Compendium of NASA Data Base for the Global Tropospheric Experiment's Pacific Exploratory Mission - Tropics B (PEM-Tropics B)

Volume 2: P-3B

A. Donald Scott, Jr., Mary M. Kleb, and James L. Raper
Langley Research Center, Hampton, Virginia

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Compendium of NASA Data Base for the Global Tropospheric Experiment's Pacific Exploratory Mission - Tropics B (PEM-Tropics B)

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SUMMARY

This report provides a compendium of NASA aircraft data that are available from NASA’s Global Tropospheric Experiment’s (GTE) Pacific Exploratory Mission – Tropics B (PEM-Tropics B) conducted in March and April 1999. The PEM-Tropics B mission provided the scientific community an opportunity to continue the investigation of tropospheric chemistry over the north and south tropical Pacific Oceans. Conducted during March and April 1999, PEM-Tropics B was an airborne study that complimented the PEM-Tropics A mission. It provided an opportunity to investigate chemical and transport properties of the tropical troposphere during contrasting meteorological conditions. PEM-Tropics B was conducted during the southern-tropical wet season when the influence from biomass burning observed in PEM-Tropics A was minimal. Major deployment sites were Hawaii, Kirimitati (Christmas Island), Tahiti, Fiji, and Easter Island. The broad goals of PEM-Tropics B were to improve understanding of the oxidizing power of the atmosphere and the processes controlling sulfur aerosol formation. In addition it was also an effort to continue to establish baseline values for chemical species that are directly coupled to the oxidizing power and aerosol loading of the troposphere.

PEM-Tropics B was conducted as part of the National Aeronautics and Space Administration’s (NASA) Global Tropospheric Experiment (GTE). The GTE is an ongoing element of the Tropospheric Chemistry Program, a Research and Analysis
(R&A) program within the Science Division of NASA’s Office for Earth Science Enterprise. PEM-Tropics B included measurements aboard NASA’s DC-8 and P-3B aircraft. The major thrust of GTE has been to utilize NASA’s DC-8 and P-3B aircraft to carry multi-instrument payloads into regions of the global troposphere where natural and/or human impacts are believed to be particularly significant in effecting chemical composition changes and/or where the troposphere is still relatively unaffected.

The format of this compendium utilizes data plots (time series) of selected data acquired aboard the NASA/Dryden DC-8 (vol. 1) and NASA/Wallops P-3B (vol. 2) aircraft during PEM-Tropics B. The purpose of this document is to provide a representation of aircraft data that will be available in archived format via NASA Langley’s Distributed Active Archive Center (DAAC) or are available through the GTE Project Office archive. The data format is not intended to support original research/analyses, but 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 will include numerous supporting data including meteorological observations/products, results from surface studies, satellite observations, and data from ozonesonde and rawin sonde 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) has helped place GTE observed ozone distributions/budgets into a global perspective (temporal and spatial) and has been used 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 1999. 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 the 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 near the Equator – Atlantic (TRACE-A). The Pacific Exploratory Missions in the Western Pacific Ocean (PEM-West) Phases A and B focused on the impact of emissions from the Asian continent over the northwest Pacific Ocean during contrasting meteorological conditions. The Pacific Exploratory Missions over the Tropical Pacific (PEM-Tropics) Phases A and B studied the oxidizing power of the atmosphere and sulfur chemistry over the Pacific basin also during contrasting seasons.

The GTE, managed as part of 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 Competency.

SYMBOLS AND UNITS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
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<td>Atmospheric and Boundary Layer Experiment</td>
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<tr>
<td>CITE</td>
<td>Chemical Instrument Test and Evaluation</td>
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<td>Distributed Active Archive Center</td>
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<td>GTE</td>
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<td>ITCZ</td>
<td>Inter-Tropical Convergence Zone</td>
</tr>
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<td>National Aeronautics and Space Administration</td>
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<tr>
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<td>parts per billion, by volume</td>
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<td>ppmv</td>
<td>parts per million, by volume</td>
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</table>
The National Aeronautics and Space Administration’s PEM-Tropics B mission, conducted in March and April 1999, was a major component of the Global Tropospheric Experiment, a project within the Earth Sciences Enterprise program. The long-range goal of the GTE is to contribute substantially to scientific understanding of human impacts on the chemistry of the global troposphere. Changes in chemical composition of the troposphere on a global scale have been well documented during these last two decades and have given rise to considerable concern that these chemical changes in the troposphere, which are expected to increase as population increases and economic activity expands, will lead to changes in the earth’s climate. The PEM-Tropics B campaign had two main objectives, (1) Provide baseline data for chemical species that determine the oxidizing power and aerosol loading of the tropical Pacific, and (2) Evaluate the chemical and dynamic factors controlling ozone, OH, and aerosol levels over this remote region. Within this framework, 5 specific tasks were identified: (1) quantify the fast photochemical processes controlling OH concentrations, (2) investigate the factors responsible for large-scale low concentrations of tropospheric ozone over the equatorial Pacific, (3) study the role of the ITCZ and SPCZ as barriers to atmospheric transport between the Northern and Southern Hemispheres and within the South Pacific, (4) investigate the scavenging of gases/aerosols associated with deep convection and gas-to-aerosol conversion taking place in convective outflows, and (5) elucidate the processes controlling photochemistry and aerosol formation beneath the trade wind inversion.
The broad design of the PEM-Tropics B campaign employed a series of flights utilizing the NASA Dryden DC-8 and NASA Wallops P-3B aircraft from remote operational sites in the South Pacific Basin. The DC-8’s operational sites were Hilo, Hawaii; Nadi, Fiji; Papeete, Tahiti; and Easter Island. The P-3B’s operational sites included Christmas Island and Papeete, Tahiti. From these primary bases, flights covered a latitude range of about 20°N to 30°S and 165°E to 95°W in longitude. Table 2a summarizes the DC-8 flights and Table 2b summarizes the P-3B flights. DC-8 flight tracks are shown in Figure 2a while the P3B flight tracks are shown in Figure 2b. Flights 1 through 4 for the DC-8 and flights 1 and 2 for the P-3B, all test flights, are not included in Figure 2a or 2b, respectively. DC-8 flights 6-8, 10-12, 14-18, and 20 were site-intensive flights based out of Hawaii, Fiji, Tahiti, and Easter Island, respectively. DC-8 ferry/transit flights included (a) flight 5 from Dryden to Hawaii; (b) flight 9 from Hawaii to Fiji; (c) flight 13 from Fiji to Tahiti; (d) flight 19 from Tahiti to Easter Island; and flights 21 and 22 from Easter Island to Dryden (via Costa Rica). P-3B flights 6-11 and 13-16 were site intensive flights from Christmas Island and Tahiti, respectively. P-3B ferry/transit flights included (a) flights 3-5 from Wallops to Christmas Island (via Dryden and Hawaii); (b) flight 12 from Christmas Island to Tahiti; and (c) flights 17-19 from Tahiti to Wallops (via Hawaii and Monterey, California). Data archival was optional for flights 2-4 for both the DC-8 and P-3B. Flight plans consisted of combinations of controlled rate of ascent or descent spirals, ramp-up or ramp-down flight legs, and constant altitude flight legs selected to meet the scientific objectives of each flight. In general, 8 to 10 hour missions were flown on the DC-8 covering an altitude range of 300 meters to 10 km. P-3B flight missions ranged from 6 to 10 hours covering an altitude range of about 150 meters to 7 km.

