Compendium Of NASA Data Base For The Global Tropospheric Experiment's Pacific Exploratory Mission West-B (PEM West-B)

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GLOBAL TROPOSPHERIC EXPERIMENT'S
PACIFIC EXPLORATORY MISSION WEST-B (PEM WEST-B)

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SUMMARY

The report provides a compendium of NASA aircraft data that are available from NASA's Global Tropospheric Experiment's (GTE) Pacific Exploratory Mission West-B (PEM West-B) conducted in February and March 1994. The NASA PEM West experiments (PEM West-A and -B) are a major component of the East Asia/North Pacific Regional Study (APARE), a project within the International Global Atmospheric Chemistry (IGAC) Program. PEM West flight experiments focused on the Pacific rim region and were primarily based at Guam, Hong Kong, and Japan. The broad objectives of the experiments were to study chemical processes and long-range transport associated with Asian continental outflow over the northwest Pacific Ocean and to document the magnitude of the human impact on the oceanic/marine atmosphere over this region with an emphasis on ozone and sulfur chemistry (gas). PEM West-B, studied late-winter to early-spring meteorology during which Asian continental outflow was enhanced in comparison to outflow during the early-fall (September and October) time frame of the 1991 PEM West-A measurements. Results from PEM West-A and B are public domain (see Appendix B). PEM West-A data are summarized in NASA TM 109177 entitled "Compendium of NASA Data Base for the Global Tropospheric Experiment's Pacific Exploratory Mission West-A (published February 1995) and an in-press special issue of the Journal of Geophysical Research – Atmospheres.
The format of this compendium utilizes data plots--time series and altitude profiles--of selective data acquired aboard the NASA/Ames DC-8 aircraft during PEM West-B. The purpose of this document is to provide a representation of aircraft data that are available in archived format via NASA Langley's Distributed Active Archive Center (DAAC). The data format is intended only to assist the reader in identifying data that are of interest. This compendium is for only the NASA aircraft data. The DAAC archived data bases include numerous supporting data including meteorological observations/products, photochemical modeling products, results from surface studies, satellite observations, and sondes releases.
INTRODUCTION

The goal of the NASA Tropospheric Chemistry Program is to develop an understanding of the chemical cycles that control the composition of the troposphere and to assess the susceptibility of the global atmosphere to chemical change. A major component of the NASA program is the Global Tropospheric Experiment (GTE), which consists of a series of field experiments designed to (1) evaluate the capability of instrument techniques to measure, under field conditions, the minute concentrations of key chemical species in the troposphere; and (2) systematically address tropospheric chemistry issues relevant to global change, through airborne sampling expeditions, coupled with modeling and laboratory studies. GTE is primarily an aircraft-based program supplemented by ground-based measurements. Satellite data also play important roles. Space Shuttle observations of tropospheric carbon monoxide distributions have been used to plan and direct the course of expeditions, for example, over tropical rain forests and for continental outflow into the tropical Atlantic Ocean. Landsat land-surface images have facilitated the extrapolation of regional Arctic-tundra measurements into global-scale conclusions. Total Ozone Measurements from Satellites (TOMS) have helped place GTE observed ozone distributions/budgets into a global perspective (temporal and spatial) and to guide intensive aircraft studies over the tropical Atlantic Ocean. Weather data returned by environmental satellites have guided flight planning for research flights. The Distributed Active Archive Center (DAAC) data include many of the satellite, surface, and meteorological products used to support GTE missions or analyses.

The GTE airborne expeditions have focused on studies of the remote global atmosphere in order to provide well-documented baseline measurements of the unperturbed environment and to fully understand the chemical cycles underlying the natural environment. Table 1 and Figure 1 summarize GTE missions conducted through 1994 and the PEM Tropics mission scheduled for 1996. The GTE expeditions have been conducted in a diverse range of environments and with different scientific goals. The Chemical Instrument
Test and Evaluation (CITE) series was designed to study our ability to measure key tropospheric gaseous species by exposing selected instrumentation to a wide range of measurement conditions. The Atmospheric Boundary Layer Experiments (ABLE) were designed to study the emission, chemical processes, and dynamics of the boundary layer, and have been conducted over ecosystems known to have significant influence on the global troposphere. The importance of long-range transport of natural and anthropogenic emissions on the global troposphere has been investigated in the Pacific Exploratory Missions (PEM) and the Transport and Atmospheric Chemistry Experiment in the Atlantic (TRACE-A).

