Chapter 1. Global agroclimatic patterns

Chapter 1 describes the CropWatch agroclimatic indicators 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 fourteen 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 ww.cropwatch.com.cn.

1.1 Overview

Contrary to several previous reporting periods, monitoring results for the four-month period of April to July 2015 do not display very coherent spatial variations of abnormal weather conditions. Globally,[1] the RAIN indicator exceeds the recent average by 4%, while TEMP and BIOMSS were respectively 0.4°C and 1% above average; RADPAR was average.

Very abundant rainfall—more than double the expected amounts—was recorded in southern Mongolia (MRU-47, 195% excess) and adjacent Gansu-Xinjiang in China (MRU-32, +130%), as well as in agriculturally unimportant sub-arctic America (MRU-65, +183%). This last MRU also experienced the largest positive temperature departure (+1.5°C) among all MRUs. Sunshine conditions were about average in all the mentioned MRUs, but some biomass accumulation potential records are broken owing to both high temperature and abundant precipitation in southern Mongolia (MRU-47, +85%), sub-arctic America (MRU-65, +185%), and Gansu-Xinjiang (MRU-32, +69%). Both southern Mongolia and Gansu-Xinjiang are major livestock production areas and have benefited from exceptionally positive conditions.

Other areas with precipitation excesses above 30% during the reporting period include central eastern Brazil (MRU-23, +64), southwest United States and north Mexican highlands (MRU-18, +57%), Lower Yangtze (MRU-37, +41%), Ural to Altai mountains (MRU-62, +39%), the U.S. Cotton Belt to Mexican Noreste (MRU-14, +38%), and the northern Great Plains (MRU-12, +30%). Several are mentioned in section 5.2 on disasters, as precipitation was often concentrated in short and violent episodes. All mentioned areas had below average sunshine but temperatures close to average, with the exception of the Ural to Altai mountains (MRU-62) where radiation was average while temperature was higher than normal (+0.8°C). All also enjoyed above average biomass production potentials, varying from +3% in the northern Great Plains (MRU-12) to much higher values such as those in the southwest United States and north Mexican highlands (MRU-18, +64%).

A number of mostly temperate areas (including some tropical highlands) in both hemispheres suffered a significant rainfall deficit in excess of 20%. In several areas, the BIOMSS deficit was between -19% and -35%. Areas with significant rainfall deficits could be described as follows:

- Eastern and southern Africa, including East African highlands (MRU-02), Madagascar (MRU-05 and MRU-06), and Western Cape (MRU-10), with water deficits from -69% to -26% and an average deficit of -45%. Temperature in this area was above average and close to the overall

[1] Globally here refers to a planetary, non-weighted average.

planetary increase. Southern Africa as a whole (MRU-09) experienced a marked rainfall deficit of 17%.

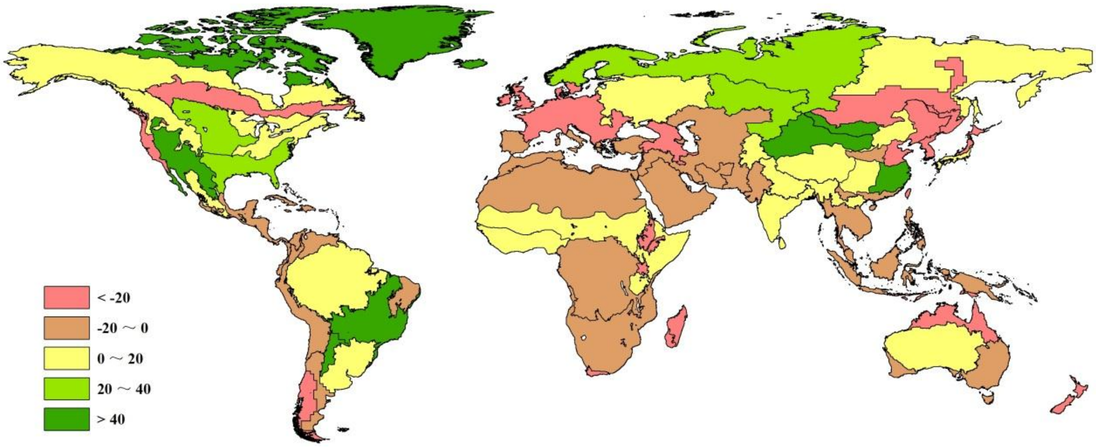
- Oceania, including northern Australia (MRU-53) and New Zealand (MRU-56), with an average deficit of -43% in both areas. Temperature was slightly above average (+0.2°C). The drought also affected the Queensland to Victoria (MRU-54; -18%).
- South America and in particular western Patagonia (MRU-27), which had a RAIN deficit of 43%, comparable with Oceania above. The temperature departure, however, was higher (+0.6°C), and it was accompanied by a 3% drop in RADPAR. Almost the entire western fringe of the American continent experienced below average rainfall (see also point (5) just below), even if less marked than in western Patagonia, covering northern South and Central America (MRU-19; -19%), the central-northern Andes (MRU-21, -17%), and the semi-arid Southern Cone (MRU-28, -15%).
- Eastern Asia, including the China Loess region (MRU-36), Northeast China (MRU-38), eastern Central Asia (MRU-52), Huanghuaihai (MRU-34), Taiwan (MRU-42), and East Asia (MRU-43), with an average deficit of -33% and deficits varying from -49% to -20%. Temperature was average and the areas experienced a positive sunshine departure of 2%.
- North America, including sub-boreal America (MRU-15) and the West Coast (MRU-16), with an average rainfall deficit of -28% in both MRUs, while temperature was above the seasonal averages by almost 1 degree (0.9°C), paralleled by a 3% increase in sunshine.
- Western Eurasia, including non-Mediterranean Western Europe (MRU-60) and the Caucasus (MRU-29), with an average RAIN deficit of -23% and deficits varying from -24% to -22%. Temperature in this area was above average and close to the overall global increase.

