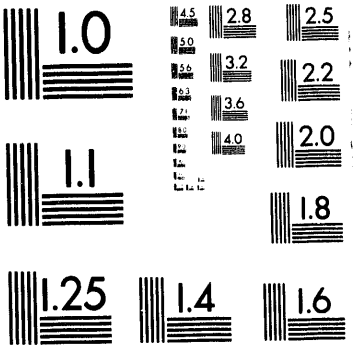
1.0
4.5
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1 of 1

Annual Performance Report

ACP Research and Scientific Coordination

U.S. DOE Grant DE-FG06-93ER61552

Submitted to the U.S. Department of Energy
by
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17 September 1992

Introduction

Activated on 1 February 1993, this research grant addresses two primary objectives:

1. conduct of specific research tasks under the DOE Atmospheric Chemistry Program (ACP), and

2. provision of scientific coordination for the Atmospheric Chemistry Program.

In summary, the project is progressing essentially as expected, with some minor exceptions. Higher than anticipated demands within Objective 2, associated primarily with the ACP Ozone Project and the recompetition of the National Laboratories portion of ACP, have resulted in a somewhat higher proportionate emphasis on the coordination activities associated with this objective. Also, the immediate need for pre-campaign modeling of the North Pacific has resulted in an acceleration of Task 1.1 (Pacific modeling, under Objective 1) relative to other tasks, particularly Task 1.2 (Atlantic modeling). Modeling activities in general have been delayed somewhat because of the noted Objective-2 demands and because of the extended time that was necessary to complete financial agreements for this grant.

Activities completed in fulfillment of these objectives during the first six months of the grant by the P.I., Dr. Jeremy M. Hales (JMH), and Envair Administrative/Technical Assistant, Marilyn S. Stottlemyre (MSS), are summarized in the following sections.

Atmospheric Chemistry Modeling Activities

Modeling activities currently in progress are the user's-manual documentation of the Pluvius II reactive storm code and the application of the global chemistry code GChM for simulations over the North Pacific. These activities have been delayed somewhat because JMH deferred purchase of the necessary computer until conclusion of financial negotiations for this grant. This occurred in August, and subsequently JMH purchased and installed a Sun SPARC 10 Mod51 computer. This system is now operational; both GChM and Pluvius codes are resident on the machine, and development on both fronts is progressing rapidly.

Modeling activities during initial months of this grant were performed on the Envair Macintosh Quadra 700 computer, which has 20 megabytes of memory compared to 128 megabytes on the Sun. The Quadra was sufficient for completion of essentially all of the necessary Pluvius II development work: the code exists in a fully documented form which is appropriate for user's manual publication, and has been tested extensively with example simulations. Transported to the Sun, this code is currently receiving further tests in a UNIX environment prior to being documented and published. The Pluvius II Operations Manual will be completed by December of this year.

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MASTER

GChM was also brought up on the Quadra. Large memory, speed, and input/output requirements of this code, however, precluded extensive development on this machine. Present plans for future GChM implementation involve the following stages:

- Define the simulation domain to encompass Eurasia and the North Pacific across to the North American Continent.

- Using representative meteorological fields, perform Asian pollutant transport simulations to estimate patterns and concentrations of Asian pollution approaching the North American west coast. Apply this information for design of the forthcoming ACP Northeastern Pacific Atmospheric Chemistry Study (NPACS).

- Archive meteorological fields observed during the NPACS measurement campaign. Execute GChM in conjunction with these fields to: 1) compare model output with field-study observations (and thus evaluate model uncertainties and possibly improve the model) and 2) provide an interpolating tool to calculate horizontal fluxes and transport rates to the North American Continent.

- Execute the model for representative meteorologies and projected future Asian emissions to estimate potential impact during future years.

The current Envair computing configuration will apply the Sun for all numerical analysis associated with these large codes. Stored numerical output from these executions will be transported to the Quadra via Ethernet for generation of output graphics. JMH will be responsible for all scientific code development and code execution. MSS, who will serve as Sun System Manager, is also responsible for preparation of all computer graphics.