The GTE, managed through the Tropospheric Chemistry Program in the Mission to Planet Earth Office, NASA Headquarters, was initiated in the early 1980s. Implementation of the GTE Project is via a Project Office at the NASA Langley Research Center, Atmospheric Sciences Division.

SYMBOLS AND UNITS

ABLE  Atmospheric Boundary Layer Experiment
APARE  East Asia/North Pacific Regional Study
CITE  Chemical Instrument Test and Evaluation
CO  carbon monoxide
CO2  carbon dioxide
C2Cl4  tetrachloroethylene
CH3CCl3  methyl chloroform
CH3OOH  methyl peroxide
CH3COOH  acetic acid
CH4  methane
DAAC  Distributed Active Archive Center
deg.  degree
DMS  dimethyl sulfide
dp  dew point temperature, degree Centigrade
fine aerosol in the size range of ~0.01 to 1 micron diameter
Ga.Inst. of Tech. Georgia Institute of Technology, Atlanta, Georgia
GIT Georgia Institute of Technology, Atlanta, Georgia
GTE Global Tropospheric Experiment
H₂O₂ hydrogen peroxide
HCOOH formic acid
HNO₃ nitric acid
IGAC International Global Atmospheric Chemistry Program
ITCZ Inter-Tropical Convergence Zone
LaRC Langley Research Center
large aerosol in the size range of 0.3 to 20 micron diameter
N₂O nitrous oxide
NASA National Aeronautics and Space Administration
NIES National Institute for Environmental Studies, Japan
NO nitric oxide
NOₓ total odd nitrogen
O₃ ozone
PAN peroxyacetyl nitrate
PEM Pacific Exploratory Mission
ppbv parts-per-billion, by volume
ppmv parts-per-million, by volume
PPN peroxypropionyl nitrate
pptv parts-per-trillion, by volume
Rel. Humidity relative humidity, percent
small aerosol in the size range of 0.1 to 3 micron diameter
SO₂ sulfur dioxide
T air temperature, degree Centigrade
Theta potential temperature, degree Kelvin
TOMS Total Ozone Measurements from Satellites
TRACE-A Transport and Atmospheric Chemistry Experiment in the Atlantic
PROGRAM AND DATA DESCRIPTIONS

The National Aeronautics and Space Administration's Pacific Exploratory Mission West (PEM West) is a major component of the East Asia/North Pacific Regional study (APARE), a project within the International Global Atmospheric Chemistry (IGAC) program. The broad objectives of the PEM West/APARE initiative is to study chemical processes and long-range transport over the northwest Pacific Ocean, and to estimate the magnitude of the human impact (specifically Asian continental outflow) on the marine/oceanic atmosphere of the region. Specific objectives of PEM West are (1) to investigate the atmospheric chemistry of ozone \( (O_3) \) and its precursors over the northwest Pacific including examination of their natural budgets as well as the impact of anthropogenic sources; and (2) to investigate the atmospheric gaseous sulfur cycle over the northwest Pacific with emphasis on the relative importance and influence of continental versus marine sulfur sources.

The Pacific Ocean is, perhaps, the only major region in the Northern Hemisphere that is "relatively" free from direct anthropogenic influences. In the remote regions of the northern Pacific and in most of the southern Pacific, it should be possible to study the biogeochemical cycles of carbon, nitrogen, ozone, sulfur, and aerosols in an environment which, from a global perspective, is least perturbed by anthropogenic activities. On the other hand, there is little doubt that long-range transport of air pollutants from Asia and, to a lesser extent, Europe and North America is beginning to have significant impact on the atmosphere over a large part of the Pacific. The results from the PEM West studies provide an extensive set of baseline data.
from which the anthropogenic impact of this region can be reliably assessed for decades to come.

The overall experiment design for the PEM-West/APARE program encompassed two field studies positioned in time such that contrasting meteorological regimes in the northwestern Pacific could be studied. The first phase of the Pacific Exploratory Mission West, PEM West-A, was conducted over the Pacific Ocean off the coast of Asia during September and October, 1991. Significant characteristics of the lower troposphere airflow during this time of year includes periods during which the predominance of flow is from the mid-Pacific (marine) regions and periods in which the marine flow is modified/mixed with Asian continental outflow. Phase B of PEM West was conducted during February and March 1994, a period characterized by maximum outflow from the Asian continent with less predominance of flow from mid-Pacific marine regions.

