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 Correlations between CropWatch agroclimatic indicators (CWAIs)

CWAIs are averages of climatic variables over agricultural areas only (refer to Annex C for definitions and to table 1.1 for 2018 JFMA numeric values).

Although they are expressed in the same units as the corresponding climatological variables, they are spatial averages, weighted by the agricultural production potential. For instance, in the "Sahara to Afghan desert" area, only the Nile valley and other cropped areas are considered. "Sahara to Afghan desert" is one of the 65 CropWatch Mapping and Reporting Units (MRU) , which are the largest monitoring units adopted to identify global climatic patterns. Correlations between variables (RAIN, TMP, RADPAR) at MRU scale derive directly from climatology. For instance, the positive correlation (R=0.425) between rainfall and temperature results from high rainfall in equatorial, i.e. in warm areas.

Therefore, departures from average variables, i.e. anomaly patterns characterize the current reporting period more meaningfully than the averages themselves. RAIN was above average in about 65% of the MRUs, resulting in RAIN being 8% above the average value of the 15-year reference period (2003-2017). TEMP was average (-0.1°C) in most MRUs while RADPAR was below average in the majority of MRUs (58 out of 65) resulting in a significantly below average value of -5%. Finally, the biomass production potential BIOMSS depends on rainfall and temperature. During the current reporting period 80% of its variations can be ascribed to RAIN variations and 20% only to TEMP. As a result, the global average is 8% above normal (55% of values are above normal).

Above average RAIN and lower than average RADPAR are the continuation of a pattern that started one year ago (Table X1) and which is bound to have agricultural consequences as sunshine is the major driver of photosynthesis. It remains to be seen if the increased precipitation can compensate reduced sunshine, especially in semi-arid areas, which include most rangelands.

Table 1.1. departure from recent 15 year average of the RAIN, TEMP and RADPAR indicators over the last year

Reporting period	year	CropWatch Indicator		
		RAIN	TEMP	RADPAR
JFMA	2017	+13%	-0.2°C	-2%
AMJJ	2017	+9%	-0.1°C	-2%
JASO	2017	+6%	+0.1°C	-3%
ONFJ	2017-2018	+8%	-0.1°C	-4%
JFMA	2018	+8%	-0.1°C	-5%

1.2 Rainfall and BIOMSS anomalies

Since rainfall and biomass are very directly connected, as already mentioned above, the BIOMSS anomalies are mentioned where appropriate in this section arranged according to rainfall anomalies. The following areas are mentioned because they experienced moderately excessive rainfall close to 10% but nevertheless expect a reduction in BIOMSS: MRU 58 (Ukraine to Ural mountains) and MRU 62 (Ural to Altai) . In the Corn Belt (MRU 13), precipitation excess reached a more significant 26% but nevertheless a biomass production potential drop of 8%.

Negative rainfall anomalies

The largest negative rainfall anomalies (below -20%) all affect several MRUs and can be grouped into seven clusters. Although the patterns are largely independent of those observed in 2017, there are, however, some similarities with the highest values (largest positive departures) occurring in Sub-arctic America (a non-cropped area) and in southern Mongolia and surrounding areas or other MRUs in eastern Asia, such as Hainan and Inner Mongolia.

A. China and southern Himalayas

Two MRUs are at the “centre” of the water deficit areas, including Qinghai-Tibet (MRU 39, -34%) and the Southern Himalayan stretch (MRU 44, -30%). Both recorded between 110 and 120 mm of RAIN. They are surrounded on the west and east by other areas of deficit, in particular Punjab to Gujarat (MRU 48, -20%), Southern China (MR4 40, -17%) and the Lower Yangtze (MRU 37, -18%). Both Punjab to Gujarat (MRU 48) and the Lower Yangtze (MRU 37) experienced a water deficit in during the JFMA reporting period in 2017 (-19% and 21%, respectively). In Southern China, the deficit was 7% in 2017.

