



MED-GOLD

WHAT ARE THE TIME SCALES OF CLIMATE SERVICES FOR AGRICULTURE?

TUESDAY 21 APRIL 2020

THE WEBINAR WILL START AT 12:30H CEST



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 776467.



Our speakers

Block 1:

Time scales of climate services for agriculture



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POLL 1 : Who is who



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TIME SCALES OF CLIMATE SERVICES



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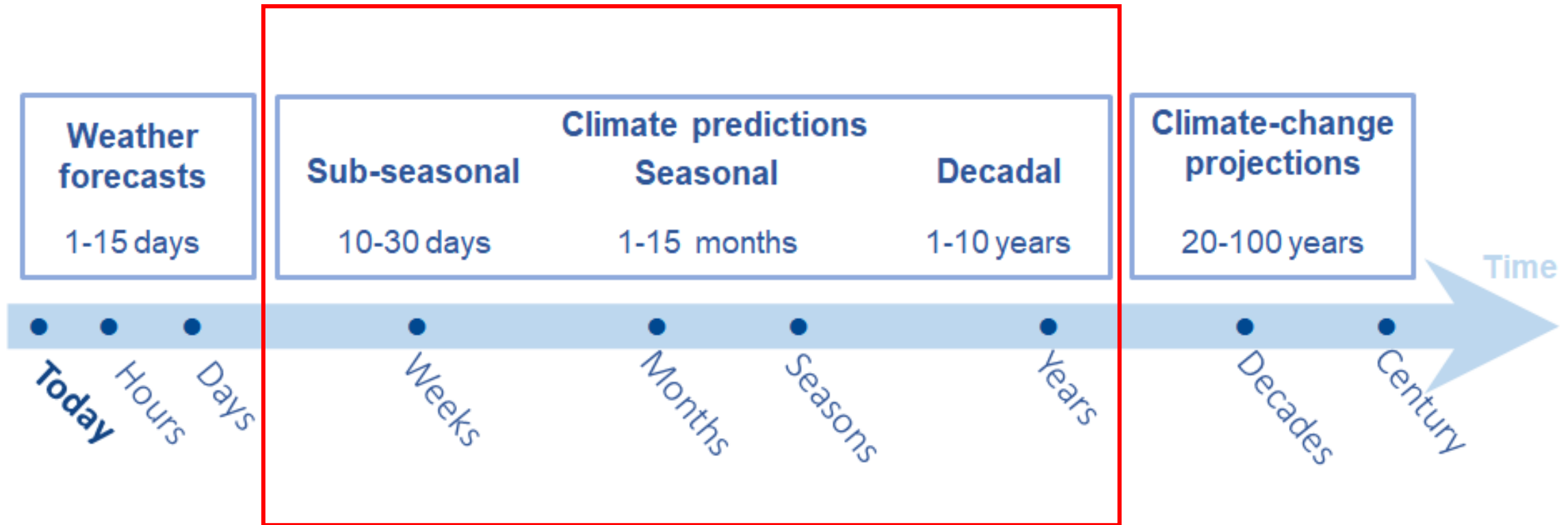
Weather prediction is a familiar concept

Provide precise information about atmospheric variables (e.g. degrees of temperature for a specific location and hour)



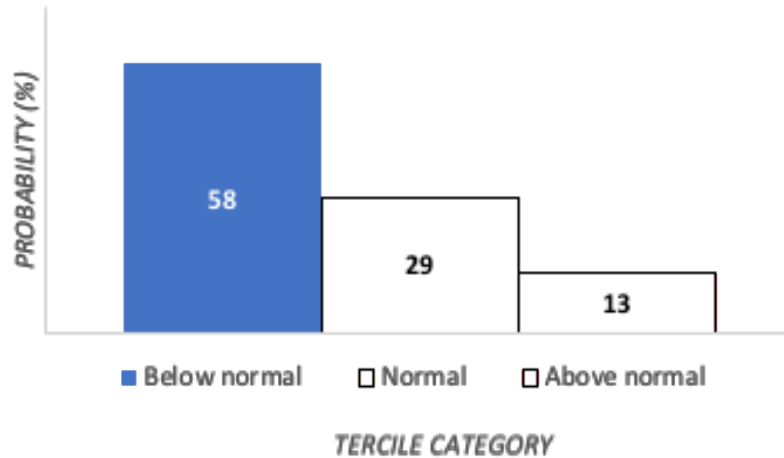
Climate prediction is not so familiar

Time scales of climate information

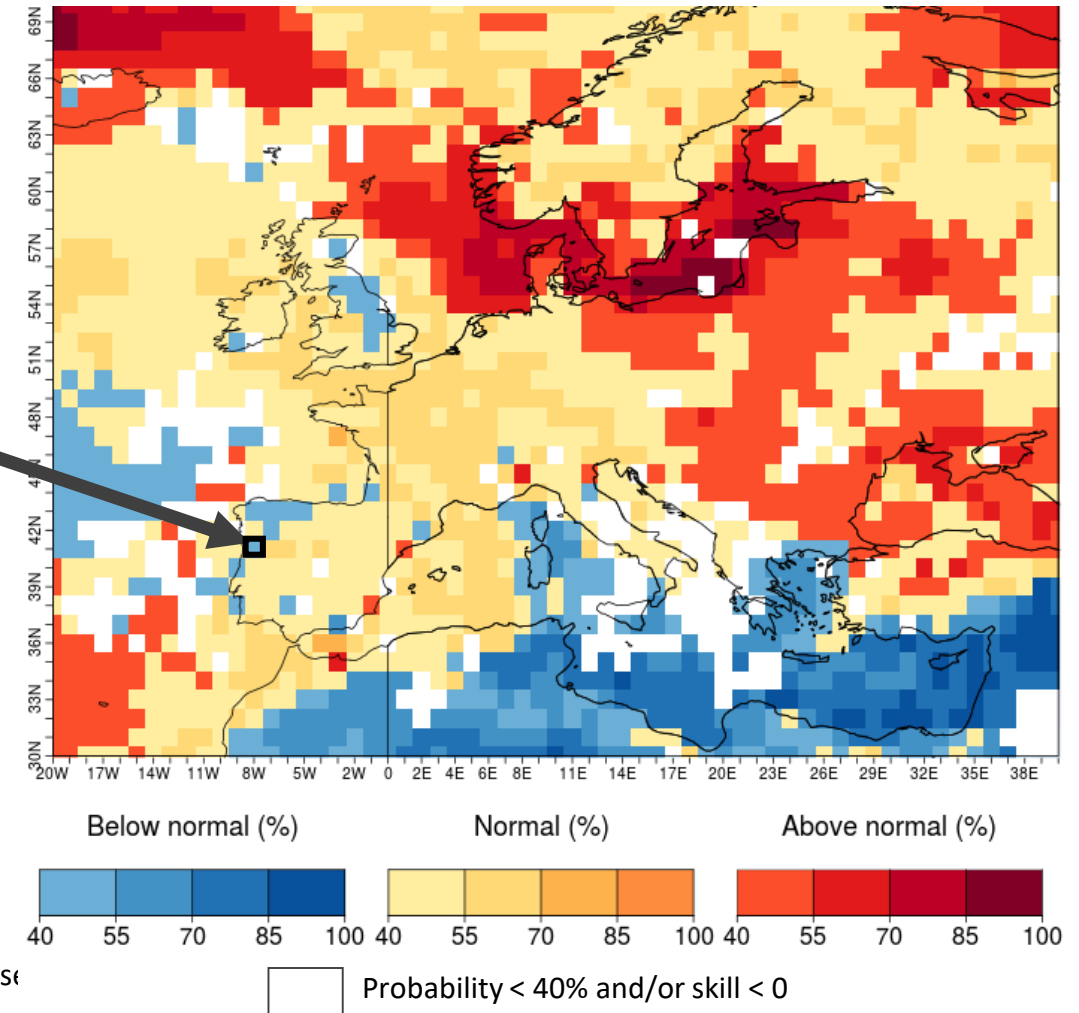


What does a climate prediction look like?

