

Program Announcement To DOE National Laboratories LAB 99-03

Environmental Meteorology Program Vertical Transport and Mixing

The Office of Biological and Environmental Research (OBER) of the Office of Science (SC), U.S. Department of Energy (DOE), hereby announces its interest in receiving proposals for the Environmental Meteorology Program (EMP), Vertical Transport and Mixing (VTMX) Science Team. The research program supports the Department's Global Change Research Program, the U.S. Global Change Research Program, and the Administration's goals to understand the meteorological processes associated with air quality and climate change.

The scope of the research to be supported under this announcement is the investigation of atmospheric vertical transport and mixing processes. The geographic focus for this research will be on urban areas affected by nearby elevated terrain, with an emphasis on studies of stably stratified conditions, periods with weak or intermittent turbulence, and morning and evening transition periods.

Background

The measurement and modeling of vertical transport and mixing processes in the lowest few kilometers of the atmosphere are problems of fundamental importance for which a fully satisfactory treatment has yet to be achieved. Important aspects of air quality modeling and weather forecasting are adversely affected by our inability to describe these processes adequately. Although a general theoretical understanding of many of the physical phenomena relevant to vertical transport and mixing processes exists, that understanding is incomplete, the representation of various phenomena in models is often poor, and the data needed to test those models are lacking. The upward and downward movements of air parcels in stable and residual layers of the atmosphere and the interactions between adjacent layers are particularly difficult processes to characterize, and significant difficulties also exist in describing the behavior of the atmosphere during morning and evening transition periods. Complications due to heterogeneous land surfaces and complex terrain further compromise our ability to treat vertical transport and mixing processes properly.

The goals of the program are to increase our understanding of the mechanisms responsible for vertical transport and mixing; to improve our ability to measure quantities required for this understanding; and to develop improved treatments of vertical transport and mixing for use in conceptual and numerical models.

Although progress in these areas would be useful in a wide variety of circumstances, there is particular interest in realizing these objectives for urban regions affected by adjacent elevated terrain (e.g., urban basins or valleys). Moreover, although a complete characterization of the diurnal cycle of vertical transport and mixing may require consideration of fully developed mid-afternoon convective conditions, the emphasis in this program will be on vertical transport and mixing processes in stably stratified conditions, in conditions of weak or intermittent turbulence, and during morning and evening transition periods.

It is anticipated that a significant component of this program will revolve around observations and data analyses from field measurement programs in urban basins or valleys conducted approximately every second or third year. The initial field experiment will most likely occur during the fall of 2000 or the winter of 2001, and likely candidate sites include Salt Lake City and Phoenix; a final determination of dates and location will be made late in the summer of 1999.

Horizontal scales of interest are on the order of two hundred kilometers or less. Vertical scales will depend on the height of the daytime mixed layer and the elevation of any nearby terrain and will generally be on the order of a few kilometers or less. It is realized, of course, that processes involving larger scales may have to be taken into account for a full understanding of smaller-scale ones.

Categories

The EMP-VTMX Program consists of four categories. Prospective investigators should explicitly specify what category or categories are addressed by the proposed research. Individuals or groups intending to participate in field experiments should describe what measurements they intend to make and what instruments will be used to make them. Those intending to analyze data from one or more instruments or who will use data in numerical or conceptual modeling should specify what data are required for their purposes.

Category 1. Analysis of Existing Data Sets.

There are a large number of existing data sets collected in previous field campaigns that may be useful in the study of vertical transport and mixing processes. Analyses or other use of these data may directly contribute to the realization of the program's goals, and they may also help to identify processes to be studied in future field experiments and in the design of those experiments.

Category 2. Field Experiments.

Experiments designed explicitly to investigate selected vertical transport or exchange mechanisms will be conducted every two to three years during this program. Measurements will include observations of surface meteorological conditions; vertical profiles of wind velocity, temperature, and humidity; turbulence; tracer concentrations; and other quantities that may be relevant to the study of vertical transport or exchange. Measurements, and subsequent analysis of the data, in one or more of these areas is encouraged. Novel approaches for obtaining and interpreting remote sensing data, combining results from a variety of instrument platforms, and relating these data to quantities that can be calculated in numerical models are also areas of research encouraged in this program.

It is not anticipated that this research program will support significant efforts in instrument development per se. However, to the extent that the use of a specific instrument might provide crucial measurements for field experiments, or that these experiments might provide an opportunity to test instrument technologies developed under other programs, support for such activities will be considered.

