# Impacts of biomass burning on ozone and its precursors over northern Australia in September 1999

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The aircraft measurement campaign (BIBLE-B) was conducted over northern Australia in August and September 1999. Large enhancements of biomass-burning primary emissions such as carbon monoxide (CO) and reactive nitrogen (NOy) were observed at altitudes below 4 km over Darwin. The increases in the mixing ratios of CO, NOy, and ozone (O3) inside the boundary layer were estimated to be 120%, 800%, and 35% of each background level, respectively. The increase in the O3 mixing ratio was consistent with the photochemical production amount of O3 calculated using the point model.

The Biomass Burning and Lightning Experiment - phase B (BIBLE-B) was conducted over northern Australia in August and September 1999. The purpose of this mission is to investigate the impacts of biomass burning on ozone (O3) and its precursors in this region. In situ measurements of O3, carbon monoxide (CO), reactive nitrogen (NO, NO2, NOy), carbon dioxide (CO2), non-methane hydrocarbons (NMHCs), water vapor (H2O), aerosols, and photolysis coefficients (J-value) were made onboard the Gulfstream-II (G-II) aircraft. Most of the flights were conducted from Darwin (12S, 131E). Darwin is located on the west coast of the Arnhem Land Peninsula, where intensive biomass burning occurs during the dry season.

Due to the existence of the stable subtropical high over northern Australia, downward motion was always dominant over Darwin for the duration of the BIBLE-B mission. Temperature profiles obtained by the radiosonde soundings over Darwin indicated the distinct and stable inversion layers at the altitude of 2-4 km. Correspondingly, large enhancements of biomass-burning primary emissions such as CO, NOy, and NMHCs were observed at altitudes below 4 km over Darwin. In contrast with the boundary layer, the mixing ratios of these species in the free troposphere over Darwin were comparable to those over the South Pacific Ocean. These results suggested that the impacts of biomass burning on the distributions of CO, NOy, and NMHCs were mostly confined within the boundary layer over northern Australia. A clear positive correlation between O3 and CO was seen in the boundary layer, suggesting that the photochemical production of O3 was caused by the biomass burning plume.

To evaluate the impacts of biomass burning in this region, the mixing ratios of CO, NOy, and O3 over Darwin were compared with those over the South Pacific Ocean. The increases in the mixing ratios of CO and NOy in the boundary layer over Darwin were estimated to be 90 ppbv and 800 pptv, respectively, corresponding to 120% and 800% of each background level. The increase in the O3 mixing ratios was estimated to be 11 ppbv, corresponding to 35% of the background. The O3 production and loss rates were calculated using the point model along the flight track. The median value of the diurnal averaged O3 net production rate was about 3 ppbv/day in the boundary layer. Considering the short residence time of 1-4 day due to the relatively strong easterly wind of up to 10 m/s in the boundary layer, the photochemical production amount of O3 was estimated to be less than 12 ppbv, which was approximately consistent with the observations.