

Joint Research Centre (JRC)

Agriculture under climate change: MARS-AGRI4CAST on-going activities



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<http://www.jrc.ec.europa.eu/>

MARS unit

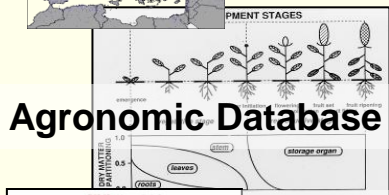
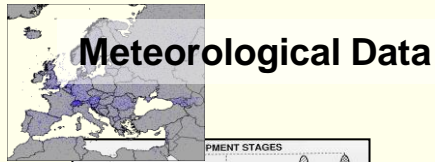
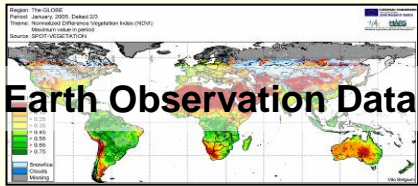
- Monitoring Agricultural ResourceS
- Mission is to provide scientific and technical support on EU Agriculture and Food Security policies

AGRI4CAST action

- Operationally in-season crop yield forecasts at a European level
- Based on a modelling infrastructure driven by agro-meteorological data and assisted by remotely sensed observations.
- Used by the European Commission as part of the decision making process on market intervention and for policy support.

Crop assessment and yield forecasting process

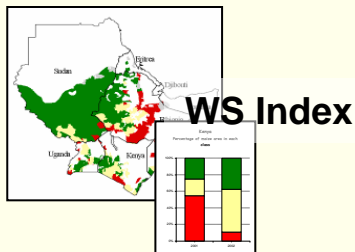
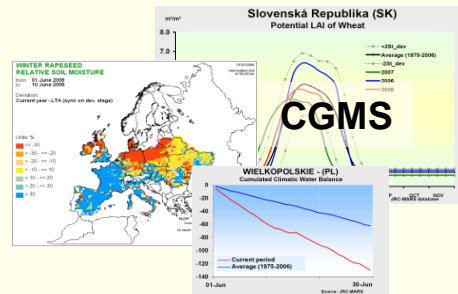
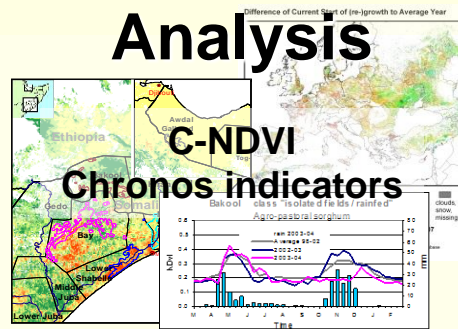
Data collection & retrieval



