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# MARS AGROMETEOROLOGICAL

2009 - 2010 WINTER CEREALS SEASON

Crop Monitoring in Morocco

Special issue with

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# NEAR-AVERAGE YIELDS FOR WINTER CROPS DUE TO DELAYED SOWING AND HISTORICALLY WARM APRIL

## HIGHLIGHT

Cereal production in the 2009-2010 agricultural season was characterized by abundant precipitation. The outcome could have been better if rain had been better distributed.

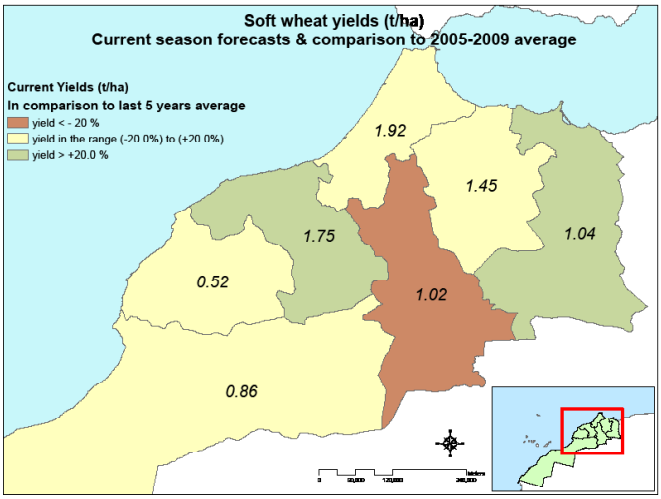
The poor distribution of rain led to different results from one administrative region to another, and from one province to another within the same region. The final results across the provinces was mainly determined by the date of planting and emergence of various diseases.

All regions of the country have been affected by the April weather, historically hot and quite dry, a very unfavourable situation for an optimal grain filling. The expected benefit is therefore lower than the previous season, but should be higher for early planting and lower for late planting.

Damage due to infestation by weeds and diseases vary from one region to another but should be within the magnitude of the previous year at national level. As for the use of nitrogen, there appears to have been no change from the previous season.

| CROPS | Yield t/ha | | | | |
|---|---|---|---|---|---|
| | 2009 * | 2010 forecasts** | Avg 5yrs | %10/09 | %10/5yrs |
| **Wheat (total)** | 2.1 | 1.8 | 1.4 | -13.4 | +23.7 |
| **Barley** | 1.7 | 1.4 | 0.9 | -25.7 | +44.4 |

*Moroccan National Statistics (DSS) , **MARS-AGRI4CAST estimates (20/05/2010)

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**Contributions**

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**Technical note** The long-term average used within this bulletin as a reference is based on an archive of data covering 1975–2009. The CNDVI is an unmixed normalised vegetation index on the base of GLOBAL LAND COVER 2000 for arable land.

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# 1. Cereals Season Overview (2009-2010)

In Morocco winter cereals (soft wheat, durum wheat and barley) are produced all over the country, occupying nearly two thirds of agricultural lands with limited variations from year to year.

The estimation of surfaces given by the Moroccan statistics' services indicates nevertheless a decrease of cereal surfaces of about 9 % (in comparison to 2008-2009 season) with the most reduction for barley (12.5 %).

A first estimate of yields simulated at AGRI4CAST (JRC) at the national level, gives **1.8 t/ha** for wheat- soft and durum - 13.4 % below in comparison to the previous campaign but still 23.7 % above the last 5 years average) and **1.4 t/ha** for barley (25.7 % below in comparison to last year and 44.4 % above the last 5 years average).

Given expected yields and acreage this year (4.7 million hectares, meaning a decrease of around 8 % compared to 2009), production is expected to reach 7.8 million tons.

| CEREALS National level | Areas * (x1,000 ha) | | | Production ** (millions tons) |
|---|---|---|---|---|
| | 2009 | 2010 | %10/09 | 2010 |
| Durum wheat | 968.6 | **981.2** | -5.2 | **1.65** |
| Soft wheat | 2009.0 | **1910.7** | -4.9 | **3.44** |
| Barley | 2182.8 | **1909.9** | -12.5 | **2.67** |
| **TOTAL** | 5160.4 | **4738.8** | -8.2 | **7.77** |

* Source: DSS (Département de Stratégie et de Statistiques, Min. of Agriculture)
** Source: JRC (Agri4cast - yields were simulated at national level as of 20 May 2010) and INRA-Morocco (use same yield forecast for both soft and durum wheat)

# 2. Agrometeorological overview

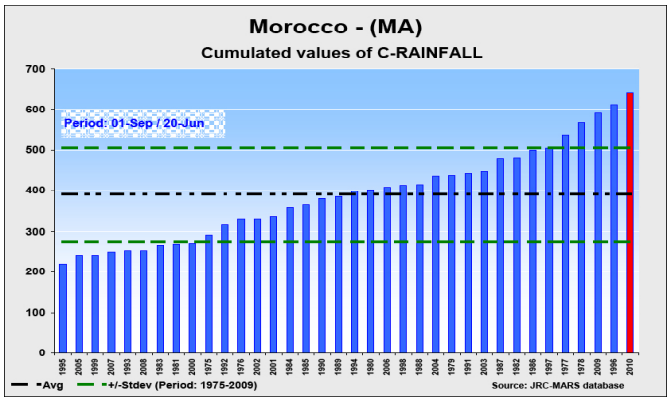
## 2.1. Rainfall

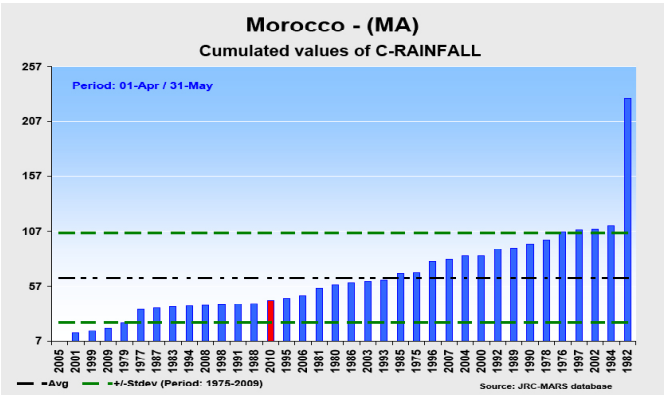
The cumulative rainfall from September 2009 to June 2010 was 640 mm, surpassing the previous season (611 mm) as well as the historical record from 1996 (589 mm), for the same period. This national record is due to the extreme rainfall in all regions with records above the 2-standard deviation long-term average. Rain was historically high in the Centre Nord (1108 mm) and Nord Ouest (923 mm) regions.

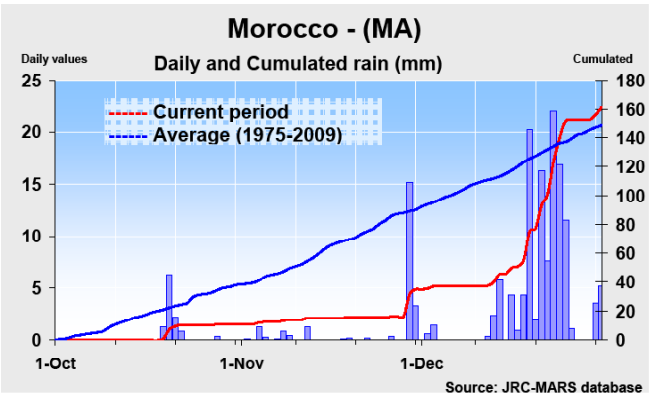
However, the rains came late despite a wet early September, and most of the rainfall was concentrated between the end of December 2009 and the second dekad of March 2010.

