

# Radcliffe Meteorological Station

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## The Weather at Oxford in 2020

2020 was a year of extreme weather at the Radcliffe Meteorological Station. The year was the joint 2<sup>nd</sup> warmest in the 206 year record, with an annual mean air temperature of 11.4°C, which is 1.7°C above the long term mean. This ties with 2006 and is beaten only by 2014, when 11.5°C was observed. 2020 was also the 13<sup>th</sup> wettest, 6<sup>th</sup> sunniest and 9<sup>th</sup> windiest year of the record. The rainfall total was much higher than average even though the number of rain days was below average.

### Annual Statistics

Metric	2020 annual mean value	Anomaly against long term mean	Rank in record / number of years in record
Mean air temperature (°C)	11.4	1.7	Joint 2 <sup>nd</sup> / 206
Absolute maximum air temperature (°C)	35.1	5.3	Joint 2 <sup>nd</sup> / 206
Lowest maximum air temperature (°C)	0.2	---	---
Mean maximum air temperature (°C)	15.8	1.8	Joint 2 <sup>nd</sup> / 206
Absolute minimum air temperature (°C)	-2.5	5.1	1 <sup>st</sup> / 140
Mean minimum air temperature (°C)	7.6	1.4	Joint 2 <sup>nd</sup> / 140
Absolute minimum grass temperature (°C)	-6.8	4.3	2 <sup>nd</sup> / 140
Mean minimum grass temperature (°C)	4.8	1.2	4 <sup>th</sup> / 140
Absolute minimum concrete temperature (°C)	-4.0	3.1	1 <sup>st</sup> / 34
Mean minimum concrete temperature (°C)	6.7	0.9	2 <sup>nd</sup> / 34
Mean soil temperature at 30 cm (°C)	12.3	1.4	3 <sup>rd</sup> / 96
Mean soil temperature at 100 cm (°C)	12.4	---	---
Highest daily rainfall (mm)	60.0	---	6 <sup>th</sup> / 254
Total rainfall (mm)	828.1	182.5	13 <sup>th</sup> / 254
Total bright sunshine (hours)	1817.4	302.8	6 <sup>th</sup> / 140
Mean daily bright sunshine (hours)	5.0	---	---
Mean wind speed (knots)	9.9	1.1	9 <sup>th</sup> / 140
No. of rain days (0.2 mm or more rainfall)	167.0	-3.2	90 <sup>th</sup> / 140
No. of wet days (1.0 mm or more rainfall)	119.0	---	---
No. of days with minimum temperature less than 0°C	22.0	-23.1	8 <sup>th</sup> fewest / 140
No. of days with ground temperature less than 0°C	6.4	-37.5	3 <sup>rd</sup> fewest / 140
No. of days with fog at 0900 GMT	7.0	-12.6	6 <sup>th</sup> fewest / 140
No. of days with snow lying at 0900 GMT	1.0	-8.4	8 <sup>th</sup> fewest / 140

*Yellow denotes anomalies more than 1 standard deviation away from the long term mean. Orange denotes anomalies more than 2 standard deviations away from the long term mean.*

## **New Records**

Records were broken for several meteorological metrics in 2020. These include:

- Warmest annual minimum temperature (-2.5°C)
- Warmest annual minimum concrete temperature (-4.0°C).
- Highest cumulative 72-hour rainfall total (1<sup>st</sup>-3<sup>rd</sup> October, 104.8 mm)
- Wettest October day on record (3<sup>rd</sup> October, 60.0 mm) – wettest day overall since 27 June 1973
- Record number of rain days for an October (27)
- Record number of dry days for a May (29)
- Sunniest month on record (May, 331.7 hours)

## **Near-Records**

Near-records were observed for several meteorological metrics in 2020. These include:

### **Temperature**

- Joint 2<sup>nd</sup> warmest annual mean maximum temperature (15.8°C)
- Joint 2<sup>nd</sup> warmest annual mean air temperature (11.4°C)
- Joint 2<sup>nd</sup> warmest annual mean minimum temperature (7.6°C)
- Joint 2<sup>nd</sup> warmest day of the 75,000 days in the record (35.1°C, 31<sup>st</sup> July)
- 5<sup>th</sup> warmest day of the 75,000 days in the record (34.4°C, 12<sup>th</sup> August)
- 7<sup>th</sup> warmest day of the 75,000 days in the record (34.1°C, 11<sup>th</sup> August)
- 4<sup>th</sup> warmest night of the 75,000 days in the record (20.4°C, 12<sup>th</sup> August)
- 4<sup>th</sup> warmest monthly mean minimum temperature on record (14.5°C, August)

