Environmental Influences on a network of low-cost CO_2 sensors

Centre for Applied Geoscience
Environmental Physics

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Session UP1.5: Atmospheric measurements

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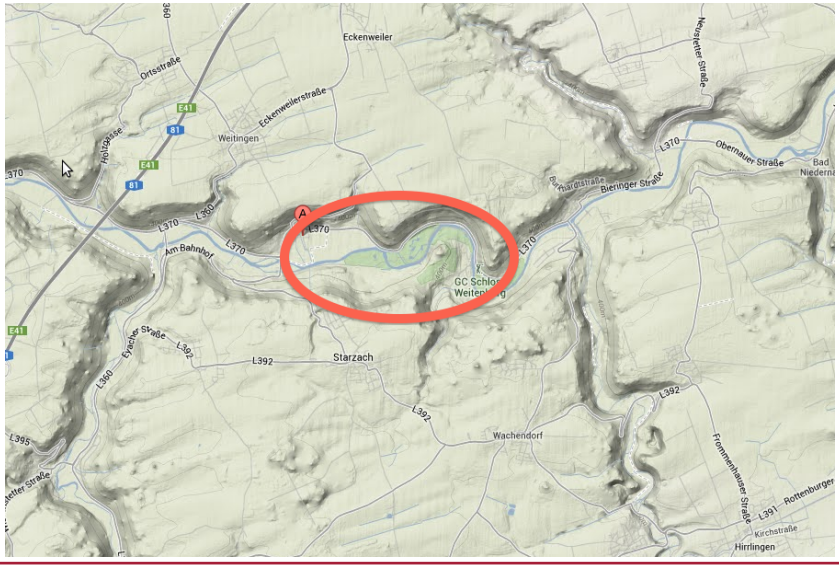
CO_2 Monitoring Project

- **Goal: Estimating the CO_2 fluxes in the Eyach valley**
- Funding
  - previously: Alfred-Teufel Foundation
  - currently: German Research Foundation (DFG)
- Sensor network based on Arduino microcontrollers 
  - low-cost sensors  
  - very flexible and easily expandable
- backed by LICOR LI-840A  and (evtly.) IRGASON 
- Live-data soon published on the **OpenSenseMap.org**

Eyach Valley



Mofettes

Influence of Mofettes

SenseAir LP8 sensor

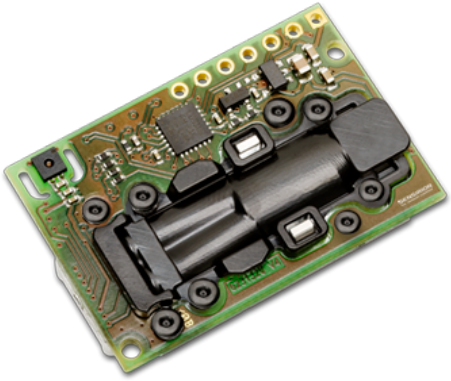
STANDARD SPECIFICATION

Operating principle	Non-dispersive infrared (NDIR)
Measurement range [CO_2]	0–2000ppm
Operation range	0–50°C, 0–85%RH non condensing
Accuracy [CO_2]	±50ppm ±3% of reading [1, 2]
RMS noise [CO_2]	14ppm @ 400ppm @ 25°C 25ppm @ 1000ppm @ 25°C
Accuracy temperature	±0.7°C
Power supply	2.9–5.5V
Peak current	125mA @ 25°C
Average current 16s measured period	225µA [3, 4]
Measurement period	≥16s
Dimensions max.	33.4 x 19.9 x 12.4mm (L x W x H)
Sensor lifetime expectancy	>15 years
Communication	UART (host - slave protocol)

source: https://senseair.com

Sensirion SCD30 sensor

- NDIR CO_2 sensor technology
- Integrated temperature and humidity sensor
- Best performance-to-price ratio
- Dual-channel detection for superior stability
- Small form factor: 35 mm x 23 mm x 7 mm
- Measurement range: 400 ppm – 10.000 ppm
- Accuracy: ±(30 ppm + 3%)
- Current consumption: 19 mA @ 1 meas. per 2 s.
- Energy consumption: 120 mJ @ 1 measurement
- Fully calibrated and linearized
- Digital interface UART or I^2C



