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). Rainfall, temperature, and radiation indicators are compared to their average value for the same period over the last fifteen years (called the "average"), while BIOMSS is compared to the indicator's average of the recent five years. Indicator values for all MRUs are included in Annex A table A.1. For more information about the MRUs and indicators, please see Annex C and online CropWatch resources at www.cropwatch.com.cn.

1.1 Overview

Over the current reporting period and based on findings from all 65 MRUs, the CropWatch indicator with the largest variability in departure from average conditions is temperature (as measured by the coefficient of variation of TEMP departures from average for all 65 units), followed by rainfall (RAIN), BIOMSS and radiation (RADPAR). Nevertheless, global temperature was close to average (-0.1 °C), while rainfall was 8% above average and radiation 4% below, which is significant and constitutes the continuation of globally low radiation values highlighted in the previous CropWatch bulletin. In general, for the reporting period, no significant correlation exists between the intensity of RAIN and BIOMSS and their departures from average. However, the correlation is negative for TEMP, i.e. warm climates had large negative departures, which is clearly visible in figure 1.2. There is positive correlation for RADPAR .

Starting with rainfall, the sections below will focus on the description of anomaly patterns (see also figures 1.1 through 1.4).

1.2 Abnormal rainfall patterns

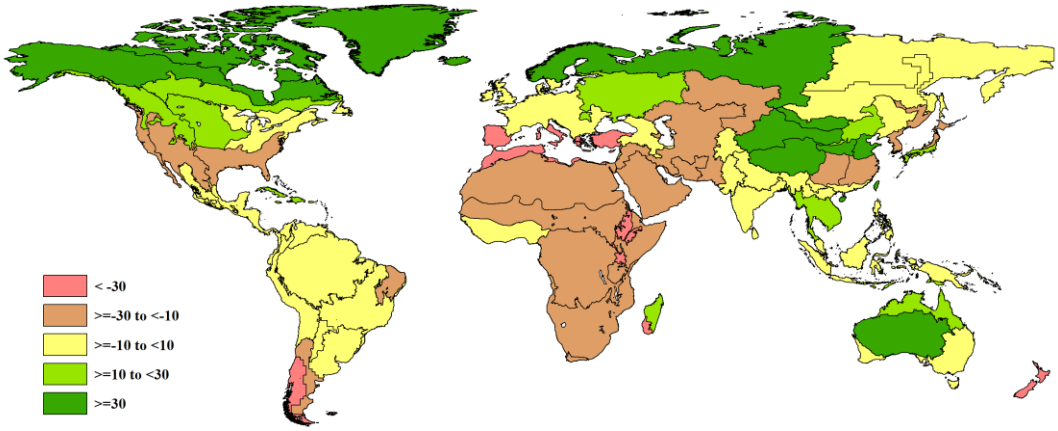
The driest areas occur in four relatively isolated southern patches in Western Patagonia (MRU-27, -50%) and the adjacent semiarid southern cone (MRU-28, -20%), the Nordeste in Brazil (MRU-22, -11%), South-west Madagascar (MRU-06, -48%) and New-Zealand (MRU-56, -48%). This is followed by a large contiguous area including almost all of Africa (except the Gulf of Guinea, MRU-03, with a slight deficit of -7%), the Mediterranean, the Middle East and western Asia extending into western central Asia. In this large ensemble, water deficit affected mostly the periphery in the north and the east: MRU-07, North Africa with a deficit of 39%, Mediterranean Europe and Turkey (MRU-59, -35%) and MRU-02, the East African highlands with a deficit of 34%. In western Asia (MRU-31) and the Ural to the Altai mountain range (MRU-62) the deficit is less severe at -15% and -13%, respectively.

The two remaining rainfall deficit patches include: two MRUs at -24% (MRU-43, East Asia; MRU-37, Lower Yangtze) as well as South-west China (MRU-41 at -18%) and a band extending from Florida to California and British Columbia with the following departure values: -29% in the Cotton Belt to NE Mexico (MRU-14); -28% along the western USA Coast (MRU-16) and -13% in the south-western USA and the Mexican highlands (MRU-18).

