

**External Review**

**Cooperative Institute for Research in Environmental Sciences (CIRES)**

**University of Colorado Boulder**

**Boulder, Colorado**

*Review Panel Members*

Walt Faulconer, Chair  
NOAA Science Advisory Board

Ana Barros, Ph.D.  
Duke University

Mike Anderson, Ph.D.  
California Department of Water Resources

Scott McIntosh, Ph.D.  
National Center for Atmospheric Research

Darrell Winner, Ph.D.  
U.S. Environmental Protection Agency

David Wilmouth, Ph.D.  
Harvard University

Fernando Miralles-Wilhelm, Ph.D.  
University of Maryland

Submitted to the

National Oceanic and Atmospheric Administration

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## **SUMMARY**

An external review of the strategic plan, science review, education/outreach and science management programs of the Cooperative Institute for Research in Environmental Sciences (CIRES) at University of Colorado (CU) was conducted on August 29th and 30th, 2016 in Boulder, CO. Guidelines for conducting the review were provided by the Cooperative Institute Program Office within the National Oceanic and Atmospheric Administration's (NOAA) Office of Oceanic and Atmospheric Research (OAR). The review was conducted under the auspices of the NOAA Science Advisory Board (SAB) and, therefore, is subject to the requirements of the Federal Advisory Committee Act (FACA). A list of review panel members is provided in Appendix I. The review panel's on-site agenda is provided in Appendix II.

The review panel that found the CIRES research programs, directed by the leadership team of Waleed Abdalati (Director) and Kristen Averyt (Associate Director for Science), to be essential to the successful research operations of NOAA and is also critical to the University of Colorado. The review panel unanimously agreed to a performance rating for CIRES of OUTSTANDING. No significant areas of concern were identified, and the recommendations put forth in this review by the committee are provided as merely suggestions to help CIRES continually improve.

### **I. OVERVIEW OF CIRES**

The Cooperative Institute for Research in Environmental Sciences is dedicated to fundamental and interdisciplinary research targeted at all aspects of earth system science, and to communicating these findings to the global scientific community, decision makers, educators, and the general public. CIRES vision and mission statements reflect their priorities:

**Vision:** CIRES is instrumental in ensuring a sustainable future environment by advancing scientific and societal understanding of the Earth system.

**Mission:** To conduct innovative research that advances our understanding of the global, regional, and local environments and the human relationship with those environments, for the benefit of society.

Research at CIRES is organized around nine research themes:

- Air quality in a changing climate
- Climate forcing feedbacks and analysis
- Earth system dynamics, variability, and change
- Management and exploitation of geophysical data
- Regional science and applications
- Scientific outreach and education
- Space weather understanding and prediction
- Stratospheric processes and trends
- Systems and prediction models and development

Examples of research from each of these themes were presented to the review panel through presentations and posters. The themes are general enough to allow continuing evolution of ongoing research under the themes. Success in meeting these themes is measured through publications generated, follow-on citations of the work, and awards earned. Feedback via surveys and follow-up meetings is also obtained.

## II. STRATEGIC PLANNING

### Findings

- CIRES has a well-written vision statement and mission statement for the research they conduct.
- CIRES has excellent administrative structure overseeing a rich and diverse research portfolio.
- The research conducted at CIRES is world-class and award winning.
- The Institute has successfully reached beyond the initial NOAA funding by developing additional research activities that are beneficial to NOAA interests.
- There is a well-organized structure for the interaction between CIRES and the NOAA Boulder Laboratories. Some of that structure is illustrated in the five-year work plan from 2012 to 2017 provided to the committee during the review. It describes research projects, identifies a CIRES lead and a NOAA lead, makes a linkage to a NOAA and a CIRES research theme and provides a statement of relevance to NOAA goals and objectives.
- Almost half of the CIRES staff is embedded within the NOAA Boulder Laboratories. The Laboratories include the divisions of the OAR's Earth System Research Laboratory (ESRL), the National Weather Service (NWS) Space Weather Prediction Center (SWPC), the National Environmental Satellite, Data, and Information Service (NESDIS), and the National Centers for Environmental Information (NCEI). CIRES staff working at the lab have a CIRES advisor and a NOAA or CIRES Science Advisor. CIRES researchers working at the University have a connection to one of nine campus departments where many CIRES fellows and faculty are embedded.
- Coordination between the NOAA Boulder Laboratories and CIRES is accomplished with regular monthly meetings between NOAA and CIRES staff.

There are apparent challenges as the individual division and center leads at the lab have their own organization and expectation for the interaction with and administration of CIRES researchers. There is a dedicated liaison staff member at the Lab who is a CIRES employee.

- CIRES and University administration appear to have a good working relationship. During the review there was mention of the University's commitment to additional investment in geophysical programs which would have direct benefit to CIRES. It was noted that follow-on meetings between CIRES and the University administration would happen after the NOAA review.
- A notable area of emerging work is managing the new shift to operations in the space weather enterprise within NOAA. NOAA moved the program out of OAR and into the National Weather Service, which has generated some challenges to sustaining NOAA engagement in the research efforts. Many opportunities exist for external partnerships that would be beneficial to NOAA. NOAA would benefit from prioritizing a continued research presence in the Space Weather Enterprise.
- The students have an organization structure (GSA) to effectively communicate their issues and concerns to CIRES administration. Students lead the GSA and appear to have positive interactions with CIRES administration. Students were open, positive and dynamic in their interactions with the review team.
- The result of such efforts is a well-run institute that has attracted funding above and beyond NOAA's initial commitments from a diverse set of outside sources and has garnered world-wide recognition for the research completed.

