

NOAA Climate Services

Climate change is real. It is here, and it is happening now, in our backyards and around the globe.

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NOAA is committed to helping governments, businesses, and communities manage climate risks, adapt to changing conditions, and reduce the threat of climate change.

With global satellite measurements dating to the 1960s, NOAA maintains the world's largest and oldest archive of satellite- and Earth-based observations. Along with NOAA's modeling capabilities, this information enables NOAA to respond to millions of annual requests for climate data vital to planning and operations across all sectors of society.

NOAA is a global leader in reporting on the state and changing state of essential climate variables. As the official U.S. source of information about climate variations and change, NOAA reports on conditions daily, weekly, monthly, seasonally, and yearly.

NOAA's integrated climate services document the past, monitor the present, project the future, and assess the impacts of climate. Examples of these services follow.



Research

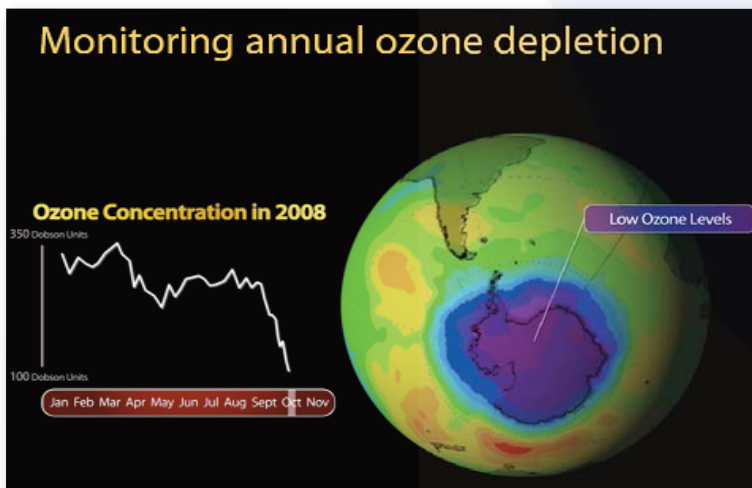
NOAA researchers worldwide collect data that significantly support the ability to forecast changes in climatic systems. This uninterrupted, reliable monitoring of the Earth's atmosphere yields important clues about long-term global changes, improving predictions of climate variations in the shorter term, such as during cold spells and periods of drought, and over centuries and beyond.

NOAA deployed the first-of-its-kind buoy to monitor ocean acidification. A result of carbon absorbed by the oceans, acidification threatens ocean and inland ecosystem health. Launched in the Gulf of Alaska, this buoy provides data to support research essential to predicting future conditions. NOAA leads the way in identifying and understanding acidification's effects on ecosystems and living marine resources.

NOAA scientists measure ozone all over the world, deploying instruments to also measure the trace gases and aerosol particles that affect its abundance. Precise measurements taken from satellites, balloons, and ground and aircraft instruments can detect small regional changes over long periods and provide maps of global and local distribution. These data are used to validate and verify NOAA climate models.

NOAA's **global science platforms** include three aircraft and two research vessels. The ships, *Ronald H. Brown* and *Ka'imimoana*, collect oceanic and atmospheric data such as solar radiation, carbon dioxide, and other fundamental building blocks for studying climate change. NOAA and international scientists use this data to analyze and model short- and long-term variability in global wind patterns and ocean circulation. Long-term data records are used to understand and predict the impacts of future climate change.

Monitoring annual ozone depletion



Observing, Monitoring and Data Stewardship

NOAA's **92 observing systems** demonstrate the immense value of high quality data. Monitoring our planet from the sun to the ocean floor, these systems provide the consistent, non-stop monitoring required for effective climate models, forecasts, and projections.

NOAA's **Carbon Tracker** is widely acknowledged as the most open and effective approach to date for estimating CO₂ emissions and uptake, especially at large spatial scales.

NOAA's **114 climate stations** comprise the U.S. Climate Reference Network, which tracks national average changes in temperature and precipitation trends with exceptional precision.

NOAA's **Carbon Cycle Greenhouse Gases Group** collects and analyzes air samples from about 100 clean air sites around the world. These measurements go into the NOAA Annual Greenhouse Gas Index and are used to validate and verify NOAA climate models.

NOAA's **six World Data Centers** effectively link users across the scientific community to many millions of climate data sets.

NOAA **sea-level standards** have been adopted by the U.S. Army Corps of Engineers for all phases of designing, engineering, managing, and maintaining civil works programs.

