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Interannual Variability and Trends of CO as seen by SCIAMACHY

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The SCIAMACHY near-infrared satellite instrument was launched in 2002 and currently provides 4 years of global carbon monoxide data. It is shown that the precision of the SCIAMACHY CO measurements is determined by the random instrument noise error. SCIAMACHY CO data with a good precision thus contains useful information for improving knowledge about sources and sinks as well as long-term variability and trends.

The SCIAMACHY data show significant interannual variability, especially between 2003 and 2004, which is mainly due to variability in biomass burning producing large amounts of carbon monoxide (CO). For example, extensive burning in Alaska in July 2004 has been clearly observed with SCIAMACHY, as well as the forest fires in Siberia in Spring 2003 and in Indonesia in 2006. Of particular interest is the interannual variation of CO in the Southern Hemisphere where biomass burning is the main source of CO. SCIAMACHY data clearly show enhanced CO columns over Australia during its biomass-burning season. Chemistry-transport model simulations using the new independent satellite-based GFEDv2 biomass-burning emission data base show a similar temporal and spatial CO distribution, indicating that the observed enhancements are indeed due to biomass burning. It is shown that the new GFEDv2 data base provides a major improvement over model simulations including climatological emissions.

The fact that SCIAMACHY is sensitive to surface CO allows for the observation of enhanced CO columns in both emission areas and in areas that are affected by long-range transport of CO. Investigation of the origin of these observed enhancements over Australia shows a large contribution of CO from South American biomass-burning regions to observed CO total columns over Australian biomass-burning regions during the 2004 fire season of up to 35%, with smaller contributions for 2003. In fact we show that the interannual variation in excess CO in Australia during the biomass-burning season is caused by interannual variation in biomass-burning CO emissions in South America. The results indicate that differences between SCIAMACHY CO and model simulations over Australia are not only due to uncertainties in local emissions but also in overseas emissions followed by efficient long-range transport. Thus, in order to understand long-term variability in CO global scale studies combining local emissions and long-range transport should be performed.