### **Finding – Security Barriers**

The physical separation of NOAA and CU naturally creates boundaries to scientific collaboration. The challenges with passing through security at NOAA and finding parking at CU serve as additional barriers.

### **Recommendation**

While acknowledging the financial challenges of this recommendation, we encourage considering construction of a new building at NOAA that is located outside of the secure area, which would serve as a point of connection for the communities from NOAA, the CU campus, and other partners.

### **Finding – Responsive vs Proactive**

It is clear that CIRES is very responsive to NOAA and gets very high marks to responding to NOAA needs.

### **Recommendation**

CIRES should also be more proactive as a NOAA partner in helping to be thought leaders in the strategic direction of critical science, research, policy, etc. This should also be reflected in the strategic planning of CIRES. For example, what are the specific goals for 2017 and what are the 5-year goals of CIRES? We encourage more strategic thought and support by NOAA in making strategic choices/ decisions. What is CIRES' strategy for growth?

### **Finding - Partnerships**

CIRES does an excellent job of partnering with many government, academic and industry organizations, as reflected by the variety of sponsors funding many of its projects.

### **Recommendation**

There are still untapped/non-traditional organizations that CIRES should investigate partnering with that could be beneficial to NOAA in the future:

- Partner with a HBCU (e.g., Howard, Morgan) that could help with diversity pipeline
- Work with more Department of Defense (DOD) and Intelligence Community (IC) organizations (e.g., National Reconnaissance Office (NRO) in Space Weather, Air Force Space Command (AFSPC) in Colorado Springs, Buckley)
- Work with other organizations with relevant connections (e.g., Southwest Research Institute (SwRI))
- Working with other parts of CU (e.g., CU-Colorado Springs near Air Force Space Command, CU-Denver) for greater community education & outreach and CIRES impact

### **Finding – Managing Growth**

CIRES has seen significant growth in both breadth and depth. This is a great indicator of success. While CIRES leadership is doing very well at managing the challenges that come with significant growth, it raises the potential concerns:

- Not losing what makes CIRES unique and special to NOAA
- Avoiding “stove pipes”
- Developing efficiencies and uniformity between the organizations
- Maintaining a “one team” culture

### **Recommendation**

Capture lessons learned and incorporate continual improvement into overall practices.

### **Finding – Tracking Metrics**

CIRES does an excellent job of tracking progress through metrics and “market indicators” (e.g., funding, awards, paper citations).

## **Recommendation**

CIRES should add a few metrics that are useful in indicating organizational health:

- Win Rate of Opportunities
- Win Rate of Dollars
- % of re-compete opportunities versus new opportunities
- Diversity

## **III. SCIENCE**

The scope of work of the CIRES collaboration with the NOAA Boulder Laboratories is encompassed within nine research themes. Important research at CIRES is happening within the framework of each of these themes. The broad scope of research conducted at CIRES in the nine areas identified during the review is remarkable. Examples of the work being conducted were presented by the researchers via oral presentation or poster.

### **Finding – Outstanding Science**

CIRES is producing outstanding science. A testament to this is over 700 publications involving CIRES authors or coauthors in 2015 alone, along with numerous awards received by CIRES scientists in the last four years. CIRES researchers are leaders and emerging leaders in their scientific fields. The numerous awards and broad recognition of the work is a testament to the high quality of the work conducted. CIRES administrators have navigated the challenges of rules governing awards to NOAA federal employees versus CIRES researchers in a reasonable fashion.

## **Recommendation**



We recommend CIRES continue with research in all nine identified themes and maintain their excellent level of scientific achievement. Well done.

### **Finding – Agile Research Capacity**

CIRES researchers have a fantastic capacity to work along the research lines of ESRL and NCEI while being nimble enough to accommodate opportunistic work like the El Nino Rapid Response effort taken on this past year. They have established themselves as the go-to institute for a number of research topics of local, regional, national, and global importance. In the case of the geophysical data center (NCEI at Boulder), they are carrying the effort almost single-handedly.

### **Finding – Ignite Talks**

The poster presentations were excellent opportunities for the review team to interact with the researchers presenting their work.

The graduate students gave “Ignite talks”, where the speaker has five minutes to speak on a subject, and the slides automatically advance every 15 seconds. The Ignite talks presented by the graduate students were brilliant and a great way to get an overview of a number of research activities. Researchers and graduate students were well spoken in presenting their material with the confidence of knowing that their work is among the best in the world.

### **Finding – Space Weather Expertise**

CIRES is ideally positioned to bring together the space weather enterprise. Space Weather is a large growth opportunity.

### **Recommendation**

The Director of CIRES should consider reaching out to other Universities, interested stakeholders (e.g., The Johns Hopkins University Applied Physics Laboratory (APL), SwRI, commercial industries), and other Government Agencies (e.g., National Aeronautics and Space Administration (NASA), DoD) involved in space weather to create a Space Weather Consortium and a Center for Space Weather Research at CU to provide some leadership and focus on this developing area.