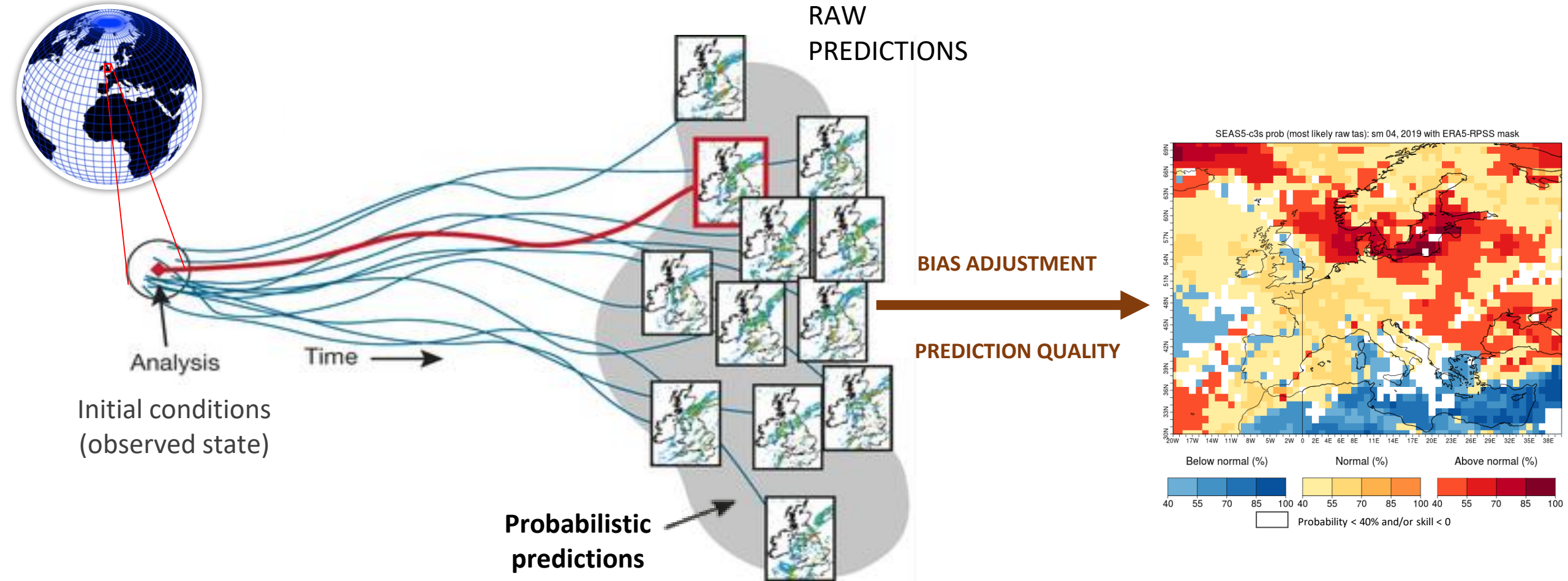
Temperature for the next month
for a specific location



Prediction of temperature for April 2019.
Most probable tercile category. ECMWF S5. Bias adjusted



How climate predictions are produced?



Quality of climate predictions: concept of skill

The quality (or skill) of climate predictions varies with:

REGION

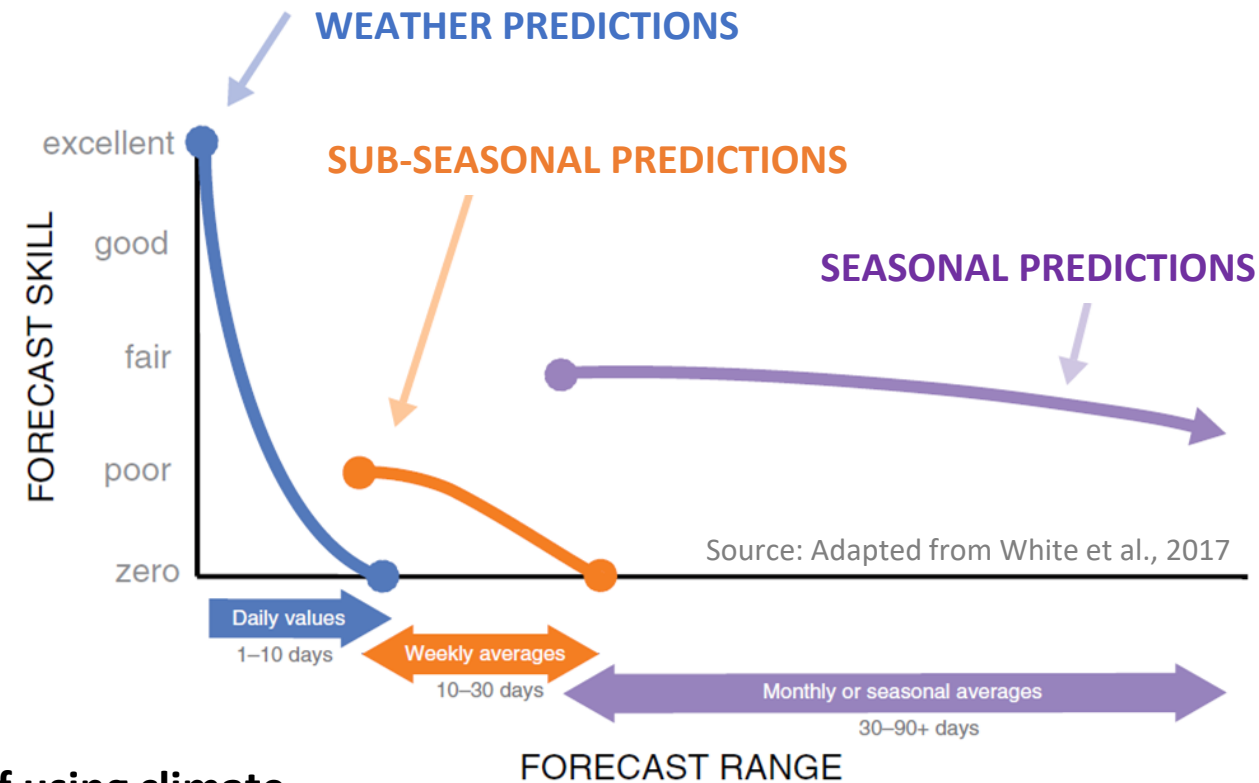
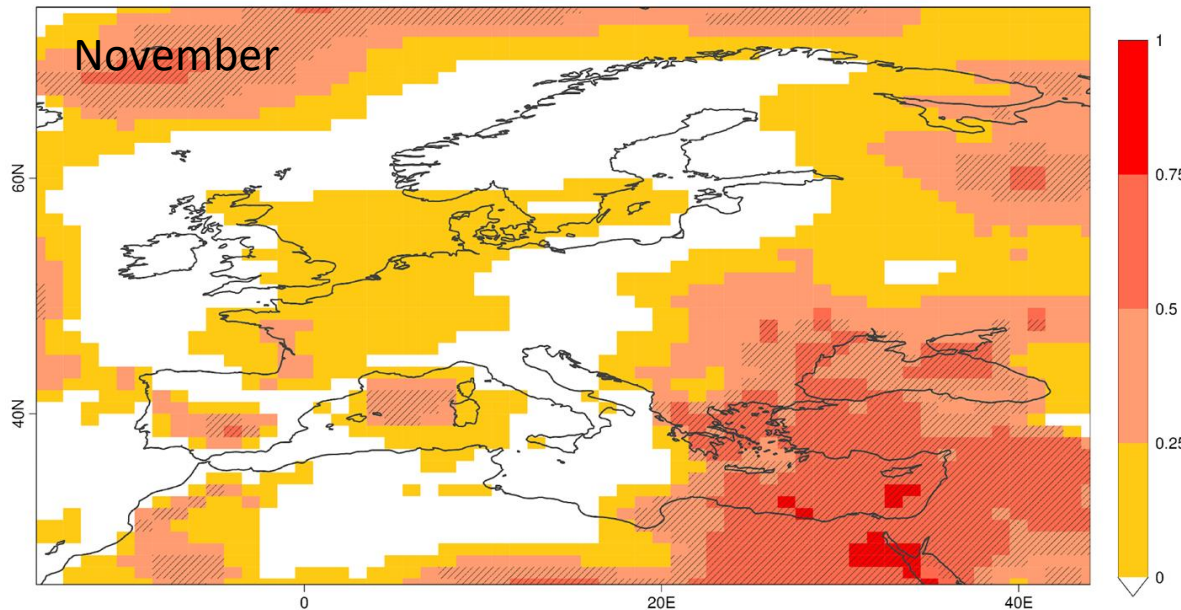
MONTH/SEASON