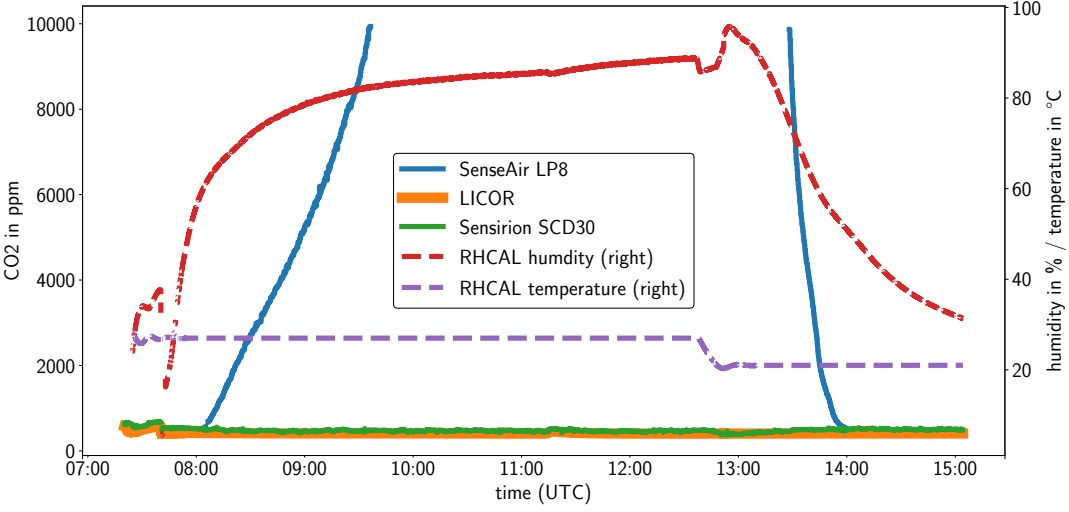
source: `https://sensirion.com`

Sensor Check Experiment Setup

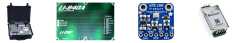
Calibration Profile

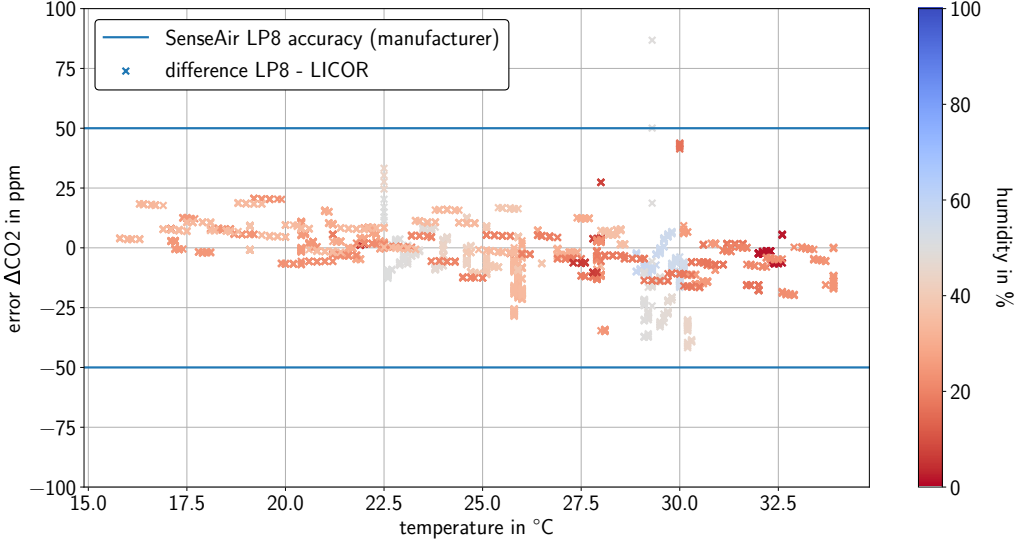




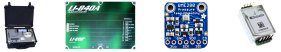


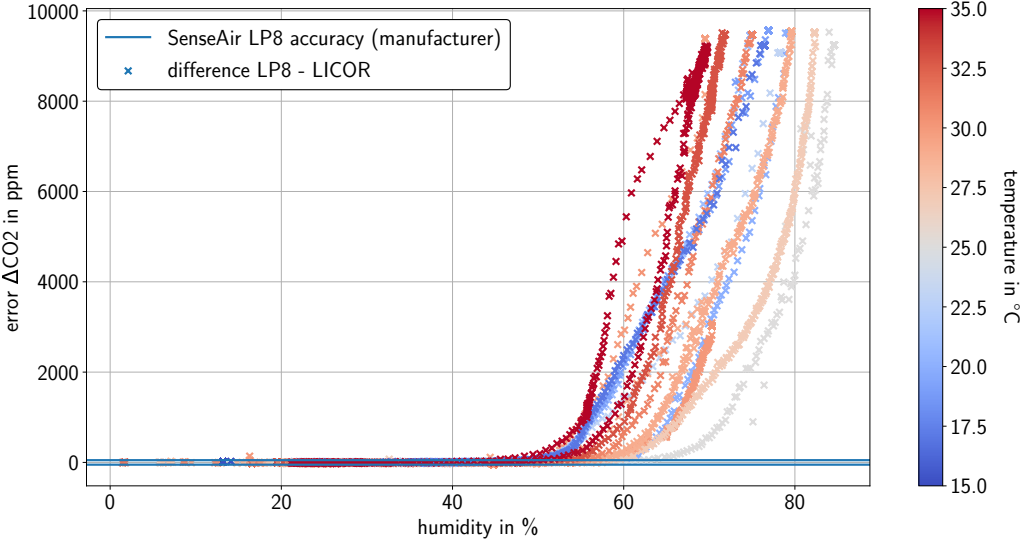
SenseAir LP8 Temperature Dependence





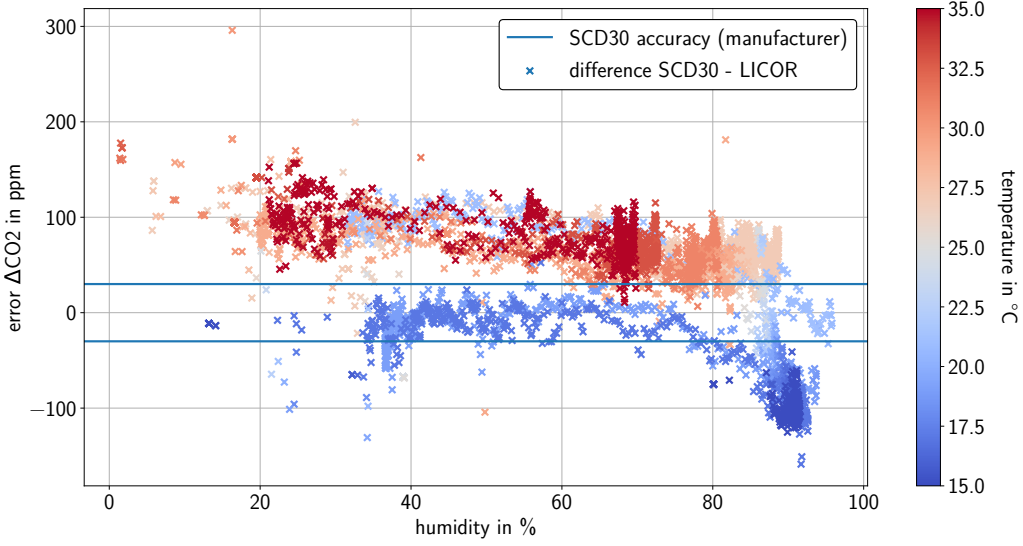
LP8 Humidity Dependence



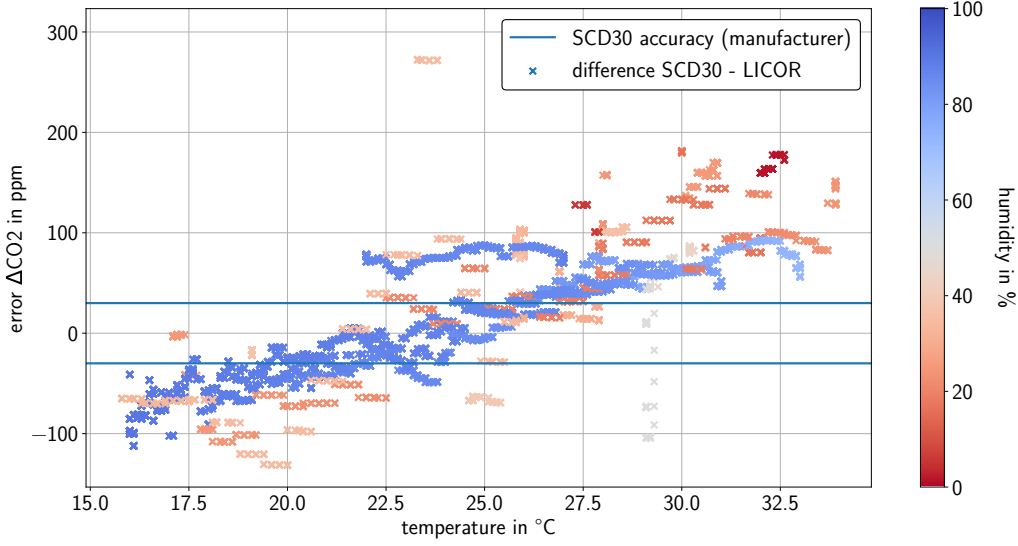


Sensirion SCD30 Humidity Dependence