1.2 Rainfall

Over the reporting period, the CropWatch rainfall indicator (RAIN) showed large variations across regions. With the exception of the Gulf of Guinea (MRU-03, +1%) and Horn of Africa (MRU-04, +7%) where close to normal rainfall was recorded, below average rainfall prevailed in the African continent, including Southwest Madagascar (MRU-06, -69%), Madagascar (MRU-42, -44%), the Western Cape (MRU-10, -41%), East African highlands (MRU-02, -26%), Western Cape (MRU-10, -43%), southern Africa (MRU-09, -17%), equatorial central Africa (MRU-01, -10%), and North Africa-Mediterranean (MRU-07, -10%). Below average rainfall also occurred in Mediterranean Europe and Turkey (MRU-59, -7%), non-Mediterranean Western Europe (MRU-60, -22%), eastern Central Asia (MRU-52, -26%), East Asia (MRU-43, -49%), maritime Southeast Asia (MRU-49, -18%), Punjab to Gujarat (MRU-48, -11%), mainland Southeast Asia (MRU-50, -11%), North America's West Coast (MRU-16, -28%), New Zealand (MRU-56, -46%), northern Australia (MRU-53, -40%), and Queensland to Victoria (MRU-54, -18%). Some production zones of China also suffered below average rainfall, including Taiwan (MRU-42, -44%), Huanghuaihai (MRU-34, -36%), Northeast China (MRU-38, -25%), the Loess region (MRU-36, -20%), Hainan (MRU-33, -17%), and Southern China (MRU-40, -9%).

In contrast, the production zones of North America received abundant rainfall, including those recorded in the Northern Great Plains (MRU-12, +30%), Cotton Belt to Mexican Noreste (MRU-14, +38%), Southwest United States and North Mexican highlands (MRU-18, +57%), Corn Belt (MRU-13, +10%), and British Columbia to Colorado (MRU-11, +12%). As a main rice production zone for China, Lower Yangtze (MRU-37, +41%) received abundant rainfall. Abundant rainfall was also recorded in southern Asia, including the southern Himalayas (MRU-44, +17%), as well as in the Pampas (MRU-26, +20%) and central eastern Brazil (MRU-23, +64%) in South America.

Figure 1.1. Global map of rainfall anomaly (as indicated by the RAIN indicator) by MRU, departure from 14YA, April-July 2015 (percentage)