The DC-8 transit flight from Dryden to Hilo investigated northern tropical chemistry. The Hilo, Hawaii based flights focused primarily on photochemistry. Flights 6 and 8 studied sunrise and sunset photochemistry, respectively. Flights 7 and 9 examined equatorial chemistry and equatorial photochemistry, respectively. Fiji flights (10 – 12) investigated the SPCZ, ozone trough, and photochemical aging of air. The Fiji to Tahiti transit flight, 13, was a general equatorial survey. The first Tahiti local flight, flight 14, characterized southern latitudes. Tahiti flights 15 and 16 focused on sunrise and sunset
HOx/NOx photochemistry, respectively. The remainder of the DC-8 flights were
designed to study transport; ITCZ inflow/outflow (flight 17), frontal crossing
characterization (flight 18), tropical convective outflow (flight 19), South American
outflow (flight 20), South/Central American outflow (flight 21), and Central American
outflow (flight 22).

The P-3B science objectives focused primarily on HOx photochemistry, sulfur and
aerosol chemistry. The Dryden to Hilo transit flight (flight 4) studied the transport of US
pollution. During the flight from Hilo to Christmas Island interhemispheric gradients
were studied. Many of the Christmas Island flights were designed to assess HOx and
DMS chemistry. Flights 6-8 examined sunset and sunrise HOx and DMS. Flight 9, from
Christmas Island, was an equatorial survey. Flight 10 investigated equatorial upwelling
and sunrise DMS and flight 11 focused on equatorial HOx. The transit flight from
Christmas Island to Tahiti (flight 12) studied interhemispheric trace gas gradients. Tahiti
local flights 13 and 15 focused on convective clouds, specifically gas/particle conversion.
Tahiti local flight 14 examined low-to-mid altitude HOx. The last Tahiti local flight (16)
focused on sunrise sulfur flux and DMS oxidation. The transit flight from Tahiti to
Honolulu investigated boundary layer HOx chemistry. The Honolulu to Monterey, CA
and Monterey, CA to Wallops transit flights studied long-range Asian and North
American outflow and continental layers, respectively.

The core set of measurements aboard the aircraft focused on evaluating the oxidizing
power and aerosol loading of the atmosphere and transport properties of the remote South
Pacific. The aircraft data include a suite of chemical measurements which include, but
are not limited to, ozone, nitrogen oxide, nitrogen dioxide, nitric acid, nitrous oxide,
peroxy acetyl nitrate (PAN), methane, carbon monoxide, carbon dioxide, peroxyde,
hydroperoxyl radical, sulfur dioxide, sulfuric acid, aerosols, actinic flux, water,
halocarbons, alkyl nitrates, dimethyl sulfide (DMS), and dimethyl sulfoxide (DMSO),
among others. Table 3 lists the investigators and measurements for the DC-8 and Table 4
lists the same for the P-3B. Archived parameters are given in Table 5. For a complete
list of plotted parameters, see Table 6.
The PEM-Tropics B data is not yet available on the Langley DAAC. At a time yet to be determined, the PEM-Tropics B DAAC data archive will include (1) data taken aboard the DC-8 aircraft; (2) data taken aboard the P-3B aircraft; and (3) ozonesonde data. The ozonesonde network was formed and began measurements during the pre-deployment phase of PEM-Tropics B. The ozonesonde data include releases from the following locations prior to mission deployment: Easter Island, Chili; Papeete, Tahiti; Pago Pago, American Samoa; Suva, Fiji; and Lauder, New Zealand. All PEM-Tropics B data is currently available on the GTE archive.

