S.P.I. 04.89

Monitoring Agriculture with Remote-Sensing MARS

EUROPEAN COMMISSION
Joint Research Centre
I.P.S.C - MARS Unit

ipsc Institute for the Protection and Security of the Citizen

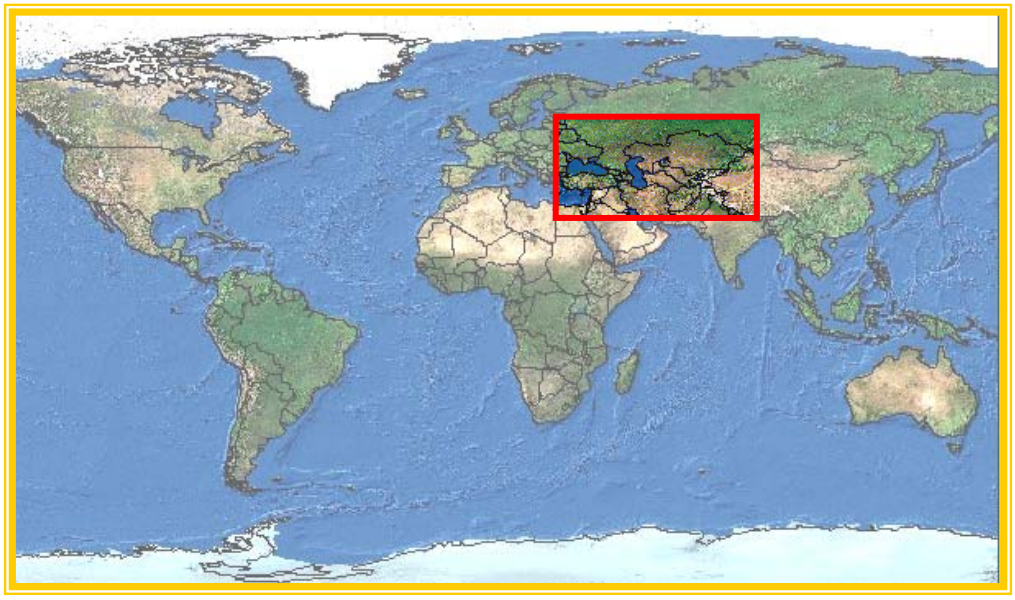
MONITORING AGRICULTURE for FOOD SECURITY

Russia and Central Asian Countries

Situation at the End of April 2004

Agro-meteorological overview for March-April 2004

Bulletin N1, 2004



Introduction

The present Bulletin is dedicated to the analysis of the agro-meteorological situation in Russia and Central Asian countries during the period from the beginning of March to the end of April 2004, and gives a qualitative assessment of the winter cereals status at the end of this period.

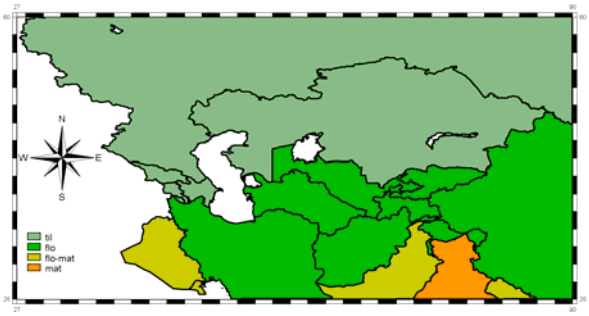
Crops. In most countries of the region, it is mid-season for winter crop development. Only in Northern India winter crops are close to harvesting.

Wheat and barley are the main crops cultivated during the winter period in most countries. Additionally, sugar cane and rape seed are grown in Northern India, Northern Pakistan, Western China and Northern Nepal, as well as potatoes and fodder crops in Afghanistan, rice in Northern India, and rye in Russia and Kazakhstan. In many countries of the region more than 90% of wheat and barley are cultivated as winter crops. However more than 90% of wheat and barley in Kazakhstan, near 70% of wheat and more than 90% of barley in Russia are spring crops. Near 90% of barley in Armenia, and Kyrgyzstan, and near 40% of wheat in Kyrgyzstan, more than 60% of barley in Tajikistan, and near 40% of barley in Georgia is cultivated in summer too.

