AÑO JUBILAR 2017
CARAVACA DE LA CRUZ

A Pilgrim's Climatological Guide to

Caravaca de la Cruz

GOBIERNO DE ESPAÑA
MINISTERIO DE AGRICULTURA Y PESCA, ALIMENTACIÓN Y MEDIO AMBIENTE
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Introduction

The celebration of a Jubilee Year in perpetuity is a privilege which the town of Caravaca de la Cruz shares with just a handful of world cities, including Rome, Jerusalem and Santiago de Compostela. On the occasion of its Jubilee Year 2017, Spain's State Meteorology Agency (AEMET) is updating an earlier brochure, published in 2003, on the climate of this town in Murcia. Compiled by AEMET's Murcia Regional Office, it seeks to give travellers and pilgrims basic information about weather and climate conditions which they may find useful when planning their visit.

Temperature, precipitation (either as rain or snow), storms, wind, humidity and insolation are the weather variables that most affect travellers. This brochure will provide them with the most relevant statistics about Caravaca de la Cruz, with short texts and accompanying charts that are easy to interpret. The data is based on observations undertaken in the municipality and provides more than enough information for a study of this kind.

In addition to up-to-date weather data, the document includes a brief climate survey in the form of charts on the Camino de Levante *(the Levante Pilgrims' Way) and future tendencies, in the form of climate projections for Caravaca de la Cruz.*

We trust the publication will prove useful and would also recommend that, in addition to the information shown here, both before and during their journey, pilgrims keep up to date with the daily weather forecasts which the AEMET meteorology agency publishes several days in advance at:
http://www.aemet.es/es/eltiempo/prediccion/

Miguel Ángel López González
President of AEMET

Panoramic view of Caravaca de la Cruz with snow

A Pilgrim's Climatological Guide to CARAVACA DE LA CRUZ

Caravaca de la Cruz is in the north west of the Region of Murcia (figure 1), 625 metres above sea level. Most of the municipality is at high altitude and two thirds of its territory lies more than 800 metres above sea level.

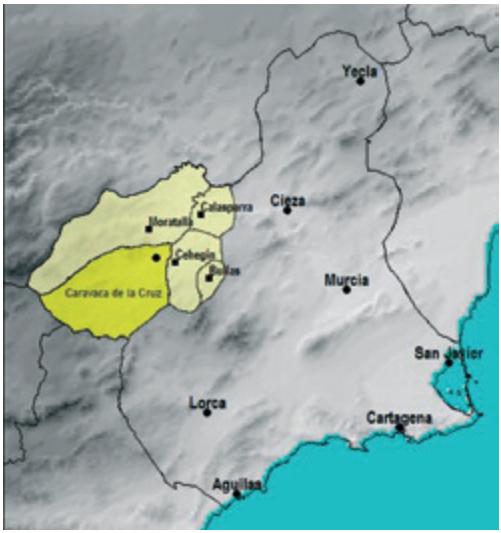


Figure 1. The area marked in yellow is the north-west district of the Region of Murcia and its municipalities.

The distance from the city to the Mediterranean coast is about 80 kilometres as the crow flies. But the landscape is actually very rugged. The highest mountain ranges are to be found to the north and west of the municipality. These are Sierra de los Mojantes (1605 metres) and Sierra del Gavilán (1477 metros) respectively, with Cerro Gordo (1187 metres) just 3 kilometres from the town of Caravaca de la Cruz. To the south and south west, there is a series of hills and plateaus at a somewhat lower altitude, which include Sierra de la Pinosa, Sierra Áspera and Cuerda de la Serrata. The central and eastern sectors feature a series of high catchment areas, drained by the Argos and Quípar rivers, which run the whole length of the municipality from west to east and which are home to its main villages.

Tourist route Fuentes del Marqués

The local flora is made up of conifer, pine and holm-oak forests which dominate the higher altitudes, while ground vegetation is a mixture of rosemary, lavender, gorse, juniper, mastic, bearberry and tufted heathland. In the lower-lying areas, the heathland features rosemary and heather. Black and white poplars grow on riverbanks.

