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Ozone production and hydrocarbon reactivity in Hong Kong, Southern China

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Abstract. Data obtained in Hong Kong during the Hong Kong and the Pearl River Delta (PRD) Pilot Air Monitoring Study in autumn 2002 are analyzed to unravel the relationship between ground-level ozone (O_3), pollution precursors, and cross-border transport. Ten ozone episodes, during which the hourly O_3 concentration exceeded 100 ppbv in 9 cases and 90 ppbv in one case, are subject to detailed analysis, including one case with hourly O_3 of 203 ppbv, which is the highest concentration on record to date in Hong Kong. Combined with high-resolution back trajectories, dCO/dNO_y (the ratio of enhancement of CO concentration above background to that of NO_y) is used to define whether O_3 is locally or regionally produced. Five out of the ten Hong Kong O_3 -episodes studied show a "pollution signature" that is indicative of impact from Guangdong Province. Examination of speciated volatile organic compounds (VOCs) shows that the reactivity of VOCs is dominated by anthropogenic VOCs, of which the reactive aromatics dominate, in particular xylenes and toluene. Calculations using a photochemical box model indicate that between 50–100% of the O_3 increase observed in Hong Kong during the O_3 episodes can be explained by photochemical generation within the Hong Kong area, provided that nitrous acid (HONO) is present at the concentrations derived from this study. An Observation-Based Model (OBM) is used to calculate the sensitivity of the O_3 production to changes in the concentrations of the precursor compounds. Generally the production of O_3 throughout much of the Hong Kong area is limited by VOCs, while high nitric oxide (NO) concentrations suppress O_3 concentration.

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