Chapter 1. Global agroclimatic patterns

Chapter 1 describes the CropWatch agroclimatic indicators (CWAIs) for rainfall (RAIN), temperature (TEMP), and radiation (RADPAR), along with the agronomic indicator for potential biomass (BIOMSS) for 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) and radiation (RADPAR). Nevertheless, global temperature was about average (-0.1°C), while rainfall was 18% above average and radiation 2% below.[1] In general, for the reporting period, no significant correlation exists between the intensity of the agroclimatic variables and their departures from average, although RAIN and TEMP, and TEMP and RADPAR, are positively correlated (R=0.41 and R=0.82, respectively), which results from well-known behavior of climate variables.

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

Rainfall

From October 2016 to January 2017, the global spatial variability of RAIN (figure 1.1) was far less coherent than for TEMP and RADPAR. Dry conditions prevailed mostly in the East African highlands, the Horn of Africa and Madagascar, the Nordeste, and southern Asia. Several of these areas are not in their rainfed growing seasons and normally expect limited rain during the reporting period. Marked deficits, however, should be mentioned in Asia for MRU-45 (Southern Asia, RAIN, -48%) and MRU-46 (Southern Japan and Korea, -25%), in Africa for MRU-2 (East African highlands, -40%), MRU-4 (the Horn of Africa, -44%), and MRU-5 (the main agricultural areas of Madagascar, -41%), as well as for Oceania (MRU-56, New Zealand, -52% and MRU-55, Nullarbor to Darling, -40%). The two areas that deserve mentioning in South America include MRU-27 (Western Patagonia, -44%) and again MRU-22, the Brazilian Nordeste with -30% rainfall.

The largest positive departures, some of which are also mentioned in section 5.2 on disasters affected MRU-47 (Southern Mongolia, +366%), distant MRU-48 (Punjab to Gujarat, +201%, where rainfall has benefited winter crops), as well as several areas in China from west to east (MRU-32, Gansu-Xinjiang, +156%; MRU-35, Inner Mongolia, +151%; MRU-36, the Loess region, +121%; MRU-34, Huanghuaihai, +107%; and MRU-38, Northeast China with +90%). Finally, in MRU-50 (Southeast Asia), 631 mm were recorded, an excess of 79% over average.

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[1] Averages are not weighted by the areas of the MRUs.

Abnormal temperature patterns

For temperature (figure 1.2), the most striking features are below average temperature over most of Eurasia, as well as above average temperatures in northern America, eastern Asia, and in the Brazilian Nordeste. In the remaining, mostly tropical areas, close to average (Africa) and slightly below average conditions (everywhere else) are displayed.

In Eurasia, the area with below average temperatures runs from Spain and the western Mediterranean to eastern Siberia (MRU-51), encompassing 11 MRUs. The largest departures in this area are those of Eastern Siberia (MRU-51 with TEMP, -2.3°C), non-Mediterranean western Europe (MRU-60, -2.1°C), the Ural to Altai mountains (MRU-62, -1.9°C), and both the Caucasus (MRU-29) and the Ukraine to the Ural mountains (MRU-58) with -1.6°C below average.

In North America, most of the continent (except along the western coast) experienced above average temperature, most notably in the Corn Belt (MRU-13, +1.5°C) and, to a lesser extent, the Cotton Belt (MRU-14, +1.4°C), the northern Great Plains (MRU-12, +1.0°C), and, in Mexico, the Southwest and northern Highlands (MRU-18, +0.8°C). Next, in Asia, temperature departures in the area from the southern Himalayas (MRU-44) to Inner Mongolia (MRU-35) and southern China (MRU-40) were most noticeable in Southwest China (MRU-41, +0.9°C), South China (MRU-40, +1.0°C), the Lower Yangtze (MRU-37, +1.0°C), and the Loess region of China (MRU-36, +1.3°C).

In South America and the Caribbean, the only area that needs mentioning is MRU-25 (central-north Argentina) with temperatures of 1.3°C below average. MRU-22, the semi-arid north-eastern area of Brazil recorded 0.8°C above average. In the remaining areas of tropical Africa, Southeast Asia and Oceania, temperature was between 0.5°C and 1.0°C below average.