According to the Köppen Climate Classification System, Caravaca de la Cruz can be defined as wet and temperate – also known as "Mediterranean climate" (coded Cs in this system) – with hot summers in most of the municipality, except the far west where they are more temperate. In this area, the Mediterranean influence is tempered by the high altitude, with lower temperatures and more rainfall than in neighbouring areas.

TEMPERATURE SUMMARY (1981-2010)

Average temperature	15.3 °C
Average maximum temperature	21.2 °C
Average minimum temperature	9.4 °C
Absolute maximum temperature	41.0 °C (*)
Absolute minimum temperature	–9.0 °C (29/01/2006)
Average temperature in hottest month (July)	24.6 °C
Average temperature in coldest month (January)	7.1 °C
Average annual no. of days with max. temperature ≥ 35 °C	16 days
Average annual no. of days with min. temperature ≤ 0 °C	24 days

Table 1. Temperature summary taking normal values for the reference period 1981-2010 at weather station 7119A Caravaca "Polideportivo". (*) Several dates (05.08.1985, 04.07.1994 and 22.07.2009).

PRECIPITATION SUMMARY (1981-2010)

Average annual precipitation	384 mm
Maximum annual precipitation	891 mm (1989)
Minimum annual precipitation	152 mm (1983)
Average precipitation wettest month (November)	45 mm
Average precipitation driest month (July)	6 mm
Maximum monthly precipitation	260 mm (November 1989)
Maximum daily precipitation	99 mm (14/11/1989)
Average no. of days per year with precipitation	61 days
Average no. of days per year with precipitation ≥ 10 mm	12 days

Table 2. Rainfall summary based on normal values for the reference period 1981-2010 at weather station 7119A Caravaca "Polideportivo".

River in Fuentes del Marqués

The average annual temperature (table 1) is around 15 °C, with an average temperature variation of approximately 12 °C, giving the Caravaca de la Cruz climate a somewhat continental character. Average precipitation (table 2) is around 380 mm (or l/m^2) a year.

In seasonal terms, and in comparison to the rest of the Region of Murcia, the overall climate conditions can be described as follows:

- Winters are relatively cold, with an average temperature of 9 °C and an average 24 days of frost per year. January is the coldest month, with an average temperature of about 7 °C. Average rainfall is around 100 mm.
- Springs are mild and wet in Caravaca de la Cruz, with average temperatures of 17 °C and 100 mm average rainfall.

- Summers are generally moderately hot, with an average temperature around 23 °C, and the average temperature in the hottest month (July) about 25 °C, with an average of 16 days over 35 °C. With an average rainfall of 60 mm, they are also dry, although less so than the rest of the Region of Murcia.
- Autumns are cool and wet, with average temperature of 12 °C and average rainfall of 120 mm.

Average maximum temperatures (figures 2 & 3) range from 12 °C in January to 32 °C in July. The absolute maximum temperature recorded between 1986 and 2016 was 42.0 °C, on 10 August 2012.

Source in Fuentes del Marqués

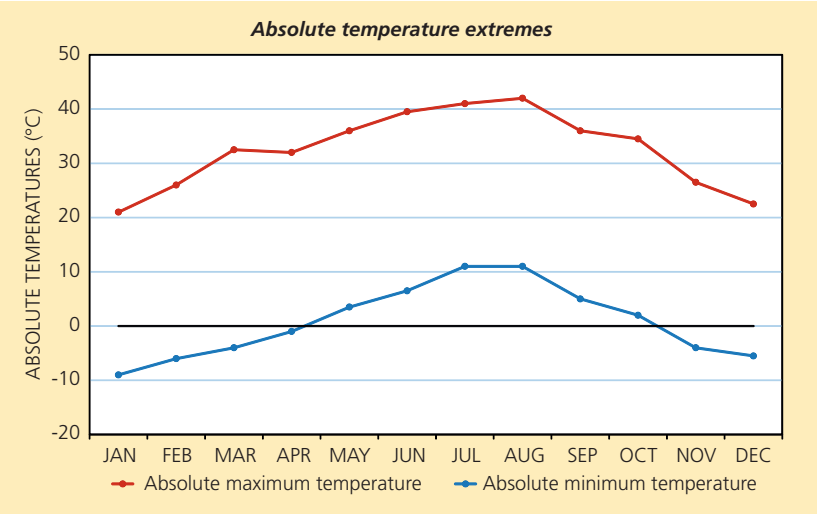


Figure 2. Absolute monthly temperatures recorded in the period 1986-2016. Maximum temperatures shown in red, minimum in blue.

