

Crop yields and climatic conditions in Portugal: Trends and variability in the last ten years

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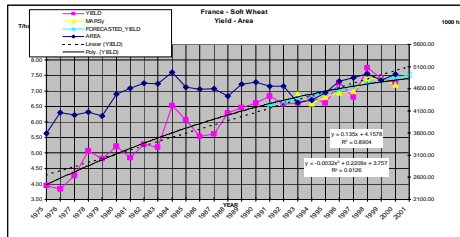
Outline

- AGRI4CAST – Crop monitoring and yield forecasts of agricultural activities in EU 27 including Portugal
- Trends and variability analysis for the monitored crops in Portugal
- Example of the climatic conditions affecting the yield variability in 2005 and 2007
- Conclusions and Outlook

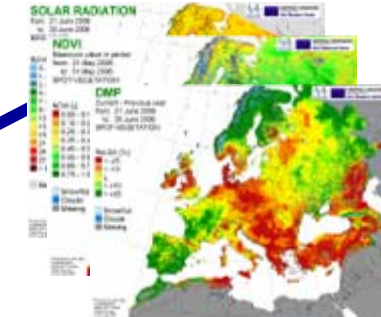
AGRI4CAST – crop monitoring activities

- AGRI4CAST (Action n° 21103 - Crop Production Forecasts / Estimates and Climate Change Impact on Agriculture) is centered on the **JRC's crop yield forecasting system** aiming at providing **accurate and timely crop yield forecasts** for the **union territory** and other strategic areas of the world
- This system is able to monitor **crop vegetation growth** and include the short-term effects of **meteorological events** on **crop yields**.
- Results are regularly published in form of **bulletins** containing analysis, forecasts and thematic maps on crop yield expectations.

The system is made by remote sensing, meteorological observations, agro-meteorological modeling and statistical analysis tools.



Remote Sensing infrastructure (data since 1991)



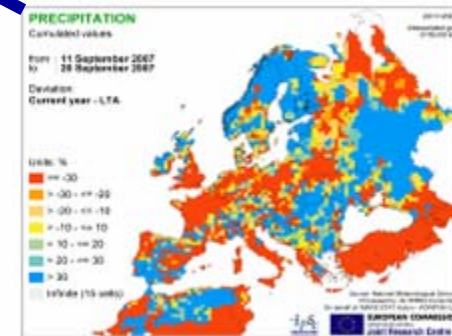
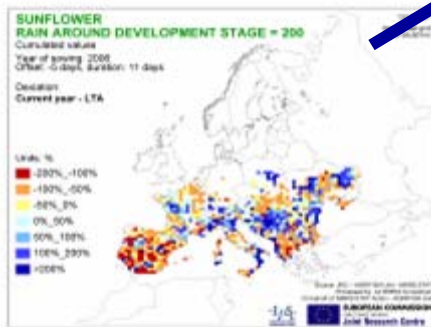
Statistical analyses: time series, tendency analyses, etc.

MARS Yield Forecasts at national level - End of August 2007

	SOFT WHEAT				DURUM WHEAT				BARLEY				GRAIN MAIZE	
	yield-00	yield-01	%20100	%20100	yield-01	%20100	yield-00	%20100	yield-01	%20100	yield-01	%20100	yield-01	%20100
EU15	6.7	6.6	-0.9	2.6	2.3	-12.9	4.8	4.8	-4.8	9.0	9.0	0.0	-0.2	-
B	8.0	8.1	0.1	-	-	-	8.5	8.5	2.8	8.8	10.2	6.5	-	-
D	7.5	7.6	-1.1	-	-	-	5.4	8.1	-5.0	-	-	-	-	-
G	7.5	7.6	6.2	8.0	6.2	2.2	5.8	8.1	3.3	9.2	8.7	-5.8	-	-
I	3.5	3.5	2.9	2.9	2.7	20.2	3.3	2.8	15.0	8.2	8.4	2.3	-	-
E	1.9	1.9	-2.0	-	-	-	41.1	3.4	2.8	-26.7	8.2	7.9	-	-
F	-	-	-	-	-	-	1.2	1.2	0.9	-	-	-	-	-
J	-	-	-	-	-	-	1.7	1.7	0.2	-	-	-	-	-
A	-	-	-	-	-	-	0.0	0.0	0.0	-	-	-	-	-
P	-	-	-	-	-	-	0.0	0.0	0.0	-	-	-	-	-
S	8.0	8.0	-2.3	8.0	8.0	0.0	4.0	3.8	-4.4	-	-	-	-	-
SE	8.0	8.1	1.2	8.0	8.0	0.0	5.8	8.7	-1.2	-	-	-	-	-

Note: The national yield forecasts are based on agro-meteorological model outputs and AVHRR indicators at NUTS 1 level in combination with time trend analysis. Rape and sunflower yields calculation do not include the areas planted for industrial uses. Yield figures are rounded to 100 kg.