### **Rainfall**

- 4<sup>th</sup> wettest month on record (October, 185.3 mm) – the wettest month since October 1875
- 2<sup>nd</sup> wettest October on record (185.3 mm) – the wettest October since October 1875
- 2<sup>nd</sup> driest May on record (3.5 mm) – the driest May since May 1795

### **Wind Speed**

- 3<sup>rd</sup> windiest month on record (February, 15.4 knots) – the windiest since February 1990

## Monthly Statistics

**January** was an anomalously warm month in Oxford. The mean air temperature of 6.8°C was the joint 8<sup>th</sup> warmest for a January on record, and 3.0°C above average. The January mean minimum concrete temperature of 2.8°C was the warmest on record. Nights were especially mild, with only 6 days of ground frost. This was the joint second fewest number for a January, tying with 1921 and only beaten by 5 days in January 1916. Rainfall and sunshine totals were close to the long term mean.



**February** was a month of wet and windy weather, with successive Atlantic storms (Ciara and Dennis) bringing consistent rain and gusty conditions. Wind speeds were exceptional, with the mean wind speed of 15.4 knots ensuring that February was the 3<sup>rd</sup> windiest month on record, and the windiest month in Oxford for 30 years (last beaten in February 1990). 95.3 mm of rainfall also made February the 8<sup>th</sup> wettest February on record. The month was anomalously warm, with a mean air temperature of 6.7°C, which was 2.5°C above average. Sunshine totals were average for the time of year. The only day of snow for 2020 was recorded on 27<sup>th</sup> February.

Unusually for 2020, **March** was an average month in many respects. Neither temperature nor rainfall diverged significantly from long term means, although the month was windier (12.1 knots, 18<sup>th</sup> windiest March on record) and sunnier (158.3 hours, 16<sup>th</sup> sunniest March on record) than normal.



**April** was another exceptionally warm month. The mean air temperature of 11.1°C was the 4<sup>th</sup> warmest for an April on record, and 2.7°C above average. The mean maximum temperature of 17.5°C was also the 4<sup>th</sup> warmest for an April on record, and 4.3°C above average. Continuously bright and settled weather brought the sunshine total up to the 6<sup>th</sup> highest for an April on record (232.9 hours), unlike the UK as a whole for which it was the sunniest April on record. This was in part because the RMS record goes back an extra 48 years compared to the Met Office UK-wide analysis. Rainfall was average for the time of year.

**May** was the sunniest calendar month observed in the 140 years of sunshine data held at the RMS, which is the world's longest continuous sunshine record. The 331.7 hours beat the previous record set in July 1911 by over 20 hours. Oxford's sunshine in May was higher than the May average for Malaga, and 173% higher than the Oxford average of 192 hours. Overall,



spring 2020 was the sunniest on record, with 59.3 more hours of sunshine than the previous record set in 1990. May was also the 2<sup>nd</sup> driest on record (3.5 mm), and the driest since 1795. May had the joint highest mean maximum temperature for a May (20.0°C, 3.2°C above average), and the highest number of dry days for a May on record (29). Thomas Caton Harrison is photographed observing the sunshine.

**June** was an average month in many respects, except for a few metrics, including an unseasonably high maximum on the 25<sup>th</sup> of 31.2°C (the 12<sup>th</sup> warmest ever June day). Unlike previous months, rainfall and sunshine totals were normal for the time of year, although rainfall was more frequent than average.



In **July**, a maximum temperature of 35.1°C was recorded on the 31<sup>st</sup>, which was the joint second highest value ever recorded at the RMS. 35.1°C was previously recorded on 19<sup>th</sup> August 1932 and on 3<sup>rd</sup> August 1990. Mean air temperature, rainfall and sunshine were average, although July was the 6<sup>th</sup> windiest July on record (10.6 knots, 2.7 above average).

**August** was exceptionally warm. The mean air temperature of 18.6°C was the joint 6<sup>th</sup> warmest for an August on record, and 2.4°C above average. The mean minimum temperature was 14.5°C, which was the 4<sup>th</sup> warmest month on record, the 2<sup>nd</sup> warmest for an August on record, and 2.5°C above average. The mean monthly concrete minimum temperature was the 3<sup>rd</sup> warmest on record (14.4°C). A maximum temperature of 34.4°C was recorded on the 12<sup>th</sup>, which was the 5<sup>th</sup> highest temperature ever recorded at the RMS. Additionally, a maximum temperature of 34.1°C was recorded on the 11<sup>th</sup>, which was the 7<sup>th</sup> highest temperature ever recorded at the RMS. The minimum on the 12<sup>th</sup> was 20.4°C, which was the 4<sup>th</sup> warmest night on record, and one of the 10 tropical nights (minimum > 20°C) recorded at the RMS. Rainfall for the month was above average, while sunshine was average for the time of year.

