2021 PORTFOLIO

Chelsea R. Thompson, PhD

Graphic Designer / Research Scientist

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Rev. 3 June 2021

About Chelsea

Chelsea Thompson is an atmospheric chemist, science communicator, and graphic designer with the University of Colorado's Cooperative Institute for Research in Environmental Sciences (CIRES) working at NOAA's Chemical Sciences Laboratory (CSL) in Boulder, Colorado.

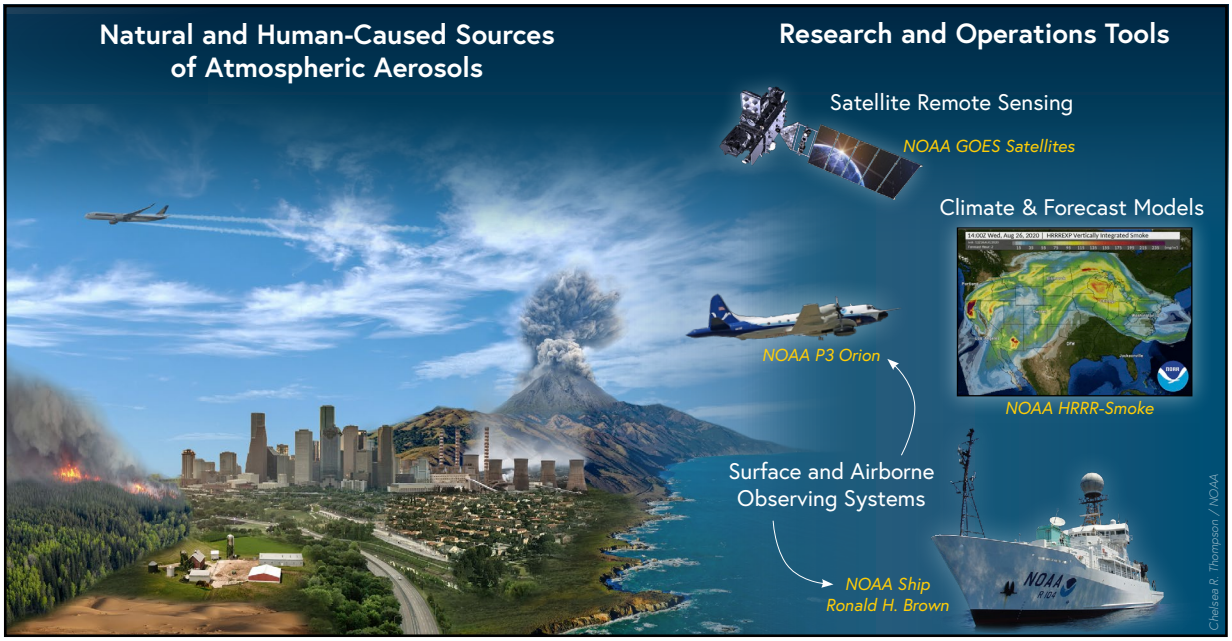
Chelsea received a Bachelor of Science with Honors in Forensic Science with a Chemistry minor from the University of Central Florida in Orlando, Florida. She then attended Purdue University in West Lafayette, Indiana and earned her PhD in Analytical Chemistry under the mentorship of Prof. Paul Shepson. Her PhD research focused on chlorine and bromine radical chemistry in the High Arctic that leads to depletion of ozone and gaseous elemental mercury during polar spring. She spent two spring field seasons in Utqiagvik (formerly Barrow), Alaska as a researcher as part of the OASIS (Ocean-Atmosphere-Sea Ice-Snowpack) project and one summer season as the Science/Laboratory Manager at the NSF-funded field station. While in Utqiagvik, Chelsea was able to engage with the indigenous community and was privileged to help prepare native foods and participate in the Nalukataq annual whaling festival.

Upon completion of her doctorate work in 2012, Chelsea moved to Boulder, Colorado to begin a postdoctoral position at the University of Colorado's Institute for Arctic and Alpine Research and was awarded an NSF Postdoctoral Research Fellowship. There she began studying oil and gas emissions and their impacts on air quality and on unusually high wintertime ozone in the Uintah Basin, Utah. In 2015, she joined the Tropospheric Chemistry group at NOAA CSL, where she participated in the SONGNEX airborne project, measuring nitrogen oxides (NOy) and ozone over western U.S. oil and gas shale basins. From 2016-2019, she participated in the NASA Atmospheric Tomography (ATom) mission, flying four round-trip global circuits aboard the NASA DC-8 research aircraft measuring NOy and ozone in the remote atmosphere.

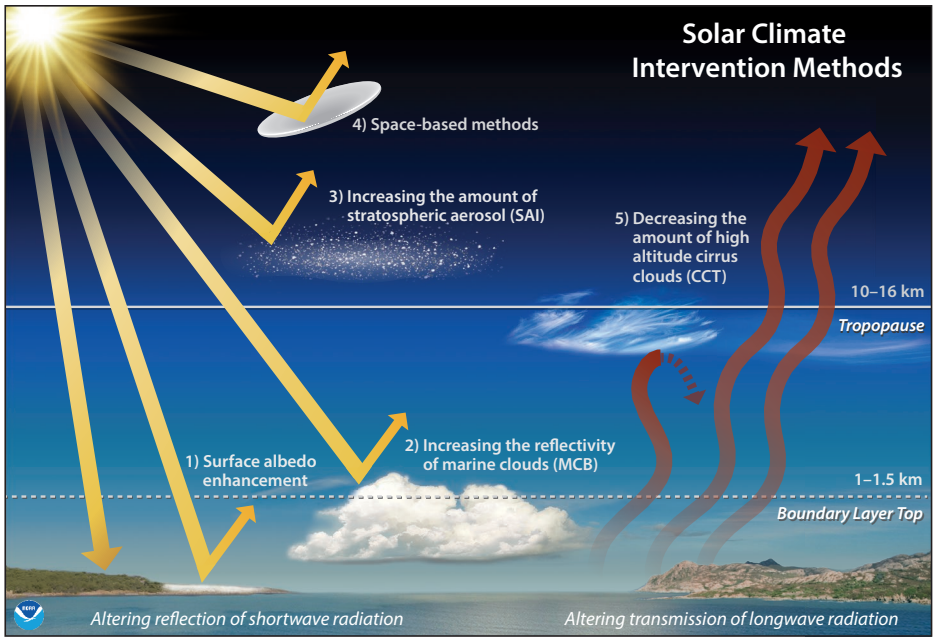
After a year in the private sector, Chelsea returned to CSL and has moved into the role of Communications Lead and graphic designer for the laboratory. Chelsea has a passion for science communication and believes strongly in the power of visual communication to engage the public. As the Communications Lead, Chelsea is able to blend her scientific and artistic backgrounds to create graphics, illustrations, and other products for publications, laboratory communications, public engagement, and international scientific assessments.

