Geophysical Research Abstracts
Vol. 15, EGU2013-151-1, 2013
EGU General Assembly 2013

Free-Troposphere ozone and carbon monoxide over the North Atlantic for 2001-2011

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In-situ measurements of ozone (O_3) and carbon monoxide (CO) over the mountaintop PICO-NARE station located in the Azores are analyzed together with results from atmospheric chemical transport modeling and satellite remote sensing data to examine the evolution of free-troposphere ozone and CO over the North Atlantic for 2001-2011. The GEOS-Chem chemical transport model captured the seasonal cycles for CO and O_3 well but biased low for CO, particularly in springtime. Statistically significant (significance level of 0.05) decreasing trends were found for both O_3 and CO based on statistic analysis of the observational data. The best estimates for the trends of ozone and CO are -0.2 and -0.3 ppbv/year respectively. These decreasing trends were confirmed with GEOS-Chem simulation results. These decreases have been partly attributed to the decreases in North American emissions over this period, which more than offset the impacts on North Atlantic background O_3 and CO from emission increases in Asia. Additional factors including climate change that could potentially contribute to these trends are also explored through both statistical analysis and sensitivity model simulations.