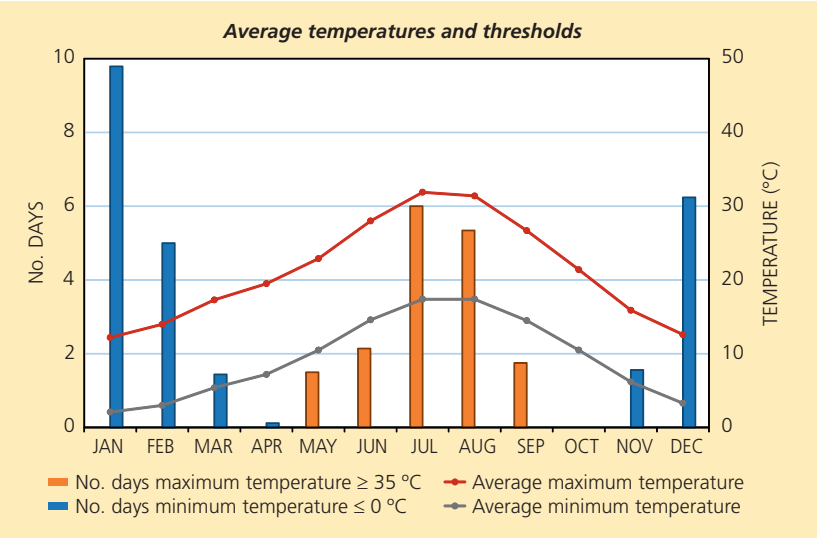


Figure 3. Number of days with maximum temperatures equal to or above 35 °C shown in orange; number of days with minimum temperatures equal to or lower than 0 °C shown in blue; monthly average of maximum temperatures shown in red; and minimum temperatures in grey. Data calculated from the 1986-2016 series.

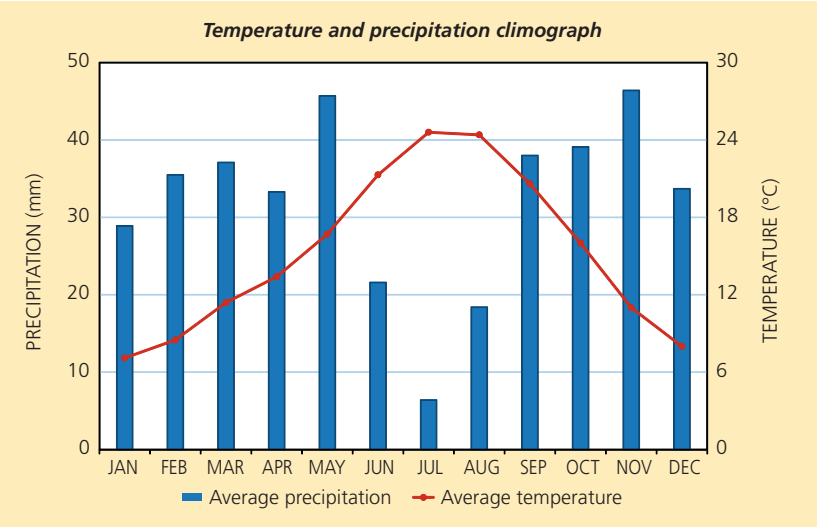


Figure 4. Average monthly precipitation (blue columns) and average monthly temperature (red line) for reference period 1981-2010.

On the other hand, temperatures reach or exceed 35 °C (figure 3) on between 5 and 6 days, during the months of July and August, with virtually no such days between October and April.

Average minimum temperatures (figures 2 & 3), range from 2 °C in January and 18 °C in August. The absolute minimum temperature recorded in the same period was –9 °C on 29 January 2006. The average number of days with frost (figure 3) is ten in January, about 5 in January and negligible the rest of the year.

The annual rainfall cycle (figure 4) is at its lowest in summer, with a monthly minimum of 6 mm in July. Annual maximum levels occur in autumn and spring, particularly in the months of November and May, with figures close to 45 mm. There is a slight drop in precipitation in winter, when it falls to about 30 mm a month.