Yield forecasts



Agrometeo indicators (crop growth model)

Meteorological infrastructure (data since 1975)

Crops forecasted

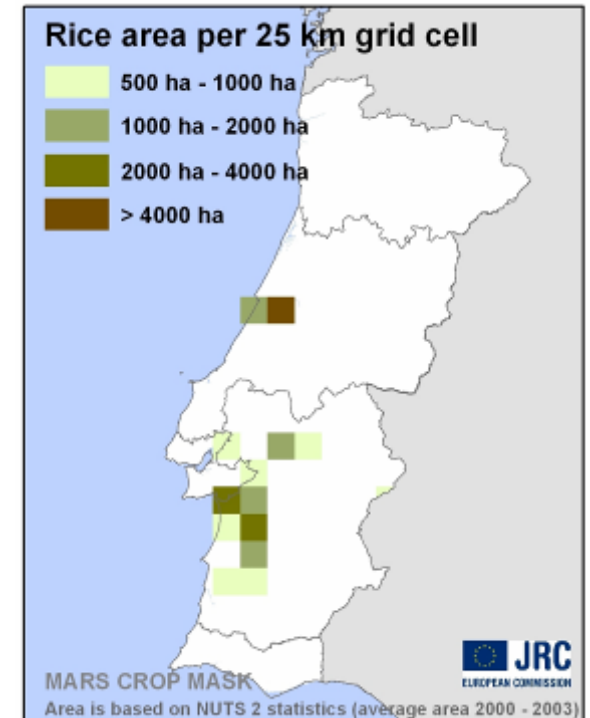
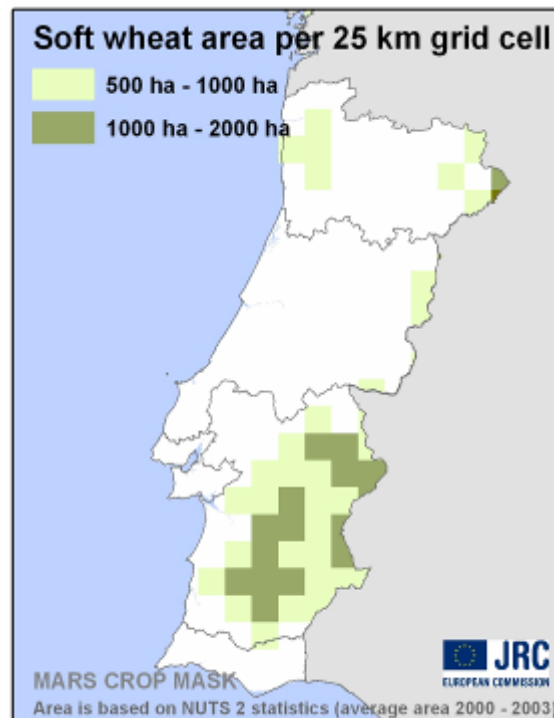
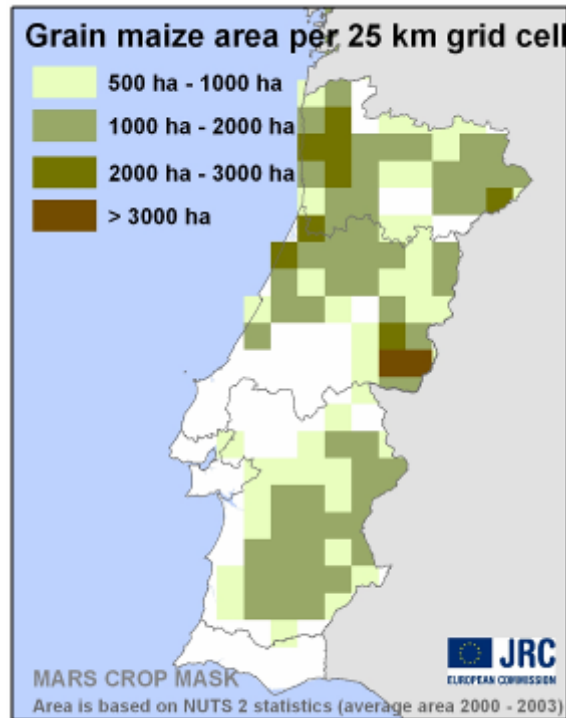
For **EU 27** the following crops are regularly forecasted by Agri4Cast: wheat (soft and durum), barley (winter and spring varieties), grain maize, rapeseed, sunflower, rice, sugar beet, potato and forage crops.