### **Finding – Social Sciences**

Some CIRES presentations mentioned the integration with social sciences but no real evidence or products were shown.

### **Recommendation**

Social science integration may not be a major focus area or core competence of CIRES. However, given the growing importance of social science at NOAA, CIRES should make an effort to address it through more proactive partnerships, etc. This is an opportunity to help NOAA.

## **IV. SCIENCE MANAGEMENT**

CIRES identifies new intellectual opportunities within NOAA through dialogue with NOAA sponsors and by responding to NOAA competitive funding opportunities. CIRES also responds to funding opportunities posted by other entities, such as other federal agencies.

### **Finding - Financial Growth**

In terms of financial goals, the Institute has exceeded expectations. Their outstanding work has attracted additional funding and has increased in each of the last four years. They have done well in attracting a diverse group of researchers to the Institute.

### **Finding – CIRES/ Boulder Laboratories Interface**

The institute offers avenues for exploration of new frontiers through an internal award program and with visiting fellows. The institute members have opportunities to pursue research areas of interest with a few notable exceptions at the NOAA Boulder Laboratories. One of the challenges in the science management area of the institute is adapting to the different rules and expectations of the individual divisions at ESRL and the centers (SWPC, NCEI), which has led to some concerns and frustration with some of the researchers. The institute is aware of the issue and is working with the laboratories to address the situation to the extent possible. Continued efforts on this front would help the sense of overall community within the institute. It would benefit NOAA to encourage the Lab Division and Center heads to reach a consistent approach to enable CIRES researchers to pursue their research interests in a manner consistent with meeting the research needs of the Lab. CIRES administrators have demonstrated a willingness to work with the Labs and Centers to find an equitable solution.

### **Finding – PI Recognition**

In some ESRL divisions, CIRES scientists are not allowed to be the Principal Investigator (PI) on proposals that are submitted through NOAA. This creates a situation in which CIRES scientists do not receive appropriate external recognition for their work or for the independence with which they have functioned in their research. Many CIRES scientists with whom we spoke raised this issue as a concern for their careers if they choose to leave CIRES and advance their careers elsewhere.

## **Recommendation**

We recommend that a new internal designation of 'Science PI' is established to recognize the leadership of CIRES scientists on awarded proposals they wrote but were not allowed to be externally listed as PI. This will enable the CIRES scientists to have an official acknowledgement of their efforts that can be listed on a CV for career advancement in the future. (The spirit of this recommendation is in line with the policy already in place where CIRES internally acknowledges its own scientists when their NOAA colleagues receive awards from the Department of Commerce that involved significant CIRES effort.)

## **Finding – Career Advancement**

The capability for individuals to achieve advancement and recognition in their career track is important in any profession. CIRES has four levels of internal promotion for both Research Scientists and Associate Scientists, allowing for career advancement within the cooperative institute. CIRES also internally awards scientists when their collaborative efforts with NOAA colleagues leads to Department of Commerce awards being issued on the NOAA side, as well as with annual Outstanding Performance Awards within CIRES.

## **Recommendation**

CIRES should continue with the current program of career track advancement and recognition that seems to be working well. The framework of job titles that reflect different levels of seniority and achievement is important, as well as issuing awards for outstanding achievement.

## **Finding – Workforce Diversity**

Diversity is somewhat lacking at CIRES with approximately 80% of employees being white and 62% being men.

### **Recommendation**

While the statistics at CIRES reflect a larger lack of diversity in the field in general, more intentional pursuit of diversity is recommended. This should begin by establishing relationships with underrepresented graduate students prior to graduation and could take the form of cluster hires. There is a need to expand involvement of people not historically involved or represented in NOAA science programs.

### **Finding – Funding Stability**

A majority of CIRES scientists who are employed by CU as research associates or research scientists are principally housed at the David Skaggs Research Center and work closely with NOAA Boulder Laboratory scientists to meet critical research and operational needs. This arrangement enables highly effective and productive research activities in support of NOAA's national mission. CI funding levels for individual CIRES Scientists vary widely from full-time support to a fraction of the annual salary, which may vary year-to-year depending on specific NOAA needs.

### **Recommendation**

To achieve sustainable, long-term, efficient access (recruitment and retention) to a quality workforce with the breadth and depth of knowledge and skills required beyond NOAA's year-to-year and short-term research needs, it is necessary to further enhance

professional development and satisfaction of CIRES research scientists. This requires strategic collaborative planning among CIRES, NOAA and CU to further develop processes and infrastructure specifically targeting the ability of partially funded CIRES employees to secure continued full-time financial support, to foster equitable access to career development opportunities, and to nurture a climate of intellectual entrepreneurship and leadership that is essential to discovery and innovation consistent with the University’s mission and NOAA’s capacity-building responsibilities.

### **Finding – Aging Workforce**

Cuts in staffing at the NOAA Boulder Laboratories have resulted in an aging organization.

### **Recommendation**

NOAA should prioritize stabilizing the NOAA Boulder Laboratories’ federal work force.