Large positive departures occur essentially in one area of major agricultural relevance, encompassing Huanghuahai (MRU-34) and the Loess region of China (MRU-36) at +47% and +113%, respectively. Adjacent areas less important for crops (but not for livestock) are listed hereafter by increasing values of rainfall excess: MRU-39 (Qinghai-Tibet, +36%), Gansu-Xinjiang (MRU-32, +80%) and southern Mongolia

(MRU-47, +204%). Although its rainfall departure reaches just 27%, MRU-35 (Inner Mongolia) is also part of this cluster. Smaller departures to be mentioned include Madagascar (MRU-05, +14%), continental south-east Asia (MRU-50, +30%), MRU-11 and MRU-15 (British Columbia and the Northern Great Plains, +21% and +25%, respectively) as well as MRU-58 (the area from Ukraine to the Ural mountains) with +22%.

Figure 1.1. Global map of October 2017 to January 2018 rainfall anomaly (as indicated by the RAIN indicator) by MRU, departure from 15YA (percentage)

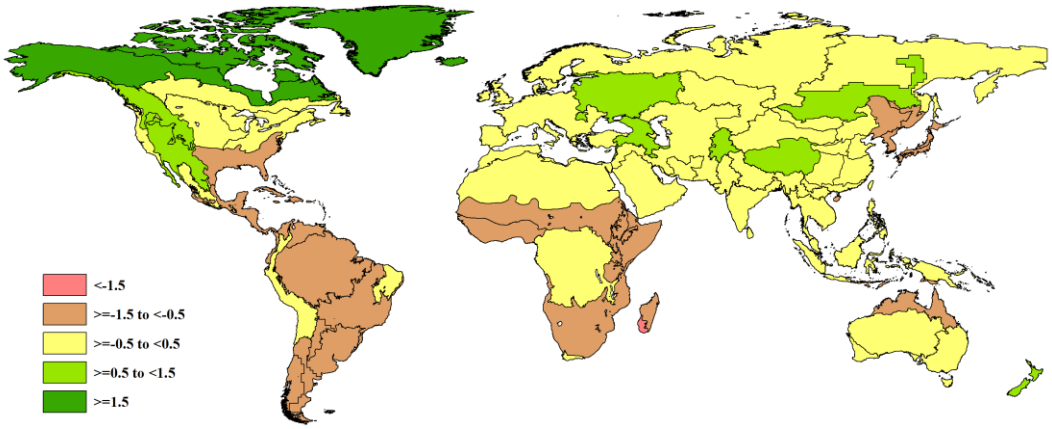


1.3 Abnormal temperature patterns

With the exception of southern Madagascar (MRU-06, -1.9 °C) most temperature anomalies in agriculturally relevant areas were moderate, not exceeding or close to -1.0 °C. As already mentioned in the introduction, negative rainfall departures (colder than expected weather) occurred mainly in the tropics, including most of sub-Saharan Africa and the American continent south of and including the Cotton Belt.

Among the 8 African MRUs (MRU02, East African highlands, MRU04 Horn of Africa, MRU05 Madagascar, MRU08 Sahel, MRU09 Southern Africa and MRU03 Gulf of Guinea) departures vary between -0.7 °C and -1.1 °C. For the 8 American MRUs (MRU-28 semi-arid Southern Cone, MRU-20 Caribbean, MRU26 Pampas, MRU14 Cotton Belt to Mexican Nordeste, MRU23 Central eastern Brazil, MRU27 Western Patagonia, MRU19 South and Central America and eventually MRU24, Amazon) values are somewhat lower between -0.6 °C and 1.0 °C.

Figure 1.2. Global map of temperature anomaly (as indicated by the TEMP indicator) by country and sub-national areas, departure from 15YA (degrees Celsius)



Positive anomalies occurred mainly in three areas: in north America (MRU-11 British Columbia to Colorado +0.8 °C, MRU-18 U.S. and N. Mexican highlands +1.1 °C), Europe (MRU-29 Caucasus +0.9 °C, MRU-58 Ukraine to Ural mountains +1.4 °C) and Asia (MRU-30 Pamir area and MRU-39, both at +0.9 °C).

