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Front: ©Ron Thomas/Spring desert wildflowers in Anza Borrego Desert State Park, CA/Getty Images.

Back: Smoke and Fire in Southern California: Thick smoke was streaming from several fires in Southern California when the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA’s Terra satellite acquired a natural-color image in the afternoon on December 5, 2017. On the same day, the Multi Spectral Imager (MSI) on the European Space Agency’s Sentinel-2 satellite captured the data for a false-color image of the burn scar. Active fires appear orange; the burn scar is brown. Unburned vegetation is green; developed areas are gray. The Sentinel-2 image is based on observations of visible, shortwave infrared, and near infrared light.


Instrument(s):
Terra - MODIS
Sentinel-2

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EDITOR AND AUTHOR AFFILIATIONS (ALPHABETICAL BY NAME)

Abernethy, R., Met Office Hadley Centre, Exeter, United Kingdom
Ackerman, Steven A., Cooperative Institute for Meteorological Satellite Studies, University of Wisconsin–Madison, Madison, Wisconsin
Adler, R., University of Maryland, College Park, Maryland
Albaní Encarnación, Adelina, National Meteorological Service of Mexico, Mexico
Aldeco, Laura S., Servicio Meteorológico Nacional, Buenos Aires, Argentina
Alfaro, Eric J., Center for Geophysical Research and School of Physics, University of Costa Rica, San José, Costa Rica
Aliaga-Nestares, Vannia, Servicio Nacional de Meteorología e Hidrología del Perú, Lima, Perú
Allan, Richard P., University of Reading, Reading, United Kingdom
Allan, Rob, Met Office Hadley Centre, Exeter, United Kingdom
Alves, Lincoln M., Centro de Ciencias del Sistema Terrestre, Instituto Nacional de Pesquisas Espaciais, Cachoeira Paulista, Sao Paulo, Brazil
Amador, Jorge A., Center for Geophysical Research and School of Physics, University of Costa Rica, San José, Costa Rica
Anderson, John, Department of Atmospheric and Planetary Science, Hampton University, Hampton, Virginia
Andreassen, L. M., Section for Glaciers, Ice and Snow, Norwegian Water Resources and Energy Directorate, Oslo, Norway
Argüez, Anthony, NOAA/NESDIS National Centers for Environmental Information, Asheville, North Carolina
Armitage, C., Woodland Trust, Grantham, United Kingdom
Arndt, Derek S., NOAA/NESDIS National Centers for Environmental Information, Asheville, North Carolina
Avalos, Grinia, Servicio Nacional de Meteorología e Hidrología del Perú, Lima, Perú
Azorín-Molina, César, Regional Climate Group, Department of Earth Sciences, University of Gothenburg, Gothenburg, Sweden
Báez, Julián, Dirección de Meteorología e Hidrología de la DINAC and Universidad Católica Ntra. Sra. de la Asunción, Asunción, Paraguay
Bardin, M. Yu., Institute of Global Climate and Ecology of Roshydromet and Russian Academy of Sciences, and Institute of Geography of Russian Academy of Sciences, Russia
Barichivich, Jonathan, Universidad Austral de Chile, Valdivia, Chile; Center for Climate and Resilience Research (CR2), Chile
Baringer, Molly O., NOAA/OAR Atlantic Oceanographic and Meteorological Laboratory, Miami, Florida
Barreiru, Sandra, Argentine Naval Hydrographic Service, Buenos Aires, Argentina
Baxter, Stephen, NOAA/NWS Climate Prediction Center, College Park, Maryland
Beck, H. E., Department of Civil and Environmental Engineering, Princeton University, Princeton, New Jersey
Becker, Andreas, Global Precipitation Climatology Centre, Deutscher Wetterdienst, Offenbach, Germany
Bedka, Kristopher M., NASA Langley Research Center, Hampton, Virginia
Behe, Carolina, Inuit Circumpolar Council Alaska, Anchorage, Alaska
Bell, Gerald D., NOAA/NWS Climate Prediction Center, College Park, Maryland
Bellouin, Nicolas, University of Reading, Reading, United Kingdom
Belmont, M., Seychelles National Meteorological Services, Pointe Larue, Mahé, Seychelles
Benedetti, Angela, European Centre for Medium-Range Weather Forecasts, Reading, United Kingdom
