

Since 2012, the publication “Focus: Weather” has offered an analysis of the climate conditions reported by the Exotic Garden weather station, drawing on temperature and rainfall data. The data presented in the publication is representative of local weather conditions in an urban environment. For the past two years, data on sunshine and wind measured by the Department of the Environment from the roof of Monaco’s Oceanographic Museum has also been included in the Focus.

2019, a particularly hot year, was marked by two heat waves and two severe Mediterranean storms in late November and on 1 December 2019, followed by a third significant event on 20 and 21 December.

**Temperature: 2019 – a particularly hot year**

**Table 1. Temperatures by decade**

	Average	Average of minimum values	Average of maximum values	Absolute minimum	Absolute maximum
1971-1980	15.73	12.79	18.68		
1981-1990	16.23	13.37	19.08		
1991-2000	16.42	13.51	19.34	-1.5	33.7
2001-2010	16.77	13.96	19.57	-1.5	35.5
2011-2019	17.09	14.57	19.66	-0.8	34.7
2019	17.90	15.40	20.40	4.7	34.6

Unit: degree Celsius

Source: Department of the Environment

An analysis of daily averages indicates that 2019 was particularly hot for most of the year. On average, temperatures remained above the normal, except during May and November.

Summer 2019 was marked by two heat waves (in June and July), with record-breaking maximum temperatures of 34.6°C on 27 June and 33.8°C on 24 July. In general, summer and autumn 2019 saw recorded temperatures that were significantly above the normal.

**Sunshine: 274 more hours of sun than in 2018**

Solar energy and sunshine contribute to the mild winters experienced on the French Riviera and in Monaco.

In 2019, there were 274 more hours of sunshine than in the previous year (2,616 hours in 2019 compared with a total of 2,342 hours in 2018), representing a return to the levels of sunshine seen in 2017 (2,673 hours of sunshine).

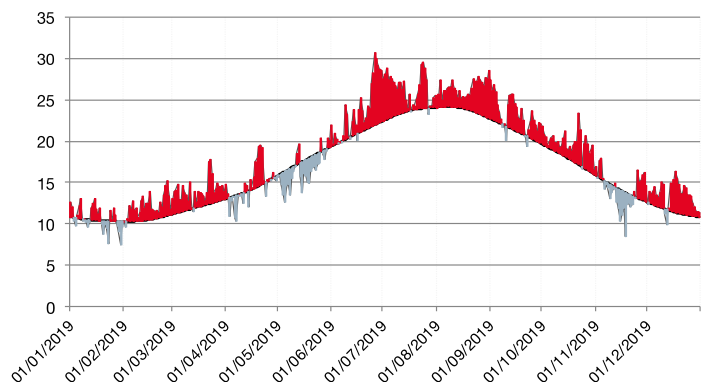
**Definitions**

- Climate normals consist of the mean precipitation and temperature values, calculated over a continuous period of 30 years, at the end of each decade.
- A 35° south-facing incline corresponds to the annual optimum for the production of photovoltaic energy.

Since the early 1970s, each decade has seen a higher average temperature than the one before it. The temperatures recorded between 2011 and 2019 confirm this trend. The increase in minimum temperatures is particularly significant. No temperatures below zero were recorded in 2019 (absolute minimum: 4.7°C in January).

With an average temperature of 17.9°C, 2019 was one of the three hottest years recorded in the Principality since 1969 (2019, 2018 and 2006), and up 1.41°C on the climate normal.

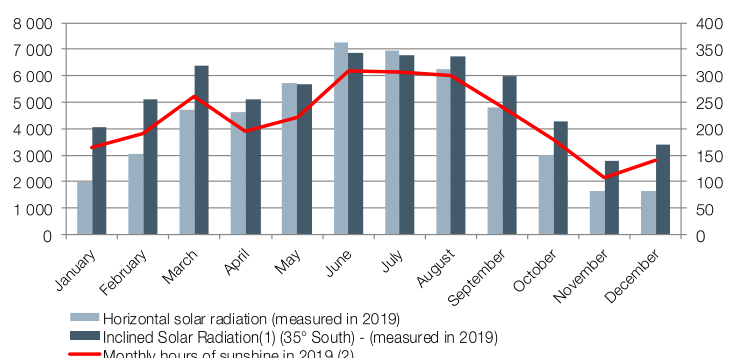
**Figure 1. Divergence of average daily temperatures in 2019 from climate normal (1981–2010)**



