Joint Research Centre (JRC)

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

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On behalf of the MARS–AGRI4CAST team

IES - Institute for Environment and Sustainability

Ispra - Italy

http://ies.jrc.ec.europa.eu/

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

MARS unit

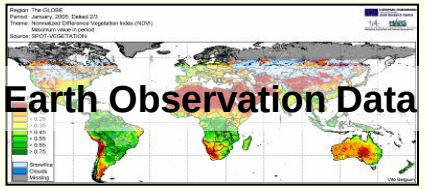
- Monitoring Agricultural ResourceS
- Mission is to provide scientific and technical support on EU Agriculture and Food Security policies

AGRI4CAST action

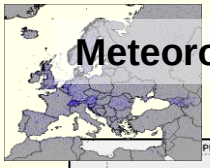
- Operationally in-season crop yield forecasts at a European level
- Based on a modelling infrastructure driven by agro-meteorological data and assisted by remotely sensed observations.
- Used by the European Commission as part of the decision making process on market intervention and for policy support.

Crop assessment and yield forecasting process

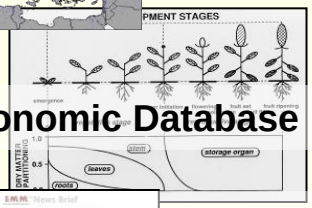
Data collection & retrieval



Earth Observation Data

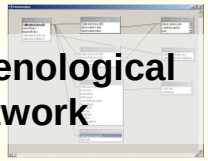


Meteorological Data



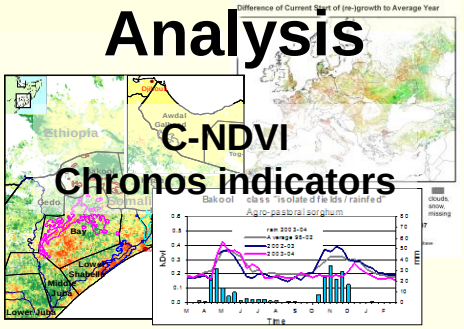
Agronomic Database

WEB Information
Media Monitor
Magazines

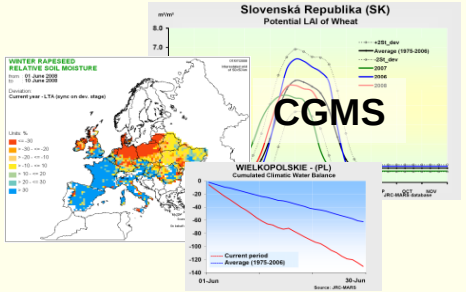


Agro-phenological network

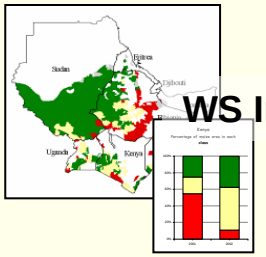
Processing & Analysis



C-NDVI
Chronos indicators