## **V. EDUCATION AND OUTREACH**

CIRES has many initiatives that fall within the realm of education and outreach (EO). Given their focus on science serving society, CIRES supports efforts to connect its science with students, the public, and the decision-making community. CIRES has a dedicated education and outreach program primarily working on K–12 education, a communications team focused on media relations, as well as administrative and researcher expertise in engaging with policy makers and the general public.

CIRES has supported the EO staff since 1996. The average CIRES expenditure on EO over the review period has been \$300K, funded through the CIRES Director’s funds and

Indirect Cost Recovery. This expenditure only supports CIRES EO. CIRES provides significant additional resources, using internal funds, to support education and outreach through other avenues as well. These include CIRES Office of Communications, the CIRES Graduate Association, and some modest support of individual scientists' engagement activities.

### **Finding – World-Class Education and Public Outreach**

With fellows/researchers spanning nine different departments within the University of Colorado, CIRES has a wide-ranging connection to education within the University. They have also developed a world-class structure for external education and public engagement that could be used as a model for others wishing to develop such capacity. They benefit from identifying education and outreach as a major program theme.

We particularly appreciated the targeted outreach to engage under-represented communities in research with K-12 activities aimed to build interest and success in the sciences. During presentations to the review panel, evidence was provided through select quotes from participants that the efforts have shown initial signs of success. Outreach efforts to tribes and to community college students are also undertaken with topic material presented on their website.

### **Finding – Excellent Publications and Programs**

The magazine format, Spheres, highlights different research activities and is well-executed. Samples of the magazine were presented to the review panel. Another highlight in the education/outreach arena is the Science on a Sphere (SoS) program which provides stunning visualization of complex geophysical data sets. This novel and engaging vehicle to present geophysical data greatly enhances communication of

science concepts to the general public. The expansion of material from the sphere to flat-screen monitors to web-based material greatly expands the reach of the material.

### **Finding – Robust Education and Outreach**

CIRES Outreach activities are excellent. This includes CI core activities such as SoS, National Snow and Ice Data Center (NSIDC) Sea Ice Index (SII) and Multisensor Analyzed Sea Ice Extent (MASIE) products, and a vigorous and noteworthy presence in the national news and social media. Efforts toward developing affordable and user-friendly SoS systems to enhance public access and specifically targeting teachers and classroom use (SoS Explorer Lite), and high-visibility projects with national footprint such as the Climate Science Connections Massive Open Online Course (MOOC) and Climate Literacy and Energy Awareness Network (CLEAN) are especially commended.

### **Recommendation**

We recommend CIRES continue their outstanding public outreach and education efforts and consider ways to expand their reach even further. As highlighted by CIRES scientists, Boulder is the world capital for atmospheric chemistry. With that in mind, we recommend that CIRES pursue education efforts with an even more global perspective, primarily through the internet. One way to do this with the public is to get them engaged with CIRES by leveraging ‘cool’ science stories through the media, such as the night sky brightness work that recently had large reach, as the open door to bring traffic to CIRES websites. NASA’s leveraging of similar efforts is no doubt part of the reason NASA has a factor of 6000 more Twitter followers than CIRES (3000 vs 18 million).

### **Finding – Excellent Graduate Student Involvement**

The CIRES graduate students at the University of Colorado were spectacular in their Ignite presentations. Private interaction with these students further instilled confidence



that the next generation of Earth scientists, who will deal with the impacts of climate change much more than the current generation, are well equipped.

There are on average 100-130 graduate students and thirty postdocs working with CIRES Faculty Fellows and CIRES Research Scientists. The panel had the opportunity to interact directly with some students and postdocs during the science review, and was impressed by their enthusiasm, and breadth and quality of the research presented. The CIRES graduate association, merit scholarships, travel awards and other community building and professional development activities including seminars, development of communication skills, and career/job planning provide high quality value to the CU graduate experience.

CIRES supports NOAA's Hollings Summer program for undergraduates, which is very successful and leads to successful recruitment of graduate students. Other Research Experience for Undergraduates (REU) programs are also noted, which involve undergraduate students in research with funding from NSF.

### **Recommendation**

CIRES should continue their active engagement of graduate students at CU and look for ways to expand the reach of the CIRES Graduate Association (CGA) even further. Being designated a CIRES student currently means simply that a student chose to join the research group of a professor or research faculty with a CIRES affiliation. This seems to exclude a number of potentially interested students at CU from benefiting from CGA offerings, particularly in the areas of workshops on improving communication skills, job fairs, etc. While non-CIRES students may not be turned away from such CGA offerings, it is a different level of outreach to actively invite these non-CIRES students to participate. CIRES should consider including non-CIRES students on their mailing lists

and actively engaging these students. This could pay dividends down the road with these non-CIRES students later pursuing employment at CIRES.

### **Finding – Long Term Vision for Education and Outreach**

CIRES Educational vision of long-term deep K-12 engagement through continued substantive engagement of students from primary to high school in the sciences, and efforts to increase awareness and interest of students in disadvantaged communities through magnet activities, has great potential for success. Whereas the impact of ongoing efforts may be limited by resources, these efforts can be viewed as testbeds to determine the effectiveness of their approach to improve students' academic prospects generally and the diversity of the college-bound population in Colorado.

