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Assessment of near-surface ozone trends over Europe in regional climate-air quality simulations: The impact of emissions

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The current study aims to investigate the contribution of emission changes to near-surface ozone trends over Europe based on regional climate-air quality simulations. A modeling system based on the air quality model CAMx (version 5.2) driven off-line by the regional climate model RegCM3, is used to estimate near surface ozone trends over Europe for the time period 1996-2006. In order to assess the contribution of changing emissions to ozone trends, two simulations were performed: The first simulation (CONST) was forced from constant emissions based on the EMEP emissions of the year 1996, while the second simulation (VAR) was forced from year to year varying emissions based on the EMEP emissions of the years 1996-2006. Both climatic and air-quality simulations were performed on a 50 km $\times$ 50 km grid with RegCM3 driven by the NCEP meteorological reanalysis fields. The vertical profile of the domain contains 12 layers of varying thickness extending to about 6.7 km. Average monthly concentration values obtained from the global chemistry climate model ECHAM5-MOZ for the year 1996, were used as chemical boundary conditions for both simulations. Near surface ozone measurements from the EMEP network are used in order to evaluate the ability of the RegCM3/CAMx modeling system to reproduce the observed ozone trends. 74 stations were selected under the 75% data availability criterion. Annual and seasonal trends were calculated by implementing linear regression analysis on both modeled and observed ozone concentrations, while the statistical significance of trends has been calculated using the Mann-Kendall approach. The modeling system reproduces the correct sign of trends for the majority of the stations, while the magnitude of the trends is much milder than the observed. Overall, the VAR simulation exhibits a better approach to the observed trends compared to the CONST simulation, especially over the hotspots of NO_x emissions (UK, Benelux).