The centerpiece of PEM West-B was a series of 16 research flights with the instrumented NASA Ames DC-8. The aircraft operated from three staging areas: Anderson Air Force Base, Guam; Kai Tak International Airport, Hong Kong; and Yokota Air Force Base, Japan. Table 2 summarizes the flights, and Figure 2 shows the flight regions. Flights 6-9, 11-12, and 14-17 were site-intensive flights based from Guam, Hong Kong, and Japan, respectively. Survey/ferry flights included (a) flights 4-5 from NASA Ames to Guam (via Hawaii), (b) flight 10 from Guam to Hong Kong and (c) flights 18-19 from Japan to Ames (via Anchorage, Alaska). While the prime objective of the survey/ferry flights was to move the aircraft to a new base of operation, the flight plans were designed to provide as much information on the atmospheric processes and vertical structure of the atmosphere as possible. The intensive flights were designed to take advantage of the geographical location of the site and prevailing meteorological conditions in addressing science objectives. As a result of the location of the three intensive sites (staging areas), flights covered a latitude range of about 45° N to the Equator and sampled air with continental lifetimes of <1 day (i.e., passed over the Asian continent within 1 day of sampling) to air which had been over the Pacific
Ocean for >5 days. The majority of flights focused on studying the impact of aged, 1 to 3 days, Asian outflow on Pacific marine regions. Unique PEM West-B sampling events included (1) two flights south to the ITCZ and Equator (flights 6 and 9), (2) a flight which encircled the island of Taiwan (flight 12), (3) an upwind/downwind study of the island of Japan (flight 15), and (4) sampling of stratospherically influenced upper-tropospheric air in which ozone was elevated to several hundred ppbv (portions of flights 17 and 18).

The core set of measurements aboard the aircraft focused on ozone and sulfur chemistry issues (gaseous). The aircraft data included a suite of chemical measurements which included ozone, nitric oxide (NO), total odd or "reactive" nitrogen gaseous species (NO_y), sulfur dioxide, dimethyl sulfide, peroxycetyl nitrate or PAN, peroxypropiony nitrate, methane, carbon monoxide, carbon dioxide, nonmethane hydrocarbons, fluorocarbons, acetic acid, formic acid, nitric acid, hydrogen and methyl peroxides. Two sets (Nagoya University and Georgia Institute of Technology) of NO and NO_y data were measured aboard the aircraft. While the two NO data sets generally agreed, the NO_y data sets did not agree in many cases. Laboratory and flight tests conducted by GIT (the results to be reported in a planned special issue of the Journal of Geophysical Research - Atmospheres dealing with PEM West-B results) suggests that the NO_y measurements obtained by the GIT instrument may lack specificity. Thus, for some flight/sampling/environmental conditions, differences in sampling procedures (e.g., inlet design/material, NO_y converter parameters/conditions, sample flow rates, etc.) between the two instrumental approaches may account for much of the observed disagreement. Prior to publication of the planned special issue of the journal dealing with PEM West-B results, those interested in using PEM West-B NO_y data are recommended to contact the respective NO_y investigators.

Aerosol measurements included filter collections for "elemental-type" analyses and optical measurements of number density in the classifications of fine (\(0.01\) to \(1\) \(\mu\) diameter), small (15 size bins covering the size range of \(0.1 - 3\) \(\mu\)), and large (30 size bins covering the size range of \(0.3 - 20\) \(\mu\)).
Table 3 identifies investigators responsible for the measurements, and Figure 3 shows a schematic of the aircraft instrument plan.

The aircraft platform as used in PEM West-B had a cruise speed at altitude of about 12 km/min and a maximum flight duration and ceiling of about 8-9 hours and 13 km, respectively. Survey flights were generally long-duration flights at high altitude (10 to 13 km) with (generally) at least one descent (spiral or ramp in addition to takeoff and landing) to about 150 to 300 m above sea level. Intensive flights combined numerous ramps, profiles, and level-flight legs to meet planned objectives. Generally, altitude profiles (spirals or ramps) were flown with ascent/descent rates of 150 to 300 m/min.

