Chapter 1. Global agroclimatic patterns

Chapter 1 describes the CropWatch Agroclimatic Indicators (CWAIs) rainfall (RAIN), temperature (TEMP), and radiation (RADPAR), along with the agronomic indicator for potential biomass (BIOMSS) in sixty-five global Monitoring and Reporting Units (MRU). RAIN, TEMP, RADPAR and BIOMSS are compared to their average value for the same period over the last fifteen years (called the “average”). Indicator values for all MRUs are included in Annex A table A.1. For more information about the MRUs and indicators, please see Annex B and online CropWatch resources at **www.cropwatch.com.cn**.

1.1 Introduction to CropWatch agroclimatic indicators (CWAIs)

This bulletin describes environmental and crop conditions for the period from April 2020 to July 2020, AMJJ, referred to as “reporting period”. In this chapter, we focus on 65 spatial “Mapping and Reporting Units” (MRU) which cover the globe, but CWAIs are averages of climatic variables over agricultural areas only inside each MRU. For instance, in the “Sahara to Afghan desert” MRU, only the Nile valley and other cropped areas are considered. MRUs are listed in Annex B and serve the purpose of identifying global climatic patterns. Refer to Annex A for definitions and to table A.1 for 2020 AMJJ numeric values of CWAIs by MRU. Although they are expressed in the same units as the corresponding climatological variables, CWAIs are spatial averages limited to agricultural land and weighted by the agricultural production potential inside each area.

We also stress that the reference period, referred to as “average” in this bulletin covers the 15-year period from 2005 to 2019. Although departures from the 2005-2019 are not anomalies (which, strictly, refer to a “normal period” of 30 years), we nevertheless use that terminology. The specific reason why CropWatch refers to the most recent 15 years is our focus on agriculture, as already mentioned in the previous paragraph. 15 years is deemed an acceptable compromise between climatological significance and agricultural significance: agriculture responds much faster to persistent climate variability than 30 years, which is a full generation. For “biological” (agronomic) indicators used in subsequent chapters we adopt an even shorter reference period of 5 years (i.e. 2015-2019) but the BIOMSS indicator is nevertheless compared against the longer 15YA (fifteen-year average). This makes provision for the fast response of markets to changes in supply but also to the fact that in spite of the long warming trend, some recent years (e.g. 2008 or 2010-13) were below the trend.

Correlations between variables (RAIN, TEMP, RADPAR, BIOMSS) at MRU scale derive directly from climatology. For instance, the positive correlation between rainfall and temperature results from high rainfall in equatorial, i.e. in warm areas.

Considering the size of the areas covered in this section, even small departures may have dramatic effects on vegetation and agriculture due to the within-zone spatial variability of weather. It is important to note that we have adopted a new calculation procedure of the biomass production potential in the August 2019 bulletin. The new approach includes sunshine (RADPAR), TEMP and RAIN. Readers are referred to the August 2019 bulletin for details.

1.2 Global overview

At the global scale, temperatures continue to stay at or near record highs in 2020: Between January and July, they were 1.05°C above the 20th-century average, only 0.04°C below the record set in 2016 according to NOAA, which bases its analyses on a global data set spanning 141 years. May tied with 2016 as the warmest May on record. June was the third warmest on record, while July ranked as second. Both months were 0.92°C above their respective averages measured during the last century. For the northern hemisphere, this was the hottest July ever.

CropWatch calculates the temperatures over cropland only. Averaged over all cropland, temperatures were 0.1°C lower than the 15-year average (15YA) for this period ranging from April to July, 2020. Rain continued to be above average (+4.6%). Increased cloud cover associated with rain reduced the photosynthetically active radiation (RADPAR) by 1.0%. Biomass (+0.1%) stayed close to the 15YA. Overall, the prospects for crop production were quite favorable, mainly because no large scale droughts were observed and the increased precipitation over cropping regions dampened the effects of the global warming trend during this monitoring period.

