Final Technical Report

Use of an existing airborne radon data base in the verification of the NASA/AEAP Core Model
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The primary objective of this project was to apply the tropospheric atmospheric radon (^{222}Rn) measurements made by Dr. Kritz' group (flying aboard NASA aircraft based at the Ames Research Center) to the development and verification of the global 3-D atmospheric chemical transport model under development by NASA's Atmospheric Effects of Aviation Project (AEAP).

The AEAP project had two principal components--a modeling effort, *whose goal was to create, test and apply an elaborate three-dimensional atmospheric chemical transport model (the NASA/AEAP Core model) to an evaluation of the possible short and long-term effects of aircraft emissions on atmospheric chemistry and climate*--and a measurement effort, whose goal was to obtain a focused set of atmospheric measurements that would provide some of the observational data used in the modeling effort. My activity in this project was confined to the first of these components.

Both atmospheric transport and atmospheric chemical reactions (as well the input and removal of chemical species) are accounted for in the NASA/AEAP Core model. Thus, for example, in assessing the effect of aircraft effluents on the chemistry of a given region of the upper troposphere, the model must keep track not only of the chemical reactions of the effluent species emitted by aircraft flying in this region, but also of the transport into the region of these (and other) species from other, remote sources--for example, via the vertical convection of boundary layer air to the upper troposphere.

Radon, because of its known surface source and known radioactive half-life, and freedom from chemical production or loss, and from removal from the atmosphere by physical scavenging, is a recognized and valuable tool for testing the transport components of global transport and circulation models.

The development and application of the NASA/AEAP Core model, which physically was located at the computational facility of the Department of Energy Lawrence Livermore Laboratory, was carried out by the AEAP Core Modeling Team. Membership in the team consisted of approximately 50 scientists, drawn from NASA, the Department of Energy, the university community, and private industry.

Team members were generally involved in the work of the Team on two levels: participation in the semi-annual Team Meetings, which reviewed progress, and discussed and decided on the direction, scope and timing of future Team efforts; and working with various individual team members, or sub-groups of team members, on specific modeling tasks.

As a Team member I was invited (and expected to attend) the semi-annual Team Meetings, which generally were held in January and in June. Although there was some overlap between them, the Core modeling effort, as well as the Core modeling team, was divided into two components: stratospheric and tropospheric. Most of the Team meetings covered both regions of the atmosphere, though some meetings were confined to discussion of only one of these regions. Thus in the course of my participation in the activity of the Team under this JRI I attended the Team meetings which focused on the tropospheric modeling effort, as well as those which covered both regions of the atmosphere. During the duration of this project I attended and participated in the Team meetings held in June, 1995 (Hyannis, MA), January, 1996 (Irvine, CA), June, 1996 (Boulder, CO) and August, 1997 (Washington, DC).

In the course of my participation in those meetings and in this project I carried out the following tasks:

1) To gather together my own, as well as suitable tropospheric radon measurements made by others, and to communicate the dates, locations and an assessment of the quality of these data to the Core modeling Team;

2) To work with Team members in deciding which of those datasets could best be used for comparison with model output, and to help establish the parameters of those model runs;

3) To work with the Team in the comparison of the model output (i.e., the predicted (or calculated) atmospheric radon distributions) with the corresponding observed distributions;

4) Where significant discrepancies existed, to work with Team members in identifying the portions of the model algorithm where modification/improvement might be in order; and

5) To work with Team members in the preparation of reports and peer-reviewed publications.

6) In addition, I also worked with the Global Emissions Inventory Activity of the International Global Atmospheric Chemistry Project (IGAC/GEIA) to provide to the Team a preliminary assessment of possible variations of the global radon source function with season and location.

Three publications were produced in connection with my activity in this project:

WMO/ISCU/IOC World Climate Research Programme,
Working Group on Numerical Experimentation
Global Tracer Transport Models (August, 1997)

Evaluation and intercomparison of global atmospheric transport models using ^{222}Rn and other short lived tracers, Journal of Geophysical Research, vol. 102, pp. 5953-5970, 1997.

Atmospheric Effect of Subsonic Aircraft: Interim Assessment Report
NASA Reference Publication 1400, 1997.

No inventions were made during the course of this Joint Research Interchange/ Cooperative Agreement; nor was there any residual property or equipment.