

## Fact sheet No. 7 – Climate of Southwest England

### Introduction

The counties included in this area are Cornwall, Devon and Somerset together with the Isles of Scilly.

Much of the landscape of Devon and Cornwall consists of plateaux at varying levels. The plateaux surfaces reach the sea in cliffs, for which the area is famous, but with a few areas of sand dunes as well.

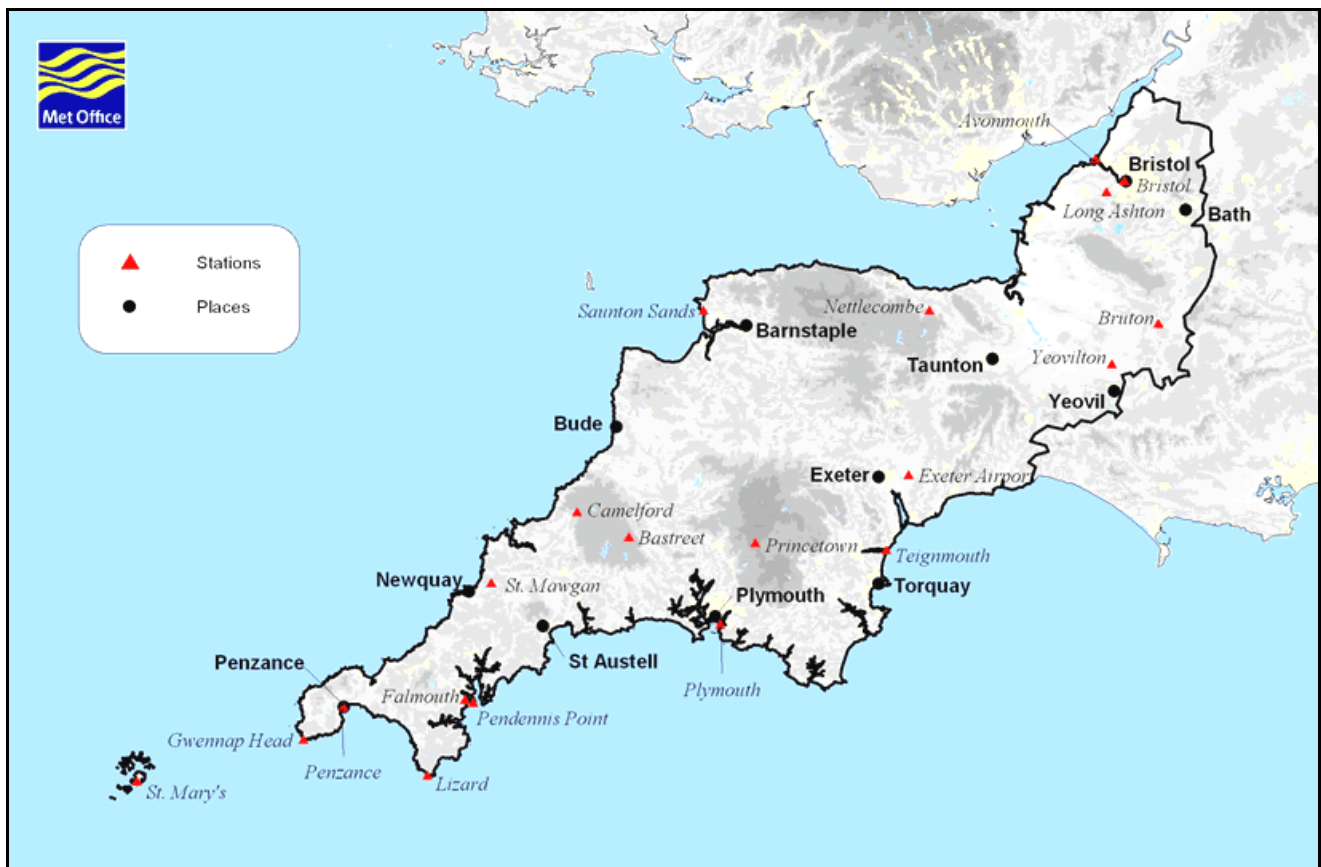


Figure 1. Map of Southwest England.

The plateaux are deeply incised by rivers, and many of the lower river valleys have been submerged to form picturesque estuaries such as the Dart and Tamar.

The highland areas coincide with the granite outcrops forming Dartmoor and Bodmin Moor and reach 621 metres on Dartmoor.

The high ground of Exmoor, made up from gritstones and slates, reaches 521 metres at its highest point. It lies in the counties of Devon and Somerset.

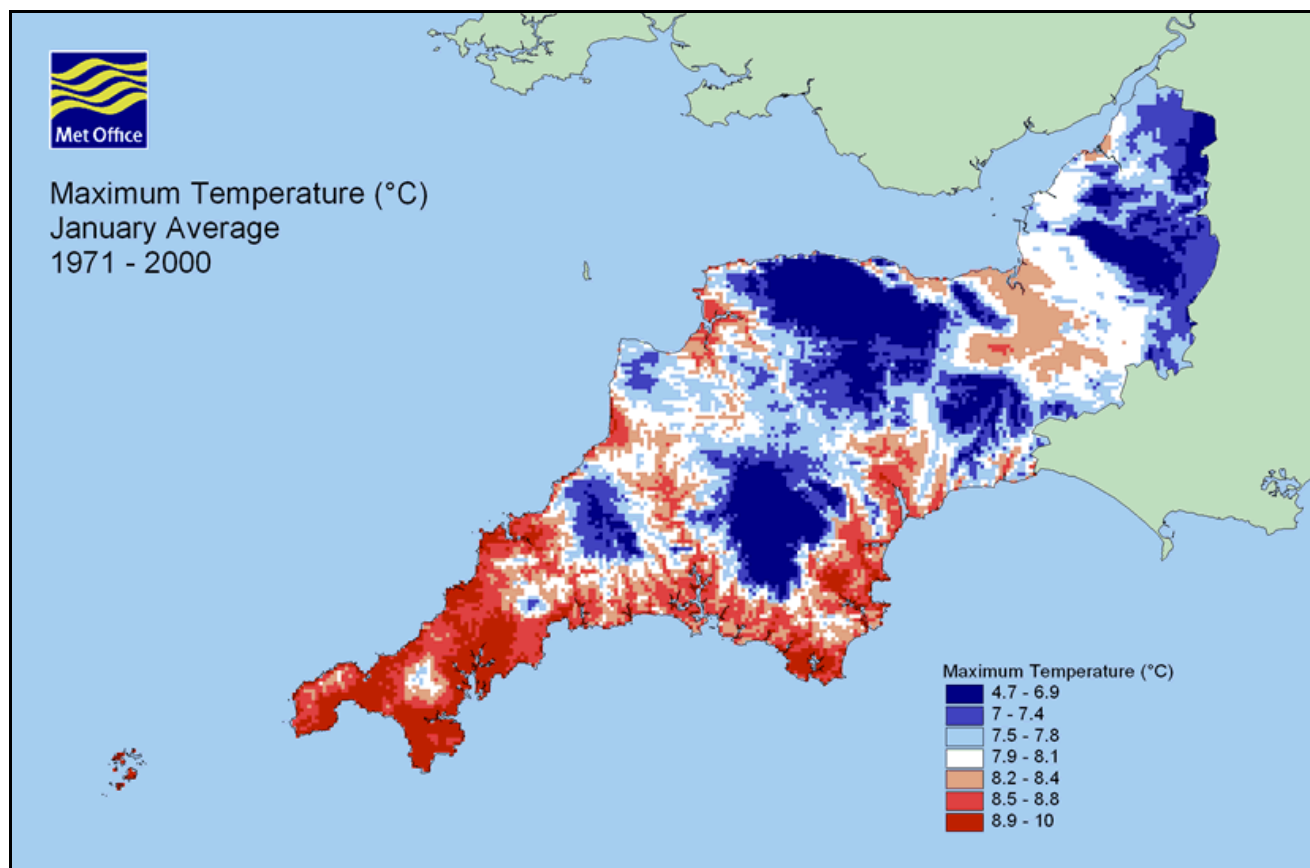
To the east of Exmoor are the low lying Somerset Levels. This is an area similar to the Fens, which lies just above sea level and in the past was subject to flooding. To the south of Bristol lie the Mendip Hills, an area of limestone rocks. The porous nature of the limestone has led to a lack of surface streams with most drainage underground. Extensive underground caverns have been formed, perhaps the most famous being at Cheddar.

The Isles of Scilly, which lie 40km to the west of Cornwall, total approximately 18 square km. St Mary's is the largest island and has a highest point of 51 metres.

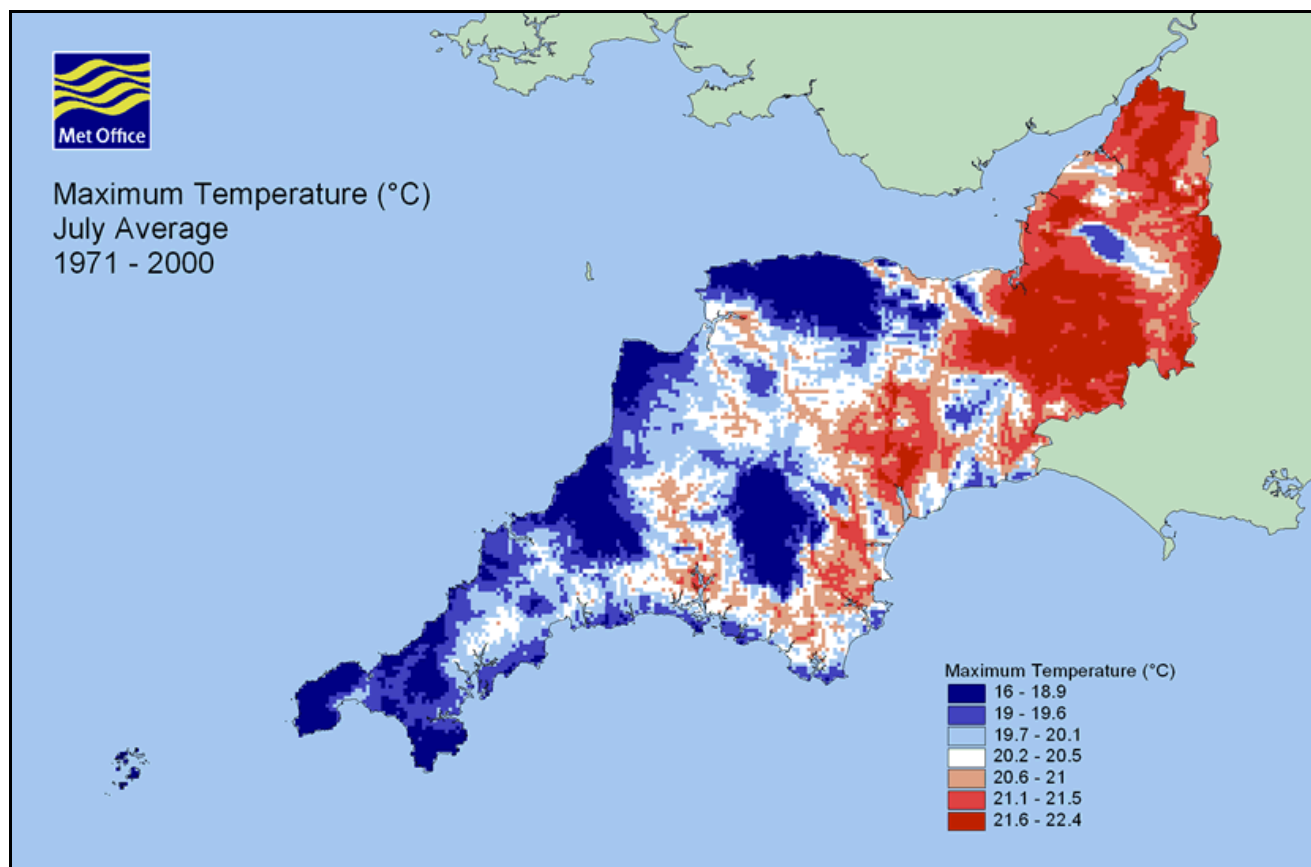
## **Temperature**

The south-west peninsula forms the most southerly and westerly part of the British Isles. The sea which surrounds the area on three sides has the highest annual mean temperature of any sea area near to the UK, close to 11 to 12 °C. With winds mainly blowing from the sea the annual mean temperatures are close to this in coastal areas of Cornwall and the Isles of Scilly. Compare this with the lowest UK annual mean temperature for low lying areas of about 7 °C in the Shetland Isles. The annual mean temperature tends to fall towards the north east where 10 °C would be more typical in Avon.