General ACP Coordination

During this reporting period JMH provided general ACP scientific coordination, including coordinating the 1993 North Atlantic Regional Experiment, serving as scientific liaison to DOE Headquarters, interacting with various ACP and non-ACP laboratories, publishing the *Monthly Update* newsletter, and providing scientific evaluations of topics of current interest to DOE's Office of Health and Environmental Research. The *Monthly Update* is a newsletter on atmospheric chemistry, which is published as a service to the general scientific community and contains reports pertinent to DOE as well as other organizations participating in atmospheric-chemistry research. Eight issues have been published thus far in 1993. Recently MSS has taken primarily editorial responsibility for this newsletter.

North Atlantic Regional Experiment

During August and September ACP participated in the International Global Atmospheric Program (IGAP) North Atlantic Regional Study (NARE) field study, which was centered in the Northwestern Atlantic. This was a combined effort, involving DOE, NOAA, the Canadian government, and the British government, and included four research aircraft. ACP's participation included three national laboratories (ANL, BNL, and PNL) as well as several universities, whose activities were centered mainly in Halifax, NS, where the G-1 aircraft was based.

ACP's research flights from Halifax were coordinated with the remaining three aircraft (based in Maine, Yarmouth, and England) to track and evaluate pollution entering and moving across the Atlantic. Some twenty G-1 flights were conducted during this period, and the results are currently being processed for modeling analysis.

JMH served as the general scientific coordinator for the ACP/NARE operation. On-site logistics coordination was provided by Dr. Peter Daum of BNL.

Technical Meeting Coordination

A major national symposium on atmospheric chemistry was chaired and coordinated by JMH, with the objectives of enhancing atmospheric chemistry research in general, and building DOE's image as a leading contributor to the atmospheric-chemistry field. Conducted as a part of the American Meteorological Society (AMS) annual meeting in January 1993, this symposium included some 50 papers addressing various aspects of atmospheric chemistry. These papers will be published in a forthcoming dedicated issue of the *Journal of Applied Meteorology*.

Based on the success of the 1993 meeting, AMS requested JMH to implement a major Conference on Atmospheric Chemistry for the January 1994 Annual Meeting in Nashville. This conference is arranged into five Special Sessions and will have over 100 presentations, which will be published in dedicated issues of the *Journal of Applied Meteorology* and the *Journal of Atmospheric Sciences*. Many of the Conference contributions are from the ACP research community. Since joining Envair in July, MSS has taken responsibility for coordinating the Conference with AMS management, the Special Session Chairpersons, and the authors, to arrange the schedules and handle logistical aspects of the Conference.

MSS is also coordinating the ACP Annual Scientific Meeting, which is scheduled for Nashville the week before the AMS conference. Roughly forty ACP participants will meet for a three-day period to review progress and to plan future joint activities.

General Atmospheric Chemistry Review and Analysis

During late winter, 1993 JMH completed a scientific report on the current level of understanding and associated research needs in atmospheric chemistry. Much of the scientific material from this report was later incorporated by DOE into the ACP *Program Operations Plan* (DOE/ER-0586T), which was published in April. The *Operations Plan* is expected to the primary ACP program guidance document to be used for the next five-year period.

Stratospheric and Tropospheric Ozone Review and Analysis

JMH also completed a comprehensive scientific review of stratospheric and tropospheric ozone, resulting in a draft report which, in addition to reviewing the field, suggested pathways for future research in the area. This report formed much of the scientific basis for the document *Overview of the Atmospheric Chemistry Program's Ozone Project* (DOE/ER-0575T), which was completed and published by DOE in January. This has been used as the basis for two research-grant solicitations and a National Laboratory request for proposals. JMH has continued to be active in providing scientific assistance in these activities.

