

## MODelling vegetation response to EXTREME Events (MODEXTREME)



### Resumen:

The continuous supply of services provided by agricultural systems is increasingly threatened by climate change in association with an estimated increase in the frequency of extreme weather events such as droughts, heat waves or heavy precipitation events.

MODEXTREME has the overarching goal to help the European and non-European agriculture face extreme climatic events by improving the capability of biophysical models simulating vegetation responses to integrate climatic variability and extremes.

### Objetivos:

Scientific objectives:

- Identify and integrate into simulation models, the responses of main crop and grassland systems to environmental conditions associated with extreme climatic events;
- Improve yield monitoring and forecasting systems via multiple observational constraints to be assimilated into process-based models across different climate conditions;
- Estimate possible trajectories of agricultural productivity in the short (during current season) to medium time horizons and associated uncertainties. This involves taking into account the genetic progress and its effects on responses to extreme environmental conditions.

Technological objectives:

- Build a consistent, multi-domain data repository for use in studying climate variability and extreme events relevant for agricultural production;
- Develop generically reusable software units that implement libraries of models. This will allow
- (i) extending the vegetation response, as implemented in existing modelling solutions, to weather extremes,
- (ii) extending the multi-model platform for plant growth and development simulations of the European Commission Joint Research Centre (MARS: Monitoring Agricultural ResourceS);
- Prototype alternate versions of the workflows for agricultural production monitoring and scenario analysis both using new modelling solutions composed in the project, and by focusing on extreme events

### Objetivos contribución:

First, an analysis of metrics for extreme events will be performed establishing scores of high and low temperatures for critical plant stages (task 1.1).

In the improvement of modelling solutions for crops and pastures, two main approaches will be followed:

- Empirical: Estimates from current models will be corrected using empirical factors for each type and intensity of weather event (task 1.4)
- Functional or semi-mechanistic: Sub-models will be formalized for inclusion in current models. These sub-models will be either mechanistic (response of growth, transpiration and yield components to water deficit and temperature) or empirical (response of Harvest Index to water stress, response of yield to frost or heat events) (tasks 1.2 and 1.3). Finally, the genetic variability of responses will be investigated for the more important crops (wheat and maize).

The project will consider a variety of crop and grassland types: Durum wheat, Bread wheat, Winter Barley, Spring Barley, Rye, Triticale, Rice, Maize, Potato, Sugarbeet, Soybean, Sunflower, Rapeseed, C3 and C4 Grassland swards (individual species and mixtures). In addition, olive will be considered as an example of application of modelling approaches to a tree.

### Entregables:

- D1.1 Report on identification of extreme events, statistical adjustment of simulated yields and modelling tools  
 D1.2 Report on modelling approaches for simulating the impact of extreme events on agricultural production

### Impacto:

The project will provide basic knowledge, models and tools to answer essential questions for a wide variety of scientists (climatologists, agronomists, plant physiologists, etc.) and stakeholders (analysts, policy-makers, etc.):

- What improvements (within agricultural systems, across Europe and outside Europe) can be made to assess the impact of extreme weather events on agricultural productions?
- What up-to-date software technologies and methodologies are available to model extreme weather events and how to integrate them into agricultural forecasting and monitoring systems?
- To which extent can the EU-27 system for agricultural forecasting and monitoring be exported to other countries?

**Presupuesto:** 2,643,841.76

## Equipo de investigación

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**Enlace:** <http://modextreme.org>

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