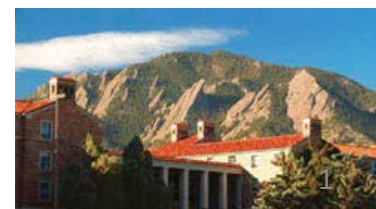


Review of the ESRL Chemical Sciences Division (2008-2014): An Overview

Dr. David W. Fahey, Director
Chemical Sciences Division
NOAA Earth System Research Laboratory
Boulder, Colorado

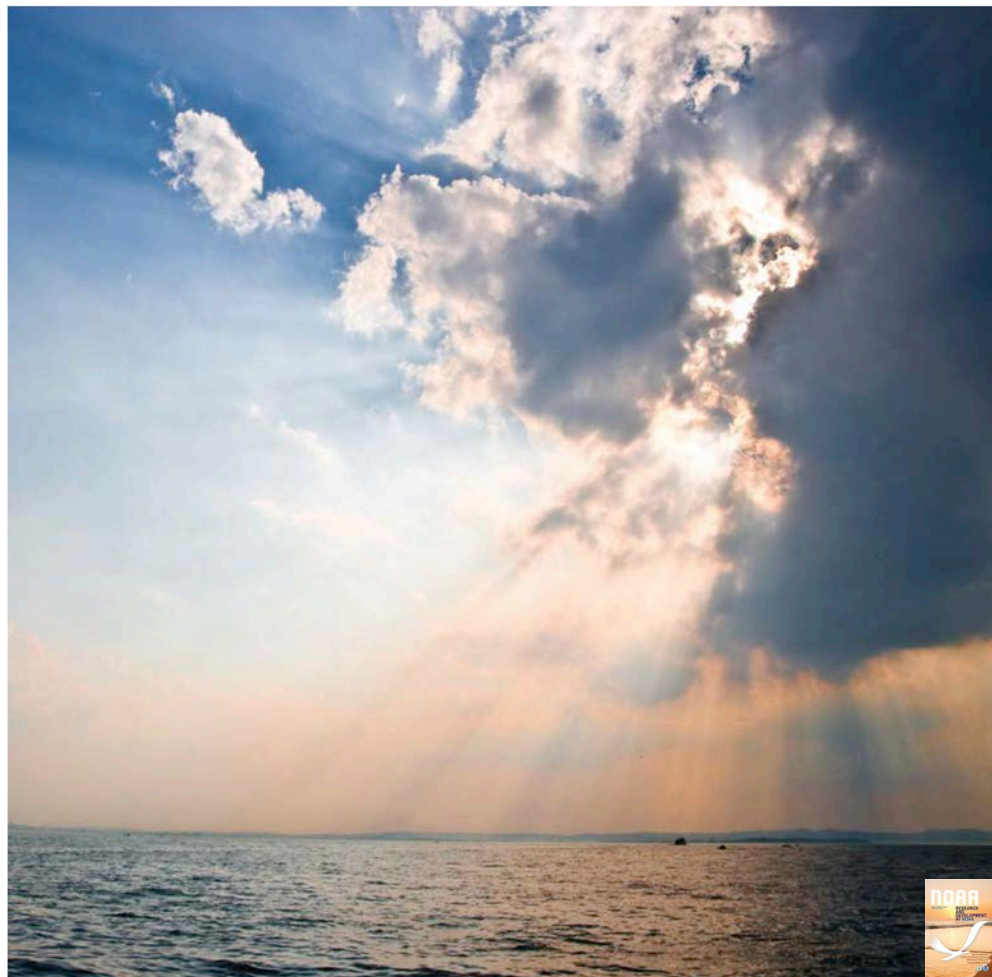
30 March 2015



Reviewing the Chemical Sciences Division

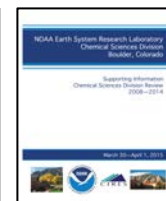
Outline*:

- Vision & mission
- Research topics
- Staffing & organization
- Funding
- Research products
- Future plans
- Review structure
- Acknowledgments



*Review documents (online):

- Research Accomplishments and Plans (46 pg.)
- Supporting Information (125 pg.)



NOAA's Mission Statement

NOAA's Mission: **Science, Service & Stewardship**

- To understand and predict changes in climate, weather, oceans, and coasts,
- To share that knowledge and information with others, and
- To conserve and manage coastal and marine ecosystems and resources.

Science at NOAA is the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; integration of research and analysis; observations and monitoring; and environmental modeling.

Service is the communication of NOAA's research, data, information, and knowledge for use by the Nation's businesses, communities, and people's daily lives.

Stewardship is NOAA's direct use of its knowledge to protect people and the environment.

NOAA's Mission Statement

NOAA's Mission: **Science, Service & Stewardship**

- To understand and predict changes in climate, weather, oceans, and coasts,

“We are this nation’s Environmental Intelligence agency. We provide timely, actionable and reliable information, grounded in authoritative science that is oriented towards real-world questions confronting families, businesses, communities and nations.”

Annual Guidance Memorandum for FY 2015

Dr. Kathy Sullivan

Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator

data, information, and knowledge for use by the Nation’s businesses, communities, and people’s daily lives.

Stewardship is NOAA’s direct use of its knowledge to protect people and the environment.

NOAA's Next Generation Strategic Plan

Corporate and strategic goals

SCIENCE & TECHNOLOGY ENTERPRISE

a holistic understanding of the earth system through research

accurate, reliable data from integrated earth observations

an integrated environmental modeling system

improved scientific understanding
 assessments identify impacts, inform decisions
 mitigation, adaptation choices supported
 a climate literate public

CLIMATE ADAPTATION & MITIGATION

reduced loss of life, property, disruption
 improved freshwater management
 transportation efficiency, safety
 healthy people, communities
 productive, efficient economy

WEATHER READY NATION

RESILIENT COASTAL COMMUNITIES & ECONOMIES

resilient coastal communities
 ocean and coastal planning, management
 safe, sound, efficient marine transportation
 improved coastal water quality
 safe, sound arctic access, management

HEALTHY OCEANS

improved understanding of ecosystems
 recovered, healthy species
 healthy habitats sustain resources, communities
 sustainable fisheries, safe seafood

NOAA'S VISION OF THE FUTURE:

RESILIENT ECOSYSTEMS, COMMUNITIES & ECONOMIES

Healthy ecosystems, communities, and economies that are resilient in the face of change

ENGAGEMENT ENTERPRISE

an engaged, educated public for informed environmental decisions

integrated services for evolving demands of regional stakeholders

international partnerships and policy leadership

modern information technology

diverse, evolving workforce

modern, safe, sustainable facilities

a high performing organization

ORGANIZATION & ADMINISTRATION ENTERPRISE



NOAA's Climate Adaptation and Mitigation Goal

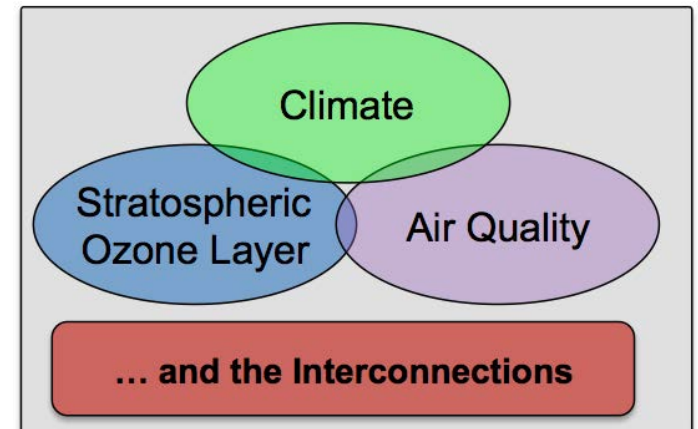


- NOAA and CSD have leadership roles in building the foundation of the Climate Change Building (and Air Quality and Stratospheric Ozone)⁶

