A microcontroller-based automatic rain sampler for stable isotope studies

Nils Michelsen[1], Gerrit Laube[2], Jan Friesen[2], Khalid Al-Mashaikhi[3], Thomas Müller[2]

[1] Institute of Applied Geosciences, Technische Universität Darmstadt, Germany; michelsen@geo.tu-darmstadt.de
[2] Helmholtz-Centre for Environmental Research – UFZ, Leipzig, Germany
[3] Ministry of Regional Municipalities and Water Resources, Salalah, Sultanate of Oman

TECHNISCHE
UNIVERSITÄT
DARMSTADT

HELMHOLTZ | CENTRE FOR ENVIRONMENTAL RESEARCH – UFZ

1. Motivation

Automatic rain samplers represent a convenient way to sequentially collect samples on various time scales (minutes to weeks). Yet, most commercially available models are expensive (several thousand Euros) and often do not minimize evaporation effectively, hampering their use in isotope studies.

2. Objectives

Hence, we aimed to develop a robust automatic rain sampler that is...
- low-cost (a few hundred Euros)
- timer-controlled (with freely selectable sampling intervals)
- open source and customizable
- oil-free, but still efficient in reducing post-sampling evaporation
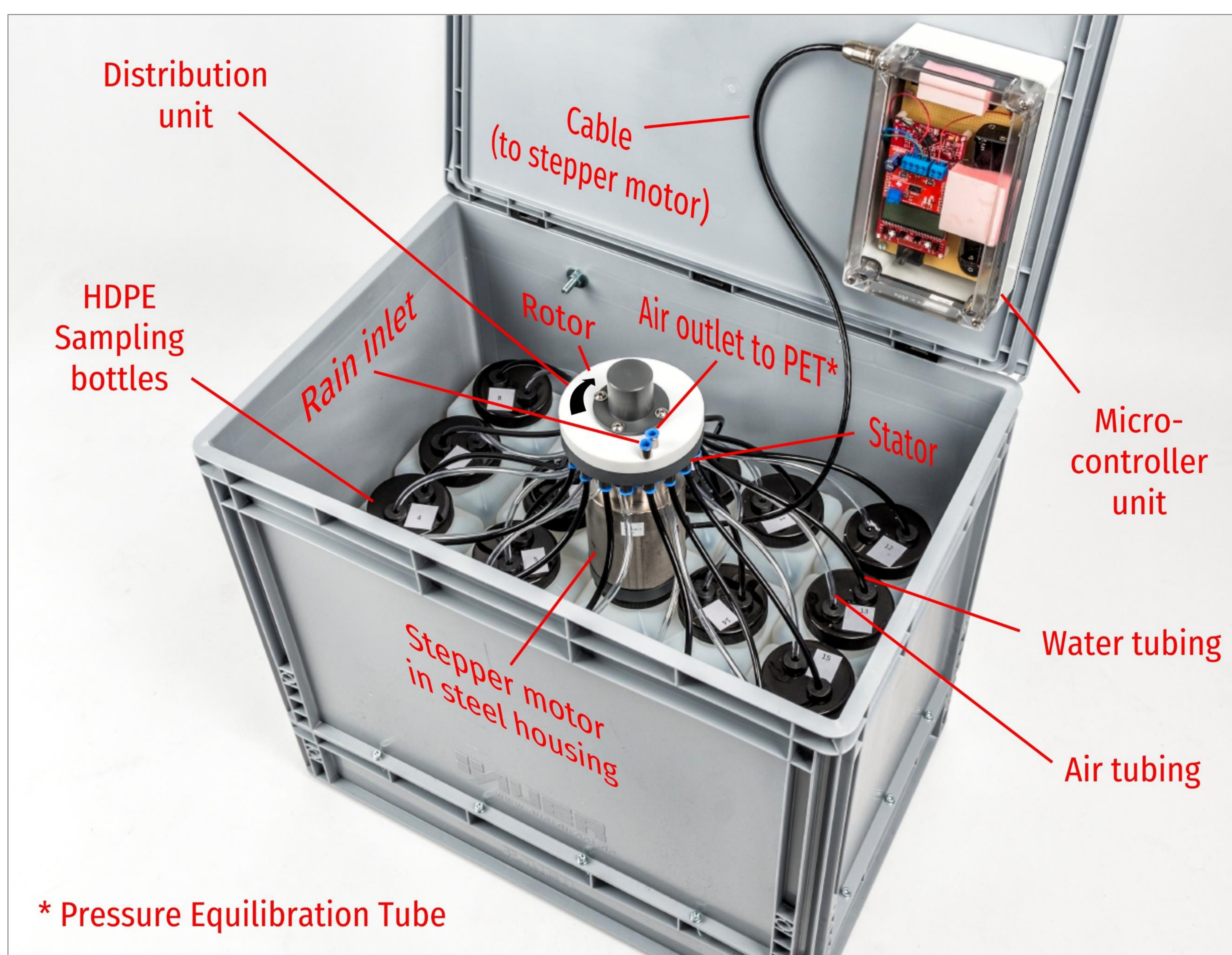
Overview of the automatic rain sampler; note that the Pressure Equilibration Tube (PET; not shown) is shared by the sampling bottles.

3. Design & Work in Progress

A distribution unit (two uniaxial discs with holes) directs the water into HDPE bottles. Displaced air flows back, through the unit, into a shared, 15 m long Pressure Equilibration Tube (cf. Gröning et al. 2012). At the end of the sampling interval, a microcontroller triggers a motor to turn the upper disc (rotor). Thereby, the rotor closes the water and air tubing of the bottle, thus isolating it from the atmosphere. Rain now flows into the next bottle. Initial tests of the basic functional capability were successful. Additional experiments, addressing the evaporation suppression under a range of environmental conditions, are in progress.

4. Acknowledgments

5. References

Gröning, M., et al., 2012. A simple rain collector preventing water re-evaporation dedicated for $\delta^{18}O$ and $\delta^{2}H$ analysis of cumulative precipitation samples. J. Hydrol. 448-449, 195-200.