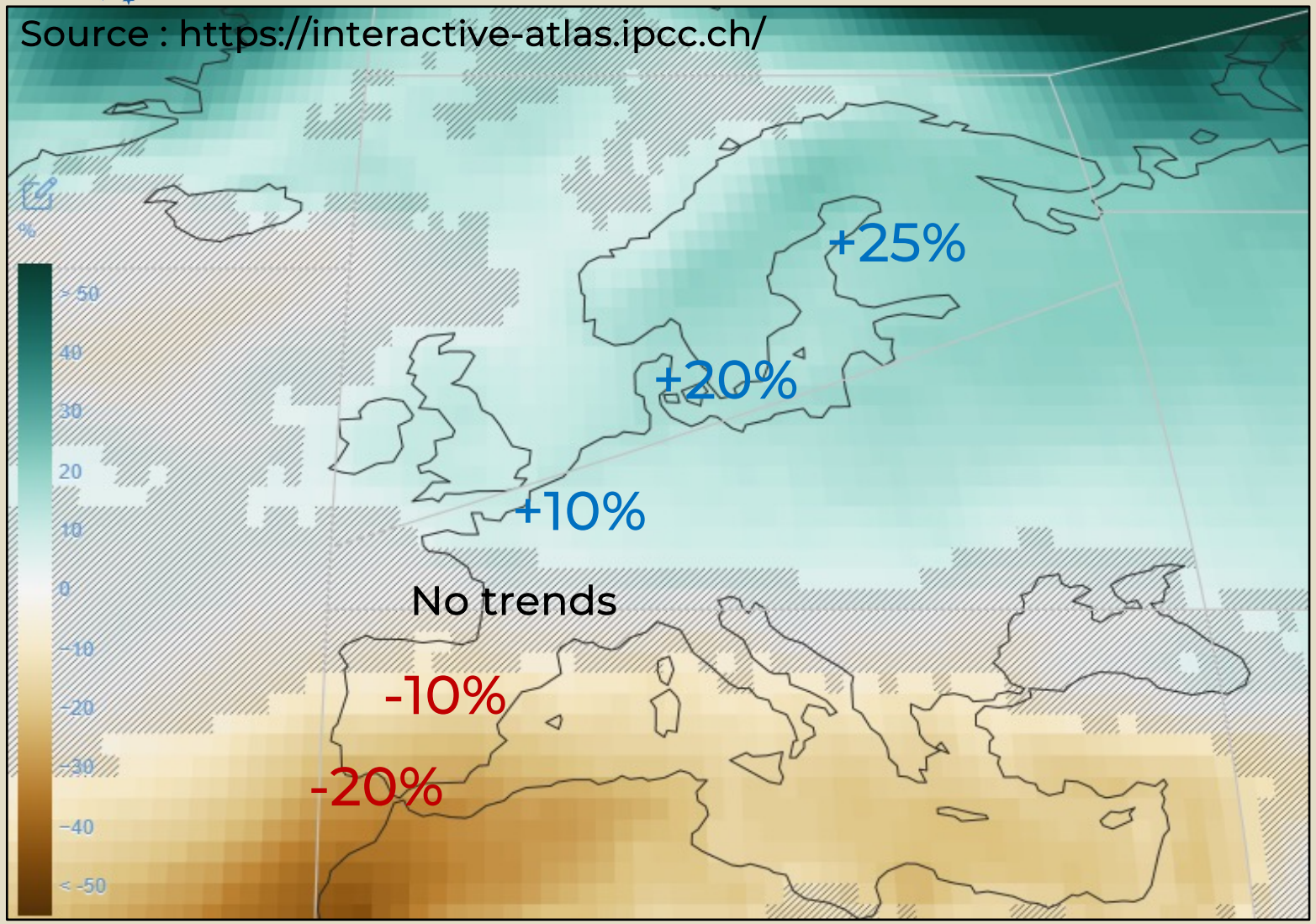
Warming +3°C
Change in annual precipitation (%)
(rel. to 1850-1900)

