19/01/2022

Information on the climate in 2021
Station: Luxembourg/Findel-Airport (WMO 06590, 376.12 m, a.s.l.)
Reference period: WMO normal period 1991 to 2020 (tables: 1981 to 2010 and 1991 to 2020)

1. Air temperature

Anomalies with respect to 2021

The annual mean air temperature for 2021 calculated by MeteoLux for its station at Luxembourg/Findel-Airport was 9.4 °C. The deviation of the annual mean air temperature from to the average of the reference period from 1991 to 2020 resulted in a negative anomaly of 0.4 K. The total number of 67 frost days was slightly above the long-term climate normal (64.4 days). Eight ice days occurred in 2021 (normal = 14 days). In 2021, only 22 summer days and one hot day occurred, significantly below the normal. The long-term average for summer days is 38 days and for hot days it is 7.4 days.

Anomalies with respect to seasons

The winter 2020/2021 showed a mean air temperature of 2.9 °C, deviating plus 1.0 K from the climate normal. During this winter the days with frost (46) corresponded exactly to the normal of 46 days of the reference period 1991–2020. The number of 8 ice days was below the normal value of 12.8 days. Spring mean air temperature (7.5 °C) was 2.1 K below the normal (9.6 °C). The spring season was characterized by 15 frost days and no ice days. The number of frost days was above the long-term average (10.5 days). Only one summer day was observed in spring. The normal for this period is 3.5 days. The summer mean air temperature in 2021 was 17.4 °C, deviating by minus 0.5 K from the long-term average (17.9 °C). During this season 17 summer days and 1 hot day occurred. This significantly falls below the normal by about 15 days, respectively 6 days. The seasonal average in autumn was 9.7 °C, which is 0.1 K below the long-term average (1991–2020). During autumn 4 summer days (climate normal 3 days) and 9 frost days (climate normal 7.8 days) occurred.

Anomalies with respect to single months

In 2021, the majority of months except for February, June, September and December were below the 1991–2020 normal (Figure 1, Table 1). During the first half of January high-pressure systems over Iceland and Scandinavia in alternation with cold northwesterly air masses caused wintery conditions in Luxembourg. Later this month low-pressure systems brought intervals with mild air, in particular a small-scale surface low with southwesterly air of sub-tropical origin. Monthly mean air-temperatures in January were 0.4 K below the climate normal. Towards the end of the first decade in February, increasingly cold air of Arctic origin flowed into Luxembourg. For several days, moderate and heavy frost prevailed. With the shift of the high-pressure zone to the southeast, the weather became somewhat milder from the middle of the month. Thus, monthly mean air-temperatures in February were 1.7 K above the 1991-2020 normal. Unsettled weather dominated large parts of March. The most striking event occurred in the last decade of March when large parts of Europe were under high-pressure influence. Warm air advection from the subtropical region caused records in maximum air temperatures, although the monthly mean value of 5.7 °C corresponded exactly to the normal. April started with unusually mild conditions. With the change of the atmospheric circulation (persistent blocked weather pattern with high pressure from Greenland towards the British Islands) air masses from northerly directions, coupled with small amounts of cloud cover as well as low wind speeds, caused cool temperatures. Thus, air temperatures in Luxembourg were significantly below the average (2.9 K). The cool and unsettled weather continued in May. This was caused by an extensive low-pressure system over Scandinavia and the cold air advection at its southern region. Luxembourg experienced below-average air temperatures (3.5 K). High-pressure dominated frequently in June, occasionally disturbed by low-pressure systems. Thus, air temperatures in Luxembourg were above the average (2.0 K).