The PEM West-B DAAC data archive includes (1) data taken aboard the NASA Ames DC-8 aircraft; (2) data measured at surface sites throughout the Pacific Rim basin; (3) sondes released from multiple locations in support of the aircraft flights; (4) photochemical modeling products used in analyses of results; and (5) numerous meteorological, land-use, and satellite data products used in flight (field) planning and post-mission analyses.

The data plots for the PEM West-B missions are given in Appendix A. For each flight, six pages of time series plots are provided: page 1 -- a pictorial diagram of the flight region and time series plots of altitude, temperature (T), dew point temperature (dp), relative humidity, and potential temperature (theta); page 2 -- ozone (O₃), carbon monoxide (CO), carbon dioxide (CO₂) methane, nitrous oxide (N₂O), and benzene; page 3 -- nitric oxide (NO) as measured by Nagoya and GIT, total odd or "reactive" nitrogen gas species (NOₓ) as measured by Nagoya and GIT, and nitric acid; page 4 -- acetylene, ethane, propane, tetrachloroethylene (C₂Cl₄), and methyl chloroform (CH₃CCl₃); and page 5 -- sulfur dioxide (SO₂), dimethyl sulfide (DMS), ethylene, peroxyacetyl nitrate (PAN), and acetone; page 6 -- hydrogen peroxide (H₂O₂), methyl peroxyde (CH₃OOH), and number density for fine, small, and large aerosol. The species were selected to provide the reader with information on both the source characteristics and photochemical history of
the air. Figure numbers correspond to flight numbers; e.g., Figure A4.2 represents page 2 of the plots for flight #4. Selected profile plots follow the time series plots as, e.g., Figure A4.7 is the first page of profile plots for flight 4. Profile plot sets include temperature, dew point temperature, ozone, carbon monoxide, and methane data plotted to the same altitude scale. One to three sets of profile plots are provided (format of two sets per page) for each flight. Table 4 summarizes the profiles selected. There are no figures with the prefix of A1, A2, or A3. Flights 1 to 3 were instrument checkout flights based at Ames and data were not archived. Data plots are in standardized format as discussed in Appendix A. The DAAC archive includes measurements aboard the DC-8 aircraft during PEM West-B which are not plotted in Appendix A.

CONCLUDING REMARKS

This compendium of data from NASA's Global Tropospheric Experiment's Pacific Exploratory Mission West-B provides only a representation of aircraft data that are available in archived format from NASA Langley's Distributed Active Archive Center (DAAC). The data presented here are intended only to serve as an overview of the PEM West-B data and provide some assistance to the reader in identifying data that are of interest and which may be obtained from Langley's DAAC archive. This compendium covers only selected NASA DC-8 aircraft data. The archived data bases include other data measured on board the aircraft as well as numerous supporting data including meteorological observations/products, photochemical modeling products, surface station observations, satellite observations, and sondes releases. GTE-sponsored analyses/results from the PEM West-B expeditions have been submitted (September 1995) for a Special Issue of the Journal of Geophysical Research - Atmospheres.
Questions or information regarding the Langley DAAC archive should be directed to Langley DAAC User and Data Services, Mail Stop 157B, NASA Langley Research Center, Hampton, Virginia 23681-0001. A brief description of the DAAC, log on procedures, and data bases is given as Appendix B.
### TABLE 1. GTE Field Expeditions

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TABLE 4. PEM West-B Profiles

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Times are GMT
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Times are GMT
Figure 2. Flight tracks for the DC-8 aircraft during the PEM West-B mission
Figure 3. Instrument location on the NASA DC-8 aircraft during PEM-West B.
APPENDIX A: PEM WEST-B DATA PLOTS

Plots are presented in a standardized format, and the data (unedited) are from the Langley DAAC archive. Relative humidity and potential temperature are calculated from measurements made on the aircraft. In some cases (mostly for moist, boundary layer conditions) relative humidity may exceed 100% (not plotted) as dew point temperature exceeded air temperature by a few degrees (assumed to be the result of instrument measurement/calibration uncertainty). For time series plots, abscissa time scales for a given flight are identical. Ordinate scales (for a given parameter) may differ among flights and were selected to best represent all the data for the species measured during the flight; thus, some data may be off-scale. As a result of the software used for the plots and the data archive use of codes (in place of valid data) for data taken (1) during instrument calibration, (2) when measurements were at "detection limit," and/or (3) when measurements were invalid, it is sometimes difficult to distinguish from the plots if data are off-scale or coded as invalid. For example, a symbol without an attached line may either mean that adjacent data are off-scale or have been coded as invalid. Inspection of the other plotted data often provides information which resolves the uncertainty. For profile plots, altitude scales are identical for all plots and the species scales are those selected for the time series plots. In order to maintain the standardized format, plots for flights in which a species data were not reported are plotted with the axes and a "NO DATA" entry.