CAMPAIGN FINANCED WITH AID FROM THE EUROPEAN UNION

ENJOY IT'S FROM EUROPE

Climate change in Europe

October to May precipitation

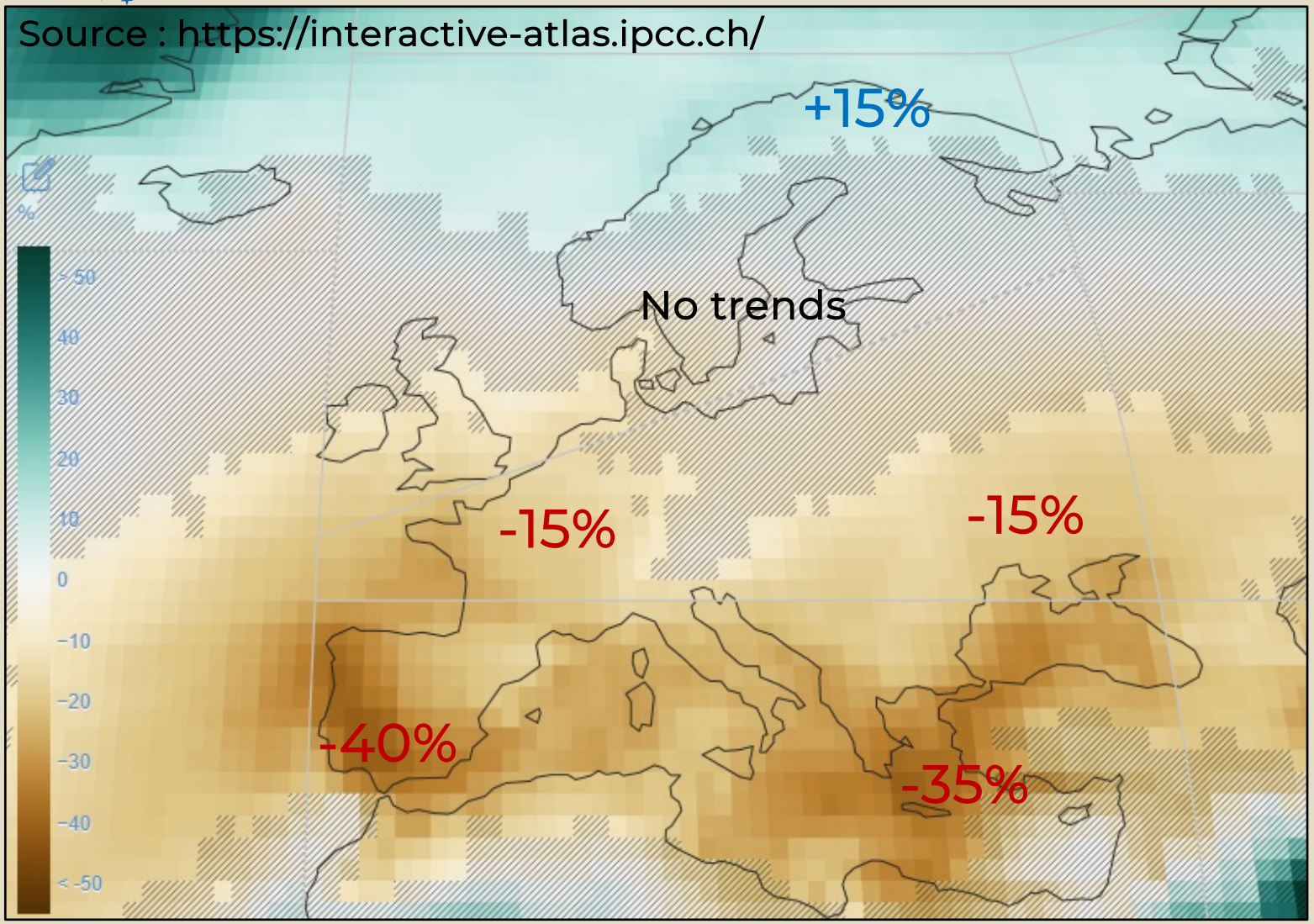


Warming +3°C
Change in precipitation (%)
(rel. to 1850-1900)

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION

Climate change in Europe

June to September precipitation



Warming +3°C
Change in precipitation (%)
(rel. to 1850-1900)

CAMPAIGN FINANCED WITH AID FROM THE EUROPEAN UNION

1. Climate change in Europe

Effective rainfall

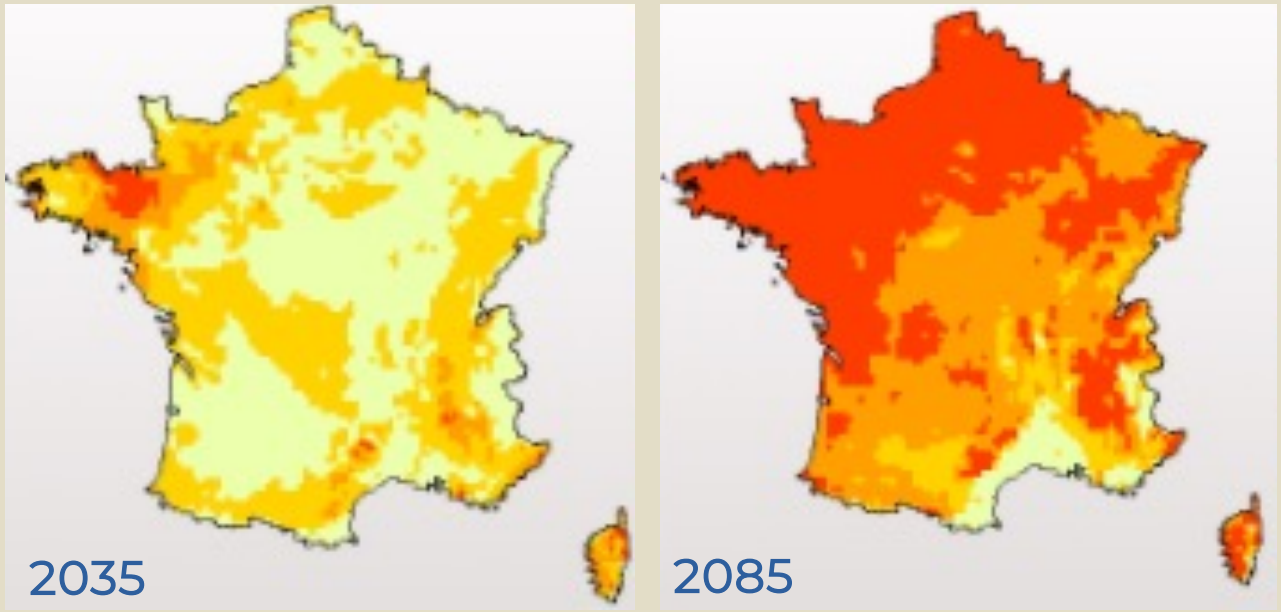
(2 minutes)