Practically all winter crops in Russia and Kazakhstan are cultivated in rain-fed conditions. In Tajikistan, Uzbekistan, Georgia and Armenia near 30% of winter crops are irrigated. In Kyrgyzstan, Azerbaijan, Iran, Iraq and Afghanistan near 40-70% of winter crops are cultivated in irrigated conditions. And in Turkmenistan, Kuwait, Northern India, Northern Pakistan, Western China and Northern Nepal practically all winter crops are irrigated.

country	*Production and Yield, 2003 (source FAO)*	
	wheat	**barley**
Russia	**34030 (1,6)**	**17946 (2,1)**
Armenia	**320 (2,6)**	**83 (1,3)**
Azerbaijan	**1575 (2,5)**	**275 (2,3)**
Georgia	**234 (1,8)**	**55 (1,3)**
Kazakhstan	**11800 (1,0)**	**2050 (1,2)**
Kyrgyzstan	**1084 (2,3)**	**146 (2,0)**
Tajikistan	**569 (1,9)**	**40 (2,0)**
Turkmenistan	**2534 (3,0)**	**31 (0,6)**
Uzbekistan	**4550 (3,7)**	**90 (1,8)**
Afghanistan	**No data**	**No data**
Iraq	**No data**	**No data**
Iran	**12900 (2,0)**	**2000 (1,4)**
Kuwait	**0,5 (2,3)**	**2,0 (1,4)**
India	**69320 (2,8)**	**1280 (1,9)**
Nepal	**1344 (2,0)**	**29 (1,1)**
Pakistan	**19210 (2,4)**	**107 (1,0)**
China	**86100 (3,9)**	**3115 (3,6)**

First figure is a production (1000 tons), figure in brackets – yield (t/ha). Green color indicates figures which are higher than normal and red color indicates figures which are lower than normal.



Winter crops status in March-April: pale green – **tillering***; green –* **near flowering***; olive green –* **flowering-maturing**; *orange –* **maturing** *(based on long-term average data, source FAO).*

Methods. The agro-meteorological situation during the period of analysis is compared with the situation during the previous season, and with long-term average data. The monitoring of the agro-meteorological situation is based on the analysis of the following dekadal data: minimal, maximal and average air temperature, sums of precipitation and global radiation, dekadal values of the climatic water balance, and maps of the Normalized Difference Vegetation Indexes (NDVI). Meteorological data are derived from the outputs of the numerical meteorological model from ECMWF (UK), and were prepared for analysis by METEOCONSULT (NL). SPOT-VEGETATION data were used as a basis for calculation of the remote sensing indicators of crop growth. Data were preprocessed by VITO (BE). Dekadal maximal NDVI values were weighted for pixels, where crops are cultivated, for each country of the region. Weighted NDVI values were used as an indicator of crop status. Dry Matter Production maps were calculated by VITO based on SPOT-VEGETATION data and information about global radiation, applying the Monteith approach.

Area cultivated and other factors (fertilizers, pesticide inputs, pests, diseases) which may be predominant in some cases are not taking into account.

The Bulletin has the following structure. The next page contains the highlights and the main results of the analysis. The following pages are dedicated to the analysis of separate indicators of the crop growth during the period of analysis.

Acknowledgements. *The following organizations were involved in data supply: VITO (BE), METEOCONSULT (NL), ECMWF (UK).*

Disclaimer. *The geographical borders are purely a graphical representation and are only intended to be indicative. These boundaries do not necessarily reflect the official EC position.*

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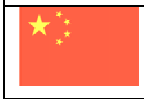
Highlights Country by Country