Throughout this area, due to temperature effects, the drop in rainfall exceeds the drop in BIOMSS (-24% Vs -11%, respectively, on average). The difference is largest in Qinghai Tibet (RAIN -34%, BIOMSS -13%) and in Southern China (RAIN -17%, BIOMSS -4%) and smallest in Punjab to Gujarat (RAIN -20%, BIOMSS -14%).

B. South-west Madagascar

The largest deficit occurred in South-west Madagascar (MRU 06), a mostly semi-arid area which is now at the end of its growing season where 274 mm were recorded instead of more than 500 mm (-46%). The BIOMSS drop is expected to reach 26%, the lowest of all MRUs.

C. Southern Australia

MRU 54 (Queensland to Victoria) had a 25% RAIN deficit and the south-west (MRU 55, Nullarbor to Darling) had a more moderate shortfall of 15 %).

D. North America

Shortage of rainfall affected two areas: the north American west coast (MRU 16, -23%), extending over California and southern British Columbia, as well MRU 18 (South-west U.S. and north Mexican highlands) where the deficit was just 11%. MRU 16 experienced abundant precipitation during the same season last year (+43%).

E. South America

The Pampas (MRU 26) suffered a moderate deficit of 14% which increased to 19% in the semi-arid Southern Cone (MRU 28). The Pampas are currently in their summer crop season and negative impacts are likely. Refer to the section on disasters (Chapter 5.XXX) for details. The same areas had abundant water supply in 2017 (+34% and +21%, respectively). The BIOMSS drop is expected to be less severe than the rainfall deficit in both areas (only 5% in MRU 28) but nevertheless 10% in the Pampas.

F. East and north-east Asia

Three MRU are to be mentioned, in decreasing order of rainfall deficit: East Asia, MRU 43 (-18%) which includes the Korean Peninsula Eastern Siberia (MRU 51, -16%), which is of relevance mostly for fisheries and forest production, and Eastern Central Asia (MRU52, 10%) where livestock production is practised. Of those MRUs, only east Asia had a rather severe deficit in 2017 (43%). In East Asia and eastern Siberia, the BIOMSS index remains close to average in spite of the water deficit.

G. Mediterranean basin

The drought in the area was moderate, affecting more seriously the north African coast (MRU 07, -11%) than southern Europe (MRU 59, -9%). Both areas recorded a more severe deficit in 2017: -20% and -34%, respectively.

Positive rainfall anomalies

Significant positive anomalies need to be mentioned only from two areas in China or bordering China and East Africa.

H. Five MRUs around north-eastern China

The MRUs include essentially MRU 47, southern Mongolia with a spectacular rainfall increase to 276 mm (compared with the average of 117 mm). The departure of +276% follows last years departure of +309%). The four remaining MRUs include MRU 34 Huang Huaihai (+36% in 2018, +15% in 2017), MRU 35 Inner Mongolia (+35%, +60%), MRU36 the Loess Region of China (+38%, +23%) and MRU38 north-east China, MRU 38 (+31%) is the only one which recorded average rainfall last year (-1%). With the exception of southern Mongolia (+177%), the BIOMSS increase is expected to be close to 30%.

I. Hainan

Hainan (MRU 33) with rainfall 57% above average (+52% in 2017) is an isolated excess spot south of a deficit areas and close to Mainland SE Asia (MRU 50) where precipitation was average. Hainan also experience low temperature (-1.0°C).

J. Eastern Africa

The two eastern African MRUs (02 East African highlands and 04, the Horn of Africa) recorded +16% and +26% of rainfall. This indicates early beginning of the rainy season in an area that has suffered drought in previous years (-27% and -30%, respectively). The area is mentioned in the section on disasters because of floods.

