Geophysical Research Abstracts
Vol. 20, EGU2018-12677, 2018
EGU General Assembly 2018

Past and future changes in surface ozone pollution in Central Europe: insights from observations and chemistry-climate model simulations

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Surface ozone (O_3) is a regional pollutant, formed when abundant solar radiation, volatile organic compounds (VOCs), and high temperature and humidity facilitate active photochemical production in the presence of oxides of nitrogen (NO_x). Most recent figures for the European Union show that in 2014 O_3 concentrations above the target value for protecting human health (120 μg/m3 daily maximum 8-hourly average (MDA8), not to be exceeded more than 25 times a calendar year, averaged over three years) where registered in 16 of the EU member states. Here we analyze changes in Central European O_3 pollution for the recent past using data from the European Environment Agency's Airbase database and illustrate potential future changes under selected Representative Concentration Pathways (RCPs). For future projections we analyze a set of transient (2006-2100) sensitivity simulations for RCP scenarios from the Geophysical Fluid Dynamics Laboratory (GFDL) chemistry-climate model CM3. These simulations have been designed to isolate effects of changes in anthropogenic O_3 precursor emissions, climate, and global background methane on surface O_3 over the 21st century.