	Russia	Agro-meteorological conditions during March-April 2004 were favorable for winter crops, and winter crops status at the end of April 2004 was better comparing with the previous year.
	Armenia	Agro-meteorological conditions during March-April 2004 were favorable for winter crops, but worse than in previous year. Winter crops status at the end of April 2004 was better comparing with the previous year.
	Azerbaijan	Agro-meteorological conditions during March-April 2004 were favorable for winter crops, but worse than in previous year. Winter crops status at the end of April 2004 was better comparing with the previous year.
	Georgia	Agro-meteorological conditions during March-April 2004 were favorable for winter crops Winter crops status at the end of April 2004 was better comparing with the previous year.
	Kazakhstan	Agro-meteorological conditions during March-April 2004 were favorable for winter crops. Winter crops status at the end of April 2004 was better comparing with the previous year.
	Kyrgyzstan	Agro-meteorological conditions during March-April 2004 were favorable for winter crops, but worse than in previous year. Winter crops status at the end of April 2004 was better comparing with the previous year.
	Tajikistan	Agro-meteorological conditions during March-April 2004 were favorable for winter crops, but worse than in previous year. Winter crops status at the end of April 2004 was close to the previous year.
	Turkmenistan	Agro-meteorological conditions during March-April 2004 were favorable for winter crops, but worse than in previous year. Winter crops status at the end of April 2004 was worse comparing with the previous year.
	Uzbekistan	Agro-meteorological conditions during March-April 2004 were favorable for winter crops, but worse than in previous year. Winter crops status at the end of April 2004 was close to the previous year.
	Afghanistan	Agro-meteorological conditions during March-April 2004 were favorable for winter crops only in the northern part of the country, and worse than in previous year. Winter crops status at the end of April 2004 was worse than in the previous year.
	Iran	Agro-meteorological conditions during March-April 2004 were favorable for winter crops, and close to the previous year. Winter crops status at the end of April 2004 was close to the previous year.
	Iraq	Agro-meteorological conditions during March-April 2004 were unfavorable for winter crops due to scarce precipitation, but close to the previous year. Winter crops status at the end of April 2004 was close to the previous year.
	Kuwait	Agro-meteorological conditions during March-April 2004 were unfavorable for winter crops due to scarce precipitation, but close to the previous year. Winter crops status at the end of April 2004 was close to the previous year.
	Northern India	Agro-meteorological conditions during March-April 2004 were unfavorable for winter crops due to scarce precipitation, and worse than in the previous year. Winter crops status at the end of April 2004 was worse than in the previous year.
	Northern Nepal	Agro-meteorological conditions during March-April 2004 were favorable for winter crops, and close to the previous year. But winter crops status at the end of April 2004 was worse than in the previous year.
	Northern Pakistan	Agro-meteorological conditions during March-April 2004 were unfavorable for winter crops due to scarce precipitation, and worse than in the previous year. Winter crops status at the end of April 2004 was worse than in the previous year.
	Western China	Agro-meteorological conditions during March-April 2004 were favorable for winter crops. Winter crops status at the end of April 2004 was better comparing with the previous year.

Results of the analysis

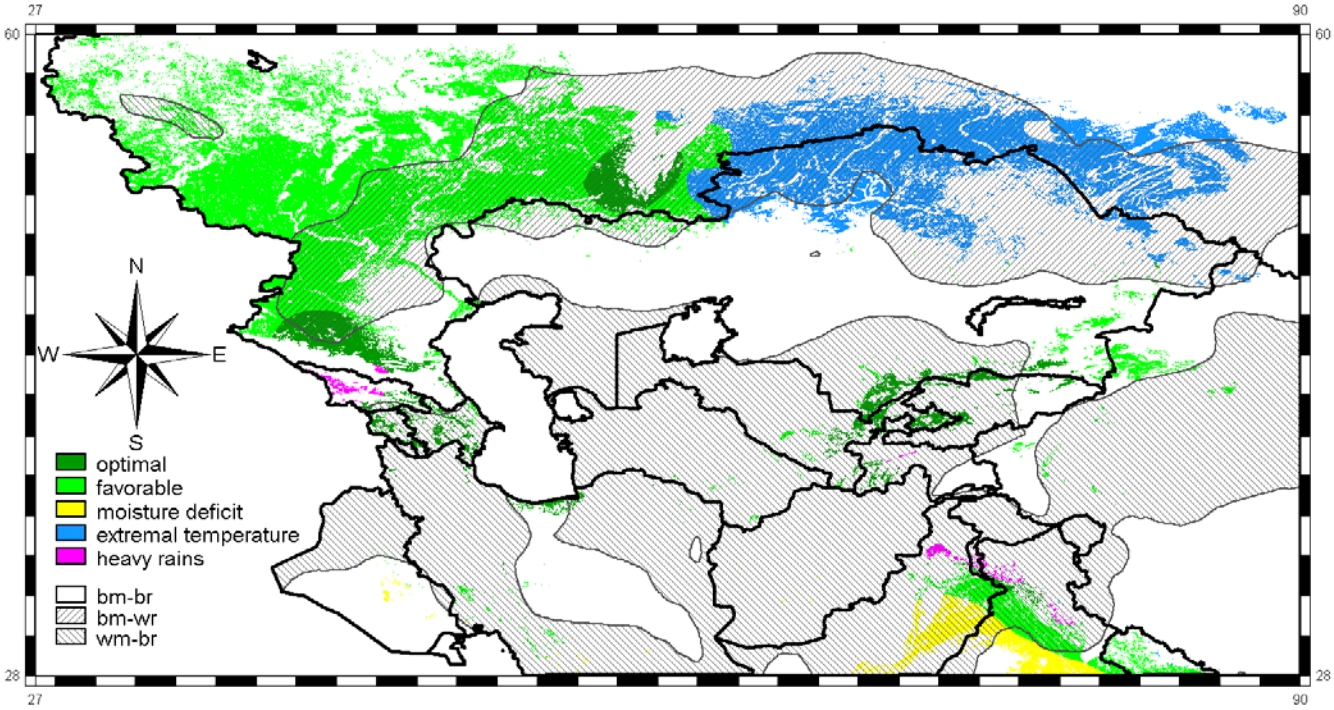
The meteorological conditions during March-April 2004 were favourable or close to optimal for winter crop growth practically in all countries of the region. Insufficient amount of precipitation in some regions of Northern India, Northern Pakistan, Afghanistan, Iran, in Iraq and Kuwait couldn't affect winter crops, which are grown primarily in irrigation conditions. Heavy rains, which took place during the period of analysis in some regions of India, Pakistan, Tajikistan, and Georgia, seems were not very harmful for winter crop because it was at the beginning of the vegetation stage in Tajikistan and Georgia, and close to harvest in India and Pakistan. Extremely low temperatures could damage winter crops in Siberian Russia, and northern Kazakhstan, but winter crop areas in these regions are small.