TEMPORAL HORIZON

Aug / system5c3s / jra55 / tas / correlation / 1994–2015 / Lead-1 / Europe

Aug / system5c3s / jra55 / tas / correlation / 1994–2015 / Lead-2 / Europe

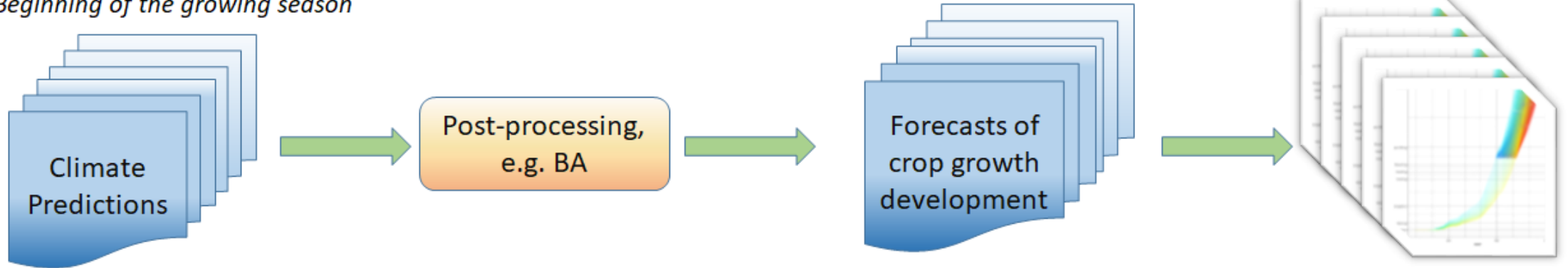
Aug / system5c3s / jra55 / tas / correlation / 1994–2015 / Lead-3 / Europe



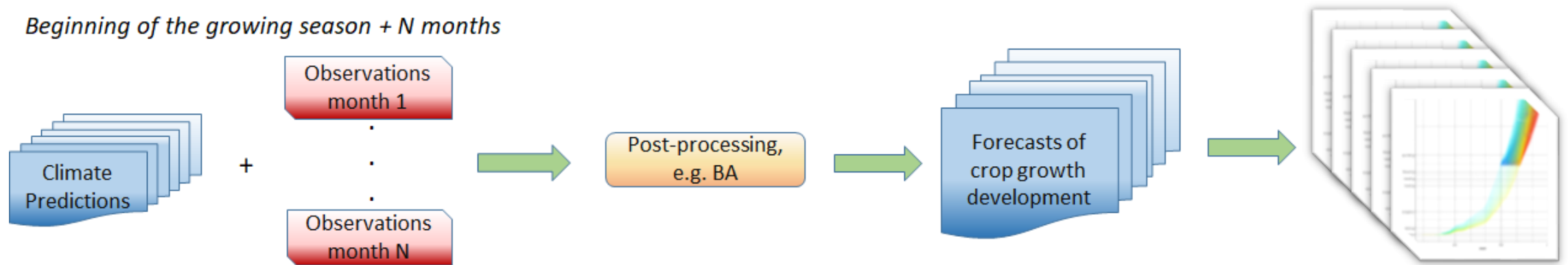
Skill > 0 ➡ In the long term, there is an added value of using climate prediction over the use of mean past observations.

