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Atmospheric Trajectory and Chemical Transport Modelling for Elevated Ozone Events in Denmark

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ABSTRACT

In this study, three Danish sites having the longest (1990-2004) time-series of ozone measurements were analysed on inter-annual, monthly and diurnal cycle variability as well as elevated and lowered ozone concentration events were identified. The atmospheric trajectory (HYSPLIT) and dispersion (HIRLAM + CAMx) models were employed to study dominating atmospheric transport patterns associated with elevated events and to evaluate spatio-temporal variability of ozone specific episode and typical seasonal patterns for Denmark. It was found that generally inter-annual variability has a positive trend, and events with low ozone concentration ($\leqslant$10 μg/m^3) continued to diminish. On a monthly scale, the highest and lowest mean concentrations are observed in May and November-December, respectively. The elevated concentrations ($\geqslant$ 120 μg/m^3) are observed during March-September. On a diurnal cycle, it is observed mostly during 13-16 of local time, and more frequent (ten-fold) compared with nighttime-early morning hours. For ozone elevated events, several sectors (or pathways of atmospheric transport) were identified depending on the sites' positions, showing the largest (39%) number of such events associated with the north-western sector, and lowest (13% each)—southwestern and northern sectors. For each site, less than 60 events showed very high concentrations ($\geqslant$180 μg/m^3). Among 12 episodes, one longest elevated episode (19-21 Jun 2000) simultaneously registered at all sites and characterized by dominating transport from the south-southwestern sector, low wind speed, clear-sky, and multiple inversions was studied using modelling tools. For this episode, both measurements and modeling (trajectory and dispersion) results showed a relatively good agreement.

KEYWORDS

Elevated Ozone Concentration Event and Episode; Atmospheric Trajectory; Chemical Transport Modeling; HYSPLIT; HIRLAM; CAMx

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