The data plots for the PEM-Tropics B are given in Appendix A. For each P-3B flight, 13 pages of time series plots are provided: page 1 – a latitude/longitude plot of the flight region and time series plots of altitude, temperature, relative humidity, and potential temperature; page 2 – ozone (O₃), carbon monoxide (CO), methyl chloride (CHCl₃), carbon dioxide (CO₂), and hydroxyl radical (OH); page 3 – nitric oxide (NO), nitric acid (HNO₃), nitrogen dioxide (NO₂), dimethyl sulfoxide (DMSO), and dimethyl sulfide (DMS); page 4 – ethyne (C₂H₂), ethene (C₂H₄), propane (C₃H₈), propene (C₃H₆), and ethane (C₂H₆); page 5 – propane/ethane, ethene/ethane, ethyne/carbon monoxide, ethene/carbon monoxide, and ethane/carbon monoxide; page 6 – carbon tetrachloride (CCl₄), perchloroethylene (C₂Cl₄), methyl chloroform (CH₃CCl₃), methyl iodide (CH₃I), and methyl chloride (CH₃Cl); page 7 – liquid water content (LWC), aerosol scattering, ultrafine aerosol (Ultra-Fine), unheated fine aerosol (FINE-UNht), and fine aerosol ratio (FINE-Ht/FINE-UHt); page 8 – peroxide (H₂O₂), methyl hydro peroxide (CH₃OOH), sulfuric acid (H₂SO₄), sulfate (SO₄²⁻), and sulfur dioxide (SO₂); page 9 – nitrate (NO₃⁻), methane sulfonic acid (MSA), methyl sulfonate (MS), ammonia (NH₃), and ammonium (NH₄⁺); page 10 – methyl nitrate (CH₃ONO₂), ethyl nitrate (C₂H₅ONO₂), isopropyl nitrate (i-C₃H₇ONO₂), n-propyl nitrate (n-C₃H₇ONO₂), and methylene chloride (CH₂Cl₂); page 11 – HCFC-141B (CH₃CFCI₂), HCFC-142B (CH₃CF₂Cl), HCFC-22 (CHF₂Cl), methylene bromide (CH₂Br₂), and bromoform (CHBr₃); page 12 – ozone photolysis frequency (J(O₃)), nitrogen dioxide photolysis frequency (J(NO₂)), peroxide photolysis frequency (J(H₂O₂)), nitrogen dioxide photolysis frequency-zenith viewing (J(NO₂)z), and nitrogen dioxide photolysis frequency-nadir viewing (J(NO₂)n); page 13 – altitude,
cabin altitude, roll angle, formaldehyde (CH₂O), and aerosol absorption. The species were selected to provide the reader with information on both the source characteristics and photochemical history of air. There are no plots prior to flight 5 for the DC-8 or flight 3 for the P-3B, as these were test flights and data archival was not required. Data plots are in standardized format as discussed in Appendix A. The DAAC archive will and GTE archive already does include other measurements aboard the DC-8 and P-3B during PEM-Tropics B which are not plotted in Appendix A.
CONCLUDING REMARKS

This compendium of data from NASA’s Global Tropospheric Experiment’s Pacific Exploratory Mission to the Tropics, Phase B (PEM-Tropics B) provides only a graphical representation of aircraft data that will be available in archived format from NASA Langley’s Distributed Active Archive Center (DAAC) and currently are available from the GTE Project Office archive. The time series plots are not intended to support original research/analysis, but serve as an overview of the PEM-Tropics B aircraft 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 or GTE’s Project Office archive. This compendium covers only selected NASA DC-8 and P-3B aircraft data. The GTE archived data base includes 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 ozonesonde and rawinsonde releases. GTE-sponsored analyses/results from the PEM-Tropics B expeditions have been submitted (August 2000) to 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 157D, NASA Langley Research Center, Hampton, Virginia, 23681-0001. A brief description of the DAAC, log on procedures, and data bases is given in Appendix B.
Table 1. GTE Field Expeditions Through 1999

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<td>1983</td>
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<td>ABLE-3A</td>
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<td>Canada – Hudson Bay, Schefferville</td>
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<td>1992</td>
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* Data archival is required  
# Data archival is optional
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Figure 2(a). PEM-Tropics B DC-8 flight tracks.
Figure 2(b). PEM-Tropics B P-3B flight tracks.
Figure 3(a). PEM-Tropics B DC-8 mission payload floor plan.
Figure 3(b). PEM-Tropics B P-3B mission payload floor plan.
APPENDIX A
PACIFIC EXPLORATORY MISSION TO THE TROPICS, PHASE B
(PEM-TROPICS B)

Plots are presented in a standardized format, and the data (unedited) are from the Langley GTE archive. Relative humidity is 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 were selected to best represent all the data for a specie measured during the flight. In order to maintain the standardized format, plots for flights in which a specie 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:

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- Flight 4P – page 46
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PLOTS OF FINAL CHEMICAL DATA

PEM-TROPICS B

Flight 3P

Transit: NASA Wallops to NASA DFRC

Test Flight No. 3

March 10, 1999
PEM Tropics B; P3-B; FLIGHT 3

Solid = Gregory
Broken = Ridley

Solid = Blake
Broken = Atlas

NO DATA
PEM Tropics B; P3-B; FLIGHT 3

NO, pptv

HNO₃, pptv

NO₂, pptv

DMSO, pptv

DMS, pptv

Solid = Blake
Broken = Bandy

NO DATA

NO DATA

NO DATA

GMT Time

19 20 21 22 23 24 25 26 27 28

150 100 50 0

1000 500 0

250 0

5 0

5.0 2.5 0.0

35
PEM Tropics B; P3-B; FLIGHT 3

C3H6/C2H6

C2H4/C2H6

C2H6/CO, pptv/ppbvC2H4/CO, pptv/ppbvC2H2/CO, pptv/ppbv

C2H6/CO, pptv/ppbv

GMT Time
PEM Tropics B; P3-B; FLIGHT 3

Solid = Blake
Broken = Atlas
PEM Tropics B; P3-B; FLIGHT 3

Solid = Blake
Broken = Atlas

CH$_3$ONO$_2$, pptv

C$_2$H$_5$ONO$_2$, pptv

n-C$_3$H$_7$ONO$_2$, pptv

CH$_2$Cl$_2$, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 3

CH3CF2CL, pptv

CH3CF2CL, pptv

CHF2CL, pptv

CH2Br2, pptv

CHBr3, pptv

Solid = Blake
Broken = Atlas

GMT Time
PLOTS OF FINAL CHEMICAL DATA

GLOBAL TROPOSPHERIC EXPERIMENT

PEM-TROPICS B

Flight 4P

Transit: NASA DFRC to Hilo, HI

Transport of U.S. Pollution

March 11, 1999
PEM Tropics B; P3-B; FLIGHT 4
PEM Tropics B; P3-B;  FLIGHT 4

NO, pptv

HNO3, pptv

NO2, pptv

DMSO, pptv

DMS, pptv

NO DATA

Solid = Blake
Broken = Bandy

GMT Time
PEM Tropics B; P3-B; FLIGHT 4
PEM Tropics B; P3-B; FLIGHT 4

- C3H8/C2H6
- C2H4/C2H6
- C2H6/CO
- C2H4/CO

GMT Time
PEM Tropics B; P3-B; FLIGHT 4

![Graphs showing time series data for LWC (g/m³), ULTRA (no./cm³ SCATTER/550nm, 1/m), FINE-UNHt (no./cm³), and Fine Ratio (HI/UBH).]
PEM Tropics B; P3-B; FLIGHT 4

