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[Volumes and Issues](#) [Contents of Issue 18](#)

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Tempo-spatial variation of emission inventories of speciated volatile organic compounds from on-road vehicles in China

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Abstract. Emission inventories of sixty-seven speciated non-methane volatile organic compounds (NMVOC) from on-road vehicles in China were estimated for the period of 1980–2005, using seven NMVOC emission profiles, which were summarized based on local and international measurements from published literatures dealing with specific vehicle categories running under particular modes.

Results show an exponential growth trend of China's historical emissions of alkanes, alkenes, alkynes, aromatics and carbonyls during the period of 1980–2005, increasing from 63.9, 39.3, 6.9, 36.8 and 24.1 thousand tons, respectively, in 1980 to 2778.2, 1244.5, 178.7, 1351.7 and 406.0 thousand tons, respectively, in 2005, which coincided well with China's economic growth. Emission inventories of alkenes, aromatics and carbonyls were gridded at a high resolution of 40 km×40 km for air quality simulation and health risk evaluation, using the geographic information system (GIS) methodology. Spatial distribution of speciated NMVOC emissions shows a clear difference in emission densities between developed eastern and relatively underdeveloped western and inland China. Besides, the appearance and expansion of high-emission areas was another notable characteristic of spatial distribution of speciated NMVOC emissions during the period.

Emission contributions of vehicle categories to speciated NMVOC groups showed annual variation, due to the variance in the provincial emissions and in the relative fractions of the seven emission profiles adopted at the provincial level. Highly reactive and toxic compounds accounted for high proportions of emissions of speciated NMVOC groups. The most abundant compounds were isopentane, pentane and butane from alkanes; ethene, propene, 2-methyl-2-butene and ethyne from alkenes and alkynes; benzene, toluene, ethylbenzene, o-xylene, and m,p-xylene (BTEX) and 1,2,4-trimethylbenzene from aromatics and formaldehyde, acetaldehyde, benzaldehyde and acetone from carbonyls.

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