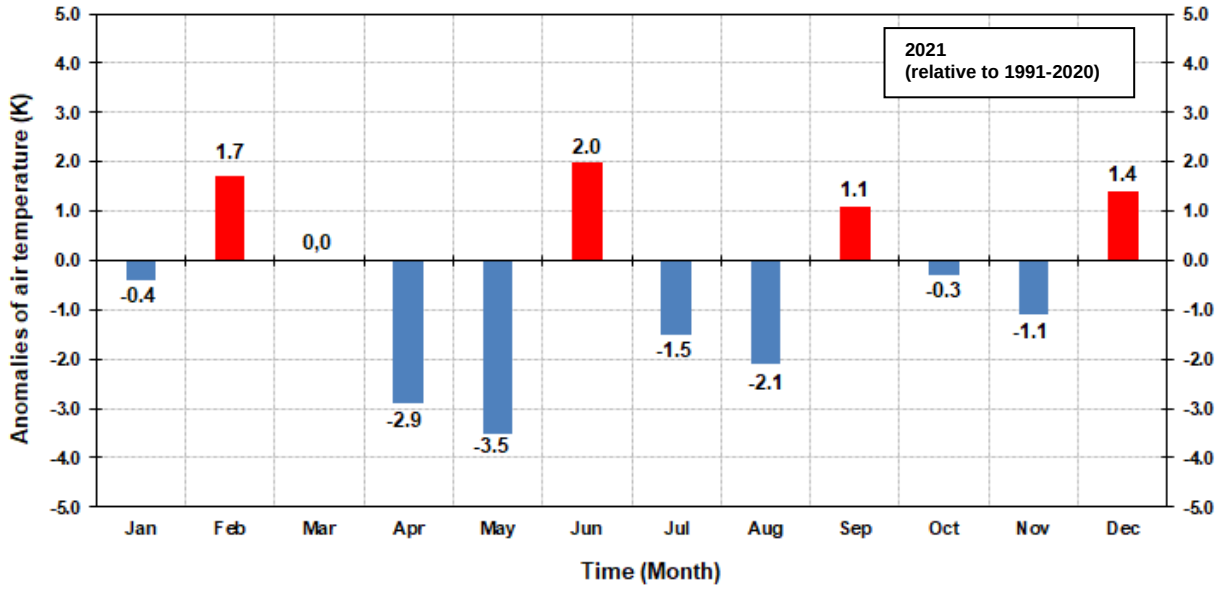

Fig. 1: Anomalies of monthly mean air temperatures (K) relative to the WMO normal period from 1991 to 2020 at Luxembourg/Findel (WMO 06590, 376 m, a.s.l.) in 2021.

In July, low pressure influence dominated in Luxembourg and air temperatures were 1.5 K below the long-term average. In August 2021, Luxembourg was mostly under the influence of low-pressure areas moving from the British Isles to southern Scandinavia. This autumn like weather pattern caused air temperatures in August to stay significantly (2.1 K) below the climate normal. After the unsettled and cool weather conditions of the summer, it was mainly high-pressure that dominated in September. Monthly mean air temperatures in September rose 1.1 K above the long-term average. Short unsettled weather periods alternated with several calm high-pressure periods in October. Thus, air temperatures in Luxembourg were only slightly below the normal (0.3 K). The persistent influence of high pressure over central Europe blocked Atlantic low-pressure systems during November. This weather pattern led to a monthly mean air temperature of 4.1 °C, deviating minus 1.1 K from the long-term average. In December, after a few high pressure periods numerous Atlantic frontal systems caused unstable weather conditions in Luxembourg. Especially after the passage of several lows unusually warm air from the Bay of Biscay region was transported to Central Europe, resulting in a positive anomaly of 1.4 K.

Table 1: Monthly and annual mean air temperatures (°C) as well as anomalies (K) relative to the WMO normal periods from 1991 to 2020 and from 1981 to 2010 at Luxembourg/Findel (WMO 06590, 376 m, a.s.l.) in 2021.

2021	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Air temperatures (°C)	1.0	3.9	5.7	6.7	10.0	18.7	17.2	16.3	15.4	9.6	4.1	3.7	9.4
Normals (1991-2020)	1.4	2.2	5.7	9.6	13.5	16.7	18.7	18.4	14.3	9.9	5.2	2.3	9.8
Anomalies (K)	-0.4	1.7	0	-2.9	-3.5	2.0	-1.5	-2.1	1.1	-0.3	-1.1	1.4	-0.4
Normals (1981-2010)	0.8	1.6	5.2	8.7	13.0	15.9	18.2	17.7	13.9	9.5	4.7	1.8	9.3
Anomalies (K)	0.2	2.3	0.5	-2.0	-3.0	2.8	-1.0	-1.4	1.5	0.1	-0.6	1.9	0.1

