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*Advancing our understanding of atmospheric composition and climate*

# Quarterly Newsletter

March 2022 | Issue 1

*(As the first Quarterly Newsletter, this issue covers January 2021 through March 2022.)*

*The **Chemical Sciences Laboratory (CSL)** is one of ten NOAA Research Laboratories located throughout the United States organized under the office of **Oceanic & Atmospheric Research (OAR)**. CSL is one of four individual labs that collectively form the **Earth System Research Laboratories (ESRL)** located within the David Skaggs Research Center (DSRC) in Boulder, Colorado. The research conducted at CSL aims to advance scientific understanding of the chemical and physical processes that affect Earth's atmospheric composition and climate.*

## Top Stories from 2021

**In February 2021, CSL held its 5-year Science Review. Here we look back on some of the top stories from CSL over the past year within the three primary research themes of Air Quality, Climate, and the Stratosphere.**

### AIR QUALITY

**Volatile consumer products contribute to air pollution in major cities**

- Fragrant consumer products a key source of ozone-forming pollution in New York City
- CSL on the Today Show: How everyday tasks are sources of air pollution

COVID-19 lockdowns lead to reductions in urban air pollutants

- Remote work may be keeping air cleaner in some cities
- Consequences of coronavirus lockdown: new study gathers data on atmospheric pollutants
- COVID-19 lockdowns reduced ozone pollution over the northern hemisphere

Emissions from wildfires lead to widespread air quality impacts

- Research shows wildfire smoke increases ozone pollution
- Smoke from wildfires influences ozone pollution on a global scale
- Chemical tomography in a fresh wildland fire plume

Colorado's historic Marshall Fire

- CSL and CIRES scientists investigate lingering air quality effects of the Marshall Fire
- The Marshall Fire: Historic firestorm illustrates some of the ways NOAA responds when disaster strikes (StoryMap)

## CLIMATE

- Simulated geoengineering evaluation: cooler planet, but with side effects
- Study of wildfire plumes provide insights into methods that might cool the planet
- This solar geoengineering idea has a Goldilocks problem
- Scientists recommend system of checkpoints to help guide climate engineering to research
- Sulfuric acid chemistry is central to the formation of particles in the stratosphere which influence the climate

## STRATOSPHERE

- Research suggests frigid Arctic air outbreaks may be predictable
- Earth has two different stratospheres
- Implications of the size and composition of aerosol particles in the stratosphere
- Giant Australian bushfire injected 1 million tons of smoke in the atmosphere

## 2021 Publications at a Glance

*CSL scientists published 141 peer-reviewed articles in 2021*


### Top highly-cited publications from 2021:

The contribution of global aviation to anthropogenic climate forcing for 2000 to 2018, coauthored by CSL's David Fahey.

Sudden stratospheric warmings, coauthored by CSL's Amy Butler.

The global impacts of COVID-19 lockdowns on urban air pollution: a critical review and recommendations, coauthored by CSL's Jessica Gilman, Steven Brown, Brian McDonald, Jeff Peischl, and Chelsea Thompson.

A decline in global CFC-11 emissions during 2018–2019, coauthored by CSL's Robert Portmann, Sean Davis, and Eric Ray.

## 2021 Major Awards & Recognitions

### NOAA OAR Employee of the Year for Leadership

Recognized for Leadership, **Dr. Gregory Frost** received a 2021 OAR Employee of the Year award "for extraordinary leadership in coordinating atmospheric

### NOAA OAR Daniel Albritton Outstanding Science Communicator Award

**Dr. Amy Butler** received a 2021 Dan Albritton Outstanding Science Communicator Award "for outstanding

composition and chemistry research across OAR programs, laboratories, and NOAA Line Offices and enhancing the role that atmospheric composition and chemistry plays in NOAA achieving its mission."

Read more

communication of NOAA research regarding the impact of variations in the stratospheric polar vortex on weather at the Earth's surface."