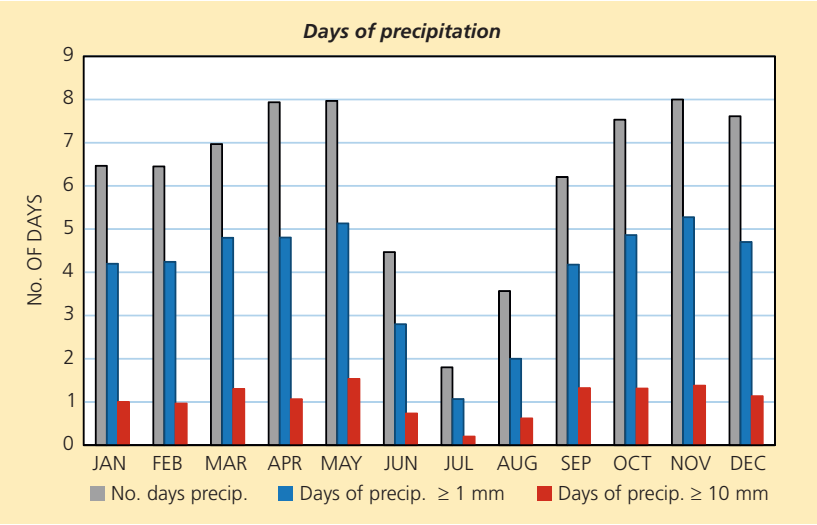


Figure 5. Number of days of monthly precipitation shown in grey; number of days of precipitation equal to or more than 1 mm in blue; and days of precipitation over 10 mm in red. Reference period: 1986-2016.

Over the annual cycle, the number of days with precipitation (figure 5) follows a similar pattern to the one for precipitation volume, with the minimum in summer – only one or two days in July – and maximum in autumn and spring, reaching an average of up to eight in April, May and November. By contrast, the number of days where precipitation reaches or exceeds 10 mm is less variable across the year, ranging from between 1 and 2, depending on the month in question.

Between 1986 and 2016, maximum daily precipitation (figure 6) was 104 mm on 28 September, 2012. In general, the maximum amounts in a day also occur in the autumn and, to a lesser extent, in spring.

Other variables of interest include the number of days with snow or storms (figure 7). Snow only occurs in the winter months although the average is less than one day per month even so.

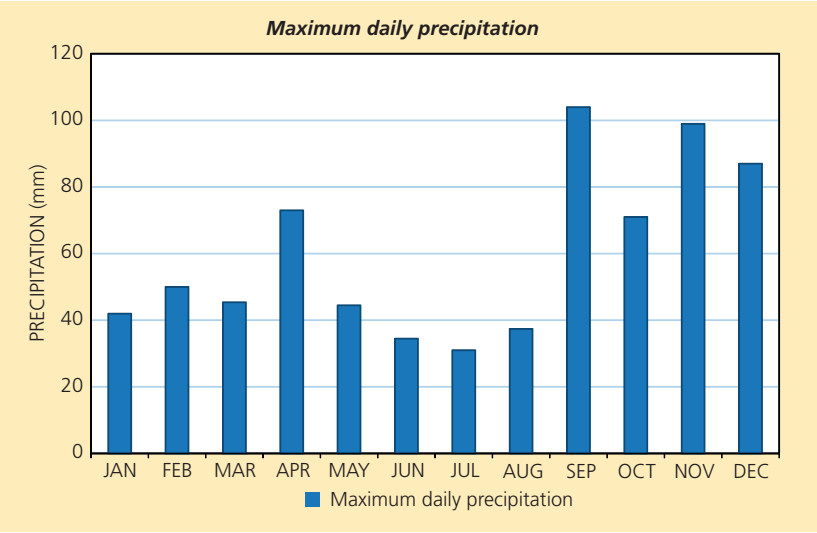


Figure 6. Maximum daily precipitation in mm recorded by month in the period 1986-2016.