Radiation

To some extent, RADPAR patterns (figure 1.3) followed those of TEMP, with abnormally low values over most of Eurasia and the southern Mediterranean, East and Southeast Asia and Oceania, as well as North America (about -5%). Southern Asia (MRU-45), Central and South America, as well as Africa recorded mostly positive departures. Noticeable differences, however, existed especially in eastern and Southeast Asia where positive temperature departures are associated with poor radiation. The largest recorded negative departures of RADPAR occurred in China—from -21% in the Lower Yangtze area (MRU-37), to Hainan, Huanghuaihai, and Southwest China (MRUs-33, 34, and 41) with about -13% RADPAR, and the Loess region (MRU-36) and Southern China (MRU-40) with about -9%. In MRU-62 (Ural to Altai mountains) as well as mainland (MRU-50) and maritime Southeast Asia (MRU-49), radiation was about 7% lower than average; other, still significant, radiation deficits were recorded in MRU-58 (Ukraine to Ural mountains) with -5%.

Combination of factors and biomass

Using RAIN and TEMP as the main variables, this section attempts to identify areas that are characterized by more than one large departure from the reference value. RAIN and TEMP may vary in the same or opposite directions, so that the first category includes areas where both rainfall and temperature departures are high, which is to say “warmer and wetter than average.” (Both “warmer” and “wetter” are relative terms, which means that -5°C is considered warmer than -10°C, even if it is still freezing. The same applies for wetter and drier.)

"Wet and warm"

Among the significant agricultural areas, warm and wet conditions happened essentially in Asia and North America, including in particular several regions of China, such as MRU-36 (the Loess region, where rainfall exceeds average by 120% and temperature by 1.3°C, while RADPAR was 9% below average). Next is MRU-35 (Inner Mongolia) with RAIN, TEMP, and RADPAR departures reaching respectively 151%, +0.7°C, and −4%, resulting in a BIOMSS increase estimated at 91%. In Huanghuaihai (MRU-12), the indicators take the following values: RAIN, +107%; TEMP, +0.6°C; RADPAR, -13%; and +99% for BIOMSS. Similar observations can be listed for MRU-47 (Southern Mongolia, BIOMSS 168% up), MRU-32 (Gansu-Xinjiang, BIOMSS up 127%), MRU-42 (Taiwan, +16% BIOMSS) and MRU-39, Qinghai-Tibet, where the BIOMSS increase is estimated to reach 15%. In Hainan (MRU-33), BIOMSS is conjectured to rise 41% due to, mostly, precipitation that is 46% above average. In all those areas, the combined increase of RAIN and TEMP has created unusual winter conditions with a likely biomass production increase that may be realized later in the season.

Other "warm and wet" areas include MRU-30 (Pamir area, +23% in BIOMSS) in Asia and MRU-12 and MRU-18 in northern America. MRU-12 covers the northern Great Plains (RAIN, +35%; TEMP +1.0°C; RADPAR, −5%; and BIOMSS, +28%). In MRU-18, the Southwestern United States and northern Mexican highlands, BIOMSS is estimated to increase 34%.

"Dry and warm"

After "wet and warm," it is possible to identify areas "dry and warm," several of which occur in Asia, starting with MRU-37 (the Lower Yangtze), with RAIN down 12% and TEMP up 1°C. RADPAR underwent a severe drop of 21%, while BIOMSS could nevertheless increase 6%. In MRU-46 (Southern Japan and Korea), a precipitation drop of 25% was accompanied by an increase in TEMP (+0.5°C), a small loss of sunshine (RADPAR, -5%) and BIOMSS down 6%. A comparable drop in BIOMSS could occur in MRU-40 (Southern China) due to similar conditions.