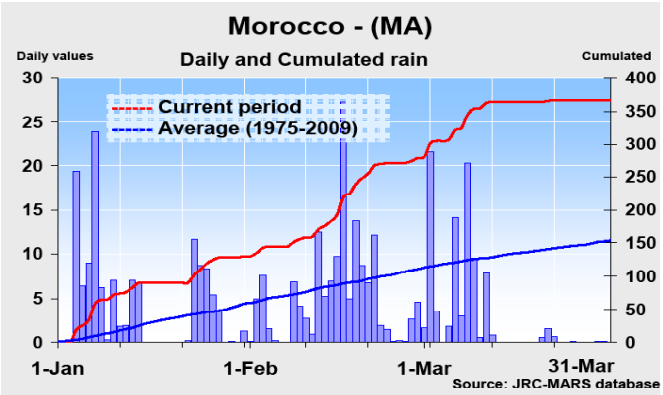
Sowing takes place usually at the end of November but in many provinces in the current season, cereals were planted as late as in the third dekad of December, as rainfall was too low. In some places farmers have re-sown.

Precipitation was quite favourable from January to March leading to a recovery for winter cereal development to some extent. April was relatively dry, with rainfall slightly lower than the long term average in all regions, except in Centre Nord.



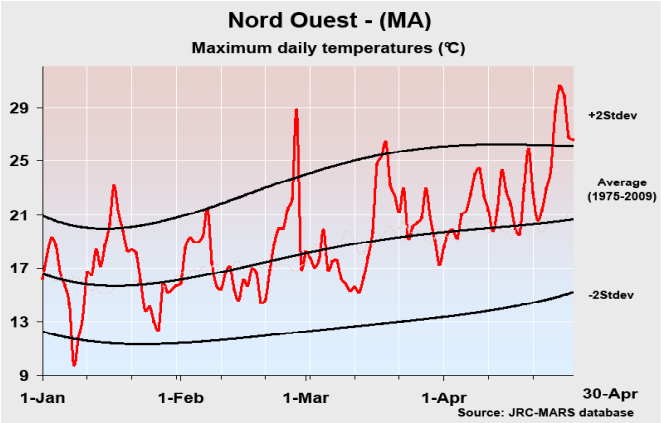
## 2.2. Temperature

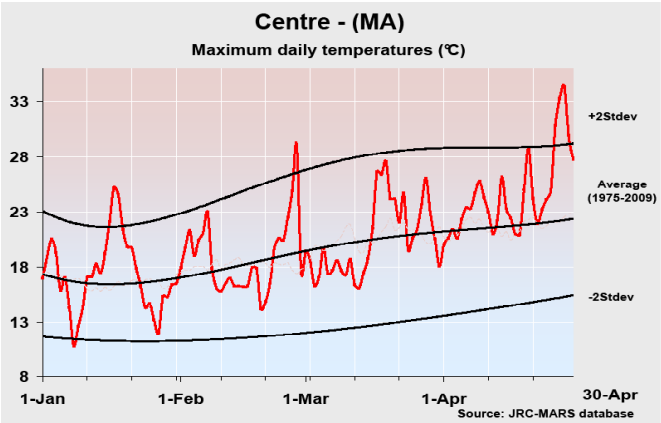
Average temperatures were relatively high during the 2009-2010 crop year, surpassing the 1996 record and often, depending from one region to another, higher than the previous year's temperatures for the same period.

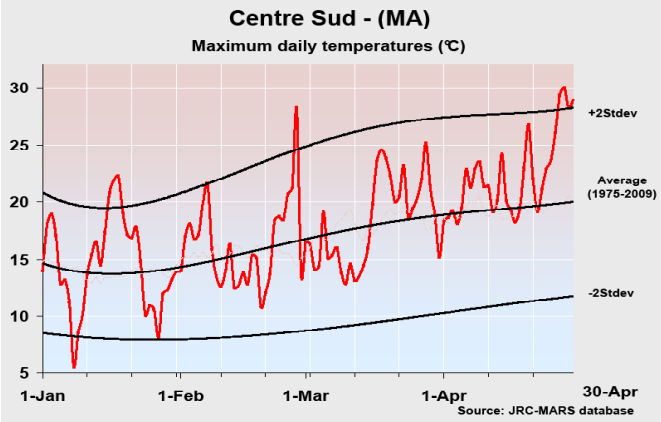
Winter was particularly mild with temperatures reaching values above the long-term average plus 2-standard deviation.

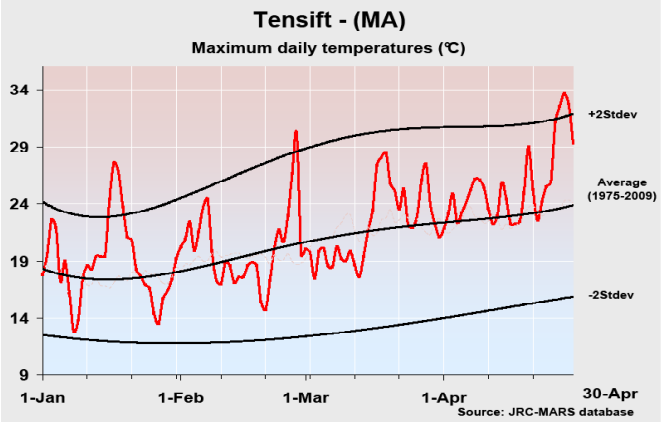
These conditions, warm temperatures and high rainfall, were very favourable for pests development (see below). More penalising were the very high temperatures experienced during the grain filling period in April, for example in Centre (the most important production region) or Tensift.

The levels were more in line with the average during the first dekad of May and even lower than the long term average during the second dekad of May.




# 3. Pests and diseases:

### An estimated grain yield losses of at least 15 % is due to weeds.

In the Sais, leaf diseases - especially Septoria - have developed because of the heavy rainfall this season. Stripe rust has caused significant damage but has been less aggressive than last season because of higher temperatures in January and February. This could offset some of the losses caused by the delay in sowing. The overall health status of the fields is therefore comparable or better than the previous season. Selected seeds were used in larger amounts, which would certainly have a positive effect on yields.

In areas of the Abda, Doukkala and Chaouia, surveys conducted during the current season have shown that Septoria diseases reached epidemic levels, averaging 40% severity level. Leaf rust was the second most important disease this season, and reached an average severity of 30%.

For barley, net blotch was the most important disease, with an average severity level of 70%. During this cropping season, barley experienced also the resurgence of scald, a disease that usually occurs in areas that are more humid..

As for insects, Hessian fly was the most damaging pest, mainly in late sown fields. An average severity of 25% was recorded. Other pests (such as gray fly and aphids) were also present, although at low levels.

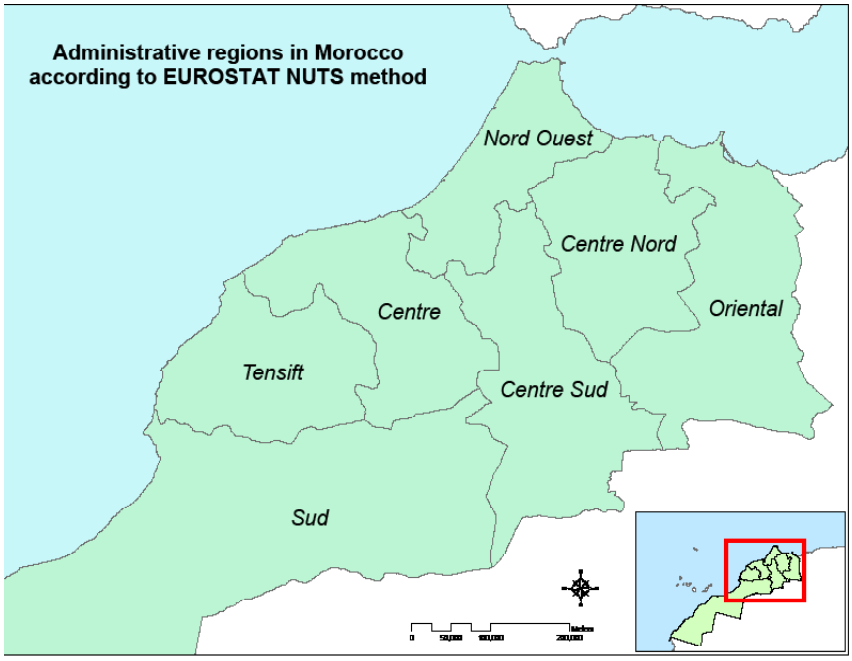
High populations of adult wheat stem sawfly were encountered (a pest whose adults appear in spring, but damage is seen only at harvest).