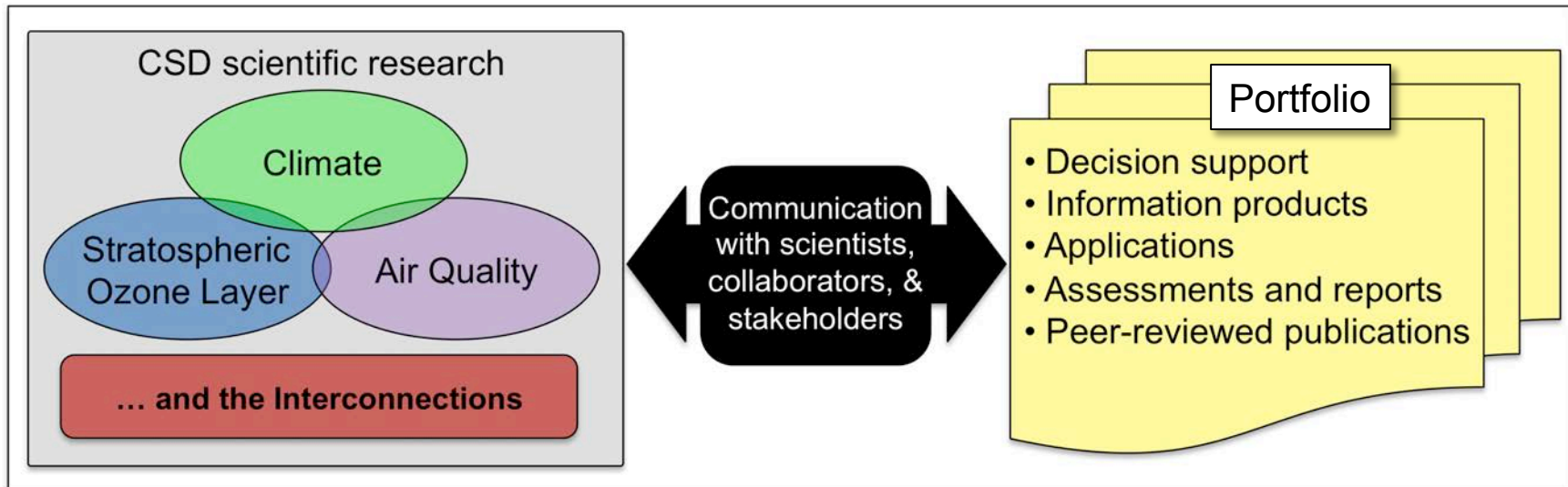
CSD Vision and Mission Statements

Vision: A nation that has the needed scientific understanding and information about our atmosphere (**environmental intelligence**) to make optimal decisions in the interests of the well being of current and future generations

Mission: To advance scientific understanding of three major environmental and societal issues of our time: **climate change**, **air quality** and **stratospheric ozone layer** through atmospheric research on the chemical and related physical processes that affect Earth's atmospheric composition



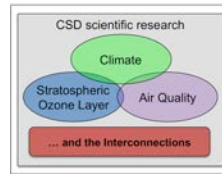
CSD Research Strategy



S. Brown (6-0)

- CSD strategy is to develop skilled scientists, tools, and methods and pursue opportunities to create this portfolio of results to address important societal issues

CSD Research Strategy



CSD competencies:

- **Identifying** new research directions and gaps in current understanding
- **Creating and exploiting** opportunities to contribute
- **Developing** new instrumentation, sampling methods and modeling techniques
- **Conducting** laboratory studies of fundamental physical and chemical processes
- **Observing** the composition and physical state of the atmosphere from a variety of platforms
- **Formulating and using** models and diagnostic and interpretive methods to advance the understanding of atmospheric processes
- **Communicating** our results to other scientists and stakeholders through decision support, information products, applications, assessments and reports and publications in the peer-reviewed literature

CSD Research Topics

Climate



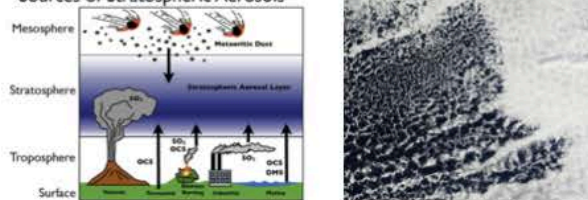
Climate: Seeking an improved understanding of the climate system

Research areas:

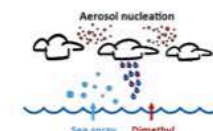
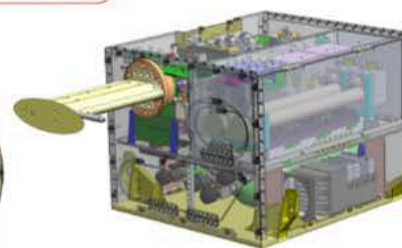
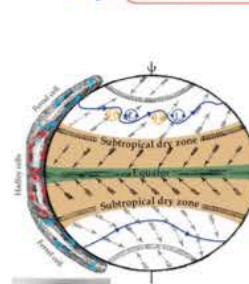
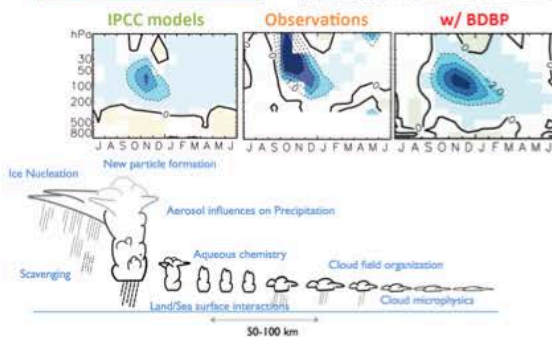
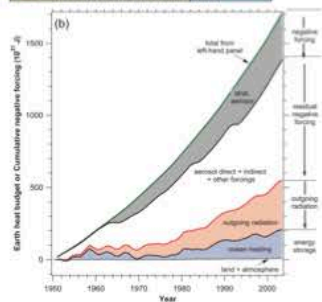
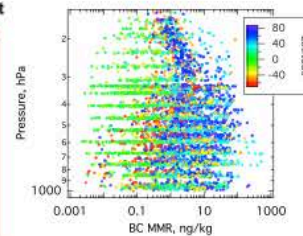
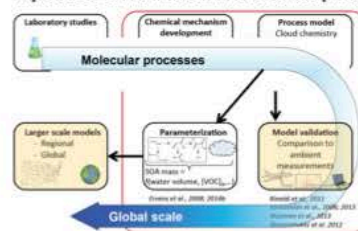
- Non-CO₂ greenhouse gases: methane, nitrous oxide, tropospheric ozone, synthetic gases
- Aerosol formation, composition, and radiative effects
- Climate model analysis
- Global energy budget and water vapor
- Atmospheric dynamics
- Boundary layer meteorology
- Instrumentation and platform development



