The FY 2003 Proposal Solicitation of the Atmospheric Chemistry Project of the NOAA Climate and Global Change Program

This summary is intended to be a supplement to NOAA's announcement of its FY 2003 Climate and Global Change Grants Program, which gives the timetable, format, and submission procedures for proposals. As an aid to those investigators considering preparing proposals, the present background document provides additional scientific information on the specific foci in atmospheric chemistry for which proposals are solicited.

Those interested in responding with a proposal to the FY 2003 NOAA solicitation should be cautioned that the availability of new funds cannot be accurately foreseen. FY 2003 budget constraints could severely limit available funds for new starts.

I. BACKGROUND

A. NOAA's Emphases and Rationale

A common major implicit theme in the Atmospheric Chemistry Project's grants is the photochemistry of ozone and fine particles in the troposphere and lower stratosphere. These species bear upon important global environmental problems. These species are: (i) radiatively important trace species, (ii) important in climate feedback mechanisms, (iii) important in controlling atmospheric oxidation and (iv) secondary pollutants with serious impacts on biota and human health. It is currently believed that a significant fraction of the ozone and fine particles in the troposphere are produced by photochemistry from precursors that have both human-influenced and natural sources. The lifetimes of the species in the troposphere are sufficiently long that they can be transported into the upper troposphere (and possibly into the lower stratosphere) and across hemispheric scales. Thus, a predictive understanding of ozone and fine particles in these regions requires a focus on the chemical and transport processes that link regional emissions to hemispheric ozone trends and distributions. The broad process-oriented goals of the NOAA Atmospheric Chemistry Program are:

- Quantifying chemical processes linking regional emissions to hemispheric and global distributions ozone and fine particles;
- Quantifying transport processes linking regional emissions to hemispheric and global distributions of ozone and fine particles;
- Predicting global and regional tropospheric ozone and fine particle distributions;

- Investigating the chemistry in the upper troposphere that influences climate.

B. International Linkages

1. International Global Atmospheric Chemistry (IGAC) Program

   The Atmospheric Chemistry Project of NOAA's Climate and Global Change Program is continuing to direct its grants support to research that aids projects of International Global Atmospheric Chemistry (IGAC) program. IGAC is a Core Project of the International Geosphere-Biosphere Program (IGBP). The IGAC program is focused on understanding the chemistry of the global atmosphere as it relates, in part, to the assimilative (i.e., oxidizing) capacity of the atmosphere, as well as, the impact of atmospheric composition on climate and the impact of climate on atmospheric composition. The IGAC program has several projects that address key aspects of the chemistry of the globe, as well as crosscutting activities that support all projects (IGAC, 1998). The research activities of the IGAC program are in various stages of readiness: many are under way now and others are still being planned. (For additional information regarding IGAC see http://www.igac.unh.edu/or contact IGAC.CPO@unh.edu.

2. Stratospheric Processes and their Role in Climate (SPARC) Program

   The Atmospheric Chemistry Project of NOAA's Climate and Global Change Program will also direct its grants support to research that aids Upper Troposphere/Lower Stratosphere (UT/LS) projects of Stratospheric Processes and their Role in Climate (SPARC) program. SPARC is a core program of the World Climate Research Program (WCRP). SPARC is focused on understanding atmospheric processes (in particular stratospheric and upper tropospheric processes) that play major roles in climate. In particular, NOAA's Climate and Global Change Program will support research focusing on chemical and microphysical processes in the upper troposphere, a part of the SPARC's UT/LS activity. (See:http://www.aero.jussieu.fr/~sparc/SPARCImplementationPlan/3)

II. FY 03 PROPOSALS

A. **Outline of Specific Research Activities**

In the 2003 Atmospheric Chemistry solicitation, the highest priority will be given to proposals in support of a new activity within the framework of IGAC, Intercontinental Transport and Chemical Transformation (ITCT). In addition, this solicitation is intended to attract proposals that will support a second activity, Stratospheric Processes and Their Role in Climate (SPARC). Both these activities are briefly described below. We anticipate that a large portion of funding support will support ITCT, with a secondary component supporting the new SPARC focus.