On the other hand, massive weed infestations were observed in most cereal fields this year, as compared to the previous season, representing thus an increase of total infestation of at lease 15%, and indicating significant damage. In addition, the heavy non-stop rainfall induced continuous germination and growth of weeds all along the season. In addition, the appearance of Brome species, mainly Bromus rigidus, in wheat was very significant, with an increase of at least 20% more infestation in the Chaouia region as compared to the previous year.

# 4. Yield forecast at NUTS1 level

Yields are presented on the basis of administrative regional levels. The forecast yields were estimated with the Crop Growth Modelling System (CGMS) at AGRI4CAST. CGMS was adapted to the specific Moroccan data sources (statistical records from "Direction de la Programmation et des Affaires Economiques" of the Ministry of Agriculture), integrating the established MARS Bulletin procedures with Moroccan expertise.

The estimates are referred to the Eurostat NUTS (Nomenclature des Unités Territoriales Statistiques / Nomenclature of Territorial Statistical Units) method which are institutional reference administrative units* . The NUTS0 corresponds to the national level; NUTS1 are intermediate sub-national units derived from the aggregation of Regional Units (see figure).




*http://epp.eurostat.ec.europa.eu/portal/page/portal/nuts_nomenclature/introduction

## 4.1. Soft wheat

Taking into account the 1978-2008 period, more than 60 % of soft wheat is produced in Nord Ouest (34%) and Centre (29%). Centre Nord, Tensift and Centre Sud produce around 30 %, (10 % each). Less than 10 % of soft wheat is produced in the Oriental and Sud regions.

All regions will record lower yields than last year, except in the Nord Ouest region, where the forecast yield is slightly higher. Note that inside a particular administrative region, the situation could be very different from one province to another, mainly regarding the sowing date chosen by farmers and the appropriate use of fertilisers.

In regard to the last 5 years performance, the estimated yields are quite promising in the main cereal production regions (Centre and Nord Ouest) and also in more minor regions (Centre Nord and Oriental). In the 3 other regions (Sud, Tensift, Centre Sud), the yields are estimated at level lower than the last 5 years average (see the map on the front page).

The yield forecast picture for the current season is quite positive therefore, and it is mainly due to the relatively well distributed precipitation recorded from December to March. The rainfall led to good relative soil moisture in main cereal production regions (Centre and Nord Ouest). The cumulated values at the end of May in those regions are higher than both the long term average (35 year series starting 1975) and the previous season. Following these conditions, the models simulated a positive crop development with anticipated stage of development for the season in comparison to both last year's record and long term average.

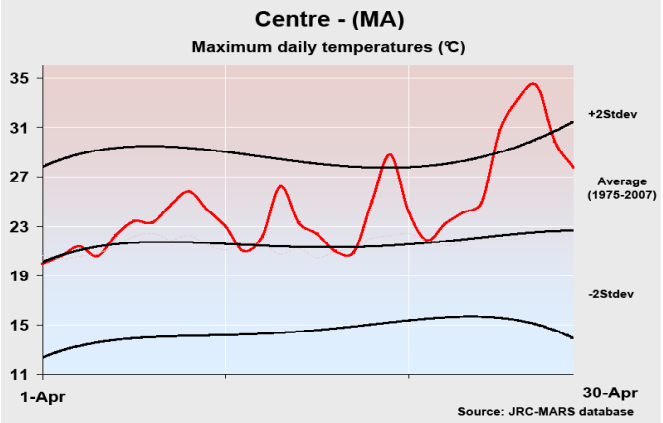
This optimistic scenario changed in April with very high maximum temperatures and relatively dry weather. For example, in the Centre region, the average maximum temperature in April was 24.8°C, a record for the 35 years long term series. These conditions are not favourable for grain filling and ripening processes. Despite this situation, the simulation of storage organs - under water limiting conditions - indicates that weights are above both the long term average and the previous year's level.

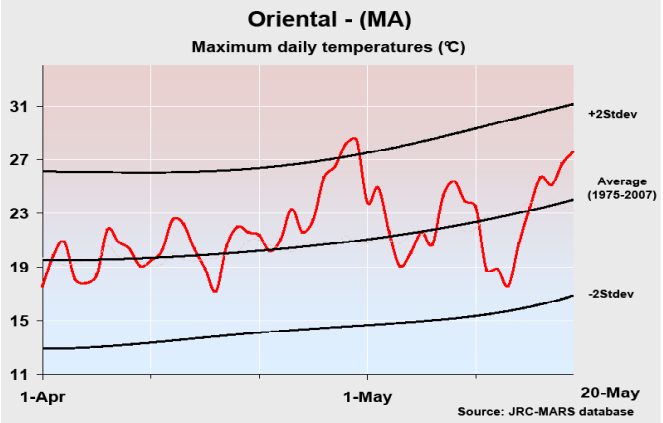
| Soft wheat | Yield t/ha | | | | |
|---|---|---|---|---|---|
| NUTS 1 | *2010 forecasts | **2009 yields | Average 5 years | %10/09 | %10/5yrs |
| Centre | **1.8** | 2.6 | 1.2 | -32.7 | +43.7 |
| Nord Ouest | **1.9** | 1.8 | 1.8 | +0.8 | +6.1 |
| Centre Nord | **1.5** | 2.0 | 1.4 | -27.5 | +3.3 |
| Centre Sud | **1.0** | 2.1 | 1.5 | -52.6 | -31.3 |
| Tensift | **0.5** | 2.3 | 0.6 | -78.5 | -15.2 |
| Oriental | **1.0** | 1.3 | 0.7 | -19.7 | +42.6 |
| Sud | **0.9** | 1.7 | 1.0 | -49.6 | -16.0 |

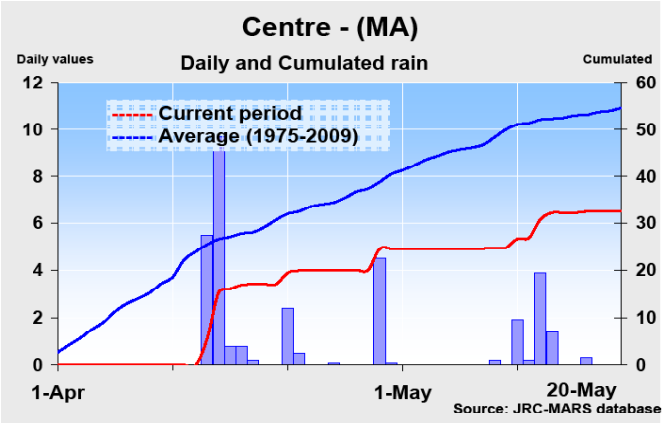
*CGMS,AGRI4CAST (20 May 2010); ** Source: INRA-Morocco

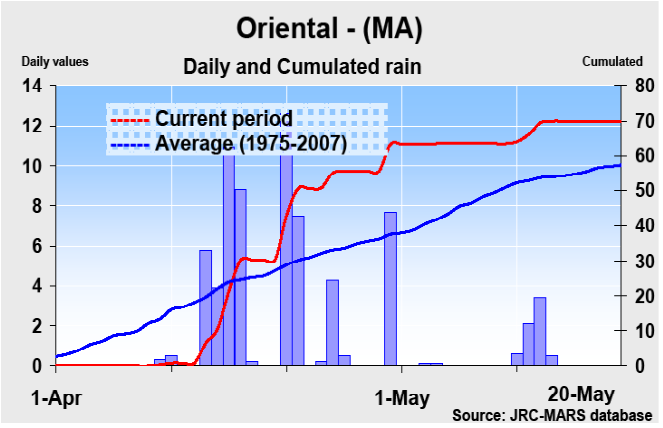
On the contrary, the same simulation for the Nord Ouest region indicates a poor evolution from mid-April and a stabilisation during the first dekad of May at a level below the long term average.

