ON THE AIR!

NOAA CIRES

AERONOMY LABORATORY

A Quarterly Newsletter of the NOAA Aeronomy Laboratory

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About this Issue...

This newsletter marks the occasion of a significant anniversary. On 16 September, ten years will have passed since the signing of the historic United Nations "Montreal Protocol on Substances that Deplete the Ozone Layer." Few could have predicted the scale of its success in marshaling the world-wide participation of scientists, governments, and industry in efforts to understand and protect stratospheric ozone... or that the general public would so embrace the issue that terms like "ozone layer" and "CFCs" would become household words.

The role of NOAA and Joint Institute scientists has been a substantial one in this continuing international "success story." This issue of *On the Air!* contains a special two-page summary that highlights the achievements of the "Montreal Protocol Decade" and looks ahead to the issues that scientists and decisionmakers will face in the coming decade, as the next chapters in the story unfold. We hope you find it interesting.

ANNOUNCEMENTS

Susan Solomon Receives UNEP Honor

The United Nations Environment Programme is honoring **Susan Solomon** on 16 September in Montreal. She will receive a UNEP Ozone Award in recognition of her research on deciphering the cause of the Antarctic ozone hole, and for her leadership and contributions to the international state-of-understanding assessments of the science related to the ozone layer. The awards ceremony will be part of a full day of activities celebrating the 10th Anniversary of the signing of the Montreal Protocol.

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Thanks Are in Order...

Several NOAA and CIRES scientists donated materials for science experiments that will be a part of this fall's curriculum at Whiteman Elementary School in Denver. **Alex Weaver** coordinated the effort; **Greg Frost** and **Demetry Gemolas** spearheaded the Aeronomy Lab's contributions. Thanks to all 20 AL staff who contributed, and special thanks to Greg for personally delivering the *entire* NOAA/CIRES contribution to the Denver teachers!

And thanks to **Donna Sueper, Barbara Herrli, LeAnn Droppleman, Tom Jobson, Matt Nowick, Tom Van Zandt, Craig Stroud, Matthew Sueper** (Donna's son) and **Verity Fridd** (Craig's wife) for providing us with the colorful flower beds around the Aeronomy Lab. The group planted a wonderful variety of mostly wildflowers. The Aeronomy Lab thanks the Technical Services department of DOC for funding the supplies through their Adopt-A-Plot Garden group.

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HOME and AWAY

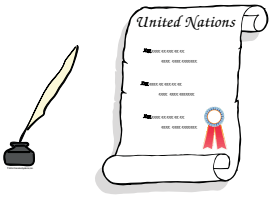
It's a busy season of field missions for many groups at the Aeronomy Laboratory:

- During the month of September, members of the Tropospheric Chemistry Program, the Theoretical Aeronomy Program, and the Computing and Networking Resources Group will be in Newfoundland for the **North Atlantic Regional Experiment (NARE)**. Aeronomy Lab scientists will be gathering chemical and meteorological data on several flights of the NOAA WP-3D aircraft, and collaborators will make measurements from the ground and from other platforms. NARE scientists are studying the chemical and dynamical processes that govern the transport of ozone precursors from the North American continent, and the subsequent formation and transport of tropospheric surface-level and "greenhouse" ozone on a hemispheric scale in the North Atlantic region. The influence of seasonal weather fronts on atmospheric chemistry and transport is of particular interest in this NARE campaign.

- Also during September, the third and final deployment of the **Photochemistry of Ozone Loss in the Arctic Region in Summer (POLARIS)** campaign will occur. Members of the Meteorological Chemistry Program and the Middle Atmosphere Program are gathering and analyzing data from instruments aboard the NASA ER-2. Combined with the earlier measurements from the spring and summer missions, the data will provide insight into the seasonal behavior of Arctic stratospheric ozone as it changes from very high concentrations in spring down to very low concentrations in autumn.

- In July and August, members of the Tropical Dynamics and Climate Program participated in a mission of the NOAA **Pan American Climate Study (PACS)**. The mission was the inaugural cruise of the new NOAA ship, the *Ronald H. Brown.* Wind and precipitation measurements gathered using AL wind profilers will contribute to the overall aim of the PACS mission, which is to improve the scientific understanding of the structure of precipitating cloud systems in the tropical Pacific Ocean.

The Montreal Protocol Decade, 1987-1997: NOAA's Role in an International Achievement



September 16, 1987: A Journey Begins

On the 16th of September, 1987, the historic agreement known as the "Montreal Protocol on Substances that Deplete the Ozone Layer" was signed by many nations of the world.

Also at that moment, scientists from NOAA and other agencies were in Antarctica studying the recently discovered "ozone hole," in what was to be a landmark international scientific mission.