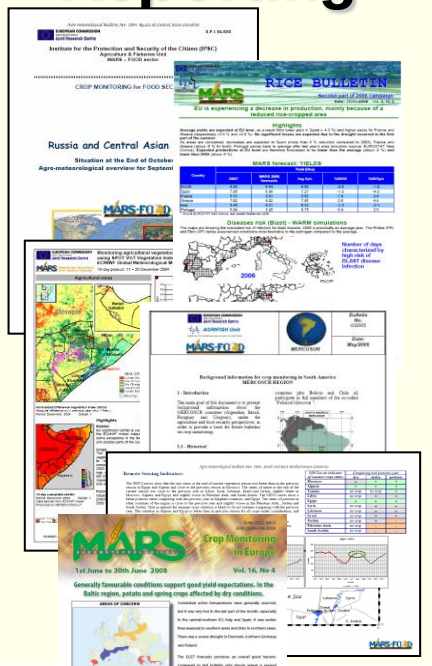


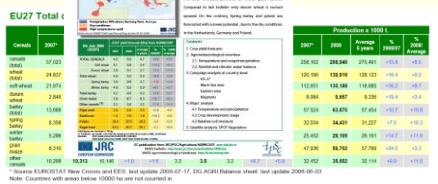
CGMS



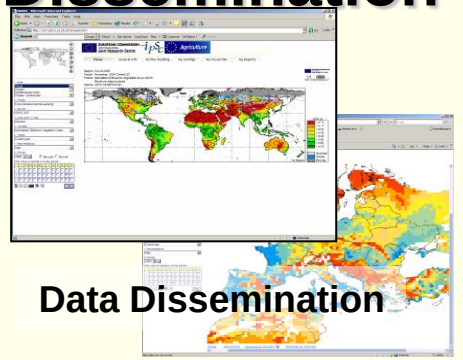
WS Index

Reporting

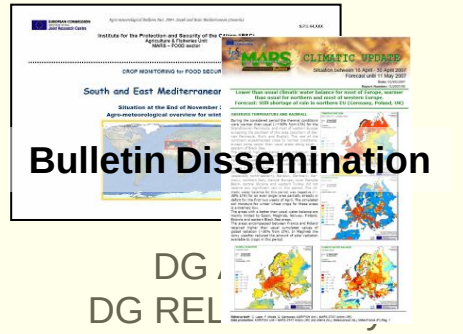




Dissemination



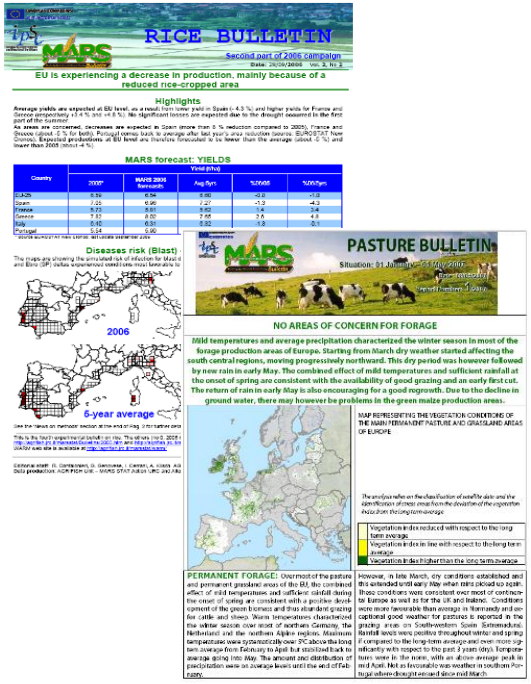
Data Dissemination

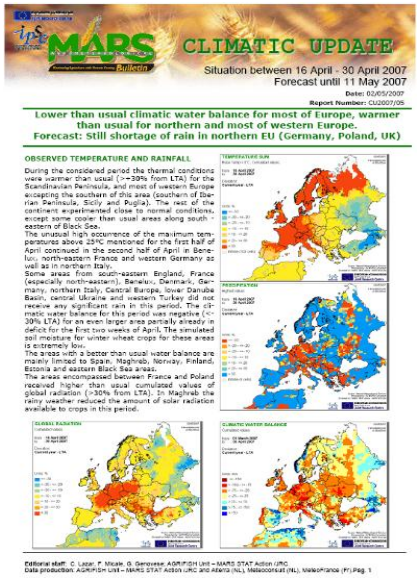


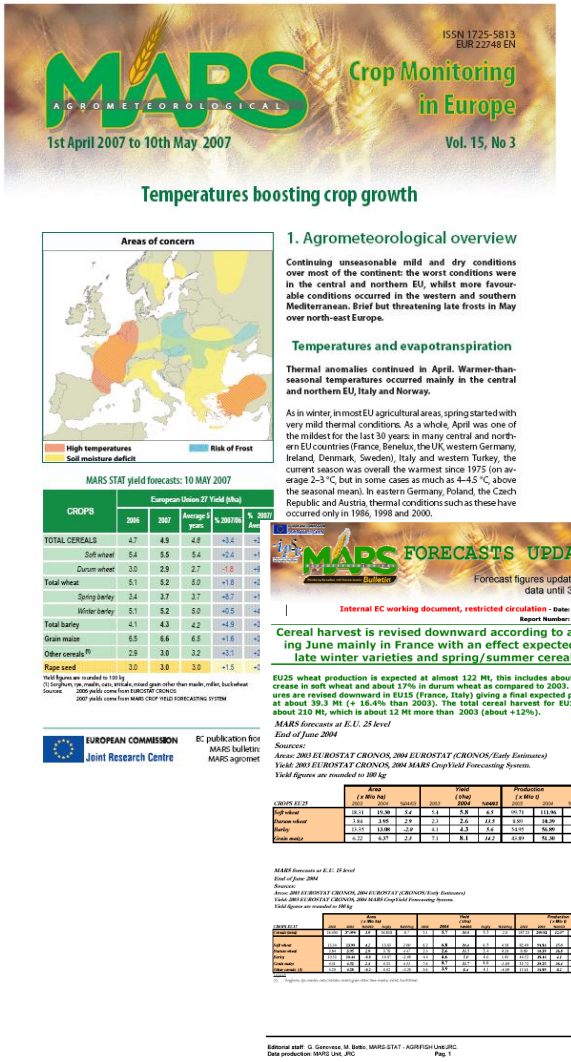
Bulletin Dissemination

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

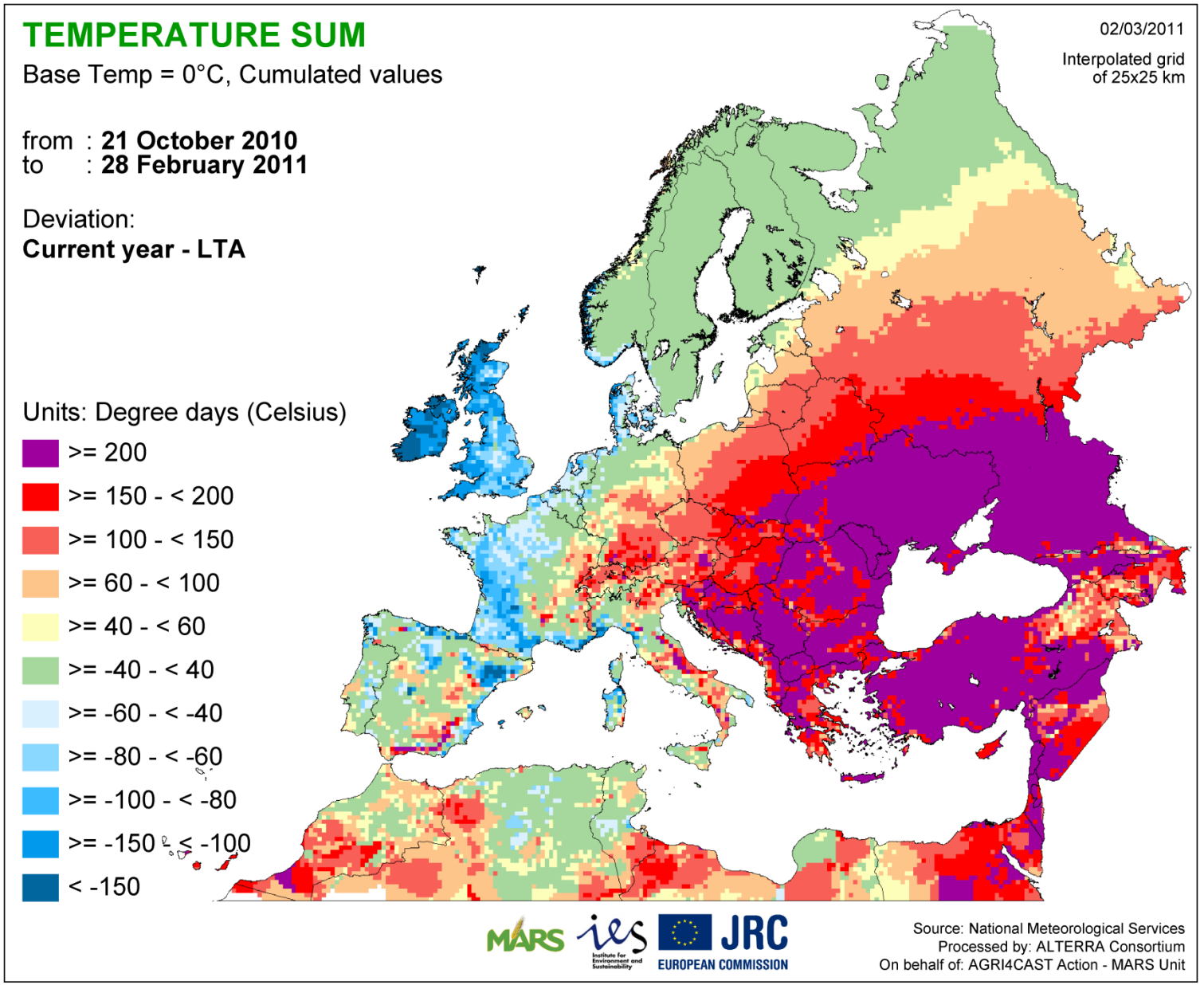
- 35 countries covered
- 11 crops monitored
- 35 years of meteo and agrometeo data
- 20 crop indicators are daily simulated by crop models
- 21 years of low resolution satellite information

