April 2016 was the warmest April on record for the planet, and the seventh month in a row to have broken global temperature records. According to data released on May 14 by NASA's Goddard Institute for Space Studies, the global temperature departure in April was 1.11 degrees Celsius above the 1951-1980 average. This topped the previous April record set in 2010 by 0.24 degrees Celsius. “Defeating a previous record by a few tenths of a degree may not sound overwhelming, but in the world of climate statistics, computed from worldwide temperatures, this is yet another record-shattering figure.”

For the first time in recorded history, the temperature across the northern hemisphere climbed above two degrees Celsius higher than “normal.” The rise occurred on March 3, 2016, and lasted only a short time, but the escalation is in line with other temperature reports. During the January-April 2016 period, the average temperature for the contiguous United States was 4.0 degrees F above the 20th-century average.

These temperatures represent the onset of a “new normal.” In its annual climate report issued on March 22, 2016, the World Meteorological Organization (WMO) predicted the future would be increases: increased temperature, increased ocean heat content, and increased loss of ice. “Hotter, Drier, Wetter. Face the Future” was the theme for World Meteorological Day on March 23, when United Nations Secretary-General Ban Ki-moon issued a rallying call for decision-makers and all actors in society to “face the future now.” The WMO predicts warmer weather around the world, accompanied by pockets of both drier and wetter conditions, depending on the region.

In an area where CO₂ concentrations do not fluctuate, levels are nearing 400 parts per million (ppm), it was reported in early May 2016. The atmospheric measuring station at Cape Grim, Australia, is on the verge of showing 400ppm, and once that level is reached, it won’t come down for a long, long time. The first 400ppm milestone was reached in 2013 when a station on the Hawaiian volcano of Mauna Loa registered a monthly average of 400ppm. But since the northern hemisphere has a seasonal cycle, increasing in summer but decreasing in winter, each year since then it has dipped back below 400ppm. David Etheridge, an atmospheric scientist from the Commonwealth Scientific and Industrial Research Organisation (CSIRO), which runs the Cape Grim station commented, “No matter what the world’s emissions are now, we can decrease growth but we can’t decrease the concentration.” The Guardian report called the reading a “grave marker.” (CO₂ concentrations will stay high, because carbon emissions remain in the atmosphere long after they are released. For a readable scientific paper analyzing this phenomenon, see “Fate of fossil fuel CO₂ in geologic time”
Once the sea rises due to the warming, that, too, will be a long-term situation. “Once the ocean warms up, the ice will not be able to recover until the oceans cool back down,” said the co-author of a sea level rise study published in the scientific journal Nature on March 31, 2016. Rob DeConto, a geoscientist at the University of Massachusetts Amherst, with David Pollard, a paleoclimatologist at Pennsylvania State University in University Park, developed a program that for the first time accurately models past sea levels. The ability to reproduce past events is considered a stringent test of the merits of any geological model. DeConto and Pollard wanted to account for the high sea levels before the last ice age—twenty feet higher than they are now—when temperatures were not much higher than at present. When they factored in erosion on the underside of the Antarctic ice sheet, caused by warming ocean currents, in addition to rising atmospheric temperatures that melt it from above, the model duplicated that history. Such melting would leave towering cliffs of ice exposed to the sea, which could make Antarctica’s ice vulnerable to rapid collapse. Active physical processes are well-known ways of breaking up ice sheets but had not before been included in complex 3D models of the Antarctic ice sheet. The model predicts more than a meter rise by 2100 and more than 15 meters by 2500. DeConto’s statement to one reporter included this dubious assurance of hope: “If emissions were quickly slashed to zero, however, the rise in sea level from Antarctic ice could be reduced to almost nothing.” nature.com, climatecentral.org, and theguardian.com

