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Impacts of using reformulated and oxygenated fuel blends on the regional air quality of the upper Rhine valley

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Abstract. The effects of using three alternative gasoline fuel blends on regional air quality of the upper Rhine valley have been investigated. The first of the tested fuels is oxygenated by addition of ethyl-tertio-butyl ether (ETBE), the second is based on a reformulation of its composition and the third on is both oxygenated and reformulated. The upper Rhine valley is a very sensitive region for pollution episodes and several meteorological and air quality studies have already been performed. High temporal and spatial emission inventories are available allowing relevant and realistic modifications of the emission inventories. The calculation period, i.e., 11 May 1998, corresponds to a regional photochemical ozone pollution episode during which ozone concentrations exceeded several times the information threshold of the ozone directive of the European Union (180 µg m^{-3} as 1 hourly average). New emission inventories are set up using specific emission factors related to the alternative fuels by varying the fraction of gasoline passenger cars (from 50% to 100%) using the three fuel blends. Then air quality modeling simulations are performed using these emission inventories over the upper Rhine valley. The impact of alternative fuels on regional air quality is evaluated by comparing these simulations with the one using a reference emission inventory, e.g., where no modifications of the fuel composition are included. The results are analyzed by focusing on peak levels and daily averaged concentrations. The use of the alternative fuels leads to general reductions of ozone and volatile organic compounds (VOC) and increases of NO_x levels. We found different behaviors related to the type of the area of concern i.e. rural or urban. The impacts on ozone are enhanced in urban areas where 15% reduction of the ozone peak and daily averaged concentrations can be reached. This behavior is similar for the NO_x for which, in addition, an increase of the levels can be noted in urban plumes over rural areas. The most important decreases of the total VOC levels are mainly located over rural areas (more than 5% reduction of the levels except in urban plumes). By comparing these results with those from a local study related to the air quality of Strasbourg, we estimate that the regional contribution to the urban air quality of Strasbourg allows an enhancement of the results by using alternative fuel blends at the regional scale.

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