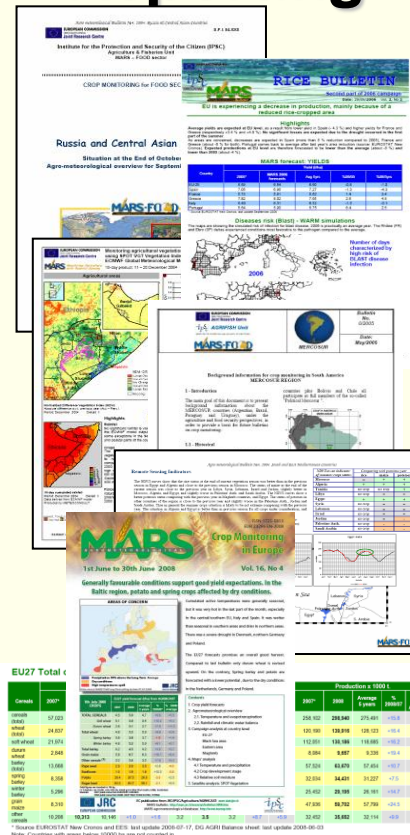
WEB Information
Media Monitor
Magazines

Agro-phenological
network

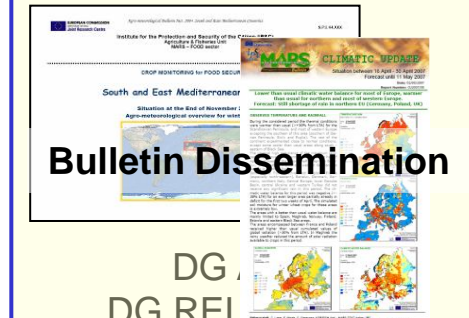
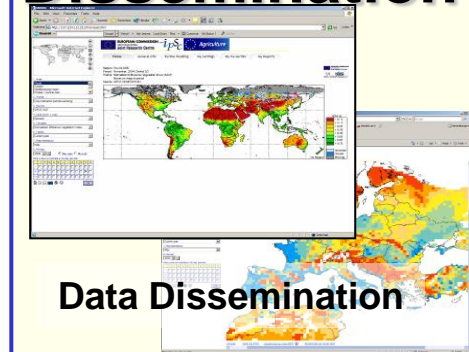
Processing & Analysis



Reporting

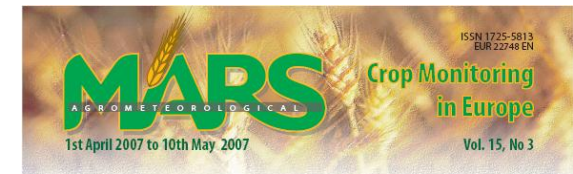


Dissemination

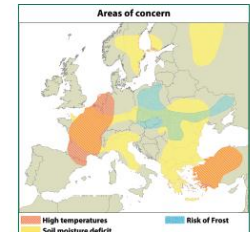


DG
DG REL
DG EUROSTAT
EU Delegations
Member States
National Agencies
Int. Institutions (FAO, ...)

- 35 countries covered
- 11 crops monitored
- 35 years of meteo and agrometeo data
- 20 crop indicators are daily simulated by crop models
- 21 years of low resolution satellite information



Temperatures boosting crop growth



1. Agrometeorological overview

Continuing unseasonable mild and dry conditions over most of the continent: the worst conditions were in the central and northern EU, whilst more favourable conditions occurred in the western and southern Mediterranean. Brief but threatening late frosts in May over north-west Europe.

Temperatures and evapotranspiration

Thermal anomalies continued in April. Warmer-than-seasonal temperatures occurred mainly in the central and northern EU, Italy and Norway.

As in winter, in most EU agricultural areas, spring started with very mild thermal conditions. As a whole, April was one of the mildest for the last 30 years in many central and northern EU countries (France, Benelux, the UK, western Germany, Ireland, Denmark, Sweden), Italy and western Turkey; the current season was overall the warmest since 1975 (on average 2-3 °C, but in some cases as much as 4-4.5 °C, above the seasonal mean). In eastern Germany, Poland, the Czech Republic and Austria, thermal conditions such as these have occurred only in 1986, 1998 and 2000.

MARS STAT yield forecasts: 10 MAY 2007

CROPS	European Union 27 Yield (t/ha)			
	2006	2007	Average 30 years	% 2007/06
TOTAL CEREALS	47	49	44	+4
Soft wheat	54	55	54	+2
Durum wheat	30	29	27	+8
Total wheat	51	52	50	+18
Spring barley	34	37	37	+8
Winter barley	51	52	50	+5
Total barley	41	43	42	+9
Grain maize	65	66	65	+18
Other cereals ¹⁾	29	30	32	+5
rape seed	30	30	30	+15



Cereal harvest is revised downward according to a drying June mainly in France with an effect expected on late winter varieties and spring/summer cereals.

EU27 wheat production is expected at almost 122 Mt, this includes about 12% increase in soft wheat and about 17% in durum wheat as compared to 2003. Maize figures are revised downward in EU15 (France, Italy) giving a final expected production at about 39.3 Mt (+16.6% than 2003). The total cereal harvest for EU15 is now about 210 Mt, which is about 12 Mt more than 2003 (+about +12%).



EC publication for MARS bulletins MARS agromet



EU is experiencing a decrease in production, mainly because of a reduced rice sown area.