1. Intercontinental Transport and Chemical Transformation (ITCT)

   Intercontinental Transport and Chemical Transformation (ITCT) is an IGAC activity that directly addresses the tropospheric chemistry and transport of ozone, fine particles and other chemically-active greenhouse compounds. The goal of the ITCT activity is to provide a better understanding of the intercontinental transport and chemical transformation of anthropogenic pollution in the Northern Hemisphere and to assess the consequences of this pollution. ITCT will constitute the major FY 2003 emphasis of the Atmospheric Chemistry Project of the NOAA Climate and Global Change Program.

   Proposals for FY 2003 are encouraged that support two ITCT field activities currently being planned for 2002 and 2004 to which NOAA is contributing. The 2002 field study (ITCT-2K2) is investigating the composition of air masses along the Pacific coast of North America. Proposals are solicited to assist in analyses of field observations related to this study. The 2004 study (ITCT-2K4) will focus on observations needed to constrain and evaluate model estimates of the outflow of chemicals from North America across the Atlantic Ocean. Proposals are encouraged for the development of new measurement techniques, intercomparison of observations from multiple airborne platforms, and the comparison of measured chemical fields with those predicted by regional/global models. More information about the ITCT program can be found on the Internet: http://www.al.noaa.gov/WWWHD/pubdocs/ITCT/.

2. Stratospheric Processes and their Role in Climate (SPARC)

   The chemistry and microphysics in the upper troposphere and lower stratosphere is a part of the newly initiated SPARC activity that addresses the understanding of the processes that influence the distribution and properties of ozone, fine particles, and other

chemically-active greenhouse compounds in the upper troposphere. It is recognized that the upper troposphere is a region of interest to the climate and for affecting chemicals that are eventually transported into the stratosphere. The impacts of the UT chemistry on climate and vice versa are important research areas. Therefore, investigating the effect of intercontinental transport and chemical processes that influence the chemistry in the UT (and thus climate) are of interest to SPARC's activities.

Proposals are invited that address the chemical state of the upper troposphere. The goal is to provide a better understanding of the chemical transformations that are responsible for ozone production and destruction in the upper troposphere and that influence the role of fine particles that affect radiation and composition in this region. Laboratory and diagnostic modeling studies are the primary foci of FY 2003 funding for SPARC-related activities.

B. Topics and details for FY2003

1. Intercontinental Transport and Chemical Processes That Involve Ozone and Fine Particles

   Initially, ITCT will focus on the investigation of the chemical transformations involving ozone, fine particles and other chemically produced greenhouse. The research needed to meet this objective involves determination of the transport and chemical transformation process that control the redistribution of ozone, fine particles and their precursors between the continents of the Northern Hemisphere. Through this research, ITCT aims to estimate the impact of human-influenced emissions from North America, Europe and Asia on the production of these compounds and the related parameters on a hemispheric scale. Specifically, the initial focus of the study is to document incidences of long-range transport of pollution into North America and Europe. As note, the aim of the Atmospheric chemistry grants component is to provide additional research in support of two international field studies that are being planned for FY-2002 and FY-2004 and to which NOAA is contributing.

   ITCT-2K2

   The first study (ITCT-2K2), will be carried out in April and May of 2002 on the West Coast of North America to investigate the composition of air masses along the Pacific coast of North

America. The study will involve two instrumented aircraft operating in concert with ground-based chemical and meteorological measurements. The aim of the study is:

- To characterize the chemical composition of the air masses coming ashore at the U.S. West Coast, and determine the relation to the sources and sinks of ozone and aerosols.

- To explore the composition of these air masses as they are transported inland, and investigate the alteration in composition associated with the addition of emissions from U.S. West Coast sources.

An emphasis of the FY 2003 grants of the Atmospheric Chemistry Project will be to assist in the subsequent analyses of field observations that were made in ITCT-2K2.