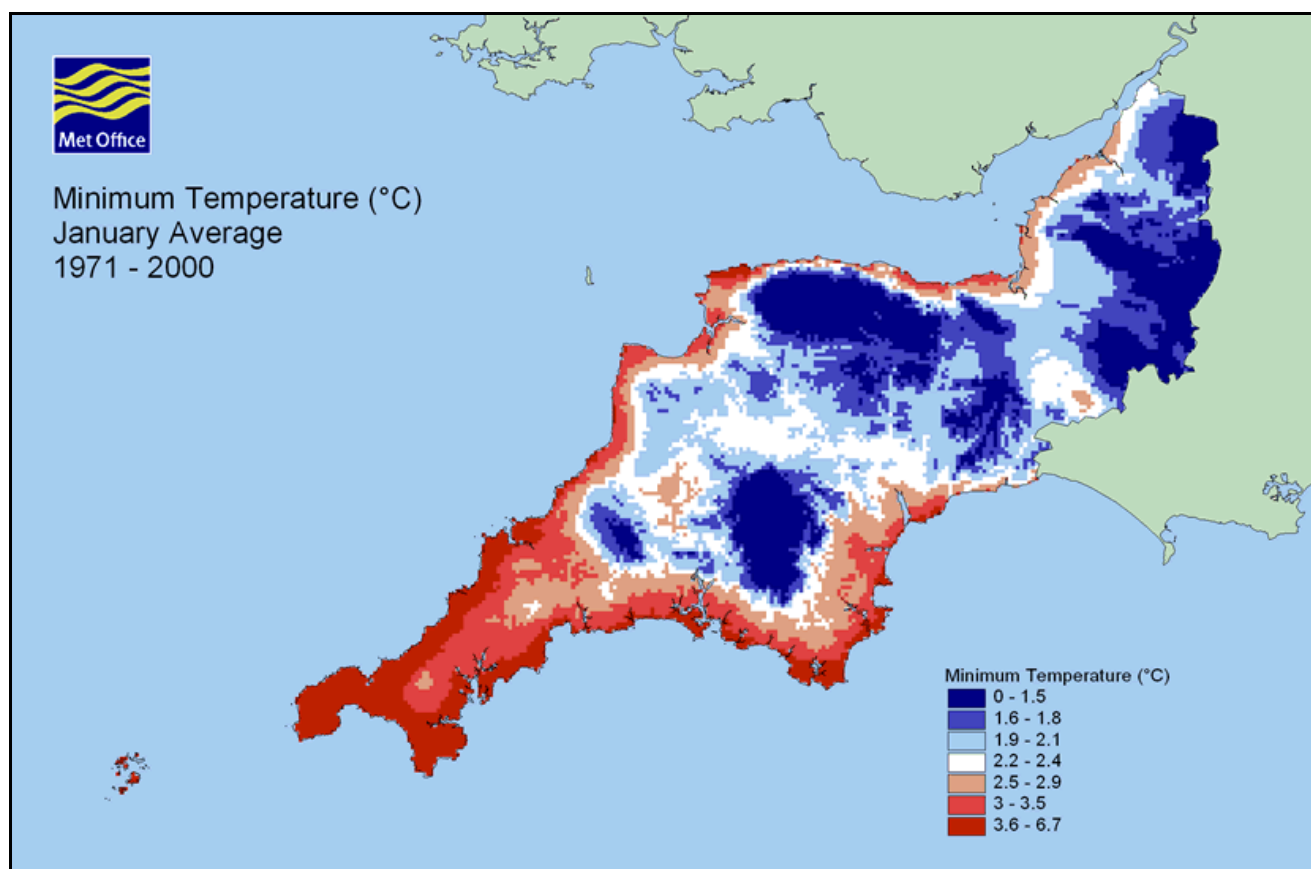
The strong maritime control of temperature is best seen in the annual temperature range, or the difference between the mean temperature of the warmest and coldest months. In west Cornwall this is about 9 °C, which is similar to that found in western Ireland or the Outer Hebrides, but it increases to about 12 °C in Avon and about 14 °C in the Midlands.



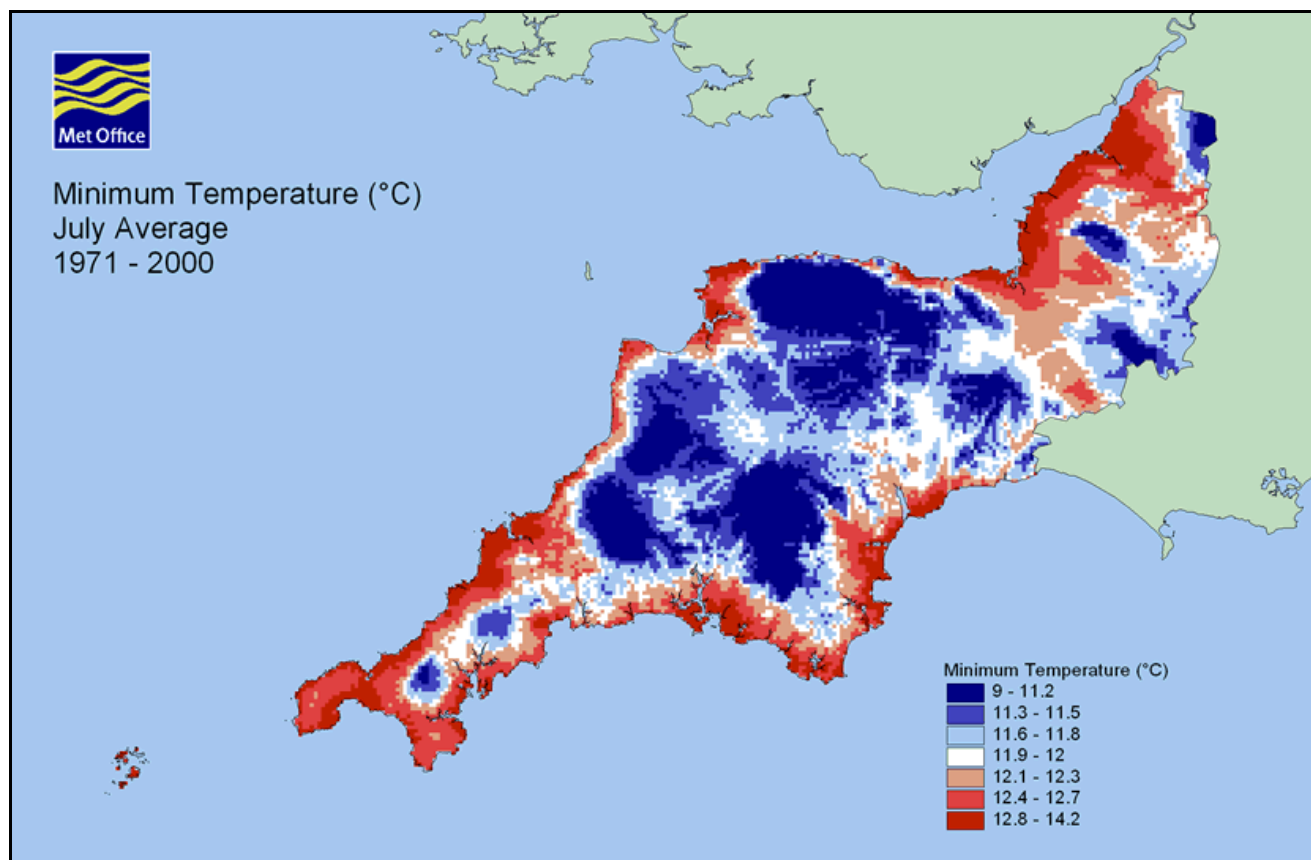
**Figure 2.** Map showing the 30-year (1971-2000) average maximum temperature values for January.



**Figure 3.** Map showing the 30-year (1971-2000) average maximum temperature values for July.



**Figure 4.** Map showing the 30-year (1971-2000) average minimum temperature values for January.



**Figure 5.** Map showing the 30-year (1971-2000) average minimum temperature values for July.

Away from the coast, altitude is the main factor affecting temperature. The mean temperature decreases with height with, for example Princetown at 414 metres on Dartmoor having an annual mean temperature of about 8 °C.

Temperature shows both a seasonal and a diurnal variation, but due to the modifying effect of the sea the range is less than in most other parts of the UK. The sea reaches its lowest temperature in February or early March, so that on average February is the coldest month in Cornwall and Devon. In this month the mean minimum temperature varies from rather more than 5 °C in the Isles of Scilly to around 1.5 °C in inland Devon. Further north east in Somerset and Avon, where the influence of the sea is less, January is the coldest month with mean minimum temperatures between 1 and 2 °C.

The strong maritime influence normally prevents very low temperatures, but low minima have been recorded occasionally. In coastal regions and the islands the lowest temperatures are found when a strong, cold easterly wind ousts the normal south westerlies. Such an occasion was 13th January 1987, which was probably the coldest day of the 20th Century in the south west. On that day minima of -9.0 °C was recorded at St Mawgan (Cornwall) and -6.4 °C on the Isles of Scilly.