Category 3. Improvement and Applications of Numerical and Conceptual Modeling Approaches.

Parameterizations of vertical transport or exchange are often based on assumptions about turbulence that are not applicable in all circumstances or on results of simulations that have been "tuned" to match a particular data set.

In many cases the choice of parameter values is left to the individual investigator. Numerical models are particularly prone to failure as the atmosphere becomes more stable and in areas where topographic and thermal forcing are all significant. New conceptual or numerical approaches may then be required to effect significant improvements in model performance. There is a need not only for further developments in numerical and conceptual modeling but also for more systematic testing and evaluation of the parameterizations and assumptions in these models. Whenever possible, such testing should be based on data and not simply on model vs. model comparisons.

Category 4. Development and Application of Tracer Technology.

Tracers are expected to be an important tool in the study of vertical transport and mixing in field measurement programs. Tracers can either be naturally occurring, such as ozone, aerosols, or radon, or material released in a controlled manner specifically to study transport and diffusion. Tracer releases may be required from multiple point sources in an urban area or from areas surrounding a city. If released from a city, point, line, and area sources may be necessary. Sampling in both vertical and

horizontal directions is desired, with time resolution ranging from hours down to minutes or less. It is expected that successful applicants in this area will play an active role in the design and execution of major field campaigns carried out in this program.

Programmatic Issues

Collaboration among funded investigators will be strongly encouraged in the EMP-VTMX Program. Each proposal from a DOE laboratory should be accompanied by a one-page abstract. A copy of the abstract must also be received, electronically, by 4:30 p.m., E.S.T., January 8, 1999. Abstracts should be sent to peter.lunn@oer.doe.gov. **Abstracts for projects approved for funding will be posted on the DOE EMP-VTMX Website** so that applicants from non-DOE laboratories/universities may have time to review the abstracts before submitting their applications. Applications from non-DOE laboratories/universities will be due approximately four weeks after the abstracts appear on the EMP-VTMX Website, the specific date for the submission of the non-DOE laboratory/university applications will appear in a Program Notice to be published in the near future. It is for that reason that the submission dates for DOE laboratories and non-DOE laboratory/university scientists are staggered. Scientists from DOE labs are encouraged to explore potential areas of collaboration with scientists from other laboratories and research organizations. Note that while independent investigations are anticipated in this program, it is important to keep the programmatic scope (vertical transport and mixing), geographic focus (urban basins or valleys), and areas of emphasis (stable conditions, conditions of weak or intermittent turbulence, and morning and evening transition periods) in mind when proposing and pursuing a course of investigation. Many of the principal research activities of this program will be associated with major field measurement campaigns and with the subsequent analysis of the data collected in them. In addition, efforts will be made to encourage scientists funded by other agencies to participate in field experiments and to share data and results with researchers in this program. An annual meeting of program participants and other interested parties is anticipated, and investigators funded under this program should plan to attend.

Science Issues

Proposers are urged to review the preliminary EMP-VTMX Science Plan posted at <http://www.pnl.gov/VTMX/>.

Given the programmatic considerations described above, examples of scientific questions that may be addressed in the EMP are:

- o What are the fundamental processes that control vertical transport for stable and transition boundary layers?
- o What measurements are required to identify and quantify these processes and how can they be made?
- o How can momentum, heat, and moisture fluxes be modeled and predicted in a stratified atmosphere with multiple layers?
- o What improvements in numerical simulations and forecasts of vertical transport and mixing during stable and transition periods are feasible and how can they be implemented?
- o What formulations are most appropriate for the description of vertical diffusion in stable air? For example, how rapidly will an elevated layer of pollutants mix towards the ground in a stable pool trapped within a basin, and how can that mixing be modeled?
- o How do pollutants move through residual layers above a stable or convective surface layer and to what extent can pollutants penetrate stable and residual layers aloft?
- o What is the sensitivity of current local weather forecast and dispersion model predictions to variations in the treatment of vertical diffusivity and turbulence? What limits our ability to forecast vertical transport in current numerical prediction models?
- o How well can remote and in situ sensors measure winds, temperature, turbulence, and pollutants in the lowest few kilometers of the atmosphere? What improvements are needed and practical?
- o How do traveling weather systems remove stable stagnant air out of a basin, and under what conditions do these removal mechanisms fail?
- o What are the effects of the thermal and roughness properties of urban areas on the vertical structure of the boundary layer?
- o What is the nature of the interaction of terrain-induced flows (e.g., drainage winds at night, upslope winds during the day, and waves) with cold air pools in basins, and how do such flows affect the formation and erosion of those pools and the dispersion of pollutants in them?