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**H2O2, pptv**

---

**CH3OOH, pptv**

---

**H2SO4, molec./cc**

---

**SO4-, pptv**

---

**SO2, pptv**

---

No Data

GMT Time
PEM Tropics B; P3-B; FLIGHT 4

NO DATA

NO DATA

NO DATA

NH₄⁺, pptv

NH₃, pptv

MS, pptv

MSA, molecules/cc

NO3⁻, pptv

GMT Time
PLOTS OF FINAL CHEMICAL DATA

PEM-TROPICS B

Flight 5P

Transit: Hilo to Christmas Island

Interhemispheric Gradients

March 13, 1999
PEM Tropics B; P3-B; FLIGHT 5

O3, ppbv

CO, ppbv

CHCl3, pptv

CO2, ppmv

OH, molecules/cc

Solid = Gregory
Broken = Ridley
Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 5

![Graphs showing the variations of C3H8/C3H6, C2H4/C3H6, C2H6/CO, pptv/ppbv, and pptv/ppbvC2H2/CO over time.](Image)
PEM Tropics B; P3-B; FLIGHT 5

Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 5
PEM Tropics B; P3-B; FLIGHT 5

- **H$_2$O$_2$, pptv**
- **CH$_3$OOH, pptv**
- **H$_2$SO$_4$, molec./CC**
- **SO$_4^-$, pptv**
- **SO$_2$, pptv**
PEM Tropics B; P3-B; FLIGHT 5

![Graphs showing data for NO$_3^-$, MS$_4$, MS, NH$_3$, and NH$_4^+$ concentration over time.](image-url)
PEM Tropics B; P3-B; FLIGHT 5

Altitude, km

Cabin Alt. ft.

Roll Angle, deg.

ClH2O, pptv

565nm, 1/m

Absorption

GMT Time

NO DATA

NO DATA
PLOTS OF FINAL CHEMICAL DATA

PEM-TROPICS B

Flight 6P

Local: Christmas Island No. 1

Sunset Boundary Layer; HO$_x$ and DMS Flux

March 15, 1999
PEM Tropics B; P3-B; FLIGHT 6

North Latitude, deg.

Altitude, km

East Longitude, deg.

Solid = Static Temp.
Broken = Project Dew Pt.

Pot. Temp., K, Rel. Humidity, percent Temperature, C

GMT Time
PEM Tropics B; P3-B; FLIGHT 6

Solid = Gregory
Broken = Ridley

Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 6

C2H2, pptv

C2H4, pptv

C3H8, pptv

C3H6, pptv

NO DATA

C2H6, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 6

---

**Graphs showing data over time:**

- **Top graph:** C3H8/C3H6 vs. GMT Time
- **Second graph:** C2H4/C3H6 vs. GMT Time
- **Third graph:** C2H2/C, pptv/ppbv vs. GMT Time
- **Fourth graph:** C2H2/C, pptv/ppbv vs. GMT Time
- **Fifth graph:** C2H6/C, pptv/ppbv vs. GMT Time

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PEM Tropics B; P3-B; FLIGHT 6

Solid = Blake
Broken = Atlas
PEM Tropics B; P3-B; FLIGHT 6
PEM Tropics B; P3-B; FLIGHT 6

H_2O_2, pptv

CH_3COOH, pptv

H_2SO_4, molec./CC

SO_4^2-, pptv

SO_2, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 6

Solid = Blake
Broken = Atlas
PEM Tropics B; P3-B; FLIGHT 6

Altitude, km

Cabin Alt, ft.

Roll Angle, deg.

CH$_2$O, pptv

Absorption 565nm, 1/m

NO DATA

NO DATA

NO DATA

GMT Time
PLOTS OF FINAL CHEMICAL DATA

PEM-TROPICS B

Flight 7P

Local: Christmas Island No. 2

Sunrise to Sunset HO\textsubscript{x} and DMS

March 17, 1999
PEM Tropics B; P3-B; FLIGHT 7

North Latitude, deg.

East Longitude, deg.

Altitude, km

Solid = Static Temp.
Broken = Project Dew Pt.

Pot. Temp., K, Rel. Humidity, percent

100

50

0

Pot. Temp., K

325

300

275

GMT Time
PEM Tropics B; P3-B; FLIGHT 7

NO, pptv

HNO3, pptv

NO2, pptv

DMSO, pptv

DMS, pptv

NO DATA

Solid = Blake
Broken = Bandy
PEM Tropics B; P3-B; FLIGHT 7

C2H2, pptv

C2H4, pptv

C3H8, pptv

NO DATA

C3H6, pptv

C2H6, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 7

C3H8/C2H6

C2H4/C2H6

C2H6/CO, pptv/ppbv

C2H4/CO, pptv/ppbv

C2H2/CO, pptv/ppbv

C2H5/CO, pptv/ppbv

GMT Time
PEM Tropics B; P3-B; FLIGHT 7

![Graph showing data over time](image)

- LWC, g/m³
- ULTRA, no./cm³ SCATTER/550nm, 1/m
- FINE-UNHtn, no./cm³
- Fine RATIO (H/F/UH)

GMT Time
PEM Tropics B; P3-B; FLIGHT 7

**NO3-, pptv**

**MSA, molecules/cc**

**MS, pptv**

**NH3, pptv**

**NH4+, pptv**

**NO DATA**

GMT Time
PEM Tropics B; P3-B; FLIGHT 7

Solid = Blake
Broken = Atlas

CH3CF3, pptv

CH3CF2Cl, pptv

CHF2Cl, pptv

CH2Br2, pptv

CHBr3, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 7

Altitude, km

Cabin Alt., ft.