From climate predictions to sectorial forecasts and assessments

Beginning of the growing season

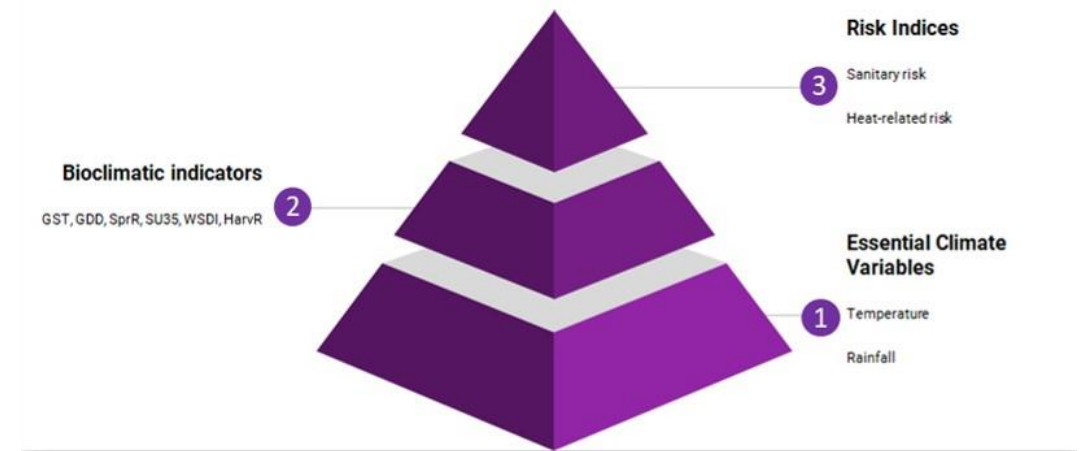


Beginning of the growing season + N months



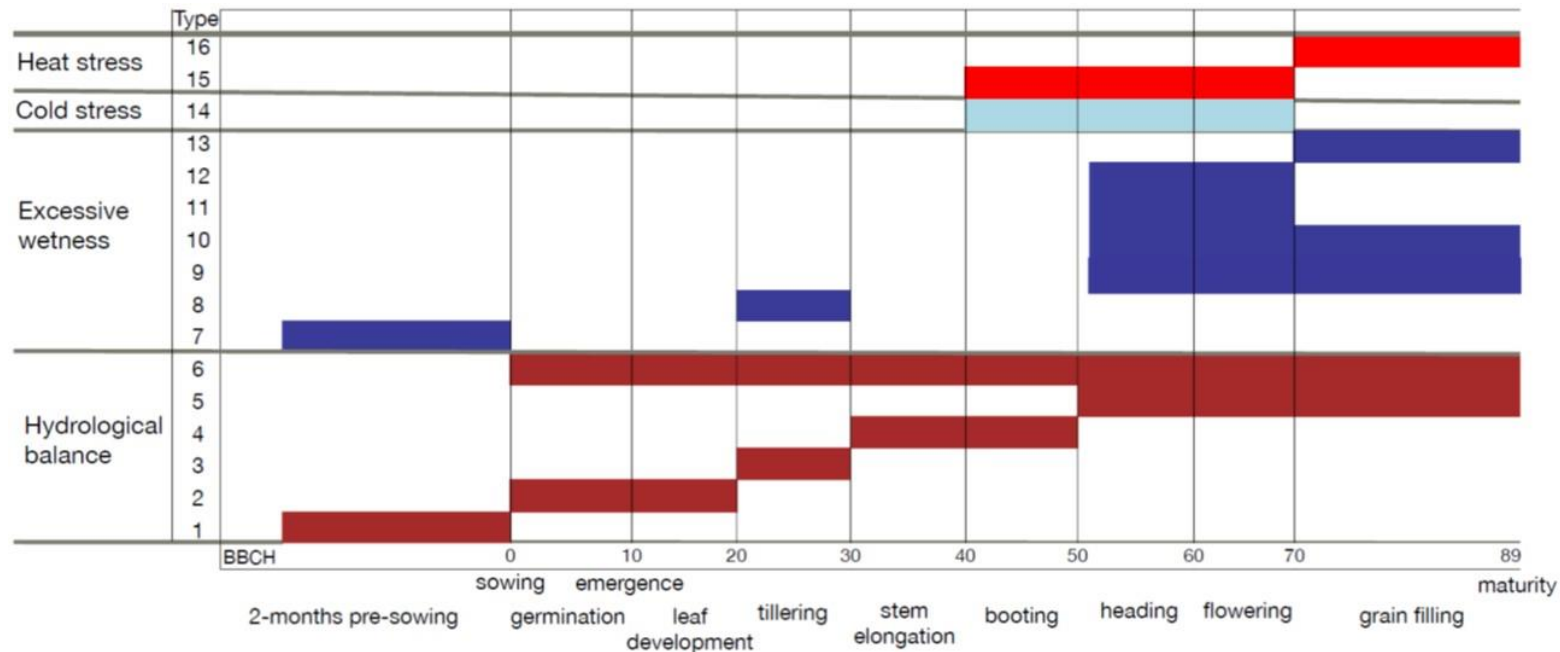


Bioclimatic indicators



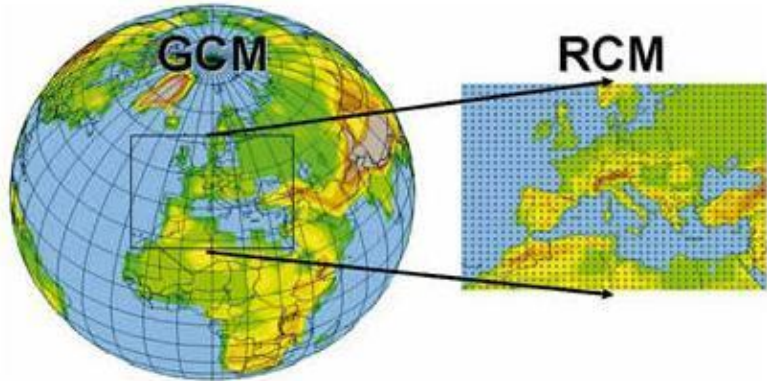
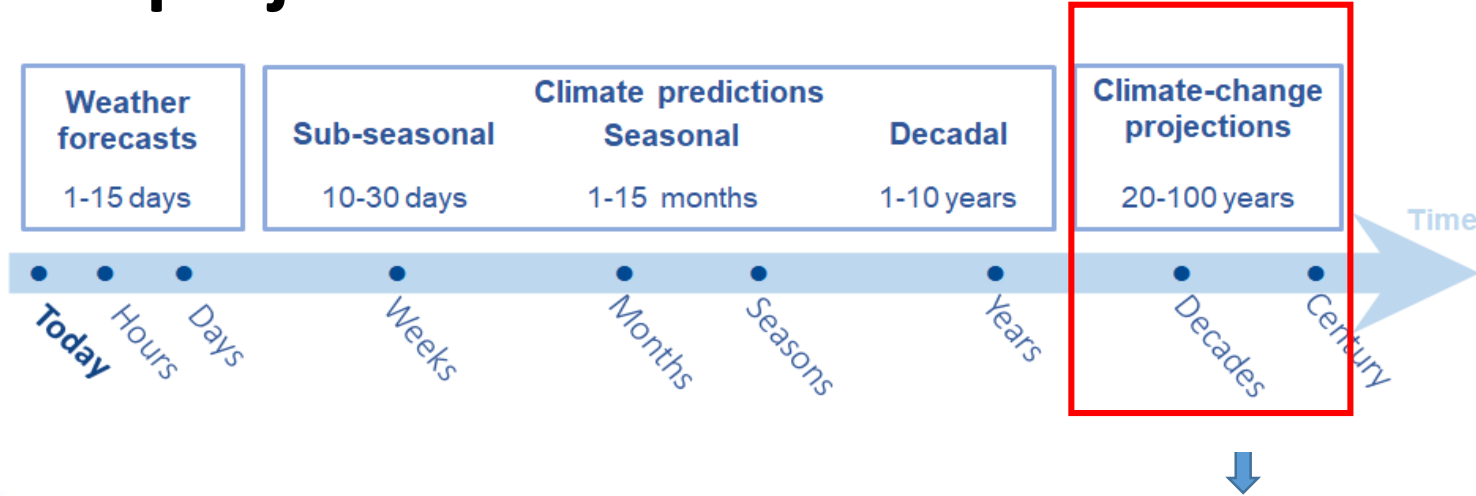
Co-designed, targeted and user-oriented, crop-specific dynamic indices

An example from the durum wheat sector



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Climate projections



Climate projections are simulations of Earth's climate in future decades (typically until 2100) obtained by running numerical models which may cover either the entire globe or a specific region e.g. Europe. These models are referred to as **Global Climate Models (GCMs)** or **Regional Climate Models (RCMs)**, respectively.

Climate models are imperfect representations of the climate system and different models respond differently to the same climate forcing agents.

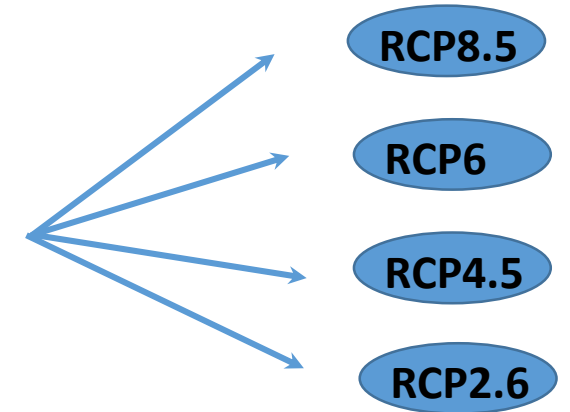


Climate projections: scenarios

It is impossible to predict anthropogenic forces (resulting in unpredictable greenhouse gases concentrations), thus different climate scenarios are used to study the response of climate statistics (mean, variability, extremes) to changing anthropogenic forces.

- Climate projections are simulations of Earth's climate in future decades (typically until 2100) based on assumed '**scenarios**'

The scenarios adopted by IPCC - for the **concentration of greenhouse gases, aerosols** and other atmospheric constituents that affect the planet's radiative balance - are the Representative Concentration Pathways (**RCPs**). Four pathways have been selected for climate modeling and research:



The following RCP scenarios were selected as the most appropriate for the MedGold project:

RCP4.5

- Representing the stabilisation scenario

RCP8.5

- Representing the scenario with very high GHG emissions



Steps for reliable climate projections

- Use of **multiple RCMs** and climate change **scenarios** ➡ to **reduce uncertainty**
- **Evaluation of the models'** historical period against observations and/or gridded datasets
- Use only the models that have a **reasonable representation of the historical climate** and/or take their ensemble mean
- Perform additional **bias correction** techniques ➡ to **further improve the selected RCMs** representation of the historical climate and extremes

What is bias correction?

Direct outputs from climate models are often not useful because of **significant biases** (systematic errors), such as consistently too high temperature or too high or low rainfall.



Why? Because of **limited spatial resolution, simplified physics and incomplete knowledge of the earth's climate system**



Therefore a bias correction method needs to be applied, which corrects the raw model output using the differences in the mean and variability between model and observations in a reference period.



Climate projections: indices calculation

In the frame of MED-GOLD, the long-term effects of the climate change on the agriculture are described through selected climate indices.

Climate index

- It is defined as a calculated value, based on certain parameters such as **temperature** and **precipitation**, that can be used to describe the state and the changes in the climate system affecting the agri sector of interest. For each climate index there is a defining equation.

