



Continuous atmospheric CO₂ and its $\delta^{13}\text{C}$ measurements (2012-2014) at Environment Research Station Schneefernerhaus, Germany

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This study presents continuous measurement of atmospheric CO₂ and $\delta^{13}\text{C}$ by PICARRO Wavelength-Scanned Cavity Ring Down Spectrometer (WS-CRDS, G1101-i) for a period of two and a half years at the remote Global Atmosphere Watch (GAW) site Environment Research Station Schneefernerhaus (UFS, Germany, 2650 m a.s.l.). Both water vapor and methane concentration show spectroscopic interferences with CO₂ and $\delta^{13}\text{C}$ in this measuring device. Without analyzer upgrade to account automatically for these effects, we present approaches for corrections for $\delta^{13}\text{C}$ and CO₂ mixing ratio as well as test the precision and stability of the device. The mean annual cycle from May 2012 to November 2014 exhibited peak-to-peak amplitudes of 13.34 ppm for CO₂ and 1.82 ‰ for $\delta^{13}\text{C}$. Regarding CO₂ mean diurnal cycle, daily maxima occurred around noon and daily minima in the afternoon. However, clear seasonal differences can be observed. For $\delta^{13}\text{C}$, the minimum of diurnal cycle occurred in the morning and the maximum in the afternoon with peak-to-peak amplitude of around 0.4 ‰ in summer, 0.2 ‰ both in spring and autumn and no diurnal cycle in winter. HYSPLIT (Hybrid Single Particle Lagrangian Integrated Trajectory Model) was used to calculate 96 hours backward trajectories reaching at UFS with an altitude of 1500 m a.g.l to characterize the origin of air masses transported to the site. Trajectories clustering resulted in five major directions, which were from west (41.2 %), southwest (14.8 %), northwest (19.7 %), southeast (12.5 %) and northeast (11.8 %). Wind speed and wind direction showed clear influences on CO₂ mixing ratio. Higher levels of CO₂ mixing ratio were measured at wind speeds higher than 6 m s⁻¹ from the northwest, northeast and southwest. The research is financed by the Bavarian State Ministry of the Environment and Consumer Protection.