The paper has received respectful comment by a number of other sea level rise researchers who work with climate models. NASA scientist Eric Rignot said the study was “absolutely realistic.” Rignot, James Hansen, and others authored a paper published March 22, 2016, in the European science journal Atmospheric Chemistry and Physics which did not receive as much support. The paper entitled “Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observations that 2°C global warming could be dangerous” presents what Rignot called “a worse-case scenario.” As with the DeConto-Pollard project, this research is influenced by the assumption that 120,000 years ago, when the temperature reached a level estimated to have been only slightly higher than today, large chunks of the polar ice disintegrated, with the result that sea level rose 20 to 30 feet. The Rignot-Hansen group concludes that even if warming is limited to 2°C, parts of the great ice sheets in Greenland and Antarctica could disintegrate rapidly due to fresh water pouring into the oceans from melting land ice. The melting could cause a feedback loop making possible a worst-case sea level rise of several feet over the next 50 years. While those claims may help explain puzzling episodes in Earth’s past when geological evidence suggests the climate underwent drastic shifts, Michael E. Mann, a climate scientist at Pennsylvania State University commented, “They conflict with the mainstream understanding of climate change to the point where the standard of proof is quite high.” Some of the discomfiture about the new paper may be due to Dr. Hansen’s dual roles as a publishing climate scientist and a political activist. Hansen argues that society is in such grave peril that he feels morally compelled to go beyond the normal role played by a scientist. The New York Times report on the paper’s publication says,
“Despite any reservations they might have about the new paper, virtually all climate scientists agree with Dr. Hansen’s group that society is not moving fast enough to reduce emissions of greenhouse gases.” nytimes.com

Another new study considers that prevailing computer models may be overestimating the cooling power of clouds. Published in the journal Science on April 8, 2016, this paper focuses on what are known as mixed-phase clouds—found everywhere and containing both cooled water and ice crystals. The balance of water and ice in clouds would affect the impact that carbon dioxide levels have on atmospheric temperatures. Using data from instruments aboard the Calipso satellite, the researchers determined that mixed-phase clouds contain more water and less ice than hitherto assumed. Ivy Tan, an author and a graduate student at the department of geology and geophysics at Yale University, commented, “With less ice in the mix to start, there is less capacity for water to replace ice.” The result would be more warming. The research concerns the factor known as equilibrium climate sensitivity. A higher sensitivity would mean that carbon dioxide levels would cause more warming than previously thought. Another author, Trude Storelvmo, associate professor in the Yale department of geology and geophysics, said, “Unfortunately, it means staying below 2 degrees is going to be even harder.” Gavin A. Schmidt, the director of NASA’s Goddard Institute for Space Studies, said that the study was in line with other recent papers that find potential issues with models. “Generally speaking, these (concerns) lead to numbers that are on the higher end,” he said. esciencenews.com

From many directions forewarnings are being issued regarding the perils of the warming that is underway.

- Forest fires will become more prevalent and more intense with climate change. The wildfire endangering Fort McMurray as well as the boreal forests of Alberta, Canada, is not a sudden flare-up, and will become more common with climate change. Researchers at the University of Montana, whose paper has been accepted for publication in the journal Ecography: Pattern And Diversity in Ecology, have concluded that northern regions could
experience four times the number of fires typical in recent decades. newseveryday.com

One of the explanations for the increase in fires seems to be an earlier melting of the spring snowpack across the Northern Hemisphere. When the melt leads to a drying of the landscape early in the fire season, the resinous trees of the boreal zone become more susceptible to fire, and lightning sets off intense fires that are nearly impossible to control. nytimes.com

- **A reduction in the amount of oxygen dissolved in the oceans due to climate change will leave marine life like fish, crabs, squid, and sea stars struggling to breathe.** The process is already discernible in some parts of the world and will become evident across large regions of Earth’s oceans between 2030 and 2040. This prediction comes from scientists at the National Center for Atmospheric Research (NCAR) and was published February 29, 2016, in the journal *Global Biogeochemical Cycles*. The entire ocean, from the depths to the shallows, gets its oxygen supply from the surface, either directly from the atmosphere or from phytoplankton, which release oxygen into the water through photosynthesis. Warming surface waters absorb less oxygen, and the oxygen that is absorbed has a more difficult time traveling deeper into the ocean because water expands as it heats up, and is less likely to sink. earthsky.org

