Photochemical ozone production at the summit of Mount Tai, in June 2006

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We performed an intensive field campaign at the summit of Mount Tai (36.26N, 117.11E, 1534m) in June 2006, where observations of O_3 and its precursors, H_2O, NOx, NOy, CO, NMHCs, and aldehydes, and relevant parameters (temperature and J values) were fully made. Using the data as input parameters to a photochemical box model, we estimated OH, HO_2, and RO_2 radical concentrations first and then in-situ net photochemical production rates of ozone, F-D(O_3), during the campaign.

The midday maximum of F-D(O_3) was ~7 ppb h^{-1} in average and the integrated amount of ozone produced in one day was estimated to be ~50 ppb. The observed daytime buildup of ozone was 23 ppb in average, which could be explained by the local photochemistry. Sensitivity model runs employing different levels of NOx and NMHCs (and CO) suggested that ozone production was limited by NOx for most of the time. This analysis implied that the ozone production was more efficient in the fresh air mass with NOx/NOy ratios higher than those observed at the mountain (~0.17) and that the ozone pollution would become severer in the future by stronger NOx emission anticipated in the North China Plain. The calculated production rate was compared with the observed ozone buildup rate studied as a function of elapsed time after the observed air mass entered a box region (31-40N, 114-121E, 0-2500m) representing the North China Plain. Exceptionally on June 9 and 10, ozone production was VOC-limited. On these days, the air mass quickly intruded into the North China Plain from its north border and high NOx/NOy ratio was observed. The OH + NO_2 + M reaction became important as radical termination reaction on the two days.