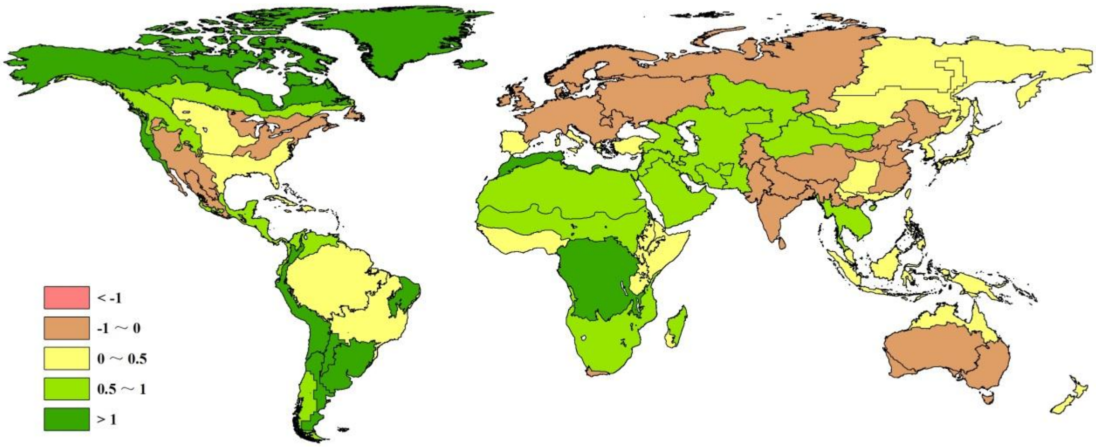
Note: Data for April-July 2015, compared with the fourteen-year average (14YA) for the same period 2001-2014.

1.3 Temperature

Temperature varied widely among regions. In 18 MRUs the temperature was lower than average by 0 to -0.6°C. Most of these MRUs are distributed in China, West Asia, Europe, and North America. In China, in the Lower Yangtze (MRU-37, -0.6°C), Loess region (MRU-36, -0.6°C), Huanghuaihai (MRU-34, -0.5°C), and Inner Mongolia (MRU-35, -0.5°C), temperature was significantly below average, which would affect the yield of spring crops. In Europe, temperature departure shows a decline in the area of the Ukraine to Ural mountains (MRU-58, -0.5 °C). In most parts of Australia, including Queensland to Victoria (MRU-54, -0.5°C), Nullarbor to Darling (MRU-55, 0.2°C), and Australian desert (MRU-63, -0.2°C), temperature was below average.

In most of South America, North America, and Africa, the temperature was above average between April and July. The greatest positive departure was found in North America, including Boreal America (MRU-61, +1.5°C) and sub-arctic America (MRU-65, +1.5°C), two areas of very limited agricultural importance. In South America, including in particular the Brazilian Nordeste (MRU-22, +1.4°C), Pampas (MRU-26, +1.3°C), central-northern Andes (MRU-21, +1.2°C), semi-arid Southern Cone (MRU-28, +1.2°C) and central-north Argentina (MRU-25, +1.1°C), the temperature anomaly significantly exceeded 1°C.

Figure 1.2. Global map of air temperature anomaly (as indicated by the TEMP indicator) by MRU, departure from 14YA, April-July 2015 (degrees Celsius)



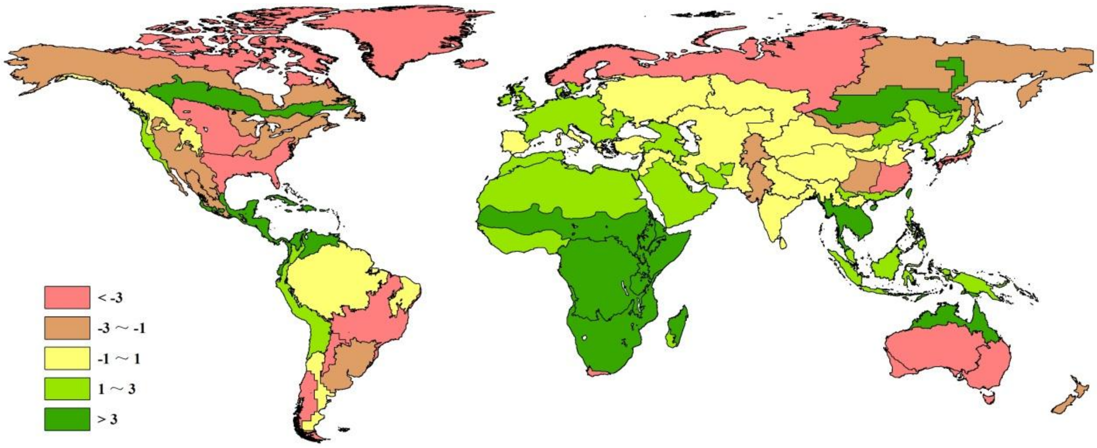
Note: Data for January-April 2015, compared with the fourteen-year average (14YA) for the same period 2001-2014.