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION

Climate change in Europe

Effective rainfall

Surface soil humidity
In mid-winter



+7% of water in the air
each +1°C
More intense rainfalls
More evapotranspiration

Warming +3°C
(rel. to 1976-2005)
Model ISBA
Source : DRIAS 2020

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION

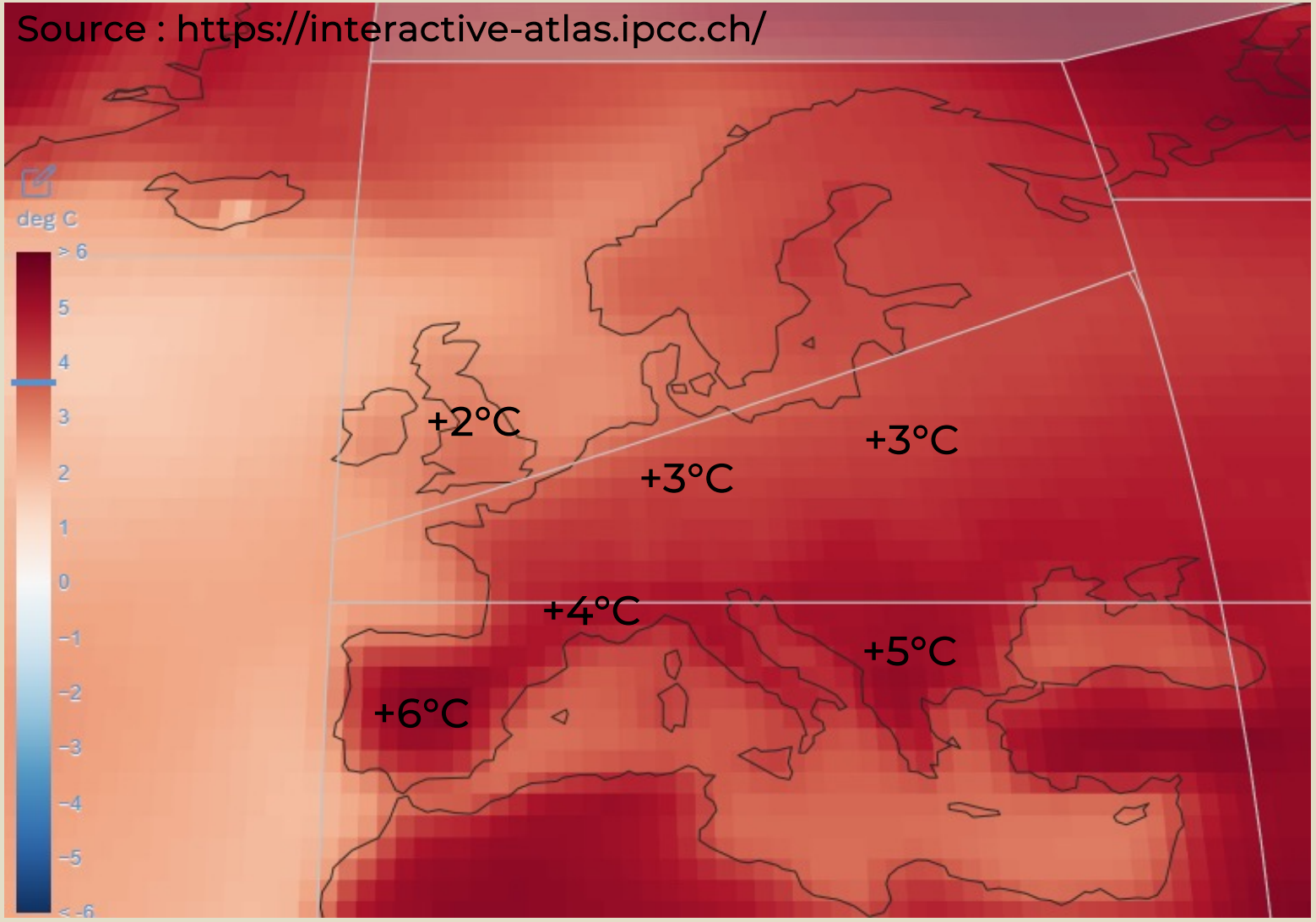
1. Climate change in Europe

Mean temperature

(1 minute)

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION

Source : https://interactive-atlas.ipcc.ch/



Climate change in Europe

Annual mean temperature

Anticipation of phenological stages
Increase of evapotranspiration

Warming +3°C
Change in mean temperature (°C)
(rel. to 1850-1900)

CAMPAIGN FINANCED WITH AID FROM THE EUROPEAN UNION

1. Climate change in Europe

Extreme temperature

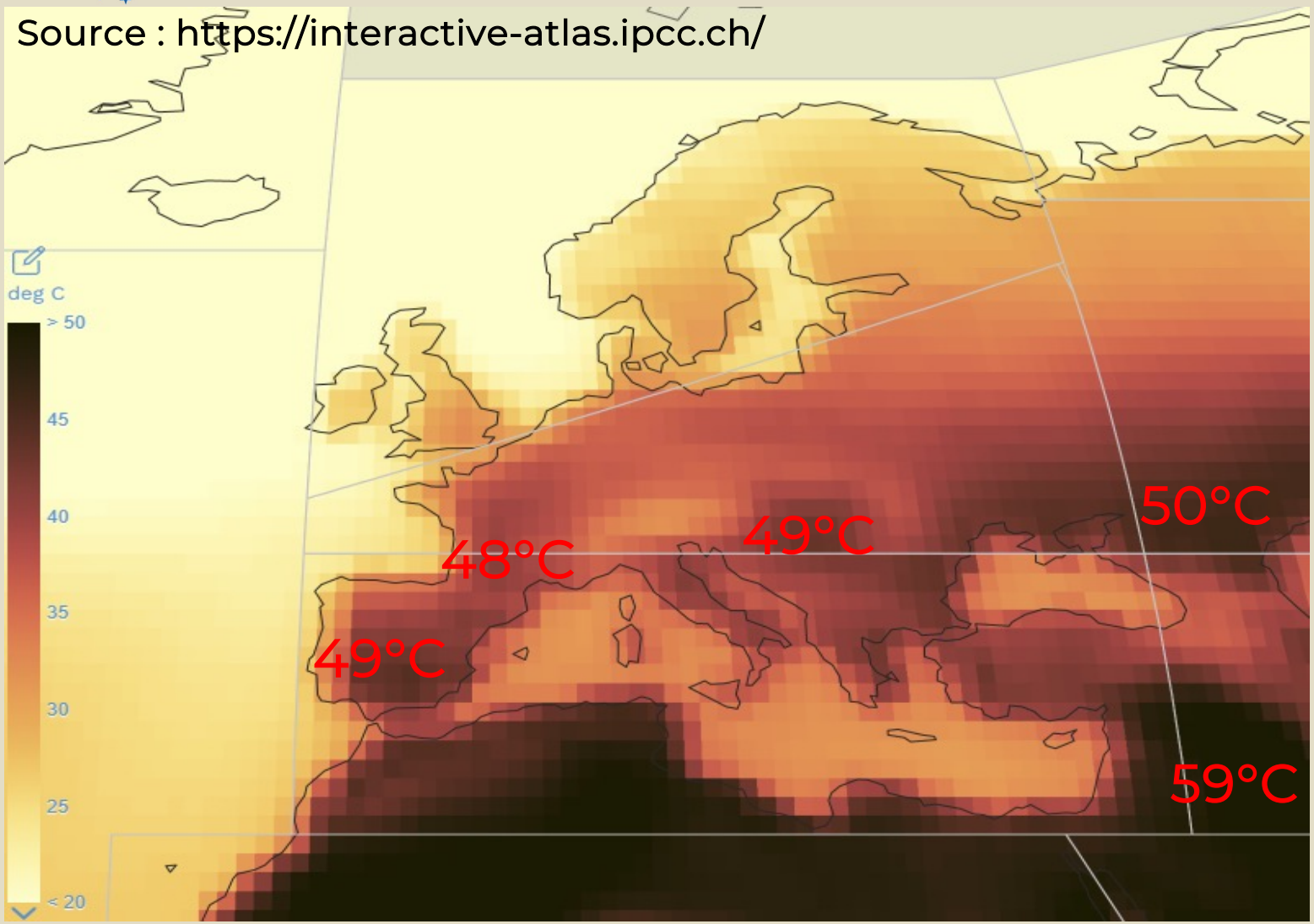
(4 minutes)