Sources of Stratospheric Aerosols



Aqueous SOA formation: Model development



CSD Research Topics

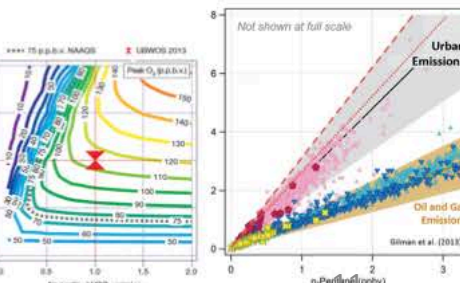
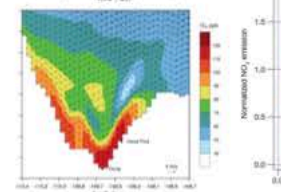
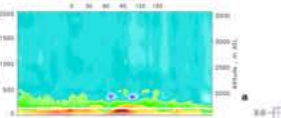
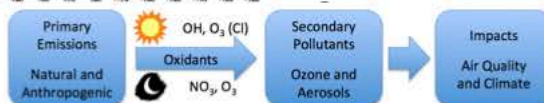
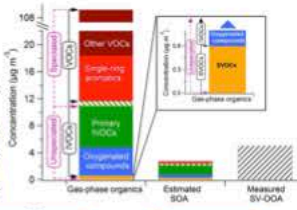
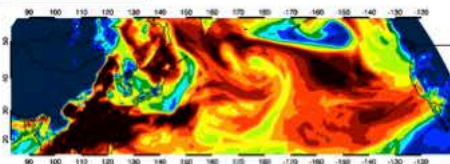
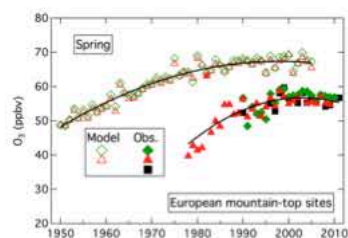
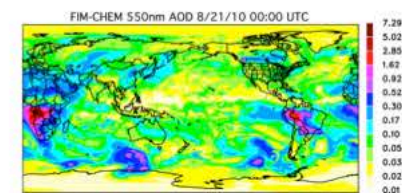
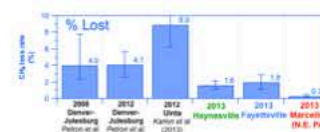
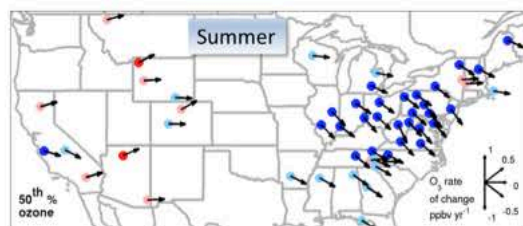
Air Quality



Air Quality: Seeking to advance understanding of the sources and processes that control air quality at local, regional and global scales

Research areas:

- Ozone precursor emissions, ozone formation and removal processes
- Emissions of aerosols and aerosol precursors
- Aerosol formation and growth, esp. organic, black carbon and sulfate aerosols
- Regional and long-range transport of pollutants
- AQ forecasting and US emission inventories
- Instrumentation and platform development



CSD Research Topics

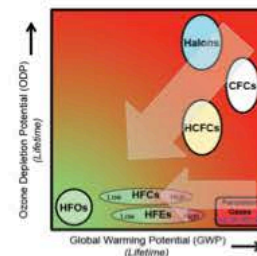
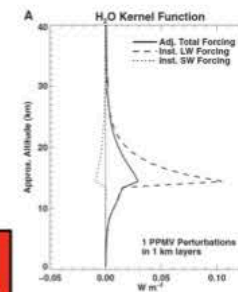
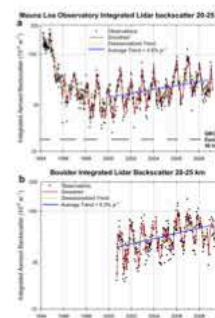
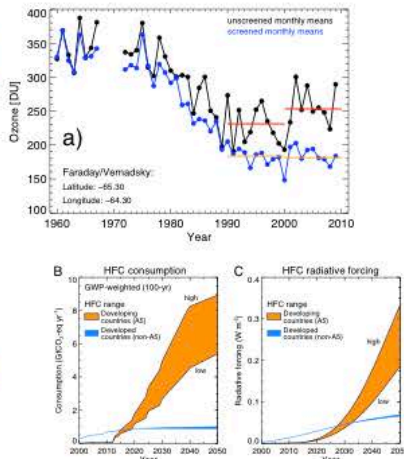
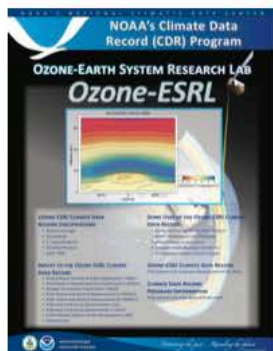
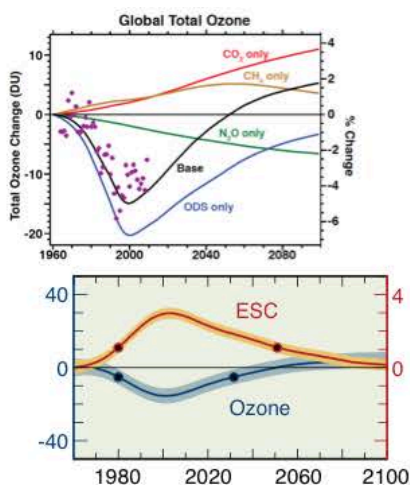
Stratospheric Ozone Layer



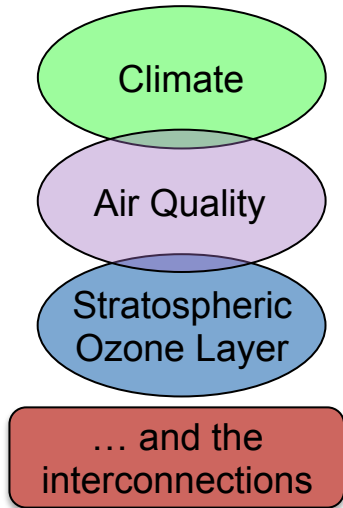
Stratospheric ozone layer: Seeking to advance our scientific understanding of the processes that govern the past, present and future composition of the stratosphere, with a special focus on stratospheric ozone depletion and recovery

Research areas:

- Ozone climatology and recovery of the ozone layer
- Emissions and dynamical processes that affect the ozone layer
- Laboratory kinetic studies to evaluate ozone-depleting substances
- Science, leadership and service for the Montreal Protocol



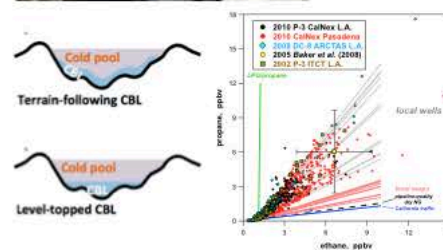
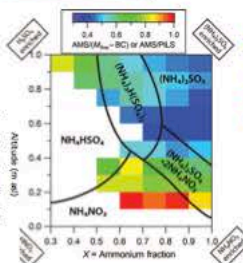
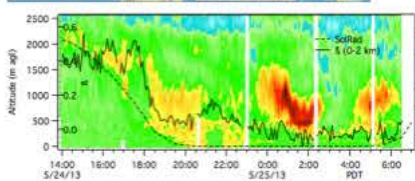
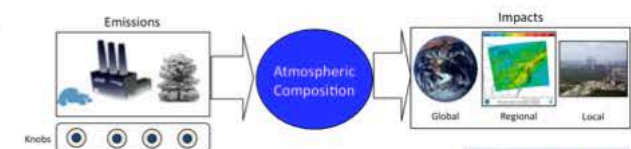
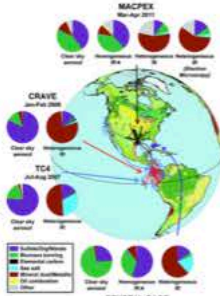
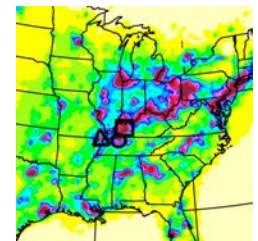
CSD Research Topics



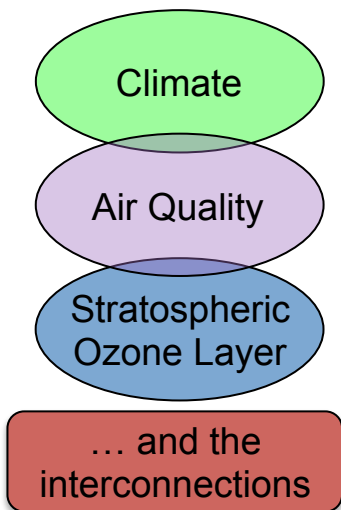
Interconnections: Seeking to leverage and optimize our scientific understanding of climate, air quality and the stratosphere through recognition of the interconnections among these topics.

