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83 Large ozone concentrations were observed during the Brazilian/American field campaign SCAR-B (Smoke, Clouds, and Radiation- Brazil) in August-September 1995, in central Brazil. Ozone observations were made using UV absorption monitors on board of a Bandeirante aircraft. Flights were made near Porto Nacional (12 degree S, 47 degree W), Cuiabd (16 degree S, 56 degree W), and Alta Floresta (9.5 degree S, 56 degree W). Most ozone observations ranged from 35 to roughly 80 ppbv, in the August-September period, which are values comparable to previous in situ experiments in the Brazilian cerrado. In addition, horizontal aircraft flights have spotted special localized high ozone mixing ratios, above 100 and 120 ppbv near Cuiaba on two occasions, and twice near Alta Floresta. This is to be contrasted to wet season averages of roughly 15 ± 5 ppbv. Surface observations during August and September at Natal (60 degree S, 35 degree W), which is located outside of the biomass burning area, show maximum ozone mixing ratios around 22 ppbv.
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OZONE MEASUREMENTS FROM AN AIRCRAFT PLATFORM DURING THE SCAR-B FIELD EXPERIMENT

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ABSTRACT

Large ozone concentrations were observed during the Brazilian/American field campaign SCAR-B (Smoke, Clouds, and Radiation-Brazil) in August-September 1995, in central Brazil. Ozone observations were made using UV absorption monitors on board of a Bandeirante aircraft. Flights were made near Porto Nacional (12° S, 47° W), Cuiabá (16° S, 56° W), and Alta Floresta (9.5° S, 56.0° W). Most ozone observations ranged from 35 to roughly 80 ppbv, in the August-September period, which are values comparable to previous in situ experiments in the Brazilian cerrado. In addition, horizontal aircraft flights have spotted special localized high ozone mixing ratios, above 100 and 120 ppbv near Cuiabá on two occasions, and twice near Alta Floresta. This is to be contrasted to wet season averages of roughly 15 ± 5 ppbv. Surface observations during August and September at Natal (6° S, 35° W), which is located outside of the biomass burning area, show maximum ozone mixing ratios around 22 ppbv.

INTRODUCTION

Ozone measurements have been carried out near the ground at fixed sites (Cuiabá and Natal), on aircraft (in the regions near Porto Nacional, Alta Floresta and Cuiabá, see Fig.1 of Kirchhoff and Alvalá, 1996, this issue) and using balloonsondes (Cuiabá). This paper focuses on aircraft ozone results. The INPE aircraft has been described in Kirchhoff and Alvalá (1996). The instruments used to measure ozone, almost continuously in real time, are based on the ultraviolet absorption principle, and have been used extensively to measure ozone concentrations in the lower troposphere (Kirchhoff, 1988; Kirchhoff et al.(1988); and Kirchhoff et al.(1989). For upper tropospheric investigations the ozonesonde technique is preferred (Kirchhoff et al., 1991). A special ozonesonde campaign during SCAR-B is described separately (Kirchhoff et al., 1996, this issue).

RESULTS

The SCAR-B mission (McDougal, 1995; Kirchhoff, 1995) was a successful special field campaign in Brazil, in collaboration between the Space Agencies of the USA and Brazil. The major interest of this field mission was the observation of the emission of smoke and trace gases from biomass burning in the savanna regions of central Brazil (Kirchhoff and Alvalá, 1996a, this issue). Previous work in this area has been presented in Kirchhoff et al. (1989), Kirchhoff and Rasmussen (1990) and Kirchhoff et al. (1992).

A mass plot of the observed ozone concentrations from the aircraft platform is shown in Fig. 1. The ozone mixing ratio is shown as a function of height. The observations were always made at the same heights, and are the result of averaging over time periods of 6 minutes. The variability that was observed in the August-September period of 1995 (see dates and locations in Table 1 of Kirchhoff and Alvalá, 1996a, this issue) is roughly within the limits that have been observed previously, that is, between

about 30 and 80 ppbv. Also shown in Fig. 1 is the average of all 15 profiles, shown by the heavy line and larger dots. It varies between 45 and 60 ppbv.

