

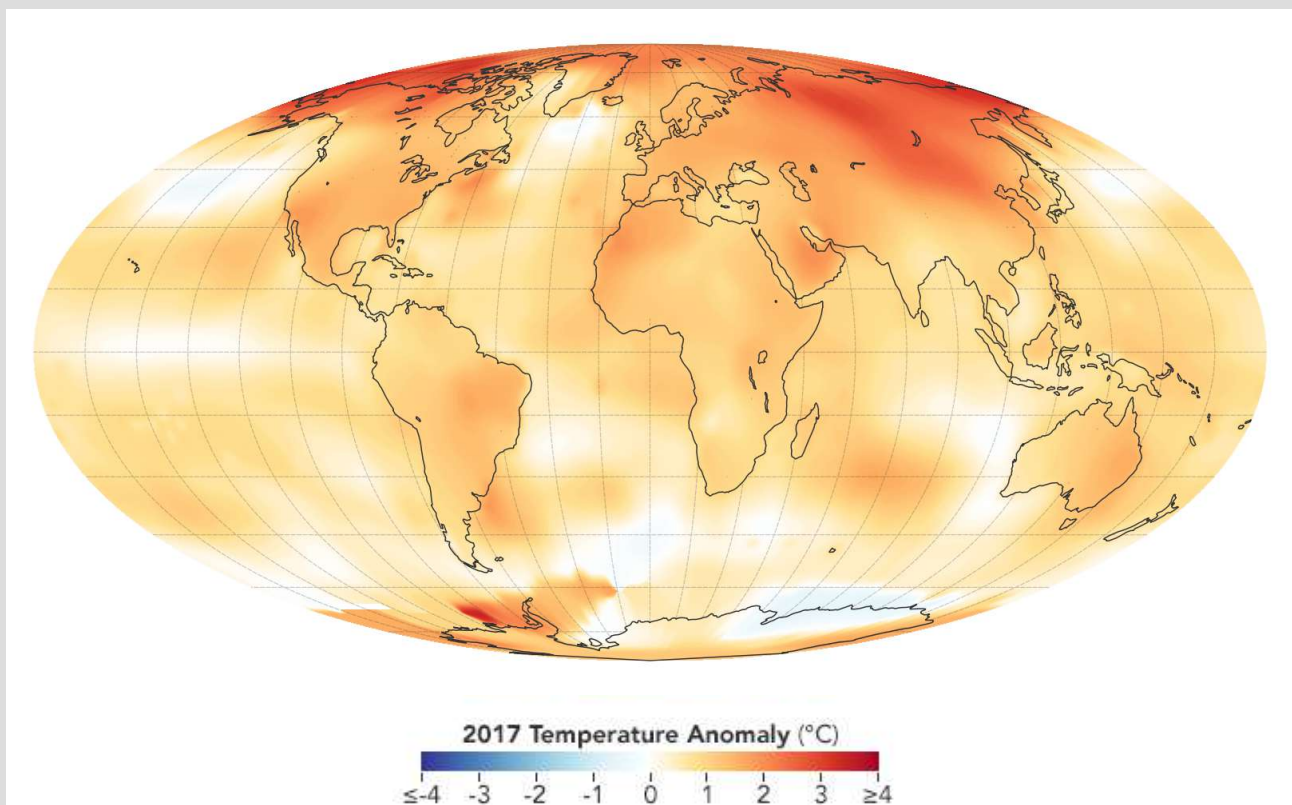
A photograph of a sunburst filtering through a forest canopy onto a bed of fallen leaves and green shoots. The sun is positioned in the upper center, creating a bright starburst effect with rays of light extending downwards. The forest floor is covered in a thick layer of dark, brown, and orange autumn leaves. Several green shoots, likely bluebells, are visible in the foreground, poking up through the leaf litter. The background shows the dark silhouettes of bare trees against the bright light of the sun.

Prime Meridian

(83) January 31, 2018

We all know that 2017 was one of the warmest years on record - but what are the lessons for education and campaigning?