Research areas:

- Organic aerosols, black carbon, tropospheric ozone
- Attributing surface ozone sources
- Boundary layer processes
- Emission inventories
- Megacity methane emissions
- Ship emissions



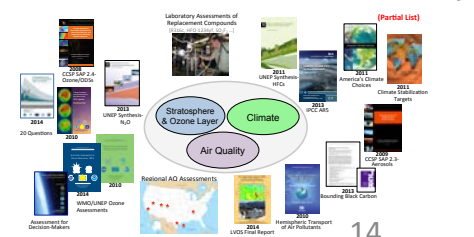
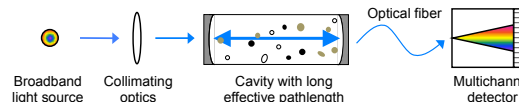
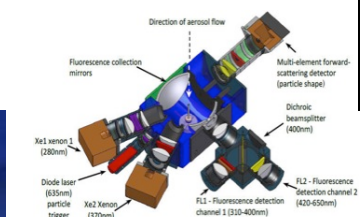
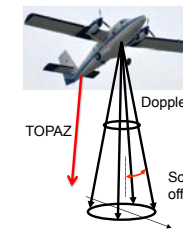
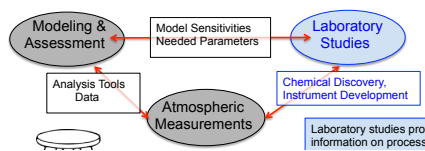
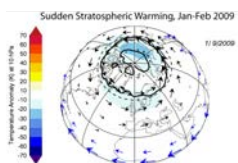
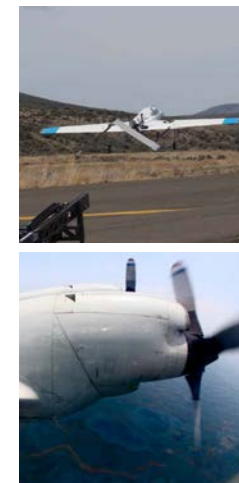
CSD Research Topics



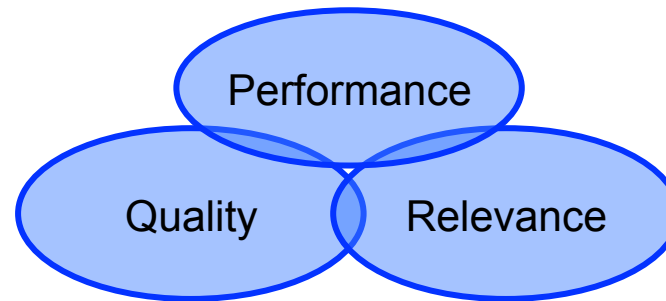
Interconnections: Developing new research tools and methods. Describe new approaches that will enhance our understanding of air quality and climate issues and their connections. Special topics of **airborne missions** and **assessments**.

Research areas:

- Stratospheric warmings
- New detectors for gases and aerosols
- Laboratory studies
- Offshore oil and gas blowouts
- Wind profiling and boundary layer dynamics
- Agricultural emissions



OAR Review Criteria



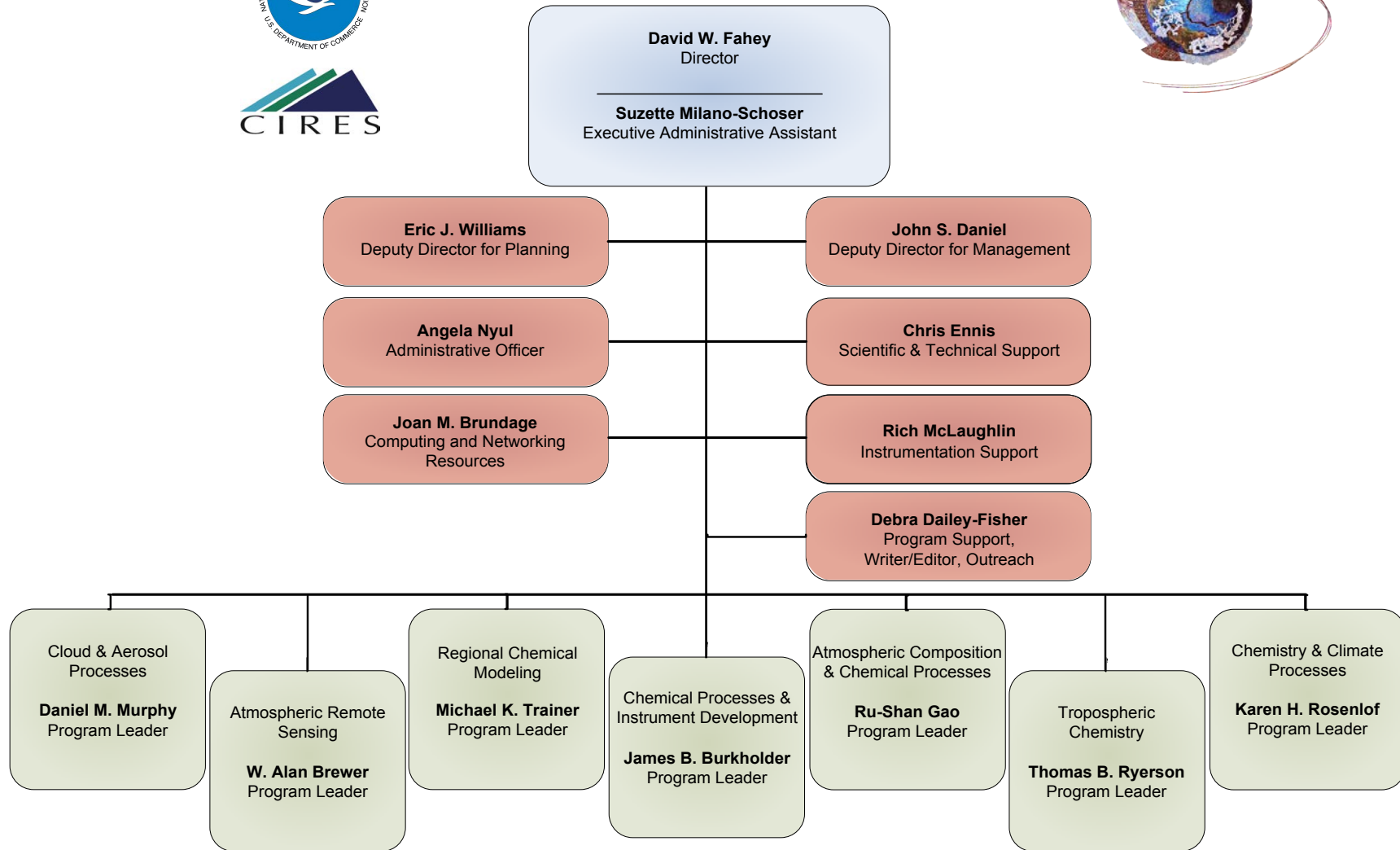
Performance: The effectiveness and efficiency with which research and development activities are organized, directed and executed

Quality: The merit of the scientific and technical work within the scientific community

Relevance: Value of the research results to users beyond the scientific community

“Not everything that counts can be counted,
and not everything that can be counted counts.”
Albert Einstein