Sample Work

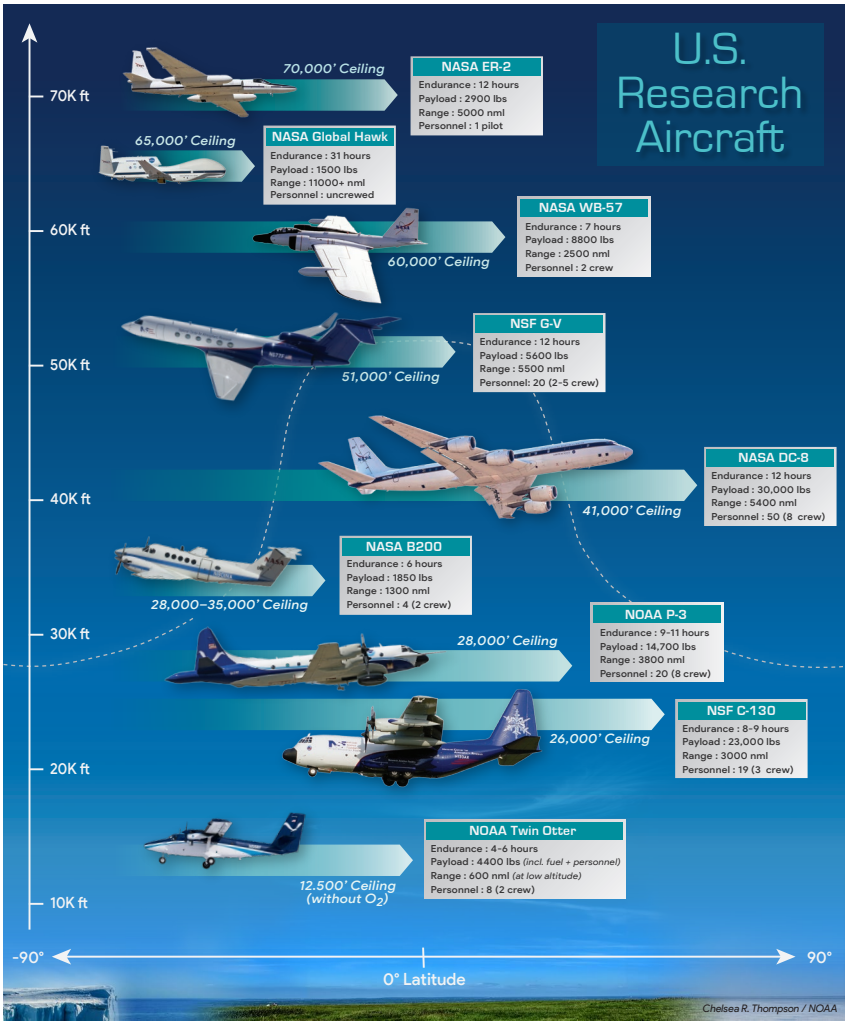
Scientific Schematics & Illustrations



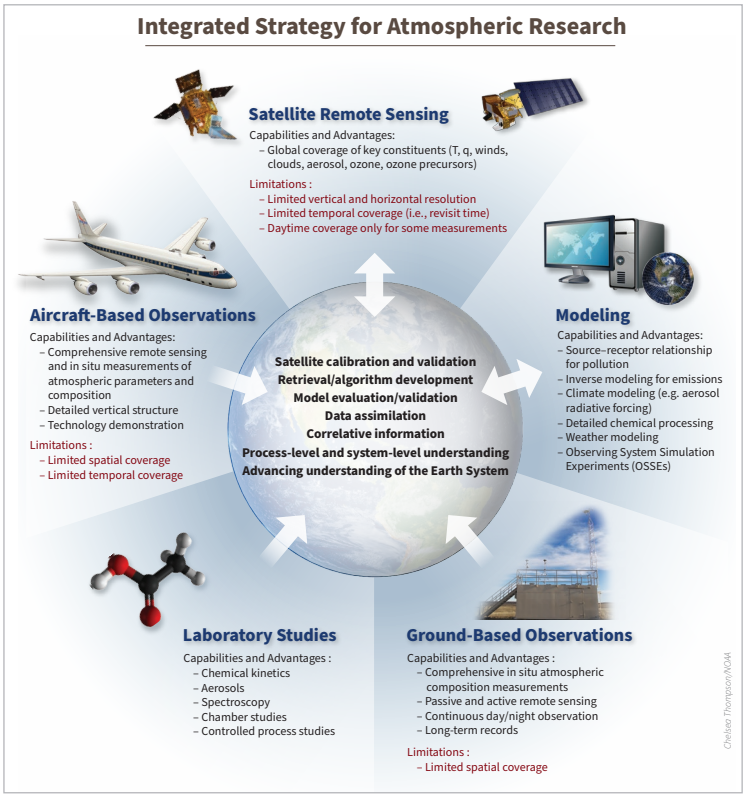
Sources of atmospheric aerosols and NOAA's research and operations tools used to address aerosol-weather-climate intercations, produced for the NOAA Science Council's State of the Science Fact Sheet on Aerosols, Weather, and Climate (2021 update).



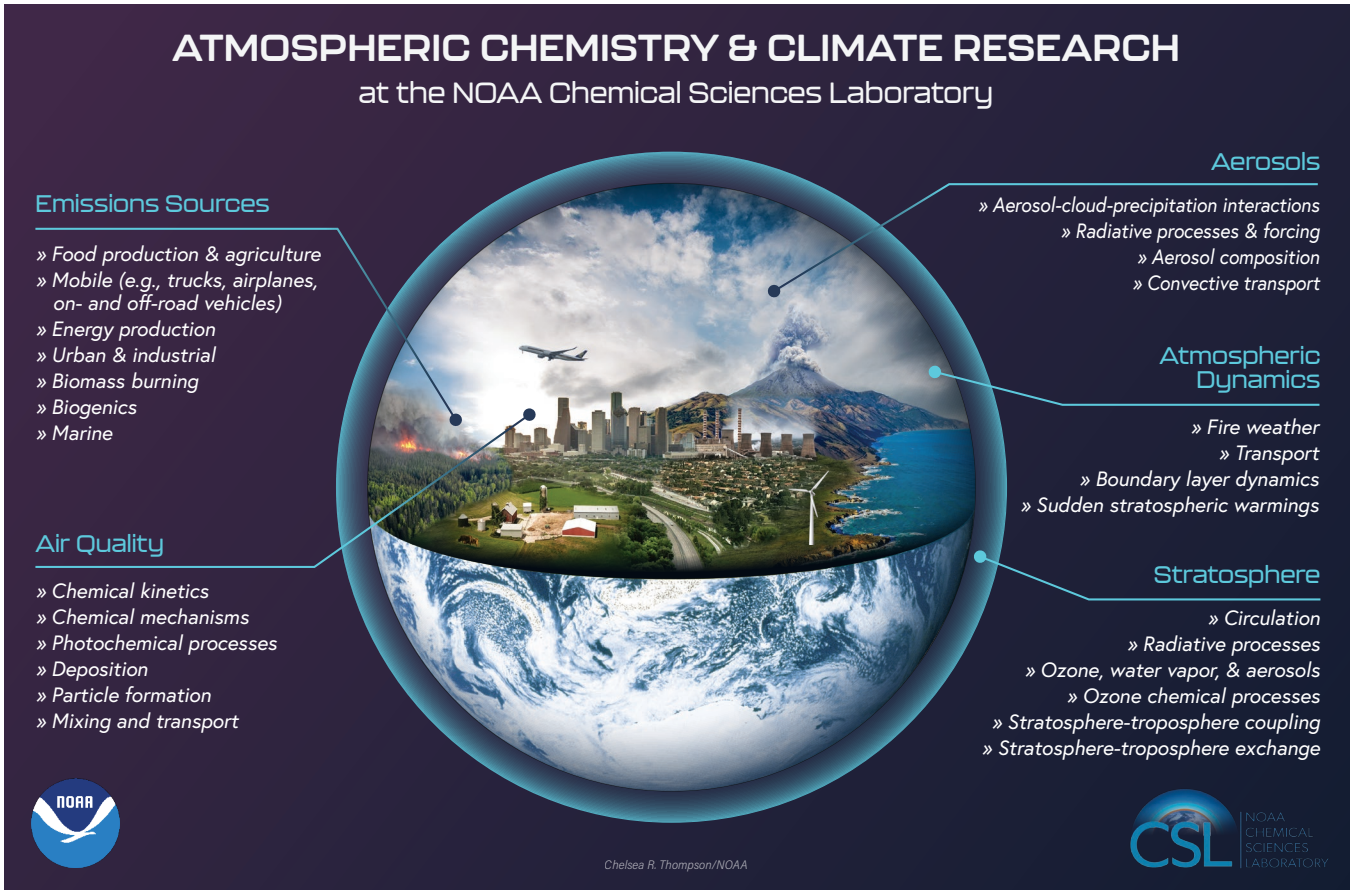
Proposed solar radiation management methods for climate intervention, first published in AGU's EOS magazine, 19 March 2021. (Link to article)



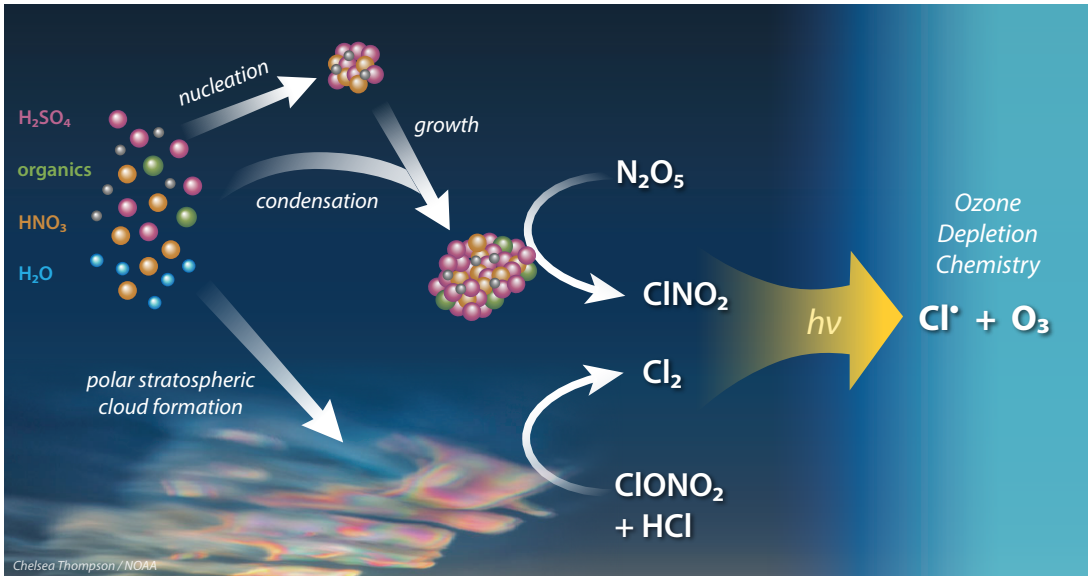
Current U.S. Government-owned fleet of aircraft used for atmospheric research and their capabilities. First published in The National Academies of Science, Engineering, and Medicine's report on *Future Use of NASA Airborne Platforms to Advance Earth Science Priorities*, May 2021.



