



# Rendezvous2021

Annual Science Symposium • May 21

## Celebrate outstanding science with your CIRES colleagues!

The CIRES Members' Council is pleased to announce the 16<sup>th</sup> annual CIRES Rendezvous. This institute-wide symposium spotlights the depth, breadth, and quality of the pacesetting science being done at CIRES. We hope to encourage collaborations that might result in new interdisciplinary research, and to facilitate connections among our many innovative scientists, science support staff, and administrative staff. The event includes an entire afternoon devoted to science and poster presentations by CIRES members.

### AGENDA

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**10:00 AM - 11:30 AM STATE OF THE INSTITUTE/AWARDS (via [YouTube Link/Live Stream](#))**

**11:30 AM - 12:30 PM BREAK/GRAB SOME LUNCH (on your own)**

**12:30 PM -1:00 PM GETTING TO KNOW TOPIA/PHASING IN (via [Topia Link](#))**

**1:00 PM - 4:30 PM POSTER SESSIONS/CHANCE TO INTERACT WITH COLLEAGUES**

**(The entire Poster Session will be in Topia. Use the [Topia Link](#) to participate.)**

**Find the list of poster abstracts and the schedule of poster talks here:**

**<https://ciresevents.colorado.edu/rendezvous/posters>**

Hosted by



[cires-cmc@lists.colorado.edu](mailto:cires-cmc@lists.colorado.edu)

# From the Director

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Dear Colleagues,

Welcome to the annual CIRES Rendezvous! It is hard to believe that we have been working in a largely remote capacity for over a year now. Clearly, this challenge hasn't slowed us down: FY20 funding was \$105.9M, an all-time high for CIRES, and our research productivity remained high. You will hear about an incredible diversity of research accomplishments during Rendezvous this year: CIRES scientists are presenting on ocean-sea ice-atmospheric forecasting improvements in the Arctic; tense water management issues in the Dolores River watershed; subsidence in Lagos, Nigeria; and innovations in understanding aerosol formation and various air pollutants.

You'll also see updates from MOSAiC, which provided new knowledge on Arctic sea ice, and impressive investigations into the atmosphere during COVID. CIRES scientists and colleagues sought to understand more about the atmosphere during the pandemic's shutdowns, and learned a great deal.

I'm grateful for your efforts. You've shown that CIRES is nimble and able to respond quickly to the urgent environmental science questions of the day.

While we are a research institute full of world-class scientists and many leaders in our fields, I am very proud of our students, as well. CIRES just recognized seven graduate students with research awards to support their impressive work. These and other early-career researchers will no doubt ensure our legacy continues and that CIRES will remain a world leader in environmental research.

I would like to express my most sincere gratitude to and respect for each of you for your unique, shared, and critical contributions to the success of CIRES. This year has presented challenges unlike any we have seen before. But once again, the quality of our research, its importance to society, and the commitment and talent of our people who conduct and support that research make CIRES stand out. So thank you all for your efforts. Thank you for all we have collectively achieved in the past year, and most importantly: Thank you for all for your commitments to the successful execution of our mission. The world is a better place because of CIRES and because of you!

Sincerely,

A handwritten signature in blue ink, appearing to read 'Waleed Abdalati', written over a white rectangular background.

Waleed Abdalati  
CIRES Director

## 5 Years of Service

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Eric Adamson  
Seth Arens  
Athanasios Boudouridis  
Mary Ellen Byers  
Susan Cobb  
Matthew Coggon  
Finn Dahl  
Candida Dewes  
Hui Ding  
Michael Erickson  
Matthew Fisher  
Dominic Fuller-Rowell  
Audrey Gaudel  
Guoqing Ge  
Benjamin Green  
Anne Handschy  
Gaelle Hervieux  
Kristopher Karnauskas  
Michael Laxer  
Erin LeFevre  
Wen Wei Liao  
Kathryn McKain  
Julia McMillen  
Paul Moth  
John Mund  
Matthew Price  
Erin Reeves  
Richard Saltus  
Kenneth Schuldt  
Daniel Seaton  
Sang-Ik Shin  
Laura Slivinski  
Lawrence Spencer  
Diana Stovern  
Kristy Tiampo  
Daniel Wilkinson  
Christina Williamson  
Li Zhang  
Mistia Zuckerman

