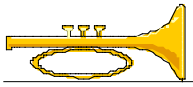
ON THE AIR!

NOAA CIRES

AERONOMY LABORATORY

A Quarterly Newsletter of the NOAA Aeronomy Laboratory

Volume 1, Number 2 April - June 1996



ANNOUNCEMENTS

New Seminar Coordinator

John Daniel will be the new seminar coordinator for the Aeronomy Laboratory, commencing with the 1996 Fall lineup. He takes over for **Andy Langford**, who has done a remarkable job during the last two years. Assisting John will be **Kathy Green,** who takes over for **Nanette Plock**. A big "THANK YOU" to Andy and Nanette, and "thanks" (in advance) to John and Kathy for their help with this important job.

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David Hanson is being honored at a CIRES luncheon on Friday, May 17. The event celebrates his receipt of the American Geophysical Union's 1996 Macelwane Medal for his work in advancing the understanding of heterogeneous chemistry of the atmosphere.

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House Ozone Hearing Transcript Available

We recently obtained a transcript of the hearing in which **Dan Albritton** testified in at the House of Representatives: "Hearing on Scientific Integrity and Public Trust: The Science Behind Federal Policies and Mandates, Case Study I — Stratospheric Ozone: Myths and Realities" (9/20/95). A copy (all 228 pages!) is available and may be checked out for short-term use. See Chris Ennis (ext. 7538) if you are interested.

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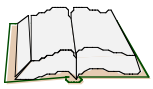
"Yellow Book" Available



You might like to tuck away a spare copy of the latest stratospheric ozone assessment (the World Meteorological Organization/United Nations Environment Programme *Scientific Assessment of Ozone Depletion: 1994* -- known as the "yellow book" to friends and family). No second printing is planned, and supplies are still adequate if you foresee future needs for yourself or colleagues. The next such review of the scientific understanding of the ozone layer will not occur until 1998. See Jeanne Waters (ext. 3134).

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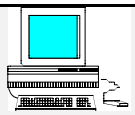


A BIT ON COMPUTING

The Aeronomy Laboratory now has a new Home Page on the World Wide Web, located at the address http://www.al.noaa.gov. It gives a very general overview of the activities of the Aeronomy Laboratory. A special aspect is that we have included the Executive Summary of the most recent stratospheric ozone assessment, including its section on "Common Questions About Ozone." Take a look and see what you think — we'd like to get your feedback. [Practical note: we now have a site license for Netscape, a Web "browser" that makes it easy business for you to "surf" the Web. Call us if you'd like us to get you started.]

—Walt, Cathy, and Jenny

THE FISCAL OUTLOOK: AN UPDATE FOR '96

After a succession of 13 Continuing Resolutions (CRs), NOAA now has an appropriated FY 1996 budget under which to operate for (the remainder of) this fiscal year. Its terms have been moderately anticipatable, based on those encountered in the earlier CRs. The support for the NOAA Climate and Global Change Program is funded significantly below its FY 1995 level and the support for other parts of NOAA has been reduced.

We estimate that, for the Aeronomy Laboratory, this will mean a loss of about $1,000,000 (~10%) in support for the year in which we are operating. This reduction has meant some changes in our operations.

Planning and carrying out research under a series of bits of a budget and foreseeing a likely final reduction of support have been frustrating and disappointing. Deb Wilson and her coworkers in our Administrative Office have helped enormously to smooth out our course through these CRs, and they have our thanks. Furthermore, I appreciate the patience of all that have continued to carry out our research under these circumstances.

We are at work describing the rationale and payoffs of our research proposed in the FY 1997 budget, which is currently under consideration by the Congress.

—Dan Albritton

NEW INSIGHTS: CFCs, VOLCANOES, and OZONE

What causes the "ups and downs" of ozone depletion from one year to the next? And why do the models predict less ozone depletion in the lower stratosphere than what is observed in that key region?

Susan Solomon and Bob Portmann of the Middle Atmosphere Program have offered some new in-sight in their paper in the March issue of *Journal of Geophysical Research*, co-authored with colleagues at NCAR and NASA. Their study is the first to incorporate long-term observations of atmospheric *particles*, as well as gases, into a state-of-the-art chemical/dynamical model of the stratosphere.