In the early afternoon of January 7, 2018, the light of the fast-sinking Sun fell between bare trees onto the woodland floor. It caught the shoots of bluebells poking up through the leaf litter. Vicinity of West Kingsdown, Kent.



Global temperature anomalies for 2017 according to the NASA GISS analysis. The globally averaged temperature was 0.90°C above the 1951 to 1980 mean.

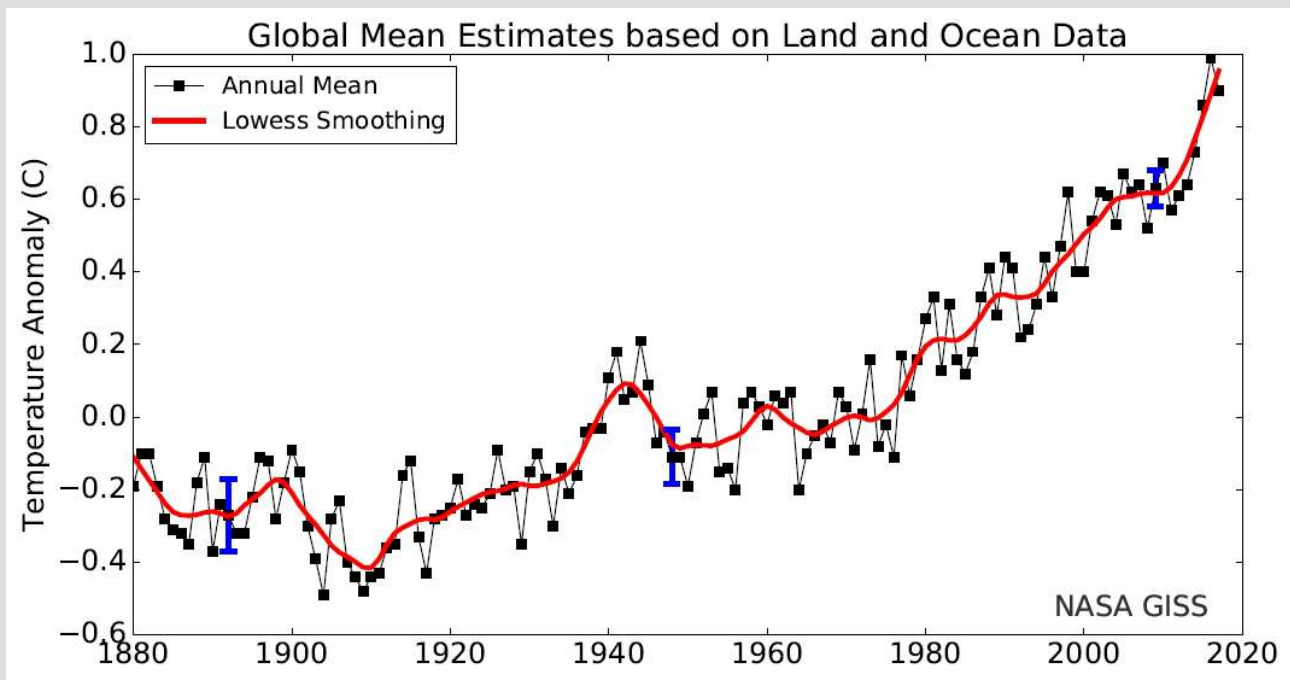
Was this the 2nd or 3rd warmest year on record? Why, ask many members of the public, if scientists can't agree, should they believe that climate change is real? Teachers and campaigners must continue to explain the realities.

Shortly after 2017 had drawn to a close, various agencies produced estimates of how its warmth had ranked compared to other years (the record began in 1880). For some people, these apparent contradictions can only undermine trust in the concept of global warming. Among widely publicised results, the one from the USA's National Oceanic and Atmospheric Administration, ranked 2017 as the third warmest year on record. This was also the finding of the UK's Met Office and the University of East Anglia's Climatic Research Unit. Meanwhile, the National Aeronautics and Space Administration's Goddard Institute for Space Studies ranked it second. The European Centre for Medium Range Weather Forecasting likewise cited 2017 as the second warmest. How should educators and climate campaigners explain this to the public at large?