## 10 Years

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Pedro Campuzano-Jost  
Daniel Crumly  
Patrick Cullis  
Douglas Day  
Raina Gough  
Shilpi Gupta  
Emiel Hall  
Jessica Henley  
Eric James  
Larisa Krista  
Matthew Love  
George Millward  
William Moninger  
Donald Murray  
Timothy Newberger  
Dusan Odstrcil  
Gopakumar Padmanabhan  
Jocelyn Turnbull  
Adam Woods  
Takanobu Yamaguchi

## 15 Years

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Rainer Bleck  
Xinzhao Chu  
Marc Cloninger  
Molly Crotwell  
Curt de Koning  
Irina Djalalova  
Ratina Dodani  
Barry Eakins  
Mariangel Fedrizzi  
Fred Fehsenfeld  
Noah Fierer  
Andrew Jacobson  
Justin Mabie  
Carrie Morrill  
Jeffrey Peischl  
Gabrielle Petron  
Naomi Rempel  
Sonja Wolter

## 20 Years

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Elizabeth Cassano  
John Cassano  
Richard Grubb  
Peter Molnar  
Robert Pincus  
Betsy Sheffield  
William R. Travis

## 25 Years

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Florence Fetterer  
Fred Moore  
Christoph Senff

## 30 Years

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Paul Johnston  
Tim Fuller-Rowell

## 35 Years

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Don "Hoop" Hooper  
Duane Kitzis

## 40 Years

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Robert E. Sievers

# PROMOTIONS

## Associate Scientist II

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Matthew Gentry  
Christian Herrera

## Research Scientist II

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Adam Ahern  
Christopher Amante  
Alison Banwell  
Ilann Bourgeois  
Kai-Lan Chang  
Yaosheng Chen  
Jake Gristey  
Meng Li  
Courtney Peck  
Matthew Rossi  
Hannah Vagasky  
Isaac Vimont

## Associate Scientist III

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Michael Brandt  
Ratina Dodani  
William Diment  
Thomas Falkowski  
Matthew Fisher  
Jessica Henley  
Gaelle Hervieux  
Zhuxiao Li  
Laura Melling  
Paul Moth  
Jay Patel  
Erin Reeves  
Molly Smith  
Adam Woods  
Mistia Zuckerman

## Research Scientist III

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Hazel Bain  
Laura Bianco  
Matthew Druckenmiller  
Benet Duncan  
Jason English  
Mariusz Pagowski

## Senior Associate Scientist

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Andrew Barrett  
Kimberly Baugh  
Nathan Campbell  
Kelly Carignan  
Finn Dahl  
Kathryn Heightley  
Erin LeFevre  
Evan McQuinn  
Elizabeth Ossowski  
William Rowland  
Aaron Sweeney  
Ken Tanaka

## Senior Research Scientist

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Barry Eakins  
Maria Capotondi  
Michael Hobbins  
Siri Jodha Singh Khalsa  
Manoj Nair

## Administrative Associate III

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Anna Fudale  
LuAnn Line  
Rebecca Stossmeister

## Senior Administrative Associate

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Kathleen Bogan  
Lone Hansen  
Karin Vergoth

# AWARDS



CIRES scientists are often integral to NOAA award-winning science and engineering teams but cannot be given certain federal awards, such as the prestigious Department of Commerce Gold, Silver, and Bronze Medals. The CIRES Director recognizes the extraordinary achievements of CIRES scientists working in partnership with federal colleagues.

## CIRES Gold Medals

### Philip Pegion

For development and accelerated implementation of NOAA's flagship Global Forecast System GFSv15.1, a foundation for FV3 based Unified Forecast System.

### Geoff Dutton, Lei Hu, J. David Nance, Debra Mondeel, Fred Moore, Ben R. Miller, Eric Ray, Carolina Siso

For discovering the recent production and release of CFC-11, indicating a major violation of the Montreal Protocol.

**MORE AWARDS ON NEXT PAGE**

## CIRES Gold Medals (continued)

**Finn Dahl, Barry Eakins, Erin LeFevre, Elliot Lim, Brian Meyer, Rick Saltus**

For successful orchestration of seafloor mapping & data science initiatives imperative to fulfill U.S. Extended Continental Shelf (ECS) project goals.

**Juan V. Rodriguez, William Rowland, Margaret Tilton**

For innovative engineering and science approach that avoided \$28M in repair cost to deliver NOAA instruments to Metop-C to improve weather forecast.