Given below are the beginning page numbers for each flight's sequence of plots:

Flight 4 - page 23
Flight 5 - page 31
Flight 6 - page 39
Flight 7 - page 47
Flight 8 - page 55
PEM (B) PACIFIC MISSION: FLIGHT 4

Altitude, km

Temperature, °C

Relative Humidity

Theta, deg. K

Figure A4.1
PEM (B) PACIFIC MISSION: FLIGHT 4

Solid = O3
Broken = CO

Figure A4.2
Figure A4.3

PEM (B) PACIFIC MISSION: FLIGHT 4

NO DATA

NO DATA

NO DATA
PEM (B) PACIFIC MISSION: FLIGHT 4

Acetylene, pptv

NO DATA

Ethane, pptv

NO DATA

Propane, pptv

NO DATA

C2Cl4, pptv

NO DATA

CH3Cl3, pptv

NO DATA

Figure A4.4
Figure A4.5
Figure A4.6
PM (B) PACIFIC MISSION: FLIGHT 4 PROFILE AT 2030 GMT

PEM (B) PACIFIC MISSION: FLIGHT 4 PROFILE AT 0100 GMT
PEM (B) PACIFIC MISSION: FLIGHT 5

Solid = O3
Broken = CO

Figure A5.2

32
Figure A5.3
Figure A5.4
PEM (B) PACIFIC MISSION: FLIGHT 5

Figure A5.5
PEM (B) PACIFIC MISSION: FLIGHT 5 PROFILE AT 2030 GMT

PEM (B) PACIFIC MISSION: FLIGHT 5 PROFILE AT 0415 GMT
PEM (B) PACIFIC MISSION: FLIGHT 6

Figure A6.1

39
PEM (B) PACIFIC MISSION: FLIGHT 6

Solid = O3
Broken = CO

Figure A6.2
PEM (B) PACIFIC MISSION: FLIGHT 6

Figure A6.4
Figure A6.5
PEM (B) PACIFIC MISSION: FLIGHT 6

Figure A6.6

GMT Time
PEM (B) PACIFIC MISSION: FLIGHT 6 PROFILE AT 0030 GMT

PEM (B) PACIFIC MISSION: FLIGHT 6 PROFILE AT 0130 GMT
PEM (B) PACIFIC MISSION: FLIGHT 7

Figure A7.1
PEM (B) PACIFIC MISSION: FLIGHT 7

Solid = 03
Broken = CO

Figure A7.2
PEM (B) PACIFIC MISSION: FLIGHT 7

Figure A7.3
Figure A7.4
PEM (B) PACIFIC MISSION: FLIGHT 7

H2O2, pptv

CH3OH, pptv

Fine, no./cm³

Small, no./cm³

Large, no./cm³

NO DATA

Figure A7.6

52
PEM (B) PACIFIC MISSION: FLIGHT 7 PROFILE AT 2330 GMT

- Altitude, Km
- Temperature, C
- Dewpoint, C
- Ozone, ppbv
- CO, ppbv
- Methane, ppbv

PEM (B) PACIFIC MISSION: FLIGHT 7 PROFILE AT 0315 GMT

- Altitude, Km
- Temperature, C
- Dewpoint, C
- Ozone, ppbv
- CO, ppbv
- Methane, ppbv
PEM (B) PACIFIC MISSION: FLIGHT 8

