NOAA Chemical Sciences Laboratory

Photo credit: Sam Hall/NCAR

Detecting and understanding changes in our atmosphere in order to protect lives, national security, and vital socioeconomic systems.

NOAA's Chemical Sciences Laboratory (CSL) is a world leader in atmospheric composition and chemistry research—pioneering studies from the air we breathe to the stratosphere's role in climate. CSL's groundbreaking work responds to the needs of our stakeholders in public health, national security, and safeguarding vital socioeconomic systems.

CSL's scientific capabilities enable:

- Monitoring and enforcement of international treaties
- Accurate air quality and weather forecasting
- Informed strategies for cleaner air and a more livable climate for every American
- Public health protection from air pollution and wildfire smoke
- Detection of unauthorized climate intervention by foreign actors
- A scientific foundation to evaluate climate intervention methods

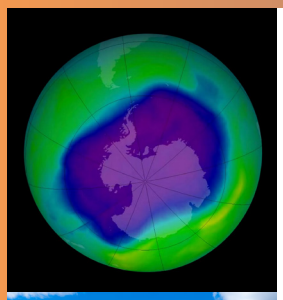
NOAA CSL advances the scientific understanding of the chemical and physical processes that affect Earth's atmospheric composition to:

- Make the Air We Breathe Cleaner & Healthier
- Advance Wildfire Science & Response
- Deliver Authoritative Emissions Data
- Provide Critical Observations for Next-Generation Models
- Safeguard the Ozone Layer
- Incorporate Atmospheric Chemistry & Composition in Weather Forecasts
- Inform Sustainable Space Exploration
- Provide the Scientific Foundation for Evaluating Climate Intervention

CSL provides unique expertise, technologies, and leadership to protect our atmosphere and the people, ecosystems, and economies that depend on it.

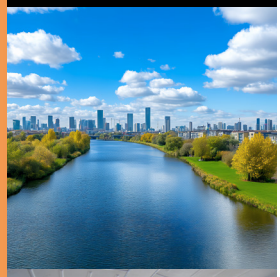
Chemical Sciences Laboratory
Oceanic and Atmospheric Research
National Oceanic and Atmospheric Administration

For more information, visit:
csl.noaa.gov
research.noaa.gov



Safeguarding the Ozone Layer

CSL led the historic 1987 Antarctic research field campaign that confirmed the chemistry that leads to the formation of the ozone hole—laying the groundwork for the Montreal Protocol that has saved countless lives. Today, CSL continues to serve in global leadership roles to ensure recovery of the ozone layer through its observations and modeling of stratospheric ozone. CSL also serves in a leading role in the scientific assessments of ozone depletion that provide the scientific basis for the Montreal Protocol decisions that have protected the global ozone layer. **CSL capabilities provide the U.S. and world with critical intelligence on potential treaty violations and the tools to protect future generations from harmful ultraviolet radiation.**

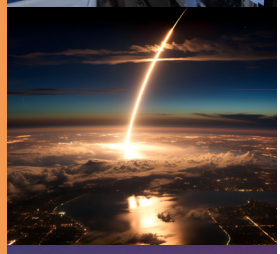


Making the Air We Breathe Cleaner and Healthier

Through decades of collaboration with state and local agencies as well as industry, CSL offers unmatched observing and modeling capabilities to identify pollution sources, track chemical and physical transformations, and assess their impacts on human and ecosystem health—leading to informed strategies to make the air we breathe cleaner. The observations from CSL's one-of-a-kind suite of highly specialized instruments are used to train air quality models and improve forecasts, which make America safer, stronger, and more prosperous. **CSL capabilities provide communities with vital observations and modeling that lead to cleaner air and healthier people.**

Providing Critical Observations for Training Next-Generation Models

Breakthroughs in the advancement of AI (artificial intelligence) has led to large-scale efforts developing the next generation of AI-based weather and air quality forecast models. Unlike traditional computer models that are built on complex mathematical and physical equations, AI models rely heavily on observational training data across all manner of potential atmospheric conditions in order to gain predictive capabilities. This means that the transition towards AI-driven models will require more observational capacity. **CSL capabilities provide the advanced instrumentation and expertise in airborne measurements to maintain and increase our capacity for these critical observations.**

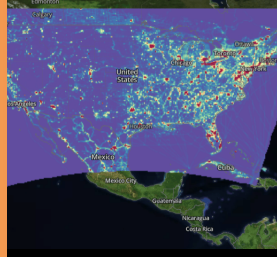


Informing Sustainable Space Exploration

CSL discovered exotic metals in the stratosphere from the ablation of satellites and rockets reentering the atmosphere—opening the door to an entirely new field of study. As space traffic grows, CSL is pioneering research on its atmospheric impacts, ensuring that space exploration advances sustainably. **CSL capabilities provide answers to vital questions about the potential effects on the ozone layer and climate from the booming space economy.**

Advancing Wildfire Science and Response

In an era of increasing mega-wildfires, CSL is delivering urgently needed innovation—from developing high-resolution uncrewed aerial systems with thermal sensors that detect wildfires earlier to real-time wind field mapping that predicts fire movement. CSL's wildfire smoke research based on its observations and modeling characterizes the composition of hazardous components of wildfire smoke and uses cutting-edge satellite observations to enhance smoke and air quality forecasts, leading to more accurate health advisories. **CSL capabilties provide first responders and emergency managers with technologies that can save lives and reduce devastation, and communities with the information to take precautions to avoid wildfire smoke.**



Delivering Authoritative Emissions Data

Emission of air pollutants and greenhouse gases have profoundly impacted the planet, lowering air quality, altering the climate, and disrupting ecosystem nutrient cycles. CSL is a global leader in developing science-based emissions data for air pollutants and greenhouse gases. These data, grounded in CSL's world-class observational and modeling capabilities, are critical for informing policy and assessing progress towards emission reductions. **CSL capabilities provide decision makers and industry with the trusted, authoritative data necessary to guide effective policies and responsible business strategies for clean air and a livable planet.**

Providing the Scientific Foundation for Evaluating Climate Intervention

CSL's essential observations of stratospheric gases and aerosols provide the scientific foundation for understanding potential climate intervention methods, such as stratospheric aerosol injection. CSL is the only research institution in the world with the instruments, capabilities, and scientific expertise to make detailed observations of gases and aerosols in the stratosphere from aircraft. CSL is also the sole institution worldwide conducting routine monitoring of stratospheric aerosol via balloons. These observations are crucial to evaluate the risks and benefits of climate intervention methods. CSL's high-precision instruments and cutting-edge models are also vital to detect any unauthorized climate modification efforts by foreign actors. **CSL capabilities provide the U.S. and the world with fundamental scientific capabilities to assess climate intervention methods and identify threats from deliberate attempts to alter the global climate.**

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