On a global scale, most regions benefitted from above-average rainfall. Central Asia (+32%), followed by East Asia (+9%), North America (+7%) and Europe (+6%) had the highest increase over the 15YA. Negative departures for total rainfall were observed in two regions only: Central and South America (-7%) and Oceania (-6%).

Temperatures over cropland in North America and Europe were 0.5°C below the 15YA. East Asia also experienced slightly cooler-than-average temperatures (-0.2°C), whereas temperatures were 0.2°C above average in Central and South America. For the other regions, the deviations were minimal, hovering around +/-0.1°C.

Central and South America (+1.7%) and South Asia (+1.0%) were the only regions for which above average solar radiation was observed. The largest reductions were noted for East Asia (-3.6%), Central Asia (-2.9%), North America (-2.4%), Oceania (-2.3%), followed by Africa (-1.5%) and Europe (-1.4%).

Accordingly, biomass production, which is calculated as a function of rainfall, temperature and solar radiation, changed as follows: Increases were estimated for South Asia (+6.4%), Central Asia (+2.3%) and Central and South America (+1.4%). Decreases were noted for East Asia (-5.6%), Europe (-3.8%), Oceania (-3.0%) and North America (-1.4%) and no departure from the 15YA for Africa.

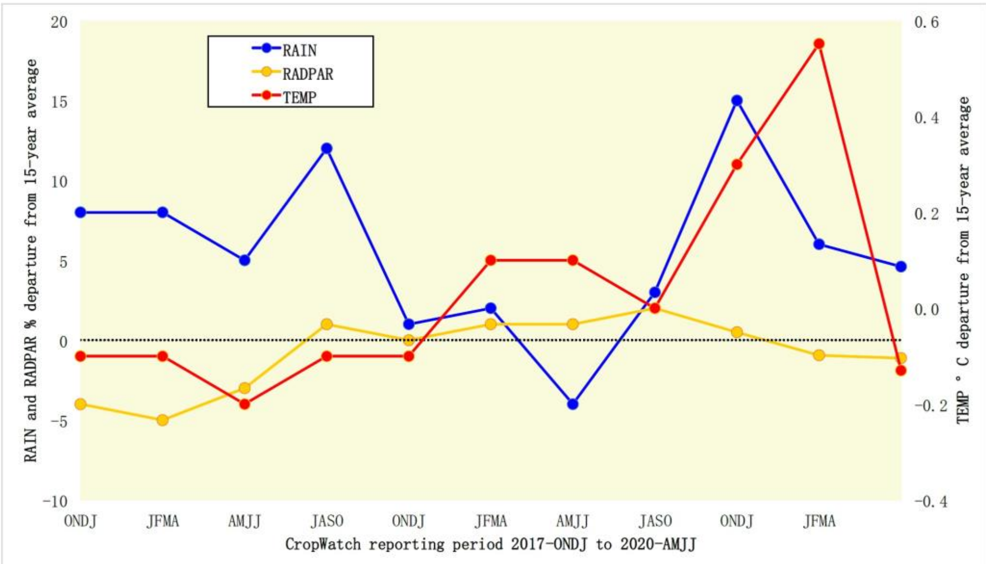
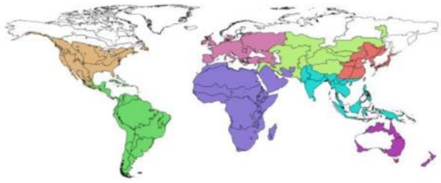


Figure 1.1 Global departure from recent 15 year average of theRAIN, TEMP and RADPAR indicators since 2017 ONDJ period (average of 65 MRUs, unweighted)

Table 1.1 Departures from the recent 15-year average of CropWatch agro-climatic indicators over regional MRU groups. Within each group, averages are weighted by the agricultural area of individual MRUs. "Others" include five non agricultural areas shown in white in the map. They are located mostly at high northern latitudes, and characterized by the largest positive TEMP departure. Some of them experienced unusually intense fires in their recent summer season.

