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BTEX, nitrogen oxides, ammonia and ozone concentrations at traffic influenced urban sites in an arid environment

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Urban air pollution is an inevitable consequence of the urbanization and implies growing concern of scientists, policymakers and an increasing fraction of the population. Air pollution is an acute problem especially in the developing countries, where the growing population, developing industry and improving life standards are generating environmental challenges.
Qatar is located on the northeastern coast of the Arabian Peninsula, has area of 11,586 km2 and population 2,634.234 that has increased by 1.5-fold during the past 10 years. New districts have been constructed in the capital, Doha, expanding the area of the city. Qatar has more than 1,200 km of paved road network that is rapidly increasing due to the infrastructural development. The number of passenger cars in use in Qatar is expected to reach about 912,000 units by 2020.
The rapid development of motorization results harmful effect on the air quality. The most important traffic related air pollutants are carbon monoxide, nitrogen oxides, sulfur dioxide, non-methane hydrocarbons mainly BTEX and particulate matter. Secondary pollution like ozone formation is also related to traffic emission as its precursor molecules are emitted from traffic sources.
Spatial distribution of the air pollution was studied in Doha, capital of Qatar in the course of two monitoring campaigns conducted in early spring, 2016. Time-weighted averages of BTEX components as well as NO, NO_2, ammonia and ozone were measured by absorption tubes at 15 locations of the city concerning different types of environments such as background, urban residential, urban downtown and traffic influenced locations. Results show high variation of the air pollution level among the sampling locations. The average NO_x concentration slightly exceeded the annual limit value (108 ug/m3 vs. 100 ug/m3) and the exceedances were significant at locations with intensive traffic. Opposite behavior was found for ozone concentration that has the highest level at background locations (ranging from 36 to 71 ug/m3) and the lowest at the most polluted sites (12-30 ug/m3). The BTEX concentrations have been found to be over the American and European levels, but far under the values reported from the MENA region. The average BTEX concentration was 15.3 ug/m3, peaking at 40.5 ug/m3 at the most polluted location. Average benzene, toluene, ethyl-benzene, xylenes concentrations were 1.5, 4.7, 2.5, 5.0 and 2.3 ug/m3 respectively. The average toluene to benzene ratio was 2.87 that confirms the traffic origin of the pollution. (m+p)-xylene to benzene ratios were used for the characterization of the photochemical age of the pollution and thus, indirectly the distance of the sources. The ratios were ranging from 1.6 to 5.0. Despite the desert environment elevated level of ammonia was found (17.6 ug/m3 in average). The NO_3 concentration was correlated with NO_x that indicates traffic origin of ammonia. Other hotspots like animal market, as well as fertilizer treated big grassy park have been identified. The results indicate the dominancy of vehicle emission in the formation of the city's air quality. Atmospheric modification of the components via photochemical reactions was found to be important.