Prime Meridian

(66) February 28, 2017

HOW DEEP IS THE CRISIS FOR CLIMATE RESEARCH IN THE USA?

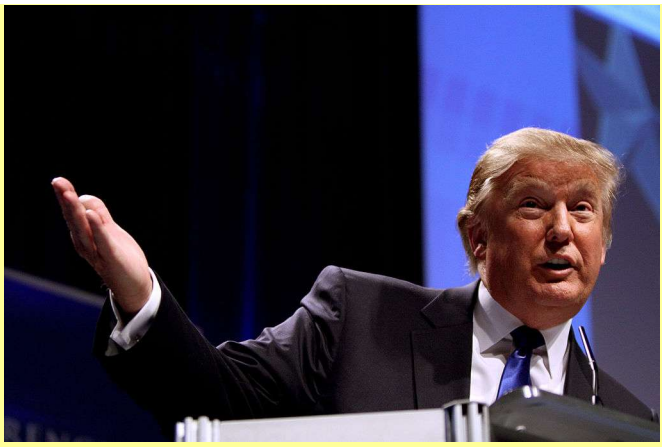
The USA's agencies NASA and NOAA are performing vital research in monitoring and understanding Earth's climate. However, Trump's administration perceives this as "politicized" science, and NASA could be stripped of this role in favour of Solar System exploration alone. This would be a substantial blow for the urgent efforts being made by the international scientific community to get to grips with human-driven climate change.

Climate round-up for January 2017 page 8.

Below: Rocky Mountains from International Space Station Expedition 50. Thomas Pesquet (ESA). Jan. 9, 2017

What is the future of climate research under Donald Trump?

The USA is a world leader in climate science, but that role could soon be under threat.



Right: Trump addressing the Conservative Political Acion Conference in 2011. Gage Skidmore CC BY-SA 2.0.

We enter 2017 with huge uncertainties about the new administration's future role in the international climate effort and even about the future of climate research by US government agencies.

Concerted and well co-ordinated international action will be necessary to head off the threat posed to human communities by rising temperatures. Forging this response has been the purpose of a succession of international climate conferences. Following the Jan. 20 inauguration of the USA's new president Donald Trump, however, references to action on climate quickly disappeared from the revised White House website.

Trump has demonstrated an acute sensitivity to the expression of criticism and of opinions other than his own and a disinclination to follow the tradition of western leaders to grin and bear it.

In a tweet on Feb. 17, 2017, Trump wrote "*The FAKE NEWS media (failing @nytimes, @NBCNews, @ABC, @CBS, @CNN) is not my enemy, it is the enemy of the American People!*" He had expanded the list published in an earlier tweet. He has banned journalists from major news outlets, including the BBC, from his conferences. The latter, to be objective, is a tactic not unknown in political circles, but the former sent shock waves around the world. The phrase "*enemy of the people*" has unAmerican echoes of Soviet era repression. The President has gone so far as to assert that: "*Information is being illegally given to the failing New York Times & Washington Post by the intelligence community (NSA and FBI?). Just like Russia.*"

The relevance of this to climate change? Trump and his advisors see claims of climate change and the role of human activity in causing it as a rival political stance. They have explicitly denounced "*politicized science*." They see legislation designed to encourage clean air and water in the same light.

Whilst mainstream media have been reviled, the pro-Trump online *Breitbart News*, founded in 2007 by the late Andrew Breitbart (1969-2012) has been welcomed. Its former executive chairman Steve Bannon served as chief executive officer to Trump's presidential campaign and is presently a Whitehouse advisor. Breitbart has carried articles such as "*Climate Change: The Greatest-Ever Conspiracy Against The Taxpayer.*" This was based on an address made in March 2016 by climate counter-advocate James Delingpole to an organisation styling itself the World Taxpayers' Association, in Berlin. Delingpole sees moves to reverse our negative impact on the environment in one-dimensional terms: "*In the guise of saving the world's environment they could advance all their usual obsessions - control, regulation, state intervention, puritanism, compulsory immiseration - though this time with a smiling, fluffy face.*"

Needless to say, any good cause can be, and historically many have been, abused to promote a totalitarian agenda. That does not constitute grounds to allow climate change to undermine the well-being of civilisation – which would involve the break down of the very economic systems and possibly the free society, that climate counter-advocates insist that they wish to preserve.