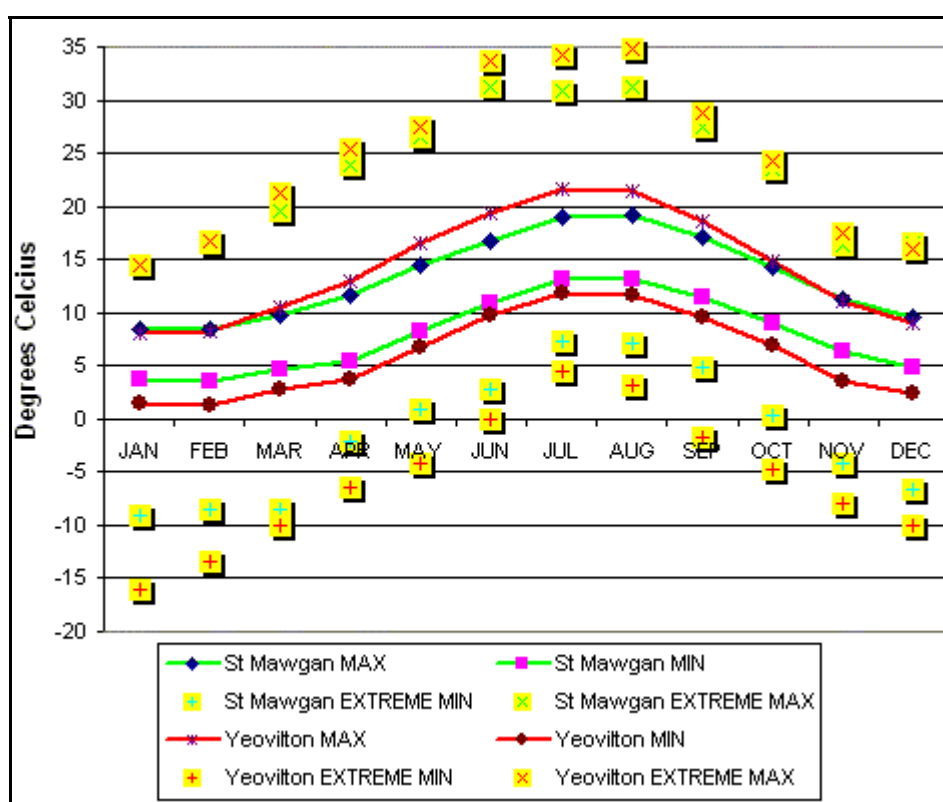
Away from the coast, spells of frosty weather with clear and calm nights have produced records such as -15.0 °C at Exeter Airport on 24th January 1958 and Bastreet (Cornwall) on 1st January 1979. Yeovilton (Somerset) reported -16.1 °C on 14th January 1982.

July and August are the warmest months in the region with mean daily maxima ranging from around 19 °C in coastal Cornwall to 21 °C in inland areas of Somerset and Avon. This is compared with 22.5 °C that is typical of the area of highest UK temperature around London.

Instances of extreme high temperatures are rare and are associated with hot air brought from mainland Europe on south easterly winds accompanied by strong sunshine.

Records include 35.4 °C at Saunton Sands, a site which is next to a large dune/heath area in north Devon, and 34.5 °C at Yeovilton in Somerset, both on the 3rd August 1990. The highest UK temperature stands at 38.5 °C at Brogdale, near Faversham (Kent) on 10th August 2003.

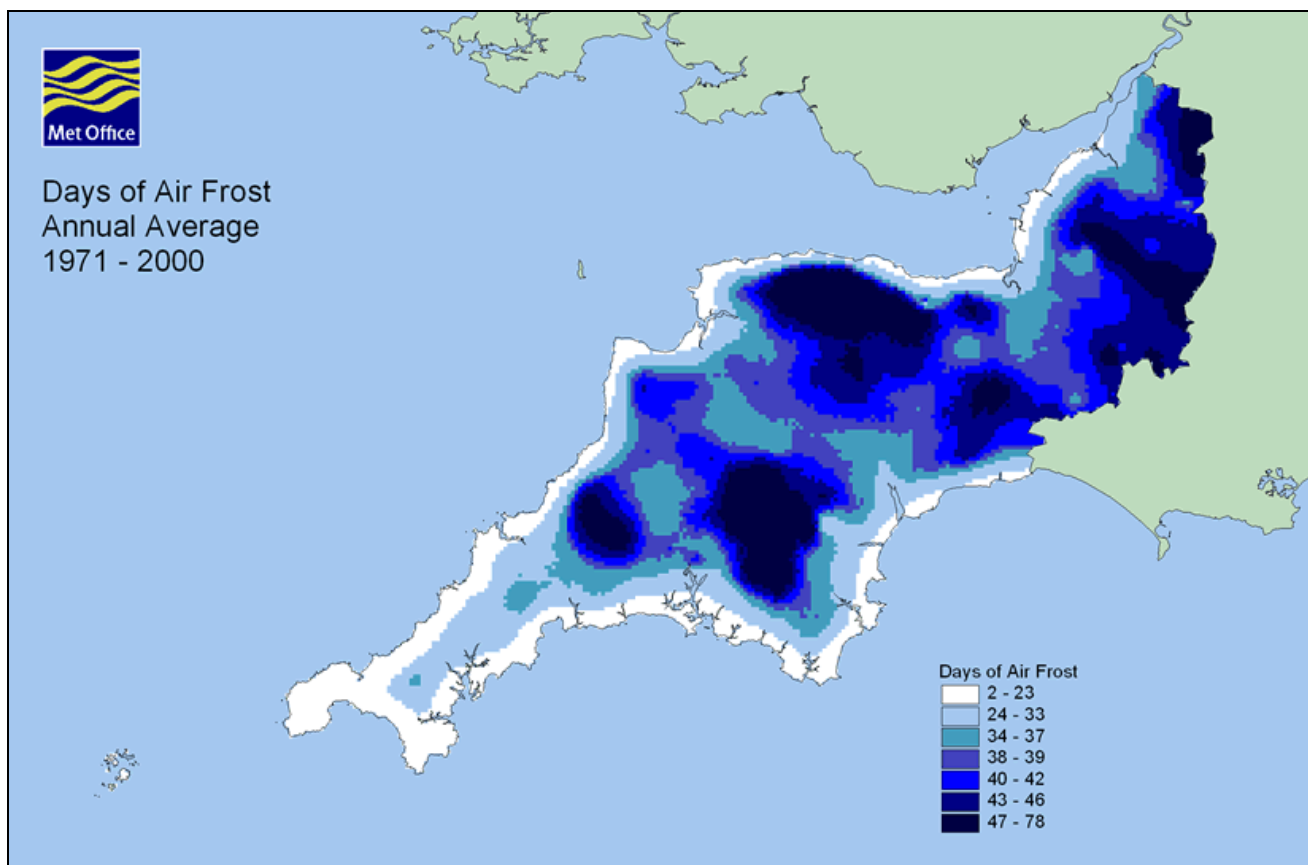
The variation of mean daily maximum and minimum temperature for the months, together with the extreme highest and lowest temperature for Yeovilton and St. Mawgan is shown in Figure 6. Yeovilton has the lower minimum temperature throughout the year because it is inland. It also has higher mean maximum temperatures except in mid-winter when St Mawgan is slightly higher. St Mawgan has lower maximum temperatures in summer because of the cooling influence of the sea. The inland site at Yeovilton has higher extreme maximum and lower extreme minimum temperatures compared to St. Mawgan.



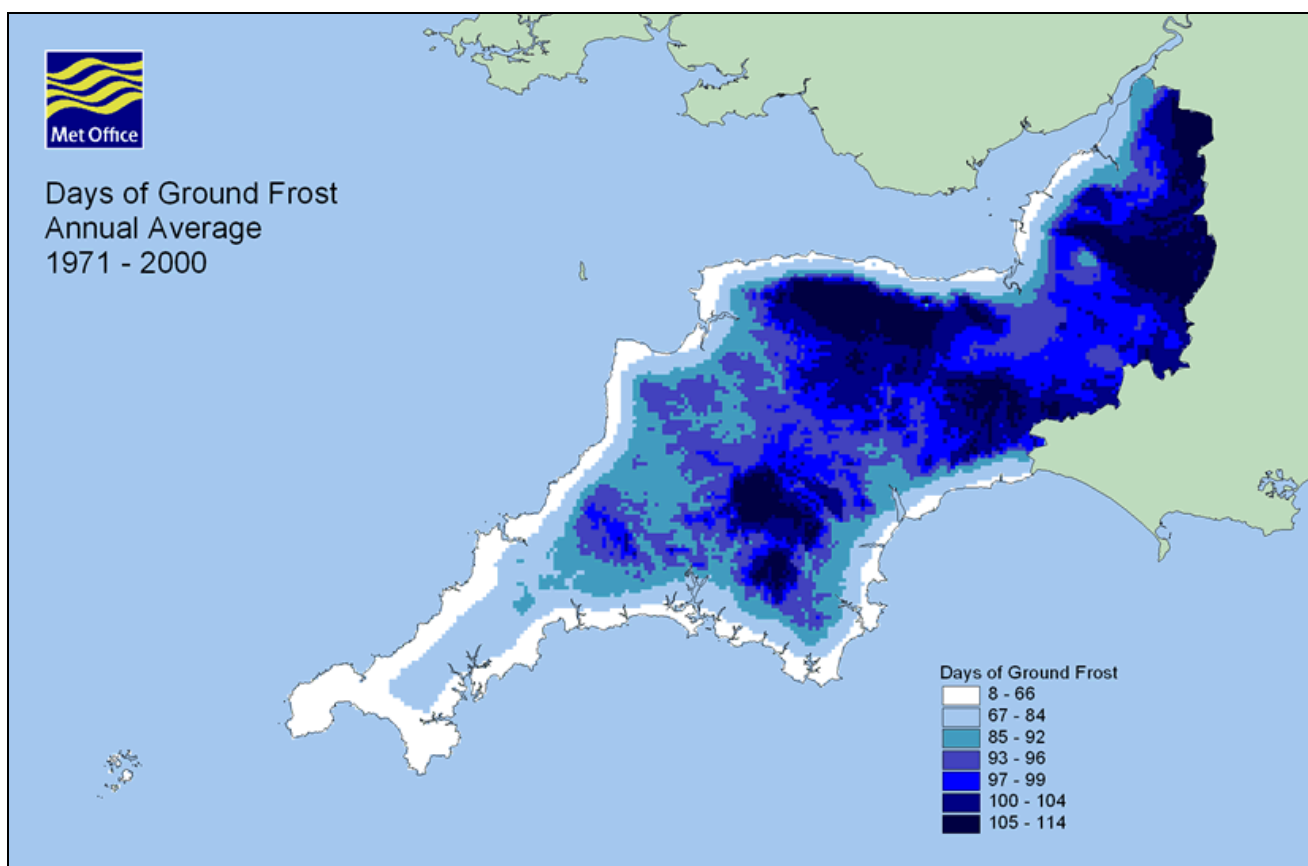
**Figure 6.** Mean daily maximum and minimum temperature (1971-2000) and extremes at Yeovilton and St. Mawgan.

Frost frequency is highly variable across the region and despite its reputation for mildness can be relatively high in some places. The Isles of Scilly will experience an air frost only very occasionally, usually when cold continental air arrives on an easterly wind. Here the mean frequency of air frost is less than two per year. It rises to around 15-20 in coastal areas of Cornwall and Devon. Frequencies exceed 50 per year in inland low-lying spots in Somerset and Avon. The first air frost of autumn can be expected about mid October inland in Avon and Somerset. The continuing warmth of the sea usually prevents coastal autumn frosts. Air frost in April is common and in May is not unheard of. Ground frosts follow a similar pattern to air frost. Most coastal locations have between 35 and 60 days per year, but in some eastern inland districts this rises to more than 100 days per year. Figures 9 and 10 show monthly mean air and ground frost frequencies at St. Mawgan and at Long Ashton, near Bristol.