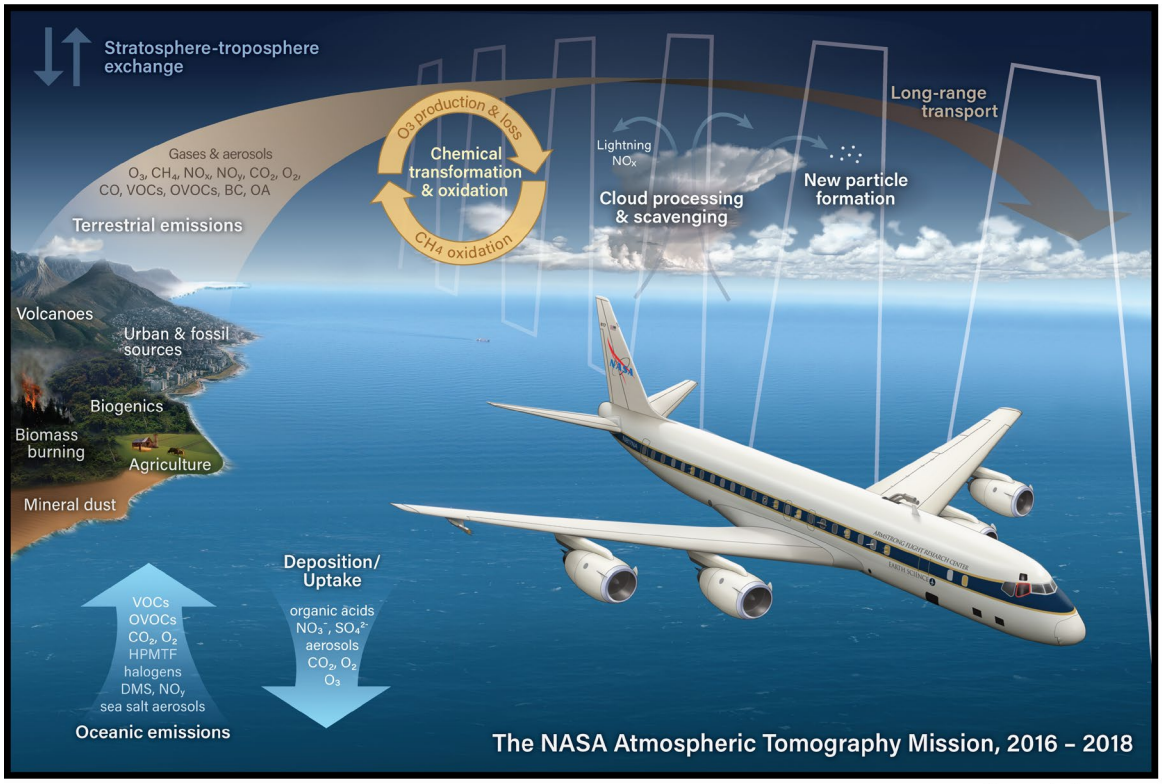
Integrated strategy for atmospheric research incorporating diverse tools and methods. First published in The National Academies of Science, Engineering, and Medicine's report on *Future Use of NASA Airborne Platforms to Advance Earth Science Priorities*, May 2021.



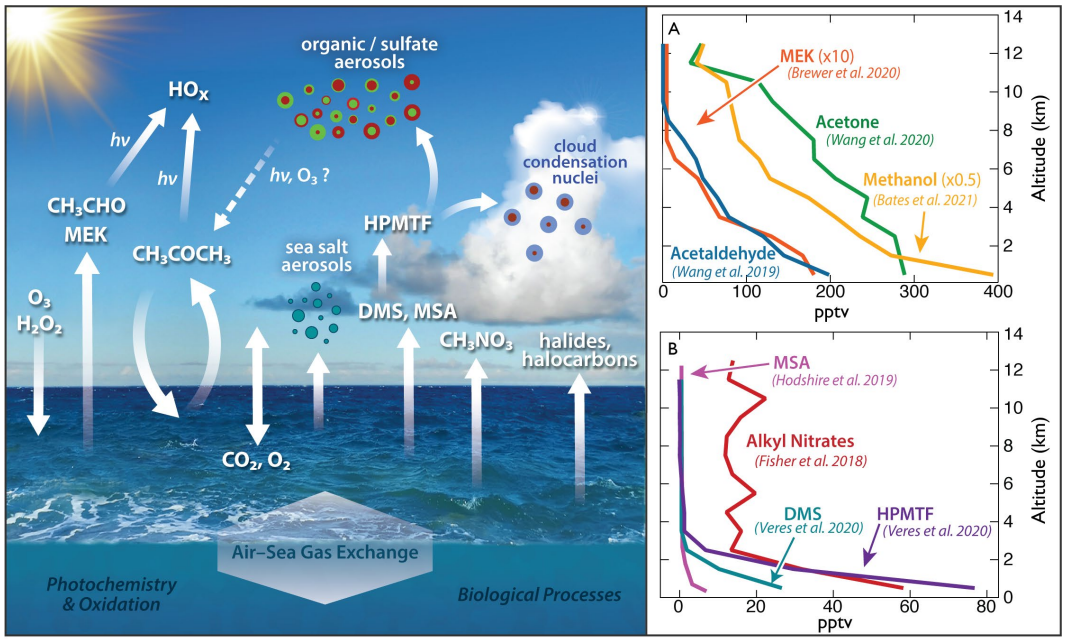
Overview of research topics pursued at the NOAA Chemical Sciences Laboratory, produced for internal and external communications.



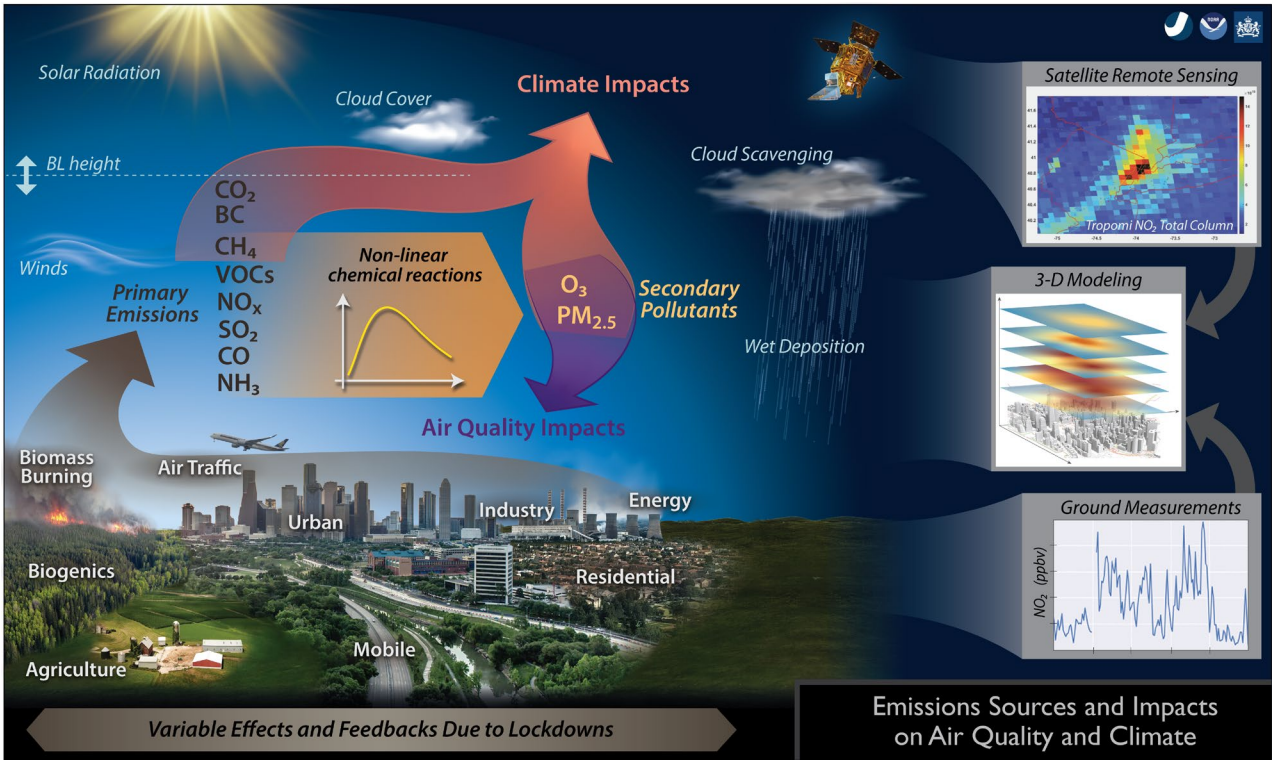
Schematic of heterogeneous chlorine chemistry occuring on stratospheric aerosols and polar stratospheric clouds, produced for scientific presentations.



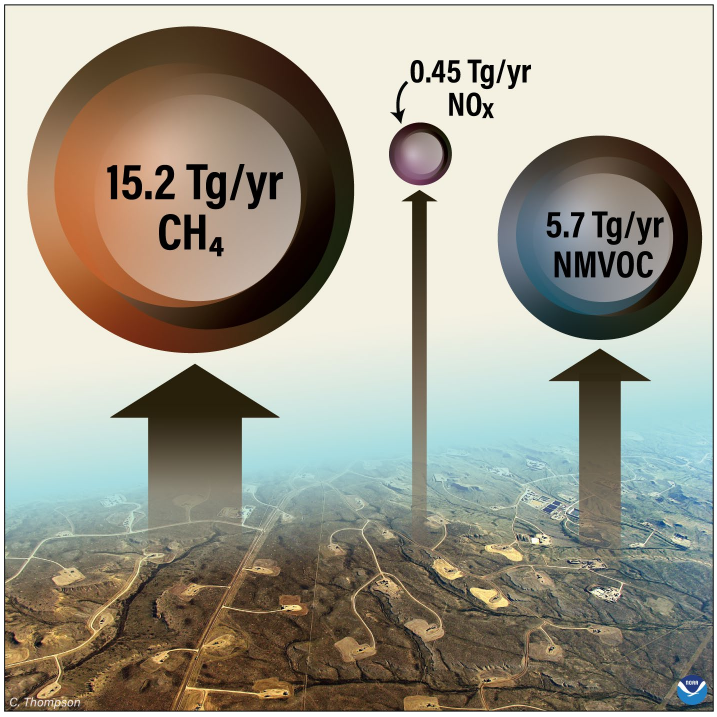
Schematic summarizing the primary gases, aerosols, and atmospheric processes studied during the NASA Atmospheric Tomography (ATom) mission, to be published in forthcoming mission overview publication *(Thompson et al., BAMS, submitted 2021)*. Digital rendering of aircraft by Dennis Dickerson, Respond Grafiks.