The Environmental Protection Agency is now under the control of one of its fiercest opponents.

Trump's nominee to head the Environmental Protection Agency was Scott Pruitt, Oklahoma's attorney general. Pruitt has been a dedicated opponent of the EPA, having challenged it in court some 14 times during the period of the Obama administration. Legislation under attack concerned mercury pollution, smog, carbon emissions and water quality, which many would consider fundamental contributions to public health. In 13 cases, Pruitt acted in combination with vested interests who had funded his political aspirations. He co-authored a piece in the *National Review,* in which he stated "*global warming has inspired one of the major policy debates of our time. That debate is far from settled. Scientists continue to disagree about the degree and extent of global warming and its connection to the actions of mankind.*" Pruitt was accused by New York's attorney general Eric T. Schneiderman, as both a "*dangerous and unqualified choice*" and "*agent of the oil and gas industry*".

Pruitt, clearly, cannot be regarded as an objective commentator. We should not, however, respond to his statements about global warming in the way that the medieval church might have been expected to recoil from a contradiction of its cherished doctrines. The existence of a global warming trend must be understood as a conclusion emerging from research, not as a sacred political dogma. Pruitt's statement contains a beguiling partial truth: scientists do indeed continue to disagree about the degree and extent of global warming – that is their job. This does not mean that global warming is not real, nor that our greenhouse gas emissions are not driving it, only that climate science advances through a succession of models, with ongoing adjustments to the predicted sensitivity of climate to human emission of greenhouse gases. That is the way that it should be. Pruitt has twisted this truth into a misleading debating point against the idea of global warming.

Explaining how climate research works must be a key task for those who engaged in promoting the public understanding of science. Pruitt's statements are a reminder that it will not be easy to communicate the relatively subtle narrative of scientific endeavour in the face of sloganeering from politicians of all political colours

The Endangered Species Act is under attack.

If anyone still imagines naively that we all basically share a common culture when it comes to endangered species and the preservation of ecosystems (even if developers and drillers feel obliged on occasions to understate the impact that their projects are likely to have) a brief glimpse at *Breitbart News* will suffice to blow that illusion away. The plight of endangered species is mocked by writers who evidently delight in shocking and winding up their ecologically-minded opponents (see, "*Animals That Aren't Delicious or Useful Deserve to Be Extinct*," August 2015. Our advice; grown ups should refuse to be riled by juvenile anti-panda jibes.

Moves from within Congress to pull the USA's 1973 Endangered Species Act to pieces have been more subtle and disturbing. The *Energy and Environment News* quoted Senator John Barrasso of Wyoming as telling the Environment and Public Works Committee (which he chairs) that he aims at "*eliminating a lot of the red tape and the bureaucratic burdens that have been impacting our ability to create jobs*". House Natural Resources Committee Chairman Congressman Rob Bishop has been quoted as saying that the Endangered Species Act has been hijacked as tool to control the land. It was slated for having obstructed land use planning, employment, cattle ranching, agriculture, creation of housing, mining and even management for ecology. Campaigners claim that the Act has probably prevented around 1,000 species from actually dying out, although, according to the government, a mere 11 species out of 1,195 have recovered from being endangered. A CNN reviewer, Natalie Pawelski, pointed out that "*Saving animals has meant saving habitats -- and preserving forests and wetlands, beaches and deserts has meant preserving the face of America.*"

Trump has NASA and NOAA in his sights.

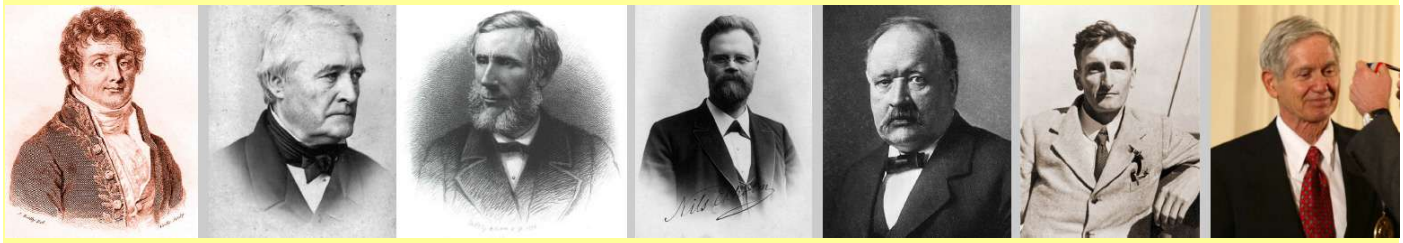
An Oct. 19, 2016 piece in Space News by two Trump advisors laid out an expansive vision for space exploration that included public, private and military sectores. Robert S. Walker was former chairman of the U.S. House Science, Space, and Technology Committee and of the Commission on the Future of the U.S. Aerospace Industry. He became space policy advisor to Trump's presidential campaign. Peter Navarro, a highly controversial economist, is a business professor at the University of California-Irvine.