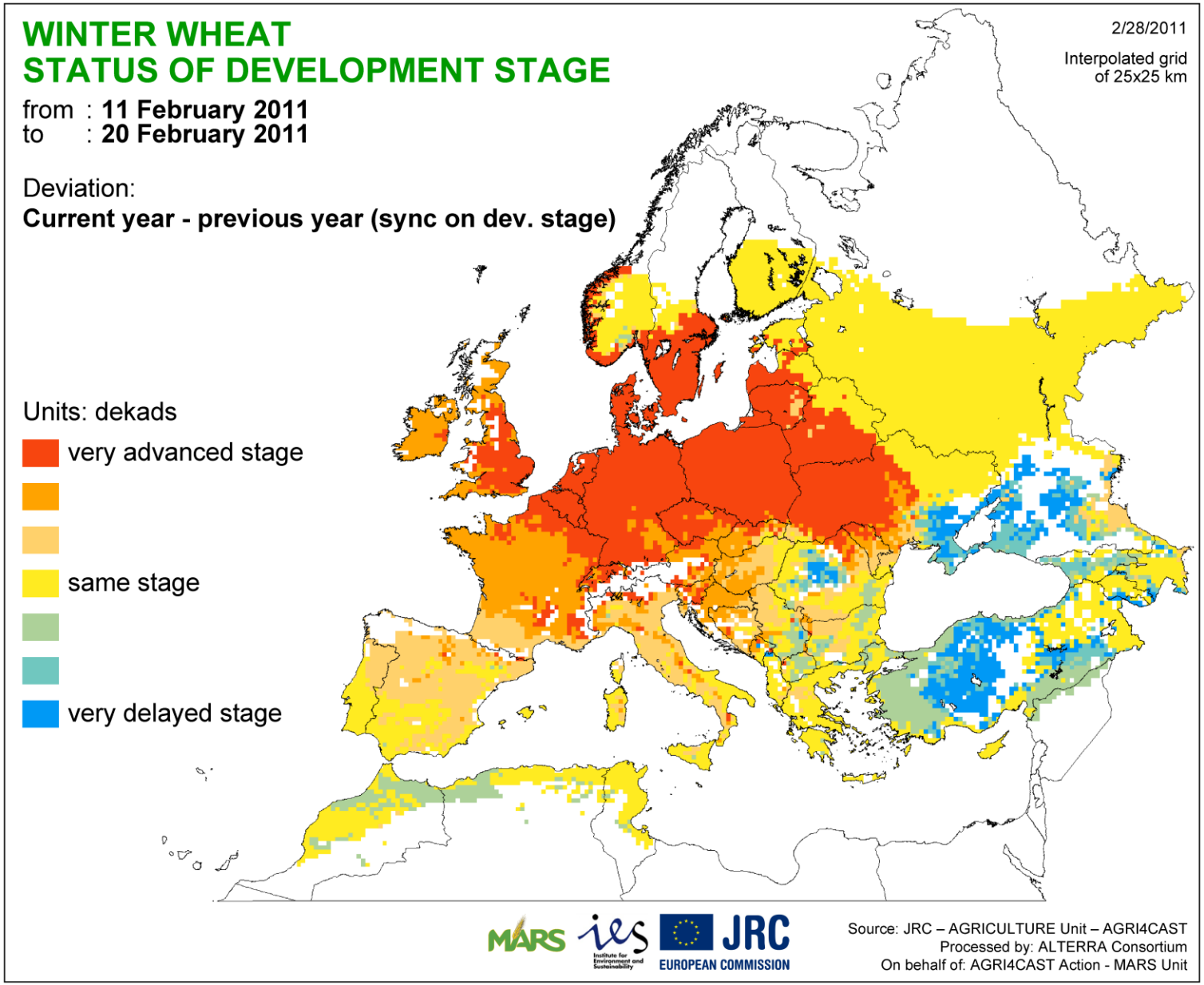


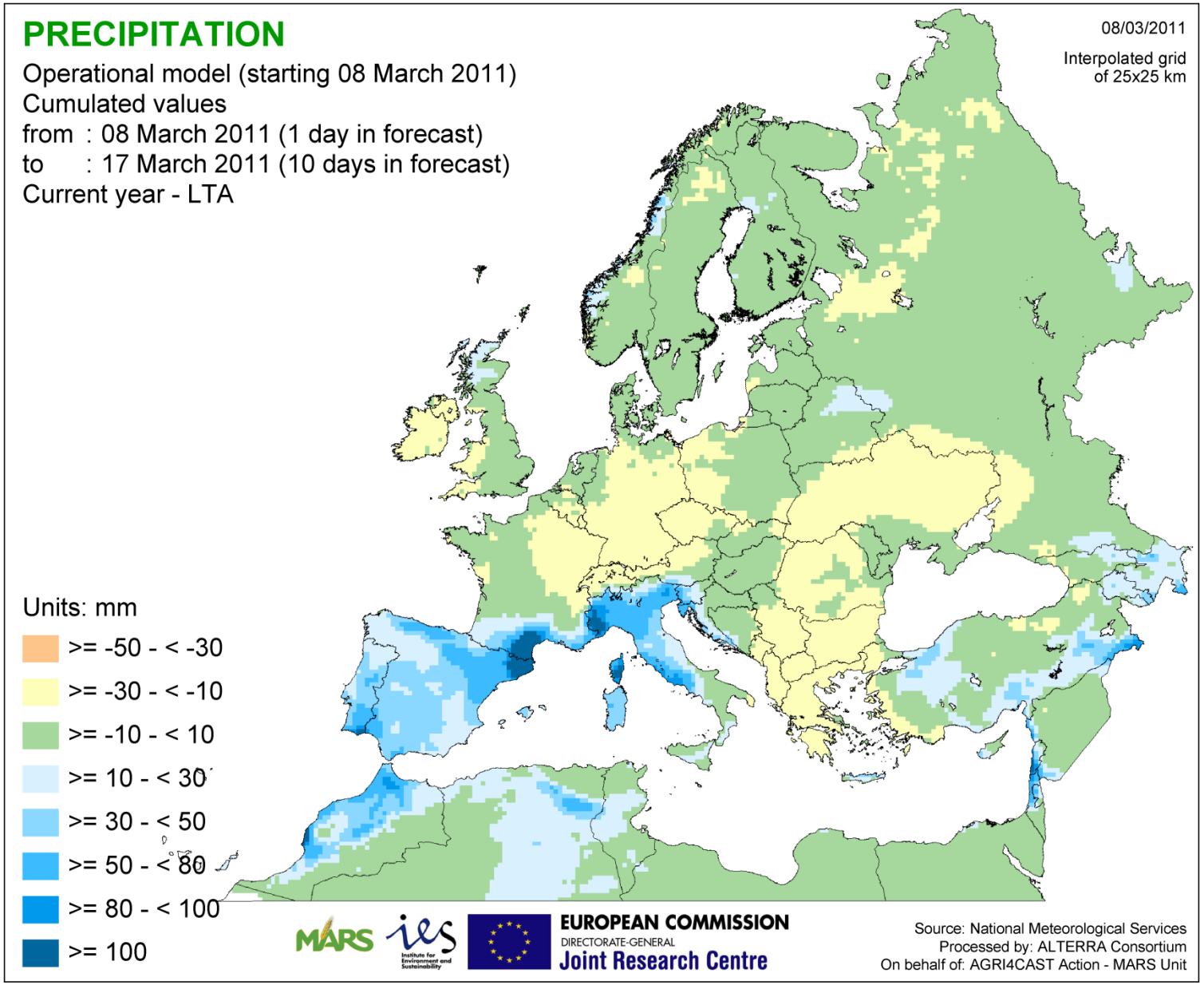




Main web tool to access all the information
http://www.marsop.info


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)
>= 200
>= 150 - < 200
>= 100 - < 150
>= 60 - < 100
>= 40 - < 60
>= -40 - < 40
>= -60 - < -40
>= -80 - < -60
>= -100 - < -80
>= -150 - < -100
< -150
MARS
Institute for Environment and Sustainability
JRC EUROPEAN COMMISSION
Source: National Meteorological Services
Processed by: ALTERRA Consortium
On behalf of: AGRI4CAST Action - MARS Unit


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
very delayed stage
MARS
Institute for Environment and Sustainability
JRC
EUROPEAN COMMISSION
Source: JRC – AGRICULTURE Unit – AGRI4CAST
Processed by: ALTERRA Consortium
On behalf of: AGRI4CAST Action - MARS Unit


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
>= -50 - < -30
>= -30 - < -10
>= -10 - < 10