## CIRES Gold Medal SWPC Group Plaque

**The CIRES SWPC Team including Hazel Bain, Ratina Dodani, Mariangel Fedrizzi, Dominic Fuller-Rowell, Kiley Gray, Jeffrey Johnson, Ben Rowells**

For the planning, development, and implementation of a brand new space weather forecast service to support international aviation requirements.

## CIRES Silver Medal

**Gilbert P. Compo, Don “Hoop” Hooper, Chesley McColl, Prashant D. Sardeshmukh, Laura C. Slivinski, Catherine Smith, Lawrence J. Spencer**

For creating a 200-year Historic Reanalysis dataset of global weather and extremes from only surface pressure and sea surface temperature observations.

## CIRES Bronze Medals

**Matthew Martinsen**

For eliminating any potential Mauna Loa Observatory sources of CFC-11 and other trace gases to ensure integrity of long-term data records.

**Adam Ahern, Ravan Ahmadov, Kenneth Aikin, Ilann Bourgeois, Wyatt Brown, Pedro Campuzano-Jost, Matthew Coggon, Douglas A. Day, Zachary Decker, Hongyu Guo, Jose-Luis Jimenez, Joseph Katich, Aaron Lamplugh, Macy Morgan, Benjamin Nault, J. Andrew Neuman, Demetrios Pagonis, Jeff Peischl, Derek Price, Pamela Rickly, Michael A. Robinson, Mindy Schueneman, Donna Sueper, Carsten Warneke, Ann Weickmann, Caroline Womack, Michael Zucker**

For outstanding execution of the FIREX-AQ mission, a joint venture with NASA to improve understanding of air quality and climate impacts of fires.

**Terence Bullett, Justin Mabie, Brian Meyer**

For securely relocating environmental records from Colorado to North Carolina, preserving and ensuring accessibility to the data and reducing costs.

## CIRES Administrator Plaques

**Dave Allured, Irina Djalalova**

For implementing and upgrading NOAA's Air Quality Forecasting Capability for improving the lives of Americans and saving billions of dollars per year.

**Adam Ahern, Kenneth Aikin, Megan Bela, Ilann Bourgeois, Matthew Coggon, Zachary Decker, Karl Froyd, Maxwell Holloway, Joseph Katich, Aaron Lamplugh, Brian McDonald, Stuart McKeen, Macy Morgan, J. Andrew Neuman, Jeff Peischl, Catherine Rasco, Pamela Rickly, Michael A. Robinson, Kyra Slovacek, Troy Thornberry, Richard Tisinai, Nicholas L. Wagner, Carsten Warneke, Laurel Watts, Ann Weickmann, Christina J. Williamson, Caroline Womack, Michael Zucker**

For the planning and conduct of the largest interdisciplinary research project ever to study wildfire smoke composition, chemistry, and evolution.

**MORE AWARDS ON NEXT PAGE**

# AWARDS

## CIRES Administrator Plaques (continued)

**Christian Bethge, Athanasios Boudouridis, Samuel Califf, Stefan Codrescu, Jonathan Darnel, Kevin Hallock, J. Marcus Hughes, Fadil Inceoglu, Brian Kress, Larisza Krista, Anna Liao, Paul Loto'aniu, Janet Machol, Courtney Peck, Juan V. Rodriguez, William Rowland, Daniel Seaton, Jason Shapiro, Margaret Tilton, Pamela Wyatt, Erika Zetterlund**

For achieving a fully operational GOES-R constellation, culminating a decades-long effort.

## Technology Transfer Plaques

**Richard McLaughlin, Hagen Telg, Troy Thornberry, Laurel Watts**

For creating a unique instrument to measure atmospheric particles and helping a small company successfully commercialize it to yield \$1M+ in sales.

## NCEI Awards

### NCEI-CO ARCHIVE STORAGE SOLUTION PROJECT

**Charles Anderson, Veronica Martinez, William Rowland, Carrie Wall Bell, Pamela Wyatt**

The security of NCEI archival storage is of critical importance to NOAA and our global network of external users. This group of individuals is being recognized for their outstanding service to ensure the NCEI archive remains reliable and accessible. The team

worked together under strict time constraints to secure additional archival storage space at NCEI-Colorado. This effort required determining current and future archive requirements, identifying and evaluating various alternatives, effectively communicating the group's findings to NCEI leadership, and implementing the preferred solution. The collaborative approach taken by these individuals serves as a model for other cross-office discussions and reflects the spirit of OneNCEI.