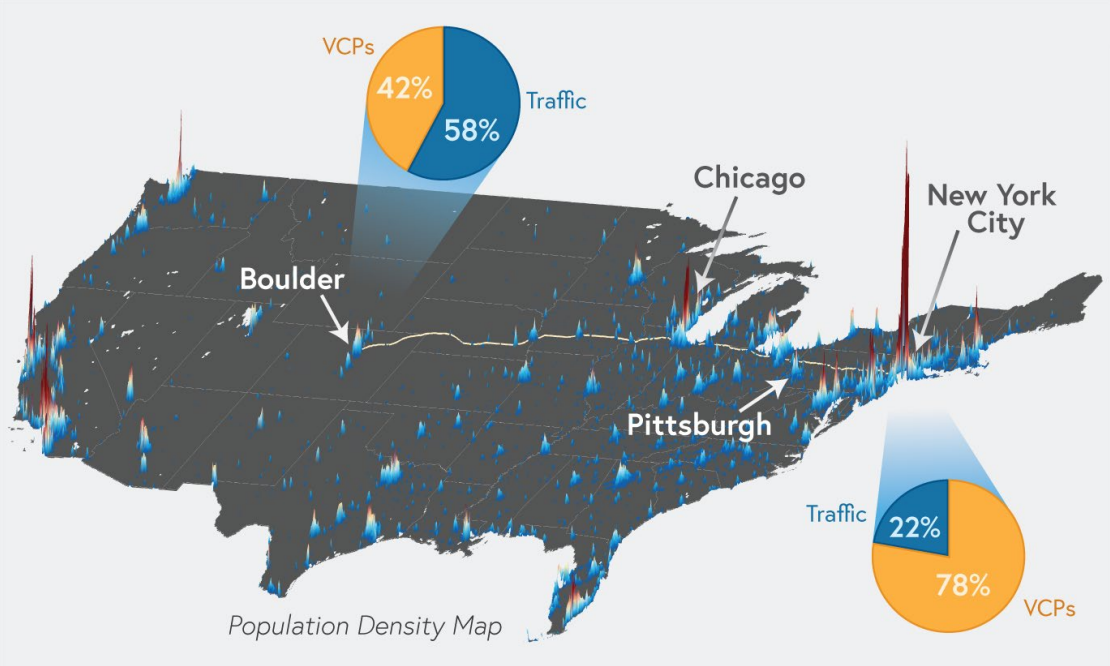
Schematic showing marine emitted/deposited gases and aerosols that have been studied to date using data from the NASA Atmospheric Tomography (ATom) mission, along with example vertical profiles observed during the mission, to be published in forthcoming mission overview publication *(Thompson et al., BAMS, submitted 2021)*.



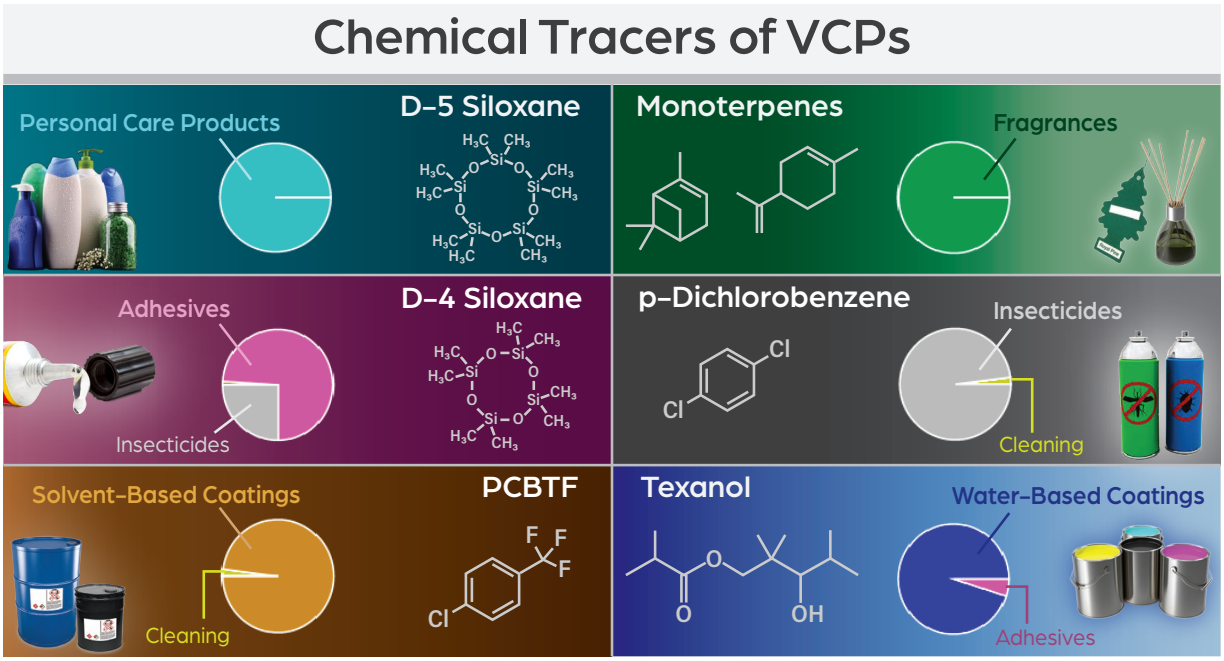
Schematic illustrating the diverse emissions sources that impact air quality and climate and the complex chemical and meteorological processes that can significantly affect observed levels of pollutants in the atmosphere. Produced for a publication reviewing a large body of scientific literature on reduced levels of pollution during the 2020 COVID-19 lockdowns (Gkatzelis et al., 2021).



Abstract / Table of Contents art for scientific journal article by Francoeur et al. (2021) illustrating the magnitude of emissions determined for U.S. oil and gas production basins.



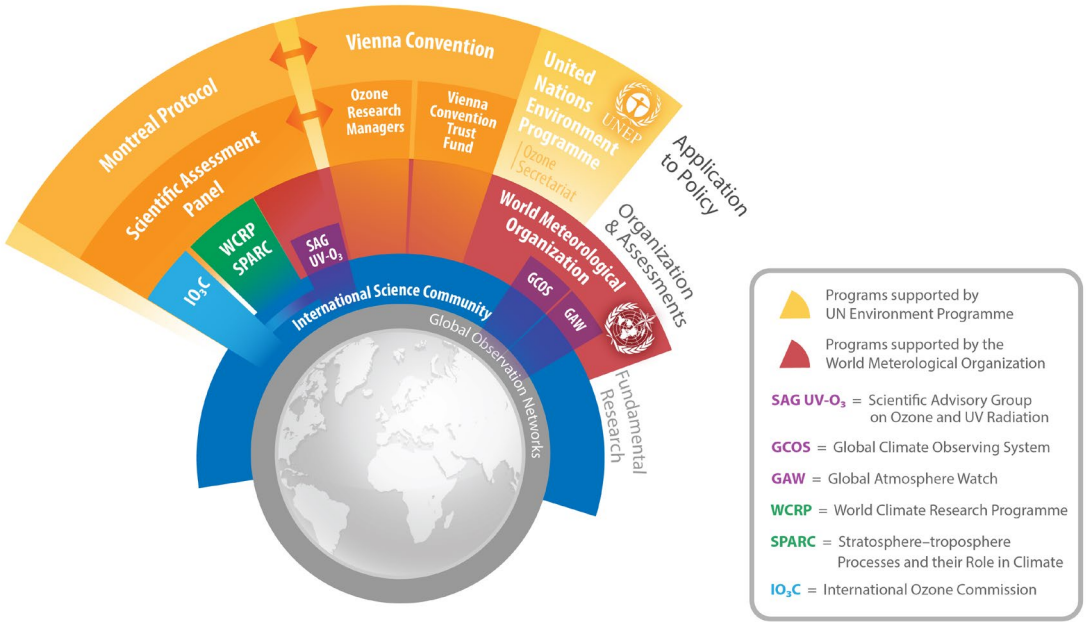
Abstract / Table of Contents art for scientific journal article by Gkatzelis et al. (2021) illustrating the relative contributions of traffic emissions and volatile chemical products (VCPs) emissions to total VOC emissions calculated for Boulder, Colorado and New York City.



Abstract / Table of Contents art for scientific journal article by Gkatzelis et al. (2020) showing six chemical compounds that are used as tracers to identify different categories of volatile chemical products in urban air.

Informational & Organizational Graphics

International Organizations Involved in Ozone Research



International organizations involved in ozone research with application to the Montreal Protocol. Produced for the United Nations Environment Programme Ozone Secretariat.