CSD Organizational Chart



- CSD has a strong, robust and flexible organizational structure

CSD Research Program Areas



Cloud and Aerosol Processes

Measuring and understanding how atmospheric particles affect clouds, climate, and air quality

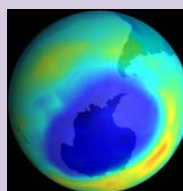
Program Leader: Dan Murphy



Tropospheric Chemistry

Developing and deploying state-of-the-art instruments to understand how processes in the lower atmosphere affect air quality and climate today – and in the future

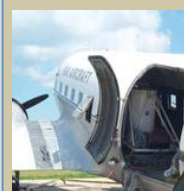
Program Leader: Tom Ryerson



Chemistry & Climate Processes

Understanding atmospheric chemistry and climate processes with integrated analysis and modeling

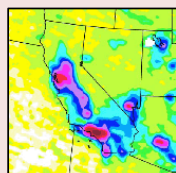
Program Leader: Karen Rosenlof



Atmospheric Remote Sensing

Developing and using laser-based instruments for deployment on land, ship, and aircraft to understand atmospheric processes that affect air quality, weather, and climate

Program Leader: Alan Brewer



Regional Chemical Modeling

Using models and observations to understand atmospheric pollutant transport, processing, and effects on air quality and climate

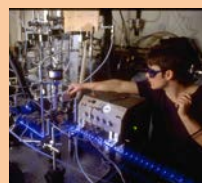
Program Leader: Michael Trainer



Atmospheric Composition and Chemical Processes

Conducting airborne field measurements critical to understanding climate, air quality, and ozone depletion

Program Leader: Ru-Shan Gao



Chemical Processes and Instrument Development

Developing instrumentation to improve our ability to study key atmospheric species in the laboratory and field

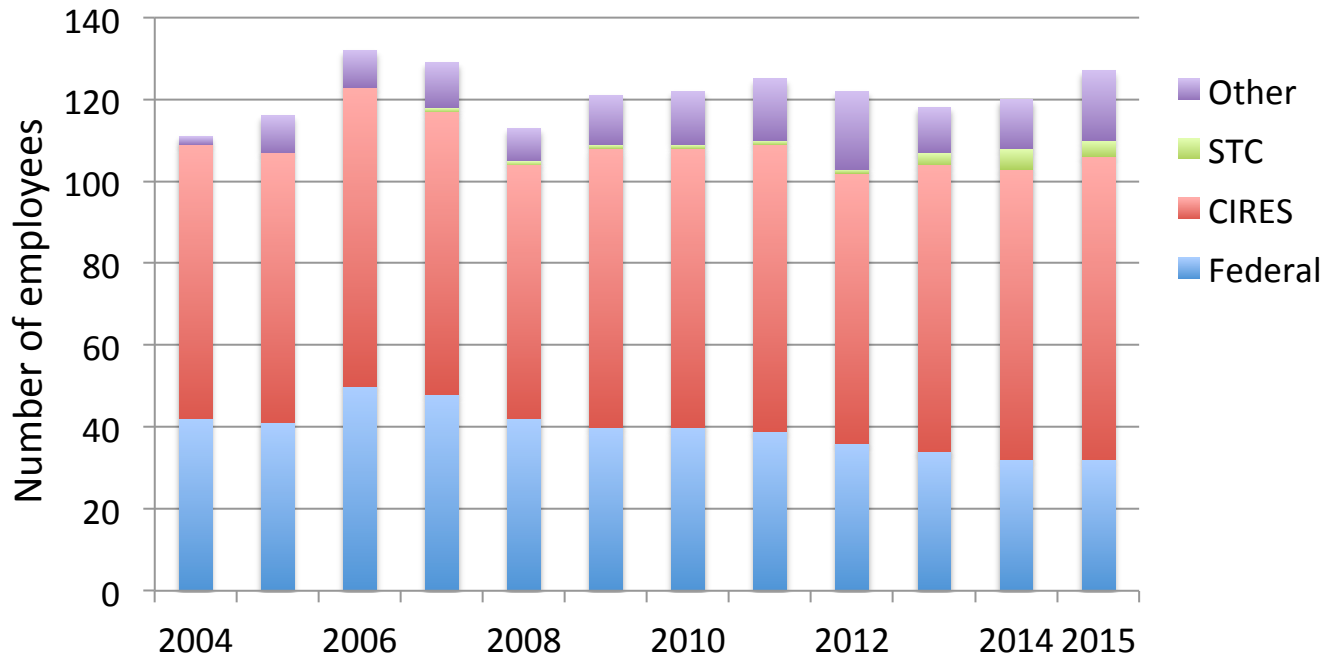
Program Leader: Jim Burkholder

- CSD has Program Leaders with outstanding accomplishments and experience

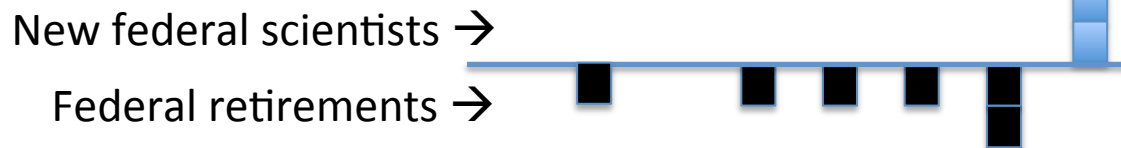
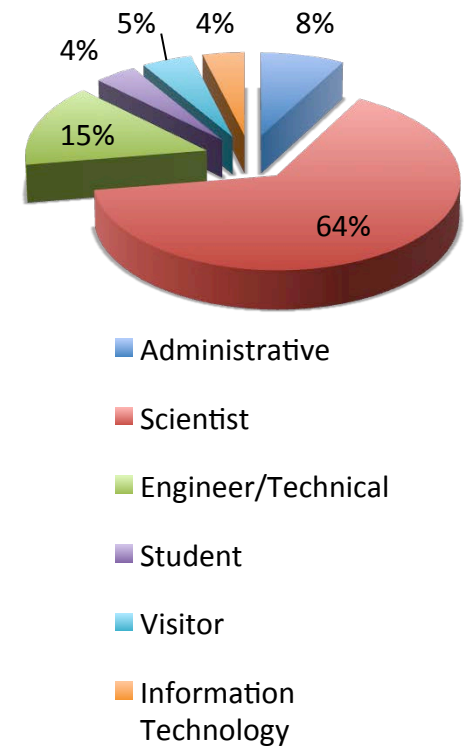
CSD Personnel Data



By Affiliation

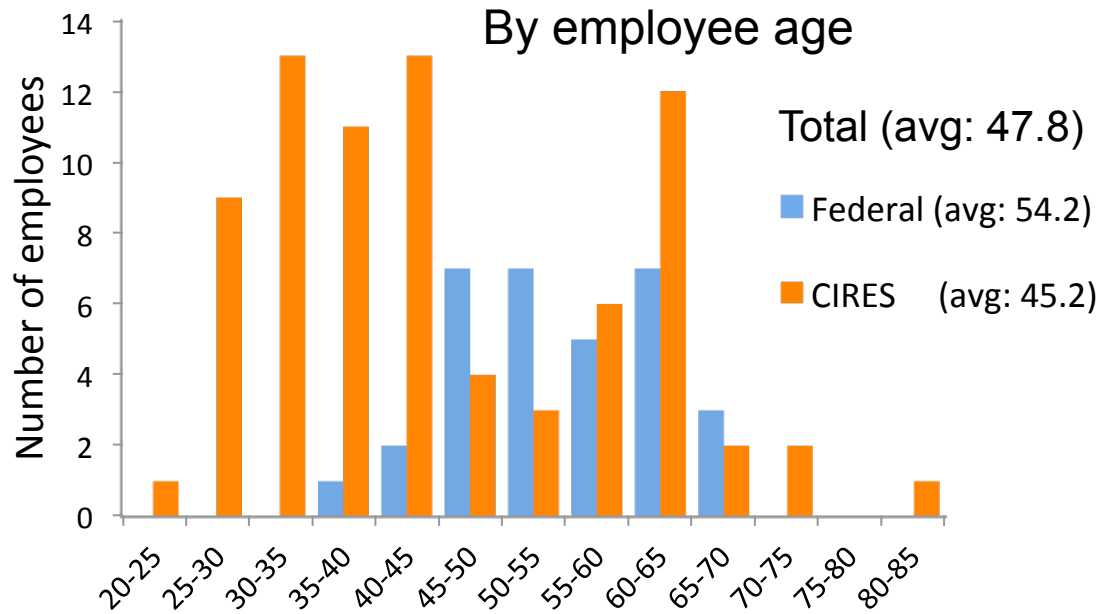


By Job Function



- CIRES is an essential component of CSD's continued success
- Increasing the Federal scientific staff is a high priority for the future