Read more

## 2021 NOAA Silver Sherman Award

Dr. Brian McDonald, a researcher in CSL's Regional Chemical Modeling program, was recognized with a NOAA Silver Sherman Award by OAR Deputy Assistant Administrator Ko Barrett. Brian received this award for donating his PECASE award money to enable NOAA and partners to collect aircraft measurements of air pollution in northeast US cities during the COVID-19 lockdowns.

Read more

## 2021 NOAA Silver Sherman Award

CSL's Information System Security Officer Ken Jamieson was recognized with a NOAA Silver Sherman Award by CSL Director David Fahey. Ken was recognized "for outstanding support of Information Technology (IT) services within the NOAA Chemical Sciences Laboratory (CSL)."

Read more

## 2022 NOAA Silver Sherman Award

CSL's Executive Administrative Assistant Ronda Knott was recognized with a NOAA Silver Sherman Award by CSL Director David Fahey. Ronda was recognized "for outstanding performance as the Executive Administrative Assistant to the Director of

## 2021 CIRES Outstanding Performance Award

CIRES and CSL scientist Dr. Matthew Coggon received a CIRES Outstanding Performance Award in the Science and Engineering category for changing our understanding of urban and wildfire ozone

the NOAA Chemical Sciences Laboratory (CSL) during the COVID-19 pandemic."

Read more

formation and resulting in air quality impacts by pioneering experimental and numerical chemical modeling work on biomass burning and volatile chemical product emissions.

Read more

## 2021 CIRES Outstanding Performance Award

CIRES and CSL scientist Dr. Stuart McKeen, a researcher in CSL's Regional Chemical Modeling program, with colleagues Dr. Ravan Ahmadov and Dr. Eric James at the NOAA Global Systems Laboratory (GSL), received a CIRES Outstanding Performance Awards in the Science and Engineering category for leading a multi-year effort to implement a biomass burning module in an existing hourly Numerical Weather Prediction system to predict smoke movement.

Read more

## 2021 CIRES Outstanding Performance Award

Catherine Rasco, Dr. Megan Melamed, and Dr. Chelsea Thompson received CIRES Outstanding Performance Awards in the Service category for redesigning the Chemical Sciences Laboratory website and orchestrating excellent use of ESRI StoryMaps in support of the 5-year laboratory review.

Read more

## 2021 NOAA Bronze Medals

The highest honor award granted by the Under Secretary of Commerce for Oceans and Atmosphere, the Department of Commerce Bronze Medal, recognizes federal employees for superior performance and is awarded to individuals, groups (or teams), and organizations. Two team Bronze Medals were awarded in 2021 with CSL team members.

CSL Program Lead Dr. Gregory Frost, with Georg Grell (GSL), Rick Saylor (GSL), Ivanka Stajner (NWS), Jeff McQueen (NWS), Jun Wang (NWS), and Shobha Kondragunta (NESDIS), received a NOAA Bronze Medal for scientific achievement "for the development of the Global Ensemble Forecast System - Aerosols (GEFS-Aerosols) model to support air quality alerts and visibility forecasts."

CSL Director Dr. David Fahey, CSL program lead Dr. Gregory Frost, and CSL scientist Dr. Brian McDonald received a NOAA Bronze Medal for organizational development "for expeditiously and skillfully coordinating research that leveraged the unique scientific opportunity resulting from the COVID-19 global pandemic." On the team are Ariel Stein (ARL), Jim Butler (GML), Jennifer

Mahoney (GSL), Venkatachalam Ramaswamy (GFDL), Ken Mooney (CPO), Mitchell Goldberg (NESDIS), and Shobha Kondragunta (NESDIS).

Read more

# Current Activities

## CSL Returns to the Stratosphere for the SABRE Mission


Test flights for the Stratospheric Aerosol processes, Budget and Radiative Effects (SABRE) mission were conducted throughout February in Houston, TX. Scientists from CSL and CIRES, along with NASA and university partners, deployed to Ellington Field to test new atmospheric instrumentation on NASA's high-altitude WB-57 research aircraft. The test flights allowed the scientists to check the performance of research instruments, many of which were newly developed or have never been flown at extremely high altitudes.

