5.011 Changes in Air Quality in Different World Regions for the Past Decades: analyses using chemistry-climate simulations and observations from satellite and monitoring stations.

Early Career Scientist

Presenting Author:
Thierno Doumbia, LATMOS/IPSL, UPMC Univ. Paris 06 Sorbonne Universités, UVSQ, CNRS, Paris, France, thiernodoumbia@yahoo.fr

Co-Authors:
Claire Granier, LATMOS/IPSL, UPMC Univ. Paris 06 Sorbonne Universités, UVSQ, CNRS, Paris, France ; NOAA ESRL/CSD and CIRES, Boulder Colorado, USA and Max Planck Institute for Meteorology, Hamburg, Germany
Katerina Sindelarova, LATMOS/IPSL, UPMC Univ. Paris 06 Sorbonne Universités, UVSQ, CNRS, Paris, France
Simone Tilmes, National Center for Atmospheric Research, Boulder, Colorado, USA
Idir Bouarar, Max Planck Institute for Meteorology, Hamburg, Germany
Louisa Emmons, National Center for Atmospheric Research, Boulder, Colorado, USA
Andreas Richter, University of Bremen, Bremen, Germany
Andreas Hilboll, University of Bremen, Bremen, Germany
Jean-Francois Lamarque, National Center for Atmospheric Research, Boulder, Colorado, USA
Steven Turnock, Institute of Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, United Kingdom

Abstract:

Surface emissions of atmospheric compounds have changed dramatically in many world regions during the past decades. In this study, we investigate the spatial variability of long-term changes of atmospheric compounds such as carbon monoxide (CO) and nitrogen dioxide (NO_2) over the 1980-2010 period, as simulated by the Community Atmospheric Model (CAM4-Chem). Simulated trends are compared with temporal changes derived from different satellite and ground-based observations, with a focus on Europe, North America and Eastern China regions. Results of simulations using the Hadley Centre Coupled Model-United Kingdom Chemistry and Aerosols model (HadGEM3-UKCA) are included in the analyses.
Similar negative trends in the CO and NO_2 tropospheric columns are generally observed in both CAM4-Chem and HadGEM3-UKCA simulations and measurements, especially in Europe and the USA. Significant model-observation differences in CO and NO_2 trends are shown in other regions. During the 2000-2010 period, CAM4-Chem simulated an increase in CO column trends while MOPITT reported a decrease in Eastern China, in contrast with the significant increase in anthropogenic CO emissions during this period. Such

differences could be linked to several factors such as uncertainties in the chemical dynamical schemes included in the model, as well as inaccuracies in the satellite retrievals, or in the surface emissions, which mainly drive the CO trends. Temporal changes in tropospheric NO_2 columns from model simulations were consistent with satellite observations as well as surface measurements from the US-EPA and EMEP networks in Europe and the USA. However, the magnitudes of modeled trends were generally lower than those from satellite and surface observations.