



The comparison of two high altitude carbon dioxide records from the Jungfrauoch area (Switzerland) reveals diurnal differences

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Carbon dioxide (CO₂) is the most important anthropogenic greenhouse gas and a major contributor to the current global warming. Over the last 170 years, atmospheric CO₂ shows a continuous increase due to anthropogenic activities. For decades, the Sphinx Laboratory (3570 m a.s.l.) of the High Altitude Research Station Jungfrauoch (Swiss Alps) has been hosting numerous experiments and constitutes a lead location for atmospheric measurements in Europe. A key feature of the site is the remote setting and its exposure to pristine air masses with only sporadic pollution events originating from the lowlands. Since December 2014, we have an additional location available for research at the Jungfrau East Ridge around 120 meters higher up (3690 m a.s.l.) and 1 km westward from the Sphinx Laboratory. This new location is not accessible for tourists and thus is investigated for air quality parameter measurements. Here, we compare two CO₂ records measured at the Sphinx Laboratory and the East Ridge facilities, respectively, (i) to evaluate the suitability of the new site and (ii) to investigate the potential pollution inherent to the touristic exploitation of the Jungfrauoch. Over years, CO₂ values are in agreement and results show robust nighttime values that are indistinguishable within the measurement precision whereas a mean daily difference of less than 1 ppm is seen. These diurnal variations are compared with the planetary boundary layer height data obtained by a ceilometer instrument, multiple climatic parameters and also the number of visitors to Jungfrauoch. Preliminary results indicate that the Sphinx Laboratory is slightly affected by different processes during the day and especially in summer (highest CO₂ excess values for mean summer midday values of maximal 1.5 ppm) that may potentially be due to difference in air mass movements or to the number of visitors. Other factors may also be involved in these diurnal variations. Nevertheless, a first source of anthropogenic contamination has already been minimized onsite. Since spring 2017, tourists are informed about sensitive measurements being done at Jungfrauoch and are asked not to smoke on the tourist terrace, which helped to reduce the aerosol emissions. Yet, for CO₂ this had no effect. In summary and as expected, our preliminary results show the suitability of the East Ridge as an additional new location to perform high quality atmospheric measurements.