**September** was a relatively warm, dry and sunny month. There was an 18 day dry spell from the 4<sup>th</sup> to the 22<sup>nd</sup>, and the number of rain days (7) was well below average. Sunshine hours exceeded the norm for the time of year (173.4 hours, 15<sup>th</sup> sunniest September on record). In the last week of the month, there was a fresher and cooler feel to the weather, with most of the rainfall recorded at this time and cloudier conditions more prevalent. Doctoral student Roxana Shafiee is photographed trying her hand at the rainfall measurements in September.



**October** was the 4<sup>th</sup> wettest month on record (185.3 mm), the 2<sup>nd</sup> wettest October on record, and the wettest month since October 1875, when 189.0 mm was recorded. 27 rain days were recorded in October, which is a record for an October month. A large fraction of the rainfall was associated with Storm Alex between the 1<sup>st</sup> and the 3<sup>rd</sup>. 60.0 mm was recorded on the 3<sup>rd</sup>,

which was the wettest October day on record, the 6<sup>th</sup> wettest day on record at the RMS, and the rainiest day for over 47 years (since 27<sup>th</sup> June 1973). 37.6 mm was recorded on the 2<sup>nd</sup>, which was the 8<sup>th</sup> wettest October day on record. The 72 hour rainfall total from Storm Alex was a record 104.8 mm. Interestingly, Oxford's all-time wettest October in 1875 was accompanied by extensive flooding in the city. That wasn't repeated in October 2020, despite the less than 4 mm difference in rainfall totals. This may be due to the lower moisture content of soils following the relatively dry September, which would have meant the ground being able to hold onto rainwater. But the absence of flooding on a similar scale almost certainly also reflects today's improved management of watercourses. Sunshine hours in October were 34 hours below average, while minimum temperatures were above average, and pushed the air temperature slightly above the long term mean. The absolute minimum temperature of 5.3°C was the 5<sup>th</sup> warmest for an October on record. No days of ground frost were recorded, which is unusual for an October. David Crowhurst is photographed recording the rainfall in October.



The photographs above show the 60.0 mm of rainfall recorded in the rain gauge on 3<sup>rd</sup> October.

**November** was slightly warmer and drier than average, with a mean air temperature of 8.6°C and rainfall total of 35.4 mm. However, the statistics for this month were, unlike previous months, meteorologically unexceptional. The first half of the month was notably warm. The second half of the month was slightly cooler, with fog and mist more prevalent.



**December** was a wetter than average month in Oxford. 99.4 mm was delivered, which was 43.0 mm above the long term mean. Notably, there was 26 mm of rainfall on the 23<sup>rd</sup>, and 17 mm of rainfall on the 26<sup>th</sup> associated with Storm Bella. These two events fully account for the rainfall anomaly. As the soil was still in a saturated state due to the exceptional rainfall in October, the

addition of 43.0 mm of rainfall in a short time period caused widespread flooding impacts across Oxfordshire. Temperature and sunshine metrics were normal for the time of year. The photograph shows a completely flooded Christ Church Meadow on 27<sup>th</sup> December.

## **RMS News**

### **Impact of Coronavirus on observations at the RMS**

The sudden onset of the coronavirus pandemic and national lockdown on 23<sup>rd</sup> March posed the inevitable question of how the readings for the UK's longest continuous daily weather record would be able to continue. Fortunately, Thomas Caton Harrison stepped up to the plate and stayed in Oxford for the duration of the first lockdown to ensure the readings were maintained. He covered the entire 85 days of shifts from 23<sup>rd</sup> March to 15<sup>th</sup> June. This was an outstanding commitment to keeping the records afloat. It would have been all too easy to have found ourselves with the longest gap in the entire record. Without his observations, we would never have known that May 2020 was the sunniest month in the history of the RMS, and the driest May since 1795. We thank Thomas for his service as an observer at this time. David Crowhurst covered the entire 27 days of shifts during the second national lockdown from 5<sup>th</sup> November to 2<sup>nd</sup> December, and we thank him for his commitment to the records as well. At the time of writing (January 2021), a third national lockdown has just been announced. We are in a fortunate position as two observers (David Crowhurst and Anlin Chen) are able to cover the daily weather readings for the duration of this lockdown.