The following crops are monitored in **Portugal**:

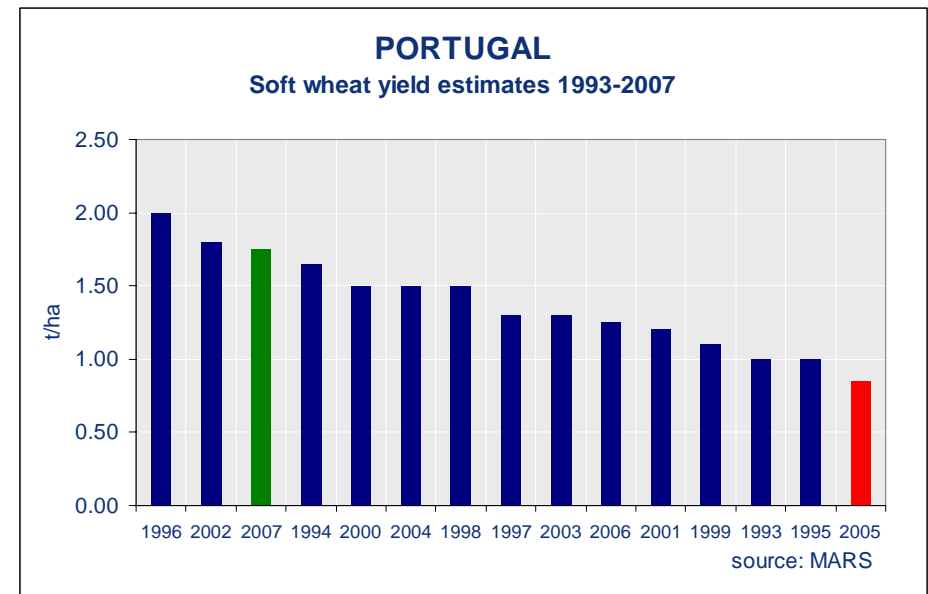
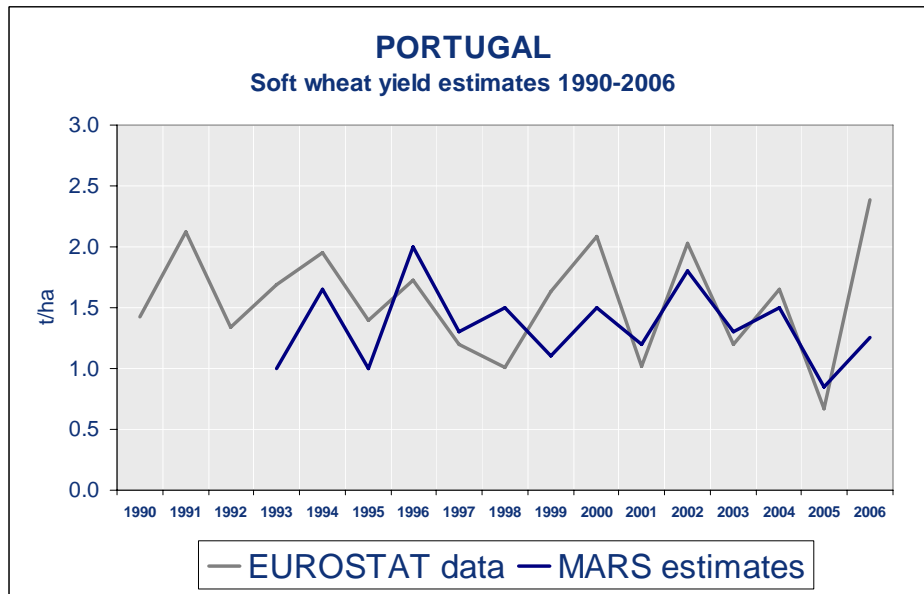
	2007 planted surface (Area x 1000 ha)	% of total EU27
soft wheat	61.00	0.27%
barley	40.00	0.29%
rice	25	6.31%
grain maize	117.00	1.38%
potato	41.00	2.01%

