NASA Upper Atmosphere Research Program: Research Summary 1988-89

A. Title of Research Task

The ER-2 Meteorological Measurement System

B. Principal Investigator and Institution

K. Roland Chan
NASA, Ames Research Center
M.S. 245-5
Moffett Field, CA 94035

C. Abstract of Research Objectives

The objectives of ER-2 Meteorological Measurement System (MMS) are:

1. To measure the meteorological parameters (pressure, temperature, and the three-dimensional wind vector) accurately.

2. To provide high-resolution data on atmospheric state variables and aircraft flight track to ER-2 investigators on a timely basis.

3. To conduct collaborative research in atmospheric dynamics and chemistry.

D. Summary of Progress and Results

1. MMS successfully participated in the Airborne Antarctic Ozone Experiment (AAOE) based in Punta Arenas, Chile in August and September of 1987.

2. MMS instrumentation (new 20-Mbyte disc, static pressure measurement, power supply, etc.) was improved to minimize single-point failures.

3. Calibrations of the MMS instrumentation (individual sensors, laboratory study of the INS dynamics, system response tests, inflight aircraft maneuvers) were performed. Temperature is accurate to ± 0.3 K, pressure ± 0.3 mb, and wind ± 1 m s^{-1}. Sampling rate is 5 s^{-1}.

4. Much improved software for fast data downloading and postflight processing (incorporating all calibration results) was developed.

5. MMS successfully participated in the Airborne Arctic Stratospheric Expedition (AASE) based in Stavanger, Norway in January and February of 1989.

6. STEP (Stratosphere-Troposphere Exchange Project) MMS 1-Hz and 5-Hz data were revised.

7. AAOE MMS 1-Hz and 5-Hz data were revised.

8. AASE MMS 1-Hz and 5-Hz data were revised.

9. MMS data link via telemetry and real-time computation capability of MMS measurements were developed and successfully demonstrated.

10. Many scientific collaborative activities were conducted and are on-going.

E. Journal Publications

1. Chan, K. R., S. G. Scott, T. P. Bui, S. W. Bowen, and J. Day, Temperature and horizontal wind measurements on the ER-2 aircraft during the 1987 Airborne Antarctic Ozone Experiment, J. Geophys. Res., 1989.
2. Scott, S. G., T. P. Bui, K. R. Chan, and S. W. Bowen, The Meteorological Measurement System on the NASA ER-2 aircraft, J. Atm. Oceanic Tech., 1989.
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4. Loewenstein, M., J. R. Podolske, S. E. Strahan, and K. R. Chan, Nitrous oxide as a dynamical tracer in the 1987 Airborne Antarctic Ozone Experiment, J. Geophys. Res., 1989.
5. Murphy, D. M., A. F. Tuck, K. K. Kelly, K. R. Chan, M. Loewenstein, J. R. Podolske, M. H. Proffitt, and S. E. Strahan, Indicators of transport and vertical motion from corrections between in situ measurements of the Airborne Antarctic Ozone Experiment, J. Geophys. Res., 1989.
6. Podolske, J. P., M. Loewenstein, S.E. Strahan, and K. R. Chan, Stratospheric nitrous oxide distribution in the southern hemisphere, J. Geophys. Res., 1989.
7. Kelly, K. K., A. F. Tuck, D. M. Murphy, M. H. Profitt, D. W. Fahey, R. L. Jones, D. S. McKenna, M. Loewenstein, J. R. Podolske, S. E. Strahan, G. V. Ferry, K. R. Chan, J. F. Vedder, G. L. Gregory, W. D. Hypes, M. P. McCormick, E. V. Browell, and L. E. Heidt, Dehydration in the lower Antarctic stratosphere during later winter and early spring, 1987, J. Geophys. Res., 1989.
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9. Strahan, S. E., M. Loewenstein, J. R. Podolske, W. L. Starr, M. H. Profitt, K. K. Kelly, and K. R. Chan, Correlation of N20 and ozone in the southern polar vortex during the Airborne Antarctic Ozone Experiment, J. Geophys. Res., 1989.
10. Brune, W. H, J. G. Anderson, and K. R. Chan, In situ observations of ClO in the Antarctic: ER-2 aircraft results from 54°S to 72°S latitude, J. Geophys. Res., 1989.
11. Fahey D. W., K. K. Kelly, G. V. Ferry, L. R. Poole, J. C. Wilson, D. M. Murphy, M. Loewenstein, and K. R. Chan, In situ measurements of total reactive nitrogen, total water vapor, and aerosols in polar stratrospheric clouds in the Antarctic stratosphere, J. Geophys. Res., 1989.
12. Gandrud. B. W., P. D. Sperry, L. Sanford, K. K. Kelly, G. V. Ferry, and K. R. Chan, Filter measurement results from the Airborne Antarctic Ozone Experiment, J. Geophys. Res., 1989.
13. Proffitt, M. H., J. A. Powell, A. F. Tuck, D. W. Fahey, K. K. Kelly, A. J. Kruger, M. R. Schoeberl, B. L. Gary, J. J. Margitan, K. R. Chan, M. Loewenstein, and J. R. Podolske, A chemical definition of the boundary of the Antarctic ozone hole, J. Geophys. Res., 1989.
14. Wilson, J. C., G. V. Ferry, M. Loewenstein, D. W. Fahey, S. D. Smith, K. R. Chan, and K.K. Kelly, Observations of condensation nuclei in the Airborne Antarctic Ozone Experiment: implications for new particle formation and polar stratopsheric cloud formation, J. Geophys. Res., 1989.
15. McKenna, D. S., R. L. Jones, A. T. Buckland, J. Austin, A. F. Tuck, R. H. Winkler, and K.R. Chan, The southern hemisphere lower stratosphere during August and September 1987: analyses based on the United Kingdom Meteorological Office global model, J. Geophys. Res., 1989.
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17. Rodriguez, J. M., M. K. W. Ko, N. D. Sze, S. D. Pierce, J. G. Anderson, D. W. Fahey, K.K. Kelly, C. B. Farmer, G. C. Toon, M. T. Coffey, L. E. Heidt, W. G. Mankin, K. R. Chan, W. L. Starr, J. F. Vedder, and M. P. McCormick, Nitrogren and chlorine species in the spring Antarctic stratosphere: comparison of models and AAOE observations, J. Geophys. Res., 1989
18. Several others