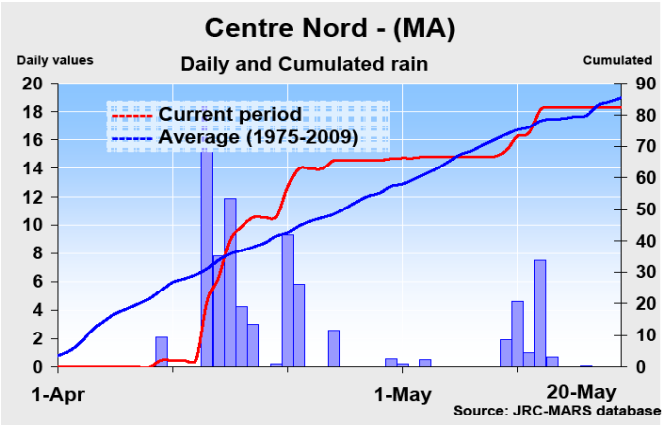
The situation in the Oriental region is a rather particular, since the conditions during the grain filling and ripening were favourable. The maximum temperatures were around the average except for a few days during the last dekad of April. Cumulated rainfall reached around 70 mm for the 1 April - 20 May period.

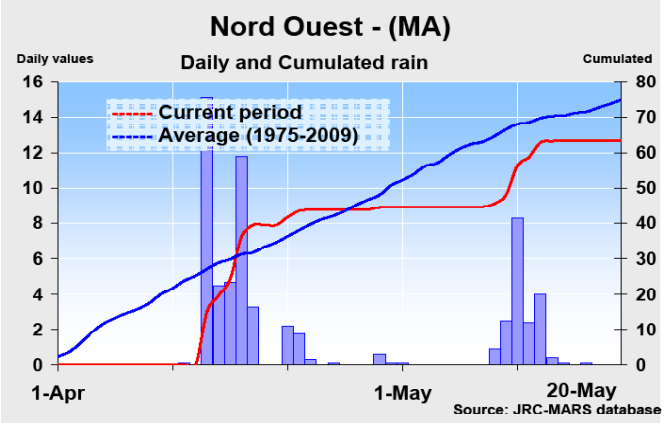


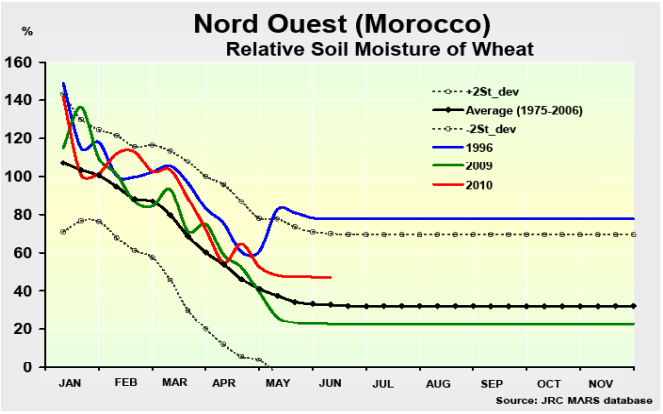



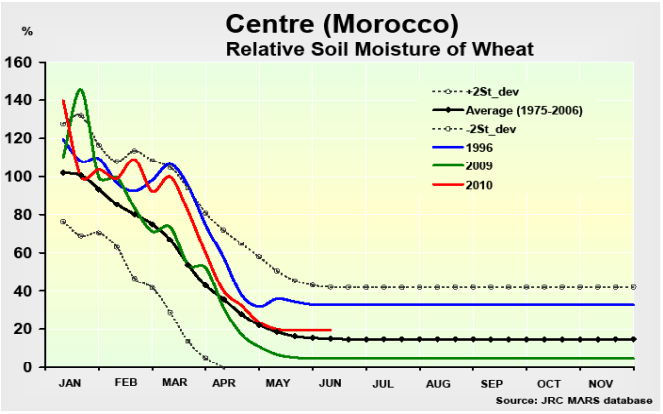



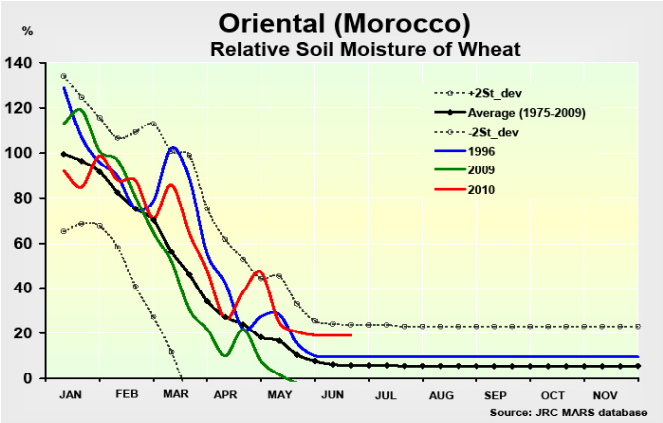



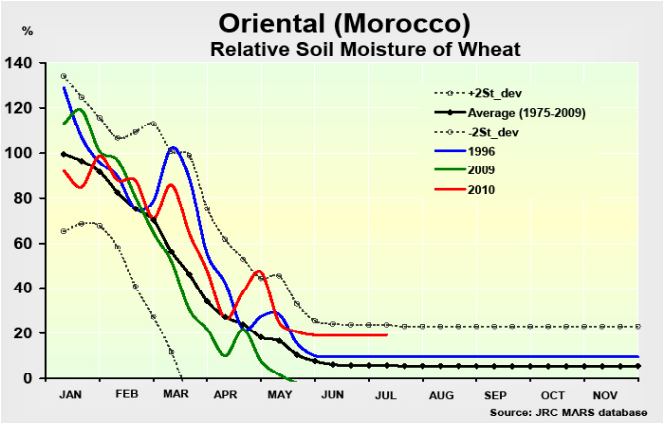



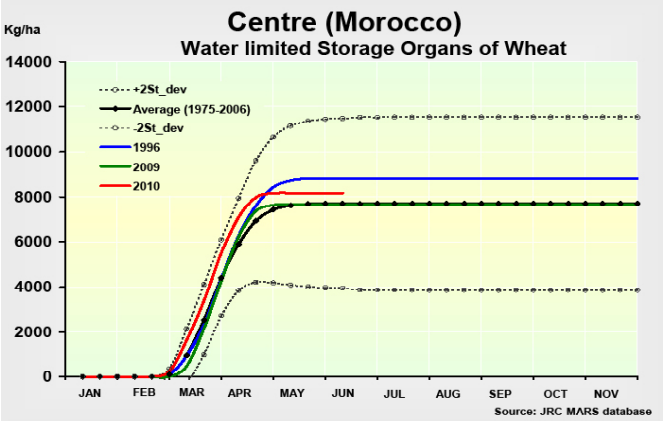



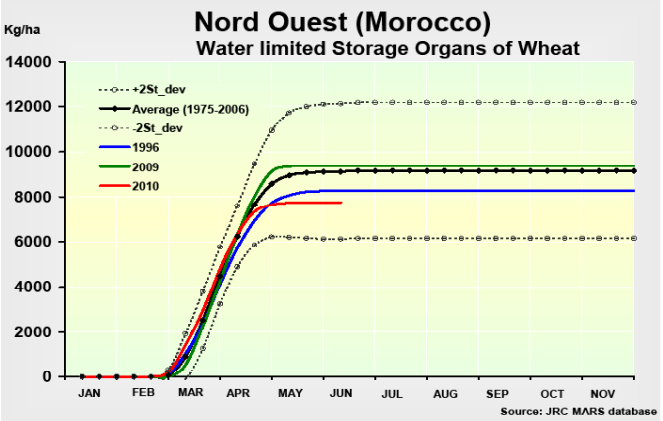



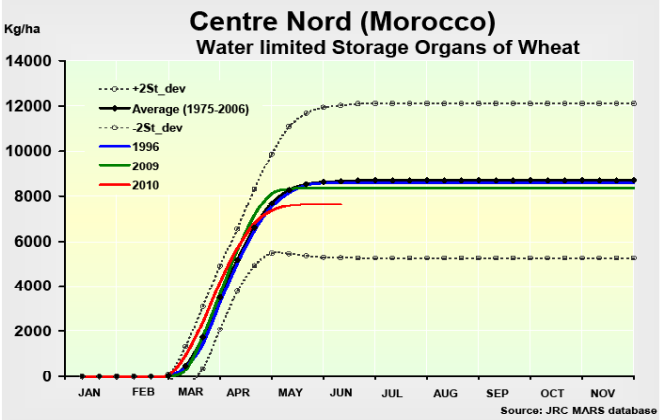



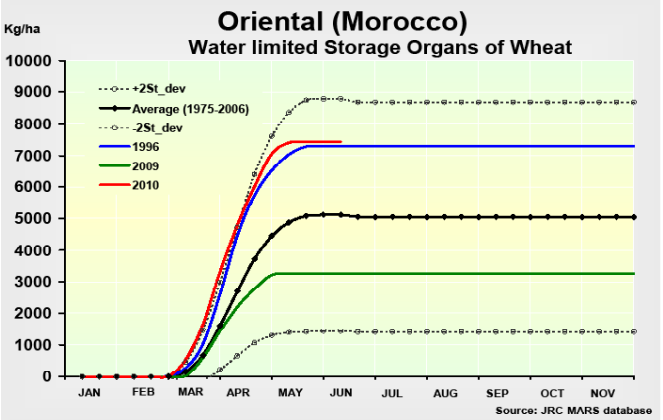



# 4.2. Durum wheat

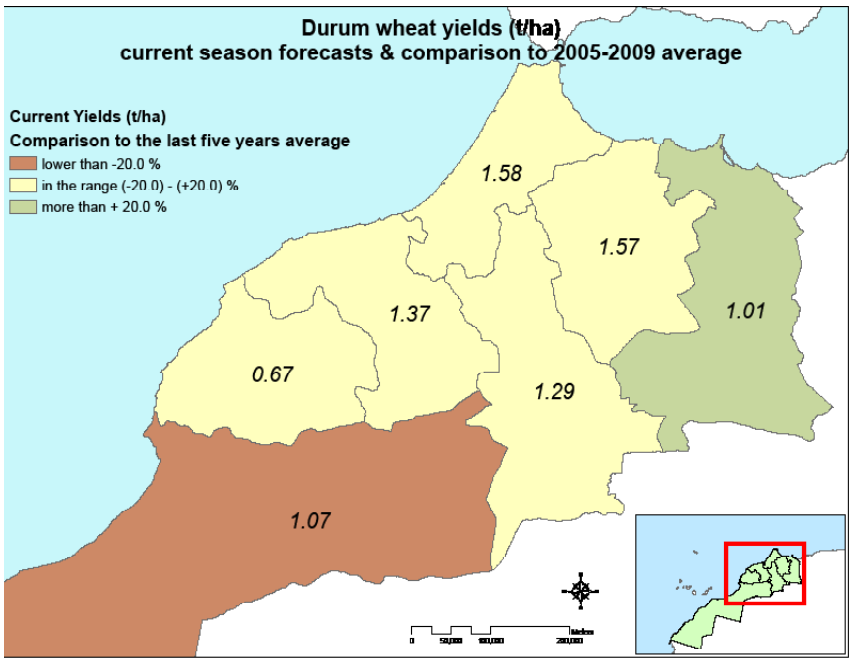
Regarding the national production since 1978, around 70 % of durum wheat is produced in the Centre region (30%), in the Nord Ouest (20%) and in the Centre Nord (20%). Tensift and Centre Sud regions produce about 10 % each, and less than 10 % of durum wheat is produced in the Oriental and Sud regions together.

The simulated yields for the current season indicate a decrease in performance in all administrative regions compared to last year, with a strong drop of about 70 % in Tensift and 50 % in Sud and Centre. (see the map).