They wrote: "*NASA was formed in the crucible of Sputnik and took this nation to the moon and stars. Today, it has been largely reduced to a logistics agency concentrating on space station resupply and politically correct environmental monitoring.*"

Also: "*NASA should be focused primarily on deep space activities rather than Earth-centric work that is better handled by other agencies. Human exploration of our entire solar system by the end of this century should be NASA's focus and goal. Developing the technologies to meet that goal would severely challenge our present knowledge base, but that should be a reason for exploration and science.*"

They concluded on an up-beat note: "*Space is the frontier on which American aspiration can become humankind's inspiration. It is our freedom and our courage that allows us to do great things. Space represents a challenge of infinite proportions. There is no environment more hostile. There are no distances to travel that are greater. And yet Americans seem to know intuitively that the destiny of a free people lies in the stars. Donald Trump fully agrees.*" This is heady stuff, with more than an echo of *Star Trek*. We at the Ecospheres Project are fully engaged in the search for other Earths – but that's no excuse to trash the planet on which we actually live, and which, as we point out frequently, is our first and most urgent priority.

Below: This view of the Earth and Moon was captured on January 15, 2017 by the GOES-16 weather satellite (launched November 19, 2016), which has been placed in geostationary orbit over equatorial America. It will provide a full disk image of Earth every 15 minutes in 16 spectral channels.



Above (left to right): Some of the major figures whose work led to our present understanding of greenhouse gases and global warming; Fourier, Pouillet, Tyndall, Ekholm. Arrhenius, Callendar and Keeling.

Walker has argued that Earth-centric science would be best undertaken by the National Oceanic and Atmospheric Administration, although Republican politicians have been very determindly assailing and seeking to obstruct NOAA for its investigation of global warming.

Walker told the Guardian (Nov. 23, 2016): "*My guess is that it would be difficult to stop all ongoing Nasa programs but future programs should definitely be placed with other agencies. I believe that climate research is necessary but it has been heavily politicized, which has undermined a lot of the work that researchers have been doing. Mr Trump's decisions will be based upon solid science, not politicized science.*"

What are Donald Trump's credentials to speak for "*solid science*"? In an infamous tweet (7:15 pm, November 6, 2012), he stated that "*The concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive.*"

This is an astonishing claim and one that is readily refuted. It opens a window into the Trump administration's disturbing ignorance of climate science.

In reality, the history of interest and concern about the release of greenhouse gases into the atmosphere is so well known that there is simply no room to plead for it having being created as a propaganda device by the People's Republic of China.

Jean Baptiste Joseph Fourier (1768-1830) recognised that the atmosphere must play a role in raising the temperature of the Earth above the expected equilibrium temperature. A fellow Frenchman, Claude Servais Mathias Pouillet (1790-1868) contributed to the field and made the first quantitative estimates of the solar constant (1228 W/m^2, compared to the modern value of 1367 W/m^2). Irish physicist John Tyndall (1820-1893) carried out experiments which demonstrated the reality of the greenhouse effect, notably that atmospheric water vapour absorbs infra-red radiation. Swedish colleagues Nils Gustaf Ekholm (1848-1923) and Svante August Arrhenius (1859-1927). Arrhenius progressed from investigating the origin of ice ages to considering the role of the gas carbon dioxide in raising the temperature of the Earth's surface. In 1896 he published his work *On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground*, (Svante Arrhenius, S. (1896b). *London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science* (fifth series), April 1896. vol 41, pages 237–275.

