



NOAA  
GLOBAL  
MONITORING  
LABORATORY

# The Planetary Pulse

SPRING/SUMMER 2026



## Feature Story

### Pioneering NOAA-University of Colorado research converges on role of microbes in methane's surge

Scientific investigations into the rapid rise of atmospheric methane since 2007 have debated the roles of emissions from fossil fuel production versus microbial processes like wetlands and agriculture. Pioneering studies by a team of scientists from NOAA's Global Monitoring Laboratory and the University of Colorado Boulder have identified microbial emissions as the dominant driver of this important greenhouse gas over the last two decades and imply that fossil fuel-related emissions have remained relatively stable. Currently, fossil fuels represent about one quarter of microbial emissions at the global scale. The research utilized high-precision measurements of methane concentrations and analyzed the ratios of the isotopes of carbon and hydrogen to distinguish between microbial and fossil fuel sources. >>>

An aerial photo of the vast width of the wetland created at the flooded confluence of the Amazon and Tapajos rivers in Brazil. Credit: John Miller/NOAA



## Research News



### GML's trace gas and water vapor measurement system installed on United 737

In June, a GML team traveled to a United Airlines maintenance facility in Greensboro, NC, where, during a 60-day heavy maintenance visit for a 737 aircraft, they installed a rack system for the laboratory's Measurements of Carbon and H<sub>2</sub>O version 1 (MACH1) program. Following the maintenance visit, the GML team oversaw the upload, ground test, and a two-hour flight test of the MACH1 system. The flight test confirmed the system is performing well, revealing significant vertical gradients in carbon dioxide, methane, carbon monoxide, and water vapor, resulting from strong vertical stratification caused by summer plant growth and excessive surface heating.

GML is leveraging commercial aircraft as observing platforms for trace gas vertical profile measurements. Credit: NOAA



### GML team installed wildfire research mobile monitoring systems in Colorado

In July, a GML team deployed the SMOLDER (Situational Measurement and Optical Detection of fire Emissions and Radiation impacts) wildfire air quality trailer at the NCAR Marshall Field Site in Boulder. Led by researchers in the lab's Global Radiation, Aerosols, Cloud Division, the project unifies measurement systems across GML divisions and areas of expertise to improve understanding of wildfire smoke's impact on air quality and climate. The GRAD group is investigating future deployment sites for measurements with this system, including deployment at prescribed burns.

SMOLDER is designed for investigations of smoke plume tracking and detection; characterization of changes in aerosol optical properties and trace gases associated with plume aging and evolution; smoke impacts on surface radiation budget and boundary level evolution; and satellite and model evaluations.

The SMOLDER mobile installation at the NCAR Marshall Field Site in Boulder County. Credit: Scott Stierle, CIRES and NOAA

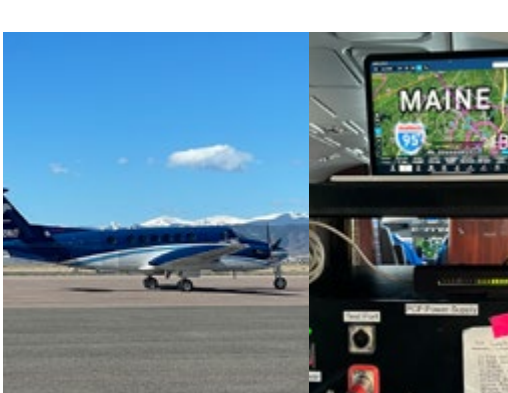


### Access to NOAA's world-renowned Mauna Loa Observatory restored

More than three years after lava from Hawaii's erupting Mauna Loa volcano buried a mile of the road leading to NOAA's Mauna Loa Atmospheric Baseline Observatory (MLO), road crews have carved a temporary road restoring access to the site. The road was completed March 26, 2026.

