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Vertical distribution of HONO and NO_2 in traffic pollution observed using MAX-DOAS measurements in Melbourne

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Current understanding of how nitrogen dioxide (NO_2) and nitrous acid (HONO) interact in the atmosphere is limited by a lack of vertically resolved pollution observations. In recent times, multi-axis differential optical absorption spectroscopy (MAX-DOAS) has been established as a valuable atmospheric chemistry tool, capable of providing vertical distributions of aerosols and pollutant trace gases including HONO and NO_2. One limitation of the MAX-DOAS technique is the necessary reliance on a priori information in the retrieval of both aerosol extinction and trace gas concentration profiles. If no co-located aerosol or trace gas measurements exist, as is the case in much of Australia, uncertainty due to estimating these a priori parameters can be high. However, Australia is an ideal place to study the interaction of pollution plumes with the surrounding environment due to its generally good air quality with isolated but often significant pollution events. In this study, the first MAX-DOAS measurements from Melbourne, Australia, are used to understand how varying a priori parameters affect the aerosol, NO_2 and HONO profile retrievals. With confidence from understanding these limitations, retrieved trace gas concentrations from a month-long field campaign are then presented. On some days, morning peaks provide evidence for NO_2 and HONO as night-time reservoirs for nitrogen oxides. However on other days, day-time peaks of NO_2 (up to 15 ppb) and HONO (up to 0.5 ppb) are evident, most likely due to traffic pollution. Analysed alongside meteorological data, these results can be used to understand HONO and NO_2 distributions as pollution from the adjacent motorway interacts with the surrounding environment.