Extremes and peculiarities

The maximum air temperatures, recorded at Luxembourg/Findel-Airport on March 31, 2021 (23.5 °C), exceeded the existing absolute record from March 29, 1968 (22.2 °C). This event can be referred to as unprecedented. The monthly mean air temperature of 6.7 °C recorded during April 2021 at Findel-Airport is the lowest value measured since 1989. Spring 2021 was unusually cold in Luxembourg. It was the coldest spring since 2013. The maximum air temperature of 12.5 °C recorded on the 30st of December 2021 at Findel-Airport is the third-highest air temperature ever recorded in the last decade of December since 1947. This event can be referred to as exceptional.

2. Precipitation amount

In this report observed days of precipitation are based on daily sums between 06 UTC and 06 UTC on the following day.

Anomalies with respect to 2021

The annual precipitation amount reached 784.2 mm in 2021. Annual rainfall was about 5.7% lower than the long-term average of 831.3 mm (1991 to 2020). The total number of 168 precipitation days (≥ 0.1 mm) was slightly below the long-term climate normal (177.4 days).

Anomalies with respect to seasons

Seasonal precipitation in winter 2020/2021 amounted to a total of 263.9 mm at Luxembourg/Findel-Airport, about 20.0% above the long-term average (220.6 mm). In spring the precipitation amount reached 157.2 mm. The seasonal precipitation total was about 12% lower than the 1991 to 2020 climate normal (179.3 mm). Seasonal precipitation in summer amounted to 306.2 mm, significantly above the normal (41%) for the 30-year period from 1991 to 2020 (217 mm). MeteoLux recorded 116.4 mm in autumn, thus well below the normal (214.5 mm) at Findel-Airport. The number of precipitation days (≥ 0.1 mm) in winter 2020/2021 reached 57, slightly exceeding the climate normal (51 days). During spring the precipitation days reached 37 days, just below the long-term average (42 days). In summer the number of precipitation days (43) was just above the climate normal (40 days). The number of precipitation days in autumn 2021 summed up to 36, thus clearly below the normal (45 days).

Anomalies with respect to single months

With the exception of January, May, and most of all July precipitation amounts throughout 2021 were all lower than the climate normal. Significant precipitation deficits occurred in September (Figure 2, Table 2). After some high-pressure periods at the beginning of the year the impact of low pressure systems caused unsettled weather in Luxembourg. These westerly conditions brought longer periods of continuous precipitation. In January 94.2 mm of precipitation were measured, nearly 32% above the climate normal. After a wet start in the beginning of February dry weather periods prevailed, resulting in precipitation amounts of 52.0 mm and just 7.5 mm below the long-term average. During March Luxembourg was much drier than average. Precipitation amounts in March were 40.2 mm, thus 29% below the climate normal. The blocked weather pattern with high pressure over western and central Europe caused below the average precipitation sums in April (-13.2 mm). May was substantially wetter than normal in Luxembourg. A dominant low-pressure systems over Northern Europe with unsettled weather from the Atlantic caused precipitation amounts to rise about 10% above the long-term average. In June, Central Europe was several times under the influence of high-pressure systems, which were often impacted by lows. This frequently resulted in local thunderstorms and heavy rain showers. However, precipitation amounts at Findel Airport were only 55.8 mm in June, thus about 24% below the climate normal.

