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Global trend analysis of surface CO simulated using the global atmospheric chemistry general circulation model, EMAC (ECHAM5/MESSy)

Jongmin Yoon (1), Andrea Pozzer (1), Jos Lelieveld (1,2)

(1) Atmospheric Chemistry Department, Max-Planck Institute of Chemistry, P.O. Box 3060, 55020 Mainz, Germany (jongmin.yoon@mpic.de, +49 (0) 6131 305 4009), (2) The Cyprus Institute, Energy, Environment and Water Research Center, P.O. Box 27456, 1645 Nicosia, Cyprus

Carbon monoxide (CO) is an important trace gas in tropospheric chemistry. It directly influences the concentration of tropospheric hydroxyl radical (OH), and therefore regulates the lifetimes of various tropospheric trace gases. Since anthropogenic activity produces about 60% of the annual global emission of the tropospheric CO, temporal trend analysis of surface CO is needed to understand the increasing (decreasing) influence of humans on the cleansing capacity of the atmosphere. In this study, the global trend of surface CO from 2001 to 2010 was estimated using the EMAC (ECHAM5/MESSy for Atmospheric Chemistry) model. The simulation is based on the emission scenario based on RCP8.5 (Representative Concentration Pathways). The global EMAC simulations of monthly surface CO are evaluated with monthly MOPITT (Measurements Of Pollution In The Troposphere) observations (i.e. MOP03TM), and the spatial correlations range from 0.87 to 0.97. The simulated trends are compared with the data from a global surface CO monitoring network, the World Data Centre for Greenhouse Gases (WDCGG), which includes also the NOAA/CMDL (Climate Monitoring and Diagnostic Laboratory of the National Oceanic and Atmospheric Administration) Cooperative Air Sampling Network. Over the United States and Western Europe, the significant decreases of surface CO are estimated at -49.7$\pm$2.7 and -38.6$\pm$2.7 ppbv per decade. In contrast, the surface CO increased by +12.4$\pm$10.2 and +7.2$\pm$3.7 ppbv per decade over South America and South Africa, respectively.