Healthy science is about different teams of researchers tackling problems independently. This means that they approach measuring global temperature using different methodologies. A principle reason for seeming discrepancies is that the methods used to average temperatures between meteorological stations across the world are distinct. It would, in fact, be deeply suspicious if they all came up with exactly the same figures. Regardless of the exact ranking, NASA emphasised that: "The long-term records of the two agencies remain in strong agreement, and both analyses show that the five warmest years on record have all taken place since 2010."

Campaigners must convey also the fact that regions will differ in how they respond to a global situation with overall long-term warming. This is a consequence of the complexity of the Earth's climate system and of short-term fluctuations in weather.

The UK's Met Office reported that 2017 was the fifth warmest year for the UK since records began in 1910: "The year as a whole was rather warmer than average for the UK. The months from February to June were all warmer than average, whereas the second half of the year saw temperatures nearer to average with the exception of a warm October."



Above: The NASA GISS estimate of global warming since 1880.

For the UK as a whole, said the Met Office, the mean temperature for 2017 was 9.6°C. This was 0.7°C above the 1981-2010 average. England's mean was 10.4°C. This was 0.8°C above the mean. Our region, which the Met Office calls England SE & Central S, was the warmest region in the UK. It was 11.1°C and it was 0.7°C above the norm.

Prime Meridian

This newsletter is published by the Ecospheres Project, a trans-Atlantic research and media collaboration. Prime Meridian follows global environmental issues alongside the cycle of the seasons in South East England. It steps back to look at the Earth in its astronomical context and it pursues the search for other habitable worlds.

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**Right: A field of broccoli in Kent, South East England.
January 3, 2018.**



Seasons in South East England December 2017



Above: Fields and hedgerows around Ash in Kent were dusted with snow on the morning of Dec. 10, 2017.

Warmer and rainier than normal.

Short days and deepening chill were relieved by the usual festivities plus a “supermoon.”

Left: This was 2017's only supermoon. The *EarthSky* website credits the term to astrologer Richard Nolle, but astronomers flag up these larger than normal Moons to stimulate public interest. A New or Full supermoon occurs within 90% of the Moon's perigee (closest part of its orbit to the Earth). The Moon's mean distance is 384,402 km. Full Moon was on Dec. 3, 5:47 UTC, when the Moon lay at 357,987 km. Perigee was on Dec. 4 at 08:42 UTC, with the Moon at 357,492 km (Universal Coordinated Time is a time standard corresponding essentially to the GMT time zone). Photos taken early hours of Dec. 4. Below: Sun sets behind bare trees at around 16:30.





Above: Advent service in the chapel of Kings College London. Dec. 8, 2017.

The UK Met Office provisional figures show that it was cold, but warmer than might be expected. The mean temperature for the UK as a whole was 4.1°C (0.2°C higher than the 1981-2010 long-term average). That for England was 4.7°C (0.3°C above the norm). Our region (England SE and Central S) was the second warmest in the UK at 5.2°C (0.2°C above the norm). The warmest region, however, was England SW & Wales S, at 5.7°C. That region also showed the largest departure from usual (0.5°C above the norm).

Looking back further in time, however, and using the period 1969 to 1990 as our baseline, we find that our region was 0.5°C warmer than the average for December.

Photos right and below are from around West Kingsdown, Kent on December 9, 2017.

Right: A chilly, but sunny day out in the fields. It is easy to see how seed heads of *Clematis vitalba* have earned this plant the popular name of Old Man's Beard. A bird nest lost its cover in autumn leaf fall.

Below: The Sun may be out, but it has failed to thaw this shadowed frost pocket.





Above & left: Snowy scenes around Ash in Kent, on the morning of December 10. There was no more than a dusting of snow, and thawing set in quickly, but the effect was picturesque while it lasted. Below: Horse wrapped up against the cold on Dec. 12.