- **Climate change could kill more than 500,000 adults in 2050 worldwide due to changes in diets and bodyweight from reduced crop productivity.** This warning comes from a modeling study led by Dr. Marco Springmann from the Oxford Martin Programme on the Future of Food at the University of Oxford, UK, and published in *The Lancet*. The research is the first of its kind to assess the impact of climate change on diet composition and bodyweight, and to estimate the number of deaths the deprivations will cause in 155 countries in 2050. reuters.com

- **Future ozone-related human health impacts attributable to climate change are projected to lead to hundreds of thousands of premature deaths in the United States by 2030.** On April 4, 2016, the Obama Administration issued a scientific assessment of “What Climate Change Means for Your Health and Family.” Among the hazards posed by a warmer climate: air pollution, extreme heat that makes outdoor work dangerous, increased risk of water-related diseases, exposure of food to certain pathogens and toxins, and greater risk of Lyme disease. whitehouse.gov

- **If we stay on the current emissions path, losses to global portfolios could range from about $2 trillion to $25 trillion.** Simon Dietz of the London School of Economics, lead author of the report published in *Nature Climate Change*, says climate change is a threat to all assets, not just those invested in fossil fuels. hbr.org

Is there some good news about climate? Yes, the surge in renewable energy and reduction in coal use has stalled world greenhouse gas emissions for the past two years. Falling coal use in China and the United States and a shift towards renewable energy globally have helped carbon dioxide emissions from the energy sector level off at 32.1bn metric tonnes even as the global
Economy grew over 3%. These figures come from the International Energy Association (IEA) report of March 16, 2016. Electricity generated by renewable sources accounted for around 90% of new electricity generation in 2015, and wind power produced more than half of all new electricity generation. [theguardian.com](http://theguardian.com) and [iea.org](http://iea.org)

In the “good news if” category: On Earth Day 2016, 175 nations signed the historic Paris climate agreement. The non-binding treaty, approved in December 2015 after years of United Nations climate negotiations, aims to slow the rise of greenhouse gases such as carbon dioxide. The agreement sets a target of limiting global warming by 2100 to “well below” 2 degrees Celsius (3.6 degrees F), as compared to pre-industrial levels. To accomplish that goal, each nation sets its own target for reducing emissions, and updates that mark as needed each year. [usatoday.com](http://usatoday.com) This is good news if “well below” 2 degrees C is a safe target, if countries live up to their pledges, and if they do so with all possible speed. As United Nations Secretary-General Ban Ki-moon told the gathering at UN headquarters in New York on Earth Day, "We are in a race against time."

INEQUALITY—In the Voting Booth

The United States ranks high in inequality when measured against other developed countries. This judgment comes from The Poverty and Inequality Report 2016 released by the Stanford Center on Poverty and Inequality on February 1, 2016. The report looks at 21 nations in North America, Continental Europe and Australia—ten well-off and 11 less so. The United States is 10th among the ten well-off countries, and 18th among the twenty-one in three key categories: income inequality, wealth inequality, and safety net. Only Spain, Estonia, and Greece scored worse in these three respects. The report states: “It is noteworthy that the US performs poorly in domains that have historically been regarded as its strengths. . . . [T]he distinctive benefit of its flexible and unregulated labor market was supposed to be the jobs that such deregulation delivered.” Yet only Italy and Spain fare worse than the US in prime-age employment among women, and only Spain fares worse in prime-age employment among men. [stanford.edu](http://stanford.edu)