The stratosphere has a natural "background" level of particles, produced primarily from the biological emissions of a gas known as carbonyl sulfide. But major volcanic eruptions (like the Mt. Pinatubo eruption in 1991) can lead to huge spikes in that background when their sulfur dioxide emissions get transformed into sulfate particles. Those particles (like polar stratospheric clouds) accelerate the ozone destruction of human-made chlorine and bromine compounds — and the new paper shows that much of the variability in the yearly global ozone losses is due to variations in the atmosphere's particle content.

By taking the effects of particles into consideration, the model also comes closer to explaining how ozone losses vary with altitude in the atmosphere above northern mid-latitudes. That has been one of the "puzzles" of stratospheric research, because models have not been able to explain the observed ozone profile, especially in the critical region of the lower stratosphere where most of the ozone resides. The new study still does not entirely bridge that gap, but it has taken a great step forward in more closely matching the shape of the profile.

And there's another interesting conclusion of the new research: humankind has changed, fundamentally, *how* volcanoes influence ozone. With human chlorine and bromine in the stratosphere, volcanic particles accelerate the chlorine- and bromine-catalyzed ozone destruction... but without those human influences, a major volcanic eruption actually *produces* ozone. "It's critical to remember that it is the chlorine and bromine compounds that destroy ozone," says Bob. "The volcanoes only enhance their effectiveness."

The ozone layer is expected to recover in the coming decades as a result of restrictions on CFCs and other ozone-depleting chemicals. The Aeronomy Laboratory study shows that future major volcanic eruptions will cause fluctuations during the recovery process that are both expected and temporary. The findings also underscore the importance of current efforts (by researchers in the Aeronomy Laboratory and elsewhere) to assess the effects of particles and gases from subsonic and supersonic aircraft on the ozone layer. The research of Susan, Bob, and their colleagues will enable scientists to improve their estimates of those effects.

HOME and AWAY

NARE: Mission Accomplished

Scientists in the Tropospheric Chemistry and Theoretical Aeronomy Programs were tired but smiling as they returned from their successful March-April study of ozone chemistry in the latest mission of a series of experiments known as the North Atlantic Regional Experiment (NARE). The study looked at how cold fronts transport human-made emissions eastward from the North American continent and also examined the transport of polluted Arctic air to the North Atlantic. The overall goal is to determine how these transport processes influence the formation and distribution of tropospheric "greenhouse" ozone in the northern hemisphere. Ozone is a greenhouse gas at these lower-atmospheric altitudes, meaning that it, like carbon dioxide, traps part of the surface-heat radiation that would otherwise escape to space.

Most of the Aeronomy Laboratory scientists involved were aboard the NOAA WP-3D aircraft, which was fully outfitted with instruments (and their scientists) measuring gases, aerosols, and meteorological parameters. "Home base" for the mission was the University of Rhode Island in Narraganset. David Parrish described the demanding schedule: flights of 8- to 10-hour duration, nearly every other day, for three weeks. According to Dave, there were "some very interesting cases of stratospheric intrusion." The signature of these events is that when the air has its origin in the stratosphere, the carbon monoxide levels are low and negatively correlated with ozone. In contrast, air from the polluted troposphere will show a positive correlation between the two.

Colleagues from the NOAA Climate Monitoring and Diagnostics Laboratory, other agencies, and universities made observations from ground stations, balloons, and the Wyoming King Air. The timing of the study gave the researchers a chance to observe the atmosphere's response to the return of sunlight in the spring. Their data indicate "amazing evidence of vertical transport," says Dave. Detailed analysis of that dataset is now underway.

NARE is an activity of the International Global Atmospheric Chemistry Project, which is a core project of the International Geosphere-Biosphere Program. The aim of NARE is to learn how human and natural emissions from the North American and European continents affect the formation of ozone on a hemisphere-wide scale as the air is transported to the North Atlantic region; the ultimate goal is to understand the effects on climate and atmospheric chemistry. ♣

Testing a Newcomer:

Since early February, Aeronomy Laboratory scientists Greg Huey and Dick Norton have made the short trip to the mesa west of Building 24 so that they could compare their two methods for measuring nitric acid (HNO_3). For Dick, it means making the kind of filter measurements he's made successfully for years; for Greg, it's "proving time" for the new ion-assisted mass spectrometric tech-nique he's developed over the last year or so. The outcome of this first intercomparison is of great interest to the scientific community and to both individuals — with Dick "hoping Greg puts me out of the HNO_3 business."