The Met Office reported that the month opened with an incursion of cold northern air, followed by "mild and cloudy" conditions for the rest of the first week. Dec. 7 saw strong winds from Storm Caroline, although the South East missed the worst. A "wintry spell" followed from Dec. 8 to 16. Frosts were widespread, but snow falls mostly affected northern areas. By far the wettest day at Heathrow was Dec. 10, with 20 mm of precipitation. There were 8 mm on Dec. 11 and 9 mm on Dec. 13.





Above: Snow flurries and ice hazard. New Ash Green, Kent. Dec. 10. That day saw disruption on the M25 (which rings London). Gritting lorries were at work reducing the danger of cars sliding on ice (Dec. 12). Low Sun glints from iced-over puddle at Ash, Dec. 12.

Dec. 12 saw the UK's lowest temperature of the month, when it hit -13.0°C at Shawbury in Shropshire (West Midlands, bordering Wales). Meanwhile, in our region, this was also the coldest day for Heathrow, with a low around -3.5°C .

Left & below: A mixture of bare trees and trees still bearing autumn leaves or fruits in woodland and gardens around New Ash Green and Hartley, Kent. Dec. 16, 2017.



Above: Nativity scene at St Peter's & St Paul's Church, Ash at Midnight mass, Dec. 25, 2017.

Right: Celebrations in London's Trafalgar Square (with a giant Menorah) marked the start of Hanukkah, an eight day Jewish holiday which begins on the 25th day of the Hebrew month of Kislev and lasts for eight days, being Dec. 12 to 20, 2017.



It celebrates the victory of the Maccabees (139 BC), against the Macedonian-ruled Seleucid Empire, which had forbidden Jewish practices. During the rededication of the temple in Jerusalem, the Maccabees found only one day's supply of oil to light the Menorah, but it lasted miraculously for 8 days. Kislev may be named for Ksil or Orion, a constellation prominent at this time.

Winter solstice, Dec. 21. At West Norwood, South London, pink clouds catching the final sunlight of the year's shortest day.

Below: Sunset on December 28, 2017. The days were still short, but now growing very gradually longer.





Dec. 18 saw the UK's highest temperature (15.2°C) at Cassley in Sutherland, in northernmost Scotland. The warmest day at Heathrow was Dec. 30, when it reached around 14.5°C.

Christmas 2017 was over, but the festive days would continue to New Year and into the first few days of 2018.

Cold days followed as the year drew to its close.

The Met Office explained that: "Between the 25th and 27th a mix of rain, sleet and snow caused disruption. Throughout this period, roads were closed and there was further disruption to rail and air travel. Flights at Luton and Stansted were cancelled with Stansted airport closing for a time due to snow. The last third of the month was increasingly unsettled and Storm Dylan brought further strong winds on the 30th/31st."

Dec. 27. A gust of 132 km per hour at the Needles, Isle of Wight.

With the nights longer than the days, we have had another couple of appropriate views of the short hours of sunlight.

On December 28, 2017, a sinking Sun gleamed on a icy puddle at Ash, Kent. This was very shortly after four-o'clock in the afternoon.

Dec. 31. This final picture of this year, was taken after the Sun had already set at ground level. The last day of the year was already on the way into night-time. Far about us, however, towering cumulus still basked in the closing daylight of 2017.

Monthly means for SE and central S England. Max. temp.: 16.1°C (1.3°C); min. temp.: 9.2°C (1.8°C). Hours of sunshine: 95.9 (85%). Rain: 31.7 mm (34%). Anomalies re. 1981-2010 norm in brackets. Date obtained from Met Office on-line monthly reports. Heathrow data is obtained from [WeatherOnline](#).



Global climate: December 2017 was yet another warm month, tying with 2016 as the third warmest on record.

A statement from the USA's National Oceanic and Atmospheric Administration said: "The combined global average temperature over land and ocean surfaces for December 2017 was 0.80°C . . . above the 20th century average of 12.2°C . . . — tying with 2016 as the third highest December global temperature since records began in 1880."

All the anomalies quoted below are positive. In each case, this month, 2015 was the warmest year.