Figure A8.1
PEM (B) PACIFIC MISSION: FLIGHT 8

Solid = O3
Broken = CO

Figure A8.2
PEM (B) PACIFIC MISSION: FLIGHT 8

Figure A8.3

Nagoya NO, pptv

Nagoya NOy, pptv

GIT NO, pptv

GIT NOy, pptv

Nitric Acid, pptv

GMT Time

22 23 24 25 26 27 28 29 30 31 32
PEM (B) PACIFIC MISSION: FLIGHT 8

Figure A8.4
PEM (B) PACIFIC MISSION: FLIGHT 8

NO DATA

NO DATA

Figure A8.5
PEM (B) PACIFIC MISSION: FLIGHT 8

Figure A8.6
PEM (B) PACIFIC MISSION: FLIGHT 8 PROFILE AT 0115 GMT

PEM (B) PACIFIC MISSION: FLIGHT 8 PROFILE AT 0730 GMT

NO DATA
Figure A9.1
PEM (B) PACIFIC MISSION: FLIGHT 9

Solid = O3
Broken = CO

Figure A9.2
PEM (B) PACIFIC MISSION: FLIGHT 9

Figure A9.4
Figure A9.5
PEM (B) PACIFIC MISSION: FLIGHT 9

Figure A9.6
PEM (B) PACIFIC MISSION: FLIGHT 9 PROFILE AT 0500 GMT

PEM (B) PACIFIC MISSION: FLIGHT 9 PROFILE AT 0830 GMT

NO DATA
PEM (B) PACIFIC MISSION: FLIGHT 10

![Map of the Pacific showing flight path]

- **Altitude, km**
- **Temperature, °C**
- **Rel. Humidity**
- **Theta, deg. K**

Solid = T
Broken = dp

Figure A10.1
Figure A10.2
PEM (B) PACIFIC MISSION: FLIGHT 10

Figure A10.4
PEM (B) PACIFIC MISSION: FLIGHT 10

Figure A10.5
PEM (B) PACIFIC MISSION: FLIGHT 10

Figure A10.6
PEM (B) PACIFIC MISSION: FLIGHT 10 PROFILE AT 0500 GMT

PEM (B) PACIFIC MISSION: FLIGHT 10 PROFILE AT 0715 GMT
PEM (B) PACIFIC MISSION: FLIGHT 10 PROFILE AT 0900 GMT
PEM (B) PACIFIC MISSION: FLIGHT 11

Altitude, km

Temperature, °C

Solid = T
Broken = dp

Rel. Humidity

Theta, deg. K

Figure A11.1
Figure A11.3
PEM (B) PACIFIC MISSION: FLIGHT 11

Figure A11.4
Figure A11.5
PEM (B) PACIFIC MISSION: FLIGHT 11

Figure A11.6
PEM (B) PACIFIC MISSION: FLIGHT 11 PROFILE AT 0200 GMT

PEM (B) PACIFIC MISSION: FLIGHT 11 PROFILE AT 0430 GMT
PEM (B) PACIFIC MISSION: FLIGHT 12

Figure A12.1
PEM (B) PACIFIC MISSION: FLIGHT 12

- O3 or CO, ppbv
- CO2, ppmv
- Methane, ppbv
- N2O, ppbv
- Benzene, pptv

Solid = O3
Broken = CO

Figure A12.2
Figure A12.3
PEM (B) PACIFIC MISSION: FLIGHT 12

Figure A12.4

90
PEM (B) PACIFIC MISSION: FLIGHT 12

NO DATA

NO DATA

Ethylene, pptv

PAN, pptv

Acetone, Pptv

Figure A12.5
PEM (B) PACIFIC MISSION: FLIGHT 12

Figure A12.6
PEM (B) PACIFIC MISSION: FLIGHT 12 PROFILE AT 0715 GMT

PEM (B) PACIFIC MISSION: FLIGHT 12 PROFILE AT 0930 GMT
PEM (B) PACIFIC MISSION: FLIGHT 13

Solid = O3
Broken = CO

Figure A13.2
Figure A13.3
PEM (B) PACIFIC MISSION: FLIGHT 13

Figure A13.4
Figure A13.5
Figure A13.6
PEM (B) PACIFIC MISSION: FLIGHT 13 PROFILE AT 0215 GMT

Figure A13.7

PEM (B) PACIFIC MISSION: FLIGHT 13 PROFILE AT 0845 GMT
Figure A14.1
PEM (B) PACIFIC MISSION: FLIGHT 14

Solid = O3
Broken = CO

Figure A14.2
PEM (B) PACIFIC MISSION: FLIGHT 14

Figure A14.3
Figure A14.4
PEM (B) PACIFIC MISSION: FLIGHT 14

Figure A14.5

107
PEM (B) PACIFIC MISSION: FLIGHT 14 PROFILE AT 0345 GMT

PEM (B) PACIFIC MISSION: FLIGHT 14 PROFILE AT 0800 GMT
Figure A15.1
Figure A15.2
Figure A15.3
Figure A15.4
PEM (B) PACIFIC MISSION: FLIGHT 15