CSD Personnel Data



By ethnicity

	Federal (%)	CIRES (%)
White	91	88
Asian	3	12
Hispanic	6	0
Other	0	0

High priorities for CSD are:

- Slowing average growth below 0.5 year per year
- Increasing the diversity of the combined Federal and CIRES staff

By gender

	Total	Men	Women	%Women
Total	127	88	39	31
All Federal	32	23	9	28
All CIRES	75	56	19	25
STC	5	1	4	80
Other	15	8	7	47
Federal scientists	22	20	2	9
CIRES scientists	53	42	11	21

Quality and Performance of the CSD Research Staff *



Recognition (165 entries)

Prestigious Memberships
International Awards
Presidential Awards
DOC/NOAA/OAR Awards
CIRES Awards
Other U.S. Awards
Refereeing/Reviewing Awards
Recognition from Academia
Recognition of Publications
Recognition of Posters & Presentations
Recognition of Outreach, Education,
EEO and Diversity Efforts

Leadership Roles (200)

NOAA and Other Federal
CIRES
U.S. Nonfederal
International
Field Mission Leadership
Conferences

Service to Scientific Community (67)

Editorships
Reviewer for Programs/Organizations

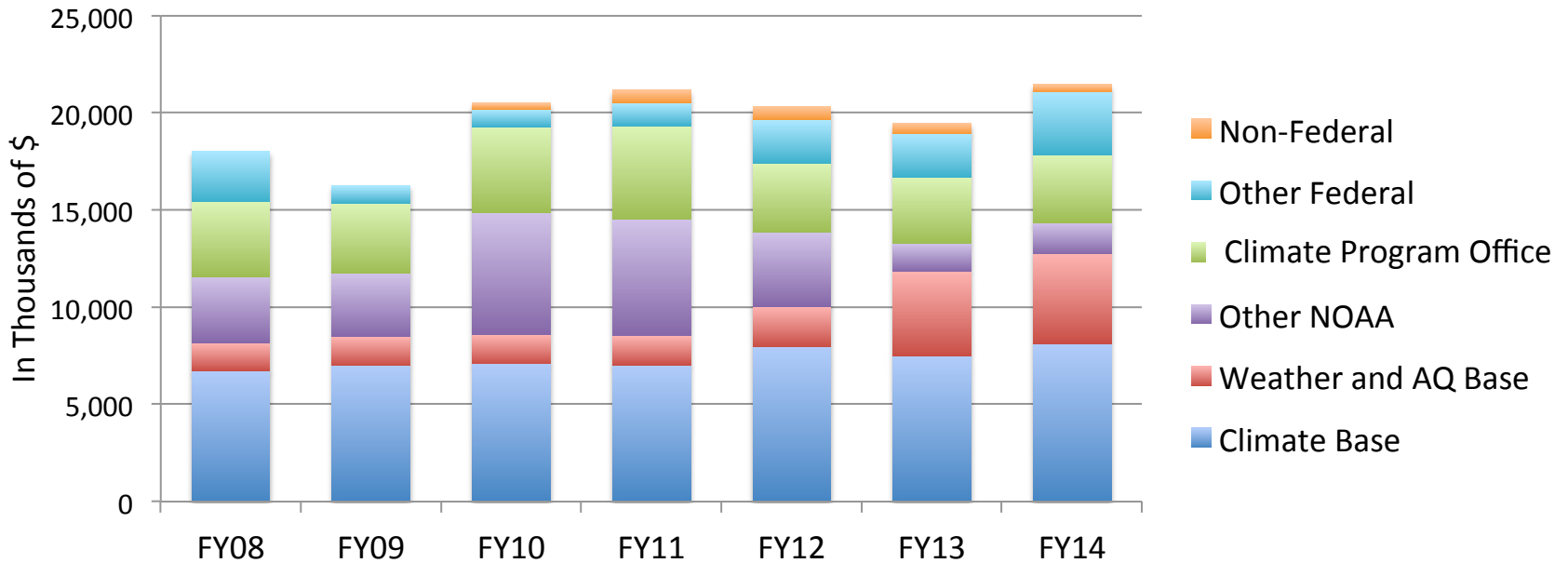
Educational Activities (75)

Education/Mentorship
Outreach
Products

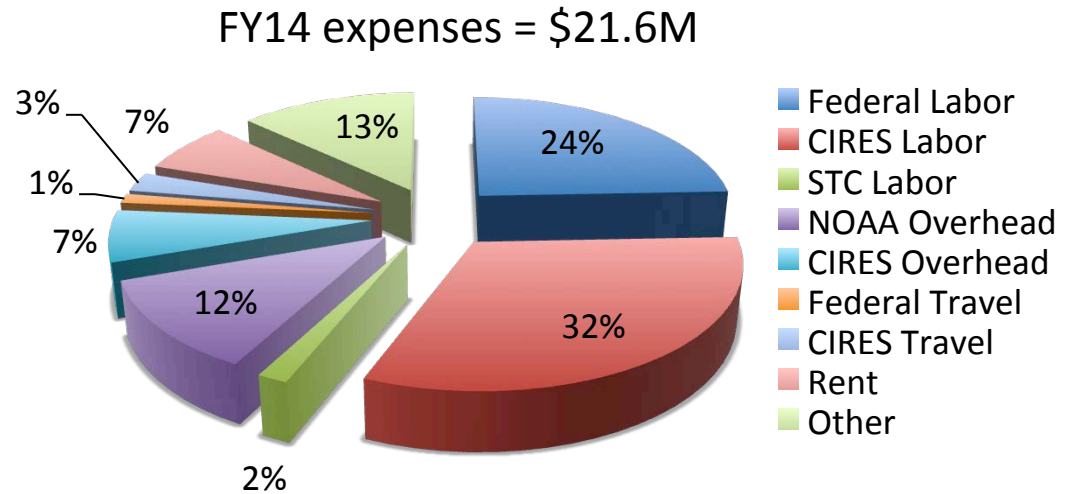
- The quality of CSD's research and support staff is outstanding