* Soft Wheat and Grain Maize are representative for winter and summer crops

Distribution of grain maize and soft wheat in Portugal



Variability of soft wheat yield in the period 1993 -2007

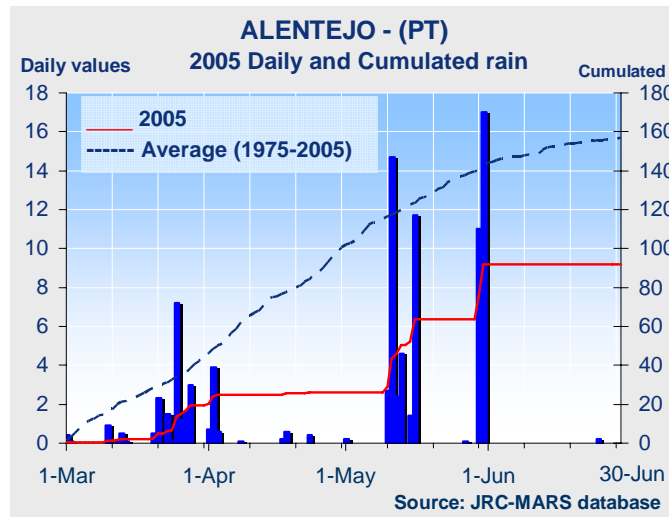
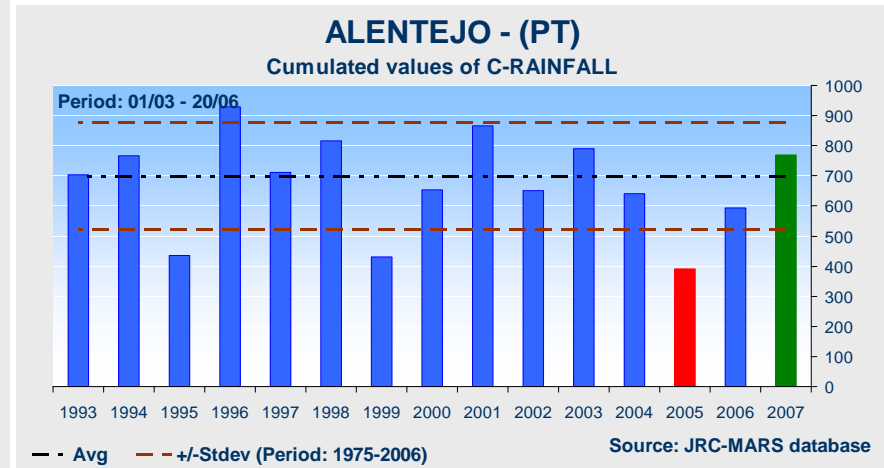
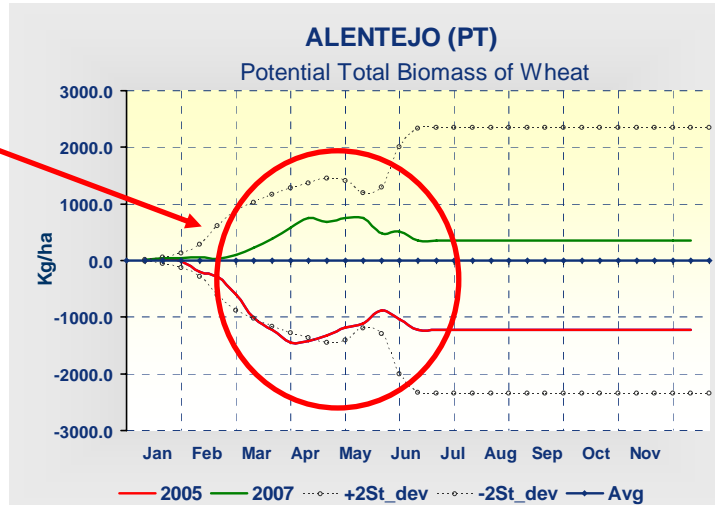


The evolution of soft wheat yields in Portugal shows no particular trend and is strongly affected and by the variability of the climate

The 2005 and 2007 seasons are representative of this strong variability.