Country	2007	MARS 2006	2007	2006	2007
China	5.9	6.0	5.9	6.0	+1
Spain	2.0	2.0	2.0	2.0	+3
France	0.0	0.0	0.0	0.0	+2
Italy	0.0	0.0	0.0	0.0	+1



NO AREAS OF CONCERN FOR FORAGE

Mild temperatures and average precipitation characterized the winter season in most of the forage production areas of Europe. Starting from March dry weather started affecting the south central regions, moving progressively northward. This dry period was however followed by new rains in early May. The combined effect of mild temperatures and sufficient rainfall at the onset of spring are consistent with the availability of good grazing and an early first cut. The return of rains in early May is also encouraging for a good regrowth. Due to the decline in ground water, there may however be problems in the green maize production areas.

MAP REPRESENTING THE VEGETATION COVERING OF THE MAIN TERRESTRIAL PASTURE AND GRASSLAND AREAS OF EUROPE

The analysis on the distribution of vegetation and the identification of areas most likely to be affected by the drought is ongoing.

Vegetation index is reduced with respect to the long term average. Vegetation index is low with respect to the long term average. Vegetation index is higher than the long term average.

PERMANENT FORAGE: Over most of the pasture and permanent production areas of the EU, the combined effect of mild temperatures and sufficient rainfall during the onset of spring are consistent with a good first cut of the green forage and a fast start of regrowth. For cattle and sheep, warm temperatures characterized the winter season over most of western Europe. The rainfall was the northern Alpine region. Maximum temperatures were significantly over 20°C above the long term average from February to April but subsided back to average again in May. The amount and distribution of precipitation were on average lower than the long term average.



Lower than usual climatic water balance for most of Europe, warmer than usual for northern and most of western Europe. Forecast: Still shortage of rain in northern EU (Germany, Poland, UK)

OBSERVED TEMPERATURE AND RAINFALL

During the considered period the thermal conditions were warmer than usual (>+30% from LTA) for the Scandinavian Peninsula and most of western Europe excepting the southern of this area (southern of Iberian Peninsula, Sicily and Puglia). The rest of the continent experienced close to normal conditions, except some cooler than usual areas along south-eastern of Black Sea.

The unusual high occurrence of the maximum temperatures above 20°C mentioned for the first half of April continued in the second half of April in Benelux, north-eastern France and western Germany as well as in northern Italy.

Some areas from south-eastern England, France (especially north-eastern), Benelux, Denmark, Germany, northern Italy, Central Europe, lower Danube Basin, central Ukraine and western Turkey did not receive any significant rain in this period. The climatic water balance for this period was negative (-30% LTA) for an even larger area partially already in deficit for the first two weeks of April. The simulated soil moisture for winter wheat crops for these areas is extremely low.

The areas with a better than usual water balance are mainly limited to Spain, Nubia, Norway, Finland, Estonia and eastern Black Sea areas. The area encompassed between France and Poland received higher than usual cumulated values of global radiation (+20% from LTA). In May/June the rainy weather reduced the amount of solar radiation available to crops in this period.

GLOBAL RADIATION: The amount of solar radiation available to crops in this period.

CLIMATIC WATER BALANCE: The climatic water balance for this period.

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Main web tool to access all the information
<http://www.marsop.info>