### **Recommendation**

The strengthening and further development of formal assessment processes and tools, including quantitative metrics to track the impact of the various programs on the educational trajectories of individual K-12 students, as well as undergraduate and graduate college recruitment, is highly recommended. This should be helpful in self-study and evaluation, and to document effective approaches that may be used by others.

### **Finding – Visiting Fellow and Postdoctoral Program**

The Visiting Fellows program supporting both postdoctoral researchers and senior scientists on sabbatical is working very well. CIRES and CU have been able to recruit and retain highly accomplished senior faculty and junior faculty and research scientists of great promise.

## **Recommendation**

The program should be nurtured and, if possible, strengthened. This is also a unique vehicle to broaden the CIRES reach beyond CU and Boulder to attract talent from around the country, to pursue new research directions, and to increase workforce diversity through targeted recruitment such as ongoing efforts at GSD.

## **Finding – Broader Opportunities**

CIRES does a very good job with education and outreach activities within their traditional focus areas. It did not appear that they were considering non-traditional areas that are in their back yard.

## **Recommendation**

Investigate other area organizations to partner with that could be beneficial for the CIRES education and outreach pipeline:

- Colorado Space Business Roundtable
- Colorado Space Alliance
- The Space Foundation
- The NDIA Rocky Mountain Chapter (i.e., Space Weather)

## **VI. SUMMARY AND CONCLUSIONS**

Overall findings by the review committee:

- The relationship between NOAA, CIRES, and the University of Colorado is of great benefit to all three entities. CIRES is essential to the successful research operations of NOAA and is critical to those at the University of Colorado.
- CIRES is highly regarded within the University and is broadly engaged.

- The CIRES director, Waleed Abdalati, is highly regarded by NOAA, CIRES, CU and the broader science community. He received particularly high praise from the NOAA division directors during the CIRES Review.

The review panel unanimously agreed to a performance rating for CIRES of OUTSTANDING. The recommendations put forth in this review by the committee are provided as merely suggestions to help CIRES continually improve.

**Appendix I**  
**CIRES Review Team Biographies**

**Ana Barros**

Ana Barros, Ph.D.  
Professor of Engineering  
Duke University  
Phone: (919) 660-5539  
Email: [barros@duke.edu](mailto:barros@duke.edu)

Dr. Barros received a Ph.D. in Civil and Environmental Engineering from the University of Washington in 1993, and she is currently the James L. Meriam Professor of Civil and Environmental Engineering at Duke University. Dr. Barros conducts research in Hydrology, Hydrometeorology, Atmospheric Sciences and Remote Sensing with emphasis on Precipitation processes and Land-Atmosphere Interactions. She is a Fellow of the American Geophysical Union and a Fellow of the American Meteorological Society, and a Senior Member of the IEEE. Dr. Barros is a member and upcoming Chair of the ASCE's Committee on Adaptation to a Changing Climate.

**Mike Anderson**

Michael Anderson, PhD, PE  
California Department of Water Resources  
3310 El Camino Avenue Room 200  
Sacramento, CA, 95821  
Phone (916) 574-2830  
Fax (916) 574-2767  
Email: [Michael.L.Anderson@water.ca.gov](mailto:Michael.L.Anderson@water.ca.gov)

Dr. Anderson received a bachelor's degree in Civil Engineering with a minor in Mathematics from Colorado State University in 1991. He received a Master's and Doctorate in Civil and Environmental Engineering with a minor in Atmospheric Science from the University of California, Davis in 1993 and 1998 respectively. Dr. Anderson is the State Climatologist from the State of California and has directed and participated in research related to extreme precipitation, monitoring using remote sensing resources, and watershed modeling advances for resources management. He served on the NOAA Climate Services Assessment for the California Drought. Dr. Anderson also

participates in the National Climate Assessment Water Management Indicators Work Group and the State of California's Climate Action Team Research Working Group which heads up the State's Climate Assessments.

**Scott McIntosh**

Scott McIntosh, Ph.D.

Director, High Altitude Observatory

Associate Director, National Center for Atmospheric Research

National Center for Atmospheric Research

Boulder, CO 80301

Phone: (303) 497-1544

Fax: (303) 497-1589

Email: mscott@ucar.edu

Dr. McIntosh received a first class double honors degree in Mathematics and Physics from the University of Glasgow (Scotland, UK) in 1995 before receiving a Ph.D. in Astrophysics from the same establishment in 1998. Dr. McIntosh is presently the Director of the High Altitude Observatory and an Associate Director of the National Center for Atmospheric Research in Boulder, CO where he is responsible for the National Center's efforts in the area of Space Weather and Solar-Terrestrial Physics. Dr. McIntosh carries out research in the Sun's chromosphere and on the connection between solar activity and the terrestrial atmosphere across timescales. Dr. McIntosh has participated in a number of senior level reviews for the National Science Foundation and National Aeronautics and Space Administration.

**Darrell Winner**

Darrell A. Winner, Ph.D.