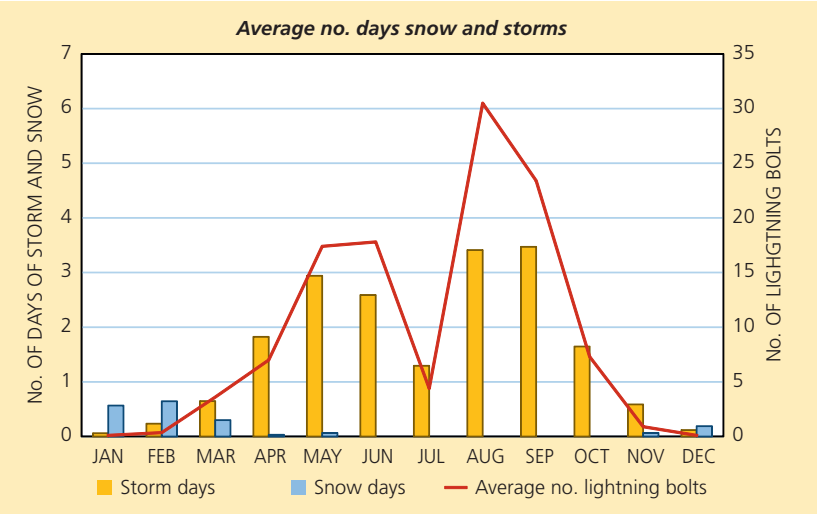


Figure 7. Average number of days of snow per month shown in blue and average number of stormy days per month in yellow (with data taken from the 1986-2016 series); average number of lightning bolts per month for the period 2000-2016 shown in red.

Façade of the Basilica-Shrine of La Vera Cruz and city walls

The annual average for the number of stormy days is 19. There are two maximum figures over the year. The first is in spring and is associated with storms caused by solar radiation warming the earth's surface. These tend to develop in the afternoon. The second and more frequent peak occurs at the end of summer and beginning of autumn and is caused by cold air entering the middle atmosphere over the Mediterranean which gets very hot at this time of year. May, August and September have the highest number of stormy days (between three and four). The month with the greatest electrical activity is August, with a monthly average of 30 lightning bolts.

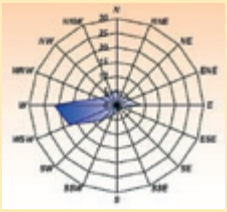
Relative air humidity shows no major variations throughout the year, although figures reach a minimum in summer (45 % in July) and a maximum in winter (68 % in December). The average annual figure is around 60 %.

Wind (figure 8) is predominantly westerly throughout the year, although less so in spring and summer when the proportion of the easterly component grows, reaching virtually equal figures in summer. In autumn, 42 % of wind is westerly, in winter 40 % and 30 % and 29 % in spring and summer respectively, with the easterly component reaching an equal proportion in summer. This dominant wind direction, with a marked absence of northwesterly wind due to the shelter provided by the Gavilán mountain range and the channelling that takes place between the Gavilán and Quípar ranges.