MLO is an internationally renowned atmospheric research facility. Since the 1950s, it has continuously monitored and collected data related to atmospheric composition and surface radiation. NOAA technicians, who had to be ferried by helicopter to the facility since 2023 to maintain limited operations, have begun restarting many of the science activities that were suspended on November 27, 2022. >>>

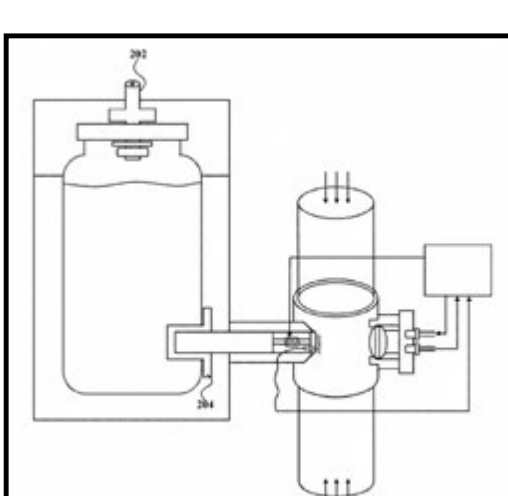
A road construction crew established a temporary road base across 1.2 miles of lava flows from the 2022 eruption of Mauna Loa volcano. This photo was taken March 3, 2026, during a project to restore access to NOAA's Mauna Loa Observatory. Credit: Christine Smith/NOAA



### GML completed ninth NOGAP survey and first aboard NOAA King Air

In April, GML successfully completed the ninth loop around the United States—and the first aboard the NOAA King Air aircraft—for the National Observations of Greenhouse gases using Aircraft Profiles (NOGAP) campaign. The NOGAP program leverages small aircraft and a turnkey instrument package for rapid measurements of carbon dioxide, methane, carbon monoxide, water vapor, and ozone, along with specially designed flask sampling systems to sample and subsequently measure more than 60 atmospheric trace gases. In each loop, the aircraft circumnavigates the United States, repeatedly profiling from 500 feet above ground level to altitudes as high as 25,000 feet.

GML designed and implemented a trace-gas inlet on NOAA's King Air aircraft, vastly expanding GML's atmospheric monitoring across the United States and the Arctic. Credit: Julianne Fernandez/CIRES and GML



### GML patent application published

GML's Emrys Hall (Ozone & Water Vapor) was notified by NOAA's Technology Partnership Office that the [US Patent & Trademark Office](#) published the patent application, Apparatus For Measuring Water Vapor In Atmosphere, on 3/26/2026. The publication number is **US-2026-0086055-A1**.

The patent describes the designs for two new versions of the frost point hygrometer that use environmentally friendly cryogen—the first uses liquid nitrogen and the second uses dry ice and alcohol. The application must go through the examination process before a patent is issued, a process that takes on average between 8-18 months from publication.

This illustration depicts the NOAA frost point hygrometer, which measures water vapor from the surface into the stratosphere on a balloon. Researchers in GML developed and are continuously improving new versions of the instrument that uses environmentally friendly cryogen. Credit: Emrys Hall/NOAA

## In Our Community



### GML/CIRES researchers attended 2026 GAW Symposium

CIRES/GML researchers Irina Petropavlovskikh and Xin (Lindsay) Lan attended the World Meteorological Organization's Global Atmosphere Watch (GAW) Symposium in WMO, Geneva, Switzerland, from April 13-17. The Symposium highlighted the Programme's broad role in delivering atmospheric composition observations, environmental services, policy support, and capacity development. More than 160 participants attended in person, with over 100 joining online, representing more than 70 countries. The meeting brought together established GAW experts alongside a wider community, including National Meteorological and Hydrological Services from all WMO Regions, space agencies, UN organizations and coalitions, and the broader scientific community.



### GML Senior Scientist attended 48<sup>th</sup> Meeting of the Open-ended Working Group of the Parties to the Montreal Protocol

In July, GML Senior Scientist Steve Montzka participated in the [48th meeting of the Open-Ended Working Group of the Parties to the Montreal Protocol](#) in Bangkok, Thailand.