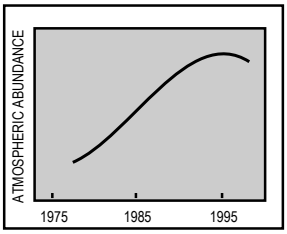
A remarkable decade of scientific, technological, and policy achievements had begun. NOAA scientific contributions would be prominent among the joint endeavors of scientists, economists, technologists, legal experts, industry leaders, and decisionmakers worldwide.

1987-1997: A Decade of Accomplishments

The stratospheric ozone layer protects life on Earth from harmful amounts of the Sun's ultraviolet radiation. The scientific understanding of the ozone layer has advanced because of the contributions of many researchers around the world, and NOAA and Joint Institute scientists have been prominent among them. NOAA/Joint Institute researchers have:

- **charted our CFC history**, documenting the steady rise of ozone-depleting chlorofluorocarbons (CFCs) in the atmosphere during the 1970s-1980s, and then detecting the first signs of slow reversal in the lower atmosphere in the 1990s after decisions to reduce CFC emissions became effective (a Montreal Protocol success story).
- **explained the cause of the Antarctic "ozone hole"** and led and participated in field studies and satellite observations that tested and improved our understanding of ozone losses.
- **discovered an ozone-climate connection**, explaining how ozone depletion cools the lower stratosphere, an important finding for research on the detection and attribution of climate change.
- **helped identify ozone-friendly substitutes for CFCs**, saving industry and the public the expense of "false starts" as well as "false alarms."
- **fostered sound decisionmaking** by playing leading roles in updating, assessing, and communicating scientific understanding to governments and industry in "user-friendly" terms — pivotal contributions in a remarkable story of the co-evolution of science and policy.

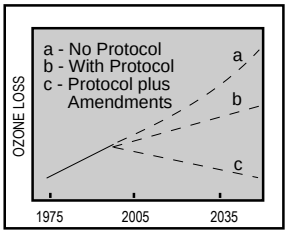
OUR OZONE SHIELD



OUR CFC HISTORY

1998 and Beyond: The Road Ahead

- Ozone-depleting chlorine levels will be at their highest in the stratosphere during the next few years; the ozone layer's "most vulnerable decade" lies just ahead.
- NOAA scientists will:
  - > look for the first signs of the recovery of the ozone layer
  - > investigate the possibility of new threats to the ozone layer
  - > continue research on evaluating ozone-friendly substitutes where needs remain
  - > advance scientific understanding of any surprises or setbacks that may be in store (e.g., what would be the implications of a protracted, very cold winter in the Arctic?)
- The "Montreal Protocol Decade" will serve as a model for future efforts on other global environmental issues — a paradigm for successful international partnerships at the interface of science, industry, and policy.



OUR OZONE FUTURE

Depletion of the Ozone Layer: How Have Science and Decisionmaking Interacted?

Scientific "state-of-understanding" assessments have been the bridge between the scientific community and decisionmakers. These reports take stock of the recent advances in science and summarize the findings in policy-relevant terms. The longest-running of these assessments are those done for the Montreal Protocol. The timeline below illustrates the decisonmakers' responses (left-hand sequence) to major scientific findings regarding the stratospheric ozone layer (right-hand sequence), as reported by the assessments requested by the Protocol.

- **UNITED NATIONS**

- **SCIENCE COMMUNITY**

ONE OF A 3-PART SET
- SCIENCE
- EFFECTS
- TECHNOLOGY & ECONOMICS

DISCOVERY OF THE PROBLEM 1975

1987 — MONTREAL PROTOCOL (FREEZE ➡ 50% CUT IN EMISSIONS OF OZONE-DEPLETING CHEMICALS)

1988

1989 — 1ST MEETING OF PARTIES

1990 — 2ND ☑ LONDON AMENDMENT (PHASE-OUTS OF MAJOR DEPLETORS)

1991 — 3RD ☑

1992 — 4TH ☑ COPENHAGEN AMENDMENT (FASTER PHASE-OUT SCHEDULE)

1993 — 5TH ☑

1994 — 6TH ☑

1995 — 7TH ☑ VIENNA ADJUSTMENT (CAPS ON OTHER OZONE DEPLETORS)

1996 — 8TH ☑

1997 — 9TH ☑

1998 — 10TH ☐

1999 — 11TH ☐ CITY X

ASSESSMENT: 1989 ☑ → OZONE "HOLE" DISCOVERED AND EXPLAINED

ASSESSMENT: 1991 ☑ → GLOBAL DOWNWARD OZONE TRENDS OBSERVED

ASSESSMENT: 1994 ☑ → INCREASE IN ULTRAVIOLET RADIATION OBSERVED

ASSESSMENT: 1998 ☐ (STARTING NOW)
- CFCs STARTED DOWNWARD ✓
- NEEDED SUBSTITUTES?
- AVIATION IMPACTS?
- OZONE-LAYER RECOVERY ?
- SURPRISES ?

ACCOUNTABILITY ?