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION

Climate change in Europe

Annual extreme temperature

Source : https://interactive-atlas.ipcc.ch/

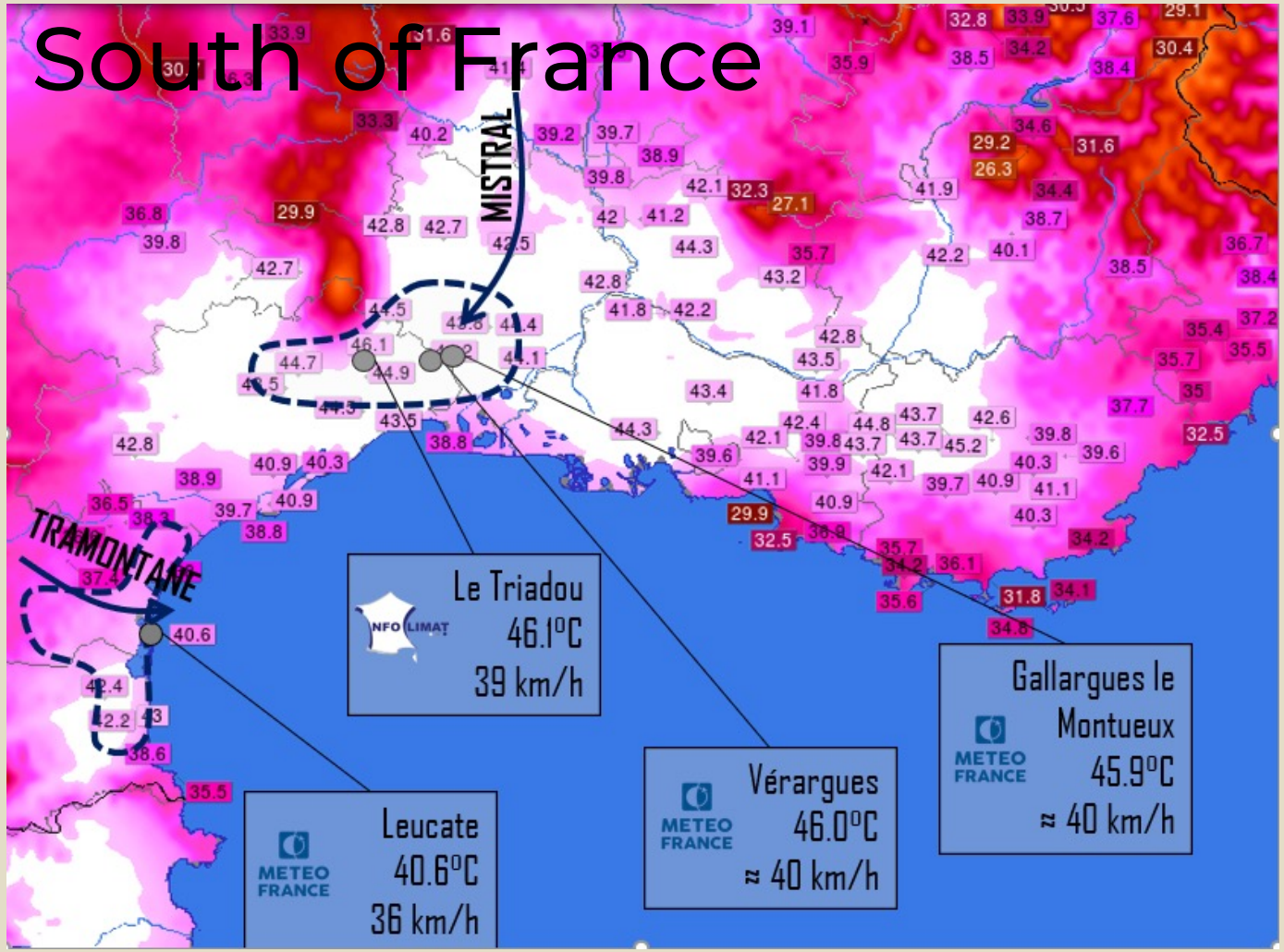


Warming +3°C
Extreme temperature (°C)
(rel. to 1850-1900)

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION

ENJOY
IT'S FROM
EUROPE

South of France



Map : www.infoclimat.fr

Climate change in Europe

Annual extreme temperature

Heat Blast or “hairdryer effect”

CAMPAIGN FINANCED WITH AID FROM THE EUROPEAN UNION

Take home messages

Climate change at +3°C : 3 zones

✓ Precipitation

Mediterranean zone is a “hot spot” of climate change
No major trends for the annual precipitation in central Europe
Evolution of the annual repartition of the precipitation – More in winter, less in summer

✓ Effective rainfall

+7% of water in the air each +1°C – More intense and less effective rainfalls

✓ Mean temperature

+2 to +6°C over Europe

✓ Extreme temperature

50°C+ reachable in Europe

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION

2. Focus on sorghum

Facing climate change

Two ways

(2 minutes)

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION

First way : adaptation

Second way : exploration

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION

First way : adaptation

Same species

New technics (genetics, practices etc.)

Second way : exploration

New species

More adapted to the new climate (hotter, summer drought as explained)

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION

First way : adaptation

Same species

New technics (genetics, practices etc.)