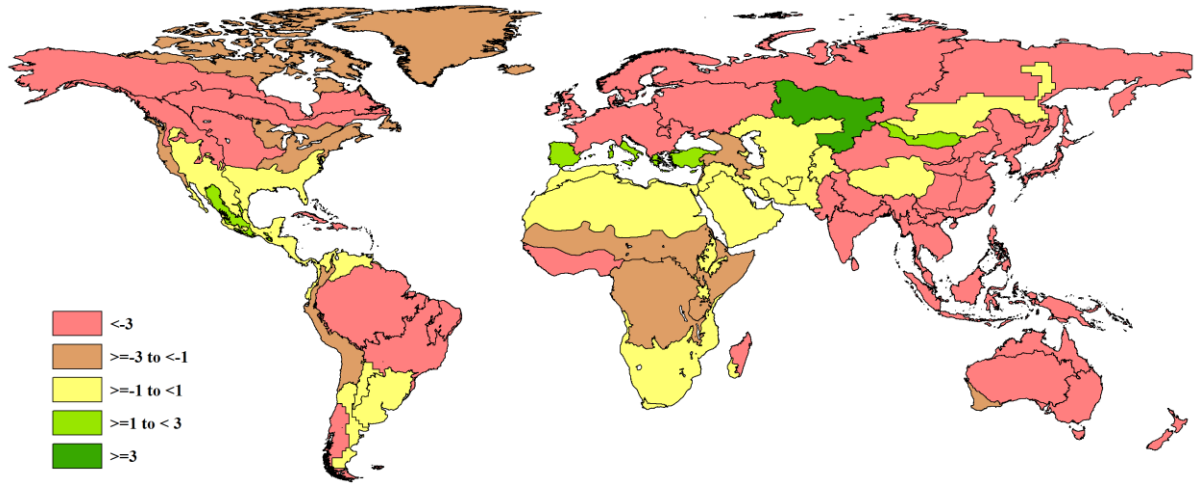
1.4 Photosynthetically Active Radiation (PAR) patterns

As mentioned in the overview, radiation was 4% below average worldwide. The situation was very similar - even in detail - to the one that prevailed during the previous reporting period (July to October 2017) when the average radiation deficit was 3%.

Very significant and record sunshine deficits, larger than 10% are reported mainly from China (MRU-33, Hainan, -18%; MRU-37, Lower Yangtze, -18%; MRU-34, Huanghuaihai, -14%; MRU-41, South-west China, -13%; MRU-40, Southern China, -13%; MRU-36, Loess region, -12%) and from the neighbouring MRU-46 (Southern Japan and the southern fringe of the Korean peninsula, -12%) as well as from the distant MRU-58 in Europe, covering Ukraine to the Ural mountains (-14%).

Only six out of 65 MRUs experienced above average RADPAR, and the departure was modest, compared with the listed deficits. They include MRU-14 (Cotton Belt to Mexican Nordeste, +1%), MRU-52 (Eastern Central Asia, +1%), MRU-17 (Sierra Madre, +1%), MRU-47 (Southern Mongolia, +2%), MRU-59 (Mediterranean Europe and Turkey, +3%) and MRU-62 (Ural to Altai mountains, +4%). Among the positive departures, MRU-59 and MRU-47 did already occur as positive outliers in July to October 2017. The low radiation is likely to have affected the development of winter crops in the northern hemisphere.

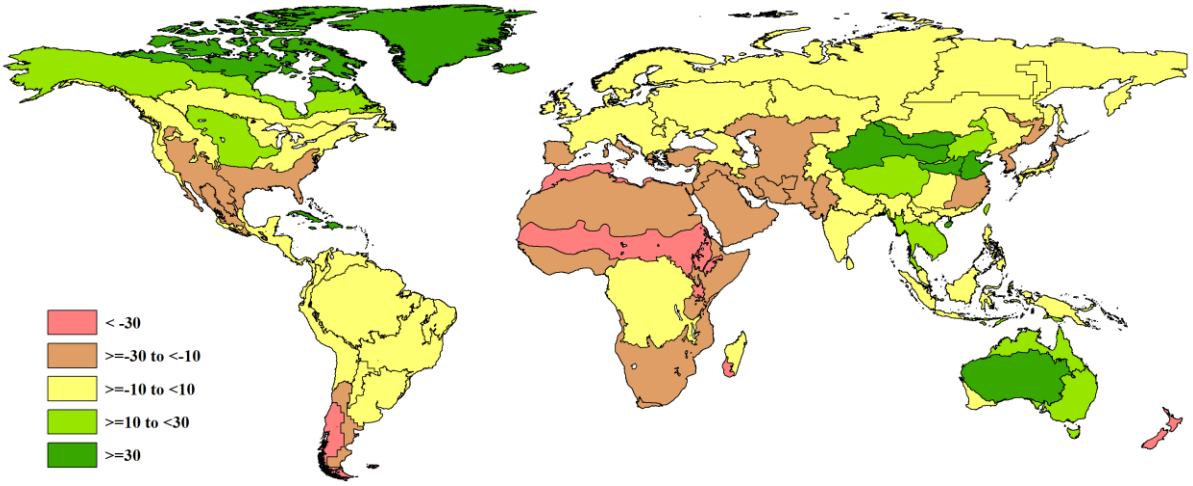
Figure 1.3. Global map of PAR anomaly (as indicated by the RADPAR indicator) by country and sub-national areas, departure from 15YA (percentage)