Stratospheric Ozone Depletion Science and Policy Milestones

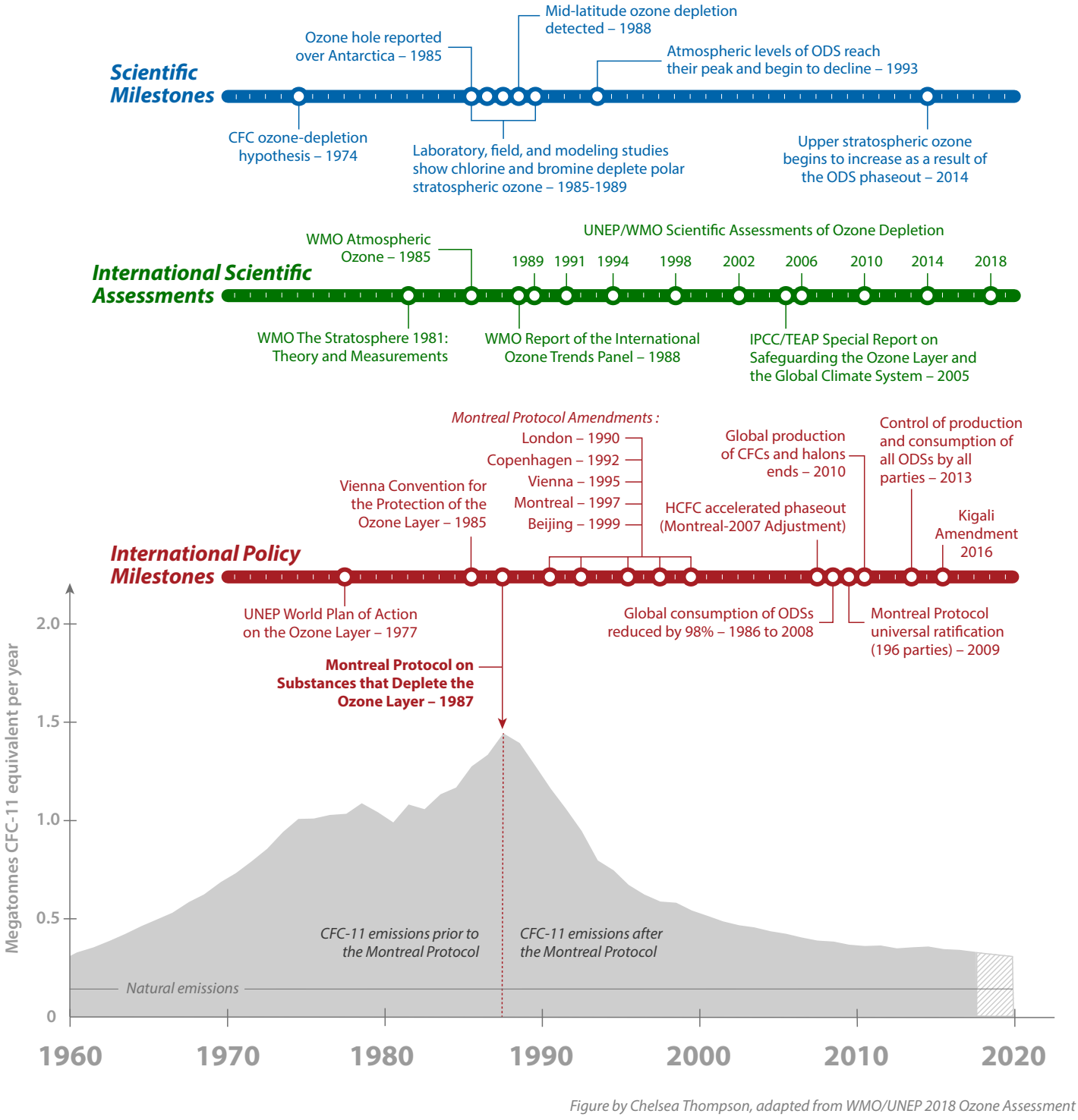
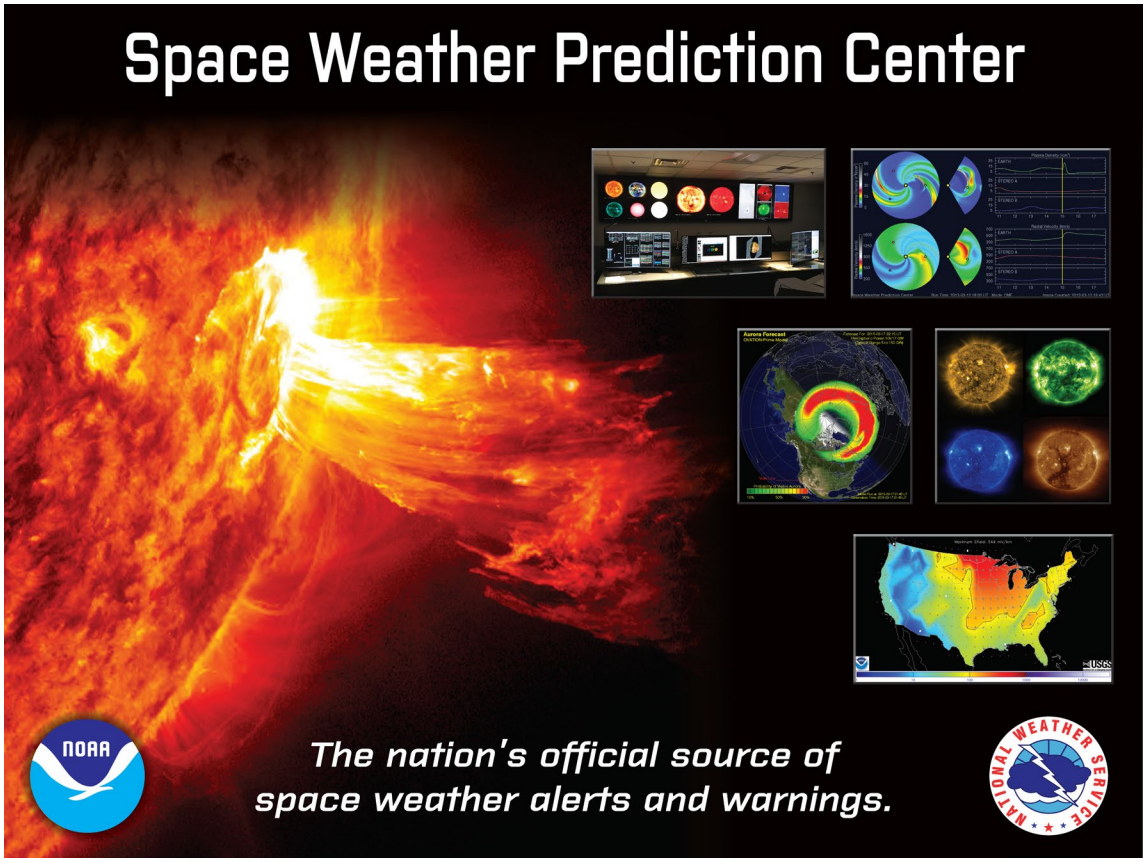
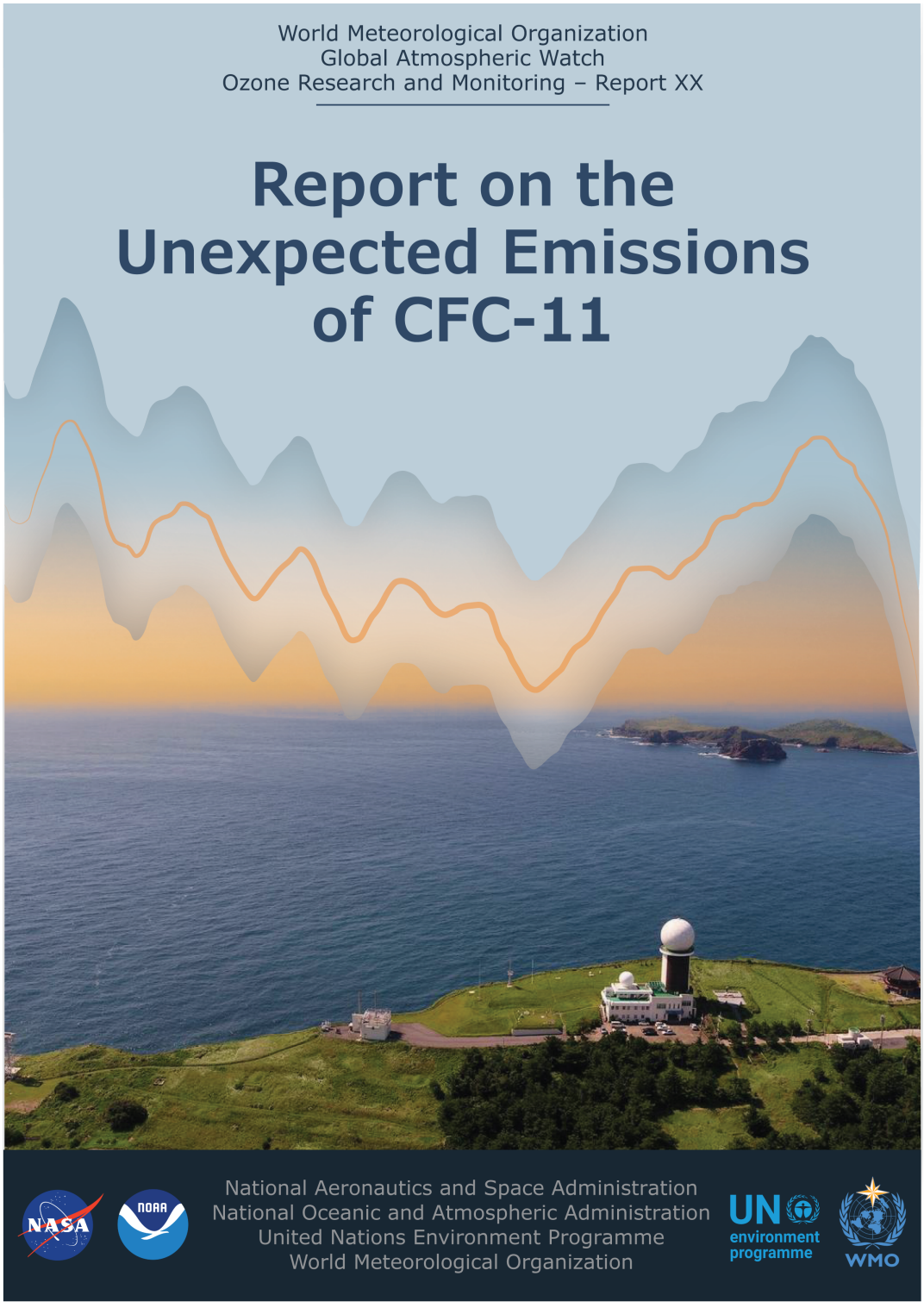