In general the meteorological situation for winter crops during March-April 2004 was better than in previous year only in Russia, Georgia, Kazakhstan, and in Western China, and was worse in Armenia, Azerbaijan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Afghanistan, Northern India, and Northern Pakistan.

The winter crop status at the end of April 2004 is likely to be better than last year in Russia, Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, and in Western China, and worse in Turkmenistan, Afghanistan, Northern India, Northern Nepal, and Northern Pakistan.

country	*comparing with previous year*	
	Meteorological conditions during March-April	*Winter crop status at the end of April*
Russia	+	+
Armenia	-	+
Azerbaijan	-	+
Georgia	+	+
Kazakhstan	+	+
Kyrgyzstan	-	+
Tajikistan	-	=
Turkmenistan	-	-
Uzbekistan	-	=
Afghanistan	-	-
Iraq	=	=
Iran	=	=
Kuwait	=	=
Northern India	-	-
Northern Nepal	=	-
Northern Pakistan	-	-
Western China	+	+

Favorability of meteorological conditions during March-April 2004 for winter crops (in color):
color on the map shows favorability and main limitations (see legend on the left)
Comparison with the conditions of previous year:
hatchings show units, where: **br** *– better radiation regime;* **bm** *– better moisture regime;* **wr** *– worse radiation regime;* **wm** *– worse moisture regime*



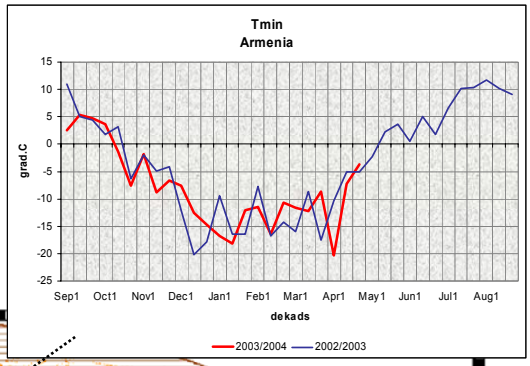
Global Radiation and Temperature Conditions