	RAIN %	TEMP °C	RADPAR %	BIOMSS %
Africa	0	0.0	-1.5	0.0
America S + C	-7	0.2	1.7	1.4
America N	7	-0.5	-2.4	-1.4
Asia centre	32	0.0	-2.9	2.3
Asia East	9	-0.2	-3.6	-5.6
Asia South	3	0.0	1.0	6.4
Europe	6	-0.5	-1.4	-3.8
Oceania	-6	-0.1	-2.3	-3.0
Others	4	0.0	-1.7	-1.3
World	**4.6**	**-0.1**	**-1.0**	**0.1**



1.3 Rainfall (Figure 1.2)

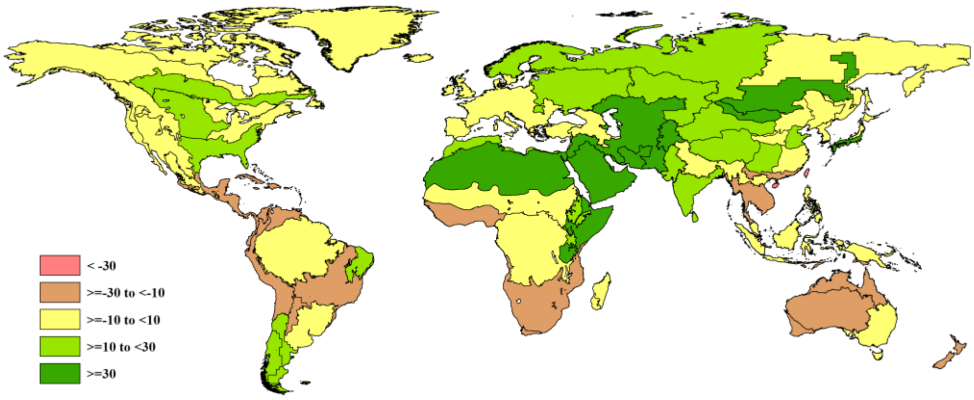


Figure 1.2 Global map of rainfall anomaly (as indicated by the RAIN indicator) by CropWatch Mapping and Reporting Unit: departure of April to July 2020 total from 2005-2019 average (15YA), in percent.

Rainfall was above average in the Canadian Prairies, the Northern Corn Belt and the Cotton Belt in the USA. Excessive rainfall in spring prevented maize sowing in parts of North and South Dakota. Other than that, rainfall conditions for North America were favorable. Central America, the Caribbean, the Andean countries, except for Austral Chile and Argentina, and large parts of Brazil suffered from below-average rainfall. Central-North Argentina was hardest hit (-29.3%). In general, the same regions in South America for which rainfall was below average during the previous monitoring period, also experienced drier-than-usual conditions during the current period.

In Africa, the countries north of the Sahel and the East African Highlands (+23.2%), including the Horn of Africa (+53.7%), received above average rainfall. The belt from the Sahara to the Afghan deserts received 50.7 mm rainfall on average (+78.3%). This region, together with the East African Highlands, continues to be plagued by locusts, which thrive on lush vegetation. Rainfall in the Gulf of Guinea was below average (-18.4%). However, the rainy season was off to a good start. Conditions were drier than usual in Southern Africa (-26%) and the Western Cape (-12.4%). In this region, wheat, which is predominantly irrigated, is the only major crop that is grown during this monitoring period.

In Western and Central Europe and Turkey, rainfall recovered to average levels, though soil moisture remains on the dry side. Rainfall was more than 10% above average for the Ukraine, which had suffered from drought conditions during early spring.

Above-average rainfall was also recorded for the Scandinavian countries, Russia, Kazakhstan, the Hindu Khush, southern India, Mongolia and most of China. Mainland South-East Asia continued to be affected by below-average rainfall (-22.3%), although average rainfall for the monitoring period was 907.5 mm. Rainfall in Eastern Australia returned to average (-1%), however the situation in South-West and Southern Australia remain critical, as rainfall was 17% below the 15YA.