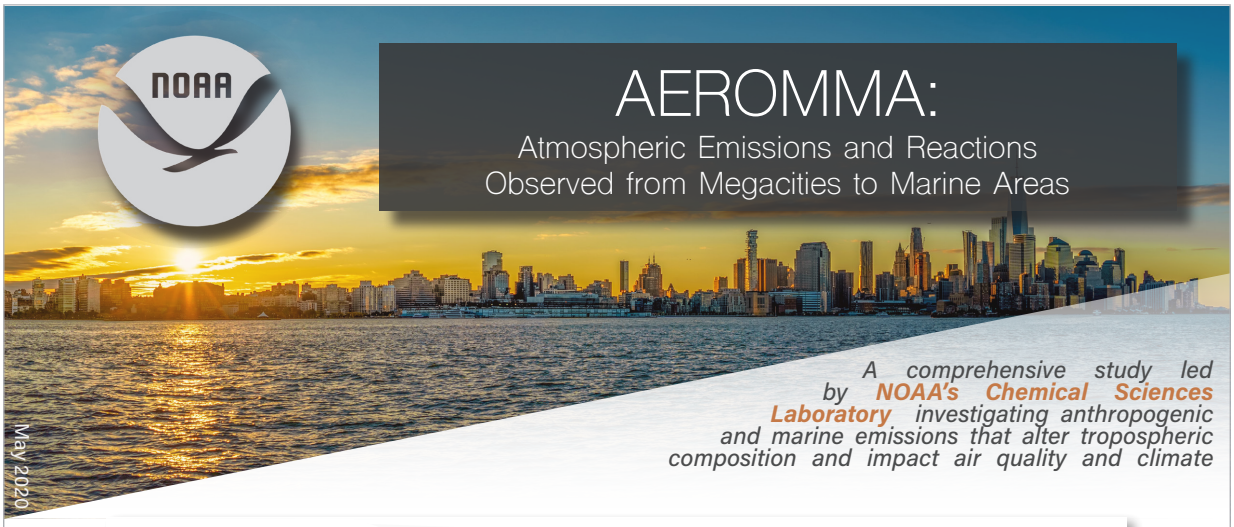
Figure by Chelsea Thompson, adapted from WMO/UNEP 2018 Ozone Assessment


Chemical Sciences Laboratory
CIRES
OZONE LAYER
AIR QUALITY
CLIMATE CHANGE
Advancing scientific understanding of climate change, air quality, and the stratospheric ozone layer.


Space Weather Prediction Center
The nation's official source of space weather alerts and warnings.

Brochures, Covers, & Report Layouts





AEROMMA:

Atmospheric Emissions and Reactions Observed from Megacities to Marine Areas

May 2020

*A comprehensive study led by **NOAA's Chemical Sciences Laboratory** investigating anthropogenic and marine emissions that alter tropospheric composition and impact air quality and climate*

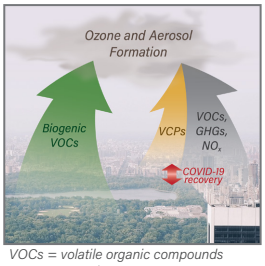
The AEROMMA project addresses emerging research needs in urban air quality, marine chemistry influences on cloud formation, and interactions at the marine-urban interface

NOAA research has identified an emerging source of volatile organic compounds to the urban atmosphere that contributes to ozone and aerosol

More than 100 million Americans live in non-attainment areas for ground-level ozone.

Tropospheric ozone is a toxic air pollutant formed through reactions involving VOCs and NO_x.

Volatile chemical products (VCPs) are emerging as a major urban source of petrochemical organics *[McDonald et al., Science, 2018]*.

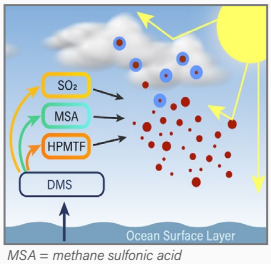


VOCs = volatile organic compounds
GHGs = greenhouse gases

A recent NOAA discovery has redefined the marine sulfur cycle, prompting a renewed look at air-sea exchange

Oxidation of ocean-emitted dimethyl sulfide (DMS) produces sulfate aerosol, which in turn impacts albedo, cloud formation, and climate.

CSD's discovery of an additional DMS oxidation product (HPMTF) shows that the marine sulfur cycle in current models is incomplete *[Veres et al., PNAS, 2020]*.

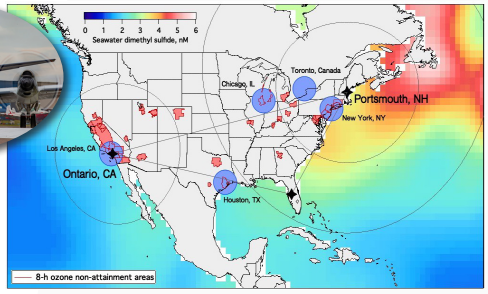


MSA = methane sulfonic acid
HPMTF = hydroperoxymethyl thioformate

AEROMMA will expand upon these new findings to assess their impacts on air quality and climate and improve our understanding of air pollution in a changing environment

Anticipated outcomes:

- Provision of timely information to environmental managers and stakeholder groups on emissions from VCPs and fossil fuel sources that impact climate and air quality.
- Assessment of emissions recovery following the COVID-19 economic slowdown
- Reduction of uncertainties in global climate models due to marine aerosols from biogenic sulfur emissions.
- Provision of urban and marine datasets to improve the representation of emissions and chemical and physical processes in the next generation NOAA weather-chemistry models.



AEROMMA will use an extensively instrumented NOAA P-3 research aircraft through a series of flights in May - July 2021. The aircraft will base in California and New England to access several major coastal and inland cities and two ocean basins. The P-3 flight range is indicated as rings on the above map.

For more information, contact Carsten Warneke (carsten.warneke@noaa.gov) or Patrick Veres (patrick.veres@noaa.gov)


National Oceanic and Atmospheric Administration
Oceanic and Atmospheric Research
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CSL STRATEGY 2021 - 2026
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NOAA CHEMICAL SCIENCES LABORATORY
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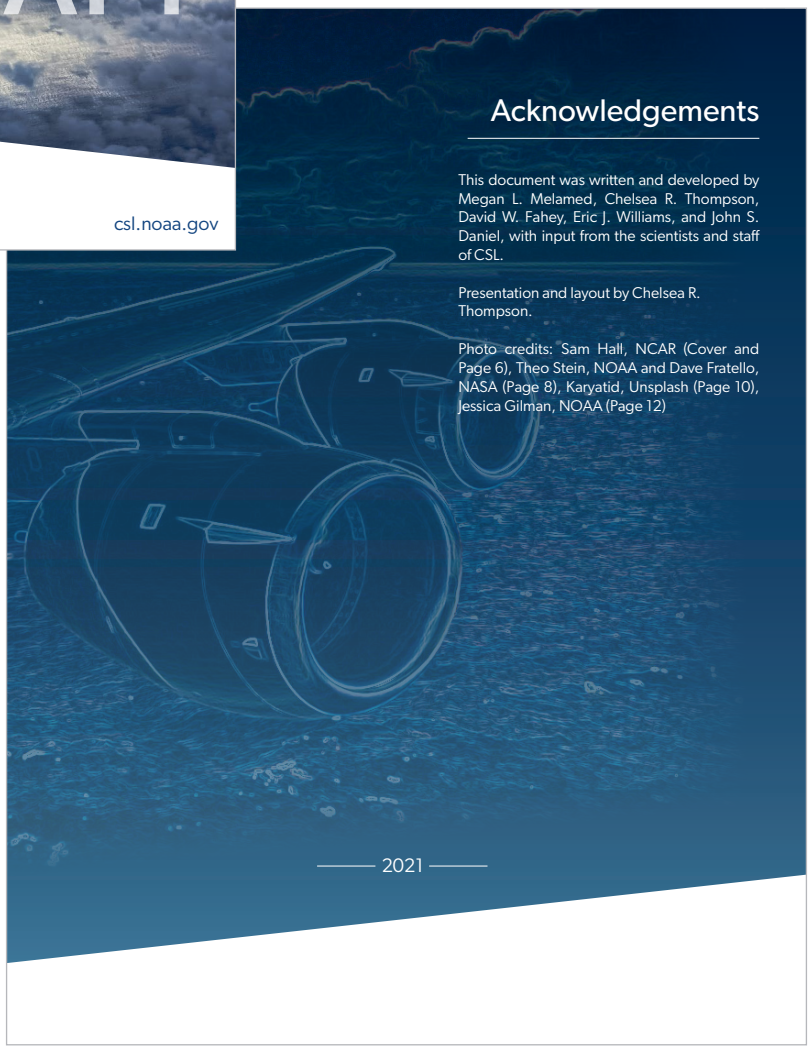
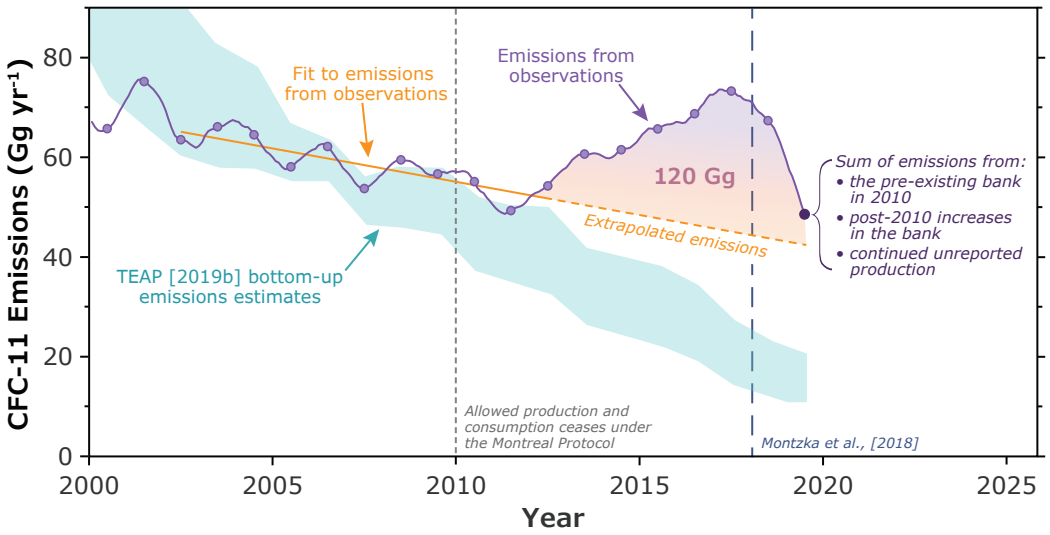