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

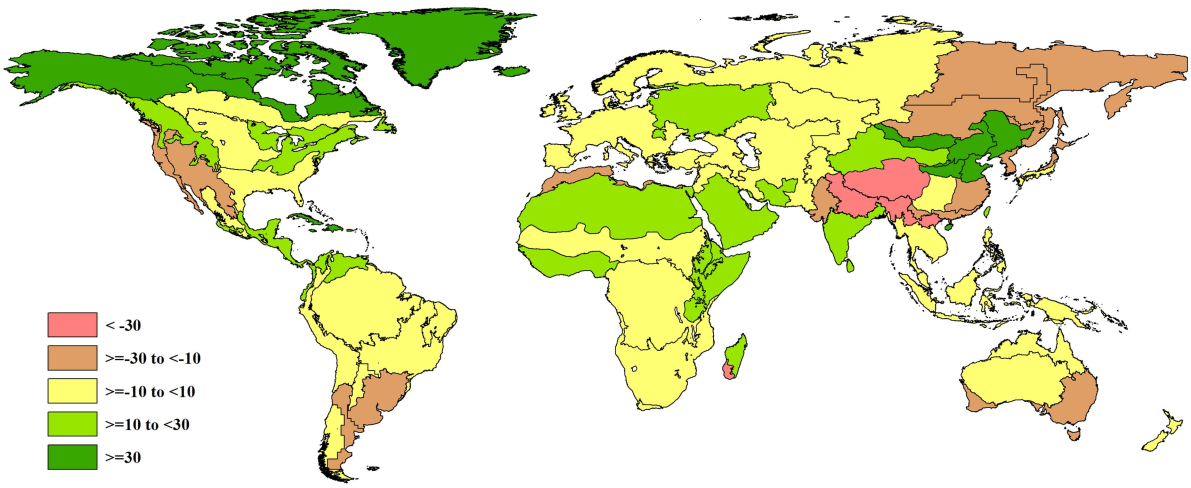
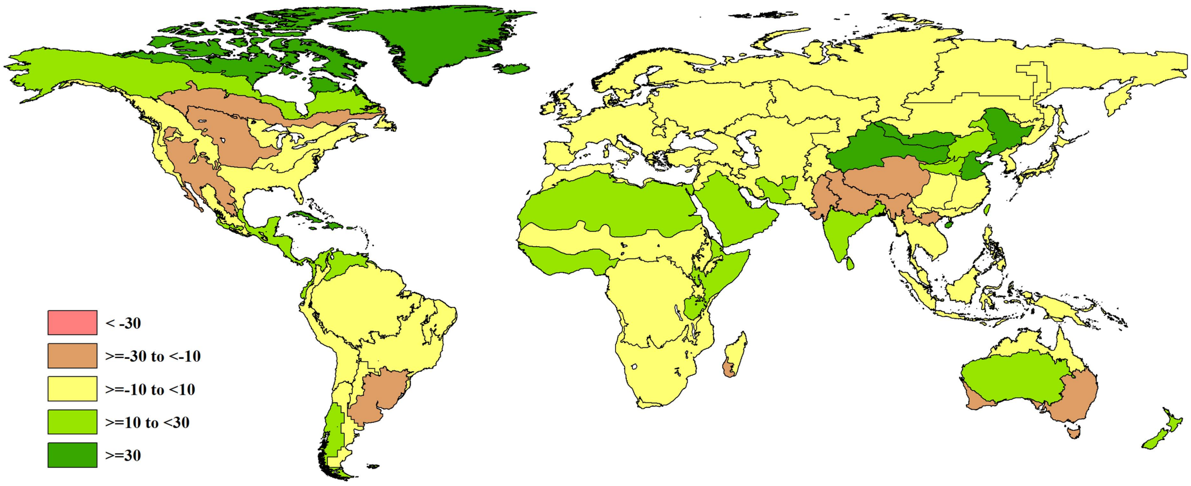


Figure 1.2. Global map of January - April 2018 biomass accumulation (BIOMSS) by MRU, departure from 5YA, (percentage)



1.3 Temperature anomalies

Many areas which recorded high or low temperature compared with average were already mentioned above because of anomalous rainfall. It is also in order to observe that the highest latitudes in north America witnessed spectacular departures (2.1°C to 5.6°C) in areas that are not relevant for crop production – but may become so if the departures persist -. Although the pattern partly overlaps with the RADPAR pattern to be described below, the two are (statistically) unrelated.