Figure A15.5
Figure A15.6
PEM (B) PACIFIC MISSION: FLIGHT 15 PROFILE AT 0300 GMT

PEM (B) PACIFIC MISSION: FLIGHT 15 PROFILE AT 0600 GMT
Figure A16.2
Figure A16.3
Figure A16.4
PEM (B) PACIFIC MISSION: FLIGHT 16

Figure A16.6
PEM (B) PACIFIC MISSION: FLIGHT 16 PROFILE AT 0300 GMT

PEM (B) PACIFIC MISSION: FLIGHT 16 PROFILE AT 0415 GMT
Figure A17.1
PEM (B) PACIFIC MISSION: FLIGHT 17

Solid = O3
Broken = CO

Figure A17.2
Figure A17.3
PEM (B) PACIFIC MISSION: FLIGHT 17

Acetylene, pptv

Ethane, pptv

Propane, pptv

C2Cl4, pptv

CH3CCl3, pptv

Figure A17.4
Figure A17.5
PEM (B) PACIFIC MISSION: FLIGHT 17

Figure A17.6

132
PEM (B) PACIFIC MISSION: FLIGHT 17 PROFILE AT 0030 GMT

PEM (B) PACIFIC MISSION: FLIGHT 17 PROFILE AT 0700 GMT
Figure A18.1
PEM (B) PACIFIC MISSION: FLIGHT 18

Figure A18.2
Figure A18.4
PEM (B) PACIFIC MISSION: FLIGHT 18

Figure A18.5
PEM (B) PACIFIC MISSION: FLIGHT 18 PROFILE AT 0730 GMT
PEM (B) PACIFIC MISSION: FLIGHT 19

Altitude, km

Temperature, °C

Rel. Humidity

Theta, deg. K

Figure A19.1
Figure A19.2
Figure A19.3
PEM (B) PACIFIC MISSION: FLIGHT 19

Figure A19.4
PEM (B) PACIFIC MISSION: FLIGHT 19

NO DATA

Figure A19.5
Figure A19.6
PEM (B) PACIFIC MISSION: FLIGHT 19 PROFILE AT 1730 GMT

PEM (B) PACIFIC MISSION: FLIGHT 19 PROFILE AT 2045 GMT
PEM (B) PACIFIC MISSION: FLIGHT 19 PROFILE AT 2145 GMT

Figure A18

Altitude, km

Temperature, C
Dewpoint, C
Ozone, ppbv
CO, ppbv
Methane, ppbv
APPENDIX B: LANGLEY DAAC DATA ARCHIVE

System Description

The Langley Distributed Active Archive Center (DAAC), located at the NASA Langley Research Center in Hampton, Virginia, is responsible for archiving and distributing NASA science data in the areas of radiation budget, clouds, aerosols, and tropospheric chemistry. This DAAC will also archive some of the data sets which result from the EOS program and other elements of Mission to Planet Earth. The DAAC has developed an on-line computer system which allows the user to log on, search through the DAAC's data inventory, choose the desired data sets, and place an order. Data may be received either electronically (via FTP) or on media such as 4mm tape, 8mm tape, or CD-ROM (prepackaged data sets only).

Log On Procedures

1. Users with an X-Windows terminal (e.g., Motif) or a Sun Open Windows display system with access to Internet, may log onto the system by entering:
   xhost + eosdis.larc.nasa.gov
   (or: xhost + 192.107.191.17)
   telnet eosdis.larc.nasa.gov
   login name: ims
   password: larcims

   At the prompts, enter x for the X-Windows interface and then your display name (name of your workstation followed by ":0" or Internet address followed by ":0").

2. Users with access to NCSA Mosaic can use the following URL address:
   http://eosdis.larc.nasa.gov/
3. Users without access to a terminal with an X-Windows display system but who have access to Internet may log onto the system by entering:
   
telnet eosdis.larc.nasa.gov
   
login name: ims
   
password: larcims

At the prompt, enter c for the character interface and then press return.