Acknowledgements
This document was written and developed by Megan L. Melamed, Chelsea R. Thompson, David W. Fahey, Eric J. Williams, and John S. Daniel, with input from the scientists and staff of CSL.
Presentation and layout by Chelsea R. Thompson.
Photo credits: Sam Hall, NCAR (Cover and Page 6), Theo Stein, NOAA and Dave Fratello, NASA (Page 8), Karyatid, Unsplash (Page 10), Jessica Gilman, NOAA (Page 12)
2021

Scientific Data Figures & Graphs



published in WMO Report on the Unexpected Emissions of CFC-11 (2021), Executive Summary

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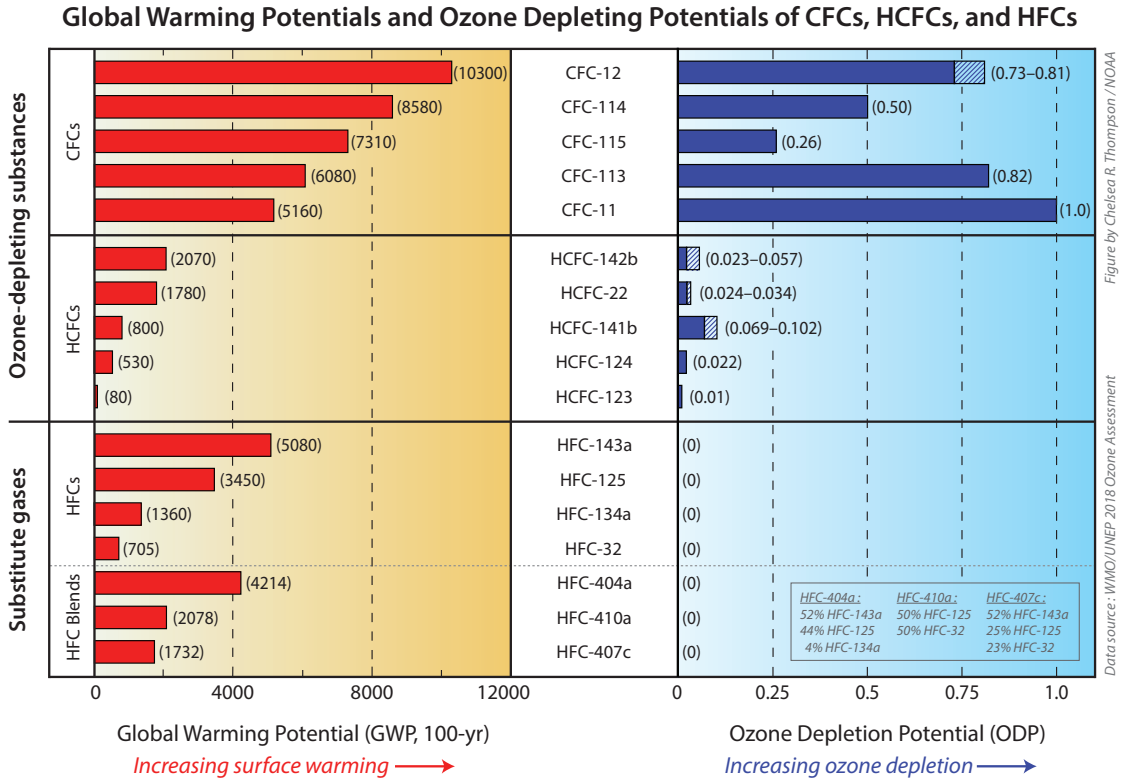
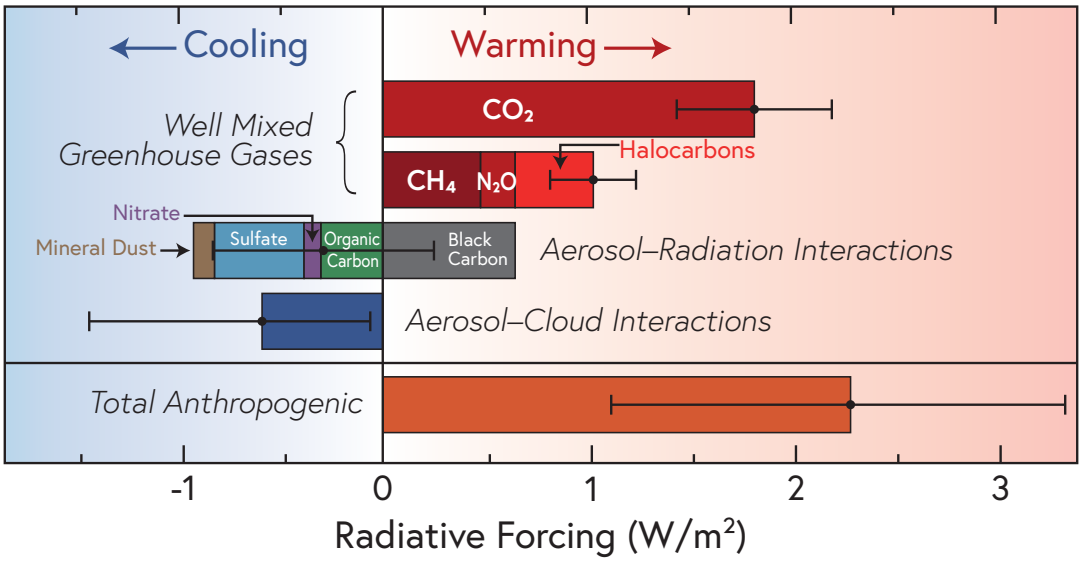
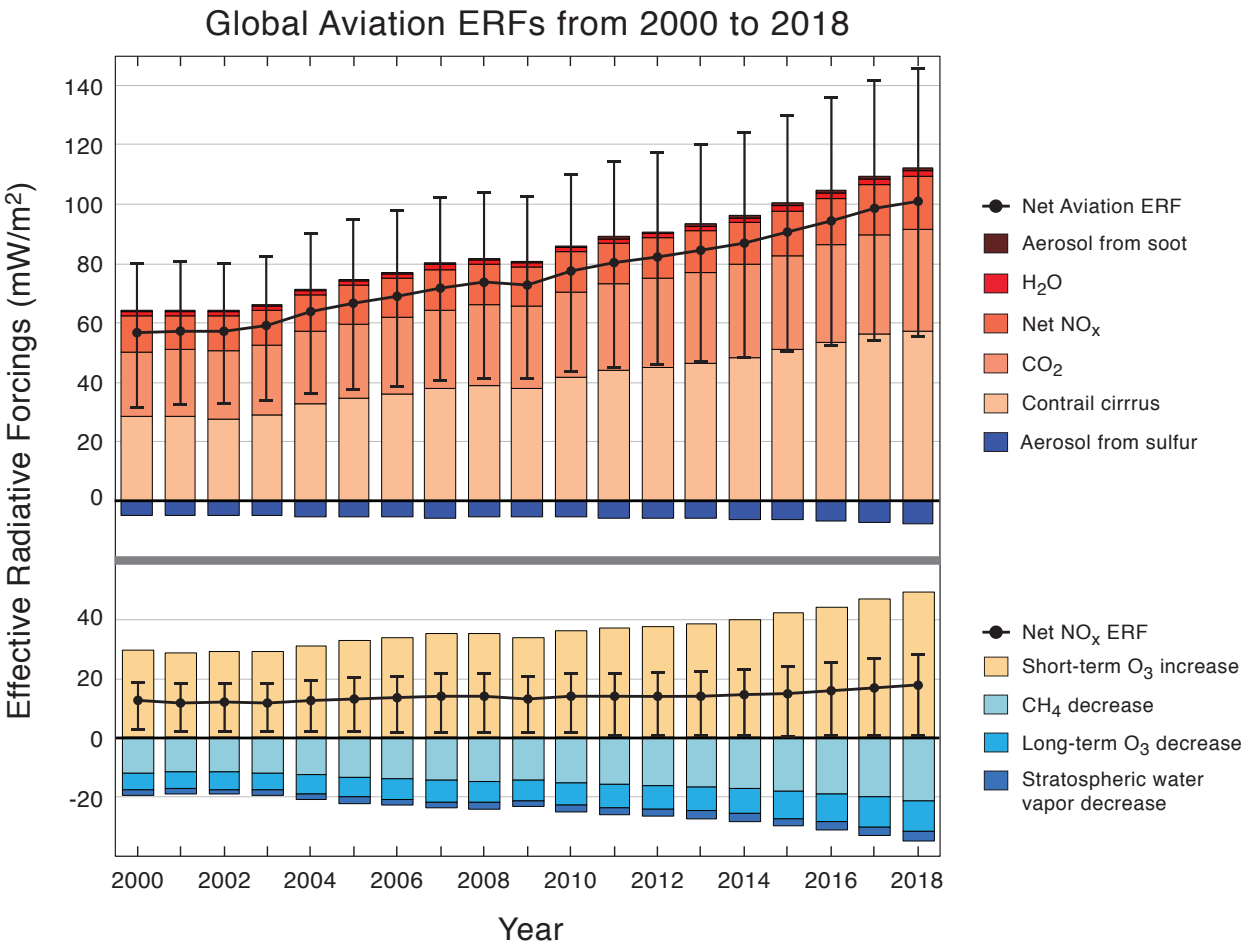
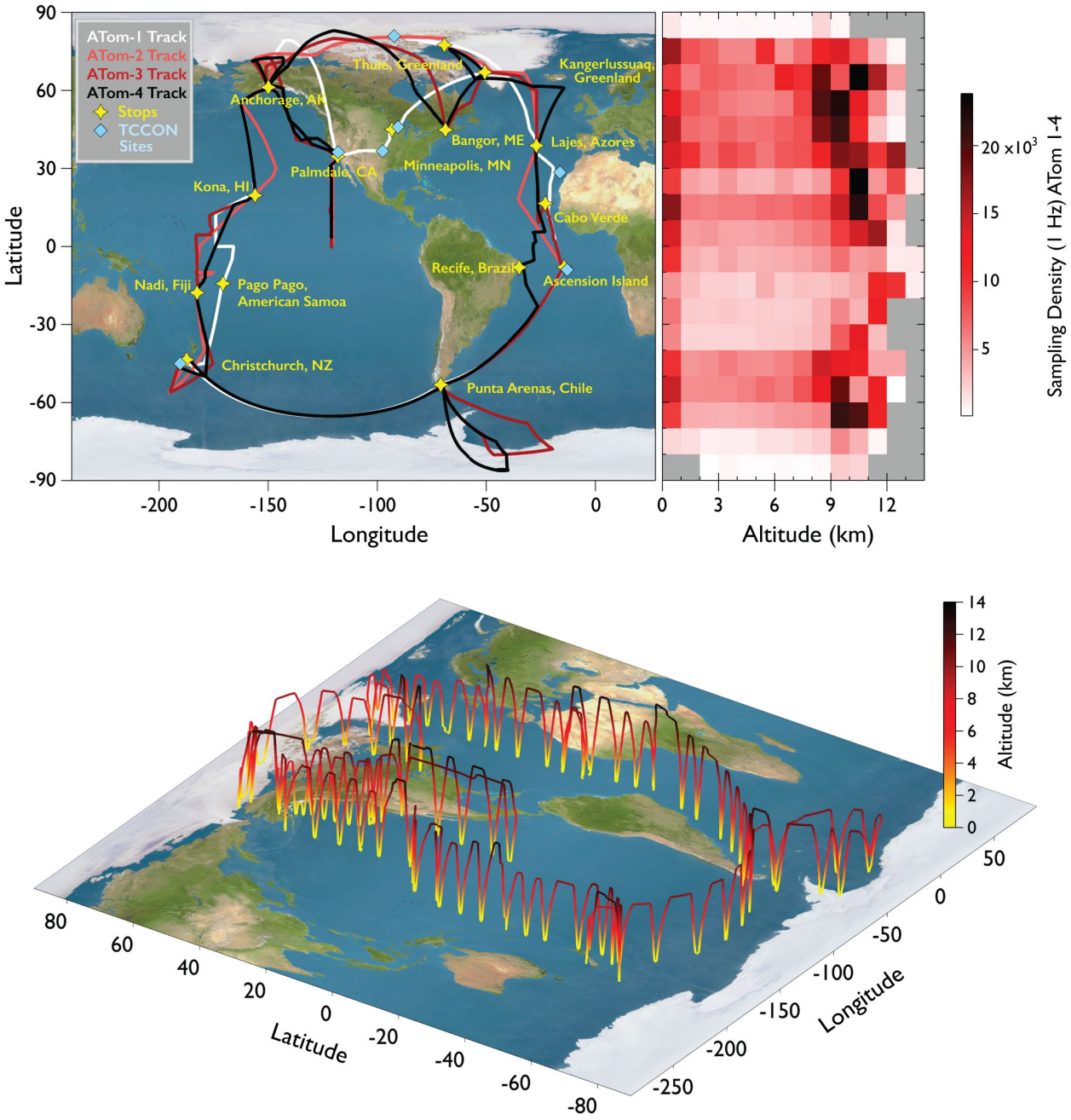