Montzka participated in the detailed work to enhance regional measurements of controlled halocarbons, following an earlier decision made by the Parties to dedicate approximately \$10 million for this purpose for the first time.

### GML welcomed Hollings Scholars and Lapenta Intern in Summer 2026

GML welcomed five summer interns (pictured right with the rest of the NOAA Boulder summer interns and their mentors) to Boulder for Summer 2026.

**Mia Robinson** (Hollings, Jackson State U.) helped verify the performance of the new automated ozonesonde calibration system developed by Alex Fritz (CIRES/GML). **Anna Hagberg** (Hollings, U. Colorado Boulder) examined historical ozonesonde and dual-sonde data from Costa Rica to develop a machine learning algorithm to detect SO<sub>2</sub> interference in ozonesonde profiles. **Zach Griffith** (Hollings, U. Alabama) set up a controlled lab experiment to evaluate the impact on the performance of an ozonesonde with an SO<sub>2</sub> filter by inserting a Naphion dryer on the inlet side of an SO<sub>2</sub> filter. **Michelle Stasik** (Hollings, U. Maryland) worked with Lizzy Asher (CIRES/GML) to examine the agreement between coincident (in space and time) measurements of water vapor in the Upper Troposphere - Lower Stratosphere from aircraft AMDAR measurements with coincident Frost-Point Hygrometer measurements in Boulder. And **Kate Rodelli** (Lapenta, U. Colorado Boulder) worked with Peter Effertz (CIRES/GML) and Irina Petropavlovskikh (CIRES/GML) to revisit work by Sam Oltmans (retired) on springtime ozone depletion events detected in the surface data record in Utqiagvik.

## Awards and Recognitions



### CIRES researcher in GML recognized with the Methane Science Career Achievement award

In April, **Xin (Lindsay) Lan** was awarded the Methane Science Career Achievement award at the Methane 250 conference in Ispra, Italy. The conference—organized by the European Joint Research Center, the UN Climate Clean Air coalition and other partners—marked the 250-year anniversary of methane's initial discovery in Ispra. Lan, a research scientist at CIRES/GML, was recognized for her research on the global methane budget, and for utilizing advanced carbon isotope analyses to disentangle microbial and fossil fuel emission sources, leading the report on the global methane trend, and serving as the chair of the World Meteorological Organization's Scientific Advisory Group on Greenhouse Gases.

Methane was discovered at Italy's Lake Maggiore in 1776. Italian physicist and chemist Alessandro Volta noticed gas bubbles rising from the decaying plant matter in the shallow, muddy waters of the lake. He collected the gas and called it "inflammable air native to marshes."

### GML team members recognized with 2025 NOAA awards

#### John Augustine: NOAA Distinguished Career Award

*For a 45-year career of significant contributions to GML's mission, culminating in its longest and most successful surface radiation network.*

#### Sweeney Group: NOAA Administrator's Award

Awardees: Colm Sweeney, Jack Higgs, Kathryn McKain, Bianca Baier, Arlyn Andrews, Vanda Grubišić

*For the development of instrumentation leading to an agreement between United and NOAA to carry GHG measurement systems on commercial aircraft.*

### GML employees recognized with NOAA Silver Sherman Awards

**Isaac Vimont** was recognized for his leadership in stabilizing GML operations during critical 2024-2025 staffing gaps. By stepping in as Acting LOGOS Division Lead and volunteering to co-author a chapter of the 2026 Ozone Assessment Report, he bridged critical management and technical gaps without compromising GML's core mission. While navigating these expanded roles, he continues to ably direct GML's atmospheric measurement program by seeking innovative solutions to new challenges with unwavering technical acumen.

**Gregg Phillips** was recognized for his exemplary leadership of the GML IT group during a challenging year. As Acting Senior IT Manager, his technical expertise ensured seamless support and superior customer service despite significant staff reductions. Beyond maintaining operations, Gregg launched two major process improvements, including a website redesign. His dedication is vital to GML for ensuring continuity and progress.