In his 1908 book *Worlds in the making; the evolution of the universe* (Academic Publishing House, Leipzig) Arrhenus wrote: "*That the atmospheric envelopes limit the heat losses from the planets had been suggested about 1800 by the great French physicist Fourier. His ideas were further developed afterwards by Pouillet and Tyndall. Their theory has been styled the hot-house theory, because they thought that the atmosphere acted after the manner of the glass panes of hot-houses.*"

Arrhenius also argued that *"Since, now, warm ages have alternated with glacial periods, even after man appeared on the earth, we have to ask ourselves: Is it probable that we shall in the coming geological ages be visited by a new ice period that will drive us from our temperate countries into the hotter climates of Africa? There does not appear to be much ground for such an apprehension. The enormous combustion of coal by our industrial establishments suffices to increase the percentage of carbon dioxide in the air to a perceptible degree."*

Ekholm likewise was an apostle of geoengineering, who argued that the human production of carbon dioxide could keep the next ice age at bay.

Prominent in the debate was another Swede, Knut Johan Ångström (1857-1910), the son of physicist Anders Jonas Ångström (1814-1874), from whom the Ångström unit of length (10^{-10}m) was named. K. J. Ångström had pioneered work on the absorption spectrum of CO_2, describing two absorption bands in the infra-red. These help to fill in gaps where water vapour does not absorb. He concluded, incorrectly, we now know, that adding more CO_2 to the atmosphere would have no effect because the absorption spectrum was simply saturated.

After the idea of the CO_2 greenhouse had languished through a period of neglect, the British scientist Guy Stewart Callendar (1897-1964), whose professional expertise was in turbine technology, launched into an investigation of the concept in the face of mainstream scepticism. He too saw the human contribution of CO_2 to the atmosphere as a means to avoid the next ice age. His work catalysed a new round of interest and it was built upon by Charles David Keeling (1928-2005) of the Scripps Institution of Oceanography set up a base on Mauna Loa, Hawaii, to monitor CO_2 and today this record is the longest available.

Keeling observed that there was an overall rise, but that superimposed upon it were seasonal variations with highest CO_2 during the Northern Hemisphere winter, when plant growth was minimal. with values falling again as plant growth got underway in the spring. His work prompted the USA's National Science Foundation (1963) and the Scientific Advisory Committee (1965) of President Lyndon Baines Johnson (1908-1973; President 1963-1969) to warn of the dangers of climate change.

The amount of CO_2 put into the atmosphere by our civilisation has already exceeded the amount needed to prevent a future ice age (see the discussion in PM 50) and is presently threatening to drive temperatures up to levels that would be injurious to human communities.

In 1984, the Belgian climate scientist André Léon Georges Chevalier Berger famously warned that the mission of greenhouse gases was "*the greatest inadvertent geophysical experiment ever begun*" Berger, A. (1984). H. Flohn & R. Fantechi (Eds.). p. 196. Kluwer Academic Publishers Group. Dordercht, Netherlands.

There can be no doubt that the present administration poses a serious threat to the future of climate research and environmental protection in the USA, and that it seek to roll back the *status quo* by decades.

Its ideological opposition to the concept of human-driven climate change is undeniable, but we cannot, at this very early stage in the Trump presidency, be certain about how far the onslaught will be carried. There will be legal challenges at every turn and NASA's climate research underpins so many activites of economic importance (including NOAA's work, land use, agriculture, fisheries, weather etc.) that even Trump may think twice.

The Ecospheres Project & Prime Meridian.

The Ecospheres Project is a trans-Atlantic collaboration to promote research & education. The principal participants, astrophysicist and planet-hunter Laurance (USA) and Martin Heath, whose background is in biology and the earth sciences, work together to explore the potential of planets and moons to support complex life. This bridges the gap between the focus on microbial-grade life at the NASA Astrobiology Institute and the search for radio signals from other civilisations being undertaken at the SETI Institute.

We are presently completing a series of papers aimed at specialist journals, whilst pursuing potential new publishing and media projects aimed at the popular market.

Investigation of distant worlds is an exciting venture on the cutting edge of 21st Century science. However, our most urgent concern must be the planet on our doorstep and the human communities who depend upon its natural life support systems for their welfare. Prime Meridian is our contribution to encouraging awareness of environmental issues and the essential role that scientific research must play in safeguarding planet Earth's inhabitants, human and otherwise.