Climate variability – Soft wheat in the Alentejo Region

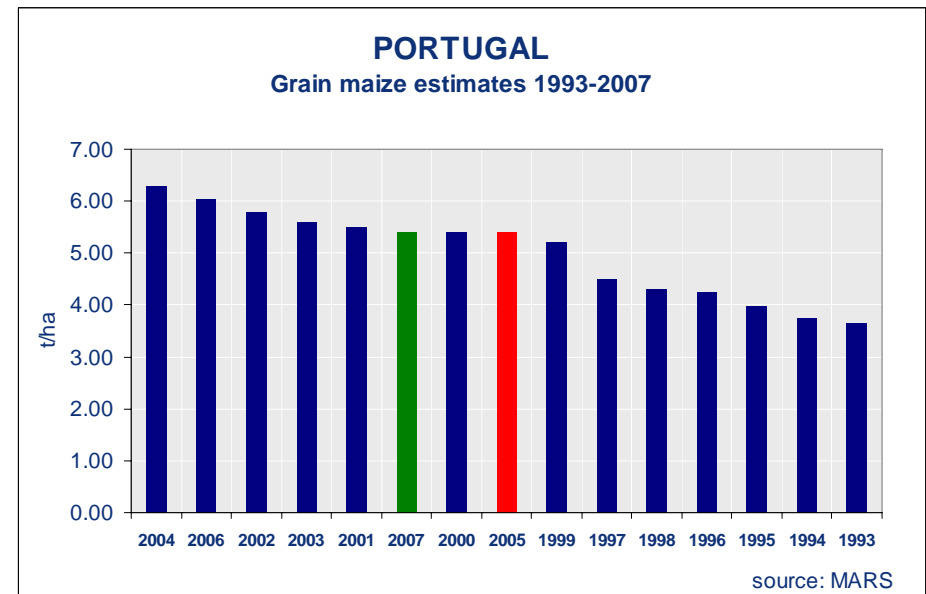
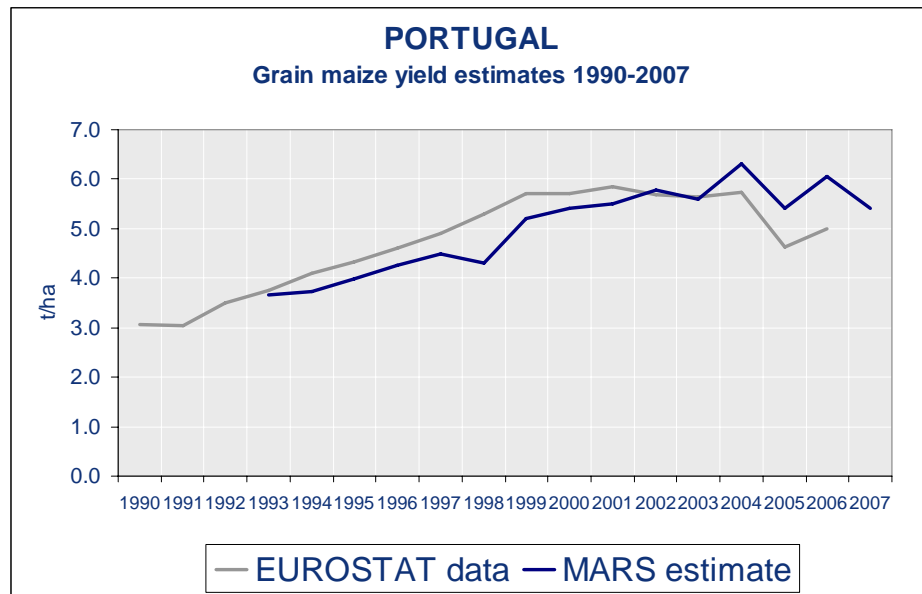
Evolution of the potential biomass estimate during the agricultural season



The yield variability of soft wheat is climate dependant and in 2007 good climatic conditions lead to a good yield (1.8 t/ha)

In 2005 delayed development and drought during most sensitive stages of crop development lead to an exceptionally low yield (0.7 t/ha)