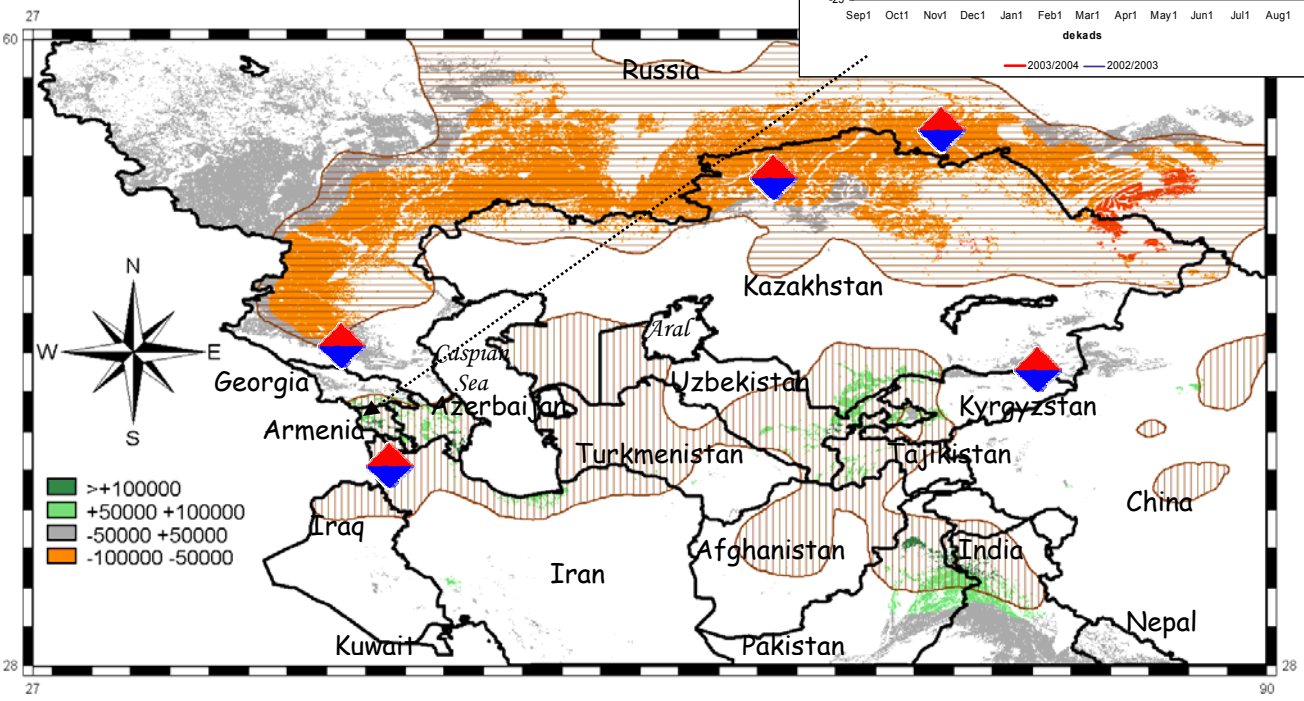
The amount of radiation in general was close to optimal for winter crop development in all countries of the region.
The radiation sum during March-April was higher than **normal** in Northern Pakistan, Northern India, Northern Nepal and Afghanistan. A slightly less than normal amount of radiation was received by croplands in other countries of the region. Only in Kyrgyzstan amount of radiation was close to normal.
Comparison with the **previous year** shows that less radiation during March-April was received only by croplands in Russia, and Northern Kazakhstan. More radiation was received in Armenia, Azerbaijan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Afghanistan, Iran, Northern India, and Northern Pakistan.
The air temperature during March-April was slightly higher than normal practically in all countries of the region. Extremely "cold" days (with minimal air temperature below -20^{0}C) were observed during March-April only in southern and Siberian regions of Russia, in northern Kazakhstan, eastern Kyrgyzstan, and in Armenia. Days with the minimum air temperature below - 4^{0}C were dominant in March in the northern regions of Kazakhstan, and in the Siberian part of Russia, where the areas with winter crops are not significant.

Global radiation (March-April)	comparing with previous year
Russia	-
Armenia	+
Azerbaijan	+
Georgia	=
Kazakhstan	-
Kyrgyzstan	+
Tajikistan	+
Turkmenistan	+
Uzbekistan	+
Afghanistan	+
Iraq	=
Iran	+
Kuwait	=
Northern India	+
Northern Nepal	=
Northern Pakistan	+
Western China	=

Difference in Global Radiation Sum (kJ/m^2) for the period March-April between 2004 and 2003 (only for croplands, in colours). Hatching shows regions with a difference higher than 5% (vertical–positive, horizontal–negative).

- extremely low air temperature





Precipitation Sum

The amount of precipitation during March-April 2004 was extremely limited in Iraq, Kuwait, southern Afghanistan, Northern India, and Northern Pakistan.

In general the amount of precipitation was higher than **normal** during this period in all former Soviet Union countries (except Kyrgyzstan and Tajikistan, where it was near normal), in Iran and in Western China, and was lower than normal in other countries of the region. The maximal negative difference with normal values was registered for Iraq, Kuwait, Northern Pakistan, Northern India, and for central and southern Afghanistan.