1.4 Photosynthetically active radiation

As a key agroclimatic indicator, Photosynthetically Active Radiation (PAR) has an obvious relationship with temperature and rainfall patterns: abundant rainfall is associated with high cloudiness, which leads to low daytime temperatures, mostly in temperate areas. As shown in the figure, most MRUs in the African continent, Caribbean region, and the west shore of the Pacific show a significant increase in PAR compared with the recent average. The areas with marked positive departures include (i) equatorial central Africa (MRU-01, +7%) and the Horn of Africa (MRU-04, +4%); (ii) Southeast Asia mainland (MRU-50, +5%), eastern Central Asia (MRU-52, +4%), and northern Australia (MRU-53, +4%); (iii) sub-boreal North America (MRU-15, +4%), northern South and Central America (MRU-19, +4%) and Caribbean (MRU-20, 4%). In contrast, PAR decreases significantly in southern Australia, including Queensland to Victoria (MRU-54, -5%) and Australian desert (MRU-63, -6%). Elsewhere, PAR also shows a decrease in the northernmost area of Eurasia (not a major crop producing region) and sub-arctic America (MRU-65, -7%). The absolute highest PAR departure from the recent reference period occurred in China Lower Yangtze (MRU-37) with -8%.

In addition to the Lower Yangtze, another major grain producing region in China shows a decrease in PAR: Southwest China (MRU 41, -2%). Favorable PAR conditions benefited Taiwan (MRU-42, +5%) and Hainan Province (MRU-33, +7%). Remaining regions in China enjoyed average levels of PAR.

Figure 1.3. Global map of PAR anomaly (as indicated by the RADPAR indicator) by MRU, departure from 14YA, April-July 2015 (percentage)



Note: Data for April-July 2015, compared with the fourteen-year average (14YA) for the same period 2001-2014.

1.5 Biomass

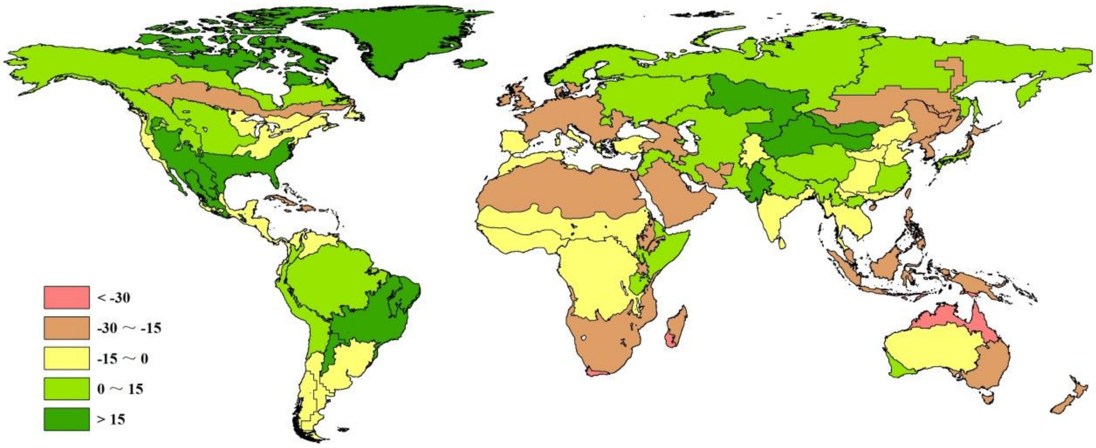
BIOMSS is a synthetic agroclimatic indicator that takes into account rainfall and temperature to estimate the potential biomass accumulation. During this monitoring period, due to the notable change in rainfall compared with average, BIOMSS is affected by the rainfall in almost all MRUs across the world. Over the reporting period, biomass variations are brought about more by RAIN anomalies than by TEMP (the R-squared between BIOMSS and RAIN is 0.79).

The greatest positive biomass departures are found in southern Mongolia (MRU-47, with BIOMSS +85% above average and RAIN +195%), Gansu-Xinjiang in China (MRU-32, +69% BIOMSS and +130% RAIN), Southwest United States and North Mexican highlands (MRU-18, +64% BIOMSS and +57% RAIN), central eastern Brazil (MRU-23, +46% BIOMSS and +64% RAIN), and Ural to Altai mountains (MRU-62, +37% BIOMSS and +39% RAIN).

Declines in BIOMSS (compared to average values for the same period) are similarly affected by decreased rainfall; the most negative biomass departures are found in Southwest Madagascar (MRU-06, -53% for

BIOMSS and -69% RAIN compared to average), Northern Australia (MRU-53, -42% BIOMSS and -40% RAIN), and South Africa's Western Cape (MRU-10, -40% BIOMSS and -41% RAIN).

Figure 1.4. Global map of biomass accumulation (BIOMSS) by MRU, departure from 5YA, April-July 2015 (percentage)



Note: Data for January-April 2015, compared with the five-year average (5YA) for the same period 2010-2014.