Revision Date: February 27, 2009

Pre-LBA TRACE-A Data

Summary

This data set contains atmospheric chemistry and meteorological data from the NASA Transport and Atmospheric Chemistry near the Equator-Atlantic (TRACE-A) field study. The NASA TRACE-A study took place in August 1992 to determine the cause and source of high concentrations of ozone that accumulate over the Atlantic ocean between southern Africa and South America during the months of August through October.

The processed, quality controlled and integrated data in the documented Pre-LBA Data sets were originally published as a set of three CD-ROMs (Marengo and Victoria, 1998) but have now been archived individually.

Pre-LBA Data Set Collection Initiative

The Pre-LBA data set collection was dedicated to providing information to the LBA research community about existing data that have been collected in Amazonia during the 20 years prior to 1998. The main goal of this activity was to compile and document existing data sets in a consistent manner and make them available prior to the beginning of the LBA experiment.

The data set compilation efforts included satellite imagery, micrometeorological observations, near surface and upper-air atmospheric conditions, surface biophysical and hydrological measurements obtained from 1970s-1990s in a number of field experiments. Data were collected for several intensive field campaigns, during the rainy and dry seasons, and other periods that vary from short intensive field campaigns to several years worth of observations, measured sometimes with a time resolution of 5 minutes and 1 hour.

Data Citation:

Cite this data set as follows:

Artaxo, P., V.W. J.H. Kirchhoff, E.B. Pereira, R.C.S. Alvala. 2009. Pre-LBA TRACE-A Data. Data set. Available on-line [http://daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. doi:10.3334/ORNLDAAC/920

The original CD-ROM citation is as follows:

Marengo, J.A., and R.L. Victoria. 1998. Pre-LBA Data Sets Initiative, 3 vols. [Pre-Large-Scale Biosphere-Atmosphere Experiment in Amazonia Data Sets Initiative, 3 vols.].CD-ROM. Centro de Previsao de Tempo e Estudios Climaticos, Instituto Nacional de Pesquisas Espaciais (CPTEC/INPE) [Center for Weather Forecasting and Climate Study, National Institute for Space Research], Sao Paulo, Brazil.

Pre-LBA Data Set Collection Metadata

Campaign: TRACE-A > Transport and Atmospheric Chemistry Experiment - A

Keywords

OZONE
BIOMASS BURNING
NITROGEN OXIDES
DC-8 AIRCRAFT
STRATOSPHERE

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Coverage

Southernmost_latitude: -40
Northernmost_latitude: -4
Westernmost_longitude: -125
Easternmost_longitude: 40
Minimum_altitude: Surface
Maximum_altitude: 10km

Location: South America and Southern Africa

Data_Resolution

Latitude_Resolution: 9S
Longitude_Resolution: 49W
Altitude_Resolution: Surface

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Constraints

Access: Data may not be used for commercial applications.
Use: Data may not be used for commercial applications.

Data Description

Data and images for TRACE-A measurements for both Africa and South America are included in the archived data. Users must select data for flights and areas of interest. Each TRACE-A Data Source entry has a corresponding compiled and compressed data file. Images are provided as companion files.

Data Type	TRACE-A Data Source (Each entry has a corresponding compiled and compressed file.)	TRACE-A Data Type	TRACE-A Data Description
DATA	NASA DC8 AIRCRAFT measurement data. **(NASA_DC-8_AIRCRAFT.zip)** NASA DC8 AIRCRAFT flight navigation and meteorological data to merge by time with measurement data. **(DC8_nav_met_data.zip)**	AIRCRAFT	ANDERSON: CO2 BRADSHAW: Nitrogen Oxides BROWELL: UV Aerosol Scattering Tropopause heights and ozone columns GREGORY: Ozone/Aerosols HEIKES: Formaldehyde PROJECT: Nav/Met Data ROWLAND: Hydrocarbons SACHSE: CO, CH4, and N2O SINGH: Acetone and Ethanol TALBOT: Acidic Trace Gases
	BRAZIL **(BRAZIL.zip)**	AIRCRAFT	Trace Gasses
		FIRECOUNT	Weekly Total Pixel Fire Counts/AVHRR
		RAWINSONDES	Rawinsondes

	FUNCEME **(FUNCEME.zip)**	AIRCRAFT	Met, Aerosol, and Radiation
	GROUND **(GROUND.zip)**	ASCENSION	Ozone sonde
		CUIABA	Ozone sonde
		FUELBERG	Kinematic Parcel Trajectory
		NATAL	Ozone sonde
		PORTO	Ozone sonde
	SATELLITE **(TOMS_SATELLITE.zip)**	SATELLITE	TOMS/NIMBUS-7
IMAGE **companion files**	BRAZIL (FIRECOUNT_IMAGES.zip)	SATELLITE	Weekly Total Pixel Fire Count Images
	PLOTS (PLOTS_IMAGES.zip)	AIRCRAFT	DC-8 Flight Trajectories
	SATELLITES (NOAA_IMAGES.zip)	SATELLITE	NOAA satellites 10, 11, and 12 - Channels 2 and 4

TRACE-A Background

A pool of ozone was initially discovered in the mid 1980s as a result of the re-analysis of ozone measurements from two operational satellites using a newly developed mathematical technique to extract the concentration of ozone in the troposphere. The satellite data provided the first hints of ozone spread over thousands of square kilometers over the Atlantic Ocean at concentrations comparable to those found in many large cities around the world during the summertime. The fact that the enhanced levels of ozone over the Atlantic were observed to be the highest during the southern hemisphere's springtime, a period of intense burning of vegetation in both southern Africa and South America, suggested a link between the biomass burning and the ozone pollution. As additional satellite data were analyzed an alternative source was suggested to be the downward transport of ozone from the stratosphere linked to a sinking motion of air prevalent over the region during the southern hemispherical springtime.