### CIRES employees in GML recipients of 2026 Innovative Research Program (IRP) grants

Investigators: **Peter Effertz**, **Brandon Noiro**

*Transitioning global ozone monitoring to the cloud: Developing a next-generation BTS retrieval algorithm to succeed the Dobson spectrometer*

The IRP is an internal CIRES competition designed to stimulate a creative research environment within CIRES and to encourage synergy between disciplines and research colleagues. The program encourages novel, unconventional, or fundamental research that might otherwise be difficult to fund. CIRES-wide competitions are conducted each year to foster an innovative research environment where risk-taking is allowed and even encouraged.

## GML Publications

Deng, Y., Ikeda, K., Tanimoto, H., **Andrews, E.**, Chan, T., Krejci, R., Heslin-Rees, D., Backman, J., Hyyvarinen, A.-P., Sharma, S. (2026). China's contribution to arctic black carbon declined from 2009 to 2022. *Earth's Future*, 14, e2025EF007441. <https://doi.org/10.1029/2025EF007441>

**Oh, Y., Bruhwiler, L., Lan, X.** et al. Isotopic constraints in methane inversions reveal larger trends in wetland emissions with improved linkage to terrestrial water storage. *Nat Commun* 17, 8112 (2026). <https://doi.org/10.1038/s41467-026-74777-4>

Park, D.-H., Laj, P., **Andrews, E.**, Rose, C., Benedetti, A., Kulmala, M., et al. (2026). Decrease in Nucleated Particles and Cloud Condensation Nuclei Observed across a Range of Environments. *Environmental Science & Technology*. <https://doi.org/10.1021/acs.est.5c18035>

**Petropavlovskikh, I.**, De Mazière, M., Thompson, A. M., Wild, J. D., Hannigan, J. W., Selkirk, H. B., et al. (2026). Overview: The Network for the Detection of Atmospheric Composition Change at 35 years: achievements and future strategy. *Atmospheric Chemistry and Physics*, 26, 8637–8675. <https://doi.org/10.5194/acp-26-8637-2026>

Pitt, J. R., Rust, D., Ganesan, A., Western, L. M., Vollmer, M. K., Mühle, J., et al.: Observations of 1,2-dichloroethane from the AGAGE and NOAA networks and derived global and regional emissions, *Atmos. Chem. Phys.*, 26, 10167–10195, <https://doi.org/10.5194/acp-26-10167-2026>, 2026.

Ray, E.A., **Baier, B.C., Moore, F.L.** et al. Observed stratospheric mean age decrease consistent with circulation acceleration. (2026). *Nat. Geosci.* <https://doi.org/10.1038/s41561-026-02011-3>

Reimann, S., Western, L. M., Lickley, M. J., et al. (2026). Continuing industrial emissions are delaying the recovery of the stratospheric ozone layer. *Nature Communications*, 17, 3190. <https://doi.org/10.1038/s41467-026-70533-w>

Shupe, M. D., Persson, P. O. G., Cox, C. J., Gallagher, M. R., Solomon, A., Sledd, A., et al. (2026). The two radiative states of the Arctic atmosphere and their impacts on the surface energy budget of sea ice. *Elementa: Science of the Anthropocene*, 14 (1): 00100. <https://doi.org/10.1525/elementa.2025.00100>

Yu, X., Canadell, J.G., Henze, D.K. et al. Incorporating methane isotopologues alters tropical and subtropical methane emission estimates. *Nat Commun* (2026). <https://doi.org/10.1038/s41467-026-72668-2>

Zhang, Z., Poulter, B., Wang, Z. et al. Emergent constraints on future methane emissions from global wetlands. *Nat. Geosci.* (2026). <https://doi.org/10.1038/s41561-026-01987-2>

Authors working in GML, either as federal employees, CIRES employees, post-doctoral candidates, students, or contractors are listed in **bold**.

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