The Templete and Concepción Tower

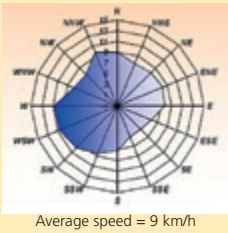
Winter wind roses

Direction frequency as %



Calm weather episodes = 2 %

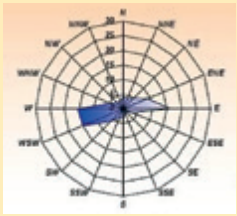
Average speed (km/h) in each direction



Average speed = 9 km/h

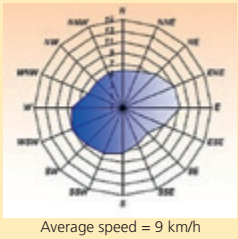
Spring wind roses

Direction frequency as %



Calm weather episodes = 5 %

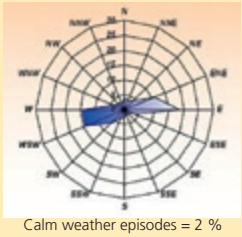
Average speed (km/h) in each direction



Average speed = 9 km/h

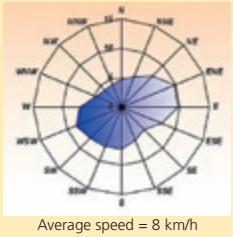
Summer wind roses

Direction frequency as %



Calm weather episodes = 2 %

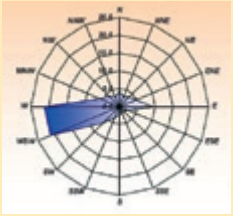
Average speed (km/h) in each direction



Average speed = 8 km/h

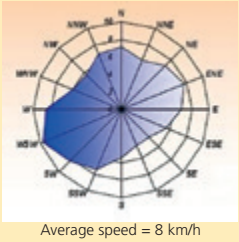
Autumn wind roses

Direction frequency as %



Calm weather episodes = 2 %

Average speed (km/h) in each direction



Average speed = 8 km/h

Figure 8. Seasonal wind roses drawn up from data compiled at the Caravaca weather station "Fuentes del Marqués", 2009-2016 period.

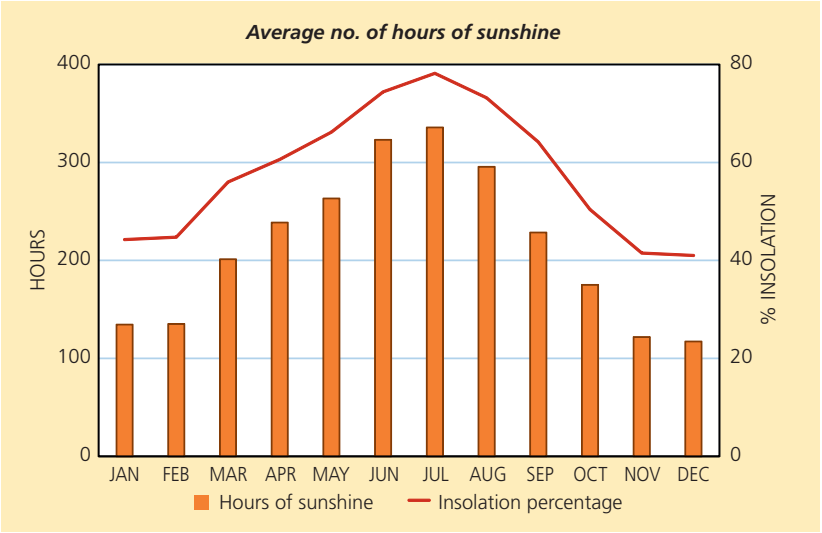


Figure 9. Average number of hours of sunshine per month shown in orange columns; percentage of monthly insolation with respect to the maximum monthly insolation in red line. Data for the 2012-2016 period

Winds are usually light, with an average speed of between 8 and 9 km/h. The third quadrant in winter and autumn, and the first quadrant in spring and summer show the highest average wind speeds. The highest gust speed recorded at the Caravaca weather station "Fuentes del Marqués" was northwesterly, reaching 105 km/h on 30 January, 2010.

The average number of hours of sunshine (insolation) in Caravaca de la Cruz (figure 9) is around 2500 hours, ranging from about 4 hours a day in December to 11 hours a day in July. The percentage of hours of sunshine, calculated using daily sunshine with respect to maximum insolation for each day is related to cloud presence.