TEMPERATURE SUM

Base Temp = 0°C, Cumulated values

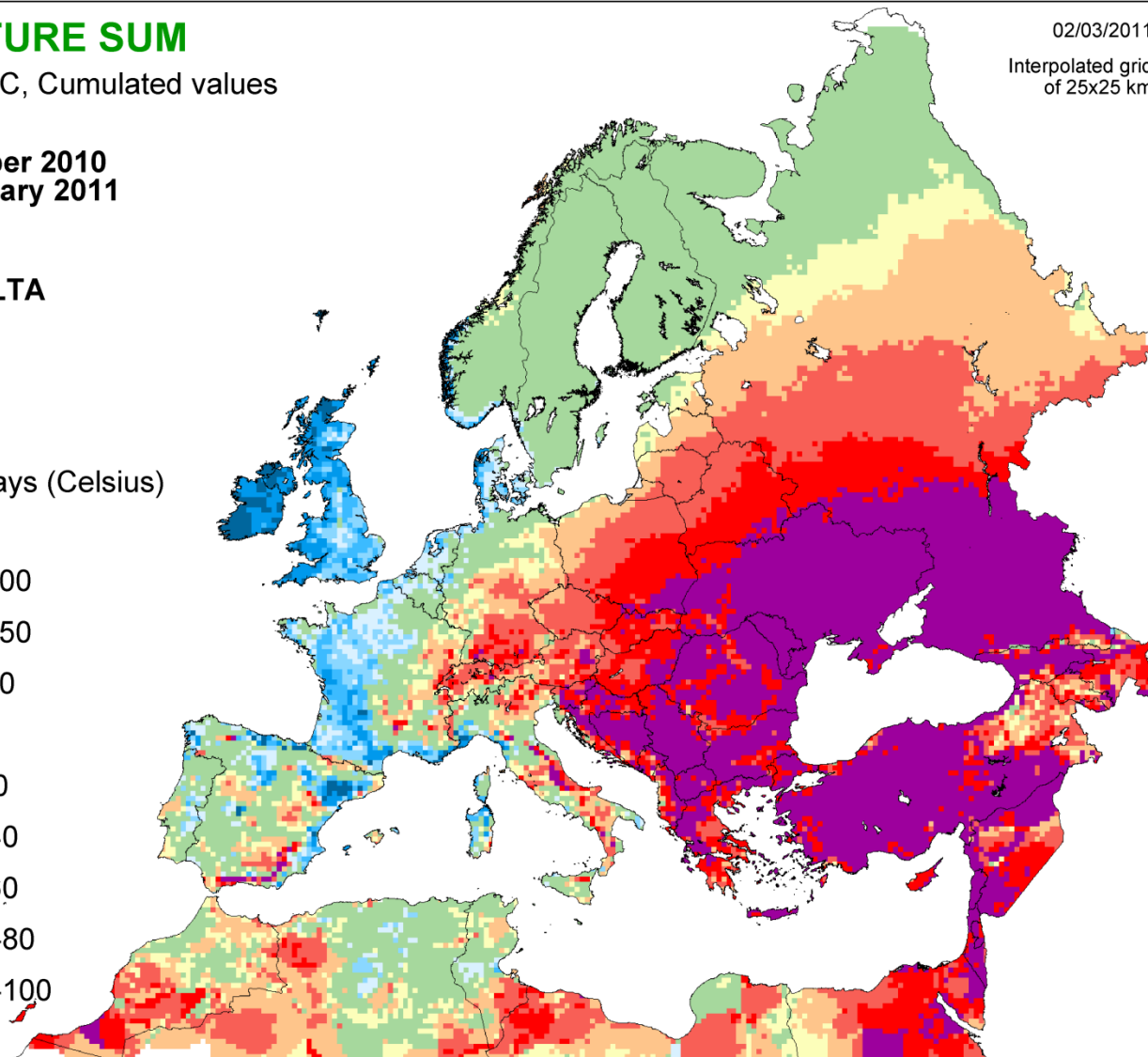
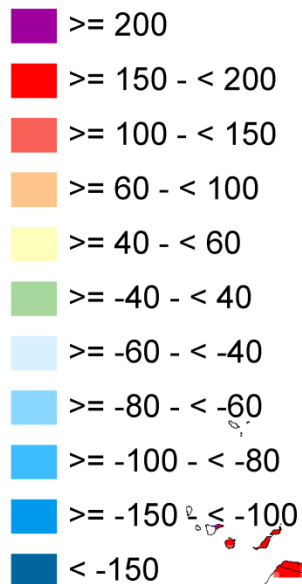
from : **21 October 2010**
to : **28 February 2011**

Deviation:
Current year - LTA

02/03/2011

Interpolated grid
of 25x25 km

Units: Degree days (Celsius)



