Geophysical Research Abstracts
Vol. 14, EGU2012-9586, 2012
EGU General Assembly 2012

The impact of Eastern U.S. megapolis emissions on carbon monoxide and ozone concentrations over Europe

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We analyzed 13 years (1996-2009) of Ozone and 7 years of CO measurements from the MOZAIC program taken during ascent and descent from European airports of commercial airliners. We determined the source regions influencing the measurements with the Lagrangian particle dispersion model FLEXPART. Additionally, we use data from the mountain station Zugspitze and the coastal station Mace Head. The data record from both stations goes from 1995 to 2009.

Subsequently, we grouped the measurements according to the dominant source regions based on the model calculations, distinguishing between measurements dominated by European, North American and Asian emissions, respectively. For North America, we furthermore identified air masses with a strong influence from the east coast megalopolis of Bosnywash (Boston, New York, Washington). Based on our assignment criteria, out of all measurements those dominated by North American samples take a share of about 20% and the Bosnywash regions is dominant for 3% of the total air samples. Therefore, given that the emissions of Bosnywash represent about 12% of the total North American emissions, their influence on European air samples is proportionally slightly higher than their share of North American emission. However, overall the Bosnywash area is shown to have a relatively weak influence on the European atmosphere, without any significant above average concentration event observed in association with Bosnywash related samples.

Additionaly a pure modeling study was performed to investigate the dispersion characteristics of plumes originated from several megacities around the globe. Based on black carbon emissions two artificial compounds were investigated: i) a totally inert tracer ad ii) a tracer subject to wet and dry deposition. The study quantifies how fast the plumes propagate in the atmosphere, how this can influences the human exposure locally and globally and how much of the plume is present and deposit in the sensitive Polar Regions.