The filter technique involves first collecting the nitric acid on a nylon filter by sampling air for anywhere from 20 minutes to a few hours, and then analyzing the filter contents using the method of ion chromatography — with a half-day turnaround at best. The new technique (developed by Greg as a result of laboratory work in the Atmospheric Chemical Kinetics group) uses a chemical ionization mass spectrometric (CIMS) technique that allows 1-second samples and "instantaneous" analysis. In addition to that advantage, the new technique promises to avoid the interferences that have plagued filter methods. Because of those interferences, Greg and Dick expected their two techniques to differ under certain conditions — and the tests were consistent with those expectations.

Early indications from the intercomparison, which also involves NCAR colleagues, give a "thumbs up" to the new technique. With a detection limit of 30 parts per trillion (ppt) for a 1-second integration, the CIMS method easily covers the 50-2000 ppt range often observed for atmospheric HNO_3. It all bodes well for the goal, which is to make the first real-time measurements of nitric acid in the troposphere. It would be a key scientific milestone because nitric acid is a major acidic gas and particle in the atmosphere and an important member of the reactive nitrogen family. Getting a handle on HNO_3 will mean gaining a better understanding of the partitioning within the nitrogen family and, ultimately, of ozone chemistry in the lower atmosphere. Greg has recently joined the Tropospheric Chemistry Program and will develop an aircraft-version of the CIMS instrument for the WP-3D, hopefully in time for a 1997 inaugural mission.

✈ ✈ ✈ *STERAO: Coming Up*

Not one... not two... but three different aircraft are expected to be used in the June-July mission of the Stratosphere-Troposphere Experiments: Radiation, Aerosols, and Ozone (STERAO). Each aircraft has its altitude (and scientific) "niche": the NOAA WP-3D flies at cloud base and at mid-cloud altitudes; the NCAR WB-57 can access the above-cloud region; and the North Dakota Citation can actually fly through clouds.

The researchers from NOAA, NCAR, and universities are looking for bad weather— thunderstorms— so they can investigate deep convection in and around those systems. They're a key mechanism for the transport of trace gases and aerosols vertically in the atmosphere. In addition, the lightning can produce large local enhancements in nitrogen oxides, and the subsequent transport in updrafts and downdrafts in the storm can have an impact on tropospheric ozone production or loss.

The investigation will focus on northeastern Colorado. "Command Central" for the operation is Jeffco Airport near Broomfield, but the orchestration of the flights involves several facilities up and down the entire Front Range. Every evening, researchers will examine data from NOAA, a national radar facility at Colorado State University, and the Denver NEXRAD radar to determine the likelihood of thunderstorms for the next day.

If it's a "go," investigators on the WP-3D will have an early wake-up call to give the chemical instrumentation its needed four-hour warmup period. During that, a crucial decision must be made on whether to fuel the WP-3D or not. Unlike the other aircraft in the mission, if the WP-3D is fueled, it *must* fly; there is not an option to drain the fuel. But "not to worry," says Fred Fehsenfeld— the Aeronomy Laboratory investigators will have planned for any contingency. If the storm does not develop as anticipated, the researchers will have a detailed alternative plan to look at the west-east long-range transport of pollutants and the influence of the mountains on transport.

The mission commences June 17 and involves a team of Aeronomy Laboratory scientists from the Tropospheric Chemistry, Meteorological Chemistry, and Theoretical Aeronomy Programs. Other participating organizations are the Climate Monitoring and Diagnostics Lab, National Severe Storms Lab, and Forecast Systems Lab of NOAA; NCAR; and universities. It's the first of three major components of STERAO, which has the aim of studying the chemistry and physics of trace gases, aerosols, and cloud particles in the upper troposphere and lower stratosphere. Other major components of STERAO are slated to occur in 1997 and 1998.

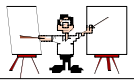
INDOEX Planning Trip

Adrian Tuck has just returned from a trip with NCAR colleagues to identify potential field sites and facilities for the 1998 Indian Ocean Experiment (INDOEX). INDOEX will capitalize on the unique "laboratory" of the equatorial Indian Ocean region to investigate the radiative cooling by human-made aerosols and to study the transport of trace gases and pollutants between the polluted northern hemisphere and the "pristine" southern hemisphere. More on this will follow in future issues of *On the Air!*