1.5 Biomass Production Potential (BIOMSS) patterns

As a result of the definition of the BIOMSS index, the spatial departure patterns closely follow rainfall patterns, even if the reference periods are different. For the current period, approximately 86% of the BIOMSS variability can be assigned to rainfall, 12% to TEMP and just 2% to RADPAR. The largest positive differences (rainfall departure exceeds the biomass response) occur in Taiwan (MRU-42) and in Southern Mongolia (MRU-47), where the value is at 46% and in Southern Mongolia (MRU-47) where the difference reaches 113%. The absolute values of the largest negative differences (the biomass increase exceeds the rainfall departure) vary between -16 and -18% and occurred in MRU-27 (Western Patagonia), MRU-16 (West Coast of North America), MRU-06 (South-west Madagascar) and MRU-59 (Mediterranean Europe and Turkey).

Figure 1.4. Global map of biomass anomaly (as indicated by the BIOMSS indicator) by country and sub-national areas, departure from 5YA (percentage)



1.6 Combinations of departures

Exceptional combinations of departure from average were defined, based on a simple index computed from the combination of the percent-ranks for RAIN, TEMP and RADPAR. Among the MRUs which are of agricultural relevance, thus excluding high latitude MRUs of the northern hemisphere, thirteen appear to have had exceptional values for each of the three CropWatch indicators. Values are considered exceptional when their percent-rank is larger than 0.75 or smaller than 0.25. The statistics refer to the current reporting period. “Exceptional” is thus not to be understood in absolute terms but in the context of the current reporting period. For instance, average sunshine is considered “exceptional” in a context where 90% of the MRUs experienced below average sunshine.

Nine MRUs displayed exceptional values for all three agroclimatic indicators. The most unusual and, potentially, the most adverse conditions occurred in the East African Highlands (MRU-02), the US Cotton Belt to the Mexican Nordeste (MRU-14), New Zealand (MRU-56) and Hainan island in southern China (MRU-33).

The following suffered from dry weather (RAIN deficit between 48% and 34%) with low TEMP (departure varying from -0.7°C to -1.1°C): MRU-02, East African highlands; MRU-09, Southern Africa; MRU-14, Cotton Belt to Mexican Nordeste and MRU-43, East Asia. MRU-56 (New Zealand) suffered from drought (-48% RAIN), high temperature (+1.2°C) and low sunshine (RADPAR -6%) while all the other MRUs listed above had close to average sunshine which, for the current period, is rather exceptional.

Cool and wet weather (RAIN departure between +29% and +43%; TEMP deviation at -0.7°C to -0.8°C) and poor sunshine (RADPAR departure from -6% to -18%) affected MRU-20 (the Caribbean), MRU-53 (Northern Australia which is not, however, an important agricultural region) and MRU-33, Hainan. Warm and wet conditions (+36% RAIN, +0.9°C TEMP) and average RADPAR prevailed in MRU-39, Qinghai-Tibet.

When considering only RAIN and TEMP because of the very unusual behaviour of RADPAR, a larger number of exceptional situations emerge in addition to those already listed, for instance, in the category of “dry and cool” MRUs (RAIN from -9% to -50% and TEMP between -0.7°C and -1.9°C) we can list MRU-04 (Horn of Africa), MRU-06 (South-west Madagascar) and MRU-09 (Southern Africa) in Africa and MRU-25 (Central-north Argentina) and MRU-27 (Western Patagonia) in South America.

Figure 1.5. Global weather conditions departing from their respective averages between October 2017 and January 2018.

"Low RAIN" is defined as a rainfall shortage in excess of 15%, while "High RAIN" covers positive departures in excess of 20%. "Low RADPAR" includes areas where the RADPAR departure is between -5% and -18%. "Low TEMP" starts below a 1.0°C negative anomaly and "High temp" above1.0°C positive anomaly. Situations not described in the legend do not occur in the data.