WINTER WHEAT STATUS OF DEVELOPMENT STAGE


from : 11 February 2011
to : 20 February 2011

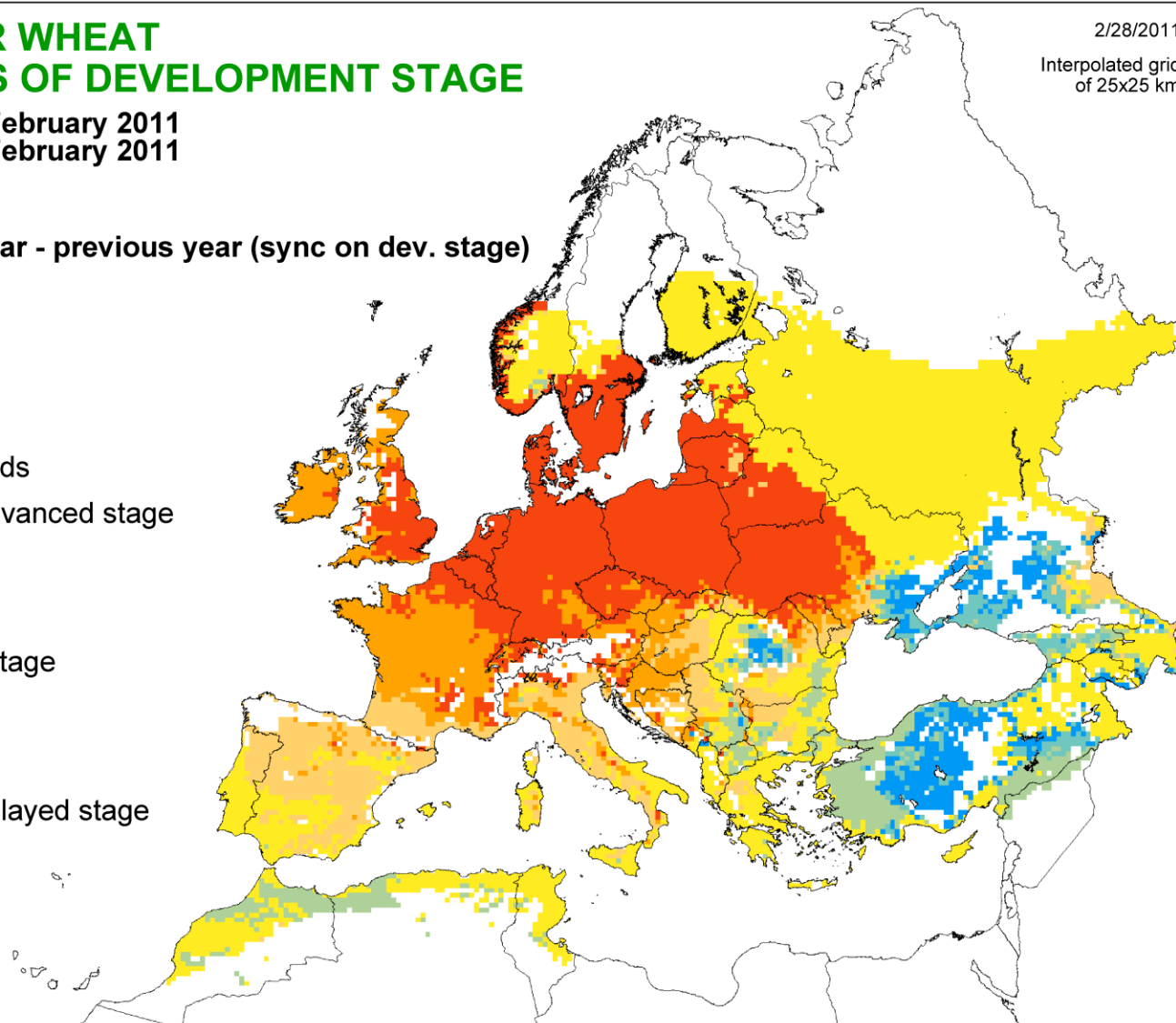
Deviation:
Current year - previous year (sync on dev. stage)

2/28/2011

Interpolated grid
of 25x25 km

Units: dekads

-  very advanced stage
-  same stage
-  same stage
-  same stage
-  same stage
-  very delayed stage