Interior of El Salvador Church

Detail from the façade of El Salvador Church

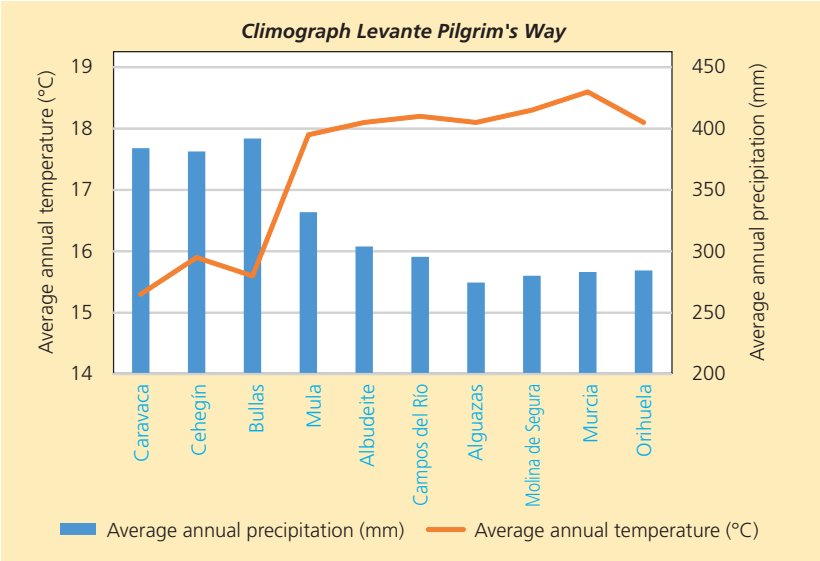


Figure 10. Average annual precipitation (mm) in the municipalities on the Levante Pilgrim's Way shown in blue; average annual temperature (°C) in orange.

The forecast for each municipality can be accessed by clicking on its name.

For pilgrims who wish to follow the Levante Pilgrim's Way, which starts in the city of Orihuela in Alicante, a climograph is included (figure 10) with the average annual figures for temperature and precipitation in the municipalities en route.

Finally, climate change projections are given for Caravaca de la Cruz to provide an insight into the 21st-century climate trends that will be encountered by future pilgrims.

The following charts show changing trends in accumulated annual precipitation, and average maximum and minimum annual temperatures, showing changes in the 1971-2000 climate period.

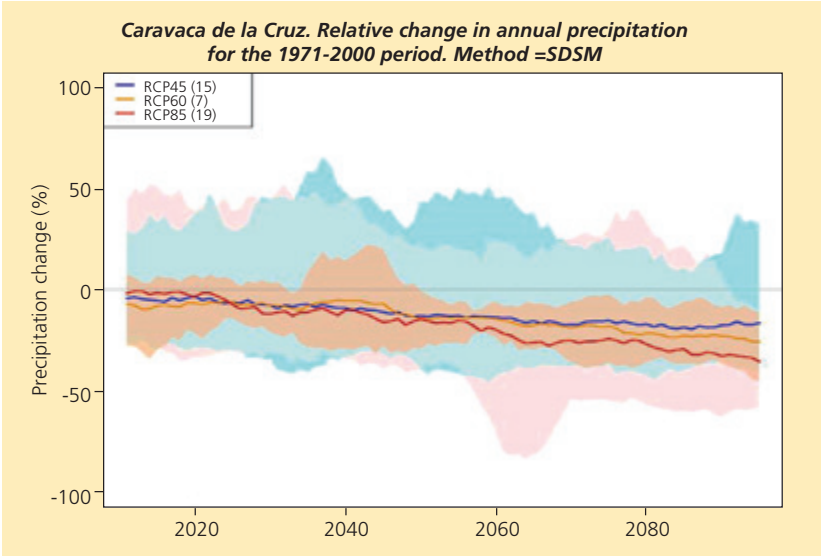


Figure 11. The solid lines represent the average projection of the set of models for each of the three forcing scenarios used. The shaded area (uncertainty) refers to the difference between the lowest and highest change values obtained by the different models used in each scenario. The number of models used in each scenario is specified in the chart legend.

The charts have been drawn up using information available on the Spanish Meteorology Agency (AEMET) website: http://www.aemet.es/es/serviciosclimaticos/cambio_climat/datos_diarios, from data derived from statistical regionalisation (based on linear regression) made on a set of global climate models based on three radiative forcing scenarios (RCP 4.5/6.0/8.5). All the models were used to prepare the Fifth Report of the Intergovernmental Panel on Climate Change (IPCC) for 2014.

Figure 11 describes the changes projected in accumulated annual precipitation for the 21st century. The most noteworthy finding is a decrease in precipitation of between 25 % and 30 % by the end of the century.