On the American continent, MRU-14 (U.S. Cotton Belt to Mexican Nordeste) showed a modest drop in RAIN (-8%) but a more significant temperature increase (1.4°C), with nevertheless about average BIOMSS (-1%). The situation is not so favorable in MRU-22, the Brazilian Nordeste (mentioned several times in this bulletin), where BIOMSS is expected to drop 28%.

"Dry and cold"

The "dry and cold" category includes a long list of more than ten MRUs in different continents, starting with Eurasia (MRU-29, the Caucasus; MRU-59, Mediterranean Europe and Turkey, where RAIN dropped 23% and TEMP by 1.4°C; and MRU-60, non-Mediterranean western Europe where the indicators are -20% and -2.1°C, respectively). Low rainfall but only slight drops in TEMP are reported from MRU-28, the semi-arid Southern Cone, MRU-54 (Queensland to Victoria), MRU-55 (Nullarbor to Darling), as well as MRU-56, New Zealand, where shortage of precipitation (-51%) could entail a BIOMSS drop of 35%. In Africa, in MRU-6 (Southwest Madagascar) and MRU-5 (which includes most of the Malagasy island), drought could result in a BIOMSS drop of 10 to 20%. Finally, in MRU-4, the Horn of Africa, the BIOMSS potential is down 37%.

"Wet and cold"

In this last category of "wet and cold," MRU-38 (Northeast China), MRU-58 (Ukraine to Ural mountains), and MRU-62 (Ural to Altai mountains) are included, with indicators for the Ural to Altai mountains (at +31% for RAIN, -1.9°C for TEMP, and -7% for RADPAR) concurring to reduce the BIOMASS production potential by 20%.

Figure 1.1. Global map of October 2016-January 2017 rainfall anomaly (as indicated by the RAIN indicator) by MRU, departure from 15YA (percentage)

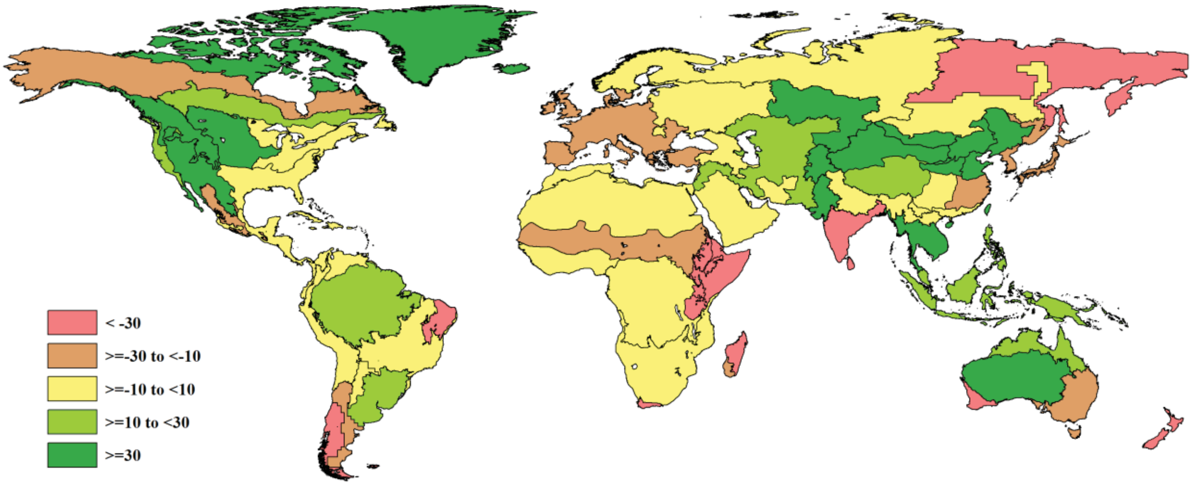

Figure 1.2. Global map of October 2016-January 2017 temperature anomaly (as indicated by the TEMP indicator) by MRU, departure from 15YA (degrees Celsius)