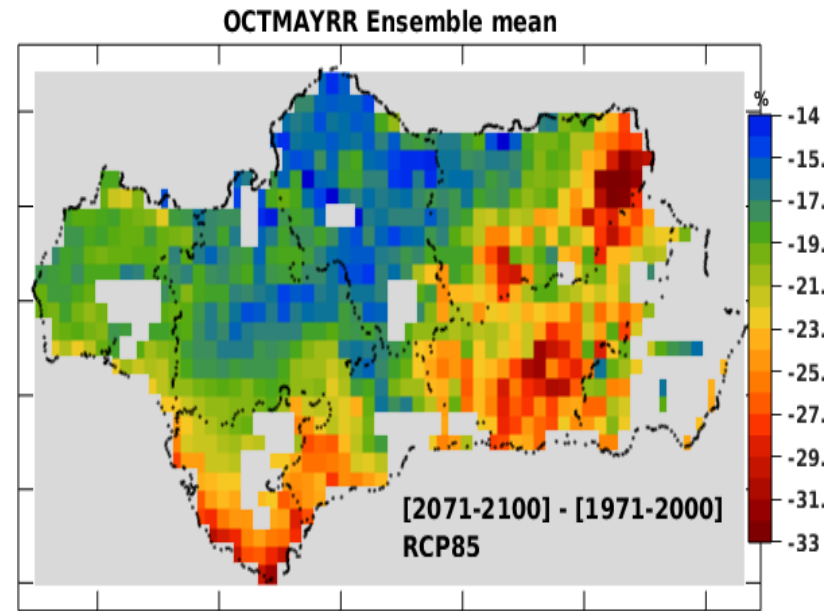
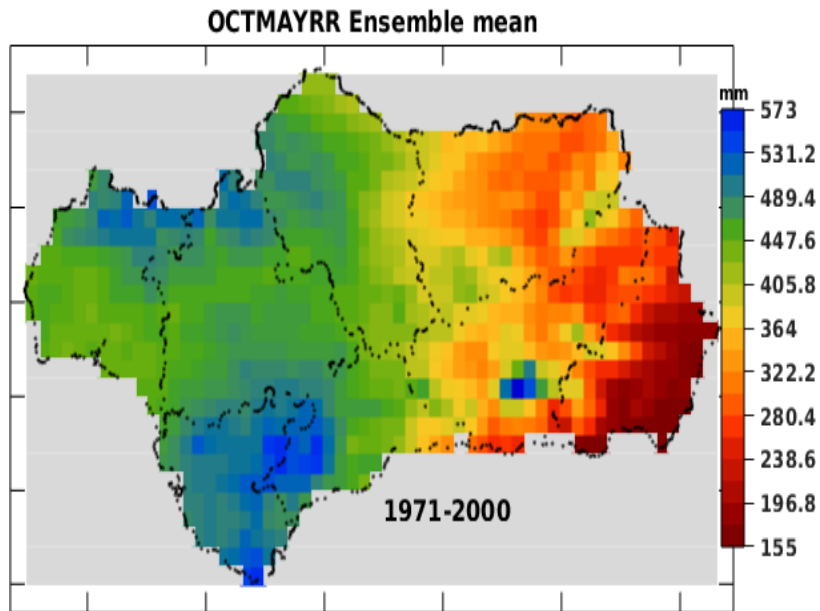
Climate indices were identified and analysed in order to meet the needs of the agricultural sector of interest.

This information can be useful for the **management** and **decision making** for risks associated to the **spread of pests** (new area in climate services), **diseases**, **yield losses** and other climate related threats for the cultivations.



Climate projections: index example for olive sector

Total winter precipitation for the period October-May (ANNRR) -> related to olive yield



Highest mean relative decrease: -21% for the distant future, under RCP8.5



EXAMPLES OF APPLICATION TO DIFFERENT CROPS/FOOD SYSTEMS



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GRAPE AND WINE



- A FAMILY-OWNED WINE COMPANY FOUNDED IN 1942, TODAY THE LEADER OF WINE PRODUCTION IN PORTUGAL.
- SOGRAPE FARMS MORE THAN 1500 HECTARES IN 5 COUNTRIES: PORTUGAL, SPAIN, ARGENTINA, CHILE AND NEW ZEALAND.
- COMPANY TURNOVER IN 2019 EXCEEDED 200 M€.



Quinta da Leda is a flagship wine estate in the eastern extreme of the Douro Wine Region of Portugal. Fungal disease in Spring is a major risk requiring decisions to be made every year as a function of expectable climatic conditions.



Spring rain and temperature drive risk of fungal disease causing crop loss and increased costs



Downy mildew (*Plasmopara viticola*) damage in a year with high sanitary risk (2016)



IMPACTS FROM:
Loss of yield
Protection products
Machinery and maintenance
Labour



Canopy management



Spraying with protection products

Timely seasonal forecast helps planning and optimization

Historical Climate

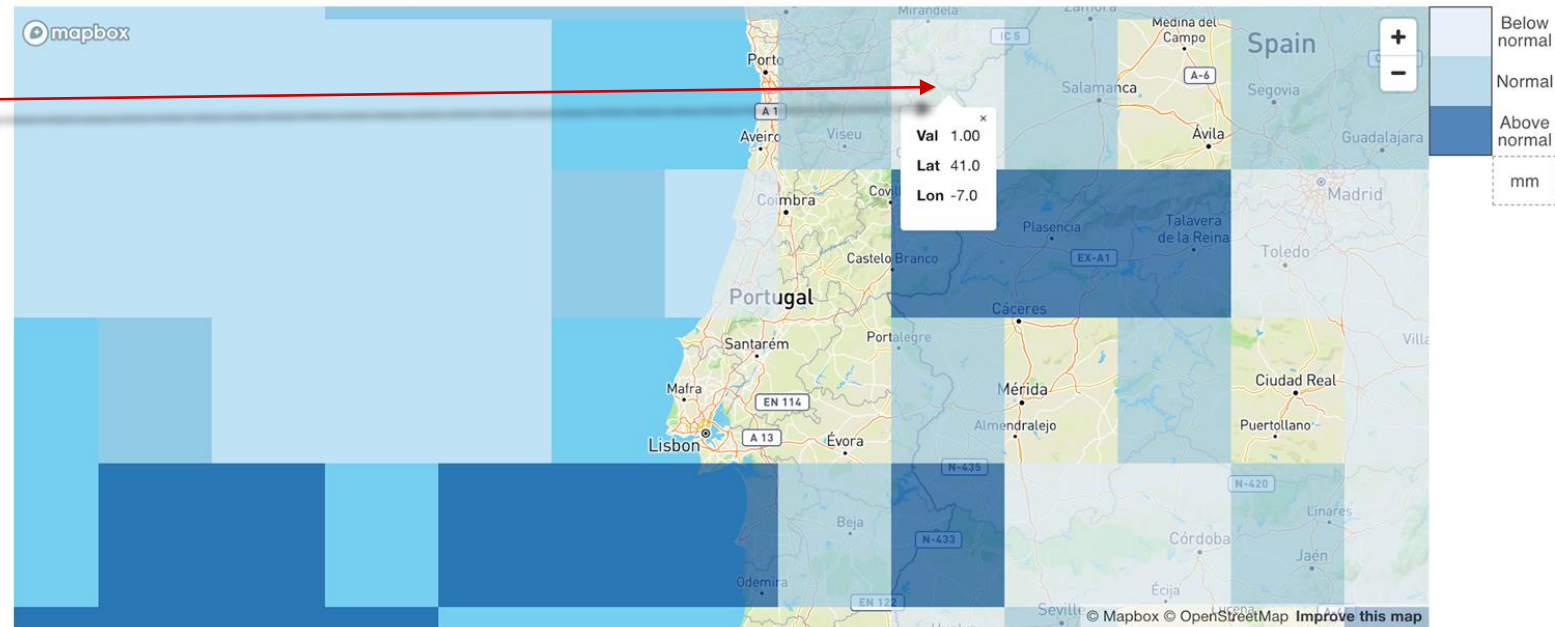
Seasonal Forecast

Long Term Projections

[Leave your feedback](#) !