Bizarre

Second way : exploratio

New species

More adapted to the new climat
summer drought as explained)

ENJOY
IT'S FROM
EUROPE

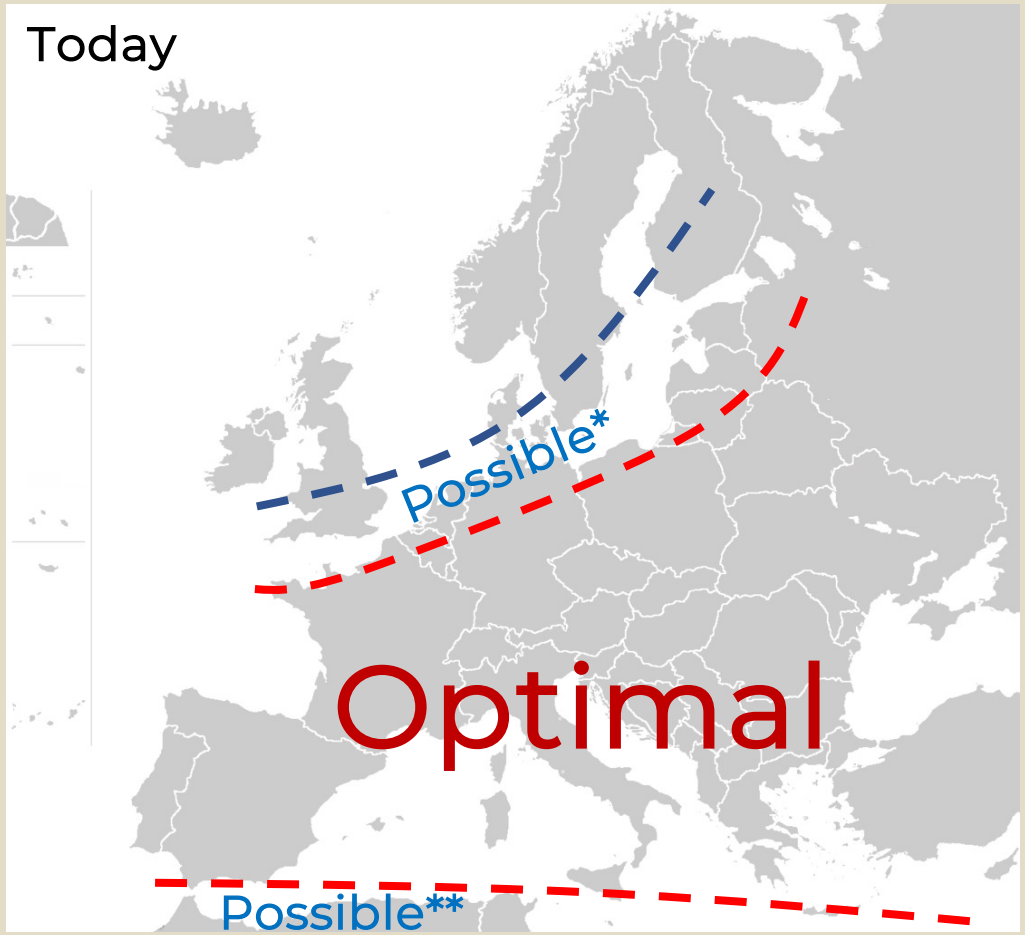
CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION

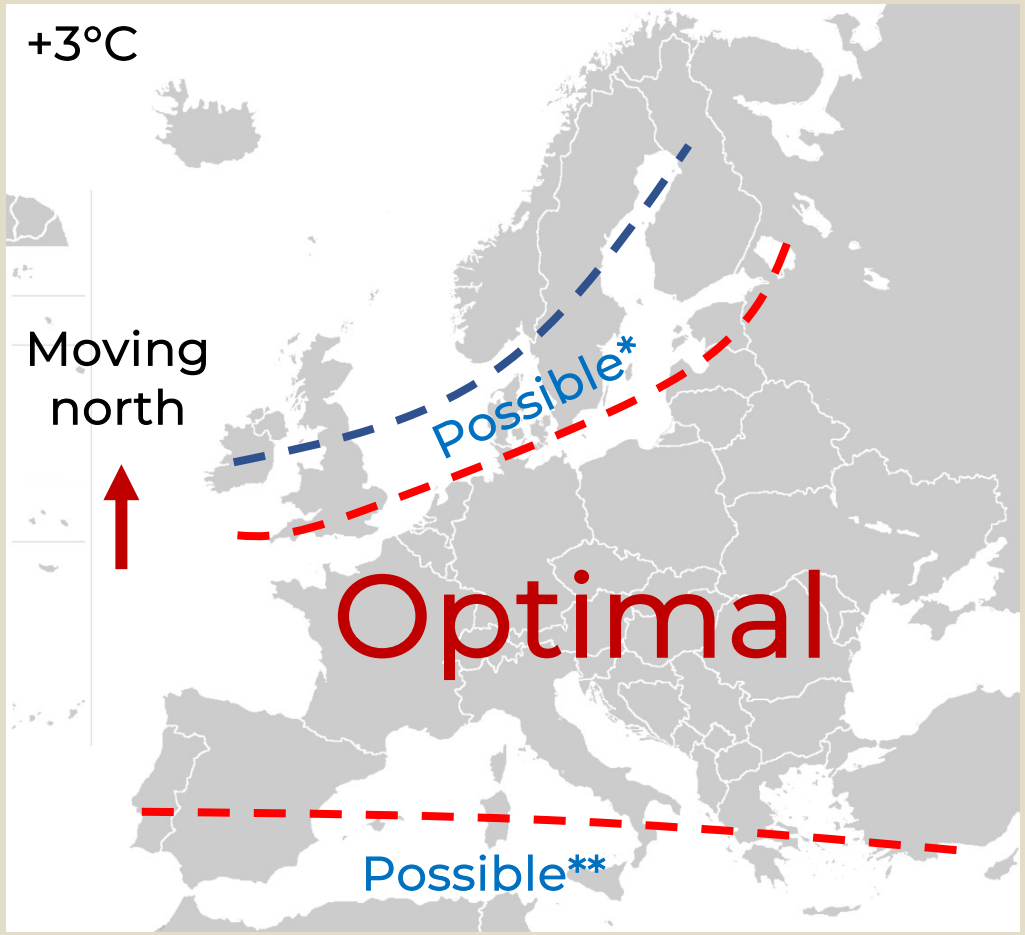
2. Focus on sorghum

Evolution of sorghum area

(2 minutes)

