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A low-power consumption device for CO2 monitoring in cave environments

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Karst systems are known to be highly heterogeneous environments with complex hydrology and transient ventilation regimes. Consequently, the subsurface pCO_2 varies in space and time, and is locally significantly increased as compared to the outside atmosphere. Studying carbon dioxide fluctuations is therefore fundamental to assess dissolution and precipitation rates of calcium carbonate in caves. Unfortunately, commercially available devices rarely suite the specific criteria required for cave monitoring and many systems face severe limitations due to power supply and/or electronics failure. Here we present a new energy-efficient device for the long-term monitoring of pCO_2 in cave environments. This hand-held instrument was specifically developed for extreme monitoring conditions (i.e. low temperatures, high relative humidity, muddy galleries, etc) and successfully tested for several months in alpine caves. Preliminary results demonstrate that precise measurements can be achieved with high temporal resolution (i.e. $\geq 1 h^{-1}$) over $\geq$6 months without significant drift. The first applications therefore demonstrate the suitability of our instrument also for speleothem research, particularly in remote cave settings.