Select type of data:

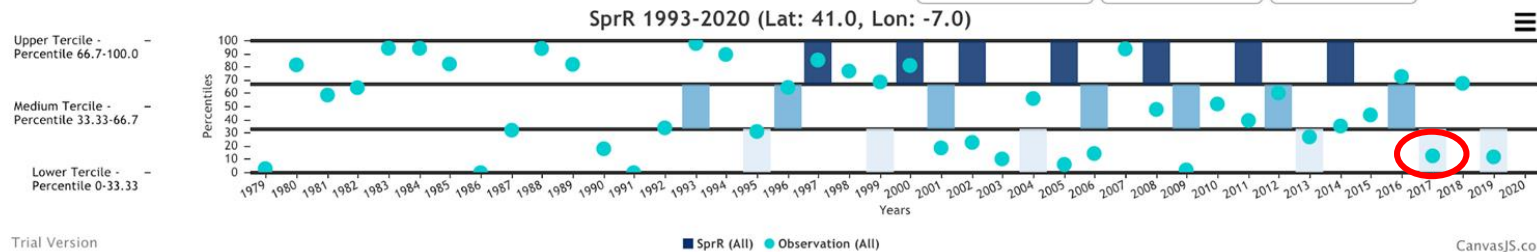
Seasonal Forecast - SprR - 2017 ?



Export as GeoJSON

Export as NetCDF

Export as JPEG



Trial Version

CanvasJS.com



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Durum wheat/pasta sector

Horta is a Spin off company of the Università Cattolica del Sacro Cuore, Italy. Its mission is to increase the value of research by **transferring the technological innovation to practical agriculture** at national and international level, by developing new cropping strategies, methods and products. The core activity of Horta is the **development of Decision Support Systems (DSSs) for sustainable crop production** based on new Information and Communication Technologies (ICTs).



For the management of durum wheat crop, the DSS granoduro.net was developed, which is presently used by farmers in the Barilla supply chain. Barilla is the main pasta producer in Italy and is the industrial partner of MED-GOLD for the durum wheat sector.

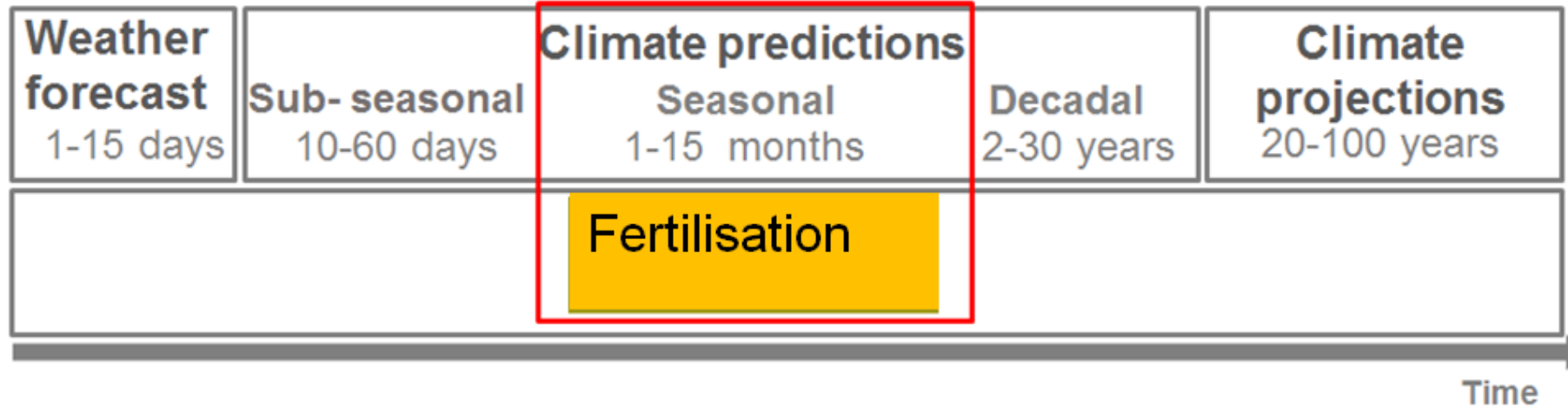


Durum wheat/pasta sector - fertilisation

The overall nitrogen is computed by a balance method and it is mainly influenced by nitrogen soil content, organic matter, crop variety and weather during autumn and winter months.

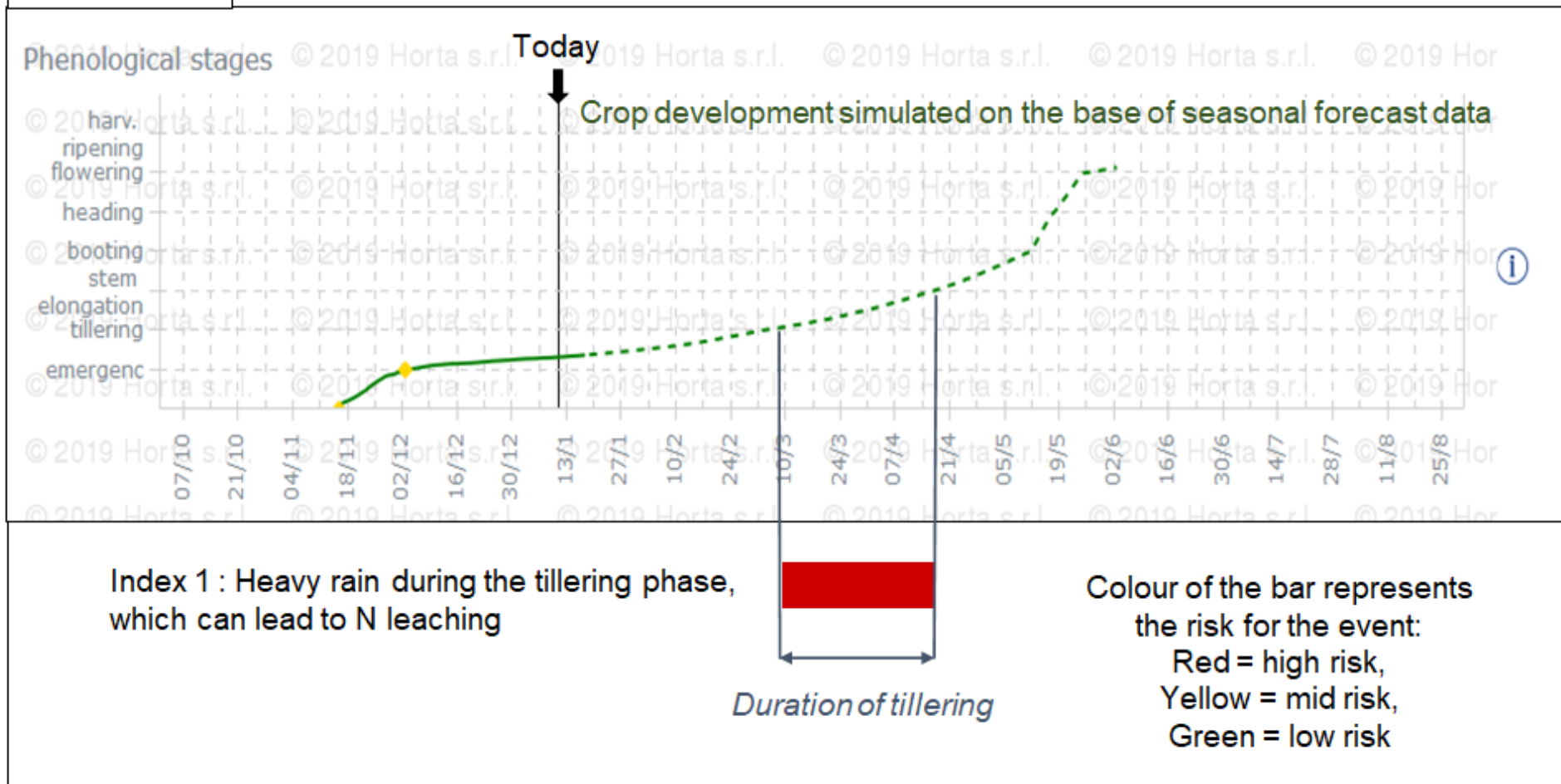
To increase nitrogen efficiency it's fundamental to split the whole seasonal dose in different phenological stages, from tillering to booting.