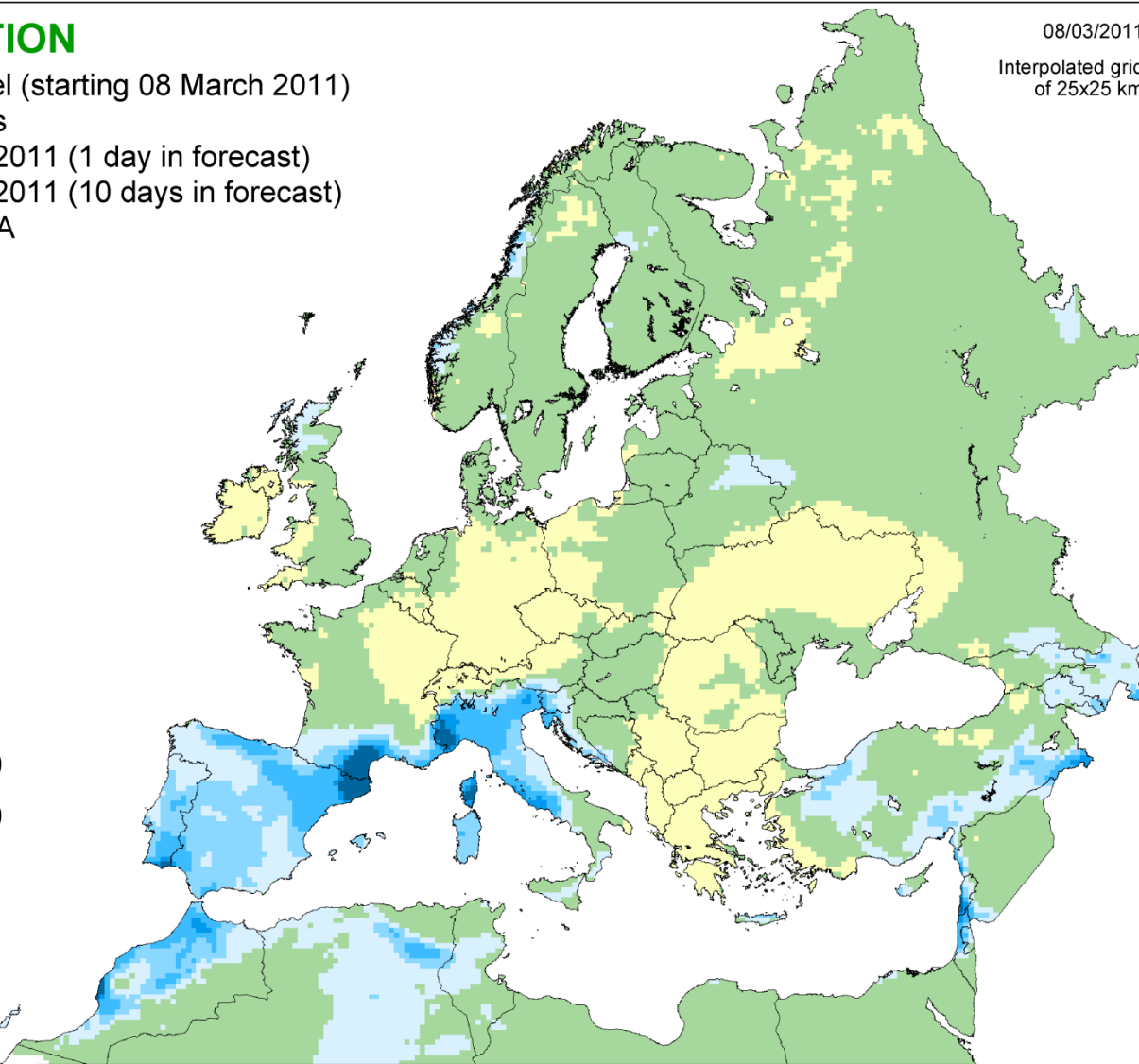
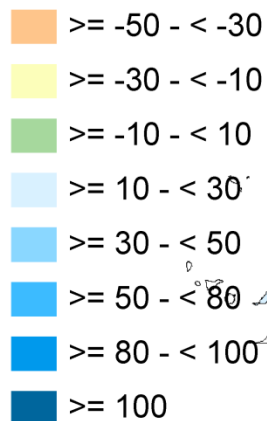
PRECIPITATION

Operational model (starting 08 March 2011)
 Cumulated values
 from : 08 March 2011 (1 day in forecast)
 to : 17 March 2011 (10 days in forecast)
 Current year - LTA

08/03/2011

Interpolated grid
 of 25x25 km

Units: mm



Analyse coincidence of variation in yield and climate in Europe

- Use of extensive MARS meteo DB and yield statistics
- (*Peltonen-Sainio et al. 2010 Agric. Ecosyst. and Envir.*)

Questionnaires on perceived risks and foreseen impacts of CC on agriculture

- (*Olesen et al. 2010 Eur. Jour. Agronomy*)

NRT Phenology indicators

- Attempts to use remote sensing DB to derive phenological indicators in near-real time (CRONOS)

Multiple demands

- climate change impacts on agriculture
- enlargement towards global monitoring
- enhanced regional analysis
- farming systems (rather than crops)
- ...