Bernhard, G. H., Biospherical Instruments, San Diego, California
Berrisford, Paul, European Centre for Medium-Range Weather Forecasts, Reading, United Kingdom
Berry, David I., National Oceanography Centre, Southampton, United Kingdom
Bhatt, U. S., Geophysical Institute, University of Alaska Fairbanks, Fairbanks, Alaska
Bissolli, Peter, Deutscher Wetterdienst, WMO RA VI Regional Climate Centre Network, Offenbach, Germany
Bjerke, J., Norwegian Institute for Nature Research, Tromsø, Norway
Blake, Eric S., NOAA/NWS National Hurricane Center, Miami, Florida
Blenkinsop, Stephen, School of Engineering, Newcastle University, Newcastle-upon-Tyne, United Kingdom
Blunden, Jessica, NOAA/NESDIS National Centers for Environmental Information, Asheville, North Carolina
Bolmgren, K., Swedish University of Agricultural Sciences, Uppsala, Sweden
Bosilovich, Michael G., Global Modelling and Assimilation Office, NASA Goddard Space Flight Center, Greenbelt, Maryland
Boucher, Olivier, Institut Pierre-Simon Laplace, CNRS/UPMC, Paris, France
Bouchon, Marilú, Instituto del Mar del Perú, Callao, Perú
Box, J. E., Geological Survey of Denmark and Greenland, Copenhagen, Denmark
Boyer, Tim, NOAA/NESDIS National Centers for Environmental Information, Silver Spring, Maryland
Braathen, Geir O., WMO Atmospheric Environment Research Division, Geneva, Switzerland
Bromwich, David H., Byrd Polar and Climate Research Center, The Ohio State University, Columbus, Ohio
Brown, R., Climate Research Division, Environment and Climate Change Canada, Downsview, Ontario, Canada
Buehler, S., Universitaet Hamburg, Hamburg, Germany
Bulygina, Olga N., Russian Institute for Hydrometeorological Information, Obninsk, Russia
Burgess, D., Geological Survey of Canada, Ottawa, Ontario, Canada
Hall, Brad D., NOAA/OAR Earth System Research Laboratory, Boulder, Colorado
Halpert, Michael S., NOAA/NWS Climate Prediction Center, College Park, Maryland
Hamlington, Benjamin D., Center for Coastal Physical Oceanography, Old Dominion University, Norfolk, Virginia
Hanna, E., Department of Geography, University of Lincoln, Lincoln, United Kingdom
Hansen, K., Geological Survey of Denmark and Greenland, Copenhagen, Denmark
Hanssen-Bauer, I., Norwegian Meteorological Institute, Blindern 0313, Oslo, Norway
Harris, Ian, National Centre for Atmospheric Science, University of East Anglia, Norwich, and Climatic Research Unit, School of Environmental Sciences, University of East Anglia, Norwich, United Kingdom
Hartfield, Gail, NOAA/NWS Weather Forecast Office, Raleigh, North Carolina
Heidinger, Andrew K., NOAA/NESDIS/STAR University of Wisconsin–Madison, Madison, Wisconsin
Heim, Jr., Richard R., NOAA/NESDIS National Centers for Environmental Information, Asheville, North Carolina
Helfrich, S., NOAA/NESDIS Center for Satellite Applications and Research, College Park, Maryland
Hemming, D. L., Met Office Hadley Centre, Exeter, United Kingdom; Birmingham Institute of Forest Research, Birmingham University, Birmingham, United Kingdom
Hendricks, S., Alfred Wegener Institute, Helmholtz Centre for Polar and Maritime Research, Bremerhaven, Germany
Hernández, Rafael, Instituto Nacional de Meteorología e Hidrología de Venezuela (INAMEH), Caracas, Venezuela
Hernández, Sosa Marieta, Climate Center, Institute of Meteorology of Cuba, Havana, Cuba
Heron, Scott F., NOAA/NESDIS Coral Reef Watch, College Park, Maryland, and ReefSense Pty Ltd, Townsville, Queensland, Australia
Heuzé, C., Department of Marine Sciences, University of Gothenburg, Sweden
Hidalgo, Hugo G., Center for Geophysical Research and School of Physics, University of Costa Rica, San José, Costa Rica
Ho, Shu-peng (Ben), COSMIC, UCAR, Boulder, Colorado
Hobbs, William R., Antarctic Climate and Ecosystems Cooperative Research Centre, University of Tasmania, Tasmania, Australia
Horstkotte, T., Department of Ecology and Environmental Sciences, Umeå University, Umeå, Sweden
Huang, Boyin, NOAA/NESDIS National Centers for Environmental Information, Asheville, North Carolina