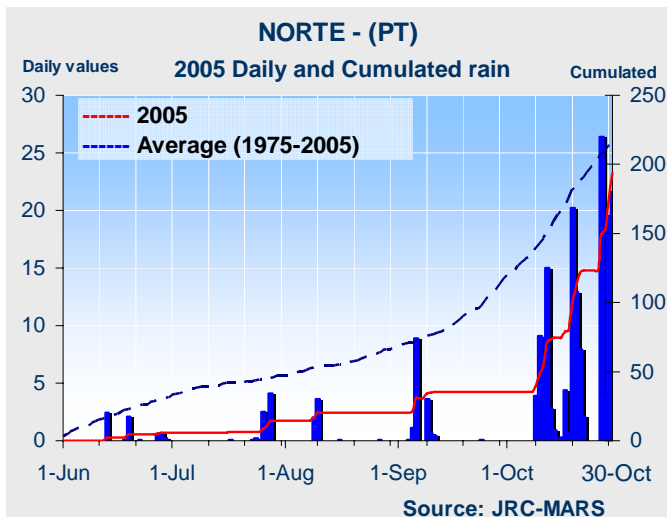
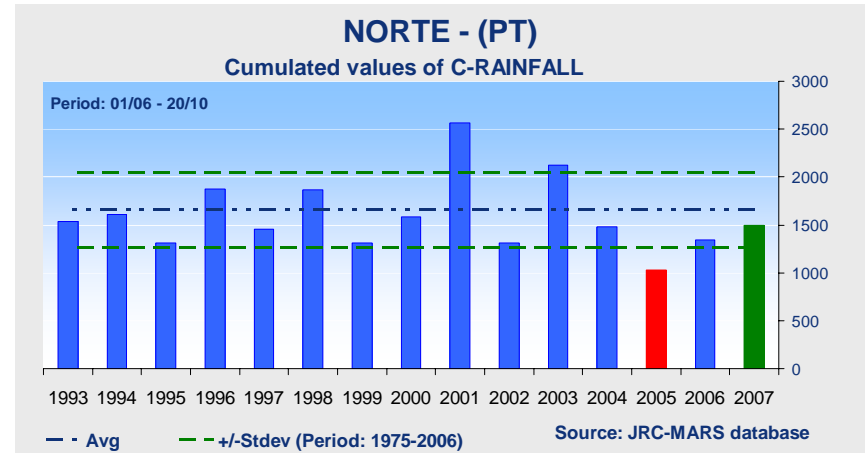
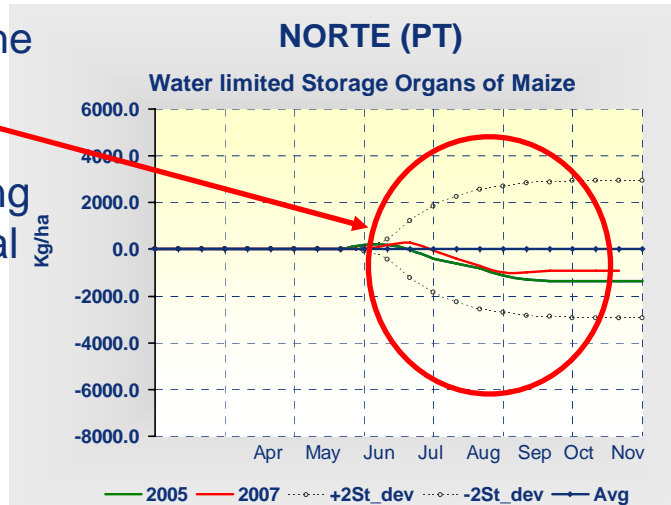
Grain maize yield variability



Grain maize in Portugal is characterized by a significant (log) trend, which seems to have reached a “plateau” in the last years. Yields are dependent from irrigation practices especially in southern and central areas, while in northern regions are more affected by climate.

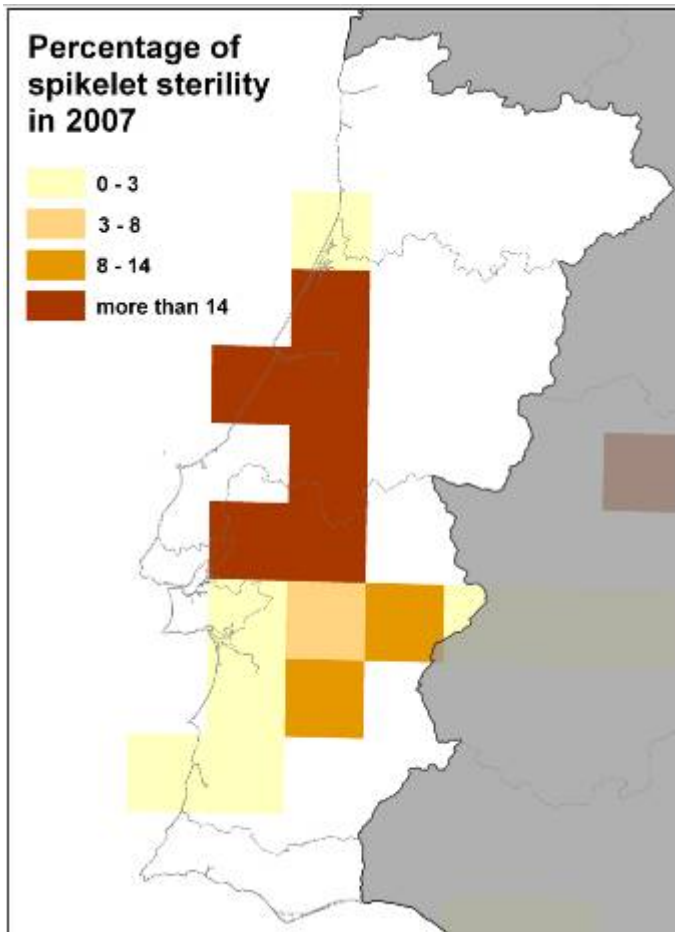
Climate variability – Grain Maize in the Norte Region