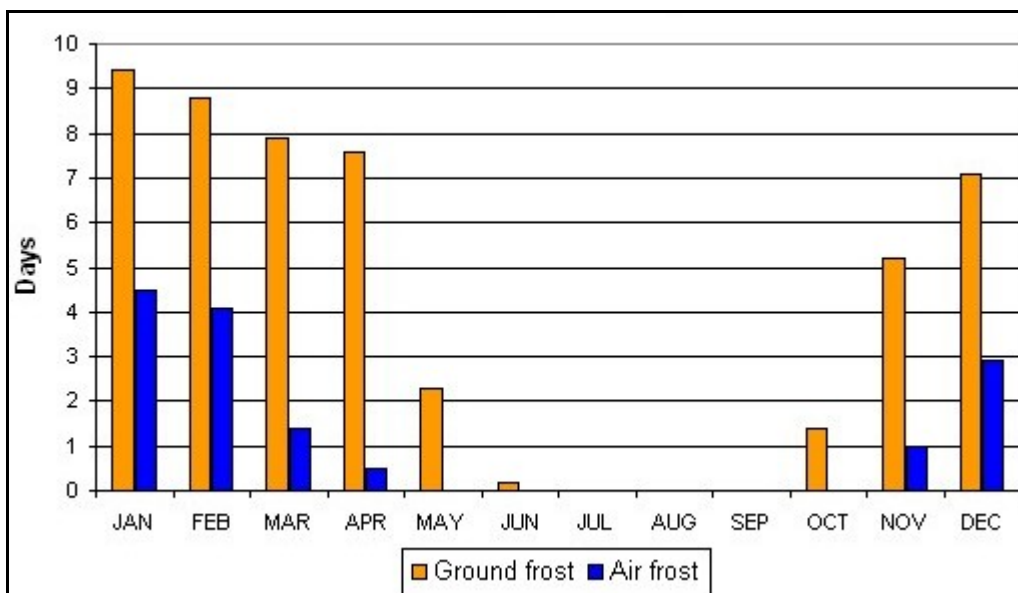




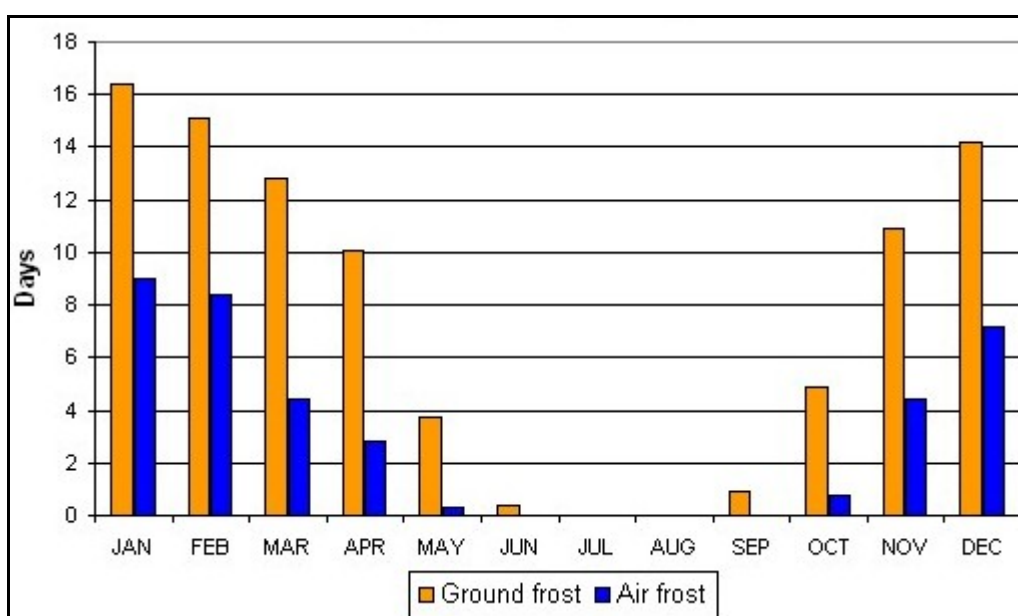
**Figure 7.** Map showing the 30-year (1971-2000) average annual number of days of air frost.



**Figure 8.** Map showing the 30-year (1971-2000) average annual number of days of ground frost.



**Figure 9.** Average number of days of air and ground frost at St. Mawgan (1971-2000).



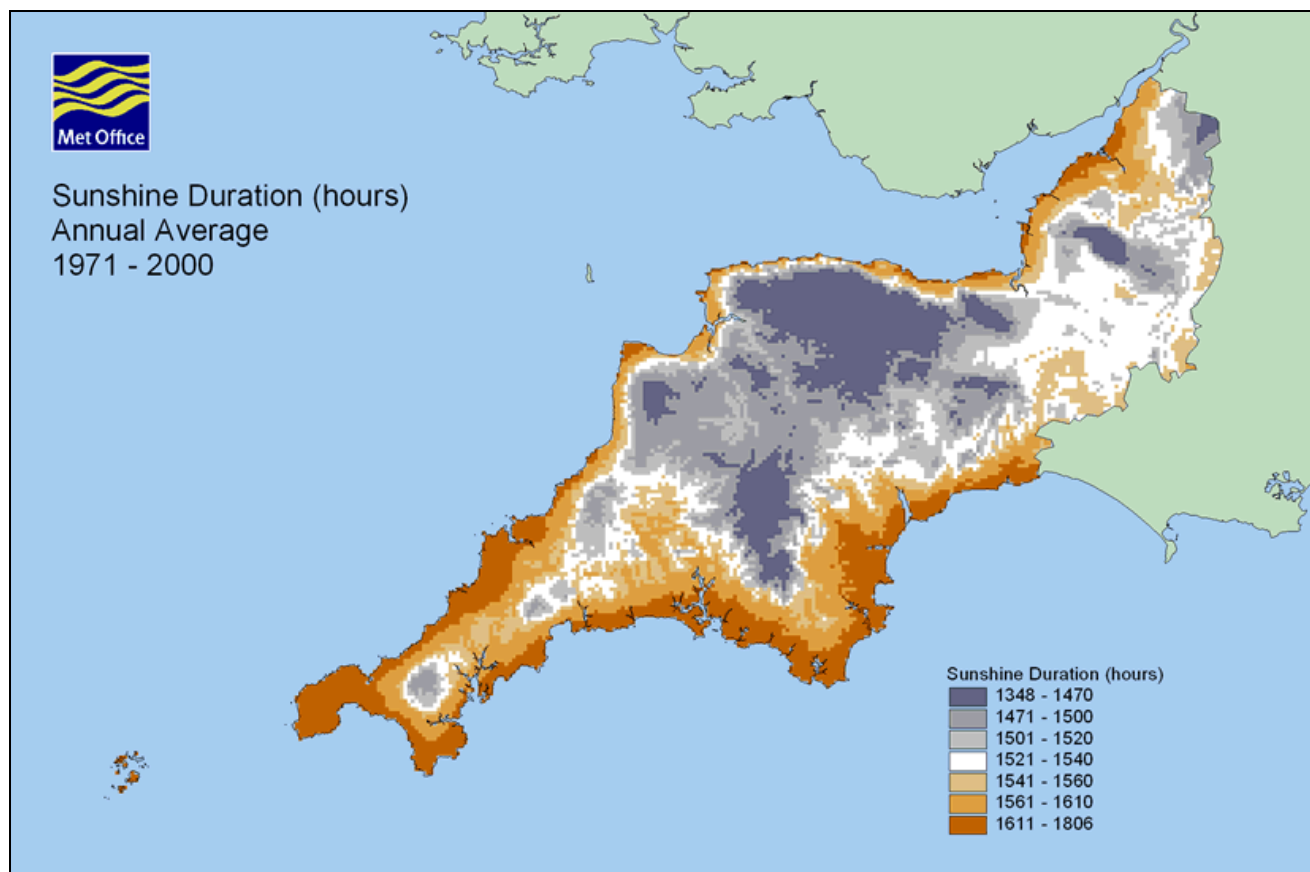
**Figure 10.** Average number of days of air and ground frost at Long Ashton (1971-2000).

## **Sunshine**

The number of hours of bright sunshine is controlled by the length of day and by cloudiness. The day is shortest in December and longest in June, and so, in general, December is the duller month and June the sunniest. The south west of England has a favoured location with respect to the Azores high pressure when it extends its influence north eastwards towards the UK, particularly in summer. Subsidence associated with high pressure reduces cloud cover and in spring and summer, when the sea is cool relative to the air, there is little convective cloud over the sea. Coastal areas are then favoured by high sunshine amounts. Inland and especially near hills, convective cloud often forms and acts to reduce sunshine amounts.

Coastal areas in the south west have average annual sunshine totals above 1,600 hours, the south (English Channel) coast being more favoured than the north (Bristol Channel)

coast. Compare this with the 1,100 hours per year recorded on the Shetland Islands. Inland the annual sunshine totals are mainly between 1,400 and 1,600 hours.



**Figure 11.** Map showing the 30-year (1971-2000) average annual hours of sunshine duration.

Teignmouth													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean (Hours)	62.3	76.3	117.8	178.8	216.1	212.4	228.8	212.4	158.7	107.9	82.8	55.8	1710.1
Max* (Hours)	115.6	134.1	193.4	255.6	307.9	323.5	324.0	316.3	250.3	144.9	121.2	89.5	-
Min* (Hours)	20.3	39.5	71.0	107.3	149.6	129.8	122.0	120.1	101.5	53.7	35.2	32.7	-

\* For period 1926-2003 (some years missing)

Yeovilton													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean (Hours)	50.2	68.9	107.6	155.4	193.1	186.0	205.8	197.8	139.8	101.1	70.2	46.8	1522.7
Max* (Hours)	79.1	114.2	164.0	241.8	273.6	271.7	268.6	292.2	183.5	143.1	97.8	94.6	-
Min* (Hours)	24.0	51.0	66.0	97.0	129.4	112.7	144.2	126.3	103.9	72.7	24.2	34.6	-

\* For period 1983-2003

**Table 1.** Monthly mean hours of bright sunshine for Teignmouth and Yeovilton for 1971 - 2000 and some recorded extremes.



Table 1 shows that the coastal site at Teignmouth has more sunshine than Yeovilton for all months. Both places have the most sun in July (with May, June and August close behind), and the least in December. The highest known monthly sunshine totals in the area are for June 1925 when 334.8 hours were recorded at Long Ashton and 381.7 at Pendennis Point in Cornwall. The highest UK monthly total is 383.9 for July 1911 at Eastbourne, only a few hours above the Cornwall record. In the dullest winter months less than 20 hours have been recorded on occasion.

Days with no sun at all in June are relatively rare and most places usually record only one or two days. However, there were seven sunless days in June 1977 at Teignmouth. Sunless days are more common in December and five or six days are the minimum to be expected. There were, however twenty days without sun at Yeovilton in December 1998 and eighteen at Teignmouth for the same month in 1995.