Modeling, Prediction and Projections

NOAA's **state-of-the-science models** provide the best possible information on future climate for regional, national, and global decision-making across all sectors. In vulnerable areas, for example, infrastructure can be designed with a better understanding of projected sea-level rise and/or changes in hurricane frequency and intensity.

NOAA's **global climate model suite** supports operational weather, hurricane, and climate forecasts from days to decades into the future. NOAA produces operational climate forecasts and information services, including 6- to 10-day and 8- to 14-day climate outlooks and monthly and seasonal precipitation and temperature outlooks.

NOAA's **climate modeling capabilities** help provide a credible picture of the future and inform effective policy choices for making climate-related decisions essential to U.S. needs, including national security and considerations about energy technologies that might exacerbate global climate change.

NOAA **scientists are simulating the entire global carbon cycle** to better understand how the cycle works and help predict how it will act and react in the future. The Earth System Modeling effort spans the Earth's atmosphere, oceans, fossil fuels, and terrestrial ecosystems.





Assessments

Scientific assessments inform our understanding of climate – how and why it is changing and what the changing conditions mean to our lives and livelihoods.

More than 120 NOAA scientists were among those awarded the 2007 Nobel Peace Prize for their collective scientific and technological contributions to the U.N. Intergovernmental Panel on Climate Change assessment reports. Sixty-four percent of federal scientists contributing to the 2001 assessment and 73 percent of federal scientists contributing to the 2007 assessment were from NOAA.

NOAA led 9 of the 21 Synthesis and Assessment Products on climate change under the U.S. Global Change Research Program and the North American Regional Climate Change Assessment Program.

NOAA led development of the *Global Climate Change Impacts in the United States*, a report produced with a consortium of experts from 13 U.S. science agencies and several universities and research institutes. Compiling years of scientific research and underscoring regional impacts, this report takes into account new data that were unavailable when prior major national and global studies were being conducted.

Capacity-Building, Outreach and Training

NOAA supports education, training and public awareness/extension programs to strengthen national, regional, and local capacity. There is substantial outreach to strengthen understanding of climate-related coastal and other hazards.



NOAA has long-term partnerships with many universities and other institutions, including 13 Cooperative Research Institutes affiliated with the NOAA Research Laboratories; 30 Sea Grant Programs coordinated under the National Sea Grant College Program; and six regional Undersea Research Centers.

NOAA is a respected international leader, partnering with the U.S. Department of State, U.S. Agency for International Development, other governments, and international and multi-lateral organizations to exchange expertise and provide capacity-building and technical assistance to colleagues around the world.

NOAA's Geophysical Fluid Dynamics Laboratory and Princeton University host a unique graduate program in atmospheric and oceanic sciences. Students, researchers, and faculty can access NOAA's super-computing resources and engage in climate modeling and climate-related policy.

NOAA's *Teacher at Sea* program has sent more than 500 schoolteachers, from kindergarten through college-level, to sea. The program offers teachers rich exposure to work aboard NOAA ships where they conduct research under the tutelage of scientists and crew.

Climate Services: On-the-Ground Delivery

With many partners, NOAA delivers regional and national climate services on multiple scales. Research, modeling, and observing systems are the backbone of these services. Nine NOAA Regional Integrated Sciences and Assessments focus research on regional climate services. Six NOAA Regional Climate Centers deliver climate services with user needs upfront, from research through application and education.



NOAA fosters leadership and networks to implement drought monitoring and forecasting at federal, state, and local levels. Farmers depend on seasonal predictions to make planting decisions. Climate assessments help fishery managers understand likely shifts in migration patterns. Whether they are local officials computing budgets for next year's snow removal, or city planners grappling with options for water resources, decision-makers across all sectors require the reliable, relevant, and easily accessible information about current and projected impacts that NOAA provides.

Climate Literacy

Climate Literacy: The Essential Principles of Climate Science, a product of the U.S. Global Climate Research Program and compiled by an interagency group

led by NOAA, explains how climate influences people and how people influence climate. Using the guide as a framework, NOAA is working with the National Science Teachers Association and other partners to revise state educational standards related to climate issues.

Climate Literacy:

The Essential Principles of Climate Science

www.noaa.gov/climateliteracy.html

Global Climate Change Impacts in the United States

www.globalchange.gov

National Oceanic and Atmospheric Administration
Science Service Stewardship

www.noaa.gov

