



Impacts of forest fires and U.S. outflow on lower free troposphere composition over the central North Atlantic: Interannual variability and conditions during the ICARTT study

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Measurements made at the PICO-NARE station (2.2 km altitude in the Azores Islands, Portugal) during the ICARTT intensive period of summer 2004 and during the previous three summers will be used to assess the impacts of biomass burning and anthropogenic emissions on CO, O₃, and nitrogen oxides in the North Atlantic lower free troposphere. Summertime CO and O₃ levels exhibit significant interannual variability. Long-range transport of emissions from boreal fires in eastern Canada (2002), Siberia (2003), and Alaska and northwestern Canada (2004) caused significant enhancements in CO and O₃. The 2004 fires resulted in the highest summertime CO levels yet observed, as well as significant enhancements in nitrogen oxides, O₃, and black carbon. These observations imply large-scale impacts of upwind ozone formation as well as continuing ozone formation in these aged forest fire plumes. North American pollution export also led to significant O₃, CO and nitrogen oxides enhancements. Transport of North American emissions was apparently the dominant source of CO and O₃ variability in the low-fire year 2001, while biomass-burning impacts dominated in 2003 and 2004.