Call for adapted solutions

- enhanced / additional simulation capabilities
- tailored modelling solutions
- enriched databases
- better use of multiple sources including RS



Started development of BioMA

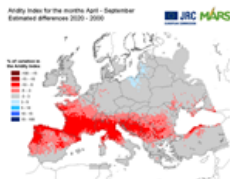
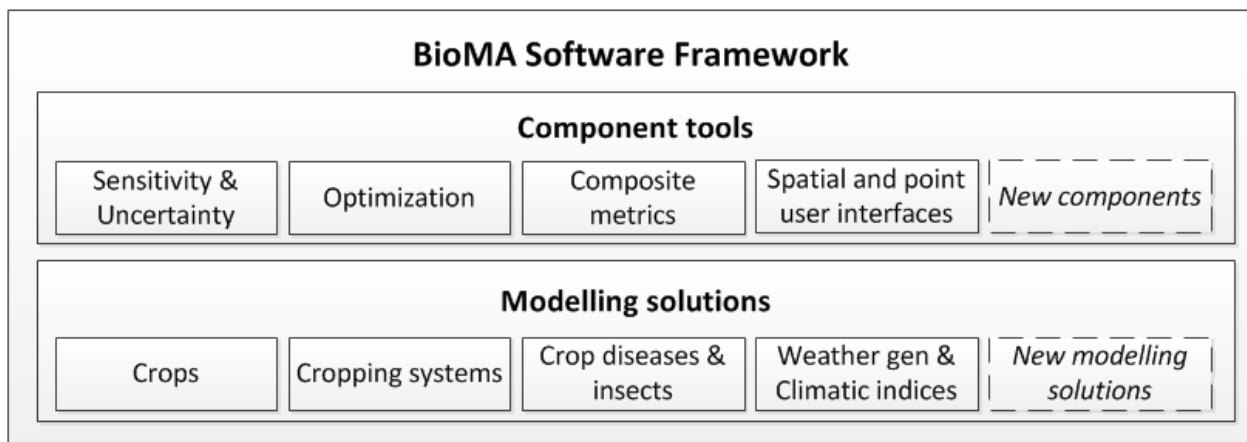
Biophysical Models Application (BioMA)

A platform for running biophysical models on generic spatial units

The key requirements of its design maximize:

- Extensibility with new modelling solutions
- Ease of customization in new environments
- Ease of deployment
- Transparency of workflows

Bio-physical Model Applications Framework



AVEMAC

- Objective is to assess agriculture vulnerabilities for the design of effective measures for adaptation to climate change in the EU
- Combined use of agro-climatic **indicators** and crop growth **simulations**
- *Input data:* bias-corrected ENSEMBLES data (Dosio & Paruolo 2011)
- *Time horizons:* 2020 & 2030 *SRES scenarios:* A1B and B1

EUROCLIMA

- Objective is to improve the knowledge of Latin American decision-makers and the scientific community concerning problems and consequences of climate change
- Emphasis on integrating into **sustainable development** strategies
- *Time horizons:* 2020 & 2050 *SRES scenarios:* A1B and B1

GLOBCAST

- The objective is to monitor the weather impact on the main producing grain areas of the world
- Will issue short term forecasts of crop productions availability.
- Will rely heavily on Remote Sensing
- Should allow estimation of world balance sheets and estimate effects on trends of prices
- The crops of interest are: Wheat, maize, soybean, rice, sugarcane, barley, rape seed, sorghum and other cereals

Future MARS infrastructure will provide a valuable tool to assess climate change impacts on agriculture within the 21st century.

Research potential for trends in vegetation development since the last 20-30 years under climate change aspects

Thank you for your attention!