Globally, land plus oceans were $0.80 \pm 0.14^{\circ}\text{C}$ above the mean, (4th warmest, with 2015 as warmest) , oceans were $0.56 \pm 0.15^{\circ}\text{C}$ above the mean (6th warmest; warmest was 2015), whilst the land areas at $1.45 \pm 0.11^{\circ}\text{C}$ (2nd warmest on record; warmest was 2015).

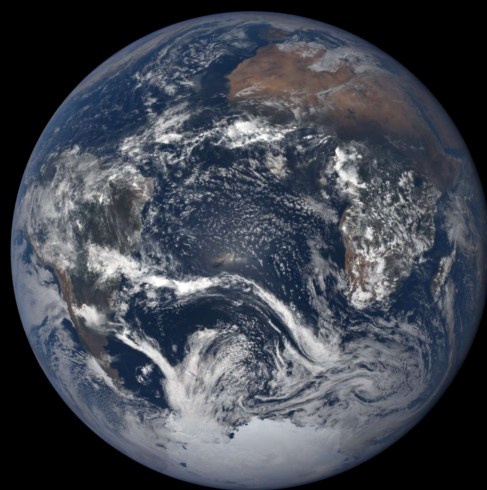
In the Northern Hemisphere, land plus ocean was $1.06 \pm 0.13^{\circ}\text{C}$ above the mean, the 2nd highest on record with 2015 as warmest. The oceans were $0.71 \pm 0.16^{\circ}\text{C}$ above the norm (3rd warmest; 2015 was warmest), while the land ($1.60 \pm 0.11^{\circ}\text{C}$ above the mean), was its 5th warmest (2015 was warmest).

In the Southern Hemisphere, the combined land and ocean temperature was $0.53 \pm 0.14^{\circ}\text{C}$ above the mean (8th warmest; 2015 was warmest). The oceans were 0.45 ± 0.15 above the mean (148th warmest, with 2015 as warmest). mean (8th warmest; 2015 was warmest). The land was 0.95 ± 0.12 above the mean (5th warmest, with 2015 as warmest).

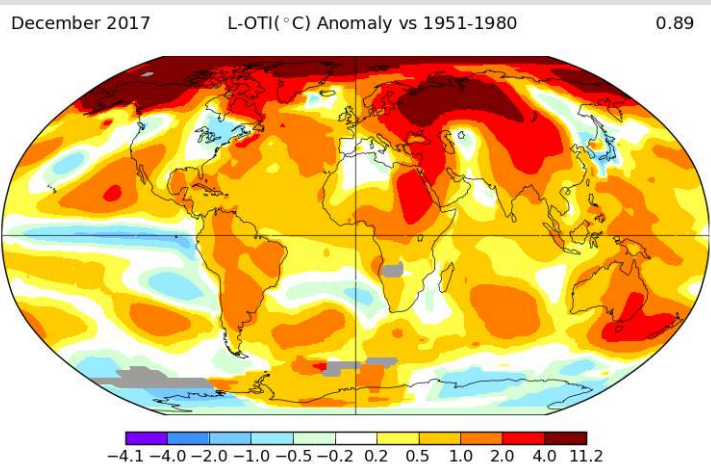
Source: NOAA National Climatic Data Center, *State of the Climate: Global Analysis for September 2017*. Published online. Data is provisional.

Above right: Planet Earth on the day of the Winter Solstice, December 21, 2017, at 11:52:55 GMT. DSCOVR mission. NASA/NOAA. We see Antarctica, where it is summer, tipped at its most

Source: NOAA National Climatic Data Center, *State of the Climate: Global Analysis for December 2017*. Published online. Data is provisional.



How different measurements revealed a globally warm December.



The UK Met Office stated that: "Globally, December 2017 was most likely the 6th warmest December on record although, given the uncertainties, it could lie anywhere between 2nd and 13th warmest." It considered data sets from NASA GISS, NOAA NCEI, Berkeley Earth and C3S also show that December was a warm month globally. "December was nominally between 2nd and 4th warmest in these data sets, which is consistent with the HadCRUT4 uncertainty range." In all cases, the month belonged with the warmest Decembers in history. Met Office Climate bulletin - December 2017.

Above: NASA GISS temperature anomalies for December 2017. Note that the NE USA was cold.