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Satellite measurement based estimates of decadal changes in European nitrogen oxides emissions

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Abstract. Long-term satellite measurements of nitrogen dioxide in the troposphere are used in combination with a continental scale air quality model in order to verify and improve available estimates of multi-annual changes of emissions of nitrogen oxides (NO_x) in Europe and the Mediterranean area between 1996 and 2005. As a result, a measurement-based data set of NO_x emissions on a 1° by 1° grid and averaged over summer months is elaborated.

The results are compared with emission data based on the EMEP emission inventory. Our data are in agreement with the EMEP estimates suggesting a general decline in the level of NO_x emissions in Western and Central European countries (France, Germany, Great Britain and Poland). Over Southern Europe and for shipping emissions, neutral to positive trends are found both for the inverted and bottom-up emissions. In contrast, considerable differences between both data sets are found in some other countries. In particular, significant negative trends instead of the positive ones in the "bottom-up" inventory are found for the Balkan countries, Russia and Turkey. The NO_x emission trends derived from satellite measurements demonstrate larger spatial heterogeneity than those calculated with the EMEP data, especially in Russia and Ukraine.

The obtained estimates of the decadal trends in NO_x emissions for Great Britain are found to be consistent with independent data from the U.K. Automatic Urban and Rural Network (AURN). It is also found that using our emission estimates yields better agreement of model calculations with near-surface ozone measurements of the European EMEP network.

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