In comparison to the last five years average, forecast yields for all regions are above, except in Tensift (-7 %) and Sud (-18 %). Despite a drop of more than 20 % in comparison to last year, the season is quite positive in Oriental with a yield foreast increase of 91 % compared to the last five year average.

| Durum wheat | Yield t/ha | | | | |
|---|---|---|---|---|---|
| NUTS 1 | 2010* forecasts | 2009** yields | Average 5 years | %10/09 | %10/5yrs |
| Centre | **1.4** | 2.6 | 1.2 | -47.2 | +14.8 |
| Nord Ouest | **1.6** | 1.7 | 1.6 | -6.9 | +0.3 |
| Centre Nord | **1.6** | 1.8 | 1.5 | -12.7 | +5.9 |
| Centre Sud | **1.3** | 1.9 | 1.2 | -35.4 | +4.9 |
| Tensift | **0.7** | 2.1 | 0.7 | -68.1 | -7.4 |
| Oriental | **1.0** | 1.3 | 0.5 | -22.5 | +91.4 |
| Sud | **1.1** | 2.1 | 1.3 | -51.4 | -18.1 |

*CGMS,AGRI4CAST (20 May 2010) ; ** Source: INRA-Morocco




## 4.3. Barley

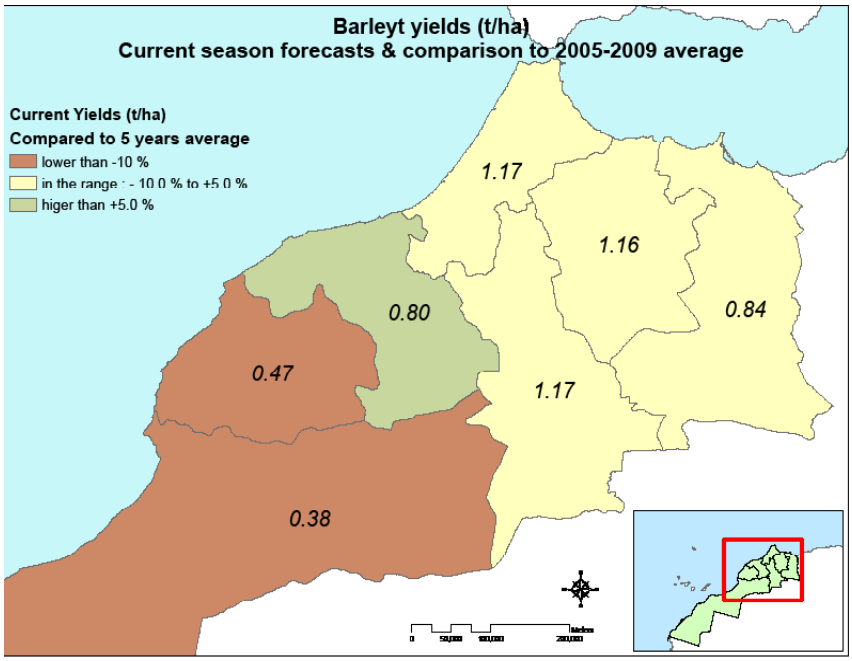
The relative importance of the barley is somewhat different from that of wheat. Nearly 60% of barley is produced in the Centre and Tensift. The Nord Ouest, Centre Nord and Oriental each account for about 10% of national production. Less than 10% is produced by the Centre Sud and Sud regions.

