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Current status of the ability of the GEMS/MACC models to reproduce the tropospheric CO vertical distribution as measured by MOZAIC

Nellie Elguindi and the MACC Team
(soln@aero.obs-mip.fr)

Vertical profiles of CO taken from the MOZAIC aircraft database are used to present (1) a global analysis of CO seasonal averages and interannual variability for the years 2002-2007 and (2) a global validation of CO estimates produced by the MACC models for 2004, including an assessment of their ability to transport pollutants originating from the Alaskan/Canadian wildfires. Seasonal averages and interannual variability from several MOZAIC sites representing different regions of the world show that CO concentrations are highest and most variable during the winter season. The inter-regional variability is significant with concentrations increasing eastward from Europe to Japan. The impact of the intense boreal fires, particularly in Russia, during the fall of 2002 on the Northern Hemisphere CO concentrations throughout the troposphere is well represented by the MOZAIC data.

A global validation of the GEMS/MACC GRG models which include three stand-alone CTMs (MOZART, MOCAGE and TM5) and the coupled ECMWF Integrated Forecasting System (IFS)/MOZART model with and without MOPITT CO data assimilation show that the models have a tendency to underestimate CO. The models perform best in Europe and the U.S. where biases range from 0 to -25\% in the free troposphere and 0 to -50\% in the surface and boundary layers (BL). The biases are largest in the winter and during the daytime when emissions are highest, indicating that current inventories only represent the minimum emissions. Data assimilation is shown to reduce biases by up to 25\% in some regions. The models are not able to reproduce well the CO plumes originating from the Alaskan/Canadian wildfires at downwind locations in the eastern U.S. and Europe, not even with assimilation. Sensitivity tests reveal that this is mainly due to deficiencies in the fire emissions inventory and injection height.