WHAT'S UP WITH PEOPLE

Stephan Borrmann from the University of Mainz is visiting the Middle Atmosphere Program from Aug. 26-Sept. 20 to work on a variety of topics concerning atmospheric chemistry and aerosols... **Yuichi Ono** from the Communications Research Laboratories in Tokyo is visiting the Tropical Dynamics and Climate Program. In his year-long visit, he will work on the analysis of wind profiler obserations from the Trans-Pacific Profiler Network. **Zachary Wilson** has completed his summer research with the TDC Program and has returned to his studies at CU... **Jenny Fox**, **Chris Masters**, and **Matt Nowick** will each work for a few months with Antarctic Support Associates. Jenny will be doing computer support work at McMurdo Station through February; Chris will work as a systems analyst from October to December, improving data acquisition systems onboard two of the Antarctic research ships; and Matt will provide field support for experiments... In the Atmospheric Chemical Kinetics Program, **Frank Sauer** has arrived from the Max Planck Institute to begin post-doctoral research. **Tomasz Gierczak** will return to the University of Warsaw at the end of September. Arriving on October 1 is **Steve Brown**, who will join the group as a National Research Council postdoctoral researcher... We wish everyone the best in their new endeavors, whether here or elsewhere!

COMMUNICATING OUR SCIENCE

To Decisionmakers: Dan Albritton will be the science advisor to the U.S. delegation for the Ninth Meeting of the Parties to the Montreal Protocol, which occurs September 15-17 in Montreal.

To the Scientific Community: Ned Lovejoy gave an invited talk at the American Chemical Society meeting, held in Las Vegas, September 8-12. Cheryl Longfellow presented a poster... Tom Van Zandt gave two invited talks at the Geophysics of Atmospheric Turbulence Workshop at Hanscom Air Force Base, MA, on September 3-4... Stu McKeen and Jim Roberts gave talks at the Meeting on Biogenic Hydrocarbons in the Atmospheric Boundary Layer held in Charlottesville, Virginia, August 24-27... In July, Ravi gave an invited presentation and Mary Gilles presented a poster at the Conference on New Aspects of Photochemistry and Reaction Dynamics in Narita, Japan... Also in July, Ken Gage presented three papers at the International Association of Meteorology and Atmospheric Sciences Meeting in Melbourne, Australia.

To Media: On July 24, Dan Albritton was one of two scientists who briefed the White House press corps on the topic of climate change. Dan's briefing on scientific "knowns and unknowns" was part of a series of events that the Administration is carrying out in order to raise the awareness of the press and the American public about climate change... The Photochemistry of Ozone Loss in the Arctic Region in Summer (POLARIS) campaign hosted an open house for the media, legislators, and the general public in Fairbanks, Alaska, on September 13.

To the Public: On July 19, Christopher Williams participated in a science "open house" in conjunction with the commissioning of the new NOAA ship, the *Ronald H. Brown*, in Savannah, Georgia. Legislators, NOAA/DOC staff, and the general public toured the ship and visited the displays, including an Aeronomy Lab display that Christopher designed and described to guests... On May 24, Ann Middlebrook helped out at the CIRES booth at the Boulder Creek Festival.

To Students and Teachers: Ravi is teaching a physical chemistry course this fall at CU... In May, Susan Solomon was interviewed by Southern Hills Junior High School about what it's like to be a scientist... Earlier in 1997, Ryan Sanders talked to a class at High Peaks Elementary School about research in Antarctica.

To Our Visitors: Dr. Joe Friday, the new Assistant Administrator for the NOAA Office of Oceanic and Atmospheric Research, visited the Boulder Labs on September 5-10. He spent the morning of September 8 at the Aeronomy Lab and discussed research with Dan Albritton, Susan Solomon, George Kiladis, Ravi, and Dan Murphy... On June 25, Chris Ennis briefed visitors from the Japanese Science and Technology Agency on research at the Aeronomy Lab. Chris also briefed visitors from the Mexico National Institute of Ecology, the U.S. EPA, and the Colorado Department of Public Health on July 8.

DOWN THE ROAD

September 18-19: Workshop on Molecular Processes, Amsterdam, The Netherlands. Ravi will give a keynote talk there and at the University of Utrecht.

September 22-24: Sixth International Conference on Carbonaceous Particles in the Atmosphere, Vienna. Dan Murphy and Ann Middlebrook will be presenting papers.

October 1-8: Tristatic Flatland Experiment (TRIFLEX97), Flatland Atmospheric Observatory, Champaign-Urbana, Illinois. Members of the Atmospheric Dynamics Program will use a new ("tristatic") method of making profiler measurements that is expected to improve accuracy.

November 24-25: American Physical Society Meeting, San Francisco. Susan Solomon will give an invited talk.

December 8-12: Fall Meeting of the American Geophysical Union, San Francisco. Several Aeronomy Lab scientists will present talks and posters.

On the Air! is a quarterly publication of the NOAA Aeronomy Laboratory. Please send any comments, questions, and suggestions to: Chris Ennis (phone 303-497-7538; email cennis@al.noaa.gov).