### NCEI-CO STEWARDSHIP OPERATIONS AND MAINTENANCE PROJECT

**Dave Neufeld, Erin Reeves, Ken Tanaka, Carrie Wall Bell, Georgie Zelenak**

This collaboration award is to recognize the joint ITSD-CCOG effort to address NCEI's CO stewardship operations and maintenance challenges. This group began an effort a year ago to address data archive and delivery issues with the NCEI-CO infrastructure, and since then they have made real and measurable improvements as evidenced by turning items in the NCEI Operations Report 'green'. To achieve these results, NCEI employees worked collaboratively and strengthened the working relationship between ITSD and CCOG. Everyone exhibited the deepest commitment to the NCEI mission and a OneNCEI approach that has resulted in success.

### NCEI-NC PARALLELS MIGRATION

**Ed Gille**

NCEI has been running a significant portion of its IT server hosting platform on an old virtualization technology called Parallels Virtuozzo, commonly called "Parallels". The platform stopped receiving security and maintenance upgrades from the provider several years ago, and NCEI adopted at the time a replacement platform called Ovirt. In an effort that has spanned the past four years, NCEI personnel from all divisions and centers have worked together towards the migration of the platform from Parallels to Ovirt.



## CIRES Outstanding Performance Awards: Science

**CRITERIA 1:** Development of new scientific, engineering and/or software tools or models directly resulting in novel research valuable to CIRES and the wider scientific community.

**CRITERIA 2:** Uncommon initiative, resourcefulness, and/or scientific creativity conducting research with potential to expand or change the direction of a particular field or discipline.

**CRITERIA 3:** Participation in collaborative and/or multidisciplinary research that engages a broader cross-section than the nominee's typical scientific or engineering community.

The OPA committee has selected these winners in the Science category:

### **Patrick Alken**

NCEI

Recognized for successfully leading the development, validation and release of the 13th International Geomagnetic Reference Field, a widely used reference geomagnetic model developed by a collaboration of 15 teams representing over 30 international institutes, and for developing new methods to infer geomagnetic main field models from various datasets, including satellite platform magnetometer data. Patrick is a co-chair of the International Association of Geomagnetism and Aeronomy Working Group V-MOD: Geomagnetic Field Modeling. Patrick's nomination praised his scientific expertise, creativity, leadership skills and multidisciplinary collaborations.

### **Pedro Campuzano Jost, Douglas Day, Demetrios Pagonis, Hongyu Guo, Donna Sueper (with citations for past CIRES employees Benjamin Nault, Jason Schroder, and David Thomson)**

CIRES/CU AEROSOL MASS SPECTROMETRY TEAM, JIMENEZ GROUP

Over the past ten years, the team has systematically developed and engineered the world's most comprehensive and high performance flight instrument for quantitatively measuring aerosol chemical composition. They are recognized as talented, hard-working, effective and dedicated collaborators. The measurements from different aircraft campaigns provide new insights into the distribution and composition of aerosols, their sources and transformation and support model evaluations and improvements. The CIRES AMS group was part of the larger team recognized by the NASA Group Achievement Award for the SEAC4RS, KORUS-AQ, ATom, and FIREX-AQ missions (NASA, 2021) and the NOAA Bronze Medal for outstanding execution of the FIREX-AQ mission.

### **Ravan Ahmadov, Eric James, Stuart McKeen**

GSL/CSL

Recognized for leading a multi-year effort to implement a biomass burning module in an existing hourly Numerical Weather Prediction system (NWP). Based on satellite observations of fire location and intensity, the High-Resolution Rapid Refresh (HRRR) now predicts the movement of smoke in three dimensions across the U.S. over 48 hours, simulating how weather will impact smoke movement and concentrations, and also how smoke will affect visibility, temperature and wind. This model was implemented into NOAA National Weather Service (NWS) operations on December 2, 2020, which makes the NWS the first of the main large operational centers in the world to effectively use aerosols from biomass burning in their highest resolution NWP model.