South East England is not merely a region through which the 0° longitude happens to run, but the region in which, at Greenwich overlooking the River Thames, the prime meridian destined to be adopted by map-makers worldwide, was defined. This newsletter follows the cycle of the seasons in the woods, fields and hedgerows of South East England, alongside global environmental issues. We step back to see our Earth in its astronomical setting and we explore the possibilities for other habitable worlds.

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Seasons in South East England

January, 2017

Above: Snow lingers in patches on the fields around West Kingsdown, Kent. Jan. 15,2017.

A cold and frosty month.

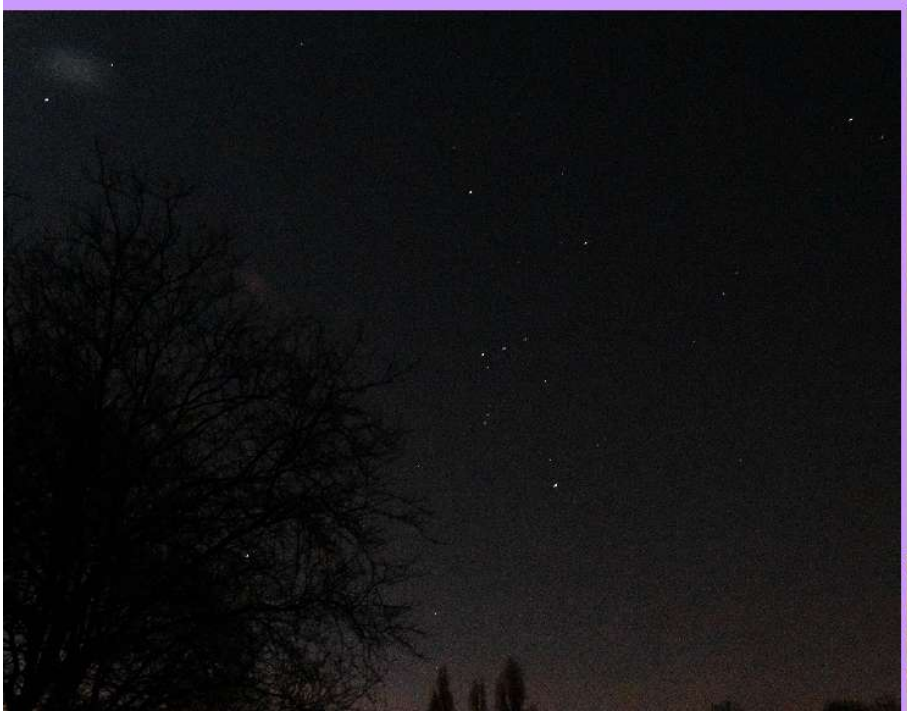
January and February are the coldest months in our region, as they are for the Northern Hemisphere in general. London enjoys the heat island effect created by cities and the London Weather Centre quotes mean temperatures of 6.8ºC for both months. Even so, January, with its short days and long nights was typically bleak, whilst managing to be even chillier than normal. There were 16.1 days of air frost, which was 6.1 days more frequent than the average. The SE was unusual here, however. For the UK as a whole the mean temperature was 3.9ºC (which was actually 0.2ºC above the 1981-2010 average), but for England the average was 3.8ºC, which was 0.3ºC *below* the norm. For our region (Met Office region SE and central S), it was 3.7ºC, which was 0.9ºC lower than the norm.

Left: Early January in S. London: The Moon, flanked by the planets Venus (below) and Mars (above), glints through the bare branches of an oak tree in Belair Park on Jan. 2. On Jan. 3, leafless trees packed the foreground in a view towards London across Dulwich and Sydenham Hill Woods. On Jan. 14, at around twenty to four in the afternoon, a vapour trail, high overhead, caught the pink glow from the setting Sun although evening had already fallen over the landscape. Below: A shallow pit in the road (15 cm across) had iced up in the early hours of Jan. 3.

Above and right: Jan. 7, 2017. Woodland and hedgerows around West Kingsdown, Kent were bare except for evergreen ivy and holly. Bales of straw stacked in a shed beside bare fields (Jan. 9).