Senior Science Advisor, National Center for Environmental Research

Office of Research & Development

U.S. Environmental Protection Agency

1200 Pennsylvania Avenue, N.W. MC 8725R

Washington, DC 20460

Phone: (202) 564-6759

Email: winner.darrell@epa.gov

Dr. Darrell Winner is the Senior Science Advisor for EPA's National Center for Environmental Research (NCER). Dr. Winner helped to plan the EPA research strategy to understand the impact of climate change on air quality and managed many of the extramural research projects on this topic. Dr. Winner earned a B.S. in Chemical

Engineering from Carnegie Mellon University, and an M.S. and Ph.D. in Environmental Engineering Science from the California Institute of Technology. Before joining EPA's Office of Research & Development, Dr. Winner worked at the Air Force Research Laboratory, as well as several different EPA Offices, including Policy, Air, and Environmental Information.

**David Wilmouth**

David M. Wilmouth, Ph.D.  
Department of Chemistry and Chemical Biology  
& School of Engineering and Applied Sciences  
Harvard University  
12 Oxford Street  
Cambridge, MA 02138  
Phone: (617) 495-5924  
Email: wilmouth@huarp.harvard.edu

Dr. Wilmouth received a B.S. in Chemistry with Highest Honors from the College of William and Mary in 1996 (1<sup>st</sup> out of 1119) and a Ph.D. in Physical Chemistry from Harvard University in 2002. Dr. Wilmouth is presently a Scientist in the Department of Chemistry and Chemical Biology & School of Engineering and Applied Sciences at Harvard University, where his area of research is atmospheric chemistry, with particular focus on halogens. Dr. Wilmouth constructs and operates flight instruments for scientific measurements onboard high altitude NASA aircraft, and he conducts laboratory experiments for spectroscopic and kinetic studies. Dr. Wilmouth currently serves on the NASA Panel for Data Evaluation, which publishes the JPL compendium of "Chemical Kinetics and Photochemical Data for Use in Atmospheric Studies."

**Fernando Miralles-Wilhelm**

Fernando Miralles-Wilhelm, Ph.D.  
Earth System Science Interdisciplinary Center (ESSIC)  
University of Maryland  
5825 University Research Court  
College Park MD 20740  
Tel: 305-7768128  
Email:fwilhelm@umd.edu

Dr. Miralles-Wilhelm received a bachelor's degree in mechanical engineering in 1987, a MS degree in engineering in 1989 from UC-Irvine, and a Ph.D. in hydrology from MIT in 1993. He presently holds a faculty position at the Department of Atmospheric and Oceanic Sciences at the University of Maryland where he also serves as Director of the Earth System Science Interdisciplinary Center (ESSIC). Dr. Miralles-Wilhelm carries out research on the interactions between water, energy, food and climate in the context of integrated assessment models and international development. He currently serves on the National Research Council's Committee on Everglades Restoration, and is also the Executive Director of the NOAA Cooperative Institute for Climate and Satellites (CICS).



# Cooperative Institute for Research in Environmental Sciences

## REVIEW AGENDA

### Sunday, August 28, 2016

**6:30 pm: Shuttle**

Homewood Suites to Dushanbe Tea House  
*Science Review Panel, NOAA CIPO Director*

**7:00 pm: Dinner (CLOSED)**

Dushanbe Tea House

**9:00 pm: Shuttle**

Homewood Suites to Dushanbe Tea House  
*Science Review Panel, NOAA CIPO Director*

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### Monday, August 29, 2016

NOAA David Skaggs Research Center

**7:30 am: Shuttle**

Homewood Suites to Dushanbe Tea House  
*Science Review Panel, NOAA CIPO Director*

**8:00 am: Registration, Coffee & Light Breakfast**

NOAA David Skaggs Research Center GB124

**8:30 am–10:30 am: Plenary Session**

NOAA David Skaggs Research Center GC402

**8:30 am: Welcome**

Waleed Abdalati, CIRES Director

**8:45 am: Welcome to NOAA David Skaggs Research Center**

Kevin Kelleher, Acting Director, NOAA Earth Systems Research Laboratory

**9:00 am: CIRES Overview: Part I**

Waleed Abdalati, CIRES Director

**10:00 am: Questions****10:30 am: Break**

NOAA David Skaggs Research Center GB124

**11:00 am –12:15 pm: CIRES Research Theme: Climate Forcing, Feedbacks & Analysis**

NOAA David Skaggs Research Center GC402

**11:00 am: Theme Overview**

Claire Granier, CIRES, Chemical Sciences Division

**11:20 am: Posters**

Poster 1: Scientific assessment to support local to global decision-making  
Jeff Lukas, CIRES, Western Water Assessment

Poster 2: Using a multi-scale approach to identify and quantify emissions from oil and gas: A case study for the quantification of GHG emissions verification  
Colm Sweeney, CIRES, Global Monitoring Division

Poster 3: Aerosol-cloud interactions and the cloud response to climate change  
Jan Kazil, CIRES, Chemical Sciences Division

Poster 4: Inferring sources and sinks of greenhouse gases from their trends and distributions  
John Miller, NOAA, Global Monitoring Division

Poster 5: Evaluating global climate models with long-term aerosol measurements  
Betsy Andrews, CIRES, Global Monitoring Division



Poster 6: Atmospheric measurements of aerosols, black carbon, and water vapor for improved understanding of their roles in the climate system  
Troy Thornberry, CIRES, Chemical Sciences Division