Compared to the previous campaign, barley yield is lower in all regions, a decrease from 22.9 % in Centre Nord to 76.1 % in the Sud. However, the estimated yield in Centre is still higher than last 5 years average.

The yields forecast in Centre Sud, Centre Nord and Nord Ouest are estimated at 1.2 t/ha in the three regions. The estimates indicate that only in Centre Nord, the yield would be higher than the 5 years average.

| Barley | Yield t/ha | | | | |
|---|---|---|---|---|---|
| NUTS 1 | 2010 forecasts | 2009 yields | Avg 1979-2008 | %10/09 | %10/5yrs |
| Centre | **0.8** | 2.2 | 0.9 | -63.6 | +9.7 |
| Nord Ouest | **1.2** | 1.6 | 1.1 | -26.8 | -6.7 |
| Centre Nord | **1.2** | 1.5 | 1.0 | -22.9 | +4.0 |
| Centre Sud | **1.2** | 2.0 | 1.2 | -41.6 | -8.5 |
| Tensift | **0.5** | 1.7 | 0.5 | -72.2 | -17.6 |
| Oriental | **0.8** | 1.3 | 0.9 | -35.5 | +1.2 |
| Sud | **0.4** | 1.6 | 0.4 | -76.1 | -12.0 |

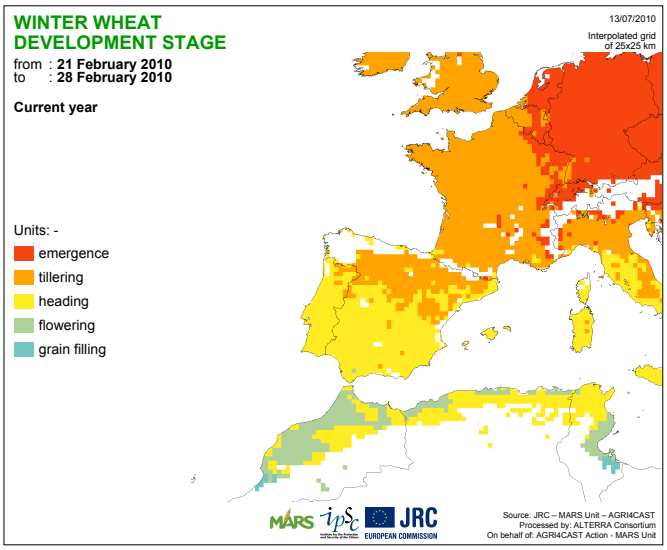
*CGMS,AGRI4CAST (20 May 2010); ** Source: INRA-Morocco