## **Rainfall**

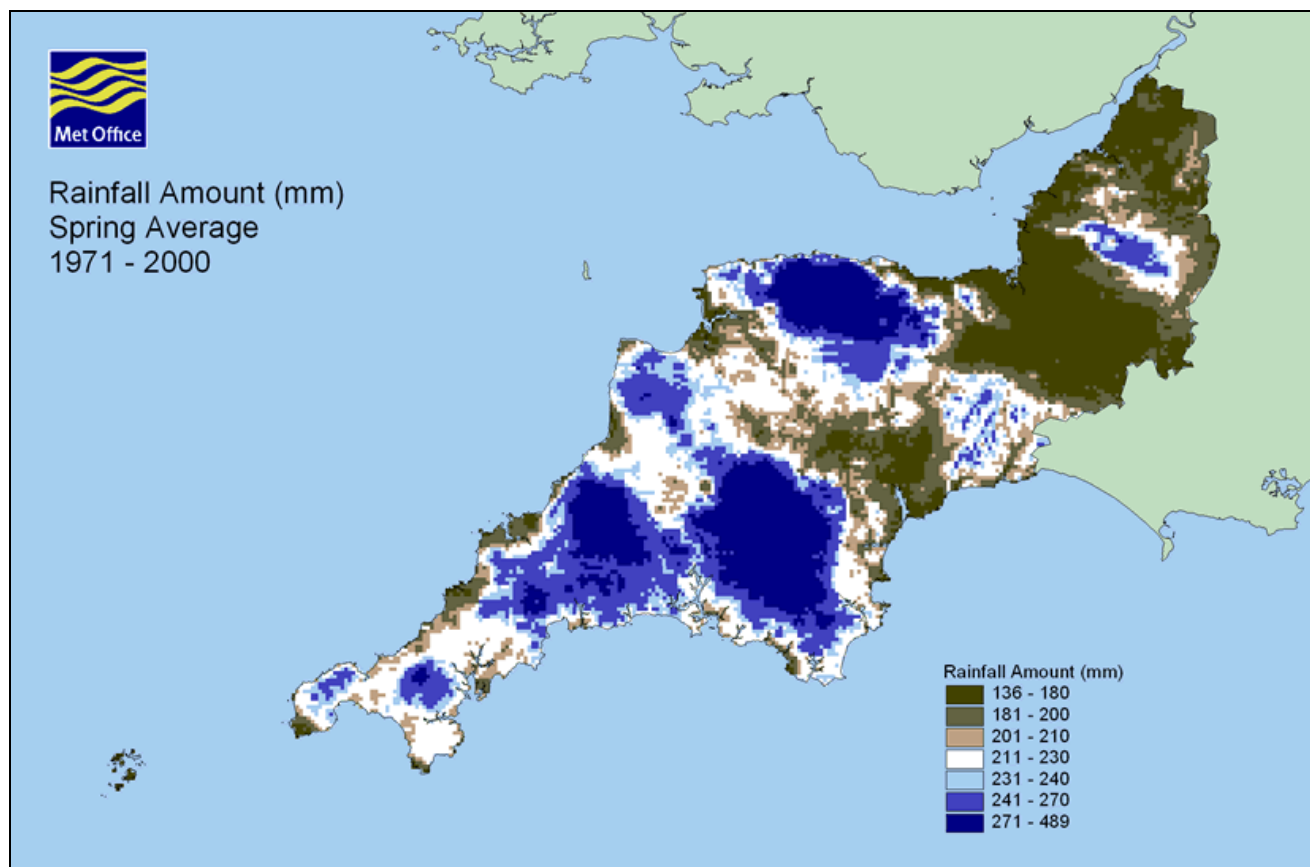
Rainfall is caused by the condensation of the water in air that is being lifted and cooled below its dew point. Rainfall tends to be associated with Atlantic depressions or with convection. The Atlantic depressions are more vigorous in autumn and winter, and most of the rain which falls in those seasons in the south west is from this source. In summer, convection caused by solar surface heating sometimes forms shower clouds and a large proportion of rainfall falls from showers and thunderstorms at this time of year.

The air humidity is an important factor determining rainfall and the sea temperature largely controls this. The sea temperature off south west England is at its maximum in late summer and autumn and is coolest in late winter and spring. As a result rainfall tends to be highest in autumn and lowest in spring.

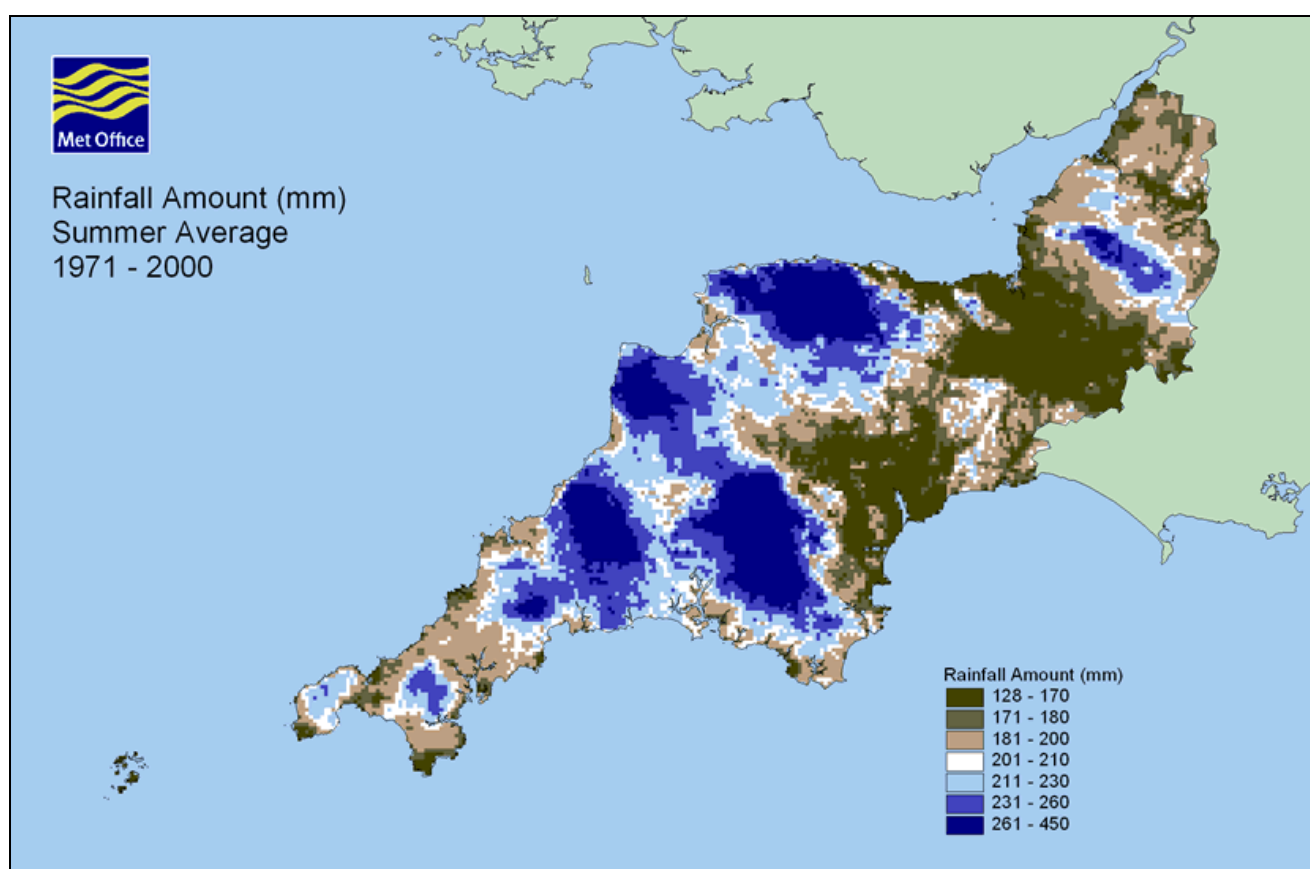
A final factor which greatly affects the rainfall distribution is altitude. Moist air which is forced to ascend hills may be cooled below the dewpoint to produce cloud and rain. A map of rainfall looks very like a topographic map. The effect of altitude is seen by comparing the records for Plymouth and Princetown which are about 23 km apart, but differ by 403 metres in altitude. The Princetown rainfall is twice the Plymouth rain on average.

Annual rainfall totals are about 850-900 mm in the Isles of Scilly. Most coastal areas of Cornwall and Devon have 900-1,000 mm, but up to double this amount falls on uplands such as Dartmoor, Bodmin Moor and Exmoor. Areas to the lee of high ground have lower totals e.g. 800 mm near Exeter and even 700 mm in the low-lying parts of central Somerset. Further east the Mendip Hills have annual totals exceeding 1,100 mm, while the Bath-Bristol area has totals around 800-900 mm. These figures can be compared to annual totals around 500 mm typical of the driest parts of Eastern England and more than 4,000 mm in the western Scottish mountains.

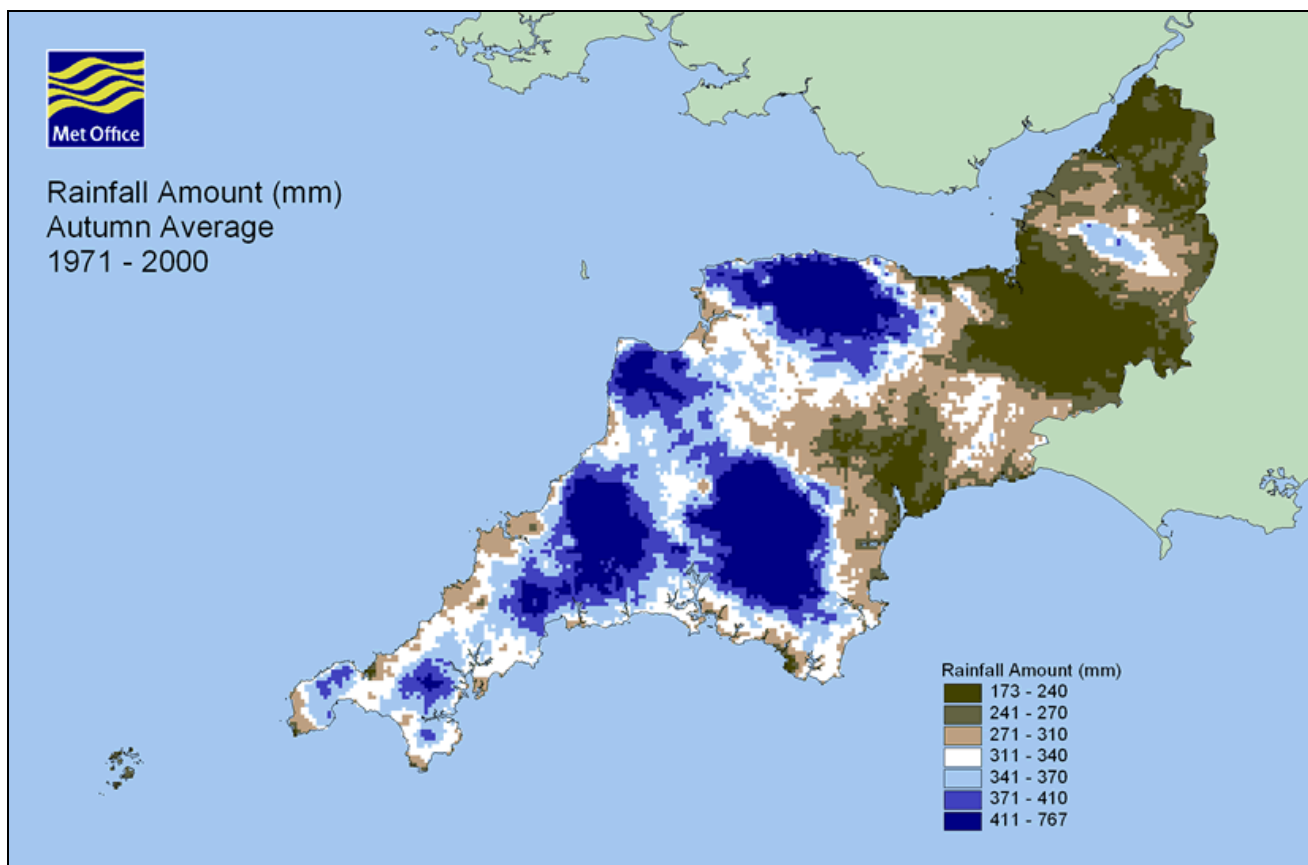
The course of monthly mean rainfall for 1971-2000 is shown for four sites in Figure 3. All the sites have a 'semi-Mediterranean' rainfall regime. The highest rainfall is in December and January when the sea is relatively warm still and the Atlantic depressions are most vigorous. The months from April to July are the driest when the sea is relatively cool and the Azores high pressure system exerts more influence. August shows an increase of rainfall over July and starts the inexorable rise in rainfall into the autumn and early winter.



