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Five year SCIAMACHY IMLM CO total columns: interannual variability, transport and biomass burning

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We present results from five years (2003-2007) of SCIAMACHY carbon monoxide (CO) total column measurements. Various episodes of enhanced CO related to long-range transport and/or biomass burning can be identified, e.g., biomass burning in Indonesia in 2006, which leads to much more enhanced CO than in other years both over land and over the oceans. Biomass burning in Amazonia shows significant interannual variation and pollutes a large part of the southern hemisphere. Certain pollution episodes are identified in the SCIAMACHY observations which are not present in model results, e.g., the Alaskan fires in July 2004 increase CO for a large part of the Northern Hemisphere, suggesting that the SCIAMACHY observations can be used to improve CO emissions inventories. We validate the SCIAMACHY CO total column observations with independent FTIR CO total column observations, and show that, given differences in collocations, instrument-noise errors and vertical sensitivity, there is in general a good agreement between observed seasonal cycles and interannual variability. The validation of the SCIAMACHY CO total column observations also highlights the unique ability of the SCIAMACHY near-infrared observations to probe the troposphere down to the surface, even at (very) high northern latitudes. The ocean surface reflectivity in the near-infrared (NIR) is too small to obtain useful CO columns from SCIAMACHY. However, the NIR cloud reflectivity is large and thus useful information about CO can be derived over clouded ocean scenes. The simultaneously retrieved methane columns can be used to estimate the cloud top height. This greatly enhances the number of useful observations and spatial coverage and allows more detailed studies of long-range transport of CO. Given the relatively large instrument-noise errors and the large spatial resolution of 120x30 km of the single SCIAMACHY CO observations, considerable improvement can be expected from the future TROPOMI mission which will continue the data record of global NIR CO observations.