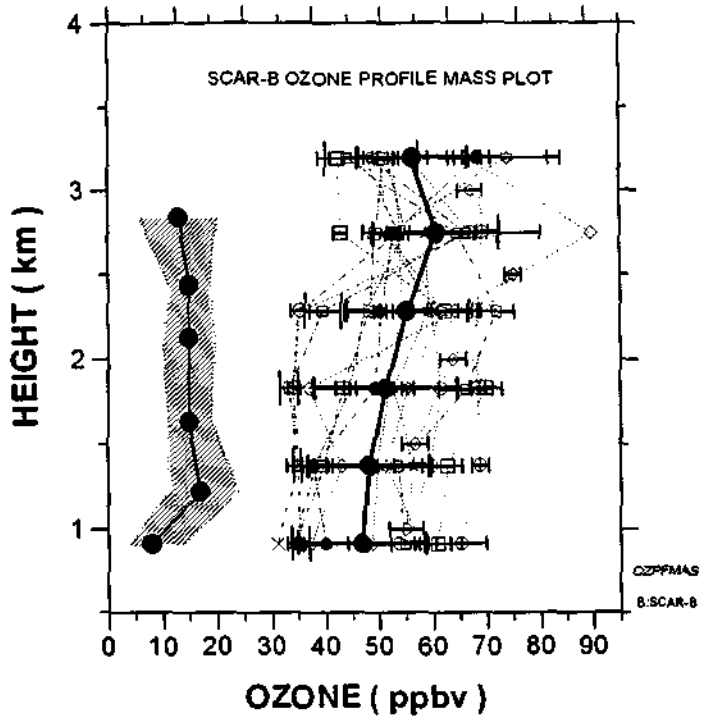

Fig. 1

In order to better assess the meaning of these concentrations, Fig. 1 also shows ozone concentrations measured in the wet season. This is a time of year when the cerrado receives its largest amount of rain and therefore biomass burning is mostly inhibited. The measurement technique that was used in the wet season is the same as that used in the dry season. The concentrations are much smaller, between about10 and 20 ppbv. It is clear, comparing the results of Fig.1, that the dry season results are larger by a considerable factor, confirming earlier results (Kirchhoff et al., 1989).

In order to further appreciate the SCAR-B ozone concentrations, another comparison is made in Fig. 2. Shown are the diurnal variations of the ozone mixing ratio at Natal, a site that is well outside of the biomass burning region. The concentrations at Natal reach maxima that are close to 22 ppbv, at most, around noontime, in August and September. These low concentrations reflect the fact that Natal always receives air masses that come from the South Atlantica region, having travelled over large distances with very little contributions from local sources.

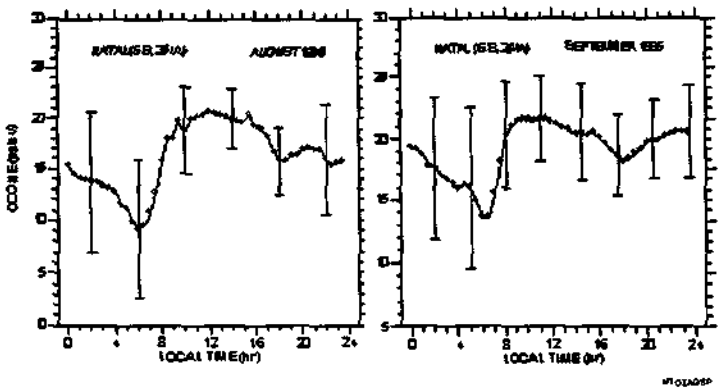

Fig. 2

The horizontal spatial variability of ozone concentrations in the region of Cuiabá is shown in Fig.2. The average concentration over the period of the measurement is 54.2 ppbv with a standard deviation of 2.4 ppbv. This shows that the spatial distribution of ozone may be quite homogeneous, in this case over a distance of about 600 km, even in a region of strong biomass burning contributions, as is the case for Cuiabá.

A mass plot of several horizontal survey flights showing ozone concentrations as a function of time (UT) is shown in Fig. 3. This gives an idea of the variability of the observations. Values as low as 25 ppbv (close to the Natal values) were seen near Porto Nacional, and values as high as 120 ppbv were observed near Cuiabá and Alta Floresta. These higher concentrations were measured at heights of 9,000 and 10,500 ft, and as shown in Fig. 3, were observed only over rather small spots.