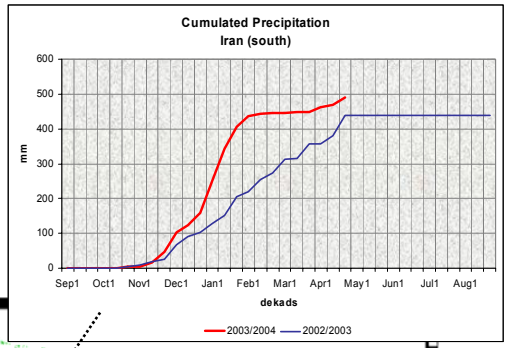
More precipitation than in **previous year** was observed during the period under analysis in Russia, Georgia, Kazakhstan, Northern Nepal and Western China, and less was observed in Armenia, Azerbaijan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Afghanistan, and in Northern Pakistan.

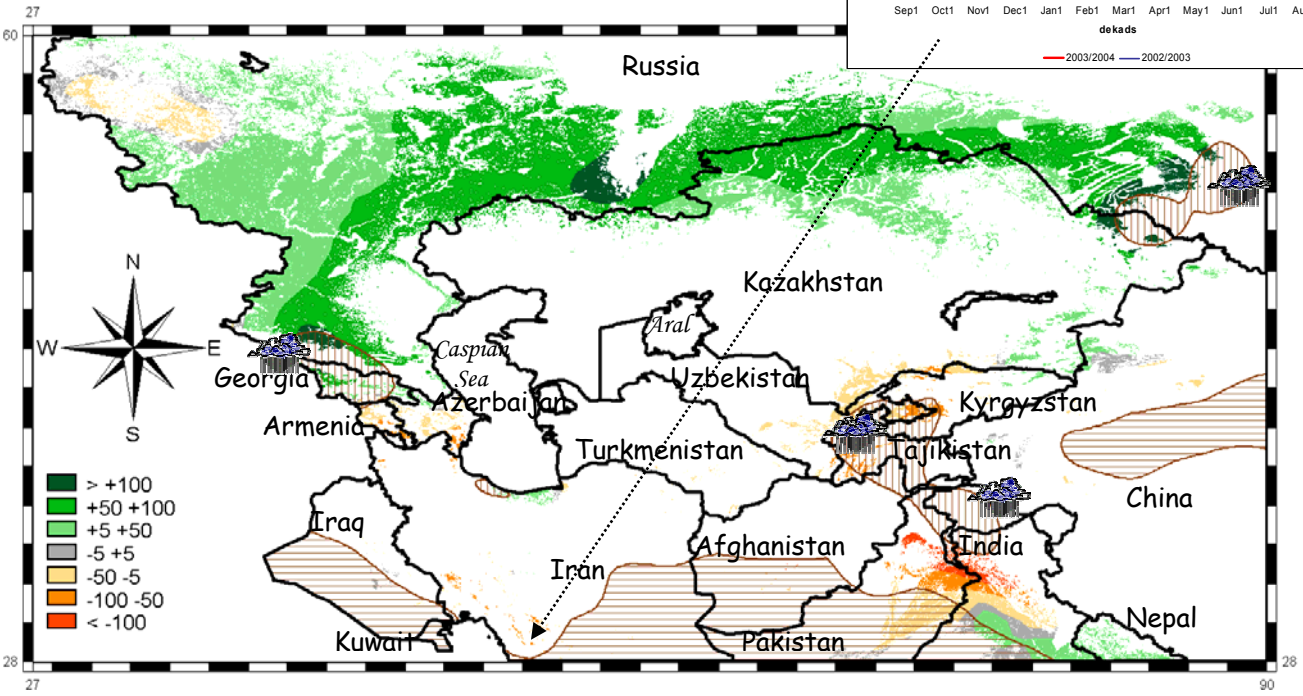
Comparison of the amount of precipitation cumulated for the current **vegetative season** (November-April) with the similar period of previous season shows that current season more favourable in terms of precipitation for winter crops in southern Russia, northern Kazakhstan, Uzbekistan, Georgia, Armenia, Iraq, and in Northern India, and worse in southern Kazakhstan, Afghanistan, and Northern Pakistan.

Precipitation (March-April)	comparing with previous year
Russia	+
Armenia	-
Azerbaijan	-
Georgia	+
Kazakhstan	+
Kyrgyzstan	-
Tajikistan	-
Turkmenistan	-
Uzbekistan	-
Afghanistan	-
Iraq	=
Iran	=
Kuwait	=
Northern India	=
Northern Nepal	+
Northern Pakistan	-
Western China	+

Difference in Precipitation Sum (mm) for the period March-April between 2004 and 2003 (only for croplands, in colours). Horizontal hatching shows regions with amount of precipitation less than 20 mm during March-April 2004, vertical hatching shows regions with amount of precipitation more than 200 mm for the same period.