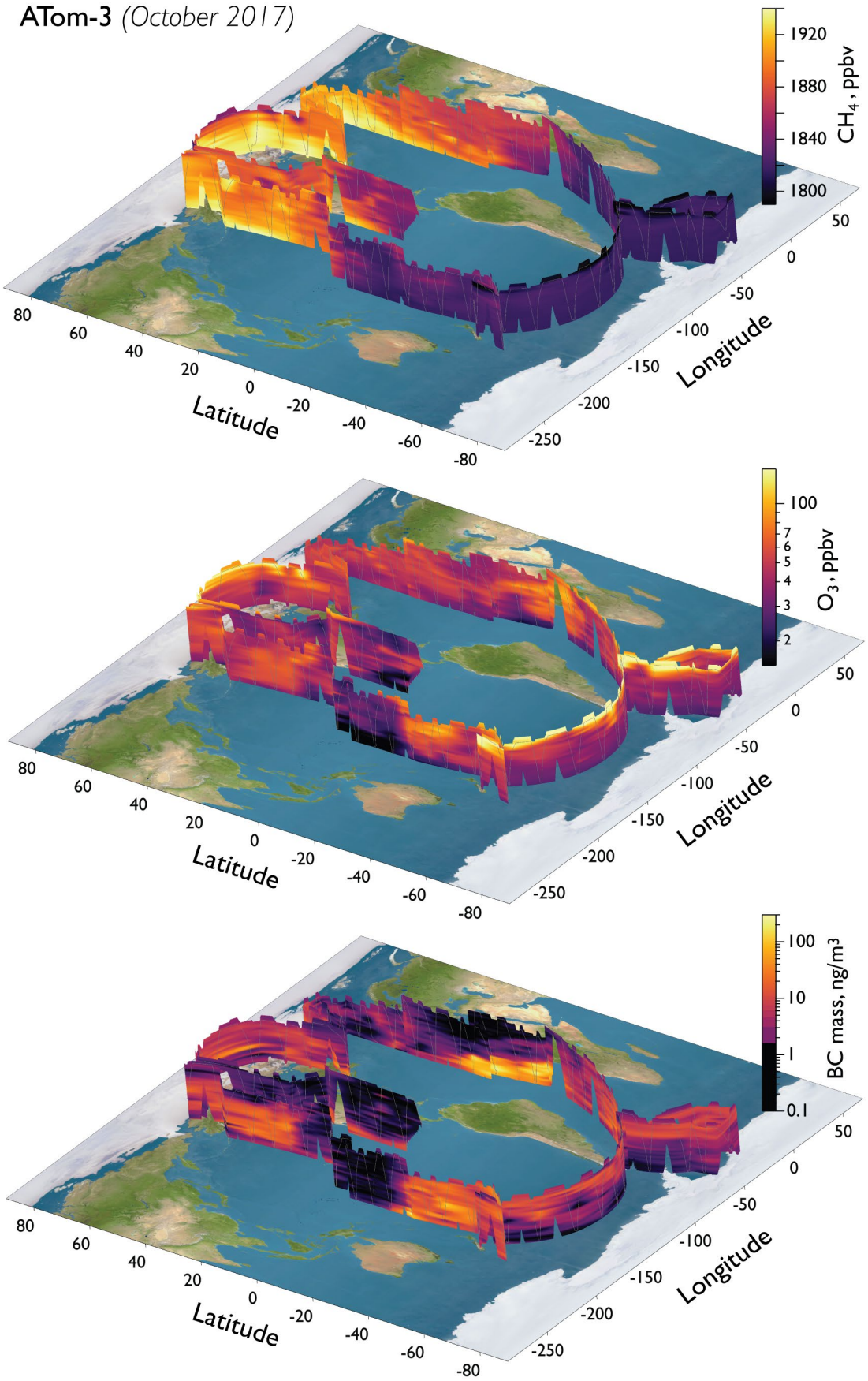
Radiative forcing of aerosol direct and indirect effects relative to greenhouse gases, from the *NOAA State of the Science Fact Sheet on Aerosols, Weather, and Climate, 2021 update.*



Effective radiative forcing (ERF) of global aviation emissions and feedbacks and growth in net ERF with time. Published in *Lee et al., 2020*

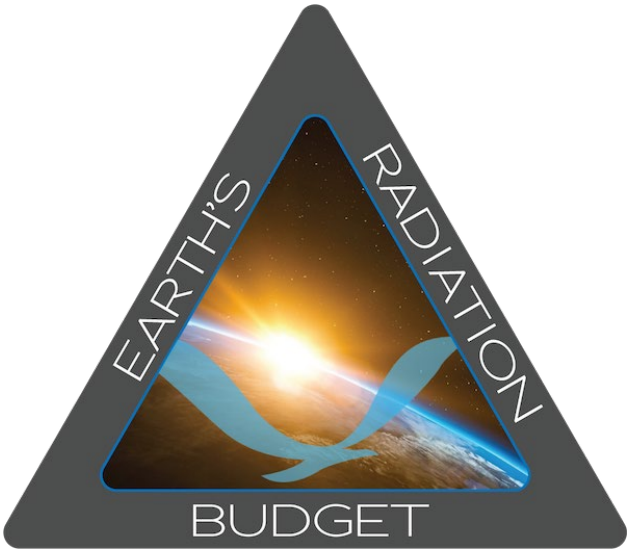


Top: Flight tracks followed on the NASA Atmospheric Tomography mission and measurement coverage as a function of latitude and altitude. Bottom: 3-D representation of the ATom-3 flight track, showing the repeated vertical profiles performed throughout the circuit. *(Thompson et al., BAMS, submitted 2021)*



Observations of methane, ozone, and black carbon collected during ATom-3 and interpolated to the 3-dimensional flight track. *(Thompson et al., BAMS, submitted 2021)*

Organization & Project Logos




LA
VEGAS
SUNVEx'21
SOUTHWEST URBAN
NOx AND VOC EXPERIMENT


NOAA
2023
AEROMMA
Atmospheric Emissions and Reactions
Observed from Megacities to Marine Areas


CUPiDS
Coastal
Urban Plume
Dynamics
Study
2023