Hubert, Daan, Royal Belgian Institute for Space Aeronomy (BIRA), Brussels, Belgium
Hueuzé, Céline, Department of Marine Sciences, University of Gothenburg, Gothenburg, Gothenburg, Sweden
Hurst, Dale F., Cooperative Institute for Research in Environmental Sciences, University of Colorado Boulder, and NOAA/OAR Earth System Research Laboratory, Boulder, Colorado
Ialongo, Iolanda, Finnish Meteorological Institute, Helsinki, Finland
Ibrahim, M. M., Department of Meteorology, Al-Azhar University, Egypt
Inness, Antje, European Centre for Medium-Range Weather Forecasts, Reading, United Kingdom
Isaac, Victor, Environment and Climate Change Canada, Toronto, Ontario, Canada
Isaksen, K., Norwegian Meteorological Institute, Blindern, Oslo, Norway
Ishii, Masayoshi, Climate Research Department, Meteorological Research Institute, Japan Meteorological Agency, Tsukuba, Japan
Jacobs, Stephanie J., Bureau of Meteorology, Melbourne, Victoria, Australia
Jeffries, Martin O., Office of Naval Research, Arlington, Virginia
Jevrejeva, Svetlana, National Oceanography Centre, Liverpool, United Kingdom
Jiménez, C., Estellas, Paris, France
Jin, Xiangze, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts
John, Viju, EUMETSAT, Darmstadt, Germany, and Met Office Hadley Centre, Exeter, United Kingdom
Johns, William E., Rosenstiel School of Marine and Atmospheric Science, Miami, Florida
Johnsen, Bjørn, Norwegian Radiation Protection Authority, Østerås, Norway
Johnson, Bryan, NOAA/OAR Earth System Research Laboratory, Global Monitoring Division, and University of Colorado Boulder, Boulder, Colorado
Johnson, Gregory C., NOAA/OAR Pacific Marine Environmental Laboratory, Seattle, Washington
Johnson, Kenneth S., Monterey Bay Aquarium Research Institute, Moss Landing, California
Jones, Philip D., Climatic Research Unit, School of Environmental Sciences, University of East Anglia, Norwich, United Kingdom
Jumaux, Guillaume, Météo France, Direction Interrégionale pour l’Océan Indien, Réunion
Kabidi, Khadija, Direction de la Méteorologie Nationale Maroc, Rabat, Morocco
Kaiser, J. W., Max Planck Institute for Chemistry, Mainz, Germany
Karakaöyli, Erdem M., NASA Goddard Space Flight Center, Greenbelt, Maryland, and Science Application International Corporation, Beltsville, Maryland
Kato, Seiji, NASA Langley Research Center, Hampton, Virginia
Kazemi, A., Islamic Republic of Iranian Meteorological Organization, Iran
Keller, Linda M., Department of Atmospheric and Oceanic Sciences, University of Wisconsin–Madison, Madison, Wisconsin
Kennedy, John, Met Office Hadley Centre, Exeter, United Kingdom
Kerr, Kenneth, Trinidad and Tobago Meteorological Service, Piarco, Trinidad
Khan, M. S., Geological Survey of Denmark and Greenland, Copenhagen, Denmark
Kholodov, A. L., Geophysical Institute, University of Alaska Fairbanks, Fairbanks, Alaska
Khoshkam, Mahbobeh, Islamic Republic of Iranian Meteorological Organization, Iran
Killick, Rachel, Met Office Hadley Centre, Exeter, United Kingdom
Kim, Hyungjun, Institute of Industrial Science, University of Tokyo, Japan
Kim, S.-J., Korea Polar Research Institute, Incheon, Republic of Korea
Klotzbach, Philip J., Department of Atmospheric Science, Colorado State University, Fort Collins, Colorado
Knaff, John A., NOAA/NESDIS Center for Satellite Applications and Research, Fort Collins, Colorado
Kohler, Michael A., NOAA/OAR Pacific Marine Environmental Laboratory, Seattle, Washington
Kramarova, Natalya, NASA Goddard Space Flight Center, Greenbelt, Maryland
Kratz, D. P., NASA Langley Research Center, Hampton, Virginia
Kruger, Andries, South African Weather Service, Pretoria, South Africa
Kruk, Michael C., ERT, Inc., NOAA/NESDIS National Centers for Environmental Information, Asheville, North Carolina
Krumpen, T., Alfred Wegener Institute, Helmholtz Centre for Polar and Maritime Research, Bremerhaven, Germany
Ladd, C., NOAA/OAR Pacific Marine Environmental Laboratory, Seattle, Washington