### **Matthew Coggon**

CSL

Recognized for changing our understanding of urban and wildfire ozone formation and resulting air quality impacts by pioneering experimental and numerical chemical modeling work on biomass burning and volatile chemical product emissions. His research is critical to CIRES' and our nation's need to understand and manage the air quality in major urban centers and wildfire-impacted areas. Matthew was recently awarded an EPA Science to Achieve Results grant to improve our understanding of the role of volatile chemical products on ambient air quality. In addition to his technical work, Matthew is one of the founders of "Science on Tap" and he regularly mentors students in science and engineering. Recently, Matthew co-founded a study group within NOAA CSL to examine issues of diversity and inclusion.

## CIRES Outstanding Performance Awards: Service

**CRITERIA 1:** Implementation of a creative or innovative idea, device, process, or system that aids in research, teaching, or outreach at CIRES.

**CRITERIA 2:** Development or improvement of a service that increases the efficiency, quality, or visibility of scientific research or outreach.

**CRITERIA 3:** Providing a service that promotes or inspires excellence and dedication to research performed at CIRES or in the wider community.

The OPA committee has selected these winners in the Service category:

**Alicia Christensen, Rebecca Batchelor, Christine Okochi, Amanda Morton, Annie Fudale, Meghan Henderson**

EDUCATION & OUTREACH, CIRES FINANCE

The team is recognized for their remarkable work to support the Research Experience for Community College Students (RECCS) program. The program provides paid internships for students to explore environmental or geosciences and to gain the confidence to transition to a four-year program in the STEM disciplines. Over the past seven years the RECCS program has matched 76 community college students from across Colorado with researchers from CIRES, NOAA, INSTAAR and the USGS. Students from every cohort say that the RECCS experience and work with their mentors has changed their life and career trajectory in a positive way. RECCS mentors attest to the exceptional professionalism of the RECCS team and the utmost care with which they approach each individual student. For 2020, the RECCS team developed a completely new RECCS program using a virtual format (RECCS Lite). Pointing to the success of the RECCS program, NSF now funds numerous Research Experience for Undergraduate programs that recruit students from community colleges.

**Kathleen Bogan, Jon Griffith, Lynne Harden, Lianna Evans Nixon, Matthew Adam Price, Matthew D. Shupe, Katherine Lucille Weeman**

EDUCATION & OUTREACH,  
CIRES COMMUNICATIONS

The MOSAiC education, outreach and communication team is recognized for their creative, impactful and extensive work in support of the year-long Arctic research expedition with 500 scientists from 20 nations including 33 researchers from CIRES. The MOSAiC content reached at least tens of thousands of people around the world through curricula, social media, news media, planetarium shows, Google expeditions and other vehicles driven by this CIRES team. Thanks to the extraordinary efforts of the entire MOSAiC Expedition team at CIRES, the educational impact of this expedition will long outlive the expedition itself. Their stories continue to attract new

educators and classrooms on a weekly basis, inspiring a new generation of Arctic advocates. By summer 2021, there will be three planetarium shows available to audiences around the world!

**John Mund**

GML

Recognized for his exceptional knowledge and talent as a database manager, programmer and IT specialist and as an exceptional team member for his motivation, dedication, and unconditional support for all people and all projects that ask for his help. John has developed excellent tools to streamline data management, quality control, sharing and archiving for GML and international collaborators. Recently John provided excellent support to revising the World Meteorological Organization Global Atmosphere Watch CO<sub>2</sub> calibration scale. John has volunteered and taught Python courses in GML. He regularly supports or mentors early career colleagues, interns and students. John has also engaged in innovative efforts to develop cloud computing capabilities for GML.

**Catherine Rasco, Megan Melamed, Chelsea Thompson**

CSL

Recognized for successfully orchestrating the adoption and implementation of the ESRI web-based presentation service for the NOAA CSL 5-year laboratory review and for the redesign of the CSL website. The team succeeded in educating and coaching more than 50 scientists with a new web-based presentation landscape to summarize each group's scientific activities from 2015 to 2020. (All this was done of course while working remotely). The nominees deserve substantial credit for the CSL review success and the high regard the review received from the review panel and our OAR and NOAA Line Office colleagues. The inclusiveness of this entire effort led by the nominees has also had the benefit of having a large fraction of the CIRES and NOAA workforce at CSL feel a sense of ownership and pride in their research and mission.



## George C. and Joan A. Reid Award

Made possible by the Reids' generous contribution to an endowed scholarship fund, the Reid Award celebrates intellectual contributions to CIRES and leadership within the broader University of Colorado Boulder community. It is awarded every two years.