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION





*Limiting factor : Low temperatures
**Limiting factor : Water

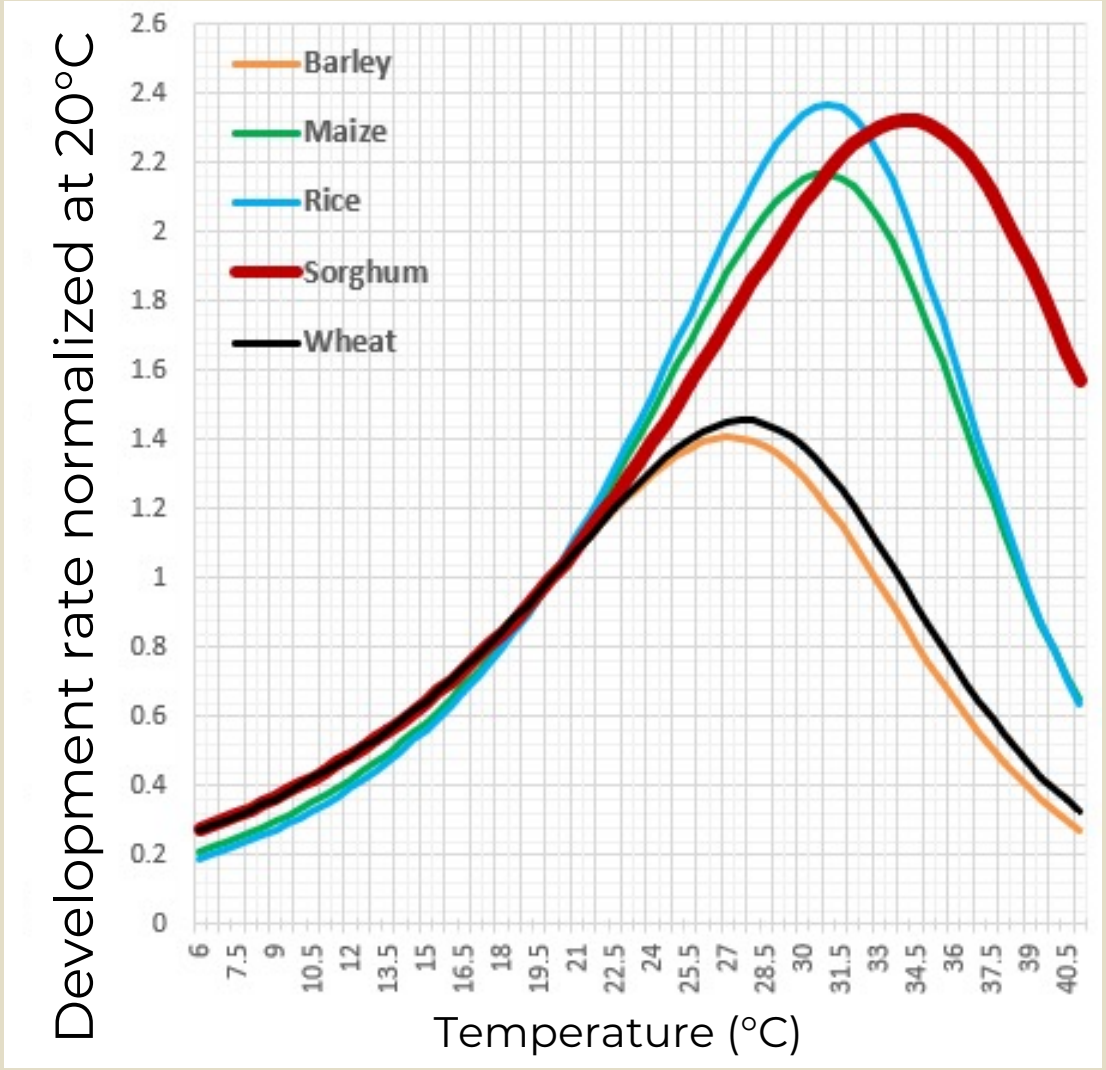
CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION

2. Focus on sorghum

Temperature response

(3 minutes)

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION



2. Focus on sorghum

Temperature response

Optimal temperature of sorghum is higher

Sorghum performs better at high temperatures

Parent et Tardieu (2012)

CAMPAIGN FINANCED WITH AID FROM THE EUROPEAN UNION

2. Focus on sorghum

Water response

(5 minutes)

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION

2. Focus on sorghum

Water response

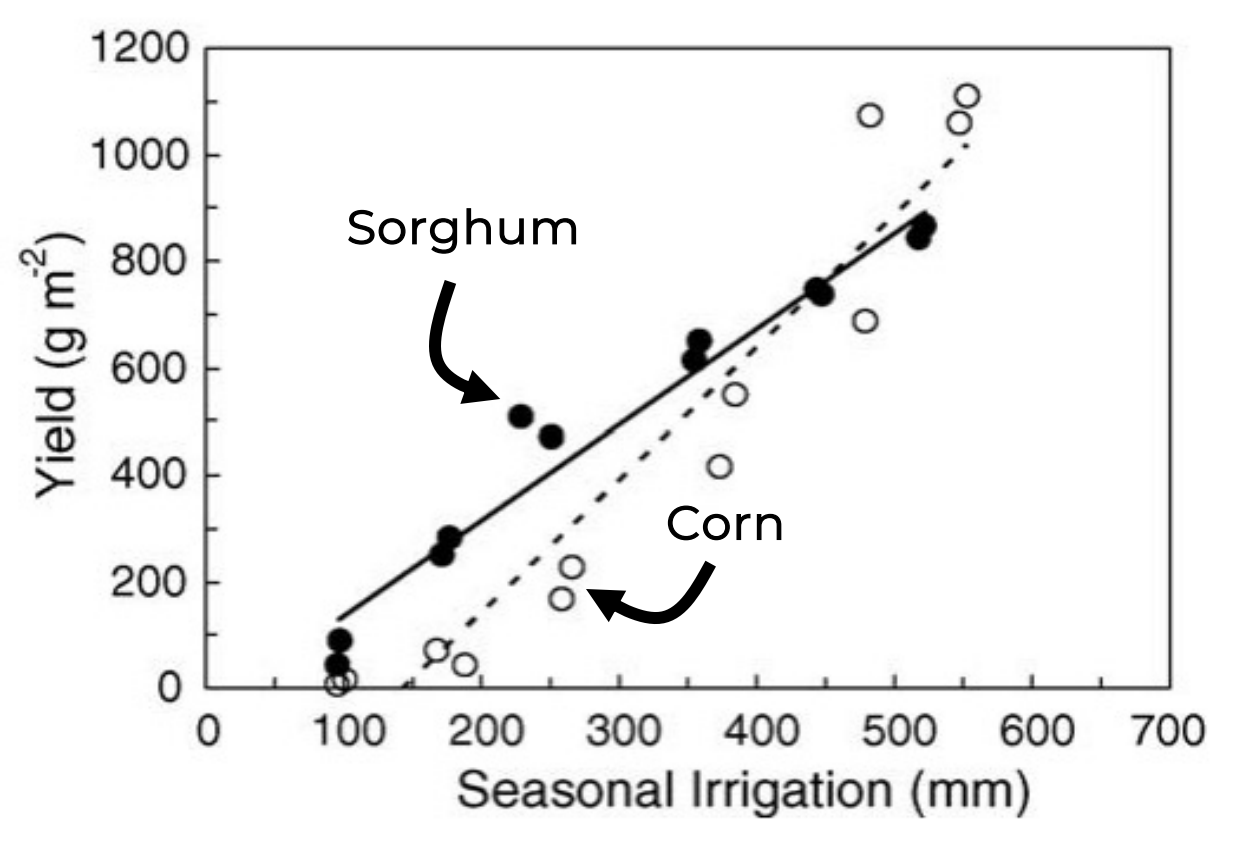
Crop	Growing period (days)	Water needs over the growing period (mm)
Rice	90-150	450-700
Corn	125-180	500-800
Barley	120-150	450-650
Wheat	120-150	450-650
Sorghum	**120-130**	**450-650**

Shorter growing period (rel.)