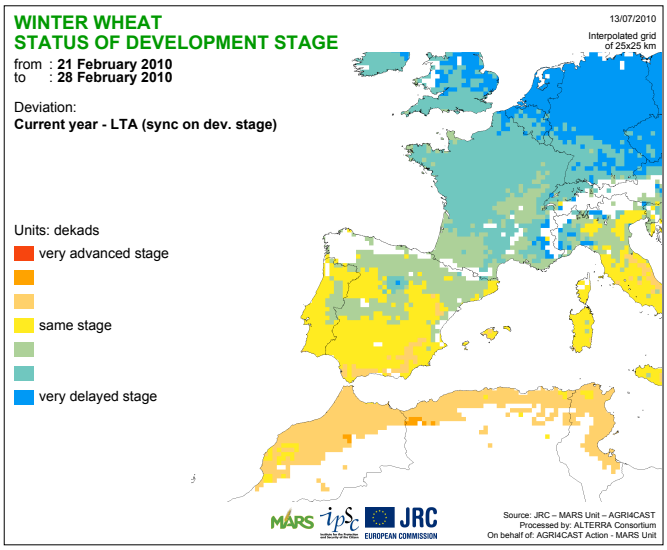


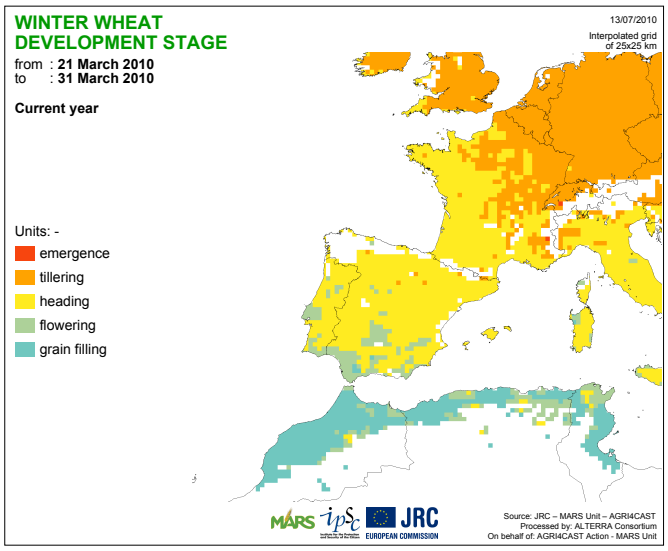
# 5. ATLAS MAP

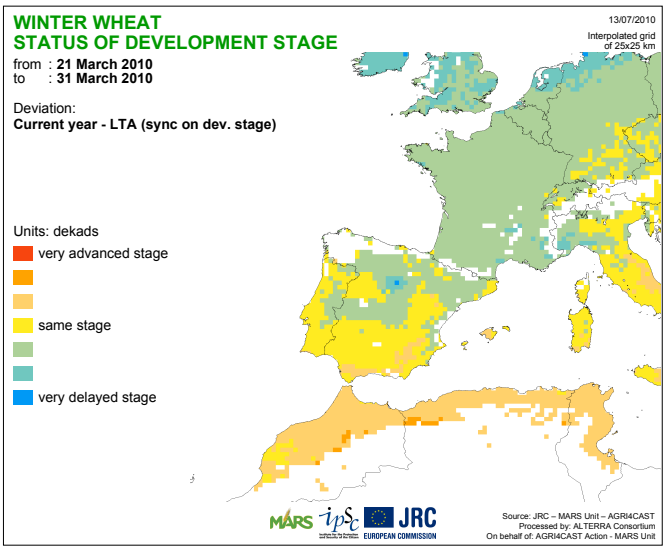
## 5.1 Wheat development stage

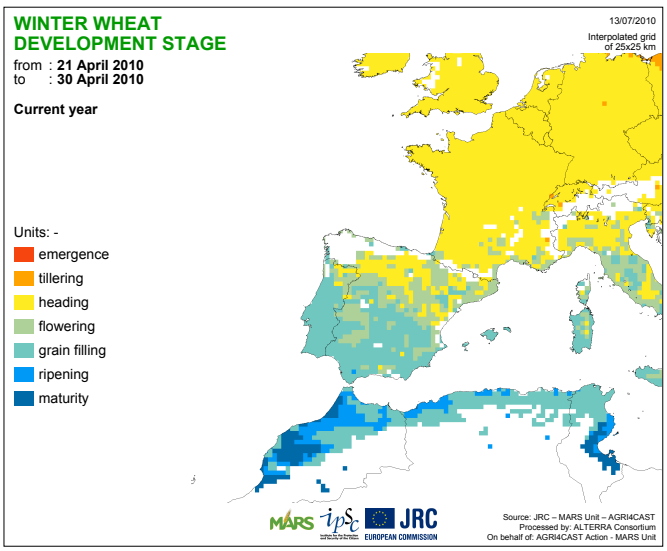
By the end of February, in the main cereal production regions (Centre, Nord Ouest), cereals were already at flowering stage. The meteorological conditions in March favoured crop development. Except in some places in the extreme north west and in the Oriental region, cereals reached grain filling stage by the end of March or early April. Unfortunately, the weather conditions in April were not favourable for good grain filling, with historical records of maximum temperatures. The ripening process evolution occurred in better conditions during May. In many provinces of Centre and Nord Ouest regions, maturity was reached already at the end of April, bringing harvesting forward. At the end of June almost 60 % of the winter cereals were harvested.