Icy conditions gripped SE England on Jan. 5 and Jan. 6. Heathrow (Greater London) enjoyed its highest temperature (over 11ºC) on Jan, 11, but the Met Office reported that on Jan. 12: "*In south-east England, snow, fallen trees and flooding affected local roads across London, Kent, Sussex and Surrey. Snow on the M25 caused long delays and problems on some slips roads, and five flights at Gatwick were cancelled due to snow.*"

Below: Frosty South London skies. The winter constellation of Orion rode high in the early evening sky above Belair Park (Jan. 13). Conditions were finger-numbing. On Jan. 12, the Moon peered down through cloud and leafless trees over the wall of a 19th Century necropolis, with a snowed car in the foreground.



Above: Snow-covered branches at New Ash Green, Kent. Jan. 13, 2017 (P. Stanford).

Right: In Belair park, S. London, the icy cover of a puddled area reflected the skeletons of trees on the gloomy afternoon of Jan. 14.

Below: Water droplets run down the twigs of a common hawthorn (*Crataegus monogyna*) on Jan. 15. Near West Kingsdown, Kent.

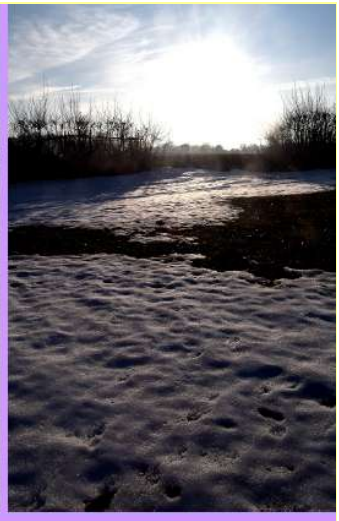
The Met Office flagged up a catalogue of seasonal weather impacts across SE England that continued for much of the month: freezing fog, snow, ice and fallen trees, blocking a railway line and roads. Air travel was likewise disrupted, with significant economic implications.

Above: The wind was whipping up clouds of powdery snow in a field near West Kingsdown on Jan. 15. In places around West Kingsdown, remnants of a light snow cover persisted in a landscape of bare woods and hedgerows on Jan. 15 (left and below).

On Jan. 12, 34.0 mm of rain fell at Hastings on the South Coast, with snow received in other places across the SE. Heathrow recorded its greatest rainfall of the month; 16 mm. The UK's Met Office recorded the passage of a band of rain, sleet and snow across our region on Jan. 13.

The lowest temperatures at Heathrow (under -4ºC) occurred on Jan 22 and 23.March 23 saw; "*hundreds of flights either cancelled or delayed due to freezing fog at Heathrow, Gatwick, London City and Southampton airports" March 24: "fog was more widespread and around 100 flights were cancelled at Heathrow, with delays at the other London airports and knock on effects across the UK and Europe.*" Jan. 25 saw the UK's highest temperature of 14.2ºC achieved at two Scottish locations, at Achfary in Sutherland and Plockton in Wester Ross.



Above: An urban fox (*Vulpes vulpes*), caught with a flash as it investigated the contents of a store for refuse bins on the night of Jan. 17. The mating season for foxes is December to February and the cubs remain with their mother for a fortnight before exploring the outside world. They disperse to find their own territories in the autumn. West Norwood, S. London. A moorhen (*Gallinula chloropus*) is confronted with its reflection in the ice cover of the lake at Belair Park, S. London (Jan. 21). A low Sun beams across snowy landscapes in on northern Kent Jan. 22.

Heathrow experienced a relatively warm day on Jan. 24 (maximum about 9.5ºC), but the temperature failed to reach 4ºC on Jan. 25 and highest temperature was below 1ºC on Jan 26. Icy roads across on the 28th caused a number of further traffic accidents across south-east England. The month"s lowest temperature (-10.1ºC) was felt in Scotland at Braemar in Aberdeenshire on Jan. 30. January had seen 14 daily minima below 0ºC.

Left: A crescent Moon in a clear sky above frosted roof tops. S. London, Jan. 21. Misty landscape near Ash, Kent on Jan. 22. Below: A horse sips from an icy trough (Ash), and the Sun sets over Belair Park, S. London, on Jan. 22.


Above: Wintry hedgerows in northern Kent. Jan. 22.