Aerosol Review and Analysis

Also during this period JMH has actively provided scientific coordination and team participation in defining climate impact by anthropogenic aerosols, and outlining suggested research activities for resolution of related climate-change issues. This has resulted in several existing and pending reports and open literature publications, notably, the report *Quantifying and Minimizing Uncertainty of Climate Forcing by Anthropogenic Aerosols* (DOE/NBB-0092T) and the article in *Science*, entitled "Climate Forcing by Anthropogenic Aerosols.".

WMO/GAW Ozone Network Development

JMH is serving as a member of the WMO committee that is working to define and implement quality assurance procedures for the WMO Global Atmosphere Watch (GAW) measurement network. In July he chaired a WMO workshop session in Garmish, Germany to produce a WMO design

document entitled *Report of the WMO Meeting of Experts for Quality Assurance/Science Activity Centres (QA/SACs) of GAW*, which will be applied as the major guide for this activity.

Future Research Efforts

Research and scientific coordination efforts for the coming grant period are expected to be consistent with the plans set forth in the original grant application. Specifically:

- JMH will continue to serve as scientific coordinator for ACP, and in this capacity will perform scientific coordination and liaison activities with ACP laboratories and university grantees.

- JMH will coordinate research planning and activities for the forthcoming Northeastern Pacific Air Chemistry Study, which will be held during 1994 and 1995.

- JMH and MSS will continue with publication of the *Monthly Update*.

- JMH will complete the Pluvius II user's manual.

- JMH will perform initial trans-Pacific air-chemistry simulations using the GChM code on the Envair SPARC 10 computer, and apply these results to trans-Pacific field-study design. MSS will develop associated computer-graphics systems and apply them for presentation of the GChM results.

- JMH will continue to serve as a general scientific liaison resource for topics on atmospheric chemistry.

Travel Summary

17-22 January	Anaheim to attend AMS meeting and Symposium of Atmospheric Chemistry
10-13 February	Long Island, NY (Brookhaven) to attend ACP planning meeting
24-26 February	Coco Beach, FL to attend DOE uv-B workshop
25-29 April	Washington, DC to attend NASA Air Chemistry meeting and visit OHER in Germantown
26-28 May	Washington, DC to attend ACP proposal review
23-24 June	New York, NY to coordinate EML activities with ACP
1-22 July	Garmish, Germany and New York, NY to attend WMO/GAW workshop and participate in EML review
30 Aug - 1 September	Halifax, NS to participate in ACP NARE study
7-9 September	New York, NY to coordinate EML activities with ACP

Publications

Studies of the Kuwait Oil-Fire Plume During Mid-Summer 1991 (with P.H. Daum, A. Al-Sunaid, K. M. Busness, and M. Mazurek). *J. Geophys Res.* in press (1993).

ACP Program Operations Plan. U.S. Department of Energy Office of Energy Research, OHER Environmental Sciences Division DOE/ER-0586T (1993).

Quantifying and Minimizing the Uncertainty of Climate Forcing by Anthropogenic Aerosols. (with J. E. Penner, R. J. Charlson, N. S. Laulainen, R. Leifer, T. Novakov, J. Ogren, L. F. Radke, S. E. Schwartz, and L. Travis) U. S. Department of Energy Office of Energy Research, OHER Environmental Sciences Division DOE/NBB-0092T (1993).

Overview of the DOE Atmospheric Chemistry Program's Ozone Project. (with W.G.N. Slinn and D. Wuebbles) U. S. Department of Energy Office of Energy Research, OHER Environmental Sciences Division DOE/ER-0575T (1993).

"Acidic Precipitation." Chapter 13 in *Composition, Chemistry, and Climate of the Atmosphere.* Van Nostrand, New York, in press.

Report of the WMO Meeting of Experts for Quality Assurance/Science Activity Centres (QA/SACs) of GAW. WMO/GAW report, in publication.

Climate Forcing by Anthropogenic Aerosols (with R.J. Charlson, S.E. Schwartz, R. D. Cess, J. A. Coakley, J. E. Hansen, and D. J. Hoffman). *Science* 255, 423-430.

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