>= 10 - < 30
>= 30 - < 50
>= 50 - < 80
>= 80 - < 100
>= 100
MARS
EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre
Source: National Meteorological Services
Processed by: ALTERRA Consortium
On behalf of: AGRI4CAST Action - MARS Unit

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 capabilites
- 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

BioMA modelling infrastucture

Bio-physical Model Applications Framework

Crop Growth Monitoring System
historical weather DB

IPCC derived weather scenarios
weather DB

Agricultural soil profiles
soils DB

Agro-management and crops
Agro-management DB

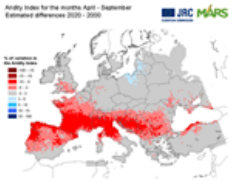
BioMA Software Framework

Component tools

Sensitivity & Uncertainty | Optimization | Composite metrics | Spatial and point user interfaces | *New components*

Modelling solutions

Crops | Cropping systems | Crop diseases & insects | Weather gen & Climatic indices | *New modelling solutions*



Map data | Time series | Model evaluation | Sensitivity analysis

MARS ies JRC EUROPEAN COMMISSION

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

CLIMPEST

- Develop a model framework for **foliar fungal pathogens** based on EU climate, crop/vegetation and biological characteristics of the fungi
- Study simulation possibilities for other harmful organisms
- Provision of interpolated climatic data and newly derived climatic indicators for the EU establishment assessment of harmful organisms

BECRA

- Objective is to develop a model framework for assessing climate change impact on **cropping systems** (Cotton and Rice) in specific districts of Mali and Burkina Faso,
- Should allow defining adaptation and mitigation strategies.
- Includes **economic modelling** for the analysis of climate change impacts on agriculture
- *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!