**See details in Supporting Information document*

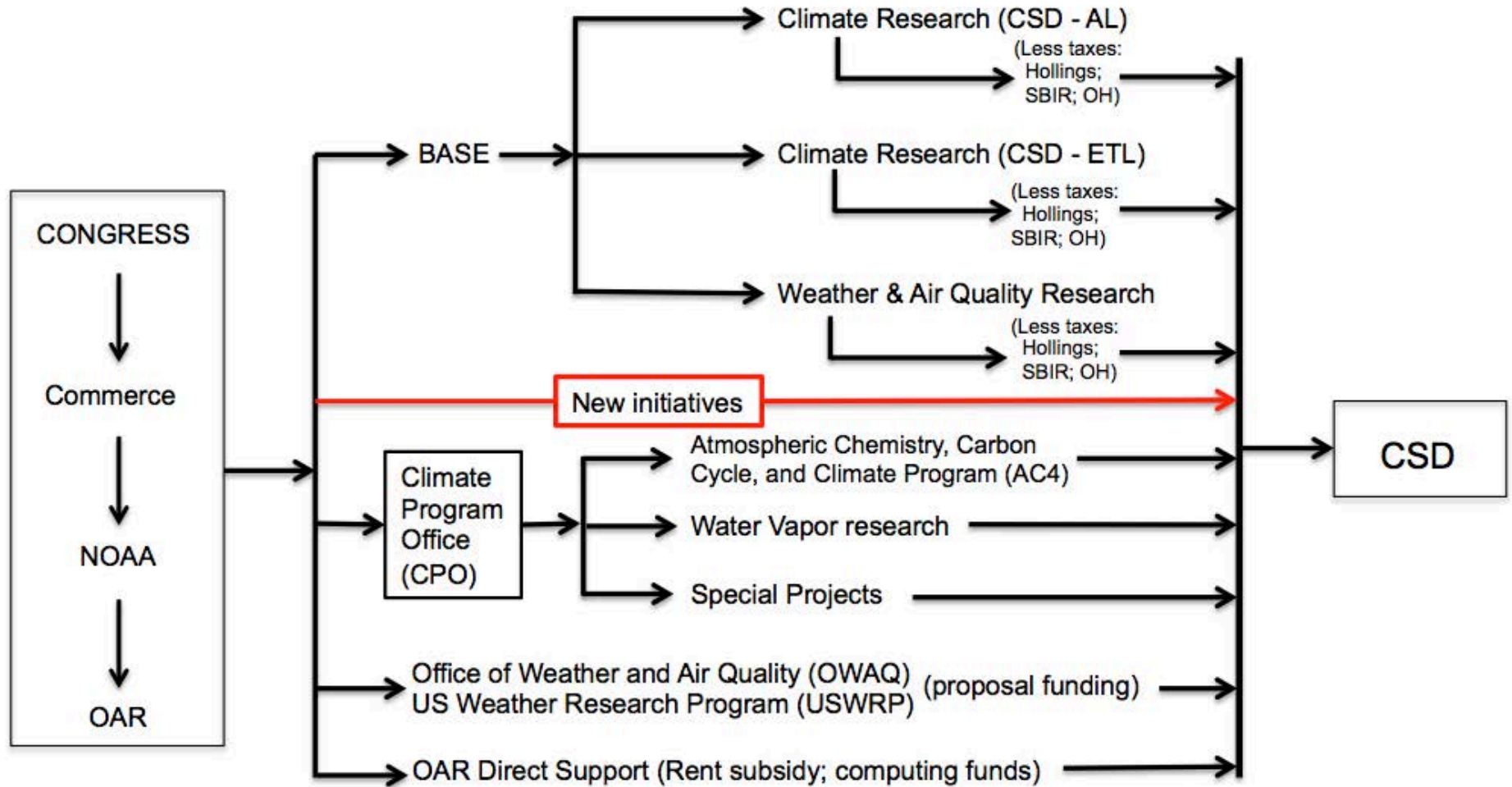
CSD Major Income Sources and Expenses



- CSD NOAA funding in constant \$\$ has declined in recent years
- Our personnel-to-total expense fraction has been constant near 77%

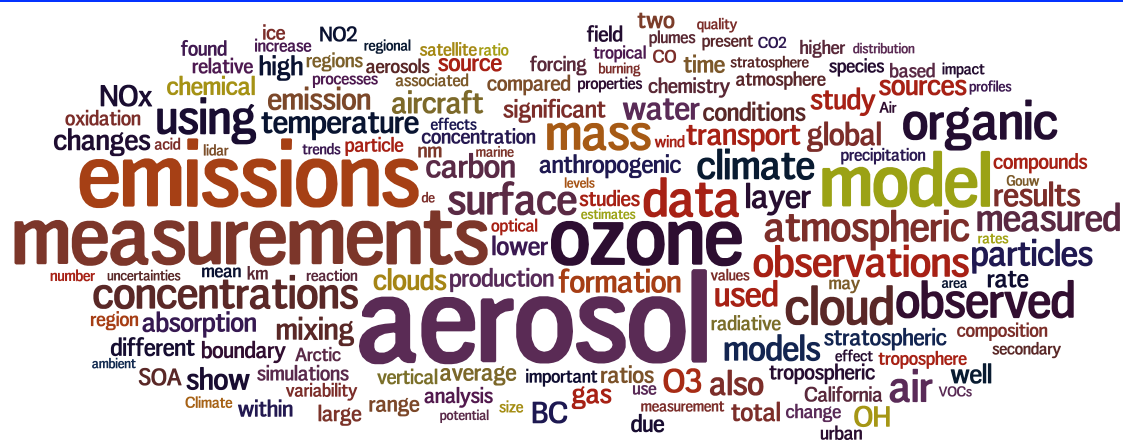


CSD Income Sources from NOAA



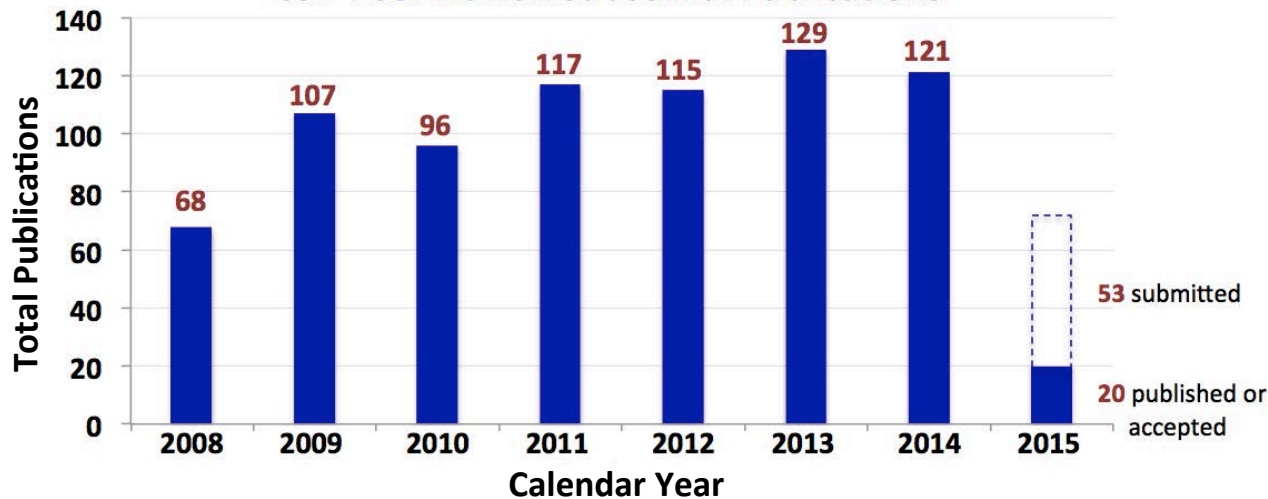
- CSD funding sources and associated processes are complex

CSD Publications



- A word cloud derived from the titles of the ~800 peer-reviewed papers published in 2008-2015
- Total citations >16800