**12:15 pm–2:00 pm: Lunch (CLOSED)**

**12:15 pm–2:00 pm:** Review Committee & NOAA Boulder Laboratories Leadership  
NOAA David Skaggs Research Center GB124

**12:15 pm–2:00 pm:** NOAA Guests & CIRES Senior Management Team  
The Egg and I

**2:00 pm–3:15 pm: CIRES Research Theme: Earth System Dynamics, Variability, and Change**

NOAA David Skaggs Research Center GC402

**2:00 pm: Theme Overview**

Laura Bianco, CIRES, Physical Sciences Division

**2:20 pm: Posters**

Poster 1: Assessing the individual and mutual effects of climate change and ENSO on extreme events  
Linyin Cheng, CIRES, Physical Sciences Division

Poster 2: El Niño Rapid Response: observations, diagnosis, and forecasts  
Matthew Newman, CIRES, Physical Sciences Division

Poster 3: The NOAA-CIRES 20th century reanalysis (1851–2014)  
Gilbert P. Compo, CIRES, Physical Sciences Division

Poster 4: Overview of atmospheric river research and the CalWater 2015 campaign  
Darren Jackson, CIRES, Physical Sciences Division

Poster 5: Advancing the nation's prediction capability by building the Next Generation Global Prediction System (NGGPS)  
Phil Pegen, CIRES, Physical Sciences Division

Poster 6: Effect of extratropical-tropical variability on air quality over the western United States  
John Albers, CIRES, Physical Sciences Division

**3:15 pm–3:45 pm: Break**

NOAA Earth Systems Research Laboratory David Skaggs Research Center GB124

**3:45 pm–5:00 pm: CIRES Research Theme: Space Weather Understanding & Prediction**

NOAA David Skaggs Research Center GC402

**3:45 pm: Theme Overview**

Timothy Fuller-Rowell, CIRES Fellow, Space Weather Prediction Center

**4:05 pm: Posters**

Poster 1: Ionosphere model development  
Naomi Maruyama, CIRES, Space Weather Prediction Center

Poster 2: Enhancing predictive capacity of coronal mass ejections  
Curt A. de Koning, CIRES, Space Weather Prediction Center

Poster 3: The role of solar observations in predicting solar storms at the earth  
Alysha Reinard, CIRES, Space Weather Prediction Center

Poster 4: Drivers of space weather predictions from below in the whole atmosphere modeling  
Valery Yudin, CIRES, Space Weather Prediction Center

Poster 5: Transitioning large-scale space weather models into operations at the National Weather Service  
George Millward, CIRES, Space Weather Prediction Center

Poster 6: Reprocessing and validation of NOAA's multi-decade space environmental data records  
Juan Rodriguez, CIRES, National Centers for Environmental Information

**5:10 pm: Shuttle**

NOAA David Skaggs Research Center to Chatauqua Dining Hall  
*Science Review Panel, NOAA guests*

**5:30 pm–6:30 pm: Social Hour (CLOSED)**

Chatauqua Dining Hall

**7 pm: Dinner (CLOSED)**

Chatauqua Dining Hall

**9:00 pm: Shuttle**

Chatauqua Dining Hall to Homewood Suites  
*Science Review Panel, NOAA guests*

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**Tuesday, August 30, 2016**

University of Colorado Boulder Campus

**6:00 am–7:15 am: Review Committee Breakfast Meeting (CLOSED)**

Homewood Suites Boulder Meeting Room

**7:15 am: Shuttle**

Homewood Suites to University of Colorado  
*Science Review Panel, NOAA guests*

**7:30 am: Registration, Coffee & Light Breakfast**

University of Colorado Campus University Memorial Center 235

**8:00 am–9:00 am: Plenary Session**

University of Colorado Campus University Memorial Center 235

**8:00 am: Welcome to University of Colorado Boulder**

Russell Moore, Provost and Executive Vice Chancellor for Academic Affairs, University of Colorado Boulder

**8:15 am: CIRES Overview, Part II**

Waleed Abdalati, CIRES Director

**9:00 am–10:00 am: CIRES Research Theme: Scientific Outreach & Education**

University of Colorado Campus University Memorial Center 235

**9:00 am: Theme Overview**

Kristen Averyt, Associate Director for Science, CIRES

**9:10 am: Integrating CIRES science with education**

Susan Sullivan, Director, CIRES Education and Outreach

**9:20 am: Why we brag about CIRES science**

Katy Human, Director, CIRES Communications Office

**9:30 am: Sea-ice index & education resources for the cryosphere**

Ann Windnagel, CIRES, National Snow and Ice Data Center

**9:40 am: Science On a Sphere®: Bringing geoscience and climate literacy to the world on multiple platforms**

Hilary Peddicord, CIRES, Global Systems Division

**9:50 am: Questions**

**10:00 am: Break**

**10:30 am–11:45 am: CIRES Research Theme: Air Quality in a Changing Climate**

University of Colorado Campus University Memorial Center 235

**10:30 am: Theme Overview**

Carsten Warneke, CIRES, Chemical Sciences Division

**10:50 am: Regional field studies of climate and air quality**

Andy Neuman, CIRES, Chemical Sciences Division

**11:00 am:** Chemistry, emissions, and transport model research  
Stu McKeen, CIRES, Chemical Sciences Division

**11:10 am:** Improving regional air quality modeling tools and predictions  
Ravan Ahmadov, CIRES, Chemical Sciences Division