Evolution of the water limited biomass estimate during the agricultural season



For Grain maize, irrigation makes it largely independent from precipitation. However, in exceptional conditions like 2005, climate influences irrigation availability thus yields

Rice monitoring and yield forecast



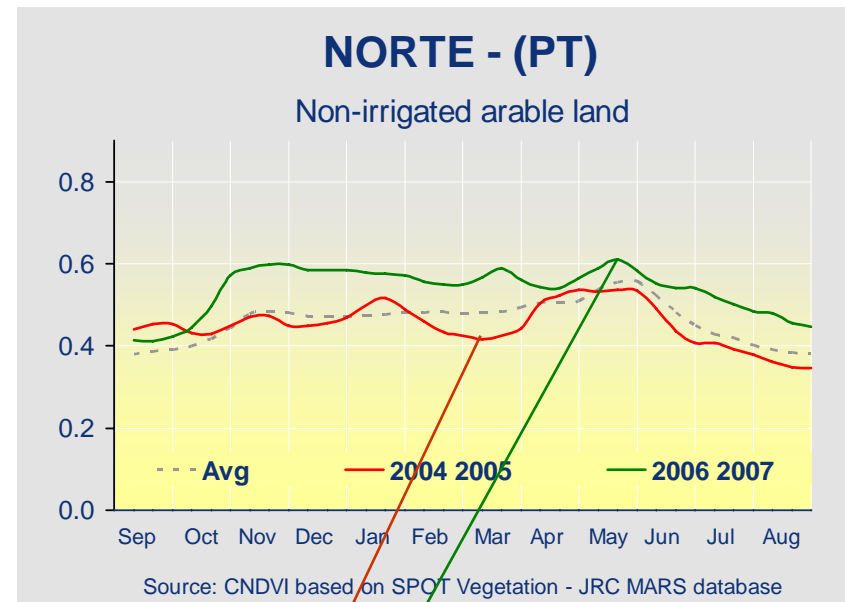
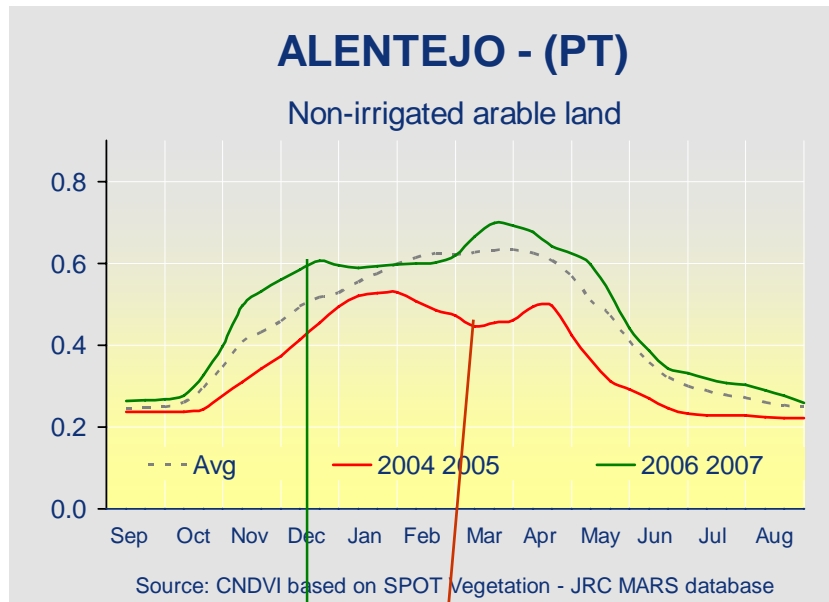
Country	Yield (t/ha)				
	2006**	MARS 2007 forecasts	Avg 5yrs	%07/06	%07/5yrs
EU-27	6.74	6.58	6.62	-2.3	-0.7
Bulgaria	4.41	4.80	4.47	8.9	7.3
Spain	7.01	6.90	7.15	-1.6	-3.5
France	5.48	5.80	5.64	5.9	2.8
Greece	7.87	7.79	7.78	-1.0	0.1
Hungary	3.23	4.28	3.84	32.3	11.4
Italy	6.86	6.67	6.52	-2.7	2.3
Portugal	5.80	5.52	5.73	-4.8	-3.7
Romania	3.26	2.86	2.92	-12.4	-2.0

