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## Inter-comparison of four different carbon monoxide measurement techniques and evaluation of the long-term carbon monoxide time series of Jungfraujoch

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**Abstract.** Despite the importance of carbon monoxide (CO) for the overall oxidative capacity of the atmosphere, there is still considerable uncertainty in ambient measurements of CO. To address this issue, an inter-comparison between four different measurement techniques was made over a period of two months at the high-alpine site Jungfraujoch (JFJ), Switzerland. The measurement techniques were Non-dispersive Infrared Absorption (NDIR), Vacuum UV Resonance Fluorescence (VURF), gas chromatographic separation with a mercuric oxide reduction detector (GC/HgO), and gas chromatographic separation followed by reduction on a nickel catalyst and analysis by a flame ionization detector (GC/FID). The agreement among all techniques was better than 2% for one-hourly averages, which confirmed the suitability of the NDIR method for CO measurements even at remote sites. The inter-comparison added to the validation of the 12-year record (1996–2007) of continuous CO measurements at JFJ. To date this is one of the longest time series of continuous CO measurements in the free troposphere over Central Europe. This data record was further investigated with a focus on trend analysis. A significant negative trend was observed at JFJ showing a decrease of  $21.4 \pm 0.3\%$  over the investigated period, or an average annual decrease of  $1.78\%/yr$  ( $2.65 \pm 0.04$  ppb/yr). These results were compared with emission inventory data reported to the Long-range Transboundary Air Pollution (LRTAP) Convention. It could be shown that long range transport significantly influences the CO levels observed at JFJ, with air masses of non-European origin contributing at least one third of the observed mole fractions.

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