Left: Two birds from the family Corvidae. A crow (*Corvus corone*) is investigating an old nest in a tree top (South London), but a couple of magpies (*Pica pica*) have arrived to compete for the site. It was early in the season, however and nesting did not actually follow.

Below: Looking across Sydenham Hill Wood towards central London. A storm cloud looms in the distance. Jan. 28. The lower photograph (flash) shows 1 cm-sized hailstones which fell on a car near Bromley, later that day.

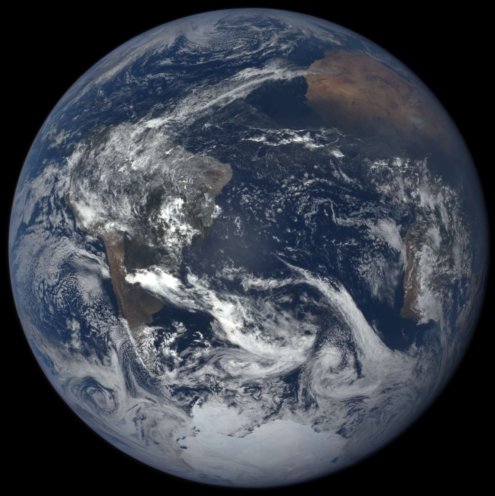
SE and central S England, Mean max. temp.: 7.2ºC (-0.3ºC). Mean min. temp.: 0.1ºC (-1.6ºC). Hours of sunshine: 77.6 (132%). Rain: 83.3 mm (104%). Anomalies re. 1981-2010 norm in brackets. Data in this article have been derived from online publications by the UK Met Office and WeatherOnline (Heathrow). Met Ofice data are provisional.

Global climate: January 2017 was the third warmest January on record.

According to the USA's National Oceanic and Atmospheric Administration, January 2017 was not a record-breaker, yet it was almost at the top of the temperature range for a record that began in 1880. January's global temperature was 0.88°C above the 20th Century mean of 12.0°C.

Our region was among those that were colder than normal. According to NOAA: "*Cooler-than-average conditions were observed across New Zealand, the western half of the contiguous U.S., central and western Australia, northern and southern parts of Africa, western and southern Asia, and much of Europe. The most notable below-average temperature departures from average were observed across the northwestern contiguous U.S. and central Europe (-3.0 °C [-5.4°F] or colder). According to NCEI's Regional analysis, three of the six continents had at least a top six warm January, with South America having its second warmest January since continental records began in 1910, behind 2016. Meanwhile, Europe had its coldest January since 2010.***" NCEI is the USA's National Centers for Environmental Information.**

The global mean temperature for land plus ocean was 0.88 ± 0.17°C above its January mean, the 3rd highest on record (January 2016 was warmest). The oceans (0.65 ± 0.15°C) above the mean, were 2nd warmest (2007 was warmest). Globally, land areas were their 3rd warmest on record at 1.54 ± 0.23°C above the norm. In the Northern Hemisphere, the combined mean temperature for land and ocean was 1.09 ± 0.21°C above the mean (3rd highest on record; 2016 was warmest). The land was 1.70 ± 0.30°C above the norm (4th warmest; 2007 was warmest). The oceans (0.73 ± 0.14°C above the mean), were 2nd warmest after 2016. In the S. Hemisphere, the mean combined land and ocean temperature was 0.67 ± 0.15°C above the mean, (3rd highest on record; 2016 was warmest). The ocean (0.60 ± 0.15°C above the norm) was the 3rd warmest; 2016 was warmest). The land (1.12 ± 0.15°C above the norm) was the 3rd warmest (2016 was warmest).



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

Above: The day of perihelion, January 4, 2017, when the Earth passes through the part of its orbit closest to the Sun. The actual moment of perihelion was at 14:18 GMT and this image was obtained by the DSCOVR satellite at 14:51:36 GMT. NASA/NOAA.

Left: Storm Egon seen in an infra-red satellite image (NOAA) as it swept on beyond the British Isles on January 13, 2017. The storm struck the UK on Jan. 12 and fears of flooding caused evacuations from coastal areas of Essex, Suffolk and Lincolnshire. It strengthened over France, with winds of 146 km per hour recorded at Dieppe. 330,00 homes were struck by power black-outs in France. Major weather impacts were felt across a wide swathe of Europe.