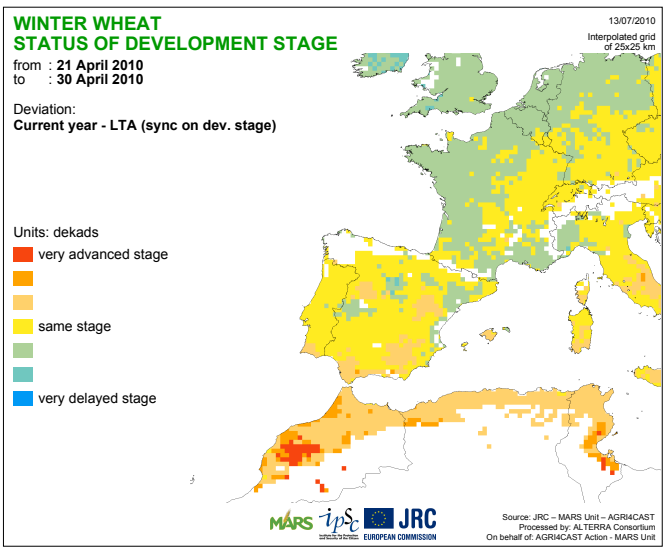


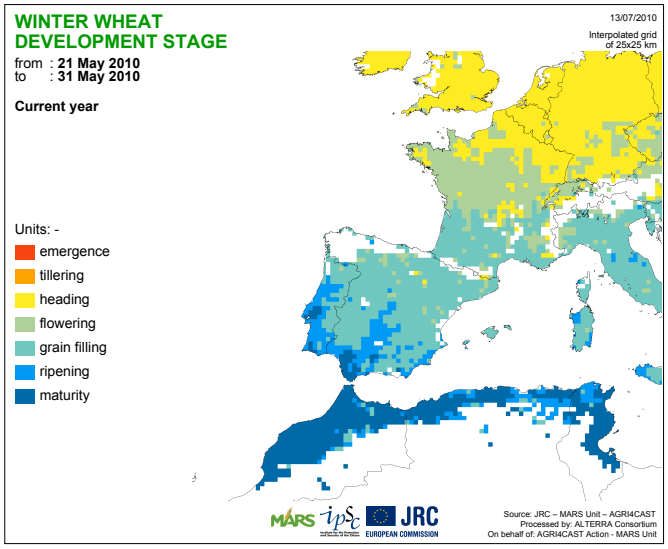



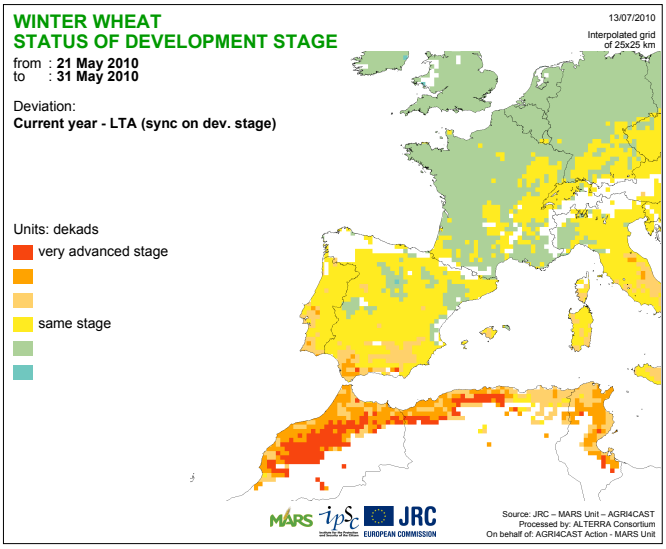



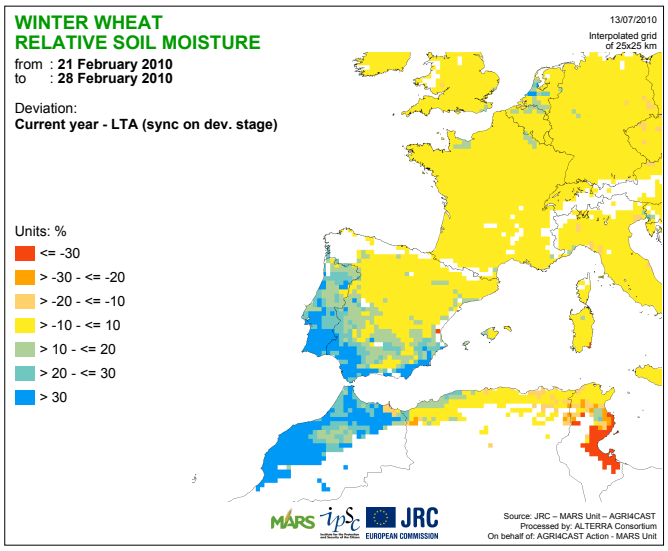



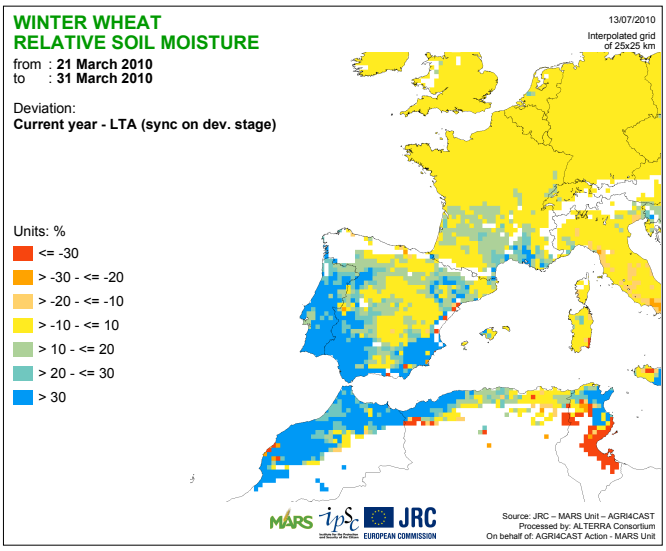



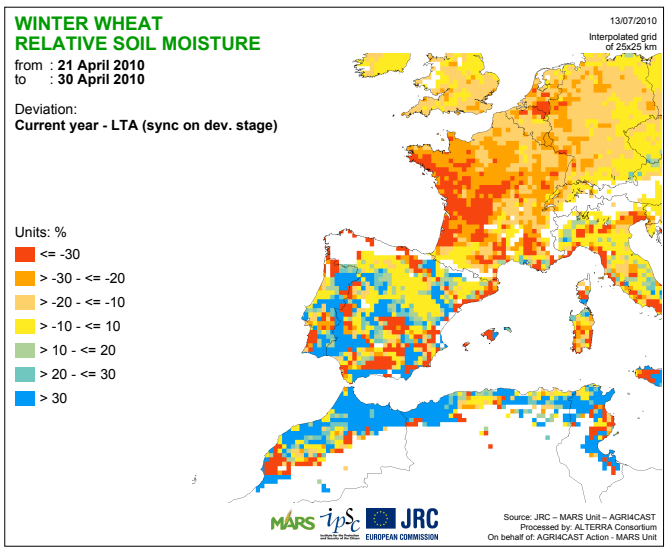


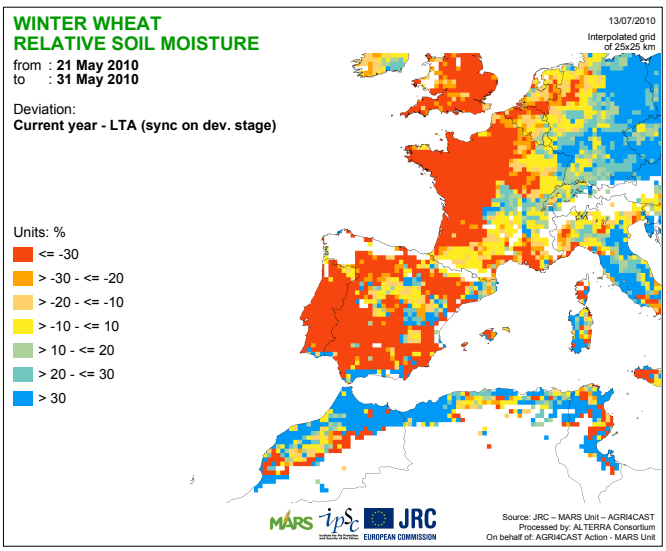




## 5.2 Relative soil moisture



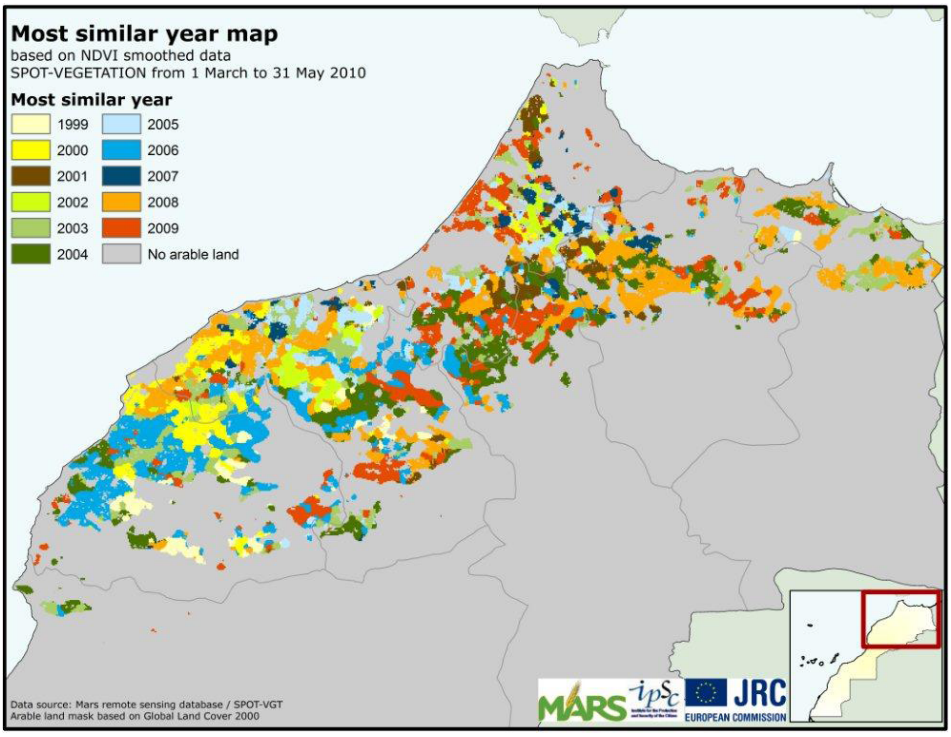



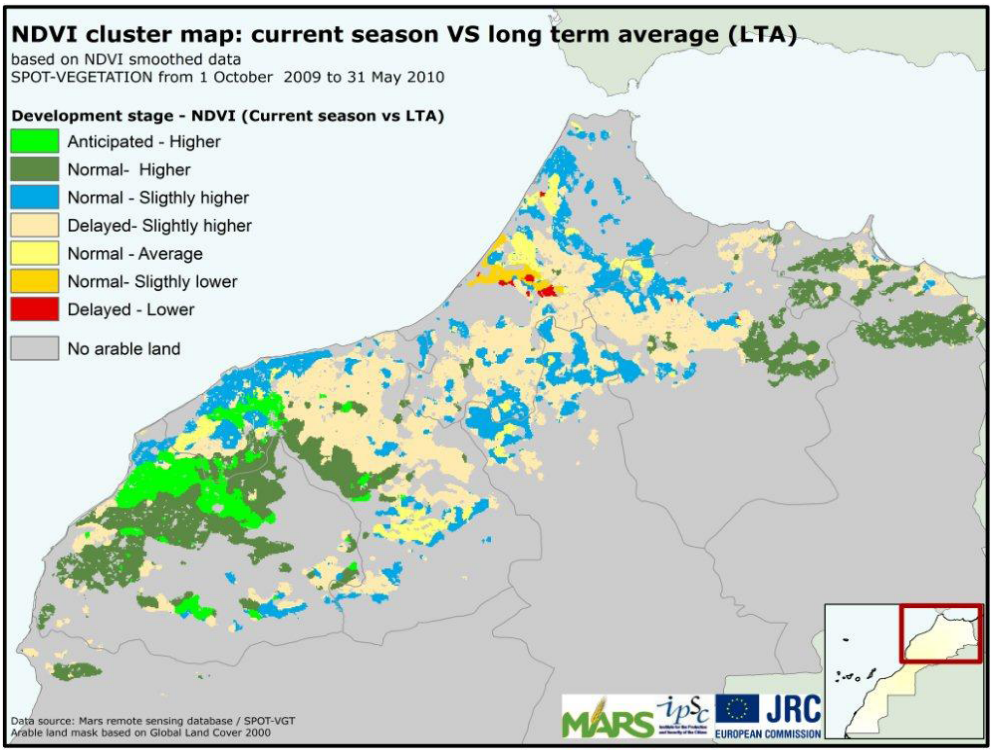
# 6. Satellite analysis

The *most similar year* map is computed comparing the current seasonal NDVI values for arable land to most similar season within the SPOT time series. The analysis is performed at pixel based and then a Majority filter, with a 7x7 pixel kernel, is applied aiming to highlight the most relevant years. The most similar year among the arable land is 2008 with almost 25% of the total pixels, while 2004 and 2006 have almost 20% each on the considered regions.




The NDVI cluster map displays the NDVI trend of current season against the long term average (LTA) dataset.

The comparison produces qualitative information on both biomass density and development stages, as the legend shows. Compared to the LTA, southern regions of Morocco have good vegetation development with stages that move from normal to advanced. Toward the ocean coast and in central regions, the plant growth moves to normal or delayed stages with biomass accumulation slightly above the average. Poor canopy evolution is present only in small regions in northern Morocco.

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