- heavy rains (more than 100 mm of precipitation per dekad)





Climatic Water Balance

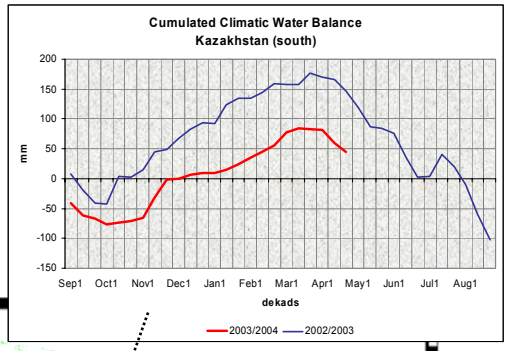
The dekads with positive climatic water balance were dominant during March-April 2004 in all former Soviet Union republics, in northern Iran, and in Western China. The climatic water balance was negative in other countries of the region.

The climatic water balance was not worse comparing **with long-term average data** in Iraq, Kuwait, Northern Nepal, and especially in Northern Pakistan, Northern India, and Afghanistan. It was better during March-April comparing with long-term average values for this period of the year in Russia, Kazakhstan, northern Iran, and Caucasus countries.

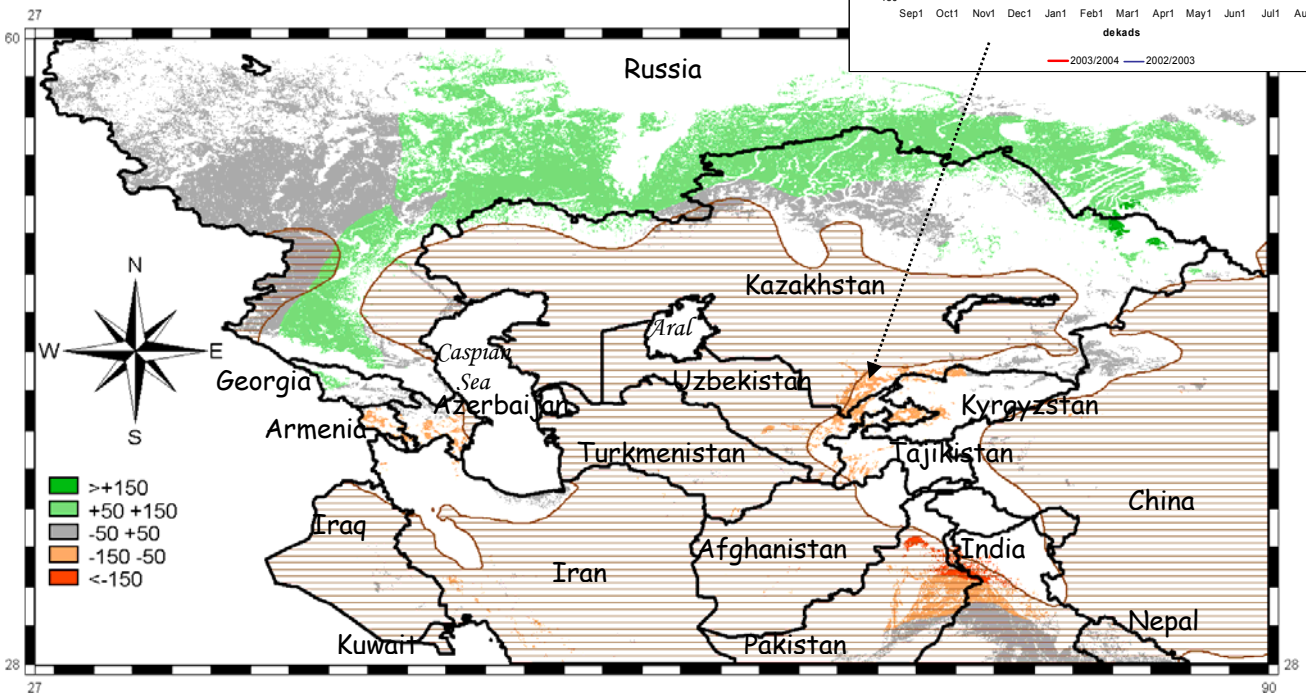
Situation is better for the period March-April in the current year than in the **previous year** in Russia, Georgia, and Kazakhstan, and worse in Armenia, Azerbaijan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Afghanistan, Iran, Northern India, and Northern Pakistan. The situation in other countries was close to the previous year.