Unit: degree Celsius

Source: Department of the Environment

**Figure 2. Average daily sunshine (in Wh/m²) and number of hours of sunshine per month in 2019**



Units: watt-hour/m², hour

Source: Department of the Environment

## Rainfall: 2019 – a very wet year

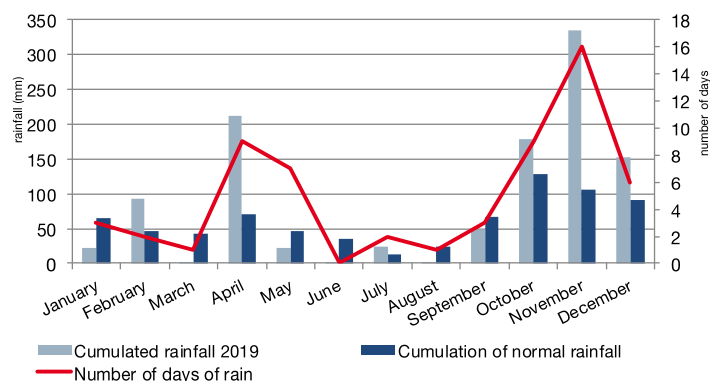
**Table 2. Ten-year rainfall assessment**

	Annual average rainfall	Observed annual maximum	Date	Number of days of rain ( $\geq 1\text{mm}$ )	Absolute max in one day	Date
1971-1980	848	1 217	en 1979			
1981-1990	706	1 114	en 1984			
1991-2000	805	1 116	en 2000	64	115.2	25/10/1999
2001-2010	695	1 134	en 2008	63	110.0	05/11/2008
2011-2019	902	1 485	en 2014	65	148.4	04/10/2015
2019	1 092			59	104.1	April 3, 2019

Unit: millimeter

Source: Department of the Environment

**Figure 3. Number of days of rain and rainfall**

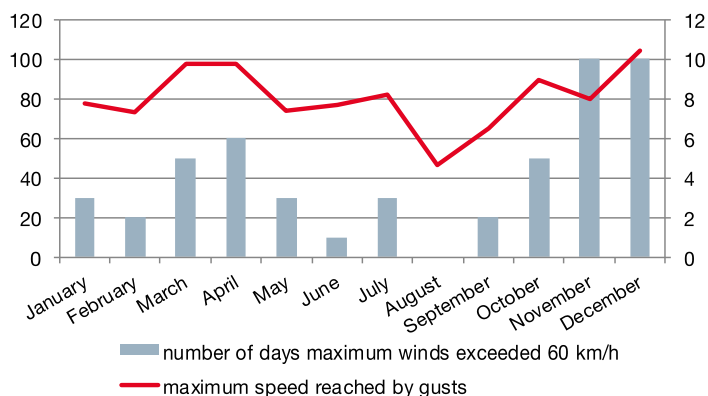


Units: millimeter and number

Source: Department of the Environment

## Wind: gust reaching more than 100 km/h

**Figure 4. Number of windy days and maximum gust speed**



Units: kilometer/hour, number

Source: Department of the Environment

## Mediterranean storms

2019 was marked by two severe Mediterranean storms in late November (from 21 to 24 November) and early December (1 December). During the November event, the strong rainfall was accompanied by particularly adverse sea conditions. The maximum wave height recorded reached nearly 8 metres, while the significant wave height (the average height of the highest one third of waves) was 3.80 metres off the coast of Monaco during the storm (CANDHIS data – Monaco campaign – CEREMA/Monaco).

An active weather disturbance also swept across south-eastern France in late December, resulting in the precautionary closure of schools in the Alpes-Maritimes region on Friday 20 December 2019.

In its conclusion to the report on these events, the French meteorological service Météo-France noted that “it is highly probable that the increase in the intensity and frequency of extreme precipitation in south-eastern France is linked to current climate warming. With regard to the future, climate models seem to agree that extreme precipitation events will continue to intensify in the region.”

The rainfall normal in Monaco is 735.4 mm and 63 days of rain per year.

Featuring five years in which there has been heavy rainfalls, including the record-breaking year of 2014, average rainfall for the current decade (2011–2019) remains higher than the normal, despite three years (2015, 2016 and 2017) in which there was less rain than usual.

Total rainfall in 2019 (1,092 mm) was 357 mm higher than the normal, despite the fact that it rained on fewer days. This excess rainfall can be explained in particular by the intense storms that occurred at the end of the year over short periods (132.7 mm of precipitation in 48 hours in November and 84.80 mm in 48 hours in December 2019).

February, April and, to a lesser extent, July also experienced total rainfall that was higher than expected, with record precipitation in April (212.60 mm, an increase of 142.30 mm compared with the normal, making this the rainiest April on record since 1969). The other months of the year experienced a shortfall, particularly the months of March, June and August, during which there was virtually no precipitation.

In 2019, wind gusts exceeded 60 km/h on 50 days.

In November and December, which were particularly windy, maximum wind speed exceeded 60 km/h on 20 days.

The strongest gust recorded on the roof of the Oceanographic Museum in 2019 was measured at 104.4 km/h on 22 December.