In March, the dining hall at Green Templeton College closed due to the lockdown and we were unable to access our Newman barometer. Pressure readings have been taken from a backup aneroid barometer ever since, which is housed within the Stevenson screen. We have not resumed taking the pressure readings from the Newman barometer due to the accessibility issues, but hope to do so in 2021.

### **Instrument updates**

In January, the Newman barometer located in the dining hall of Green Templeton College began its period of restoration. At this time, readings were taken from a backup aneroid barometer. The Newman barometer was returned from the manufacturer in February, but suffered from a notable bias (~ 5 mb). We have not fixed this bias due to the accessibility issues, but hope to do so in 2021.

A fault developed in our Vaisala probe used to measure maximum temperature in April. A mercury thermometer was therefore used to measure maximum temperature between April and September. The fault was fixed by the Met Office in September and we are now using the Vaisala probe again.

## Media articles

The extreme weather observed at the RMS in 2020 was subject to national and local media interest. David Crowhurst was interviewed for an article on the BBC News website and on BBC Oxford radio about the October rainfall, and Thomas Caton Harrison was interviewed on BBC Oxford radio about the May sunshine. The full list of articles about the weather in 2020 at the RMS is below.

### October Rainfall

Oxford: The soggy view from UK's oldest rain record. *Jonathan Amos, BBC News Science and Environment.* <https://www.bbc.co.uk/news/science-environment-54783196>

October was Oxford's fourth wettest month in history. *James Roberts, Oxford Mail.* <https://www.oxfordmail.co.uk/news/18841996.october-oxfords-fourth-wettest-month-history/>

October 2020 was the wettest month in Oxford for 145 years. *School of Geography and the Environment, University of Oxford.* <https://www.geog.ox.ac.uk/news/2020/20201102-wettest-october.html>

Oxford records its wettest October in 145 years. *Matthew Schaffel, Cherwell.* <https://cherwell.org/2020/11/17/oxford-records-its-wettest-october-in-145-years/>

Storm Alex helped Oxford smash records for the wettest October day. *Rebecca Whittaker, Oxford Mail.* <https://www.oxfordmail.co.uk/news/18771322.storm-alex-helped-oxford-smash-records-wettest-october-day/>

Oxford has wettest October day since rainfall records began in 1827. *School of Geography and the Environment, University of Oxford.* <https://www.geog.ox.ac.uk/news/2020/20201005-wettest-october-day.html>

### May Sunshine

May was sunniest month ever recorded in Oxford's history. *Pete Hughes, Oxford Mail.* <https://www.oxfordmail.co.uk/news/18491260.may-sunniest-month-ever-recorded-oxfords-history/>

Oxford basks in 140-year-old sunshine record. *Ian Curtis, Climate News Network.* <https://climatenewsnetwork.net/oxford-basks-in-140-year-old-sunshine-record/>

Oxford sees sunniest month in the world's longest continuous sunshine record. *School of Geography and the Environment, University of Oxford.* <https://www.geog.ox.ac.uk/news/2020/20200602-sunniest-May-on-record.html>

## Observers

2020 saw major staff changes at the RMS. Thomas Caton Harrison left Oxford to complete his doctorate in June 2020. We thank him for his 254 days of service as an observer. James King also left Oxford to complete his doctorate in December 2020. We thank him for his 124 days of service as an observer.

Taking the place of Thomas was David Crowhurst, a doctoral student at the School of Geography and Environment. Taking the place of James was Anlin Chen, an undergraduate student at Keble College.

## Great Conjunction of Jupiter and Saturn

On an astronomical note, the Great Conjunction of Jupiter and Saturn occurred on 20<sup>th</sup> December. The last time that Jupiter and Saturn were as close together in the night sky was in 1623. This was 144 years before the Radcliffe weather records began, and 150 years before the Radcliffe astronomical observatory was built. David Crowhurst was lucky enough to observe the event for the first time from the Radcliffe observatory grounds.



## Thanks and final remarks

Our thanks go to Stephen Burt at Reading Met and Phil Johnson at the Met Office who gave their time to advise on observing practices in 2020. We also thank Roger Brugge at Reading Met for quality control checking our readings. We thank our backup observers, Marius Ramsoy, Eli Mitchell Larson and Toyosi Ogedengbe for their service to the station during 2020. We also thank Jonathan Amos at the BBC and our correspondents at the Oxford Mail for writing excellent news articles on the 2020 weather in Oxford. Finally, thanks are due to Ian Curtis, Hannah Daley and Richard Washington at the School of Geography and the Environment for their help and advice throughout the year.

David Crowhurst

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