Lakatos, Mónika, Climatology Division, Hungarian Meteorological Service, Budapest, Hungary
Lakkala, Kaisa, Finnish Meteorological Institute, Arctic Research Centre, Sodankylä, Finland
Lander, Mark A., University of Guam, Mangilao, Guam
Landschützer, Peter, Max Planck Institute for Meteorology, Hamburg, Germany
Landsea, Chris W., NOAA/NWS National Hurricane Center, Miami, Florida
Lankhorst, Matthias, Scripps Institution of Oceanography, University of California, San Diego, La Jolla, California
Lavado-Casimiro, Waldo, Servicio Nacional de Meteorología e Hidrología del Perú, Lima, Perú
Lazzara, Matthew A., Department of Physical Sciences, School of Arts and Sciences, Madison Area Technical College, and Space Science and Engineering Center, University of Wisconsin–Madison, Madison, Wisconsin
Lee, S.-E., Korea Meteorological Administration, South Korea
Lee, T. C., Hong Kong Observatory, Hong Kong, China
Leuliette, Eric, NOAA/NWS NCWCP Laboratory for Satellite Altimetry, College Park, Maryland
L’Heureux, Michelle, NOAA/NESDIS Climate Prediction Center, College Park, Maryland
Li, Bailing, Hydrological Sciences Laboratory, NASA Goddard Space Flight Center, Greenbelt, Maryland; Earth System Science Interdisciplinary Center, University of Maryland, College Park, Maryland
Li, Tim, Department of Atmospheric Sciences, Univeristy of Hawaii, Honolulu, Hawaii
Liefer, Jan L., Antarctic Climate and Ecosystems Cooperative Research Centre and Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, Tasmania, Australia
Lin, I.-I., National Taiwan University, Taipei, Taiwan
Liu, Gang, NOAA/NESDIS Coral Reef Watch, College Park, Maryland, and Global Science and Technology, Inc., Greenbelt, Maryland
Liu, Hongxing, Department of Geography, University of Cincinnati, Cincinnati, Ohio
Locarnini, Ricardo, NOAA/NESDIS National Centers for Environmental Information, Silver Spring, Maryland
Loeb, Norman G., NASA Langley Research Center, Hampton, Virginia
Long, Craig S., NOAA/NWS National Centers for Environmental Prediction, College Park, Maryland
López, Luis A., Instituto de Hidrología, Meteorología y Estudios Ambientales de Colombia, Bogotá, Colombia
Lorrey, Andrew M., National Institute of Water and Atmospheric Research, Ltd., Auckland, New Zealand
Loyola, Diego, German Aerospace Center (DLR) Oberpfaffenhofen, Wessling, Germany
Lumpkin, Rick, NOAA/OAR Atlantic Oceanographic and Meteorological Laboratory, Miami, Florida
Luo, Jing-Jia, Australian Bureau of Meteorology, Melbourne, Victoria, Australia
Luoijas, K., Finnish Meteorological Institute, Helsinki, Finland
Luthcke, S., NASA Goddard Space Flight Center, Greenbelt, Maryland
Lyman, John M., NOAA/OAR Pacific Marine Environmental Laboratory, Seattle, Washington, and Joint Institute for Marine and Atmospheric Research, University of Hawaii, Honolulu, Hawaii
Macias-Fauria, M., School of Geography and the Environment, University of Oxford, Oxford, United Kingdom
Malkova, G. V., Earth Cryosphere Institute, Tyumen Science Center, Tyumen, Russia
Manney, Gloria L., NorthWest Research Associates, and New Mexico Institute of Mining and Technology, Socorro, New Mexico
Marcellin, Vernie, Dominica Meteorological Service, Dominica
Marchenko, S. S., Geophysical Institute, University of Alaska Fairbanks, Fairbanks, Alaska
Marengo, José A., Centro Nacional de Monitoramento e Alertas aos Desastres Naturais, Cachoeira Paulista, Sao Paulo, Brazil
Sutton, Adrienne J., NOAA/OAR Pacific Marine Environmental Laboratory, Seattle, Washington
Swart, Sebastiaan, Department of Marine Sciences, University of Gothenburg, Gothenburg, Sweden, and Department of Oceanography, University of Cape Town, Rondebosch, South Africa
Sweet, William, NOAA/NOS Center for Operational Oceanographic Products and Services, Silver Spring, Maryland
Takahashi, Kenneth S., Servicio Nacional de Meteorología e Hidrología del Perú, Lima, Perú
Tamar, Gerard, Grenada Airports Authority, St. George’s, Grenada
Taylor, Michael A., Department of Physics, The University of the West Indies, Jamaica