Lower water needs (rel.)

FAO

CAMPAIGN FINANCED WITH AID FROM THE EUROPEAN UNION

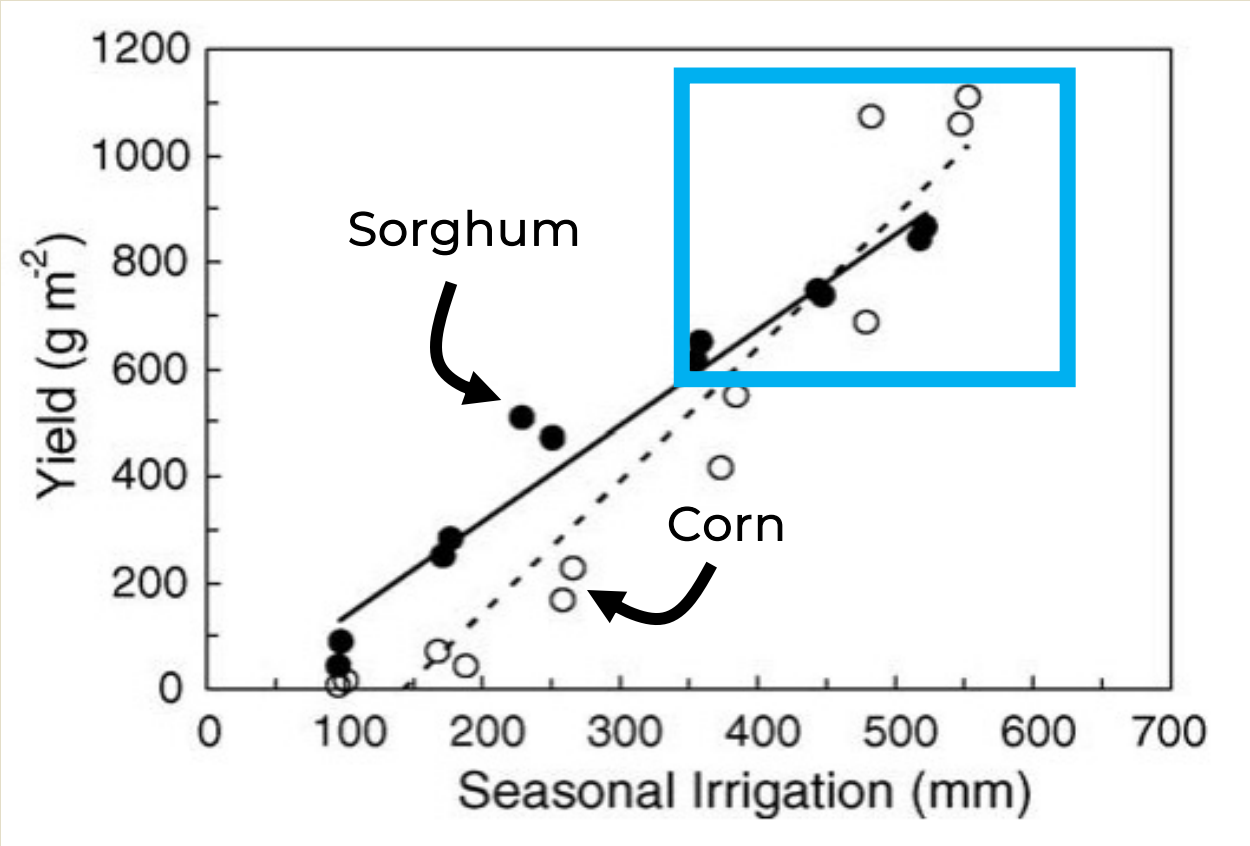


Farré et Faci (2006)

2. Focus on sorghum

Water response

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION



Farré et Faci (2006)