K. Cooler than average Equatorial and tropical areas

Most equatorial and tropical areas in America, Africa and Asia experienced slightly below average temperature. Although the departures did not exceed 1°C the pattern is rather consistent spatially. The coldest area is the Horn of Africa (MRU 04) with an anomaly of -1.5°C.

L. Cooler than average central-eastern north America.

The absolute coolest area was the northern Great Plains with a negative departure of 2.2°C. They were surrounded by areas with low temperature, except in the west.

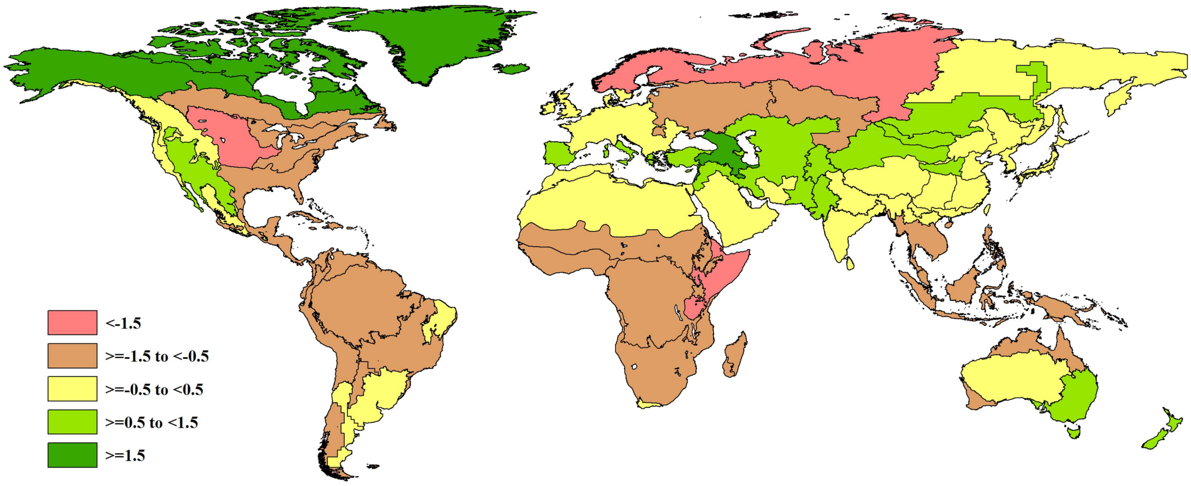
M. Cool area from Ukraine to Altai

The area encompasses two MRUs 58 (Ukraine to Ural mountains) and 62 (Ural to Altai Mountains) with temperature departures of -0.8°C and -1.2°C, respectively.

N. High temperature area of the northern Mediterranean to eastern Asia

The Caucasus (MRU 29) recorded a positive anomaly of 1.9°C, which is significant during winter. In the Pamir area (MRU30) the departure reached 1.4°C. The remaining areas (MRU 59, Northern Mediterranean to Turkey) to the Loess region in China and eastern Northern Central Asia (MRUs 36 and 52) are in the range from 0.5°C to 0.7°C.

Figure 1.3. Global map of January - April 2018 air temperature anomaly (as indicated by the TEMP indicator) by MRU, departure from 15YA (degrees Celsius)



1.4 Radiation RADPAR anomalies

With the exception of eastern South America, southern Africa, maritime south-east Asia, much of Australia and parts of northern Eurasia, most land areas experienced below average sunshine, representing approximately 90% of land areas.