**11:20 am:** International Global Atmospheric Chemistry (IGAC) Project  
Megan Melamed, CIRES, Executive Officer, IGAC

**11:30 am: Questions**

**11:45 am–12:45 pm: Reviewers & CIRES Senior Management Team Lunch (CLOSED)**

University of Colorado Campus University Memorial Center 425 (4th Floor)

**12:45 pm: Walk to CIRES**

**1:00 pm–1:20 pm: Tour Jimenez Laboratory**

**1:20 pm: Walk to University Memorial Center**

**1:30 pm–3:00 pm: CIRES Research Theme: Regional Sciences & Applications**

University of Colorado Campus University Memorial Center 235

**1:30 pm:** Regional Research Part I: Overview  
Mimi Hughes, CIRES, Physical Sciences Division

**1:45 pm:** Western Water Assessment: building climate resilience by design  
Ursula Rick, CIRES, Western Water Assessment

**1:55 pm:** Evapotranspiration and drought: early warning, monitoring, and climate-scale projections  
Mike Hobbins, CIRES, Physical Sciences Division

**2:05 pm:** Bureau of Reclamation Climate, Water and Weather Initiative  
Ben Livneh, CIRES Fellow, Assistant Professor, Civil, Environmental and Architectural Engineering

**2:15 pm: Questions**

**2:25 pm:** Regional Research Part II: Understanding Arctic system processes  
Matthew Shupe, CIRES, Physical Sciences Division

**2:40 pm:** Improved understanding of the lower Arctic atmosphere through observational studies  
Gijs de Boer, CIRES, Physical Sciences Division

**2:50 pm: Questions**

**3:00 pm: Break**

**3:15 pm–4:15 pm: Ignite CIRES: Graduate Students & Post Doctoral Researchers**

University of Colorado Campus University Memorial Center 235

**Session Moderator:**

Jordan Krechmer, Co-Chair, CIRES Graduate Association, Chemistry and Biochemistry

**Presenters:**

Abigail Koss (Chemistry and Biochemistry, NOAA Chemical Sciences Division)  
Oil, gas, and air quality

Randall Chiu (Chemistry and Biochemistry)  
A novel source of marine VOCs and OVOCs from fatty acid photochemistry

Demetrios Pagonis (Chemistry and Biochemistry)  
Laboratory studies of secondary organic aerosol chemistry

Jenna Stewart (Civil, Environmental & Architectural Engineering)  
Ensemble modeling of suspended sediment in steep mountain catchments

Karen Alley (Geological Sciences, National Snow and Ice Data Center)  
Upside-down rivers and antarctic ice shelf stability

Jeff Thompson (Co-Chair, CIRES Graduate Association; National Snow and Ice Data Center)  
Evidence for drying vegetation in Greenland?

Tasha Snow (Geography)

Glacier-ocean interactions: The warm, the cold, and the undetectable

Ulyana Horodyskyi (Geological Sciences, National Snow and Ice Data Center)

Science in the wild: blending business, academics, and athletics

**4:15 pm–5:00 pm: Remaining Themes: Highlights**

University of Colorado Campus University Memorial Center 235

**4:15 pm: CIRES Research Theme: Stratospheric Processes & Trends**

Amy Butler, CIRES, Chemical Sciences Division

**4:30 pm: CIRES Research Theme: Management & Exploitation of Geophysical Data**

Barry Eakins, CIRES, National Centers for Environmental Information

**4:45 pm: CIRES Research Theme: Systems & Prediction Modeling Development**

Jaymes Kenyon, CIRES, Global Systems Division

**5:00 pm–7:30 pm Reception & Science on a Sphere® Demonstration**

Fiske Planetarium

**7:30 pm: Shuttle**

Fiske Planetarium to Homewood Suites

*Science Review Panel, NOAA guests*

**7:45 pm: Review Committee Dinner (CLOSED)**

Homewood Suites Boulder Meeting Room

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**Wednesday, August 31, 2016**

University of Colorado Boulder Campus

**7:30 am: Shuttle**

Homewood Suites to University of Colorado

*Science Review Panel*

**8:00 am: Coffee & Light Breakfast**

**8:00 am–11:00 am: Reviewer Discussion (CLOSED)**

CIRES Fellows Room

**10:30 am: Shuttle**

Homewood Suites to University of Colorado

*NOAA guests*

**11:00 am–12:00 pm: Science Review Report to CIRES (CLOSED)**

CIRES Fellows Room

**11:30 am: Shuttle**

Homewood Suites to University of Colorado

*Admin. Review Panel*

**12:00 pm–1:00 pm: Lunch (CLOSED)**

CIRES Atrium

**1:00 pm–4:00 pm: Administrative Review (CLOSED)**

CIRES Fellows Room

**1:30 pm: Shuttle**

University of Colorado to Homewood Suites

*Science Review Panel*

**4:30 pm: Shuttle**

University of Colorado to Homewood Suites

*NOAA guests, Admin. Review Panel*