Tedesco, M., Lamont–Doherty Earth Observatory, Columbia University, Palisades, New York, and NASA Goddard Institute of Space Studies, New York, New York
Thackeray, S. J., Centre for Ecology and Hydrology, Lancaster, United Kingdom
Thoman, R. L., NOAA/National Weather Service, Alaska Region, Fairbanks, Alaska
Thompson, Philip, Joint Institute for Marine and Atmospheric Research, University of Hawaii, Honolulu, Hawaii
Thomson, L., Department of Earth Sciences, Simon Fraser University, Burnaby, British Columbia, Canada
Thorsteinssson, T., Icelandic Meteorological Office, Reykjavik, Iceland
Timbal, Bertrand, Singapore Meteorological Service, Singapore
Timmermans, M.-L., Yale University, New Haven, Connecticut
Tilmofeyev, Maxim A., Institute of Biology, Irkutsk State University, Russia
Tirak, Kyle V., NOAA/NESDIS Coral Reef Watch, College Park, Maryland, and Global Science and Technology, Inc., Greenbelt, Maryland
Tobin, Skie, Bureau of Meteorology, Melbourne, Victoria, Australia
Togawa, H., Tokyo Climate Center, Japan Meteorological Agency, Japan
Tommervik, H., Norwegian Institute for Nature Research, Tromsø, Norway
Tourpali, Kleareti, Aristotle University, Thessaloniki, Greece
Trachte, Katja, Laboratory for Climatology and Remote Sensing, Faculty of Geography, University of Marburg, Marburg, Germany
Trewin, Blair C., Australian Bureau of Meteorology, Melbourne, Victoria, Australia
Triñanes, Joaquin A., Laboratory of Systems, Technological Research Institute, Universidad de Santiago de Compostela, Santiago de Compostela, Spain, and NOAA Atlantic Oceanographic and Meteorological Laboratory, and Cooperative Institute for Marine and Atmospheric Studies, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Florida
Trotman, Adrian R., Caribbean Institute for Meteorology and Hydrology, Bridgetown, Barbados
Tschudi, M., Aerospace Engineering Sciences, University of Colorado, Boulder, Colorado
Tucker, C. J., NASA Goddard Space Flight Center, Greenbelt, Maryland
Tye, Mari R., Capacity Center for Climate and Weather Extremes (C3WE), National Center for Atmospheric Research, Boulder, Colorado
van As, D., Geological Survey of Denmark and Greenland, Copenhagen, Denmark
van de Wal, R. S. W., Institute for Marine and Atmospheric Research Utrecht, Utrecht University, Utrecht, Netherlands
van der A, Ronald J., Royal Netherlands Meteorological Institute (KNMI), De Bilt, Netherlands
van der Schalie, Robin, VanderSat B.V., Haarlem, Netherlands
van der Schrier, Gerard, Royal Netherlands Meteorological Institute (KNMI), De Bilt, Netherlands
van der Werf, Guido R., Faculty of Earth and Life Sciences, VU University Amsterdam, Netherlands
Van Meerbeeck, Cedric J., Caribbean Institute for Meteorology and Hydrology, Bridgetown, Barbados
Velden, Christopher S., Cooperative Institute for Meteorological Satellite Studies, University of Wisconsin–Madison, Madison, Wisconsin
Velicogna, I., University of California, Irvine, California
Verburg, Piet, National Institute of Water and Atmospheric Research, Hamilton, New Zealand
Vickers, H., Norut Northern Research Institute, Tromsø, Norway
Vincent, Lucie A., Environment and Climate Change Canada, Toronto, Ontario, Canada
Vömel, Holger, Earth Observing Laboratory, National Center for Atmospheric Research, Boulder, Colorado
Vose, Russell S., NOAA/NESDIS National Centers for Environmental Information, Asheville, North Carolina
Wagner, Wolfgang, Department of Geodesy and Geoinformation, Vienna University of Technology, Vienna, Austria
Walker, D. A., Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, Alaska
Walsh, J., International Arctic Research Center, University of Alaska Fairbanks, Fairbanks, Alaska
Wang, Bin, Department of Atmospheric Science and IPRC, University of Hawaii, Honolulu, Hawaii
Wang, Junhong, State University of New York, Albany, New York
Wang, Lei, Department of Geography and Anthropology, Louisiana State University, Baton Rouge, Louisiana
