Geophysical Research Abstracts, Vol. 8, 09464, 2006
SRef-ID: 1607-7962/gra/EGU06-A-09464

A multimodel simulation of the tropospheric composition over the past 40 years

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Due to the sparsity of observations, especially before the 1990s, the only way to achieve reliable estimates of trends and variability for tropospheric trace species concentrations over Europe is to use state-of-the-art three-dimensional chemical transport models. These models have now reached a state of maturity and they are widely employed in scientific studies. Up to now, no comprehensive global long-term simulations exist where changes in emissions, meteorology, and stratospheric conditions are taken into account in a consistent manner. Such simulations have only now become feasible, because of the availability of new consistent long-term meteorological data (ERA-40) and recent advances in the understanding of historic trends and variability of trace gas and aerosol emissions. During the EU funded RETRO project (2003-2006), four state-of-the-art chemical transport models have been used to perform a comprehensive global long-term tropospheric chemistry integrations covering a time period of four decades in order to both reproduce and understand the trends and variability of the tropospheric chemical composition. In this paper, we provide an overview of RETRO and of its main accomplishments. We describe the modelling setup and input datasets (dynamical fields, surface emissions of chemical species, stratospheric boundary conditions) used to drive the 3D models. The simulated distributions of tropospheric ozone and its precursors are illustrated and compared to available observations over the considered 1960-2000 time period. The different model simulated trends in atmospheric composition are then compared and discussed.