Roll Angle, deg.

CH2O, pptv

Absorption 565nm, 1/m

NO DATA
PLOTS OF FINAL CHEMICAL DATA

GLOBAL TROPOSPHERIC EXPERIMENT

PEM-TROPICS B

Flight 8P

Local: Christmas Island No. 3

Sunrise to Sunset HOx and DMS

March 17, 1999
PEM Tropics B; P3-B; FLIGHT 8

NO, pptv

HNO3, pptv

NO2, pptv

DMSO, pptv

NO DATA

DMS, pptv

Solid = Blake
Broken = Bandy

GMT Time
PEM Tropics B; P3-B; FLIGHT 8

C2H2, pptv

C2H4, pptv

C3H8, pptv

C3H8, pptv

C2H6, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 8

Graphs showing variations in

- C3H8/C2H6
- C2H4/C2H6
- C2H6/CO, pptv/ppbv
- C2H2/CO, pptv/ppbv

NO DATA for
- C2H6/CO, pptv/ppbv
- C2H2/CO, pptv/ppbv

GMT Time

0.10
0.05
0.00
0.03
0.02
0.01
0.00
1.0
0.5
0.2
0.1
0.0
8.0
7.5
7.0
6.5
6.0
5.5
5.0
PEM Tropics B; P3-B; FLIGHT 8

GMT Time

LWC, g/m³

ULTRA, no./cm³ SCATTER/550nm, 1/m

FINE-UNHt, no./cm³

Fine RATIO (Ht/UNHt)
PEM Tropics B; P3-B; FLIGHT 8

H$_2$SO$_4$, pptv

NO DATA

CH$_3$OOH, pptv

S$_2$O$_4^-$, pptv

S$_2$O$_2$, pptv

GMT Time
Solid = Blake
Broken = Atlas
PEM Tropics B; P3-B; FLIGHT 8

Altitude, km

Cabin Alt, ft.

Roll Angle, deg.

CH₂O, pptv

Absorption 565 nm, 1/m

NO DATA

GMT Time
PLOTS OF FINAL CHEMICAL DATA

PEM-TROPICS B

Flight 9P

Local: Christmas Island No. 4

Equatorial Survey

March 20, 1999
PEM Tropics B; P3-B; FLIGHT 9

**O3, ppbv**
- Solid = Gregory
- Broken = Ridley

**CO, ppbv**

**CHCl3, pptv**
- Solid = Blake
- Broken = Atlas

**CO2, ppmv**

**OH, molecules/cc**

GMT Time
PEM Tropics B; P3-B; FLIGHT 9

NO, pptv

HNO3, pptv

NO2, pptv

DMS0, pptv

DMS, pptv

NO DATA

Solid = Blake
Broken = Bandy

GMT Time
PEM Tropics B; P3-B; FLIGHT 9

C2H2, pptv

C2H4, pptv

C3H8, pptv

C3H8, pptv

NO DATA

C2H6, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 9

C3H6/C3H8

C2H4/C3H6

C2H6/C2H2/C0, pptv/ppbv

C2H6/CO, pptv/ppbv/C3H4/C0

GMT Time
PEM Tropics B; P3-B; FLIGHT 9

Solid = Blake
Broken = Atlas
PEM Tropics B; P3-B; FLIGHT 9

LWC, g/m³

ULTRA, no./cm³ SCATTER/550nm, 1/m

FINE-UNht, no./cm³

Fine RATIO (Ht/UH)

GMT Time
PEM Tropics B; P3-B; FLIGHT 9

Solid = Blake
Broken = Atlas

Solid = Blake
Broken = Atlas

Solid = Blake
Broken = Atlas

Solid = Blake
Broken = Atlas

Solid = Blake
Broken = Atlas
PEM Tropics B; P3-B; FLIGHT 9

Solid = Blake
Broken = Atlas

CH3CF2Cl2, pptv

Solid = Blake
Broken = Atlas

CHF2Cl, pptv

Solid = Blake
Broken = Atlas

CH2Br2, pptv

Solid = Blake
Broken = Atlas

CHBr3, pptv

Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 9

Altitude, km

Cabin Alt, ft.

Roll Angle, deg.

CH2O, pptv

Absorption 565nm, 1/m

NO DATA

NO DATA

GMT Time
PLOTS OF FINAL CHEMICAL DATA

PEM-TROPICS B

Flight 10P

Local: Christmas Island No. 5

Equatorial Upwelling and Sunrise DMS

March 22, 1999
PEM Tropics B; P3-B; FLIGHT 10

North Latitude, deg.

East Longitude, deg.

Altitude, km

Solid = Static Temp.
Broken = Project Dew Pt.

Pot. Temp., K, Rel. Humidity, percent

Pot. Temp., K

GMT Time

131
PEM Tropics B; P3-B; FLIGHT 10

O3, ppbv

CO, ppbv

CHCl3, pptv

CO2, ppmv

OH, molecules/cc

GMt Time
PEM Tropics B; P3-B; FLIGHT 10

- NO, pptv
- HNO3, pptv
- NO2, pptv
- DMSO, pptv
- DMS, pptv

Solid = Blake
Broken = Bandy

NO DATA
PEM Tropics B; P3-B; FLIGHT 10

GMT Time

C2H2, pptv

C2H4, pptv

C3H8, pptv

C3H6, pptv

C2H6, pptv

NO DATA
PEM Tropics B; P3-B; FLIGHT 10

C3H8/C2H6

C2H4/C2H6

C2H6/CO, pptv/mb, pptv/mb, pptv/mb

C2H6/CO, pptv/mb, pptv/mb

C2H6/CO, pptv/mb, pptv/mb

14 15 16 17 18 19 20 21 22 23 24 25

GMT Time
PEM Tropics B; P3-B; FLIGHT 10

Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 10

Graphs showing LWC (g/m³), ULTRA (no./cm³ SCATTER/550nm, 1/m), FINE-UNht (no./cm³), and Fine Ratio (H/UH) vs. GMT Time.
PEM Tropics B; P3-B; FLIGHT 10

- H2O2, pptv
- CH3OOH, pptv
- H2SO4, molec./CC
- SO4^2-, pptv
- SO2, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 10

Solid = Blake
Broken = Atlas

Solid = Blake
Broken = Atlas

Solid = Blake
Broken = Atlas

Solid = Blake
Broken = Atlas
PEM Tropics B; P3-B; FLIGHT 10

Graphs showing time series data for various chemical species over GMT Time.
PEM Tropics B; P3-B; FLIGHT 10

Altitude, km

Cabin Alt, ft.