Supplementary funding

In years in which major field campaigns are carried out, some modest supplementary funding may be available to offset the increased costs associated with field work. Prospective investigators who anticipate the need for additional support in those circumstances should request in their application the level of additional funding desired and describe the reasons for the request.

EMP field campaigns may also include the use of the DOE G-1 Research Aircraft Facility.

Educational Opportunities

Opportunities exist for the financial support of undergraduate and graduate students wishing to participate in this program through the Department of Energy's Global Change Education Program. Information can be obtained at <http://www.atmos.anl.gov/GCEP> on the Internet.

DATES: The deadline for receipt of formal proposals from DOE laboratories is 4:30 p.m., E.S.T., January 8, 1999, to be accepted for merit review and to permit timely consideration for funding in fiscal year 2000. Each proposal from a DOE laboratory should be accompanied by a one-page abstract. A copy of the abstract must also be received, electronically, by 4:30 p.m., E.S.T., January 8, 1999. Abstracts for projects approved for funding will be posted on the DOE EMP-VTMX Website, so that applicants from non-DOE laboratories/universities may have time to review the abstracts before submitting their applications. Abstracts should be sent to peter.lunn@oer.doe.gov.

ADDRESS: Formal proposals referencing Program Announcement LAB99-03 should be sent to: U.S. Department of Energy, Office of Science, Environmental Sciences Division, SC-74, 19901 Germantown Road, Germantown, MD 20874-1290, ATTN: Program Announcement LAB99-03. This address must also be used when submitting proposals by U.S. Postal Service Express Mail or any other commercial overnight delivery service, or when hand-carried by the applicant. An original and seven copies of the proposal must be submitted; however, proposers are requested not to submit multiple proposal copies using more than one delivery or mail service.

FOR FURTHER INFORMATION CONTACT: Peter Lunn, Environmental Sciences Division, SC-74, Office of Biological and Environmental Research, Office of Science, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874-1290, telephone: (301) 903-4819, E-mail: peter.lunn@oer.doe.gov, fax: (301) 903-8519.

Program Funding

It is anticipated that up to \$2 million in first-year funding will be available for multiple awards to be made in FY 2000 in the categories described above, contingent upon availability of appropriated funds. Proposers may request project support for up to four years, with out-year support contingent on availability of appropriated funds, progress of the research, and programmatic needs. The number of awards and range of funding will depend on the number of proposals received and selected for award. Annual budgets are expected to range from \$60,000 to \$300,000 in total costs.

The instructions and format described below should be followed. Reference Program Announcement LAB 99-03 on all submissions and inquiries about this program.

OFFICE OF SCIENCE
GUIDE FOR PREPARATION OF SCIENTIFIC/TECHNICAL PROPOSALS
TO BE SUBMITTED BY NATIONAL LABORATORIES

Proposals from National Laboratories submitted to the Office of Science (SC) as a result of this program announcement will follow the Department of Energy Field Work Proposal process with additional information requested to allow for scientific/technical merit review. The following guidelines for content and format are intended to facilitate an understanding of the requirements necessary for SC to conduct a merit review of a proposal. Please follow the guidelines carefully, as deviations could be cause for declination of a proposal without merit review.

1. Evaluation Criteria

Proposals will be subjected to formal merit review (peer review) and will be evaluated against the following criteria which are listed in descending order of importance:

Scientific and/or technical merit of the project

Appropriateness of the proposed method or approach

Competency of the personnel and adequacy of the proposed resources

Reasonableness and appropriateness of the proposed budget

The evaluation will include program policy factors such as the relevance of the proposed research to the terms of the announcement, the uniqueness of the proposer's capabilities, and demonstrated usefulness of the research for proposals in other DOE Program Offices as evidenced by a history of programmatic support directly related to the proposed work.

2. Summary of Proposal Contents

Field Work Proposal Format (Reference DOE Order 5700.7C) (DOE ONLY)

Proposal Cover Page

Table of Contents

Abstract

Narrative

Literature Cited

Budget and Budget Explanation
Other support of investigators
Biographical Sketches
Description of facilities and resources
Appendix

2.1 Number of Copies to Submit

An original and seven copies of the formal proposal/FWP must be submitted.