Learn more about the SABRE Mission

View the SABRE photo gallery on Flickr

SABRE is a NOAA Earth's Radiation Budget (ERB) Initiative project.

## Rapid Response Following the Tonga Volcano Eruption


The eruptions of the Hunga Tonga–Hunga Ha'apai volcano on 13 and 15 January in the southwest Pacific injected ash, sulfur dioxide (SO2), and water vapor into the stratosphere to altitudes exceeding 30 km. This eruption provided the rare opportunity to study the microphysical processes that occur when SO2 gas is emitted into the stratosphere immediately following a volcanic eruption. To take advantage of this opportunity, CIRES scientists from NOAA CSL and colleagues from the University of Houston and St. Edwards University arrived at La Réunion, an island in the Indian Ocean, 6 days after the eruption on 21 January and immediately began making in situ chemical measurements of the volcanic plume using balloonsondes that can rise to 30 km altitude. Analysis of the data collected is now underway, and colleagues at Maïdo Observatory will continue to launch balloons over the course of months to observe the plume evolution. The measurements from TR2Ex will be valuable for improving the accuracy and predictive capabilities of aerosol processes in climate models. Read more >>

Visit the TR2Ex Project Website

TR2Ex is an Intensive Operating Period (IOP) of the Balloon Baseline Stratospheric Aerosol Profiles (B2SAP) project. B2SAP is a NOAA Earth's Radiation Budget (ERB) Initiative project.

# On the Horizon

## ACCLIP 2022

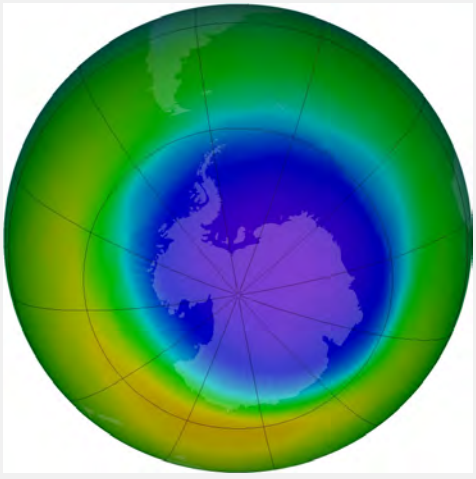
In Summer of 2022, CSL researchers will participate in the NASA/NCAR Asian Summer Monsoon Chemical & Climate Impact Project (ACCLIP) in South Korea. The NASA WB-57 and NCAR G-V research aircraft will be outfitted with state-of-the-art instrumentation to investigate trace gases and aerosols in the upper troposphere and lower stratosphere transported by the Asian Summer Monsoon.

Read more about ACCLIP >>

## CalFiDE 2022

CSL is partnering with San Jose State University for a 6 week aircraft-based study of wildfire behavior and its response to spatially and temporally evolving wind fields in California. A NOAA Twin Otter will be outfitted with a scanning Doppler lidar to measure horizontal wind fields, plume vertical dynamics, spatial extent and transport. The aircraft will also have a high-resolution infrared imaging system to track the behavior of the active flame front and other sensors to measure fire radiative power (FRP).

Read more about CalFiDE >>



## 2022 Scientific Assessment of Ozone Depletion

The WMO/UNEP ozone assessment contains the most up-to-date understanding of ozone depletion, reflecting the thinking of hundreds of international scientific experts who contribute to its preparation and review. CSL has a long history of both leading and contributing to this assessment, which occurs on a four-year cycle. CSL's Director David Fahey serves as a co-chair of the Scientific Assessment Panel (SAP) leading the 2022 report. Other CSL and CIRES staff, including John Daniel, Karen Rosenlof, Sarah Doherty, Chelsea Thompson, and Ronda Knott are serving as authors or organizers. CSL will be hosting a hybrid attendance meeting for the 2022 assessment this month in Boulder.