Roll Angle, deg.

CH2O, pptv

Absorption 565nm, 1/m

NO DATA

GMT Time
PLOTS OF FINAL CHEMICAL DATA

PEM-TROPICS B

Flight 11P

Local: Christmas Island No. 6

Equatorial HO_x

March 24, 1999
PEM Tropics B; P3-B; FLIGHT 11

O3, ppbv

CO, ppbv

CHCl3, pptv

CO2, ppmv

OH, molecules/cc

Solid = Gregory
Broken = Ridley

Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 11

NO, ppbv

HNO₃, pptv

NO₂, pptv

DMSO, pptv

DMS, pptv

Solid = Blake
Broken = Bandy

NO DATA

GMT Time
PEM Tropics B; P3-B; FLIGHT 11

C$_2$H$_2$, pptv

C$_2$H$_4$, pptv

C$_3$H$_8$, pptv

C$_3$H$_6$, pptv

C$_2$H$_6$, pptv

NO DATA
PEM Tropics B; P3-B; FLIGHT 11

Solid = Blake
Broken = Atlas
PEM Tropics B; P3-B; FLIGHT 11
PEM Tropics B; P3-B; FLIGHT 11

H2O2, pptv

CH3OH, pptv

H2SO4, molec./CC

SO4^2-, pptv

SO2, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 11
PEM Tropics B; P3-B; FLIGHT 11

CH3ONO2, pptv

Solid = Blake
Broken = Atlas

C2H5ONO2, pptv

Solid = Blake
Broken = Atlas

i-C3H7ONO2, pptv

Solid = Blake
Broken = Atlas

d-C3H7ONO2, pptv

Solid = Blake
Broken = Atlas

CH2C12, pptv

Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 11

Altitude, km

Cabin Alt., ft.

Roll Angle, deg.

Absorption, 1/m CH2O, pptv

565nm

GMT Time
PLOTS OF FINAL CHEMICAL DATA

PEM-TROPICS B

Flight 12P

Transit: Christmas Island to Tahiti

Interhemispheric Trace Gas Gradient

March 26, 1999
PEM Tropics B; P3-B; FLIGHT 12

North Latitude, deg.

East Longitude, deg.

Altitude, km

Solid = Static Temp.
Broken = Project Dew Pt.

Pot. Temp., K Rel. Humidity, percent Temperature, C

GMT Time
PEM Tropics B; P3-B; FLIGHT 12

O3, ppbv

CO, ppbv

CHCl3, pptv

CO2, ppmv

OH, molecules/cc

Solid = Gregory
Broken = Ridley

Solid = Blake
Broken = Atlas
PEM Tropics B; P3-B; FLIGHT 12

NO, pptv

HNO3, pptv

NO2, pptv

DMSO, pptv

DMS, pptv

Solid = Blake
Broken = Bandy

GMT Time
PEM Tropics B; P3-B;  FLIGHT 12

C2H2, pptv

C2H4, pptv

C3H8, pptv

NO DATA

C3H6, pptv

C2H6, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 12

**Graphs:**

1. **C₃H₈/C₂H₆**
   - No data

2. **C₂H₄/C₂H₆**
   - No data

3. **C₂H₆/C₂H₅, pptv/ppbv**
   - No data

4. **C₃H₆/C₂H₅, pptv/ppbv**
   - No data

**GMT Time:** 18 19 20 21 22 23 24 25 26 27 28
PEM Tropics B; P3-B; FLIGHT 12

CCl₄, pptv

C₂Cl₄, pptv

CH₃CCl₃, pptv

CH₃L, pptv

CH₃Cl, pptv

Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 12

Graph showing time series of LWC, g/m³, ULTRA, no./cm³ SCATTER/550nm, 1/m, Fine-Ratio (Ht/UHt) Fine-UnHt, no./cm³

GMT Time
PEM Tropics B; P3-B; FLIGHT 12

H2O2, pptv

CH3OOH, pptv

H2SO4, molec./CC

SO4-, pptv

SO2, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 12

NO3-, pptv

MSA, molecules/cc

MS, pptv

NH3, pptv

NH4+, pptv

NO DATA

GMT Time
PEM Tropics B; P3-B; FLIGHT 12

CH3NO2, pptv

C2H5ONO2, pptv

i-C3H7ONO2, pptv

n-C3H7ONO2, pptv

CH2Cl2, pptv

Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 12

CH3CFC12, pptv

CH3CF2Cl, pptv

CHF2Cl, pptv

CH2Br2, pptv

CHBr3, pptv

Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 12

J(O3), sec^-1

J(NO2), sec^-1

J(H2O2), sec^-1

J(NO2)z, sec^-1

J(NO2), sec^-1

GMT Time
PLOTS OF FINAL CHEMICAL DATA

PEM-TROPICS B

Flight 13P

Local: Tahiti No. 1

Convective Cloud: Gas/Particle Conversion

March 31, 1999
PEM Tropics B; P3-B; FLIGHT 13

O3, ppbv

CO, ppbv

CHCl3, pptv

CO2, ppmv

OH, molecules/cc

Solid = Gregory
Broken = Ridley

Solid = Blake
Broken = Atlas
PEM Tropics B; P3-B; FLIGHT 13

C2H2, pptv

C2H4, pptv

C3H8, pptv

C3H6, pptv

NO DATA

C2H6, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 13

![Graphs of CO, C\(_2\)H\(_6\)/C\(_2\)H\(_4\), C\(_2\)H\(_4\)/C\(_2\)H\(_6\), and C\(_2\)H\(_6\)/CO ratios over GMT time]
PEM Tropics B; P3-B; FLIGHT 13