Comparison of the climatic water balance cumulated for the current **vegetative season** (November-April) with the similar period of previous season shows that the current season is more favourable in terms of climatic water balance for winter crops in Russia, northern Kazakhstan, Uzbekistan, Georgia, Armenia, Iraq, and Western China, and worse in southern Kazakhstan, Kyrgyzstan, Tajikistan, Azerbaijan, northern Afghanistan, and Northern Pakistan.

Climatic Water Balance (March-April)	comparing with previous year
Russia	+
Armenia	-
Azerbaijan	-
Georgia	+
Kazakhstan	+
Kyrgyzstan	-
Tajikistan	-
Turkmenistan	-
Uzbekistan	-
Afghanistan	-
Iraq	=
Iran	-
Kuwait	=
Northern India	-
Northern Nepal	=
Northern Pakistan	-
Western China	=



Difference in Climatic Water Balance (mm) for the period March-April between 2004 and 2003 (only for croplands, in colours). Horizontal hatching shows regions with negative water balance during March-April 2004.



Remote Sensing Indicators

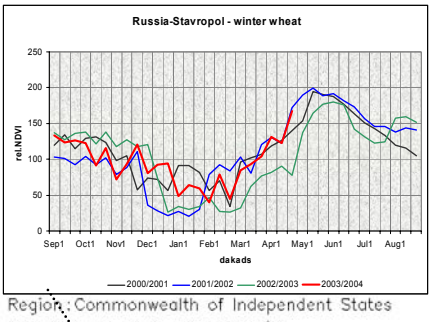
Dekadal NDVI maps demonstrate that snow cover disappeared in the Siberian part of Russia and in northern Kazakhstan only in April.

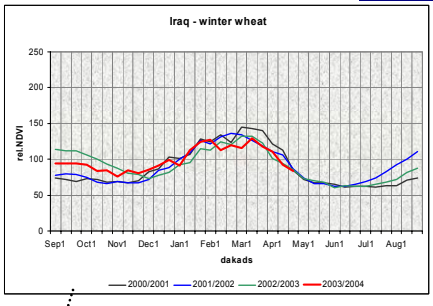
The NDVI curves shows that at the end of April the winter crops status in general was better comparing with last year in Russia, Kazakhstan, Kyrgyzstan, Caucasus countries, and in Western China, and worse in Turkmenistan, Afghanistan, Northern India, Northern Nepal, and Northern Pakistan. The situation with winter crops in Tajikistan, Uzbekistan, Iraq, Iran, and Kuwait appears close to the previous year. The results of the NDVI analysis show that crop status has high spatial variability in Turkmenistan, Tajikistan, Afghanistan, Pakistan, and Iraq.

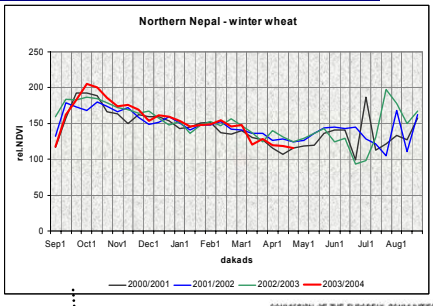
The NDVI curves behaviour in the current vegetative season is close to the 2001/2002 situation in Iran, Iraq, Kuwait, Caucasus countries, Tajikistan, Uzbekistan, and in Central regions of Russia. It is close to the 2000/2001 situation in Kyrgyzstan, Northern Pakistan, Northern Nepal, and in the rest regions of Russia.

The analysis of the Dry Matter Production modelling results shows that less dry matter than in previous year was (potentially) produced in March-April in Northern India, Northern Pakistan, central Iraq, southern Tajikistan, and in southern Turkmenistan, and more dry matter was produced in other countries, especially in southern Russia, southern Kazakhstan, northern Iran, and eastern Uzbekistan.

NDVI indicator of winter crop status	comparing with previous year
Russia	+
Armenia	+
Azerbaijan	+
Georgia	+
Kazakhstan	+
Kyrgyzstan	+
Tajikistan	=
Turkmenistan	-
Uzbekistan	=
Afghanistan	-
Iraq	=
Iran	=
Kuwait	=
Northern India	-
Northern Nepal	-
Northern Pakistan	-
Western China	+







Region : Commonwealth of Independent States
Period : April, 2004, Decade 2/3
Theme : Normalized Difference Vegetation Index (NDVI)
Maximum value in decade
Source : SPOT-VEGETATION