ITCT-2K4

The second study (ITCT-2K4) is being planned for the summer of 2004. The aim of the ITCT-2K4 studies is to participate in research that will provide the observational database needed to constrain and evaluate model estimates of the outflow of chemicals from North America across the Atlantic Ocean. This study has exceptional merit in this regard due to the extensive, high-quality emission inventories for the known ozone and aerosols precursors that have been developed for North America. The constituents of primary interest for NOAA contribution to ITCT-2K4 are ozone and its precursors (hydrocarbons and NOx), aerosols, and major greenhouse gases (CO2, CH4, N2O). The observational database will be obtained in an intensive airborne mission to be performed in the summer of 2004 along with a number of collaborative studies including satellite observations. Synthesis of the ensemble of observations from surface, airborne, and space platforms with the help of 3-D models will be used to achieve the following NOAA objectives:

- Quantify the export, chemical evolution, and transformations of radiatively and chemically important trace gases and aerosols from North America to the western Atlantic.

- Elucidate mechanisms and pathways associated with the transport and transformation processes of these trace chemicals.

- Relate the optical properties of aerosols to their microphysical and chemical properties and identify the processes that determine those properties.

Additional important tasks include development of new measurement techniques, inter-comparison of observations from multiple airborne platforms, and the comparison of measured chemical fields with those predicted by regional/global models. Theories of photochemical ozone and aerosol production and loss in background and polluted air masses will be tested and the role of aerosols in heterogeneous chemical processes and partitioning of key trace gases investigated.

The plans for the NOAA ITCT 2K4 studies will be developed in coordination with several observational programs from the United States and Europe. Integration of satellite and instrumented-aircraft observations will be a part of the study. The results of the study will greatly enhance our quantitative understanding of chemical budgets over North America in a way that improves continental source/sink estimates and their relation to global atmospheric chemistry perturbations. The current emphases of the FY 2003 grants of the Atmospheric Chemistry Project intended to support ITCT-2K4 are:

- Development and use of modeling capabilities to forecast the transport from North America of ozone, fine particles, their precursors and other fingerprint compounds of major sources.

- Development, construction, integration, and/or implementation of new ground stations capable of monitoring the inflow of pollution into North American or the outflow of pollution from North America.

- Development of spatially resolved profiling (lidar) techniques that can be operated at remote surface sites to measure ozone, fine particles or other compounds. These measurements will be used to better define the sources and processes that shape the ozone and fine-particle transport into or from North America.

- Development, construction, integration, and implementation of new airborne instrumentation and sampling methods for the NOAA G-IV aircraft in support of future studies.

2. Chemical and microphysical processes in the upper troposphere that involves ozone and fine particles.

   The current emphasis of the FY 2003 grants of the Atmospheric Chemistry project in support of SPARC's research are laboratory and diagnostic modeling investigations of chemical transformations involving ozone, fine particles, and other chemically produced greenhouse compounds. Assessment of the impact of the findings of ITCT to the global distribution of ozone and fine particles are of current interest in the context of SPARC activities. The NOAA program aims to focus on the laboratory and diagnostic modeling studies needed to assess the impact of ITCT findings to the global climate issues. This research will be used to understand, interpret and assess the global and regional climate impact of the ITCT findings. Proposals are invited that address the chemical state of the upper troposphere. The current emphases of the FY 2003 grants of the Atmospheric Chemistry Project intended to support SPARC include but are not limited to:

   - Laboratory studies to better define the odd-hydrogen (HOx) budget in UT, specifically relevant to the degradation of short-lived compounds.

   - Chemical and heterogeneous reactions that directly influence the ozone production and loss.

   - Diagnostic modeling studies that assess the impact of the findings of the ITCT field studies to global climate.

C. General Guidance

Proposal may be submitted for research that will require one two or three years of support. Proposals should be cost efficient ranging from $50K-$150K/year of funding. Proposals will be ranked based upon scientific merit, relevance to program goals, and cost effectiveness.

Letters of Intent are due May 8, 2002. Proposals are due July 8, 2002.

Guidelines for letters of intent and proposals can be found in the announcement, which can be found on the Internet. http://www.ogp.noaa.gov/grants/2003/index.htm.

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D. References

IGAC, International Global Atmospheric Chemistry Newsletter, Issue No. 12, March 1998. (c.f., Dr. Peter Czepiel; IGAC Core Project Office; Climate Change Research Center; Morse; Hall Rm. 360; University of New Hampshire; Durham, NH 03824; USA; Tel: (+1-603) 862-4520; Fax: (+1-603) 862-3874, E-MAIL: IGAC.CPO@unh.edu; INTERNET: http://www.igac.unh.edu/)