Solid = Blake
Broken = Atlas
PEM Tropics B; P3-B; FLIGHT 13

GMT Time

LWC, g/m³

ULTRA, no./cm³ SCATTER/550nm, 1/m

FINE-UNHt.no./cm³

Fine RATIO (Ht/Uh)

1E-2
8E-3
6E-3
4E-3
2E-3
0E+0
7.5E-5
5.0E-5
2.5E-5
0.0E+0
15
10
5
0
7500
5000
2500
0
0.8
0.6
0.4
0.2
0
18 19 20 21 22 23 24 25 26 27 28
18 19 20 21 22 23 24 25 26 27 28
18 19 20 21 22 23 24 25 26 27 28
18 19 20 21 22 23 24 25 26 27 28
PEM Tropics B; P3-B; FLIGHT 13

NO3−, pptv

MSA, molecules/cc

MS, pptv

NH3, pptv

NO4+, pptv

GMT Time
PLOTS OF FINAL CHEMICAL DATA

GLOBAL TROPOSPHERIC EXPERIMENT

PEM-TROPICS B

Flight 14P

Local: Tahiti No. 2

Low/Mid-Altitude HO$_x$

April 4, 1999
PEM Tropics B; P3-B; FLIGHT 14

Solid = Gregory
Broken = Ridley

Solid = Blake
Broken = Atlas
PEM Tropics B; P3-B; FLIGHT 14

C$_2$H$_2$, pptv

C$_2$H$_4$, pptv

C$_3$H$_8$, pptv

C$_3$H$_6$, pptv

NO DATA

C$_2$H$_6$, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 14

Solid = Blake
Broken = Atlas
PEM Tropics B; P3-B; FLIGHT 14

GMT Time

Fine Ratio (Ht/UH)

FINE-UNht.n0/cm3

0

0.75

0.50

0.25

0.00

20 21 22 23 24 25 26 27 28 29 30

LWC, g/m3

1E-2

8E-3

6E-3

4E-3

2E-3

0E+0

20 21 22 23 24 25 26 27 28 29 30

ULTRA, no. / cm3 SCATTER/550nm, 1/m

2E-5

4E-5

0E+0

20 21 22 23 24 25 26 27 28 29 30

FINE-UNht.n0/cm3

0

2000

1000

0

20 21 22 23 24 25 26 27 28 29 30

0.50

0.25

0.00

20 21 22 23 24 25 26 27 28 29 30
PEM Tropics B; P3-B; FLIGHT 14

NO3-, pptv

MSA, molecules/cc

MS, pptv

NH3, pptv

NH4+, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 14

Solid = Blake
Broken = Atlas

196
PEM Tropics B; P3-B; FLIGHT 14

Altitude, km

Cabin Alt, ft.

Roll Angle, deg.

565nm, 1/m CH2O, pptv

Absorption

GMT Time
PLOTS OF FINAL CHEMICAL DATA

GLOBAL TROPOSPHERIC EXPERIMENT

PEM-TROPICS B

Flight 15P

Local: Tahiti No. 3

Convective Cloud: Gas/Particle Conversion

April 5, 1999
PEM Tropics B; P3-B; FLIGHT 15

North Latitude, deg.

East Longitude, deg.

Altitude, km

Solid = Static Temp.
Broken = Project Dew Pt.

Pot. Temp., K, Rel. Humidity, percent Temperature, C

Pot. Temp., K

GMT Time

201
PEM Tropics B; P3-B; FLIGHT 15

- O3, ppbv
- CO, ppbv
- CHCl3, pptv
- CO2, ppmv
- OH, molecules/cc

Solid = Gregory
Broken = Ridley
Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 15

CCl₄, pptv

C₂Cl₄, pptv

CH₃Cl₃, pptv

CH₃I, pptv

CH₃Cl, pptv

Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 15

Graphs showing data over time with the x-axis labeled GMT Time and the y-axes labeled with various units of measurement.
PEM Tropics B; P3-B; FLIGHT 15

![Graph of H2O2, CH3OOH, H2SO4, SO4, and SO2 concentrations over GMT Time from 20th to 29th day.](image-url)
PEM Tropics B; P3-B; FLIGHT 15

Solid = Blake
Broken = Atlas
PEM Tropics B; P3-B; FLIGHT 15

Solid = Blake
Broken = Atlas

Solid = Blake
Broken = Atlas

Solid = Blake
Broken = Atlas

Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 15
PEM Tropics B; P3-B; FLIGHT 16

O3, ppbv

Solid = Gregory
Broken = Ridley

CO, ppbv

Solid = Blake
Broken = Atlas

CHCl3, pptv

CO2, ppmv

OH, molecules/cc

 GMT Time
PEM Tropics B; P3-B; FLIGHT 16

![Graphs showing data for PEM Tropics B; P3-B; FLIGHT 16](image)
PEM Tropics B; P3-B; FLIGHT 16

- CCl₄, pptv
- C₂Cl₄, pptv
- CH₃CCl₃, pptv
- CH₃I, pptv
- CH₃Cl, pptv

Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 16

- H2O2, pptv
- CH3OH, pptv
- H2SO4, molec./CC
- SO4-, pptv
- SO2, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 16

Solid = Blake
Broken = Atlas

Solid = Blake
Broken = Atlas

Solid = Blake
Broken = Atlas

Solid = Blake
Broken = Atlas

Solid = Blake
Broken = Atlas
PEM Tropics B; P3-B; FLIGHT 16

CH3CFCl2, pptv

CH3CF2Cl, pptv

CHF2Cl, pptv

CH2Br2, pptv

CHBr3, pptv

Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 16
PEM Tropics B; P3-B; FLIGHT 16

Altitude, km

Cabin Alt, ft.

Roll Angle, deg.