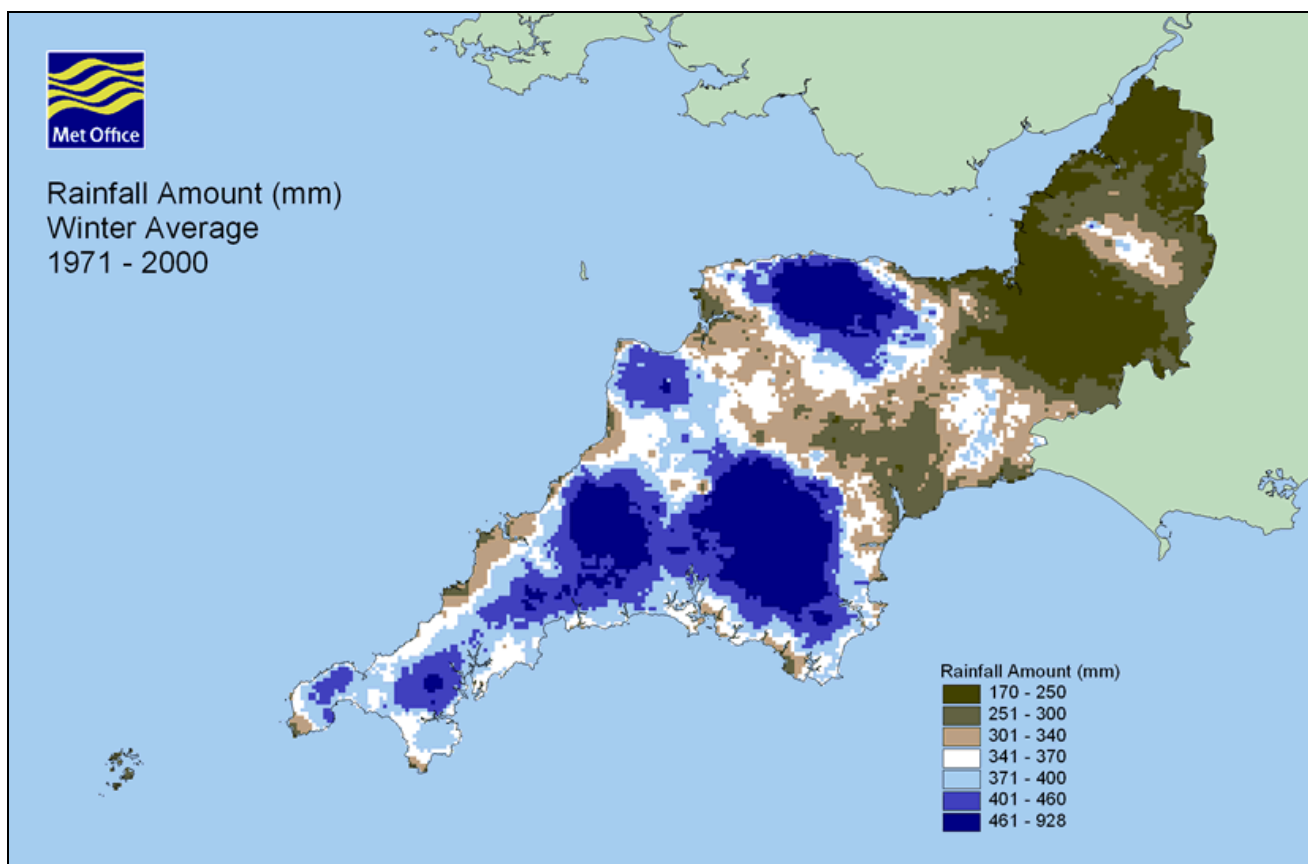
**Figure 12.** Map showing the 30-year (1971-2000) average spring rainfall amounts.



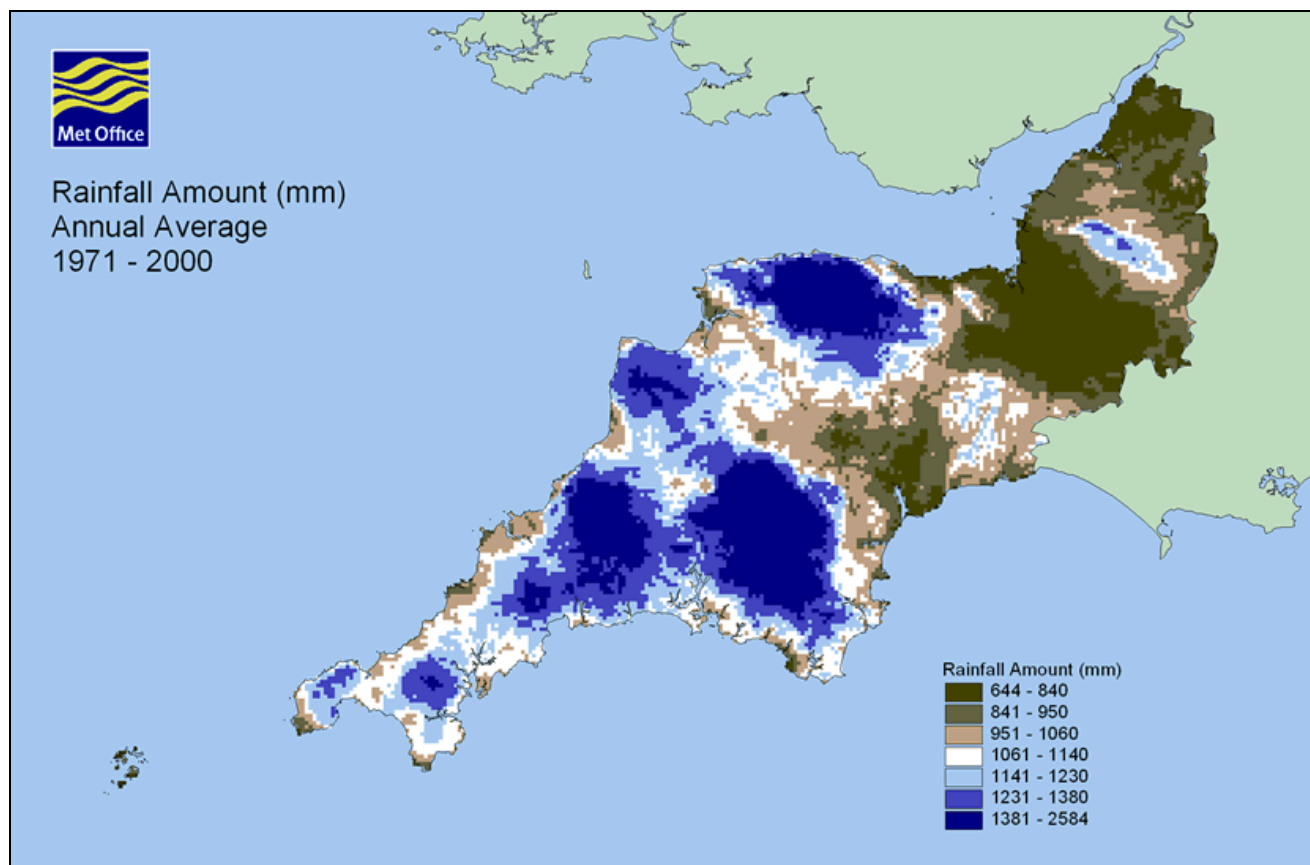
**Figure 13.** Map showing the 30-year (1971-2000) average summer rainfall amounts.



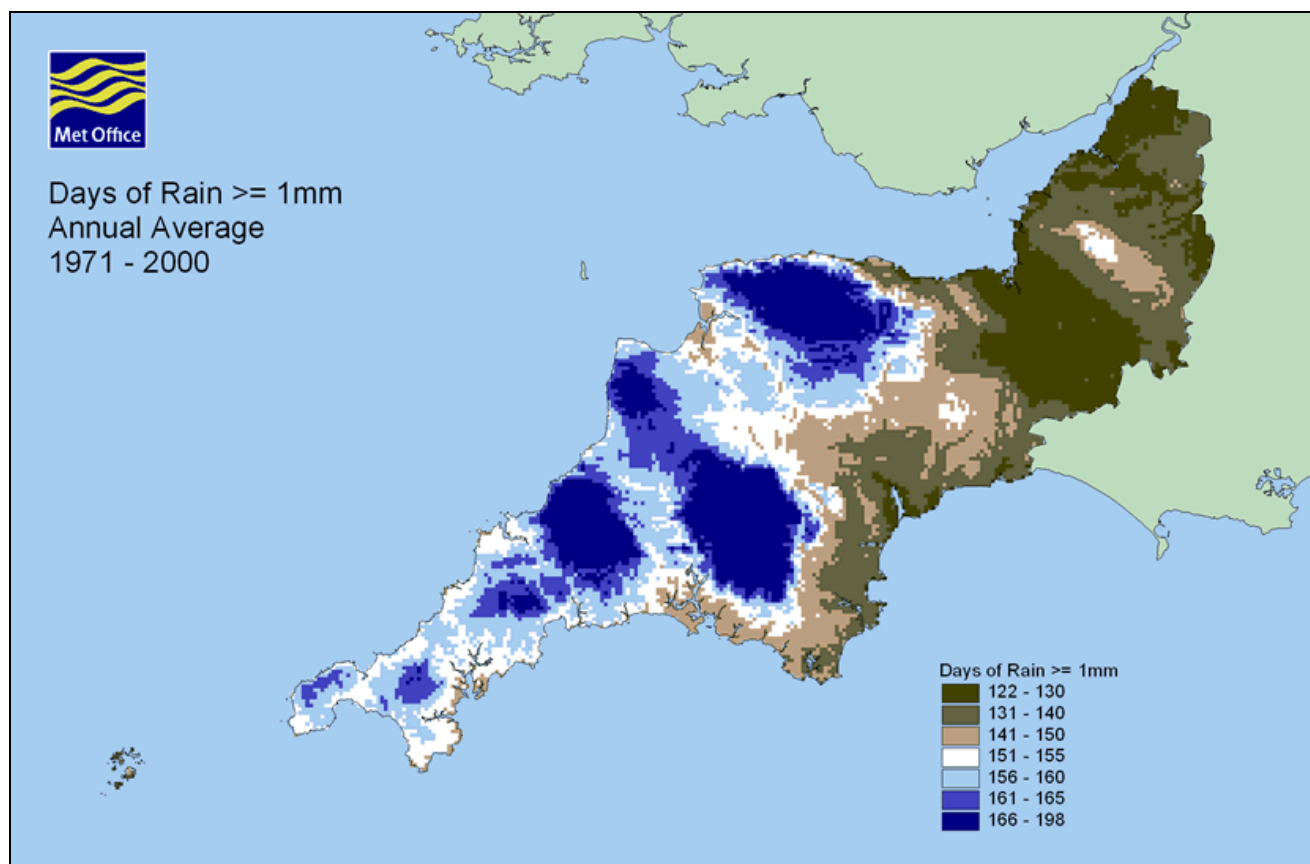
**Figure 14.** Map showing the 30-year (1971-2000) average autumn rainfall amounts.