O. Large Eurasian and African sunshine deficit area centred on China and the southern Himalayan area

Huanghuaihai (MRU 34) experienced the lowest departure from sunshine at -14%, followed by three MRUs with departures of -9% (MRU C37, Lower Yangtze; MRU 36, Loess region and MRU32, Gansu-Xinjiang). The area is bordered to the south by the Southern Himalayas (MRU 44 also at 9%) which provides the transition to western Asia (MRU 31, -7%), southern Asia (MRU 45, -5%) and continental south-east Asia (MRU 50, -7%)

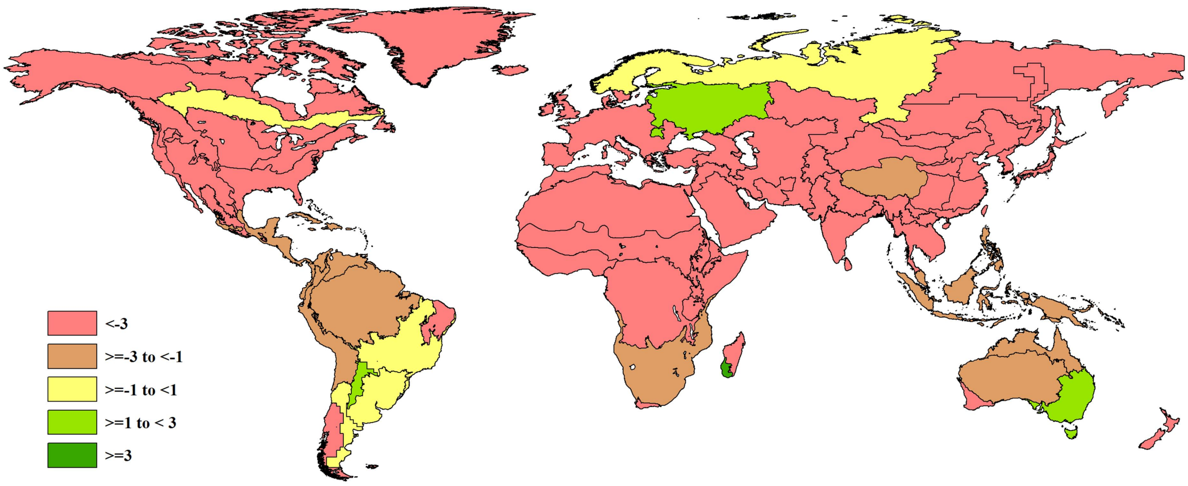
P. Areas with “average” sunshine

Few areas stand out. They include three isolated MRUs, all with a 1% departure: MRU 54 (Queensland to Victoria) in Oceania, MRU 06 (South-west Madagascar) in Africa and MRU 25, central-north Argentina.

Q. Positive sunshine departure

The semi-arid southern cone in Latin America had sunshine in excess of 5% over average.

Figure 1.4. Global map of January - April 2018 PAR anomaly (as indicated by the RADPAR indicator) by MRU, departure from 15YA (percentage)



1.5 combinations of extremes

South-west Madagascar (MRU 06) comes first with low rainfall (-46%), a slight temperature deficit (-0.8°C) and RADPAR at +5% above average. The Horn of Africa (MRU04) and Hainan (MRU 33) both experienced high rainfall (+26%, +57%, respectively), low temperature (-1, 5°C and -1.0°C) and a radiation deficit of -6% and -5%, respectively.

The three following MRUs had about average rainfall but below average radiation (-7% to -11%). but below average temperature (-0.9°C to -1.2°C): MRU 62 (Ural to Altai mountains), MRU 03 (Gulf of Guinea) and MRU 50 (mainland south-east Asia). Finally, New Zealand (MRU 56), Mediterranean Europe and Turkey (MRU 59) and the Caucasus (MRU 29) had radiation deficits between -7% and -9% and positive temperature departures (+0.7°C, +0.7 °C and +1.9°C, respectively)