Seventeen states have implemented new voting restrictions since the Supreme Court’s Shelby County v. Holder decision in 2013, and categories of people who typically have less income will be most affected by the changes. (The 2013 decision eliminated the need for fifteen states with histories of discrimination in voting to obtain federal preclearance before implementing any changes to their voting laws or practices. [wikipedia.org](http://wikipedia.org)) More stringent voter ID requirements are the most common of these measures, and a new study shows "substantial drops in turnout for minorities under strict voter ID laws." Political scientists at University of California, San Diego analyzed turnout in elections between 2008 and 2012 in states that did and did not implement the strictest form of voter ID laws. They found that these laws consistently and significantly decreased turnout—suppressed it by 10.8 points for Latino voters and 12.8 votes for multiracial Americans. For black voters in the primaries, the strict photo ID laws caused the gap with white voters to almost double to 8.5 points. Young people and the elderly are also more likely not to hold the officially endorsed identification cards. Voter fraud is the ostensible justification for tighter ID requirements, but “voter fraud is, for all intents and
purposes, practically nonexistent. The best available research on the topic, by Loyola Law School professor Justin Levitt, found only 31 credible incidents of voter impersonation in an investigation of over 1 billion votes cast.” washingtonpost.com

Kansas has enacted the strictest voter regulations in the country, led by Secretary of State Kris Kobach who put 37,000 voters in a "suspended registration status" in the 2014 elections. Along with Georgia, Alabama and Arizona, Kansas now requires documentary proof of citizenship—such as birth certificate, passport or naturalization papers. Of the more than 22,000 submitted voter registration applications received between February 1 and February 21, 2016, only 7,444 included proof of citizenship, State Elections Director Bryan Caskey said. That meant the majority of those registrants were put on the suspense list, and their voting registrations will be purged after 90 days unless proper documents are submitted. Younger citizens were affected the most. Although those between the ages of 18 and 29 comprise only 14.9 percent of registered Kansas voters, that age group makes up more than 58 percent of applicants who registered at motor vehicle offices and are on the suspense list. dailykos.com

Texas has the most stringent voter-identification law, one that could cut into the turnout of minority voters and young people, according to several election experts. A federal court in Texas found that 608,470 registered voters don’t have the voter IDs that the state now requires for voting. Residents can vote with their concealed-carry handgun licenses but not their state-issued student university IDs. In North Carolina the new law goes further than requiring a photo ID to vote. It also reduces the number of days of early voting, prohibits people from registering and voting on the same day, stops ballots cast in the wrong precinct from being counted, and ends the practice of preregistering teenagers before they turn 18. washingtonpost.com Limiting when and where voting takes place severely impacts people in low-end jobs with inflexible work hours, those with limited means of transportation, and people with disabilities as well as others who can’t stand in long lines awaiting their turn at the ballot box.

The 20 percent of wealthier Americans represent about 30 percent of the electorate already, partly because of higher turnout levels. An opinion editorial in The New York Times on April 27, 2016, by Thomas B. Edsall puts this finding in perspective. Quoting from “The Continuing Increase in Income Segregation,” a March 2016 paper by Sean F. Reardon, a professor of education at Stanford, and Kendra Bischoff, a professor of sociology at Cornell, Edsall writes that “self-segregation of a privileged fifth of the population is changing the American social order and the American political system, creating a self-perpetuating class at the top, which is ever more difficult to break into.” The research by Reardon and Bischoff shows the percentage of families with children living in very affluent neighborhoods more than doubled between 1970 and 2012, from 6.6 percent to 15.7 percent. The percentage of families with children living in traditional middle class neighborhoods with median incomes between 80 and 125 percent of the surrounding metropolitan area fell from 64.7 percent in 1970 to 40.5 percent. The geographic split leads to greater imbalance in political influence and narrowing of social sympathy. The less contact the wealthier folks have with other income groups, the less they understand or care about what happens to them. When they exercise their already greater
voting strength, they tend to reinforce their already greater economic and political power.

In January 2016 Oregon became the first state to automatically register eligible citizens who request or renew a driver’s license. They are sent a card informing them of their registration status and have 21 days to opt out from the voting rolls. Only 6 percent of registrants have chosen to opt out. When universal suffrage is the objective, however, departments of motor vehicles may be less and less the right entry point for voter registration. The percentage of people ages 16 to 44 in the United States with a driver's license has fallen steadily for three decades, according to a study by the Transportation Research Institute at the University of Michigan. In 1983, 91.8 percent of those age 20 to 24 had driver's licenses, but by 2014 that number had fallen to 76.7 percent.