A. Stratospheric General Circulation with Chemistry Model (SGCCM) (RTOP # 673-64-01-20)

B. Principal Investigator: Richard B. Rood
Code 616
NASA/Goddard Space Flight Center
Greenbelt, MD 20771
301-286-8203

Co-Investigators: Anne R. Douglass*
Code 616, NASA/Goddard Space Flight Center
Greenbelt, MD 20771
301-286-2337

Marvin A. Geller
Code 610, NASA/Goddard Space Flight Center
Greenbelt, MD 20771
301-286-5002

Jack A. Kaye
Code 616, NASA/Goddard Space Flight Center
Greenbelt, MD 20771
301-286-6371

J. Eric Nielsen
Applied Research Corporation
8201 Corporate Drive
Landover, MD 20785
301-459-8442

Joan E. Rosenfield*
Code 616, NASA/Goddard Space Flight Center
Greenbelt, MD 20771
301-286-3817

Richard S. Stolarski
Code 616, NASA/Goddard Space Flight Center
Greenbelt, MD 20771
301-286-9111

* Universities Space Research Association Resident Associate
C. The goal of this project is to enhance our understanding of the fully interactive general circulation of the stratosphere. The strategy of investigation is to construct and analyze models of the system and compare with observations. Parallel studies of observations and model simulations provide the most effective mechanism for understanding stratospheric processes.

D. In the past two years constituent transport and chemistry experiments have been performed using both simple single constituent models and more complex reservoir species models. Winds for these experiments have been taken from our data assimilation effort (Stratospheric Date Analysis System (STRATAN), RTOP # 673-41-43-20). The application of winds from data assimilation to chemistry and transport studies is unique of this research effort.

Winds from STRATAN allow the quantitative computation of stratospheric transport. This has been verified by comparison of modeled ozone behavior to ozone behavior observed by the Limb Infrared Monitor of the Stratosphere (LIMS). By using winds from STRATAN meaningful transport experiments can be carried out at much lower resolution than if a free running general circulation model (GCM) was used. Because of the great cost of chemical models, the ability to run at coarse resolutions is particularly important.

In an application of the three-dimensional (3D) model to stratospheric chemistry problems, the behavior of nitric acid in the lower stratosphere has been studied. By studying the manner in which the modeled nitric acid diverges from the LIMS observations, it has been possible to offer additional information on the longstanding problem of wintertime nitric acid chemistry. These results indicate the need for a low light source. The results strongly depend on the use of a 3D model, and comparison to 3D data.

Collaboration with the 2D modeling effort at Goddard (C. Jackman, PI) has been increased. This collaboration is exemplified by the use of the 2D model to generate production and losses for the single constituent models, the development of algorithms to generate 3D initial conditions from the 2D model, and the use of the 3D model to guide improvement of the 2D model parameterizations.

Modeling changes: The grid point GCM has been dropped. A version of the Community Climate Model is operational (spectral GCM). The radiation model has been improved, and its computational speed has been reduced 70%. Numerous simple single constituent models have been developed. A twelve reservoir species model has been developed.

E. The publication list showing the most recent publications for the Stratospheric General Circulation with Chemistry Project is attached. Numerous papers are in preparation.
Published Papers