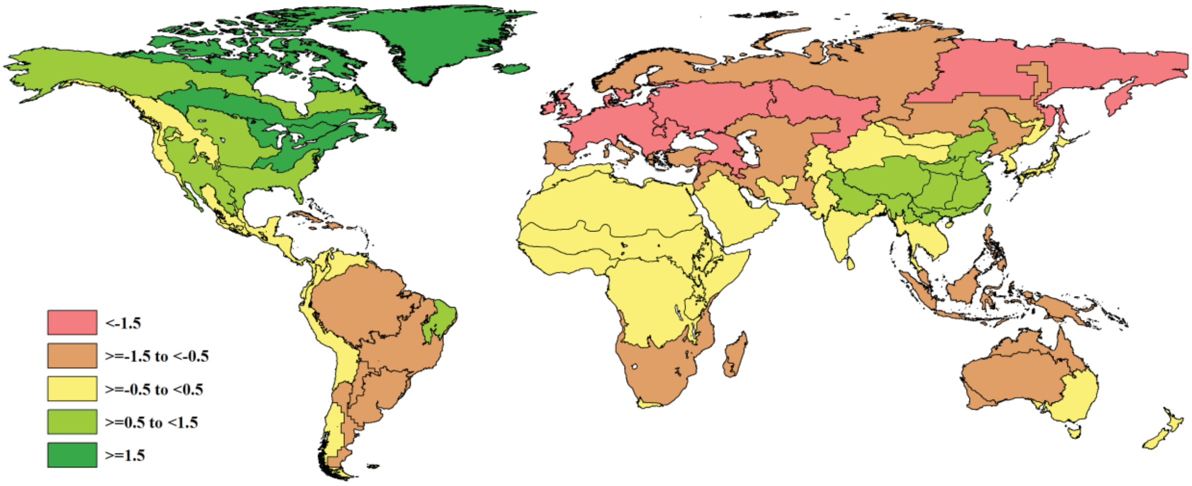

Figure 1.3. Global map of October 2016-January 2017 PAR anomaly (as indicated by the RADPAR indicator) by MRU, departure from 15YA (percentage)

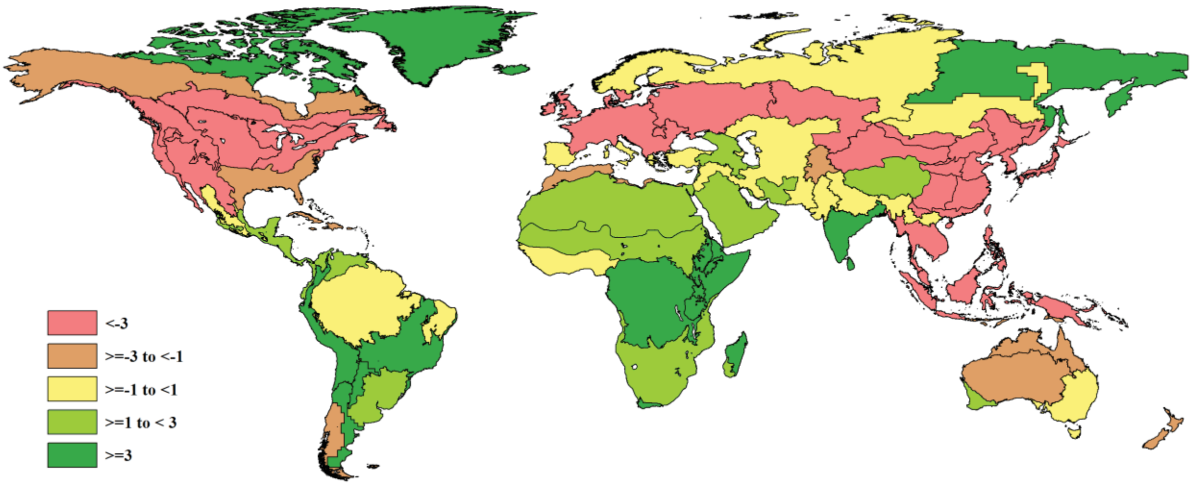

Figure 1.4. Global map of October 2016-January 2017 biomass accumulation (BIOMSS) by MRU, departure from 5YA (percentage)