Wang, M., Joint Institute for the Study of the Atmosphere and Ocean, University of Washington, Seattle, Washington
Wang, Ray, Georgia Institute of Technology, Atlanta, Georgia
Wang, Sheng-Hung, Byrd Polar and Climate Research Center, The Ohio State University, Columbus, Ohio
Wanninkhof, Rik, NOAA/OAR Atlantic Oceanographic and Meteorological Laboratory, Miami, Florida
Watanabe, Shohei, Tahoe Environmental Research Center, University of California at Davis, Davis, California
Weber, Mark, University of Bremen, Bremen, Germany
Webster, M., NASA Goddard Space Flight Center, Greenbelt, Maryland
Weller, Robert A., Woods Hole Oceanographic Institution, Woods Hole, Massachusetts
Westberry, Toby K., Department of Botany and Plant Pathology, Oregon State University, Corvallis, Oregon
Weyhenmeyer, Gesa A., Department of Ecology and Genetics/Limnology, Uppsala University, Uppsala, Sweden
Whitewood, Robert, Environment and Climate Change Canada, Toronto, Ontario, Canada
Widiansky, Matthew J., Joint Institute for Marine and Atmospheric Research, University of Hawaii, Honolulu, Hawaii
Wiese, David N., Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California
Wijffels, Susan E., Woods Hole Oceanographic Institution, Woods Hole, Massachusetts
Wilber, Anne C., Science Systems and Applications, Inc., Hampton, Virginia
Wild, Jeanette D., INNOVIM, NOAA Climate Prediction Center, College Park, Maryland
Willett, Kate M., Met Office Hadley Centre, Exeter, United Kingdom
Willis, Josh K., Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California
Wolken,考试，Alaska Division of Geological and Geophysical Surveys, and International Arctic Research Center, University of Alaska Fairbanks, Fairbanks, Alaska
Wong, Takmeng, NASA Langley Research Center, Hampton, Virginia
Wood, E. F., Department of Civil and Environmental Engineering, Princeton University, Princeton, New Jersey
Wood, K., Joint Institute for the Study of the Atmosphere and Ocean, University of Washington, Seattle, Washington
Woolway, R. Iestyn, Department of Meteorology, University of Reading, Reading, United Kingdom
Wouters, B., Institute for Marine and Atmospheric Research, Utrecht University, Utrecht, Netherlands
Xue, Yan, NOAA/NWS National Centers for Environmental Prediction, Climate Prediction Center, College Park, Maryland
Yin, Xungang, ERT Inc., NOAA/NESDIS National Centers for Environmental Information, Asheville, North Carolina
Yoon, Huang, Department of Oceanography, University of Hawaii, Honolulu, Hawaii
York, A., Alaska Fire Science Consortium, International Arctic Research Center, University of Alaska Fairbanks, Fairbanks, Alaska
Yu, Lisan, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts
Zambrano, Eduardo, Centro Internacional para la Investigación del Fenómeno El Niño, Guayaquil, Ecuador
Zhang, Huai-Min, NOAA/NESDIS National Centers for Environmental Information, Asheville, North Carolina
Zhang, Peiqun, Beijing Climate Center, Beijing, China
Zhao, Guanguo, University of Illinois at Urbana–Champaign, Urbana, Illinois
Zhao, Lin, Cold and Arid Regions Environmental and Engineering Research Institute, Lanzhou, China
Zhu, Zhiwei, Nanjing University of Information Science and Technology, China
Ziel, R., Alaska Fire Science Consortium, International Arctic Research Center, University of Alaska Fairbanks, Fairbanks, Alaska
Ziemke, Jerry R., Goddard Earth Sciences Technology and Research, Morgan State University, Baltimore, Maryland, and NASA Goddard Space Flight Center, Greenbelt, Maryland
Ziese, Markus G., Global Precipitation Climatology Center, Deutscher Wetterdienst, Offenbach am Main, Germany

**EDITORIAL AND PRODUCTION TEAM**

Griffin, Jessica, Graphics Support, Cooperative Institute for Climate and Satellites–NC, North Carolina State University, Ashevile, North Carolina
Hammer, Gregory, Content Team Lead, Communications and Outreach, NOAA/NESDIS National Centers for Environmental Information, Asheville, North Carolina
Love-Brotak, S. Elizabeth, Lead Graphics Production, NOAA/NESDIS National Centers for Environmental Information, Asheville, North Carolina