1.4 Temperatures (Figure 1.3)

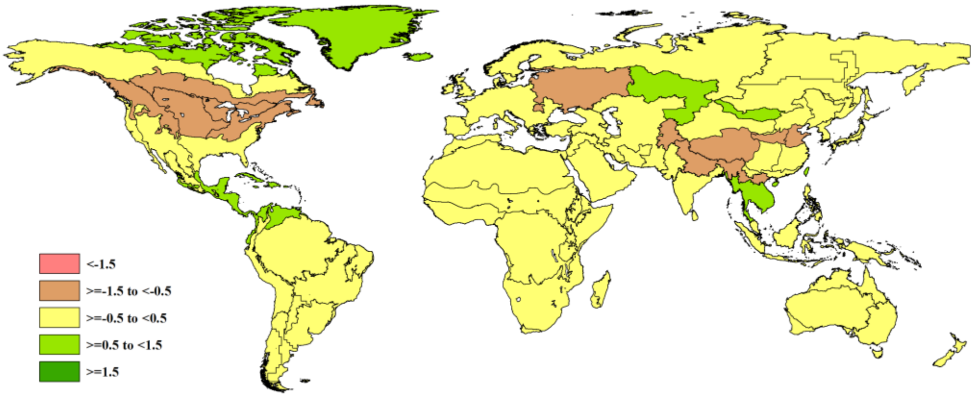


Figure 1.3 Global map of temperature anomaly (as indicated by the TEMP indicator) by CropWatch Mapping and Reporting Unit: departure of April to July 2020 average from 2005-2019 average (15YA), in °C

Average temperatures recorded during this monitoring period remained close to the 15YA for most regions on Earth during this period, i.e., they remained within -0.5 to +0.5°C. The Canadian Prairies and the northern half of the USA experienced temperatures that were 0.5 to 1.5°C below the 15YA. Central America and the Caribbean, on the other hand, experienced above-average temperatures (+0.5 to +1.5°C). The region from the Ukraine to the Ural Mountains was cooler than the 15YA (-1.0°C). Cooler temperatures (-0.5 to -1.5°C) were also observed for the Himalayas, Tibet and the North China Plain. In mainland South-East Asia, temperatures were 0.6 °C above average.

1.5 RADPAR (Figure 1.4)

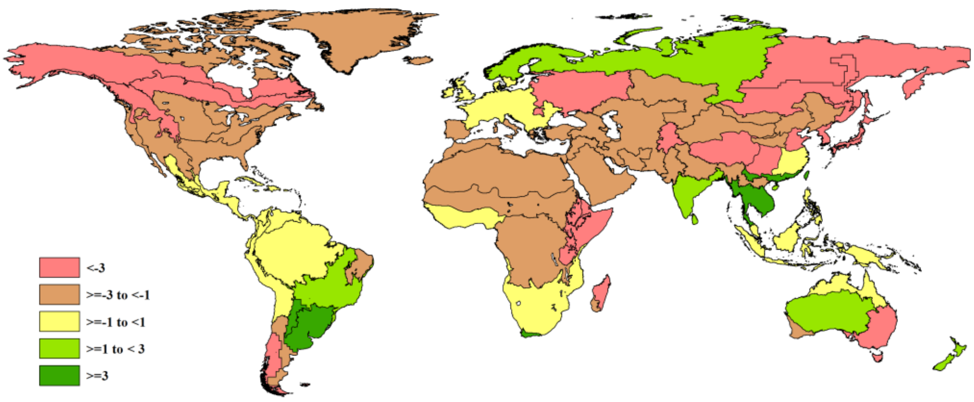


Figure 1.4 Global map of photosynthetically active radiation anomaly (as indicated by the RADPAR indicator) by CropWatch Mapping and Reporting Unit: departure of April to July 2020 total from 2005-2019 average (15YA), in percent.

Most of North America, except for Central Mexico, received below-average photosynthetically active solar radiation. Conditions in Central America, the Caribbean and the Central-northern Andes were close to average. RADPAR was up (+7%) for the Pampas and North-Central Argentina. Vast parts of Brazil also experienced above-average radiation, except for the North-East (-1.9%).