George Colvin Reid (1929–2011) was an eminent atmospheric scientist who pioneered research into critical environmental issues such as stratospheric ozone depletion and global climate change. Always a progressive thinker, he was one of the initial four fellows who founded the Cooperative Institute for Research in Environmental Sciences. Joan A. Reid (1932–2015) was one of the first women to enroll in the University of Colorado School of Law. She spent most of her career with the nonprofit Rocky Mountain Mineral Law Foundation, and was a frequent community volunteer, an avid outdoorsperson, and with her husband George, an inveterate world traveler.

### 2021 Recipient of the George C. and Joan A. Reid Scholarship: Jackson Jandreau

“Jackson has great passion for sharing his knowledge with the public, younger generations, and peers, and he is humble to learn from everyone. While in McMurdo, he spent much time in the lab learning lidar principles, laser technologies, and other lidar skills. While his 2020-2021 McMurdo deployment was cancelled due to the pandemic, he personally organized multiple Q&A Skype sessions to be conducted in Antarctica for both the Science Museum Oklahoma summer camps and middle/high school science classes to educate them about the life of a field scientist. These will still occur during the winter of his next deployment, and he is planning other similar sessions. In addition to his love for sharing his work, both his oral and written communication skills are superb, making him a valuable asset for our group's outreach and service.”

—Dr. Xinzhao Chu





Rendezvous is organized each year by the CIRES Members Council (CMC). We represent the interests of all CIRES members with respect to CIRES

governance, scientific direction, and the day-to-day workplace environment. As a representative group made up of CIRES members, we are tasked with the following:

- Representing the concerns of the CIRES Membership by bringing issues to the attention of the CIRES administration;
- Working to improve the lines of communication within and between all CIRES units;

- Providing a means of Member participation in CIRES governance and a voice on committees and working groups which form the core of that governance;
- Contributing to the process which determines CIRES' research direction and areas of research;
- Fostering a positive workplace environment and Members' connection with CIRES by facilitating Members' understanding of their roles within CIRES.

The CIRES Members Council provides the opportunity for service as well as career enhancement, benefiting representatives and constituents alike.

<https://cires.colorado.edu/about/institutional-programs/cires-members-council>

## CMC Officers



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## CMC Members



**Eric Adamson**  
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The CMC wishes to thank Eric for his leadership as Chair during the past year.



**Molly Hardman**  
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**Man Zhang**  
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EC11 EC12 EC13 EC14 EC16 EC17 EC18 EC19 EC20

**Environmental Chemistry (EC-19)**

EC1 EC2 EC3 EC4 EC5 EC6 EC7 EC8 EC9 EC10

EOMF10 EOMF11 EOMF12 EOMF13 EOMF14 EOMF15 EOMF16 EOMF17 EOMF18

**Environmental Observations, Modeling and Forecasting (EOMF-18)**

EOMF1 EOMF2 EOMF3 EOMF4 EOMF5 EOMF6 EOMF7 EOMF8 EOMF9

**Cryospheric & Polar Processes (CPP-13)**

CPP14 CPP7

CPP13 CPP6

CPP12 CPP5

CPP11 CPP4

CPP10 CPP3

CPP9 CPP2

CPP8

**Lounges**

1 2

3 4

5 6

**Bars**

A

B

C

D

**Education & Outreach (EO-8)**

EO2 EO3 EO4 EO5 EO6 EO7 EO8 EO9

**Solid Earth Sciences (SES-5)**

SES1

SES2

SES3

SES4

SES5

**Room 2 Landing Spot Map**

**Doorway**

**Room 1 Landing Spot Map**

**Lounges**

7 8

9

**Early Career Lounges**

10

11

12

13

14

15

16

17

18

**Ecosystem Science (ES-7)**

ES01

ES03

ES04

ES05

ES06

ES07

ES08

**Disco & Lounges**

19 20

21 22

23

**Western Water Assessment (WWA-7)**

WWA1 WWA2 WWA3 WWA4 WWA5 WWA6 WWA7

**Weather and Climate Dynamics (WCD-13)**

WCD2 WCD3 WCD4 WCD5 WCD7 WCD8

WCD9 WCD10 WCD11 WCD12 WCD13 WCD15 WCD16

**Administration (ADM-3)**

ADM1 ADM2 ADM3

 = map locations