3. Detailed Contents of the Proposal

Proposals must be readily legible, when photocopied, and must conform to the following three requirements: the height of the letters must be no smaller than 12 point with at least 2 points of spacing between lines (leading); the type density must average no more than 17 characters per inch; the margins must be at least one-half inch on all sides. Figures, charts, tables, figure legends, etc., may include type smaller than these requirements so long as they are still fully legible.

3.1 Field Work Proposal Format (Reference DOE Order 5700.7C) (DOE ONLY)

The Field Work Proposal (FWP) is to be prepared and submitted consistent with policies of the investigator's laboratory and the local DOE Operations Office. Additional information is also requested to allow for scientific/technical merit review.

Laboratories may submit proposals directly to the SC Program office listed above. A copy should also be provided to the appropriate DOE operations office.

3.2 Proposal Cover Page

The following proposal cover page information may be placed on plain paper. No form is required.

Title of proposed project
SC Program announcement title
Name of laboratory
Name of principal investigator (PI)
Position title of PI
Mailing address of PI
Telephone of PI
Fax number of PI
Electronic mail address of PI

Name of official signing for laboratory*

Title of official

Fax number of official

Telephone of official

Electronic mail address of official

Requested funding for each year; total request

Use of human subjects in proposed project:

If activities involving human subjects are not planned at any time during the proposed project period, state "No"; otherwise state "Yes", provide the IRB Approval date and Assurance of Compliance Number and include all necessary information with the proposal should human subjects be involved.

Use of vertebrate animals in proposed project:

If activities involving vertebrate animals are not planned at any time during this project, state "No"; otherwise state "Yes" and provide the IACUC Approval date and Animal Welfare Assurance number from NIH and include all necessary information with the proposal.

Signature of PI, date of signature

Signature of official, date of signature*

*The signature certifies that personnel and facilities are available as stated in the proposal, if the project is funded.

3.4 Abstract

Provide an abstract of no more than 250 words. Give the broad, long-term objectives and what the specific research proposed is intended to accomplish. State the hypotheses to be tested. Indicate how the proposed research addresses the SC scientific/technical area specifically described in this announcement.

3.5 Narrative

The narrative comprises the research plan for the project and is limited to 25 pages. It should contain the following subsections:

Background and Significance: Briefly sketch the background leading to the present proposal, critically evaluate existing knowledge, and specifically identify the gaps which the project is intended to fill. State concisely the importance of the research described in the proposal. Explain the relevance of the project to the research needs identified by the Office of Science. Include references to relevant published literature, both to work of the investigators and to work done by other researchers.

Preliminary Studies: Use this section to provide an account of any preliminary studies that may be pertinent to the proposal. Include any other information that will help to establish the experience and competence of the investigators to pursue the proposed project. References to appropriate publications and manuscripts submitted or accepted for publication may be included.

Research Design and Methods: Describe the research design and the procedures to be used to accomplish the specific aims of the project. Describe new techniques and methodologies and explain the advantages over existing techniques and methodologies. As part of this section, provide a tentative sequence or timetable for the project.

Subcontract or Consortium Arrangements: If any portion of the project described under "Research Design and Methods" is to be done in collaboration with another institution, provide information on the institution and why it is to do the specific component of the project. Further information on any such arrangements is to be given in the sections "Budget and Budget Explanation", "Biographical Sketches", and "Description of Facilities and Resources".

3.6 Literature Cited

List all references cited in the narrative. Limit citations to current literature relevant to the proposed research. Information about each reference should be sufficient for it to be located by a reviewer of the proposal.

3.7 Budget and Budget Explanation

A detailed budget is required for the entire project period, which normally will be three years, and for each fiscal year. It is preferred that DOE's budget page, Form 4620.1 be used for providing budget information*. Modifications of categories are permissible to comply with institutional practices, for example with regard to overhead costs.

A written justification of each budget item is to follow the budget pages. For personnel this should take the form of a one-sentence statement of the role of the person in the project. Provide a detailed justification of the need for each item of permanent equipment. Explain each of the other direct costs in sufficient detail for reviewers to be able to judge the appropriateness of the amount requested.

Further instructions regarding the budget are given in section 4 of this guide.