CH2O, pptv

Absorption 556nm, 1/m

GMT Time
PLOTS OF FINAL CHEMICAL DATA

PEM-TROPICS B

Flight 17P

Transit: Tahiti to Honolulu

Boundary Layer HO_x Chemistry

April 9, 1999
PEM Tropics B; P3-B; FLIGHT 17

NO, pptv

HNO3, pptv

NO DATA

NO2, pptv

DMSO, pptv

DMS, pptv

Solid = Blake
Broken = Bandy

GMT Time
PEM Tropics B; P3-B; FLIGHT 17

Solid = Blake
Broken = Atlas
PEM Tropics B; P3-B; FLIGHT 17

LWC, g/m³

ULTRA, no./cm³ SCATTER/550nm, 1/nm

FINE-UNHt, no./cm³

Fine RATIO (Ht/UnHt)

GMT Time
PEM Tropics B; P3-B; FLIGHT 17

CH$_3$ONO$_2$, pptv

Solid = Blake
Broken = Atlas

C$_2$H$_5$ONO$_2$, pptv

Solid = Blake
Broken = Atlas

i-C$_3$H$_7$ONO$_2$, pptv

Solid = Blake
Broken = Atlas

n-C$_3$H$_7$ONO$_2$, pptv

Solid = Blake
Broken = Atlas

CH$_2$Cl$_2$, pptv

Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 17

CH3CFCl2, pptv

CH3CF2Cl, pptv

CH2Br2, pptv

CHBr-3, pptv

Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 17

Graphs showing:
- Altitude, km
- Cabin Alt., ft.
- Roll Angle, deg.
- 565nm, 1/m CH2O, pptv
- Absorption

GMT Time

241
PLOTS OF FINAL CHEMICAL DATA

PEM-TROPICS B

Flight 18P

Transit: Honolulu to Monterey

Long-range Asian and North American Outflow

April 10, 1999
PEM Tropics B; P3-B; FLIGHT 18

North Latitude, deg.

East Longitude, deg.

Altitude, km

Solid = Static Temp.
Broken = Project Dew Pt.

Pot. Temp., K

Pot. Temp., K Rel. Humidity, percent

Temperature, C

GMT Time
PEM Tropics B; P3-B; FLIGHT 18

NO, pptv

HNO3, pptv

NO2, pptv

DMSO, pptv

DMS, pptv

Solid = Blake
Broken = Bandy

GMT Time

245
PEM Tropics B; P3-B; FLIGHT 18

GMT Time
PEM Tropics B; P3-B; FLIGHT 18

NO3⁻, pptv

MSA, molecules/cc

MS, pptv

NH₃, pptv

NH₄+, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 18

Attitude, km

Cabin Alt., ft.

Roll Angle, deg.

CH2O, pptv

565 nm, 1/m

Absorption

GMT Time
PLOTS OF FINAL CHEMICAL DATA

PEM-TROPICS B

Flight 19P

Transit: Monterey to NASA Wallops

Continental Layers

April 11, 1999
PEM Tropics B; P3-B; FLIGHT 19

NO, pptv

HNO3, pptv

NO2, pptv

DMSO, pptv

DMS, pptv

Solid = Blake
Broken = Bandy

GMT Time

NO DATA
PEM Tropics B; P3-B; FLIGHT 19

Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 19

GMT Time vs. LWC, g/m³

GMT Time vs. ULTRA, no./cm³ SCATTER/550nm, 1/nm

GMT Time vs. FINE-UNht, no./cm³

GMT Time vs. Fine Ratio (Ht/Uht)
PEM Tropics B; P3-B; FLIGHT 19

![Graphs of H2O2, CH3OOH, H2SO4, SO4, and S02 concentrations over GMT time.](image-url)
PEM Tropics B; P3-B; FLIGHT 19

NO3⁻, pptv

MSA, molecules/cc

MS, pptv

NO DATA

NH₃, pptv

NH₄⁺, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 19

Solid = Blake
Broken = Atlas

CH3ONO2, pptv

Solid = Blake
Broken = Atlas

C2H5ONO2, pptv

Solid = Blake
Broken = Atlas

d-C8H7ONO2, pptv

Solid = Blake
Broken = Atlas

CH2Cl2, pptv

Solid = Blake
Broken = Atlas

GMT Time
PEM Tropics B; P3-B; FLIGHT 19

Solid = Blake
Broken = Atlas

CH$_3$CFCl$_2$, pptv

CH$_3$CF$_2$Cl, pptv

CHF$_2$Cl, pptv

CH$_2$Br$_2$, pptv

CHBr$_3$, pptv

GMT Time
PEM Tropics B; P3-B; FLIGHT 19

Altitude, km

Cabin Alt, ft.

Roll Angle, deg.

Absorption, 565nm, 1/m CH2O, pptv

GMT Time
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 the Earth Science Enterprise. The DAAC has developed an on-line computer system, which allows the user to log on, search through the DAAC’s data inventory, choose 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 Netscape or Microsoft Internet Explorer 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:
   
ettelnet 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 157D
   NASA Langley Research Center
   Hampton, VA 23681-0001
   Phone: (757) 864-8656 (M-F 8 am – 8pm, Eastern Time)
   FAX: (757) 864-8807
   Email: larc@eos.nasa.gov
This report provides a compendium of NASA aircraft data that are available from NASA's Global Tropospheric Experiment's (GTE) Pacific Exploratory Mission-Tropics B (PEM-Tropics B) conducted in March and April 1999. PEM-Tropics B was conducted during the southern-tropical wet season when the influence from biomass burning observed in PEM-Tropics A was minimal. Major deployment sites were Hawaii, Kiritimati (Christmas Island), Tahiti, Fiji, and Easter Island. The broad goals of PEM-Tropics B were to improve understanding of the oxidizing power of the atmosphere and the processes controlling sulfur aerosol formation and to establish baseline values for chemical species that are directly coupled to the oxidizing power and aerosol loading of the troposphere. The purpose of this document is to provide a representation of aircraft data that will be available in archived format via NASA Langley's Distributed Active Archive Center (DAAC) or are available through the GTE Project Office archive. The data format is not intended to support original research/analysis, but to assist the reader in identifying data that are of interest.