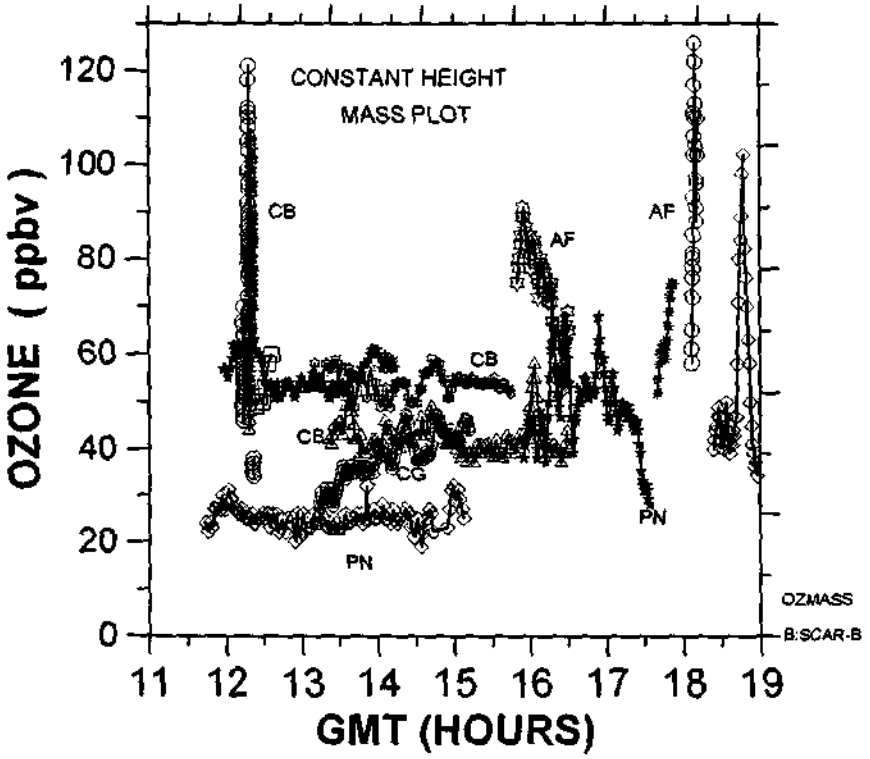

Fig. 3

CONCLUSIONS

Ozone measurements from an aircraft platform have shown extremely large ozone mixing ratio spots near Cuiabá and Alta Floresta. On August 15, 1995, the aircraft was flying at 9,000 ft and observed a high ozone spot of mixing ratio above 100 ppbv (reaching 120 ppbv) over a distance of about 10 km. Other spots were observed also at 10,500 ft, near Cuiabá, with mixing ratios above 100 ppbv. During flights near Alta Floresta, ozone maxima were detected on August 27 (100 ppbv) and on August 28, when mixing ratios of 128 ppbv were observed at 10,500 ft.

ACKNOWLEDGEMENTS

It is a pleasure to acknowledge the support of Ministro Antonio Augusto Dayrell de Lima, chief, Department of the Environment, Ministry of External Relations. Embaixador Carlos Campelo, Director of International Affairs of AEB, has worked

diligently for the success of the mission. We thank the representatives of the Ministry of the Aeronautics, EMFA, and the members of the High Counsel of AEB, the members of AEB, and especially AEB President, Dr. Luiz Gylvan Meira Filho. For logistical support we thank SAIC. We also thank all the NASA personnel involved in SCAR-B for their professionalism and cooperation during the field mission. Special thanks are extended to INPE Director Marcio Nogueira Barbosa.

REFERENCES

Kirchhoff, V.W.J.H., Surface ozone measurements in Amazonia. ***J. Geophys. Res.***, 93, 1469-1476, 1988.

Kirchhoff, V.W.J.H., E.V. Browell, and G.L. Gregory, Ozone measurements in the troposphere of an Amazonian rain forest environment. ***J. Geophys. Res.***, 93, 15850-15860, 1988.

Kirchhoff, V.W.J.H., A.W. Setzer, and M.C. Pereira, Biomass burning in Amazonia, ***Geophys. Res. Lett.***, 5, 469-472, 1989.

Kirchhoff, V.W.J.H., and R.A. Rasmussen, Time variations of CO and O_3 concentrations in a region subject to biomass burning. ***J. Geophys. Res.***, 95, 7521-7532, 1990.

Kirchhoff, V.W.J.H., R.A.Barnes, and A.L.Torres, Ozone climatology at Natal, Brazil, from in situ ozonesonde data, ***J.Geophys.Res.***, 96, 10899-10909, 1991.

Kirchhoff, V.W.J.H., Y. Nakamura, E.V.A. Marinho and M.M. Mariano, "Excess ozone production in Amazonia from large scale burnings, ***J. Atmosph. Terr. Phys.***, 54, 583-588, 1992.

Kirchhoff, V.W.J.H., SCAR-B Brasil, Missão de Campo, relatório interno INPE, 76 pp, Julho, 1995.

Kirchhoff, V.W.J.H., and P.C.Alvalá, Overview of an aircraft expedition into the Brazilian Cerrado for the observation of atmospheric trace gases, ***J.Geophys.Res.***, accepted, 1996.

McDougal, D., Smoke, Clouds and Radiation-Brazil (SCAR-B) Field Experiment, August 16 to September 14, 1995, Mission Plan, prepared by SCAR-B scientists and the SCAR-B Project Office, ***NASA special publication***, 164 pp, July, 1995.

FIGURE CAPTIONS

Fig. 1.-Mass plot of ozone mixing ratios in ppbv as a function of height. The average is also shown (heavy line, large black dots). In addition, ozone concentrations are shown for the wet season (hatched area) for comparison.

Fig. 2.- Average ozone mixing ratios for August and September 1995 at Natal, outside of the biomass burning region, showing the diurnal variation of ozone, with maximum concentrations of about 22 ppbv.

Fig. 3.- Mass plot of ozone mixing ratios for constant height flights, showing large ozone concentrations over relatively small spots, near Cuiabá and Alta Floresta.