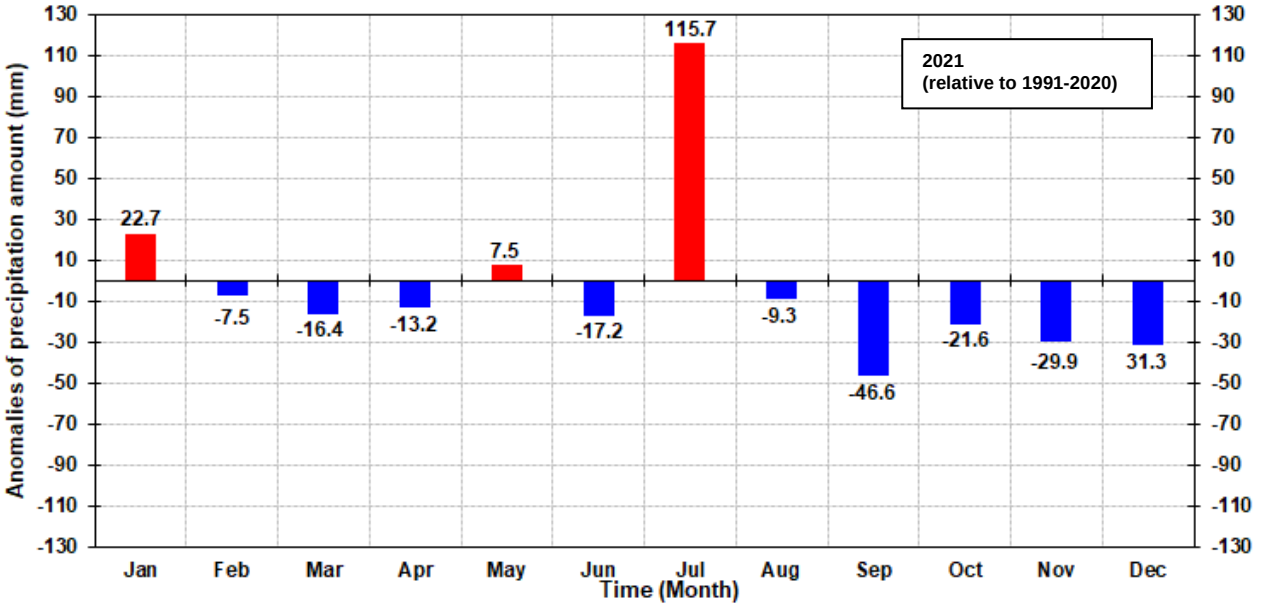

Fig. 2: Anomalies of monthly precipitation amount (mm) relative to the WMO normal period from 1991 to 2020 at Luxembourg/Findel (WMO 06590, 376 m, a.s.l.) in 2021. Observational days for precipitation are based on daily sums between 06 UTC and 06 UTC of the following day.

Due to several persistent low-pressure systems, partly stationary, the western parts of central Europe saw much above average precipitation in July, resulting in devastating floods. In July 187.8 mm of precipitation were measured, nearly 160% above the normal. August was dominated by a large number of low-pressure systems, which led to frequent rainfall. Precipitation amounts in August reached 62.6 mm, thus 13% below the normal. Several high-pressure periods in September caused extended dry periods. Thus, precipitation amounts in September were 20 mm, 70% below the climate normal. Due to several high-pressure periods in October, precipitation amounts were about 28% below the climate normal. During November the persistent influence of high pressure over central Europe blocked Atlantic lows, which led to much drier conditions (about 42% below the normal). Precipitation amounts in December were about 35% below the long-term average.

Table 2: Monthly and annual precipitation amount (mm) as well as anomalies (mm) relative to the WMO normal period from 1991 to 2020 and from 1981 to 2010 at Luxembourg/Findel (WMO 06590, 376 m, a.s.l.) in 2021. Observational days for precipitation are based on daily sums between 06 UTC and 06 UTC of the following day.

2021	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation amount (mm)	94.2	52.0	40.2	36.2	80.8	55.8	187.8	62.6	20.0	54.6	41.8	58.2	784.2
Normals (1991-2020)	71.5	59.5	56.6	49.4	73.3	73.0	72.1	71.9	66.6	76.2	71.7	89.5	831.3
Anomalies (mm)	22.7	-7.5	-16.4	-13.2	7.5	-17.2	115.7	-9.3	-46.6	21.6	-29.9	-31.3	-47.1
Normals (1981-2010)	76.6	62.5	69.1	58.2	78.5	79.9	71.0	75.4	76.3	86.8	76.0	86.7	897.0
Anomalies (mm)	17.6	-10.5	-28.9	-22.0	2.3	-24.1	116.8	-12.8	-56.3	32.2	-34.2	-28.5	-112.8

Extremes and peculiarities

July 2021 (187.8 mm) was the second-wettest July at Findel Airport since 1947. The heavy precipitation event on July 14 resulted in two absolute records in precipitation intensity. The maximum precipitation amounts within 12 hours amounted to 74.2 mm, within 24 hours to 79.4 mm. These values can be referred to as unprecedented.