CSD Peer-Reviewed Journal Publications



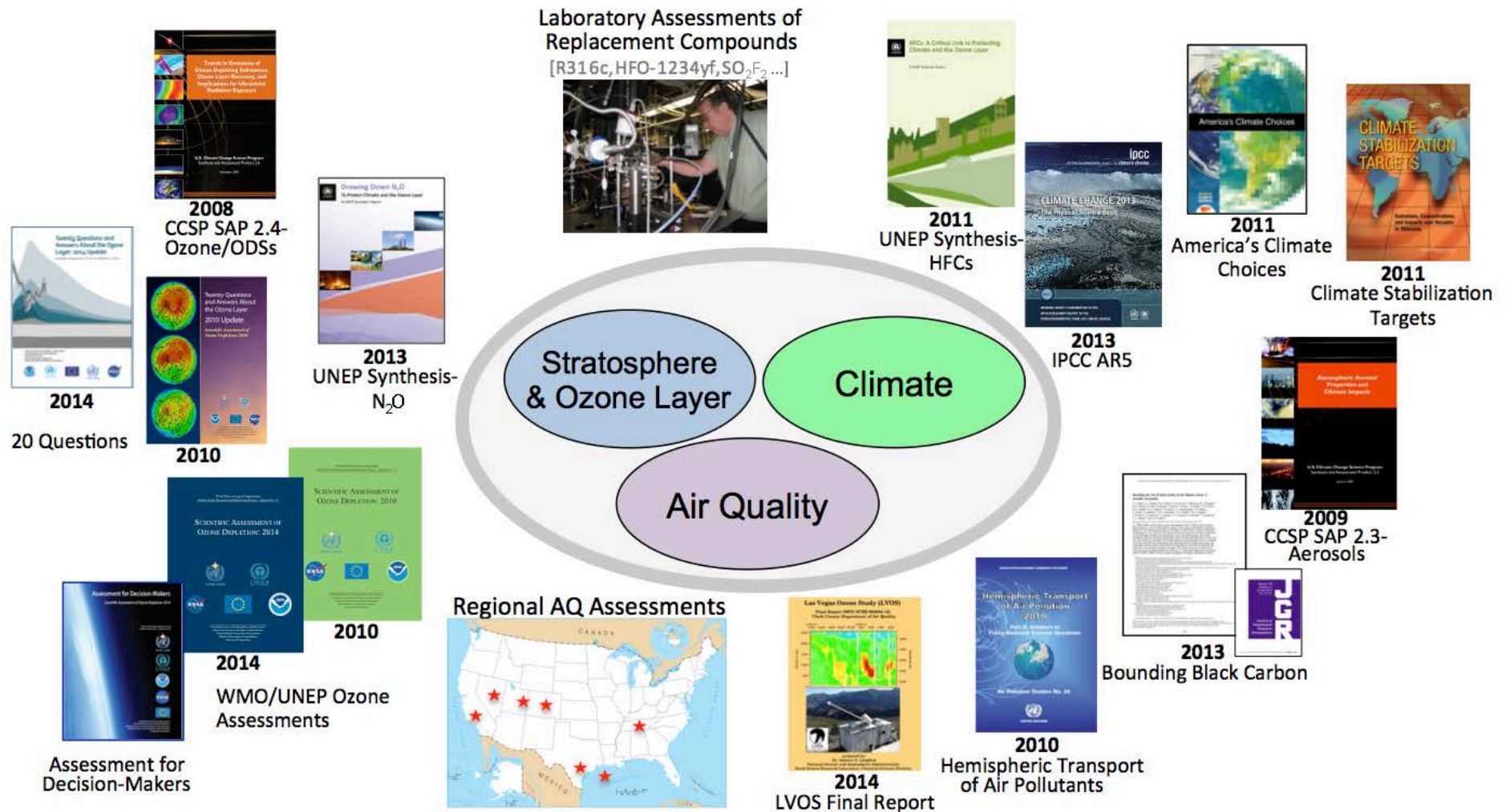
2014 median Hirsch Index = 29

- Peer-reviewed publications are CSD's primary product
- The impact of these publications is large and profound

2008-2015 author collaboration:

- External: 86%
- NOAA labs: 20%
- Universities: 72%
- NASA: 16%
- NCAR: 18%
- International: 44%
- Private sector: 11%

CSD Assessments and Stakeholders Reports



- CSD assessment contributions are outstanding in quality and quantity and have large national and international exposure and impact

Transitioning CSD Research to Stakeholders

R2X: Research to operations, applications, information and understanding

- R2X Stages
- **Research:** Stakeholder requests scientific expertise from CSD to help solve a problem
 - **Development:** CSD scientists and management develop an approach to provide a solution
 - **Demonstration:** With stakeholder approval and involvement, CSD executes research plan, with collaborators when necessary
 - **Application/Understanding/Information:** CSD research results are synthesized into scientific information that stakeholder needs
-

Examples of successful transitions of CSD research:

- Laboratory and modeling research to provide industry with actionable information on substitutes for stratospheric ozone depleting compounds (*J. Burkholder, 1-3*)
 - Field observations and modeling to provide Clark County, NV, with a scientific synthesis document that demonstrates sources of surface ozone that lead to non-attainment of the O₃ NAAQS (*A. Langford, 5-2*)
 - Leadership of international assessments that provide policy makers with the sound scientific information they need to make critical decisions concerning the environment (*C. Ennis, 7-6*)
-

- CSD provides actionable scientific information based on our unique capabilities in field observations, laboratory studies, and modeling

Future Plans of the Chemical Sciences Division*

- UAS platforms and instruments
- Bioaerosol
- Wildfires
- Oil and gas (methane and VOCs)
- Surface ozone standards
- Observations and climate modeling world
- Wind energy diagnostics
- NASA AToM mission
- Inverse/adjoint modeling



**See Research Accomplishments and Plans document*

Review Structure

- Overall goals:
 - Communicate results and their importance
 - Provide 2 levels of formal material: presentations and posters
 - Substantial discussion with many scientists, both early career and senior
- Structure:
 - Overview, 5 minute presentations, poster viewing, panel discussion
 - Electronic posters augmented with hardware and modeling exhibits
 - Tour of CSD laboratory facilities and NOAA P-3 field site
 - Lunch with early and mid-career scientists

THEME 1: Climate including the stratosphere (GC-402)

Chair: Karen Rosenlof

Timekeeper: Debe Dailey-Fisher

1000 Opening talk: Climate and the stratosphere research overview – Karen Rosenlof (1-0)

Session 1 Topics

1015 Analysis of stratospheric ozone recovery – Birgit Hassler (1-1)

1020 Ozone depletion, climate change, and policy – John Daniel (1-2)

1025 Laboratory studies of replacement compounds for ozone depleting substances – James Burkholder (1-3)

1030 Water vapor in the upper troposphere/lower stratosphere – Troy Thornberry (1-4)

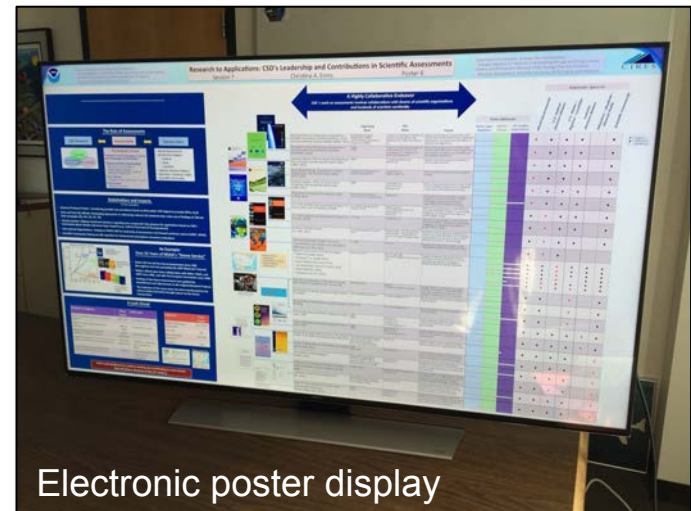
1035 Improving the understanding of the stratospheric aerosol layer – Andrew Rollins (1-5)

1040 Radiative forcing, feedbacks, and the energy budget in the climate system – Robert Portmann (1-6)

1045 Poster browsing (30 mins)

1115 Session discussion (15 mins)

Agenda



Electronic poster display

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