Misch, Deborah J., Graphics Support, TeleSolv Consulting LLC, NOAA/NESDIS National Centers for Environmental Information, Asheville, North Carolina

Riddle, Deborah B., Graphics Support, NOAA/NESDIS National Centers for Environmental Information, Asheville, North Carolina
Slagle, Mary, Graphics Support, TeleSolv Consulting LLC, NOAA/NESDIS National Centers for Environmental Information, Asheville, North Carolina
Sprain, Mara, Technical Editor, LAC Group, NOAA/NESDIS National Centers for Environmental Information, Asheville, North Carolina
Veasey, Sara W., Visualization Team Lead, Communications and Outreach, NOAA/NESDIS National Centers for Environmental Information, Asheville, North Carolina
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In 2017, the dominant greenhouse gases released into Earth’s atmosphere—carbon dioxide, methane, and nitrous oxide—reached new record highs. The annual global average carbon dioxide concentration at Earth’s surface for 2017 was 405.0 ± 0.1 ppm, 2.2 ppm greater than for 2016 and the highest in the modern atmospheric measurement record and in ice core records dating back as far as 800 000 years. The global growth rate of CO₂ has nearly quadrupled since the early 1960s.

With ENSO-neutral conditions present in the central and eastern equatorial Pacific Ocean during most of the year and weak La Niña conditions notable at the start and end, the global temperature across land and ocean surfaces ranked as the second or third highest, depending on the dataset, since records began in the mid-to-late 1800s. Notably, it was the warmest non-El Niño year in the instrumental record. Above Earth’s surface, the annual lower tropospheric temperature was also either second or third highest according to all datasets analyzed. The lower stratospheric temperature was about 0.2°C higher than the record cold temperature of 2016 according to most of the in situ and satellite datasets.

Several countries, including Argentina, Uruguay, Spain, and Bulgaria, reported record high annual temperatures. Mexico broke its annual record for the fourth consecutive year. On 27 January, the temperature reached 43.4°C at Puerto Madryn, Argentina—the highest temperature recorded so far south (43°S) anywhere in the world. On 28 May in Turbat, western Pakistan, the high of 53.5°C tied Pakistan’s all-time highest temperature and became the world-record highest temperature for May.

In the Arctic, the 2017 land surface temperature was 1.6°C above the 1981–2010 average, the second highest since the record began in 1900, behind only 2016. The five highest annual Arctic temperatures have all occurred since 2007. Exceptionally high temperatures were observed in the permafrost across the Arctic, with record values reported in much of Alaska and northwestern Canada. In August, high sea surface temperature (SST) records were broken for the Chukchi Sea, with some regions as warm as +11°C, or 3° to 4°C warmer than the long-term mean (1982–present). According to paleoclimate studies, today’s abnormally warm Arctic air and SSTs have not been observed in the last 2000 years. The increasing temperatures have led to decreasing Arctic sea ice extent and thickness. On 7 March, sea ice extent at the end of the growth season saw its lowest maximum in the 37-year satellite record, covering 8% less area than the 1981–2010 average. The Arctic sea ice minimum on 13 September was the eighth lowest on record and covered 25% less area than the long-term mean.

Preliminary data indicate that glaciers across the world lost mass for the 38th consecutive year on record; the declines are remarkably consistent from region to region. Cumulatively since 1980, this loss is equivalent to slicing 22 meters off the top of the average glacier.

Antarctic sea ice extent remained below average for all of 2017, with record lows during the first four months. Over the continent, the austral summer seasonal melt extent and