4. Users who cannot access the system or who have any questions concerning the Langley DAAC may contact:

   Langley DAAC User and Data Services
   
   Mail Stop 157B
   
   NASA Langley Research Center
   
   Hampton, VA 23681-0001
   
   Phone: (804) 864-8656
   
   FAX: (804) 864-8807
   
   email: larc@eos.nasa.gov

DAAC Data Bases

1. ERBE (Earth Radiation Budget Experiment)--Data were collected from three satellites (ERBS, NOAA-9, NOAA-10) carrying two ERBE instruments (scanner, nonscanner). The objective is to measure global albedo, fluxes, and solar incidence.

2. ISCCP (International Satellite Cloud Climatology Project)--ISCCP focuses on the study of the distribution and variation of cloud radiative properties. The objective is to improve the understanding and modeling of the effects of clouds on climate and also to elucidate the role of clouds in the radiation balance and improve our knowledge of the long-term global hydrologic cycle.
3. SAGE (Stratospheric Aerosol and Gas Experiment)--SAGE I gathered data concerning the spatial distribution of stratospheric aerosols, ozone, and nitrogen dioxide on a global scale. The goals of SAGE II are to determine the spatial distributions of stratospheric aerosols, ozone, nitrogen dioxide, water vapor, and cloud occurrence by mapping vertical profiles and calculating monthly averages of each.

4. SRB (Surface Radiation Budget)--The SRB data sets were calculated using inputs from ISCCP and ERBE data. They are designed to give global daily and monthly averages of the albedo, irradiance, cloud properties, and meteorology.

5. FIRE (First ISCCP Regional Experiment)--This series of experiments includes aircraft, satellite, and surface-based measurements of cirrus and marine stratocumulus cloud parameters. The purpose of this program is to validate and improve ISCCP data products and cloud/radiation parameterizations used in general circulation models (GCMs).

6. GTE (Global Tropospheric Experiment)--Data were collected primarily from aircraft and ground-based instruments from a variety of areas such as the Amazon Rain Forest and the northern tundra and boreal forest. Many parameters were measured including O_3, CH_4, PAN, CO, NO, NO_2, CO_2, and aerosols.

7. MAPS (Measurement of Air Pollution from Satellites)--Data were collected during Space Shuttle flights in 1981, 1984, and 1994. The main pollutant measured was carbon monoxide (CO).

8. SAM II (Stratospheric Aerosol Measurement)--This instrument was flown on board the Nimbus-7 satellite and consisted of a one-spectral channel Sun photometer, centered at 1.0 um, which viewed a small portion of the Sun through the Earth's atmosphere during spacecraft sunrise and sunset. The data obtained from this instrument were used to determine the vertical distribution of stratospheric aerosols in the polar regions of both hemispheres.
### Compendium of NASA Data Base for the Global Tropospheric Experiment’s Pacific Exploratory Mission West-B (PEM West-B)

**Author(s):** Gerald L. Gregory and A. Donald Scott, Jr.

**Performing Organization:**
NASA Langley Research Center  
Hampton, VA 23681-0001

**Sponsoring Agency:**
National Aeronautics and Space Administration  
Washington, DC 20546-0001

**Abstract:**
This compendium describes aircraft data that are available from NASA’s Pacific Exploratory Mission West-B (PEM West-B). PEM West is a component of the International Global Atmospheric Chemistry's (IGAC) East Asia/North Pacific Regional Study (APARE) project. Objectives of PEM West are to investigate the atmospheric chemistry of ozone over the northwest Pacific—natural budgets and the impact of anthropogenic/continental sources; and to investigate sulfur chemistry—continental and marine sulfur sources. The PEM West program encompassed two expeditions. PEM West-A was conducted in September 1991 during which the predominance of tropospheric air was from mid-Pacific (marine) regions, but (at times) was modified by Asian outflow. PEM West-B was conducted during February 1994, a period characterized by maximum Asian outflow. Results from PEM West-A and B are public domain. PEM West-A data are summarized in NASA TM 109177 (published February 1995). Flight experiments were based at Guam, Hong Kong, and Japan. This document provides a representation of NASA DC-8 aircraft data that are available from NASA Langley's Distributed Active Archive Center (DAAC). The DAAC includes numerous other data such as meteorological and modeling products, results from surface studies, satellite observations, and sonde releases.