

## In Situ CO Measurements at Zugspitze (47°N, 11°E)

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Measurements of carbon monoxide have been performed at the alpine site Zugspitze (2962 m above sea level) since 1990. Over the years different types of instrumentation were employed, comprising gas chromatography with HgO reduction detector (Trace Analytical RGD2) and non-dispersive infrared absorption instruments with and without gas filter correlation technique (TEI 48S and Horiba APMA-360, respectively). For most of the time two devices were operated in parallel. Advantages and drawbacks associated with the different instrumentation are shown. Currently, a vacuum ultraviolet fluorescence CO analyzer (Aerolaser AL5001) is tested in the laboratory for its future operation at Zugspitze.

The CO time series (1990–2003) was analyzed statistically, among others with respect to long-term trend and the temporal behavior of the seasonal variation. While the average annual mole fractions (ranging between 120 and 148 ppb) display just a slight decrease with time, a trend analysis of the monthly means shows interesting interannual variability (Figure 1). A period of decreasing trend from about 1999 to 2001 was followed by a remarkable CO increase in the last 2 years. Simultaneously, the peak-to-peak amplitude of the seasonal cycle decreased to 34 ppb (2002-2003 average), i.e., only 59% of the overall average of 58 ppb. This is due to elevated CO values recorded between September 2002 and September 2003. Based on daily CO mean values, the observed anomalies are put into perspective with recent results in the literature that indicate a strong CO input related to biomass burning in the Northern Hemisphere.

Moreover, the CO data from Zugspitze have been used as an indicator for anthropogenic pollution when filtering surface ozone data with respect to different atmospheric conditions, which aims at a suite of specific trend estimates.

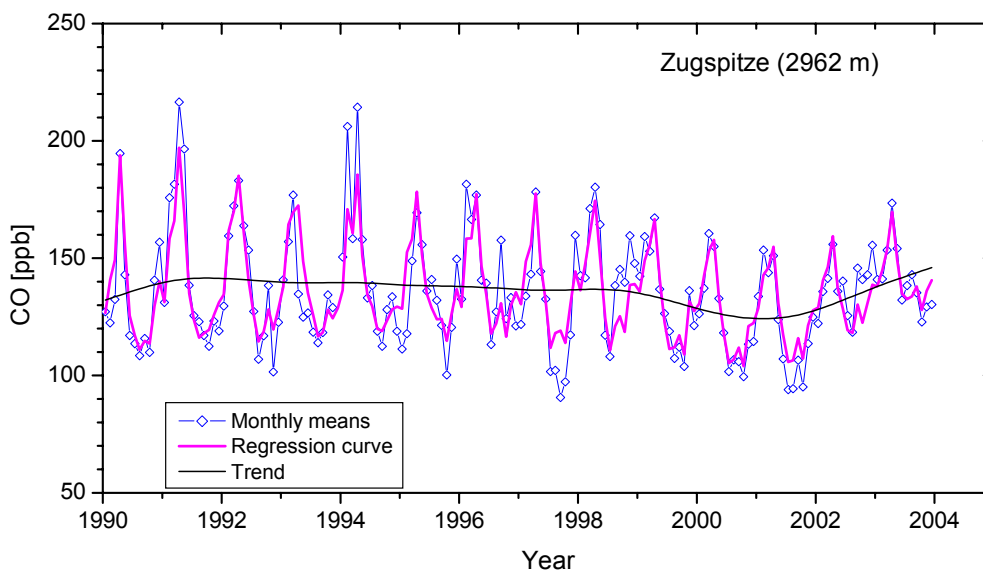


Figure 1. CO monthly means and regression curve from Zugspitze, 1990-2003.