Read more about the ozone assessments >>

## SABRE-1 2023

The SABRE project is an extended airborne

science measurement program utilizing the NASA WB-57 high-altitude research aircraft to study the transport, chemistry, microphysics and radiative properties of aerosols and trace gases in the upper troposphere and lower stratosphere (UTLS). Test flights for the SABRE Mission were conducted this February (see above) and the first research flights will begin in winter of 2023 in the northern high latitudes.

Read more about SABRE >>

## AEROMMA & CUPiDS 2023

Atmospheric Emissions and Reactions Observed from Megacities to Marine Areas (AEROMMA) addresses emerging research needs in urban air quality, marine emissions, climate feedbacks, and atmospheric interactions at the marine-urban interface. AEROMMA will bring together airborne, ground, and satellite observing systems, and state-of-the-art air quality and climate models, to investigate these research topics and to assess new capabilities for geostationary remote sensing of atmospheric composition. To support the overall AEROMMA science objectives related to urban emissions as affected by coastal meteorology, the NOAA Twin Otter aircraft will deploy to the New York City region for the Coastal Urban Plume Dynamics Study (CUPiDS) in the summer of 2023.

Learn more about AEROMMA and CUPiDS >>

# *People of CSL* — Staff Spotlight

## Meng Li

Meng Li is a CIRES scientist within CSL's Regional Chemical Modeling research program. She joined CSL in March of 2019.

Meng grew up in the Weifang City of Shandong province, China. Weifang is considered to be the birthplace of kites, and is famous for the international kite festival annually held in April. Her memories of Weifang are the vast beautiful plains planted with thousands of wheats and peanuts, the high speed trains, the fragrance of white spirit ("baijiu") spreading all over the town, the gathering of neighbors, chatting and laughing together in front of her house at summer night.

Meng earned a Bachelors of Environmental Engineering in Beijing, China in 2011, then went to the Tsinghua University, starting her research career on atmospheric chemistry, and earned a Ph.D degree in 2016. She did a postdoc at Max Planck Institute for Chemistry in Mainz, Germany before coming to Boulder. At CSL, Meng is working on quantifying and evaluating NOx and VOC emissions at a regional scale

using satellite observations, WRF-Chem atmospheric model development, and improvement of model performance based on multiple techniques.

Learn more about Meng >>

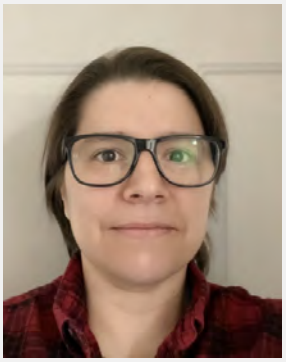
## Dillon Elsbury

Dillon Elsbury is a CIRES scientist within CSL's Chemistry & Climate Processes research program. He joined CSL in July of 2021.

Dillon originally hails from California's San Fernando Valley outside of Los Angeles. Although originally wanting to be a professional basketball player, he instead obtained a degree in Environmental Studies from UC Santa Barbara and worked there making watershed models to predict where pollutants end up in the environment. Wanting to continue work related to water quality and watershed management, Dillon went to UC Irvine for graduate school and the person who would become his advisor suggested that they work on atmospheric rivers together. While that project never came to fruition, they did a handful of projects emphasizing stratosphere-troposphere coupling with an emphasis on regional (e.g., over the North Pacific) atmospheric dynamics.

Now at CSL, Dillon uses general circulation model output to better understand the future of stratosphere to troposphere transport of ozone. He is especially interested in regional transport, such as how stratosphere to troposphere transport differs over Western North America versus over the North Atlantic.

Learn more about Dillon >>



## Sara Gibbons

Sara Gibbons is an Administrative Support Assistant at CSL. She joined the Administrative Office in May 2019.

Sara grew up in a Marine Corps family, but spent the bulk of her childhood in Missouri. She started working in a juvenile facility after college, then moved to in-patient psychiatric centers before switching to out-patient. She then switched gears and went to culinary school and worked in a few kitchens/bakeries before coming to CSL. In her free time, Sara enjoys knitting, crochet, and cross stitch while watching the Smithsonian Channel.

Learn more about Sara >>