Rain condition in the relevant phenological phase can be a driver for the farmer to chose the N form to be applied and the application of the fertilizer.



Durum wheat/pasta sector - fertilisation

Rain indexes



Olive/olive oil sector. Olive yield estimation



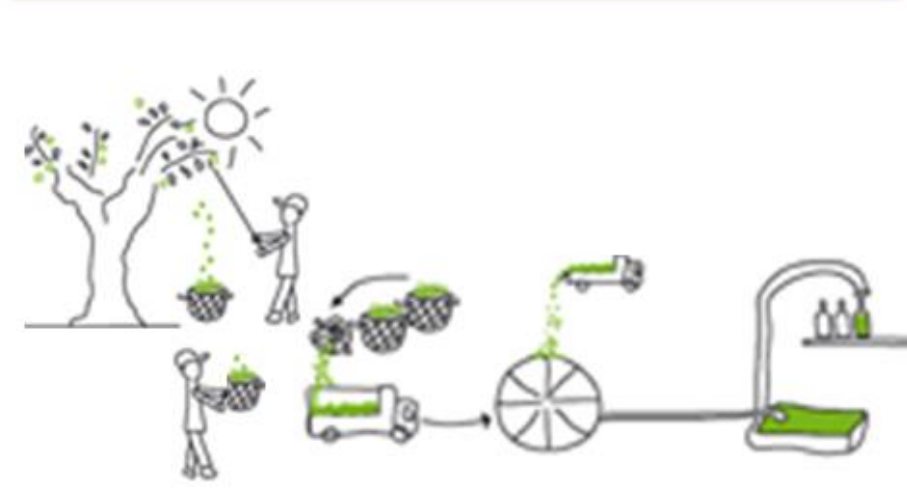
Dcoop is a Spanish multisectorial second degree cooperative with 75.000 families of farmers and stockbreeders. In the olive sector, Dcoop is the largest producer of olive oil (225.000 T) and table olives (100.000 T) in the world and is the olive industrial partner in MED-GOLD.

Olive yield estimation: The olive tree has the peculiarity of alternating a season with a large production with a season with short production in the next season; as a result, olive oil production varies every year. The large difference in the olive oil production every year affects the whole chain of this product. Knowing how some climatic factors will be in the future would allow predicting the production tendency for the next season and improving the making decisions.

Season 1: Olive trees produce a lot of olives.
Farmers harvest abundant olives.
Olive mills produce much olive oil

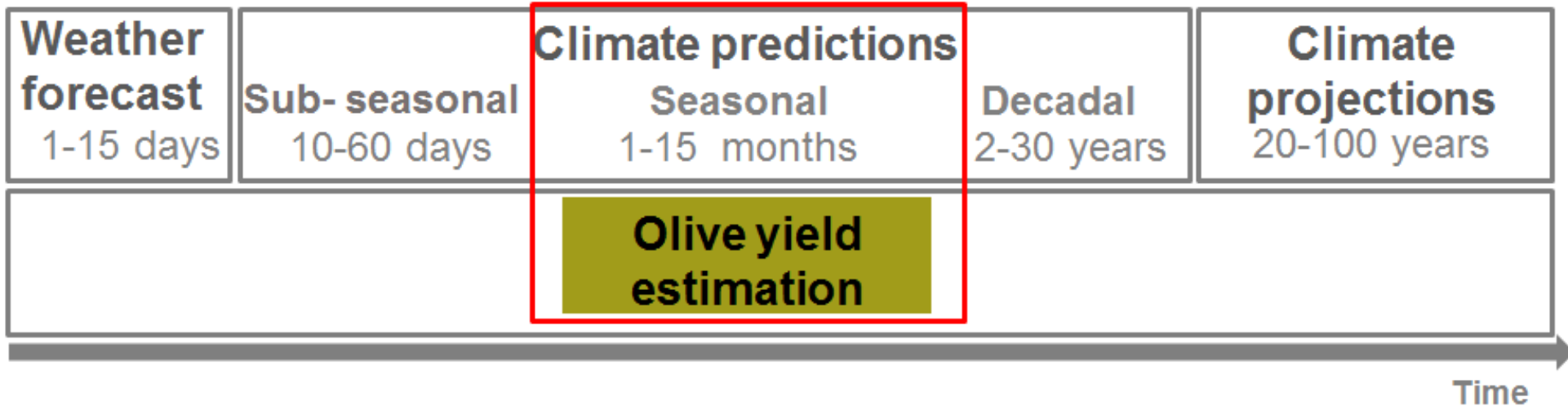


Next season: Olive trees produce few olives.
Farmers harvest limited olives.
Olive mills produce little olive oil.



Olive/olive oil sector. Olive yield estimation

The **olive yield estimation** was a key decision identified by the participants from the Olive Workshop 2018 and the Olive Focus Group 2019 organised by MED-GOLD. Also, they pointed out the temperature and precipitation as the most important climate variables in the olive yield estimation. To support their decisions related to this issue, they would need a seasonal forecast.



The participants concluded 2 types of information that would be useful to olive yield estimation:

- Total annual precipitation.
- 3 Bioclimatic indexes:
 - Maximum temperature from April to June
 - Minimum temperature from November to January
 - Total precipitation from October to May



Olive/olive oil sector. Olive yield estimation

Historical Climate

Seasonal Forecast

Long Term Projections

Leave your feedback !

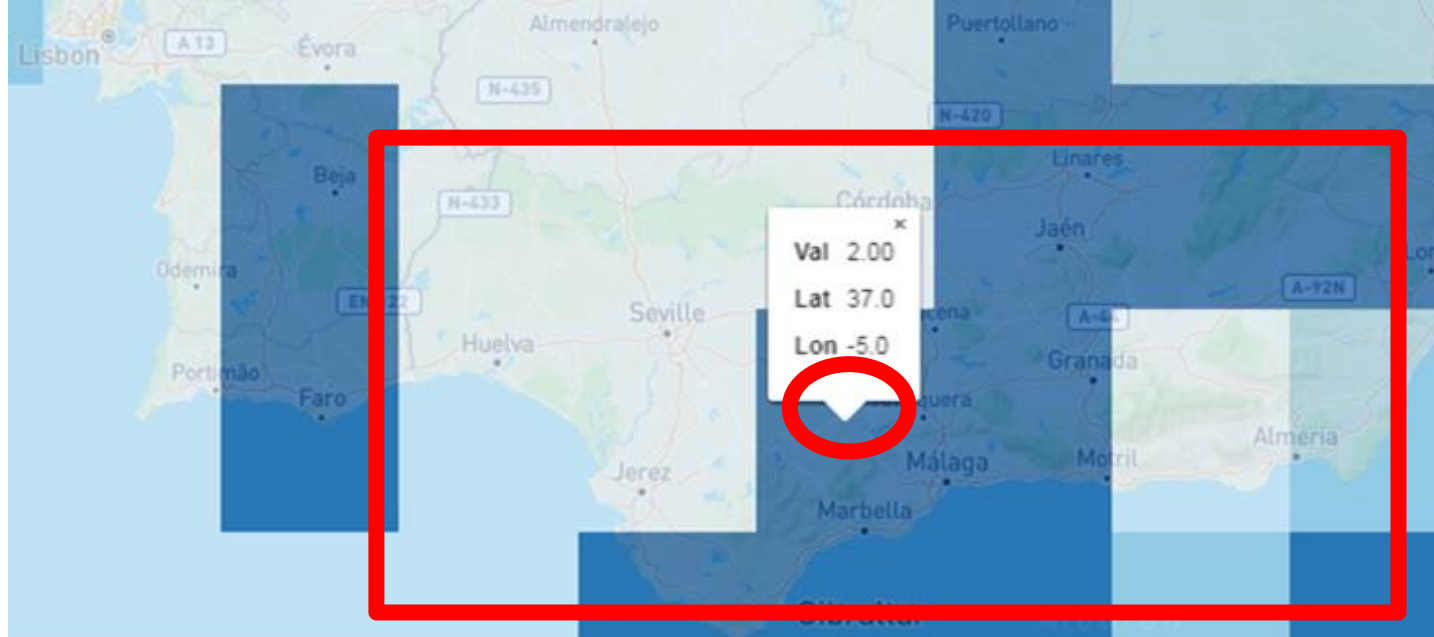
Select type of data:

☒ Climate

☐ Bioclimatic

Climate

Precipitation monthly

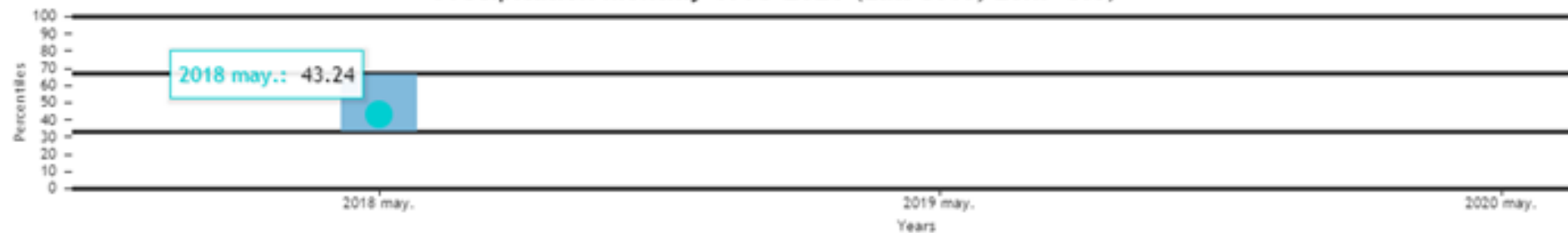


Precipitation monthly 1993-2020 (Lat: 37.0, Lon: -5.0)

Upper Tercile -
Percentile 66.7-100.0

Medium Tercile -
Percentile 33.33-66.7

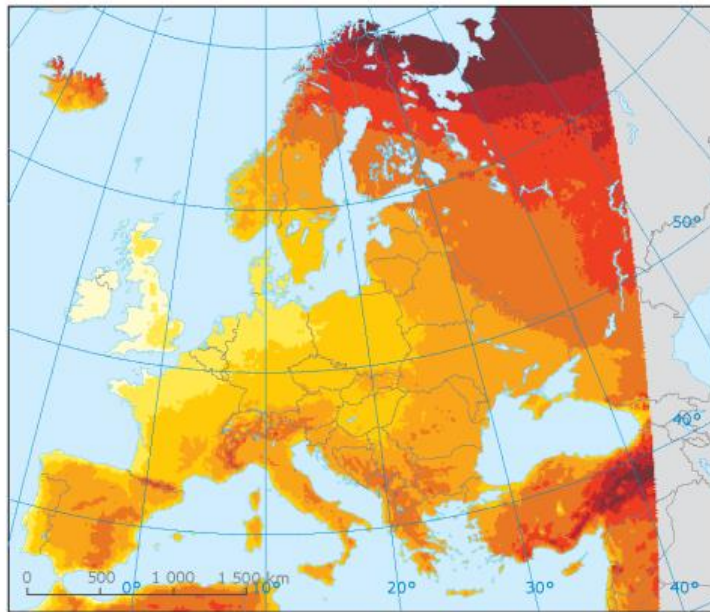
Lower Tercile -
Percentile 0-33.33



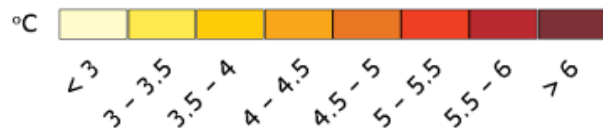
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Climate projections: Application to different sectors

Change in annual mean temperature 2071-2100 (RCP 8.5 high emissions scenario)



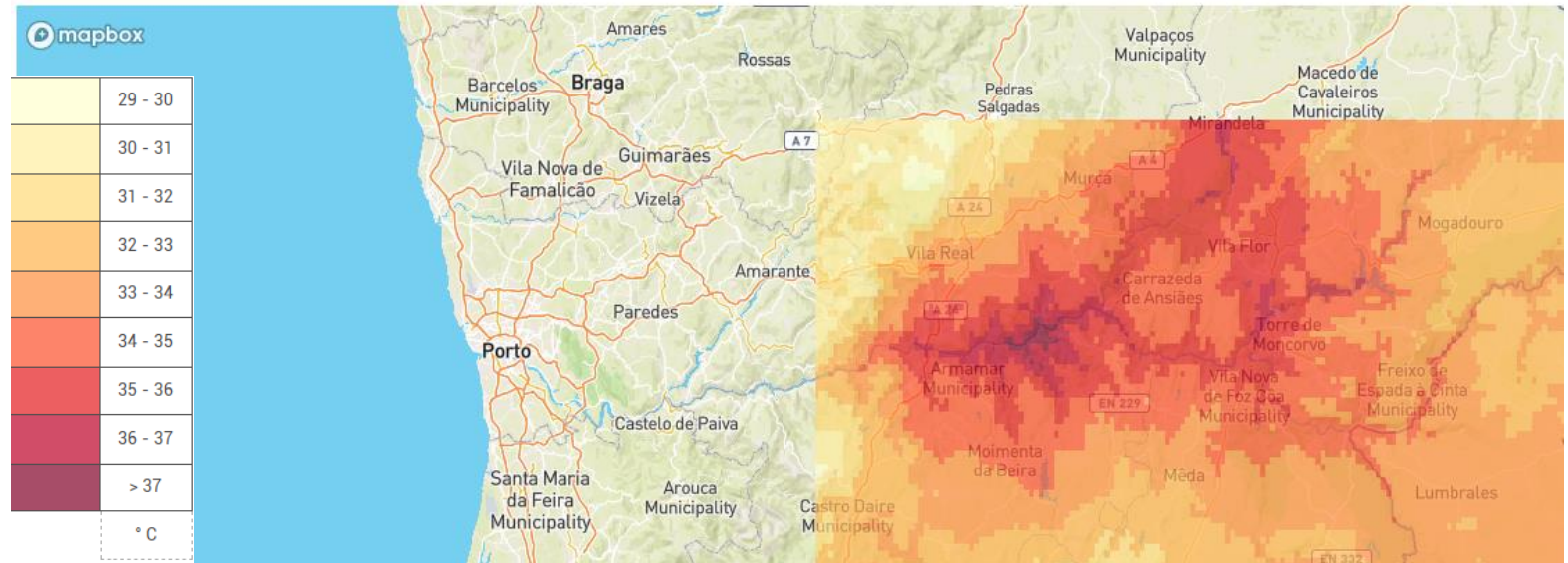
Projected changes in annual mean temperature



Source: European Environment Agency (EEA)

Maximum temperature in August 2071-2100 (RCP 8.5 high emissions scenario)

Projection - Tmax monthly - 2071-2100 August



Source: MED-GOLD climate service



POLLS 2 / 3 : About the use of seasonal predictions and climate projections



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QUESTIONS & ANSWERS



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Closing

Questions: MED-GOLD Forum: <https://forum.med-gold.eu/>

Webinar recording: MED-GOLD Website: <https://www.med-gold.eu>

Contact: communication@med-gold.eu

THANKS FOR JOINING US!



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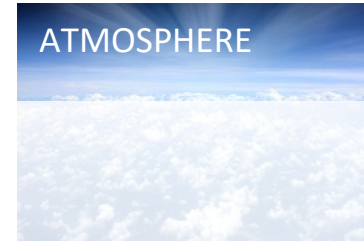
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Quality of climate predictions: skill



WEATHER PREDICTIONS

predictability comes from initial atmospheric conditions



SUB-SEASONAL PREDICTIONS

predictability comes from initial atmospheric conditions, monitoring the land/sea/ice conditions, the stratosphere and other sources

SEASONAL PREDICTIONS

predictability comes primarily from sea-surface temperature conditions; accuracy is dependent on ENSO state