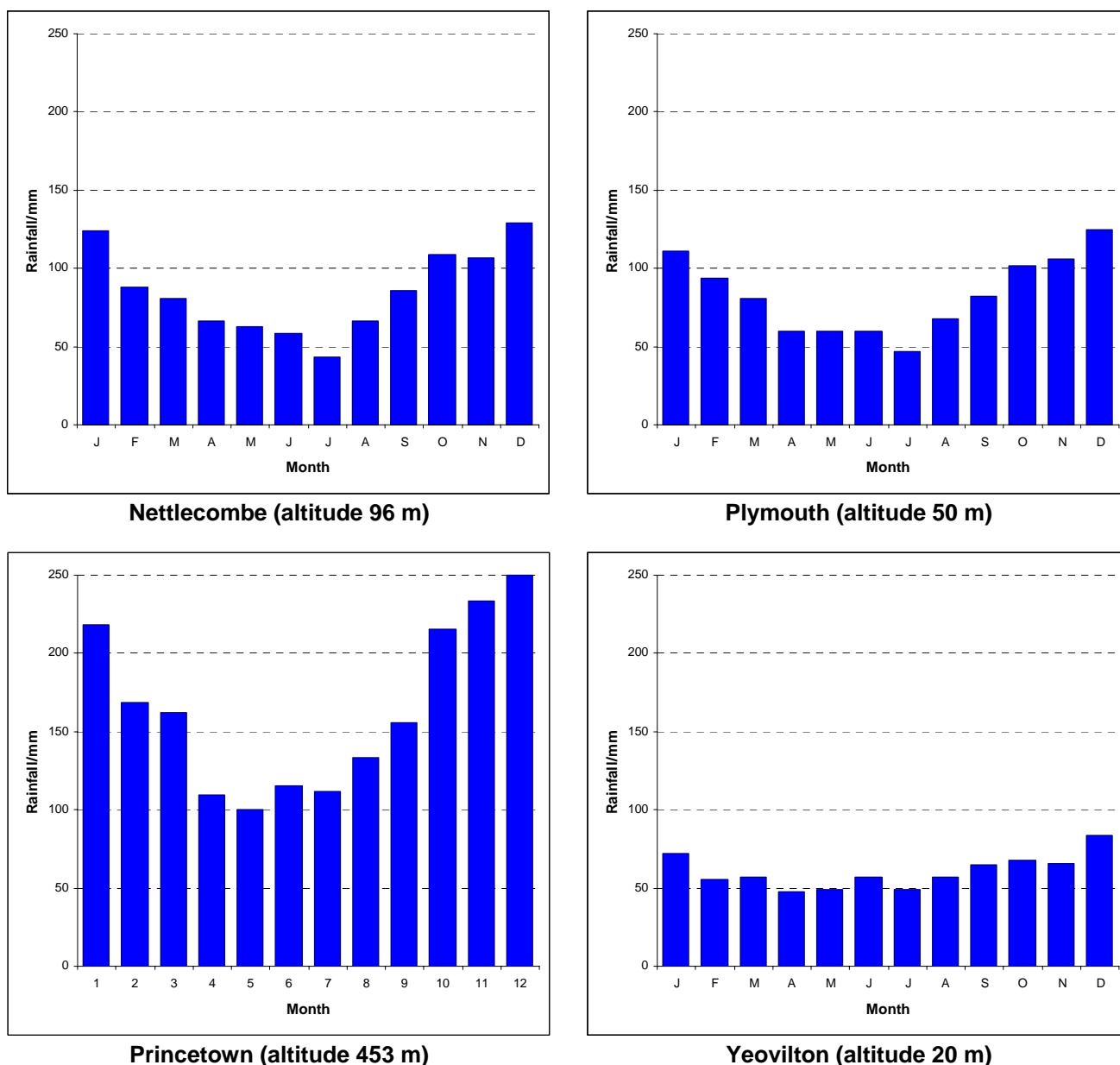
**Figure 15.** Map showing the 30-year (1971-2000) average winter rainfall amounts.



**Figure 16.** Map showing the 30-year (1971-2000) average annual rainfall amounts.



**Figure 17.** Map showing the 30-year (1971-2000) average number of days per year with rainfall amounts greater than or equal to 1 mm.



**Figure 18.** Monthly mean rainfall based on the 30-year (1971-2000) period for Nettlecombe, Plymouth, Princetown and Yeovilton.

The numbers of days with rainfall totals of 1 mm or more tend to follow a similar pattern to the monthly rainfall totals. In coastal areas in winter about 15 or 16 days is the norm, but this decreases to nine or ten in late spring and summer. In Somerset and Avon there are fewer days having 1 mm or more throughout the year. In winter about 12 or 13 days is normal with about seven to nine in summer. The numbers of days increase with altitude and at Princetown, for example, there are over 18 days in the winter months and 12 to 13 days in the summer.

The south west peninsula is prone to rare, but very heavy rainfall events lasting from about five to fifteen hours. The famous storm which devastated Lynmouth in North Devon on 15th August 1952 was an example of one of these when 228 mm fell in 12 hours. Other similar events are the 203 mm at Camelford in Cornwall on 8th June 1957 and 243 mm in 13 hours at Bruton in Somerset in June 1917. The heaviest recorded daily rainfall total in UK was at Martinstown in Dorset on 18<sup>th</sup> July 1955 when 279 mm was recorded.

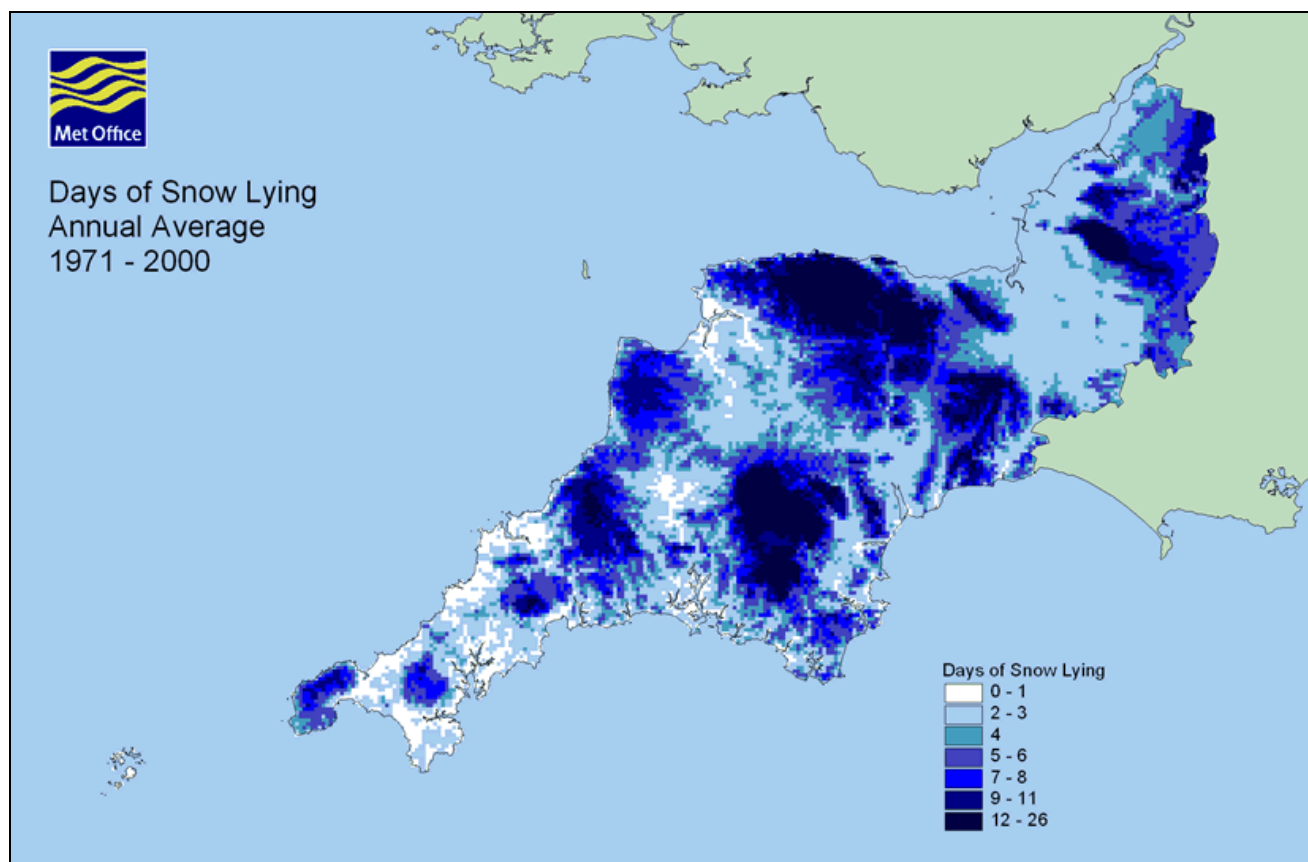


## **Snowfall**

The occurrence of snowfall is linked closely with temperature, with falls rarely occurring if the temperature is higher than 4 °C. For snow to lie for any length of time then the temperature normally has to be lower than this. In the south west snowfall is normally confined to November to April, although upland areas may have brief falls in October and May. Snow rarely lies outside of the period from December to March.

On average, the number of days with snow falling is less than 10 per winter in the islands and coastal districts of Devon and Cornwall, although slightly higher near to the upper Severn Estuary. About eight - fifteen days is typical of inland areas, with the higher figure in the north east near to the border with Wiltshire. In upland areas such as Exmoor and Dartmoor more than 25 days per year are possible. A rough average increase of about five days of snow falling per year per 100 metre increase in elevation is typical in the south west.

Lying snow is not a frequent occurrence in the south west, and in lowland areas about a third of years do not record any snow lying. In the Isles of Scilly and coastal Cornwall and Devon less than three days per year is a typical average. This increases to five-ten days per year inland with the higher figure applying to north eastern areas. Altitude is significant and a rough guide is an increase of about five days per year with snow lying per 100 metres increase in elevation. Dartmoor and Exmoor have more than 20 days per year. Compare this with Balmoral, Grampian which has about 60 days with snow lying on average. Table 2 gives some station data for 1971-2000.



**Figure 19.** Map showing the 30-year (1971-2000) average number of days per year with snow lying.

SNOWFALL						
	St. Mawgan		Long Ashton		Yeovilton	
	Falling*	Lying**	Falling*	Lying**	Falling*	Lying**
November	0.4	0.0	0.3	0.1	0.4	0.0
December	1.4	0.1	1.0	0.6	1.3	0.2
January	2.9	0.5	2.6	1.9	2.0	1.3
February	3.0	0.4	2.8	1.2	3.0	0.6
March	2.1	0.1	1.9	0.2	1.5	0.0
April	1.2	0.1	0.7	0.0	0.7	0.0
May	0.2	0.0	0.2	0.0	0.1	0.0
Annual	11.2	1.2	9.2	4.0	9.0	2.1

\*Includes any incidence of snow or sleet falling.

\*\*A day of lying snow is counted if the ground is more than 50% covered at 0900.

**Table 2.** Monthly averages (days) of snow falling and lying for 1971- 2000 at St Mawgan (altitude 103 metres), Long Ashton (altitude 51 metres) and Yeovilton (altitude 20 metres).