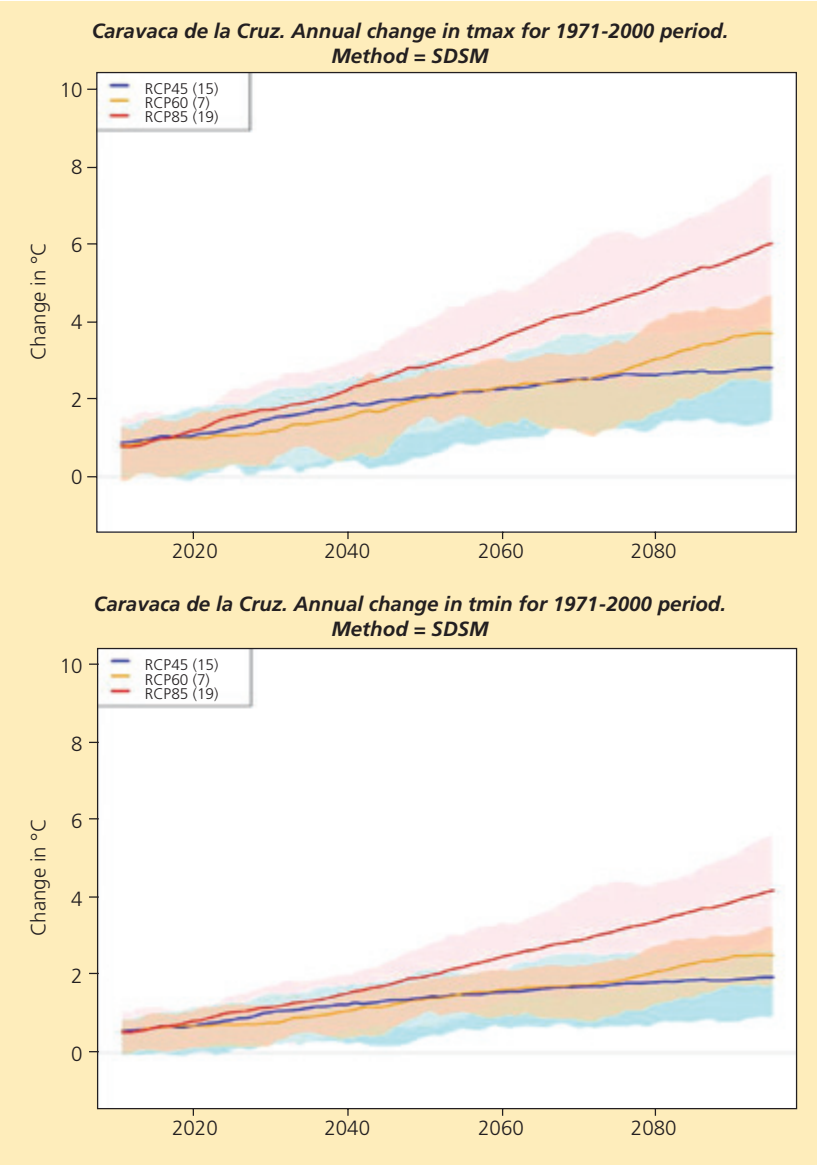


Figure 12. Changes (in °C) projected in the average annual values for maximum temperatures (top) and minimum temperatures (bottom), compared to the average values for the reference period 1971-2000.

Running of "Los Caballos del Vino"

Uncertainty in these projections (shaded areas) for the different scenarios is high, at around 50 %. If changes in accumulated precipitation are analysed for the different seasons of the year, most show a decrease and a very similar uncertainty to that obtained for annual precipitation. However, in summer the decrease in precipitation is rather greater (40 %), and the projection also shows less uncertainty compared to other times of the year.

Figure 12 shows the changes in average annual values for maximum (top) and minimum temperatures (bottom). In general, it is estimated there will be a continuous rise in both temperatures over the course of the century, a rise also observed for the different seasons. In general, the rise is higher in maximum temperatures (around 4 °C average by the end of the century) than minimum (between 2 and 3 °C), with greater uncertainty in the changes projected for maximum temperatures. As with precipitation, summer is the time for which greatest changes are projected, at around 5 °C for maximum temperature and 4 °C for minimum temperature.

NB: The projection data only indicates trends and its reliability and resolution is not comparable to observational data or short- and medium-term forecasts.

FOR FURTHER WEATHER INFORMATION

General forecast for Spain (up to 9 days) (http://www.aemet.es/es/eltiempo/prediccion/espana)
General forecast for the Region of Murcia (up to 4 days) (http://www.aemet.es/es/eltiempo/prediccion/comunidades?k=mur&w=11)
Weather information on road and driving conditions (http://meteoruta.aemet.es/p_index.html)

Santísima Vera Cruz

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