The TRACE-A mission brought together a multi-year series of ground based and balloon measurements, aircraft measurements over Brazil, southern Africa, and the Atlantic ocean, and powerful computer models of the tropical atmosphere. TRACE-A was a cooperative project between NASA and the Brazilian Space Agency (INPE), involving over 200 scientists from US, Brazil and South Africa. The center piece of TRACE-A was

the NASA DC-8 flying laboratory based at the NASA Ames Research Center. During TRACE-A, the DC-8 aircraft flew over 70,000 miles from bases in Brasilia, Brazil, Johannesburg, South Africa, Windhoek, Namibia, and Ascension Island, UK. The DC-8 was instrumented with state-of-the-art instruments for measurements of ozone and other gases that are associated with the production of ozone in the atmosphere. Two INPE aircraft from San Jose dos Campos, provided additional measurements over Brazil. Data and images from TRACE-A observations for both SA and A are included in this data set (Figure 1).

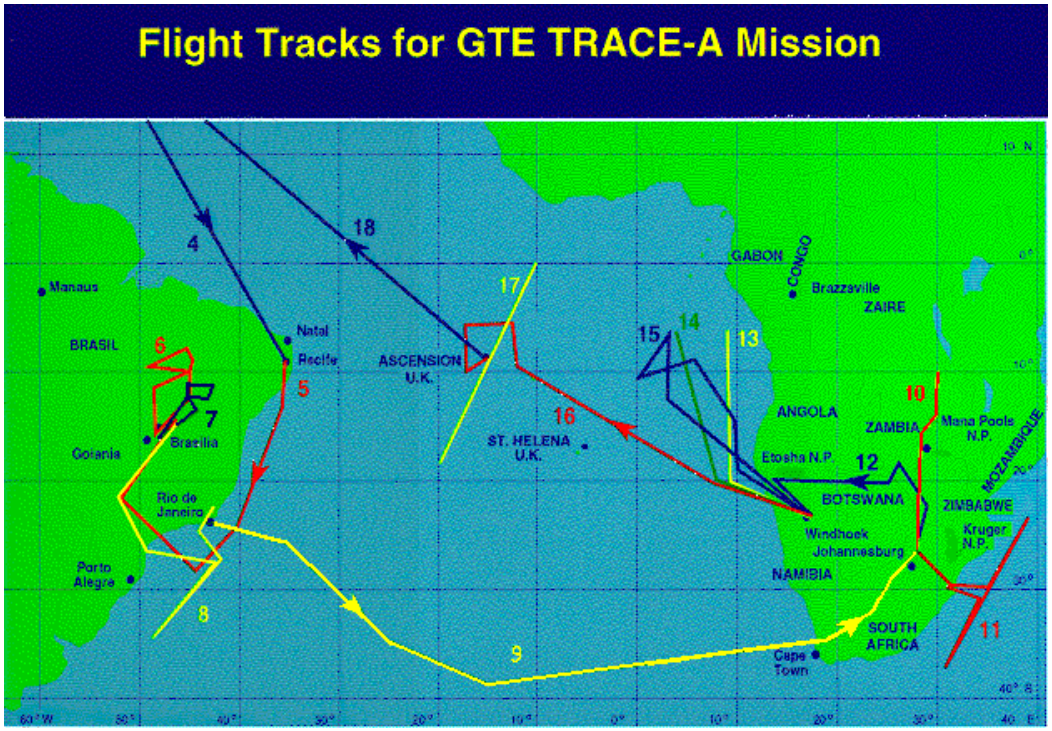

Figure 1. Flights of NASA DC-8 during TRACE-A.

During TRACE-A, another comprehensive experiment, called SAFARI (Southern African Fire-Atmosphere Research Initiative) conducted by a team of European, African, and North American scientists, studied the African fires to understand exactly what kind of vegetation burns and how this material is transformed into the air pollution pall that hangs over vast regions of South Africa, Zimbabwe, Zambia, Namibia, and Botswana during the burning season.

The picture that emerges from TRACE-A together with SAFARI, is that widespread biomass burning in both South America and southern Africa is the dominant source of the initial pollutants that lead to the formation of the high amounts of ozone over the South Atlantic Ocean. Additionally, the air motion in this part of the world is favorable for the accumulation of these pollutants over the Atlantic Ocean where the intense sunlight can do its work in transforming them into ozone and other pollution gases. The production of ozone occurred over thousands of miles and was usually the greatest at altitudes between 15,000 to 50,000 feet where relatively high concentrations of nitrogen oxides, which are needed for the production of ozone, were also measured during TRACE-A.

Results from the TRACE-A mission clearly demonstrated that the cause and source of the seasonally enhanced pool of ozone pollution over the South Atlantic Ocean is due to burning of vegetation on a massive scale in southern Africa and South America, combined with an enormous stagnation region between the two continents. What remains unclear is the source of the high concentrations of nitrogen oxides also observed by instruments aboard the DC-8 aircraft. Transport from surface sources as well as production by lightning have been suggested as the two majors sources for the high concentrations of nitrogen oxides.

Measurements of wide spread ozone plumes during the more recent (e.g. September, 1996) NASA Pacific exploratory Mission in the south tropical Pacific Ocean (PEM-Tropics) provide additional evidence of the impact that biomass burning is having on the global atmosphere.

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Data Access:

This data is available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) [http://daac.ornl.gov].

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