** Source EUROSTAT New Cronos: last update 2007-09-14

Percentage of spikelet sterility due to pre-flowering cold shocks in 2007

Indicators from Remote Sensing – convergence of results

Biomass development at regional level – non irrigated area

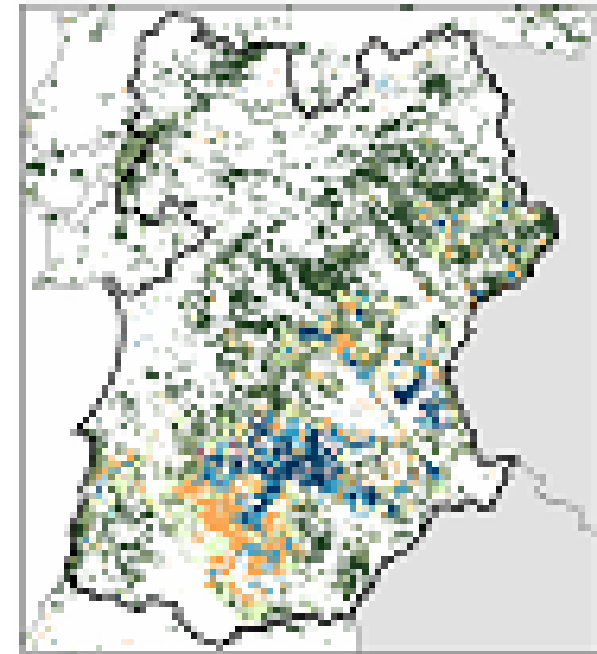
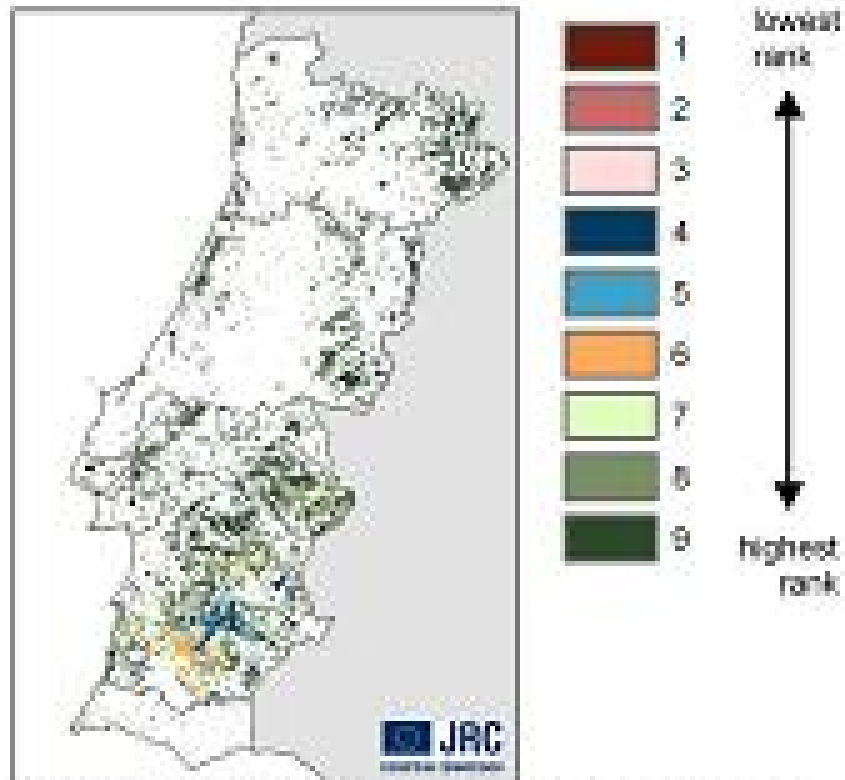


Less biomass development in 2005
 Above average biomass accumulation in 2007

Remote Sensing analysis at sub-regional level

Comparison of Cumulated NDVI Values (October - September)

Cumulated NDVI of 2006/2007 ranked within all historic years (1999/1999 - 2006/2006) for arable land



Variation in biomass accumulation for the whole season 2007 for rain fed arable land

Conclusion

- In Portugal climatic conditions are characterized by a high temporal and spatial climatic variability (North Vs South) and this is reflected on crop distribution and productive trends.
- However some crops yields are less dependant on climate than others (e.g. grain maize Vs soft wheat).
- In the JRC forecasting system these factors are all taken into consideration updating the yield forecast during the agricultural season.
- The monitoring of climatic conditions is performed at a more detailed scale than that for which the forecasts are produced.

Outlook

- Future enhancements will allow a more spatially detailed analysis of climate and biophysical factors affecting yields (e.g. increased meteorological stations net).
- Moreover the crop yield forecast will also be performed on forecasted weather data.
- The system is transferable and can be tailored to your national needs
- More information can be found under:

<http://mars.jrc.it/>