In Africa, the Western Cape (+6.2%) was the only MRU which received signifcant above-average radiation. For most parts, radiation departed by more than -1% from the 15YA. The deficit was largest for Madagascar (-6.9%), the East African Highlands (-5.4%) and the Horn of Africa (-3.3%).

In Central and Eastern Europe, solar radiation was close to average. For the region from the Ukraine to the Ural Mountains, it was 3.3% below average.

Central Asia, as well as Eastern Asia experienced below-average radiation. A large deficit was observed for the North China Plain (-4.8%), Southwest China (-8.4%) and East Asia (-4.7%). Positive departures were noted for South of India (+1.3%), Southern China (+5.4%) and mainland Southeast Asia (+5.4%).

In Australia, solar radiation was below the 15YA in the western (-1.2%) and eastern (-3.6%) wheat production regions.

1.6 BIOMSS (Figure 1.5)

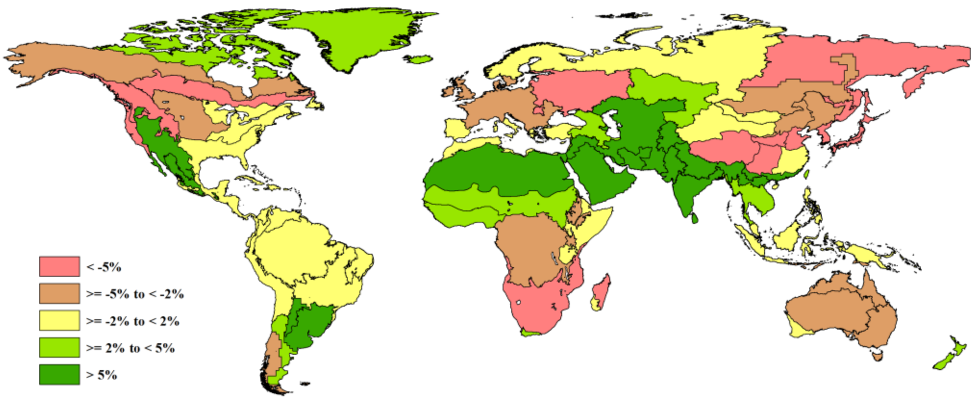


Figure 1.5 Global map of biomass accumulation (as indicated by the BIOMSS indicator) by CropWatch Mapping and Reporting Unit (MRU), departure from 15YA between between January and April 2019

The new calculation procedure for the BIOMASS indicator incorporates the combined effect of precipitation, sunshine and temperature. It is a very synthetic climate-based but agronomic value-added indicator which assesses the biomass production potential and hence the likely effect of weather on crop photosynthesis.

Biomas production was quite variable among the different regions in North America. It was above average for the Northwest of Mexico and the southwest of the USA (+5%). The West Coast (-9.9%) as well as the Canadian Prairies (-11.5%) were far below the 15 YA. The reduction was slightly less for the Northern Great Plains (-4.0%). For the remaining regions of North America, Central America and most of South America, biomass production was near the long-term average. The only exception were the Pampas (+7.2%) and Central North Argentina (+11.4%).

In Africa, biomass production was above average for the northern half, whereas a negative trend was observed for southern Africa (-8%), with the exception of the Western Cape (+3.5%).

In Europe, production was down by -3.9%. The region from the Ukraine to the Ural (-6.8%) suffered an even larger drop. This may have had a negative effect on wheat yields, as in those two regions, wheat was in the grainfilling phase in May and June.

For most of Western, Central and South Asia, production was more than 5% above the 15YA. In China, production was more than 5% below average in Tibet and Southwest China. Below average solar radiation in the Loess region (-9.1%) and the North China Plain (-8.8%) may have had a negative impact on wheat yields, which reached maturity during this monitoring period. East Asia (-7.7%) was also below average.

In Australia, the negative departures were more moderate and ranged between -3.6 to -4%.