* Form 4620.1 is available at web site:

<http://www.er.doe.gov/production/grants/forms.html>

3.8 Other Support of Investigators

Other support is defined as all financial resources, whether Federal, non-Federal, commercial or institutional, available in direct support of an individual's research endeavors. Information on active and pending other support is required for all senior personnel, including investigators at collaborating institutions to be funded by a subcontract. For each item of other support, give the organization or agency, inclusive dates of the project or proposed project, annual funding, and level of effort devoted to the project.

3.9 Biographical Sketches

This information is required for senior personnel at the laboratory submitting the proposal and at all subcontracting institutions. The biographical sketch is limited to a maximum of two pages for each investigator.

3.10 Description of Facilities and Resources

Describe briefly the facilities to be used for the conduct of the proposed research. Indicate the performance sites and describe pertinent capabilities, including support facilities (such as machine shops) that will be used during the project. List the most important equipment items already available for the project and their pertinent capabilities. Include this information for each subcontracting institution, if any.

3.11 Appendix

Include collated sets of all appendix materials with each copy of the proposal. Do not use the appendix to circumvent the page limitations of the proposal. Information should be included that may not be easily accessible to a reviewer.

Reviewers are not required to consider information in the Appendix, only that in the body of the proposal. Reviewers may not have time to read extensive appendix materials with the same care as they will read the proposal proper.

The appendix may contain the following items: up to five publications, manuscripts (accepted for publication), abstracts, patents, or other printed materials directly relevant to this project, but not generally available to the scientific community; and letters from investigators at other institutions stating their agreement to participate in the project (do not include letters of endorsement of the project).

4. Detailed Instructions for the Budget

(DOE Form 4620.1 "Budget Page" may be used)

4.1 Salaries and Wages

List the names of the principal investigator and other key personnel and the estimated number of person-months for which DOE funding is requested. Proposers should list the number of postdoctoral associates and other professional positions included in the proposal and indicate the number of full-time-equivalent (FTE) person-months and rate of pay (hourly, monthly or annually). For graduate and undergraduate students and all other personnel categories such as secretarial, clerical, technical, etc., show the total number of people needed in each job title and total salaries needed. Salaries requested must be consistent with the institution's regular practices. The budget explanation should define concisely the role of each position in the overall project.

4.2 Equipment

DOE defines equipment as "an item of tangible personal property that has a useful life of more than two years and an acquisition cost of \$5000 or more." Special purpose equipment means equipment which is used only for research, scientific or other technical activities. Items of needed equipment should be individually listed by description and estimated cost, including tax, and adequately justified. Allowable items ordinarily will be limited to scientific equipment that is not already available for the conduct of the work. General purpose office equipment normally will not be considered eligible for support.

4.3 Domestic Travel

The type and extent of travel and its relation to the research should be specified. Funds may be requested for attendance at meetings and conferences, other travel associated with the work and subsistence. In order to qualify for support, attendance at meetings or conferences must enhance the investigator's capability to perform the research, plan extensions of it, or disseminate its results. Consultant's travel costs also may be requested.

4.4 Foreign Travel

Foreign travel is any travel outside Canada and the United States and its territories and possessions. Foreign travel may be approved only if it is directly related to project objectives.

4.5 Other Direct Costs

The budget should itemize other anticipated direct costs not included under the headings above, including materials and supplies, publication costs, computer services, and consultant services (which are discussed below). Other examples are: aircraft rental, space rental at research establishments away from the institution, minor building alterations, service charges, and fabrication of equipment or systems not available off-the-shelf. Reference books and periodicals may be charged to the project only if they are specifically related to the research.

a. Materials and Supplies

The budget should indicate in general terms the type of required expendable materials and supplies with their estimated costs. The breakdown should be more detailed when the cost is substantial.

b. Publication Costs/Page Charges

The budget may request funds for the costs of preparing and publishing the results of research, including costs of reports, reprints page charges, or other journal costs (except costs for prior or early publication), and necessary illustrations.

c. Consultant Services

Anticipated consultant services should be justified and information furnished on each individual's expertise, primary organizational affiliation, daily compensation rate and number of days expected service. Consultant's travel costs should be listed separately under travel in the budget.

d. Computer Services

The cost of computer services, including computer-based retrieval of scientific and technical information, may be requested. A justification based on the established computer service rates should be included.

e. Subcontracts

Subcontracts should be listed so that they can be properly evaluated. There should be an anticipated cost and an explanation of that cost for each subcontract. The total amount of each subcontract should also appear as a budget item.

4.6 Indirect Costs

Explain the basis for each overhead and indirect cost. Include the current rates.