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Tropospheric ozone climatology over Beijing: analysis of aircraft data from the MOZAIC program

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Abstract. Ozone (O₃) profiles recorded over Beijing from 1995 to 2005 by the Measurement of Ozone and Water Vapor by Airbus In-Service Aircraft (MOZAIC) program were analyzed to provide a first climatology of tropospheric O₃ over Beijing and the North China Plains (NCPs), one of the most populated and polluted regions in China. A pooled method was adopted in the data analysis to reduce the influence of irregular sampling frequency. The tropospheric O₃ over Beijing shows a seasonal and vertical distribution typical of mid-latitude locations in the Northern Hemisphere, but has higher daytime concentrations in the lower troposphere, when compared to New York City, Tokyo, and Paris at similar latitude. The tropospheric O₃ over Beijing exhibits a common summer maximum and a winter minimum, with a broad summer maximum in the middle troposphere and a narrower early summer (June) peak in the lower troposphere. Examination of meteorological and satellite data suggests that the lower tropospheric O₃ maximum in June is a result of strong photochemical production, transport of regional pollution, and possibly also more intense burnings of biomass in Central-Eastern China. Trajectory analysis indicates that in summer the regional pollution from the NCPs, maybe mixed with urban plumes from Beijing, played important roles on the high O₃ concentrations in the boundary layer, but had limited impact on the O₃ concentrations in the middle troposphere. A comparison of the data recorded before and after 2000 reveals that O₃ in the lower troposphere over Beijing had a strong positive trend (approximately 2% per year from 1995 to 2005) in contrast to a flat or a decreasing trend over Tokyo, New York City, and Paris, indicating worsening photochemical pollution in Beijing and the NCPs.

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