WHAT'S UP WITH PEOPLE

There are three new members of the Atmospheric Chemical Kinetics Program who will be carrying out laboratory studies of atmospheric processes. **Karl Froyd** and **In-Koo Kim** are graduate students at the University of Colorado-Boulder; and **D. James Donaldson** is on sabbatical from the University of Toronto... In the Tropospheric Chemistry Program, **Chuck Eubank** has joined the group and is working with Eric Williams to develop instrumentation; **Karsten Baumann** has gone "up the hill" to work at NCAR with Brian Ridley's group; he'll be continuing his research on tropospheric chemistry; **Jamie Yee** has begun a new job as a mathematician with Lockheed Martin in Denver... In the Tropical Dynamics and Climate Program, **Eric Hoskins** departed May 2 after three years working with the group as an undergraduate. He'll do psychology research at the CU and then to go to graduate school... **Allison Grimsdell** will be joining the Atmospheric Dynamics Program in June. Her Aeronomy Laboratory research on boundary layer dynamics will start with the Flatland96 campaign in Illinois this summer... **Kathy Green** has joined the Administrative Office, working with Deb and Joanne; taking over her former position as secretary to the Tropical Dynamics and Climate Program is **Irene DeDe,** who is on very familiar ground because she worked at the Aeronomy Laboratory from 1988-89 as a secretary for the Meteorological Chemistry Program.

COMMUNICATING OUR SCIENCE



To Policymakers: Fred Fehsenfeld, Michael Trainer, and Dave Parrish are contributing to the planning of the first-ever air quality assessment, which is scheduled for 1998 as part of the North American Research Strategy for Tropospheric Ozone (NARSTO). The assessment will provide scientific information for decisonmakers and air quality managers... Dan Albritton participated in a week of briefings on the Hill in Washington, D.C., on April 29-May 3. He described the NOAA Health of the Atmosphere research to legislators, their staffers, and other groups.

To the Scientific Community: The Southern Oxidants Study (SOS) held a Data Workshop in Raleigh, NC, on May 6-9 to discuss the findings of last summer's study of regional ozone in the Nashville area. Members of the Tropospheric Chemistry and Theoretical Aeronomy Programs attended for the Aeronomy Laboratory; scientists from CMDL and ETL also participated.

To Media and the Public: In April, Dan Albritton was interviewed by the Global Climate Institute in Washington, D.C. Dan, Jerry Mahlman (NOAA Geophysical Fluid Dynamics Laboratory), and others will appear in short video segments that will be used by broadcast meteorologists.

To Kids and Teachers: Alex Weaver gave an invited talk at the National Science Teachers Association meeting in St. Louis in March. She's also working with others in CIRES to develop this summer's Colorado Alliance for Science workshop for middle school teachers... Dave Parrish and Jim Roberts gave talks to classes at Regis High School and University Hill Elementary School, respectively, this year. Each had a proud son in the audience.

To Industry: Radian Corporation has signed a new 5-year Cooperative Research and Development Agreement (CRADA) with the Aeronomy Laboratory and Environmental Technology Laboratory. The first CRADA was highly successful, resulting in the sales of about sixty of the 915 MHz wind profilers. Radian now employs about a dozen people in Boulder. The CRADA is serving as a model for other CRADAs being developed by NOAA.

To NOAA and DOC Management: Dan Albritton and Ravi met with Department of Commerce Secretary Ron Brown during his visit to Boulder in March. The Atmospheric Chemical Kinetics laboratory was one of only two laboratory stops that Secretary Brown and his staff made at the site... Diana Josephson, NOAA Deputy Under Secretary for Oceans and Atmospheres, visited the Aeronomy Laboratory in April. Carl Howard, Chris Ennis, and Ru-Shan Gao described the Laboratory's research.

DOWN THE ROAD

May: David Fahey will be in Fairbanks, Alaska, to plan for the Photochemistry of Ozone Loss in the Arctic Region in Summer (POLARIS) experiment. POLARIS, scheduled for 1997, will use the ER-2 and other platforms to evaluate stratospheric ozone loss in the northern hemisphere summer.

June-July: The Flatland96 field campaign will take place in Champaign-Urbana, Illinois, this summer, with the aim of studying boundary layer dynamics and the transport of trace gases in the lower atmosphere. Wayne Angevine and others in the Atmospheric Dynamics Program will be participating.

June 11: Dan Albritton will be "on the Hill" again, this time to give invited testimony at a special Senate hearing on ozone depletion and global climate change. The hearing marks the tenth anniversary of the original hearing on global change.

July: The Stratospheric Tracers of Atmospheric Transport (STRAT) experiment takes to the air again, with installment #4 of the multi-stage investigation. Instruments aboard the NASA ER-2 are being used to study how gases and particles are transported in the stratosphere.

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).