Sensirion SCD30 Temperature Dependence



SenseAir LP8 vs. Sensirion SCD30

influence of	 SenseAir LP8	 Sensirion SCD30
temperature	negligible	▶ slight linear trend ▶ best at 25 °C ▶ no hysteresis
humidity	▶ extreme at $RH > 50\,\%$ ▶ exponential relation ▶ strong hysteresis	▶ slight linear trend ▶ slight hysteresis ▶ best when dry**ing** and cooler

Thanks for Your Attention!

Contact

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@Umphy_

Material


https://wikimedia.org


https://co2meter.com


https://instrumart.com

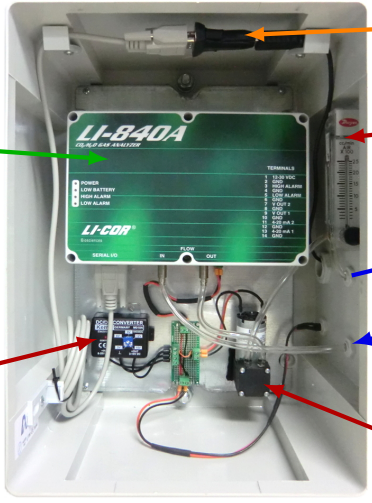

https://sensirion.com


https://adafruit.com


https://reichelt.de


https://campbellsci.com

LICOR LI-840A Setup



USB-to-Serial adaptor

flow control valve

LICOR LI-840A

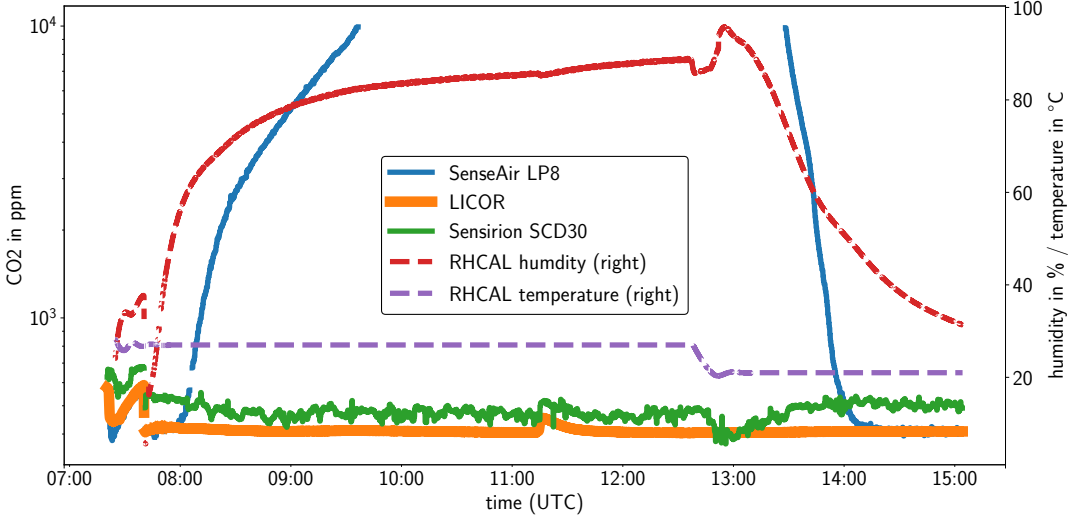
air outflow

air inflow

DCDC-converter
for the pump

pump

Calibration Profile - Logarithmic Scale



LP8 Humidity Dependence -Logarithmic Scale