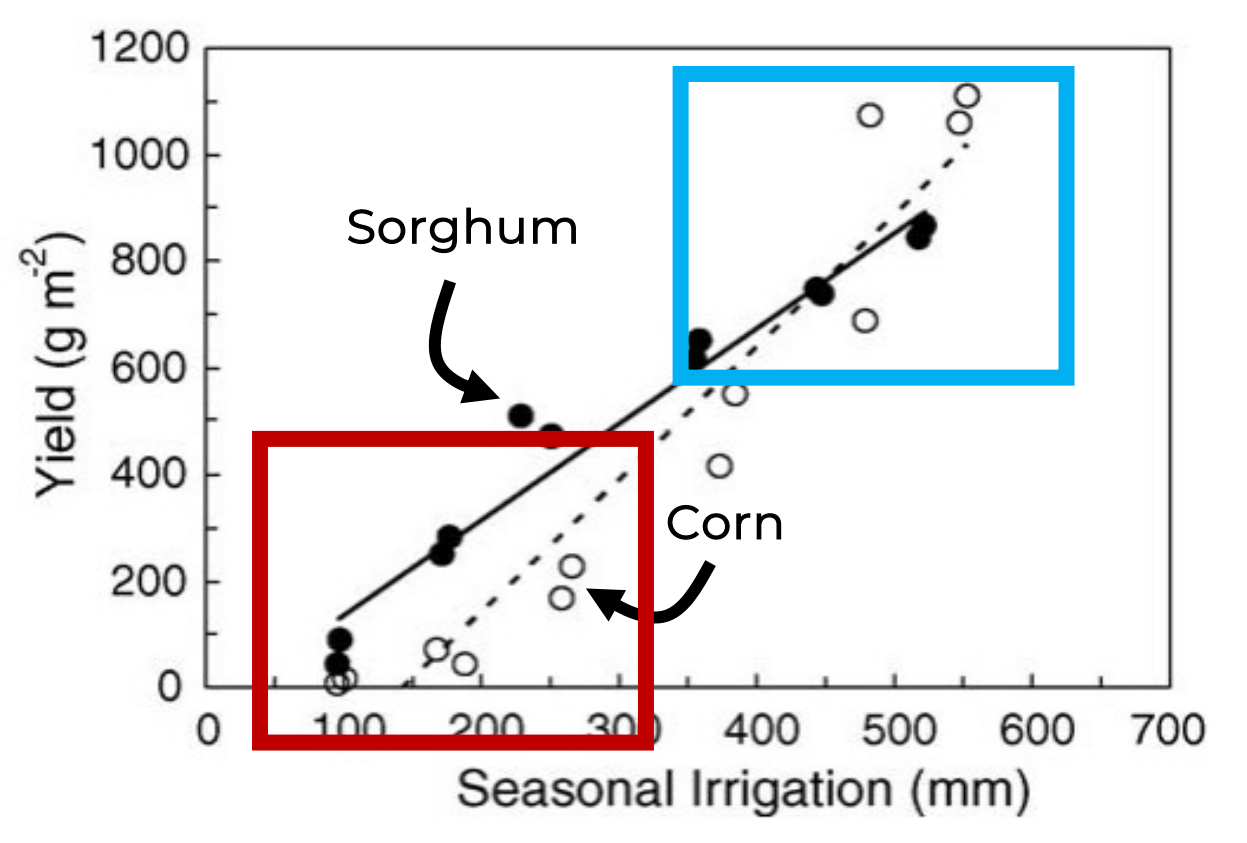
2. Focus on sorghum

Water response

No water stress

Same water use efficiency between corn and sorghum (40 kg MS/mm/ha)

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION



Farré et Faci (2006)

2. Focus on sorghum

Water response

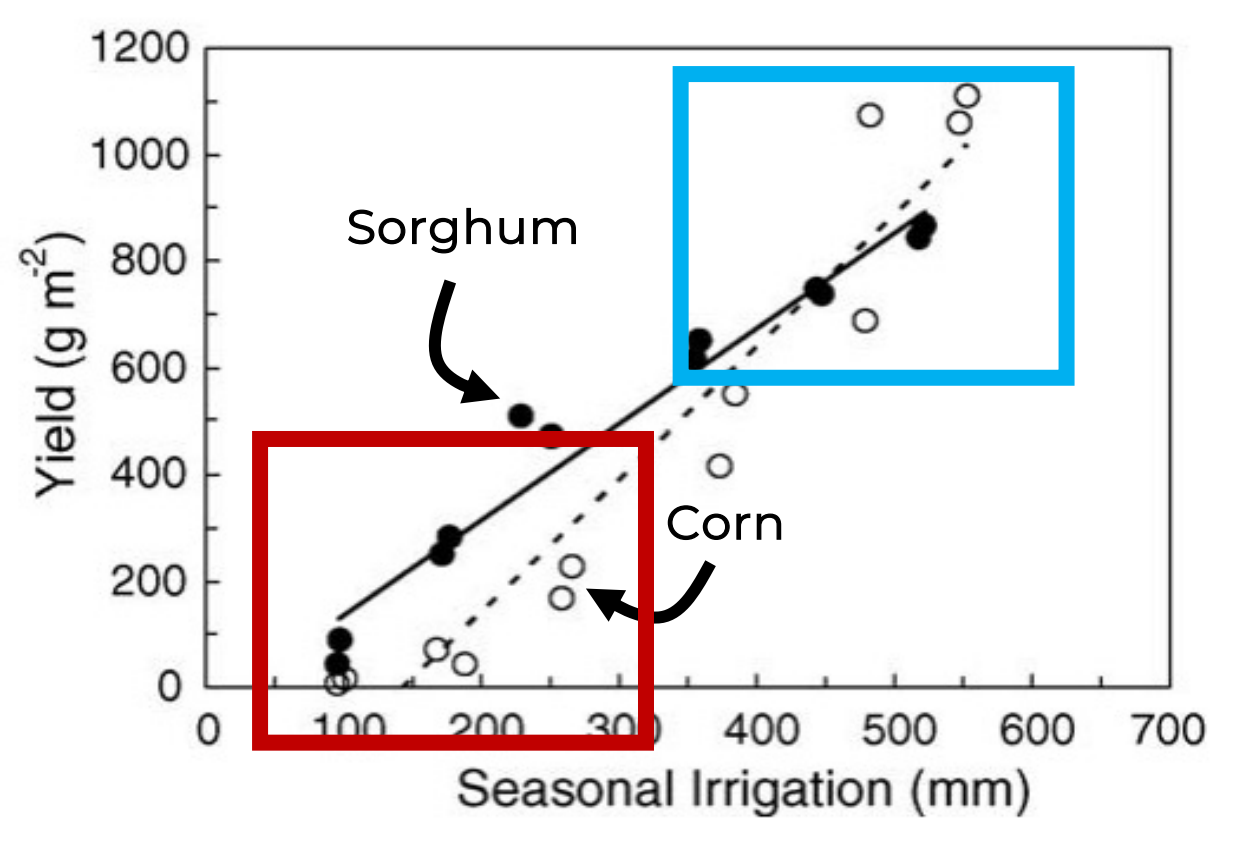
No water stress

Same water use efficiency between corn and sorghum (40 kg MS/mm/ha)

Water stress

Sorghum performs better than corn

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION



Farré et Faci (2006)

2. Focus on sorghum

Water response

No water stress

Same water use efficiency between corn and sorghum (40 kg MS/mm/ha)

Water stress

Sorghum performs better than corn
Multifactorial
Greater ability to extract water from deeper soil layers (root architecture), leaf structure, shorter growing period etc.

CAMPAIGN FINANCED WITH AID FROM THE EUROPEAN UNION

Take home messages

✓ Area of production

Area of sorghum is moving north

✓ Response to temperature

Sorghum performs better (than corn, wheat, rize and barley) at high temperatures

✓ Response to water stress

Sorghum performs better (than corn) in case of water stress.

"The sorgum adventure" is an exploration of a new species more adapted to our new climates.

CAMPAIGN FINANCED
WITH AID FROM
THE EUROPEAN UNION