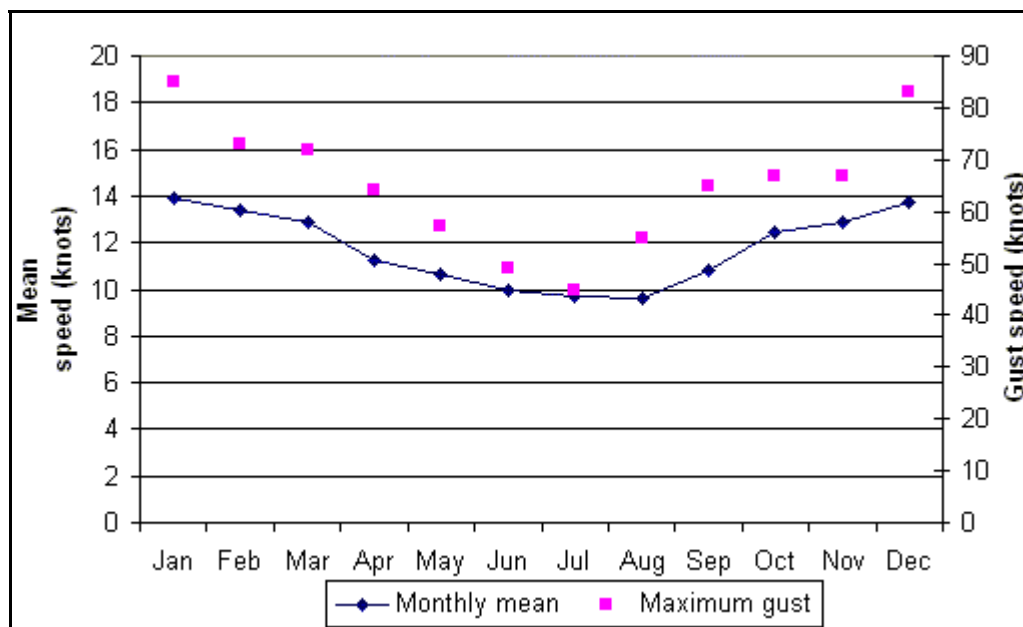
Table 2 shows that the coastal site at St Mawgan has a similar incidence of falling snow to Yeovilton which is inland and considerably further east. This demonstrates the effect of altitude since St Mawgan is the higher site.

Despite being the mildest region of the British Isles, the south west peninsula has experienced some of the most severe blizzards to affect the country. This is because of a set of circumstances that can affect the UK albeit rarely. If bitterly cold easterly winds from Europe meet a slow moving Atlantic depression situated off south west England, then a prolonged snowstorm accompanied by high winds is possible. An example is 18/19 February 1978 when fine snow accompanied by 25 knot easterly winds at temperatures as low as -2 °C deposited around 50 cm of snow in inland Devon and more than 90 cm on Dartmoor and Exmoor. On 8/9 January 1982 conditions were especially severe in the Bristol area where drifts were locally one metre deep. Another event, this time from convective showers, on 12th January 1987 produced snow depths of 35 cm in Falmouth, 39 cm in Penzance and even 23 cm on the Isles of Scilly.

## Wind

Southwest England is one of the more exposed areas of the United Kingdom, and wind speeds are on average, only greater in western Scotland. The strongest winds are associated with the passage of deep depressions close to or across the British Isles. The frequency and strength of depressions is greatest in the winter and this is when mean speeds and gusts are strongest. Figure 20 shows a typical variation of the monthly mean speed and highest gust.

In Figure 20 the months from November to March have the highest mean speeds with June to August having the lightest winds. The peak gust follows a similar pattern and in the past 30 years both December and January have both had gusts to over 80 knots. (Note: 1 knot = 1.15 mph, or 0.515 ms<sup>-1</sup>).



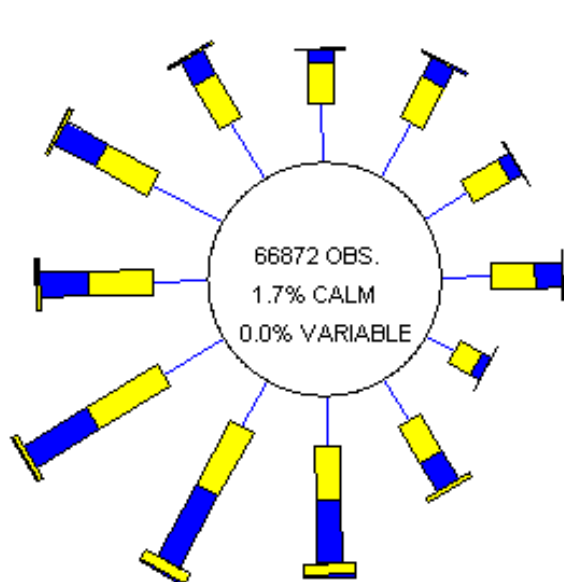
**Figure 20.** Monthly mean wind speed and the highest monthly recorded gust for the period 1971 - 2000 at St. Mawgan. The mean speed is the average of a continuous record, but the gust is an 'instantaneous' speed averaged over about three seconds.

Other coastal areas are similar to St. Mawgan, though mean speeds generally decline towards to the north east. Inland areas have lower speeds which also decrease to the northeast. At Yeovilton in lowland Somerset, for example, the mean speeds are about two thirds of those at St. Mawgan. Wind speeds also tend to increase with increasing altitude. The highest parts of Exmoor and Dartmoor are likely to have speeds similar to those on the coast.

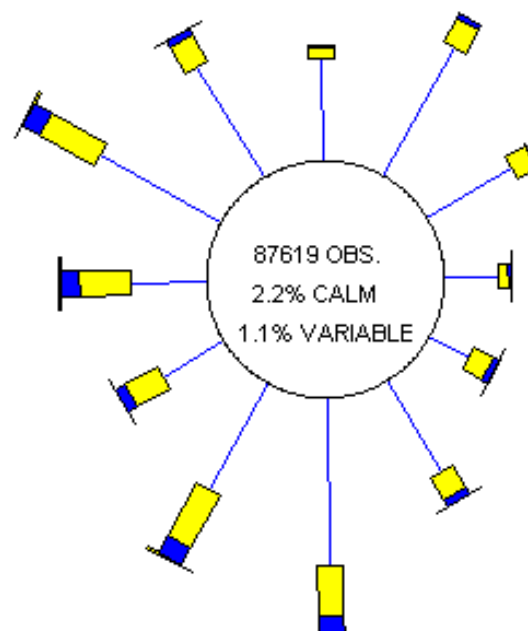
There have been several noteworthy strong wind events in the south west. On 15th December 1979 severe gales in Cornwall and the Isles of Scilly produced gusts of 91, 99 and 103 knots at Lizard, St. Mary's (Isles of Scilly) and Gwennap Head respectively. The Burn's Day storm (25th January 1990) caused considerable damage to buildings and overturned vehicles as high winds were widespread. Some stations had gusts which were the highest in the period from 1971 to 2000 and included 84 and 85 knots at Plymouth and St. Mawgan respectively. Other reports were of 79 knots at Bristol (on top of a building), 68 knots at Yeovilton and 74 knots at Exeter airport. The maximum hourly mean speed was 60 knots at Plymouth and 45 knots at Yeovilton.

Another measure of wind exposure is the number of days when gale force was reached. If the wind reaches a mean speed of 34 knots or more over any ten consecutive minutes then that day is classed as having a gale. Exposed headlands and islands have the greatest frequency of days with gale. In the Isles of Scilly the average is around 24 days per year, with a similar figure for exposed places in coastal Cornwall. It decreases to the north east especially inland. Plymouth (on the coast) has about 16 days per year, but Yeovilton in Somerset has seven and Long Ashton in Avon only four. Wind speed is sensitive to local topographic effects and land use. Places sheltered by hills, or which are in extensively wooded or urban areas, will have lower wind speeds and fewer days of gale.

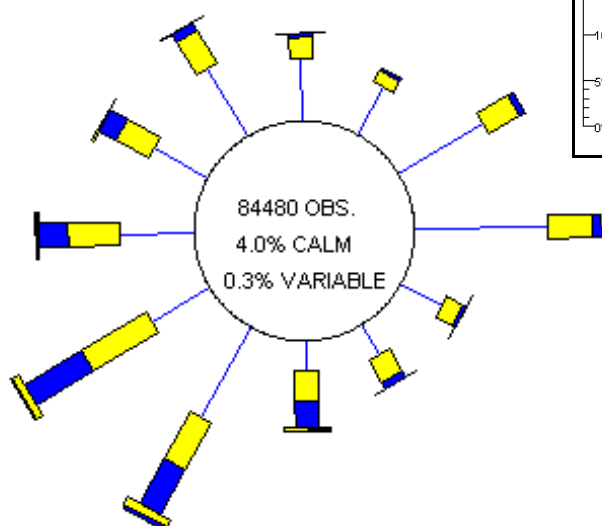
The direction of the wind is defined as the direction from which the wind is blowing. As Atlantic depressions pass by the United Kingdom the wind typically starts to blow from the south or southwest, but later comes from the west or northwest as the depression moves away.



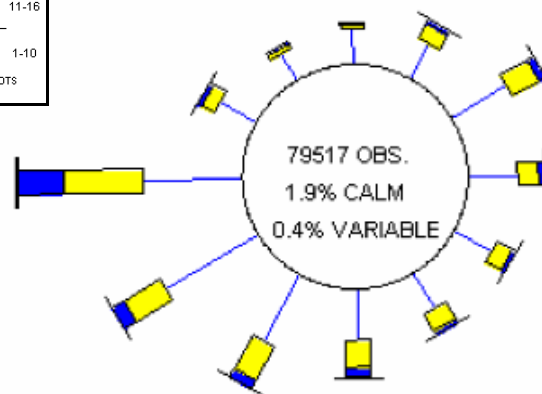
Wind rose for the period 1991 – 1999  
at St. Mary's, Isles of Scilly  
(31 metres a.m.s.l.)



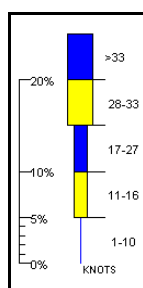
Wind rose for the period 1981 – 1990  
at Exeter (32 metres a.m.s.l.)



Wind rose for the period 1991 – 2000  
at Plymouth (50 metres a.m.s.l.)



Wind rose for the period 1991 – 2000  
at Bristol (190 metres a.m.s.l.)



**Figure 21.** Annual wind rose diagrams for St. Mary's (Isles of Scilly), Exeter, Plymouth and Bristol.

The range of directions between south and northwest accounts for the majority of occasions and the strongest winds nearly always blow from this range of directions. The wind roses in Figure 21 illustrate the typical frequency of speeds and directions during the year and confirm the predominant south-westerly direction. At Bristol, the relatively high frequency of north-easterly winds (and lack of south-easterly or north-westerly winds) reflects its situation on the Bristol Channel, aligned NE-SW. East or northeast winds can also be strong if depressions pass along the English Channel. Spring time also tends to have a maximum of winds from the north east, due to the build up of high pressure over Scandinavia at this time of year. Periods of very light or calm winds with no preferred direction are usually below 6% of the time in the islands and coastal districts. This increases to about 15% of the total time in inland areas to the north east and can be compared with a typical inland station in central England that would have light winds for around 25% of the time.

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- Number 9 – Weather Extremes
- Number 10 – Air Masses and Weather Fronts
- Number 11 – Interpreting Weather Charts
- Number 12 – National Meteorological Archive
- Number 13 – Upper Air Observations and The Tephigram
- Number 14 – Microclimates
- Number 15 – Weather Radar
- Number 16 – World Climates