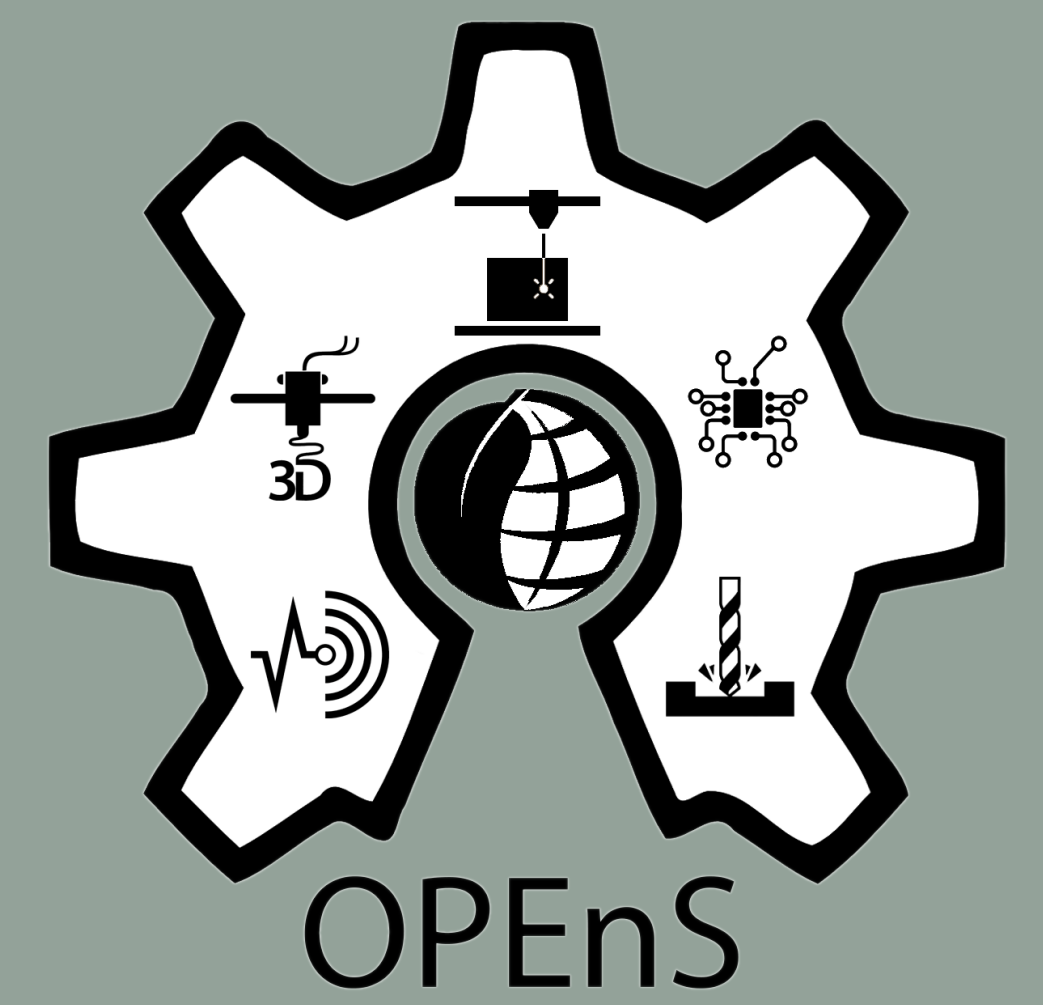




Isotopic Sampler: Evaporation FREE, oil FREE, rain sampling for isotope analysis with minimal maintenance

Gurpreet Singh^{1,2}, ColinHale-Brown¹, Lisabeth N Arellano³, Mitchell Nelke¹, John S. Selker^{1,2}
¹Openly Published Environmental Sensing Lab, ²Department of Biological & Ecological Engineering, Oregon State University, ³University of Houston



Objective

With **isotopes** we can identify the origin of rainwater, but **current sampling technology does not preserve the isotopic signature**. There is a clear need for rainfall Isotopic Sampler that allows evaporation-free sampling and can be deployed for long time periods in remote locations. At the OPeNS lab, we developed a **low-cost, evaporation-free Isotopic Sampler** that can be deployed anywhere to collect up to 3-Litres of rainfall for isotope analysis.



Figure 1. Deployed Isotopic Sampler

Features

- Operating in rain, light snow, and drizzle
- Low Cost (<\$25 with labor)
- Evaporation Free
- Oil Free
- Minimal Maintenance
- 3 - Liter sampling capacity
- Reliable and robust for field operations

Design



Figure 2. Isotopic Sampler deployed in strength test (full 3 l)

- 3-D printed SLA rainfall collector Isotopic Sampler.
- A funnel to guide rainwater to the chamber.
- The buoy sits inside the chamber, starts floating when water enters chamber through funnel to let the water flow to the bag and then seals down to the bag entrance when chamber become empty to prevent the evaporation.
- 3-liter PET-Aluminum foil bag (cost \$0.75 ea.)

Mechanical Components



Figure 3. The top part of the Isotopic Sampler is funnel with 80mm of diameter and inside the funnel is a stainless-steel mesh to prevent blockage. The funnel is screwed to the chamber and directs the water to chamber through 4mm hole at center and let the air out through 4 mm hole at the edge.

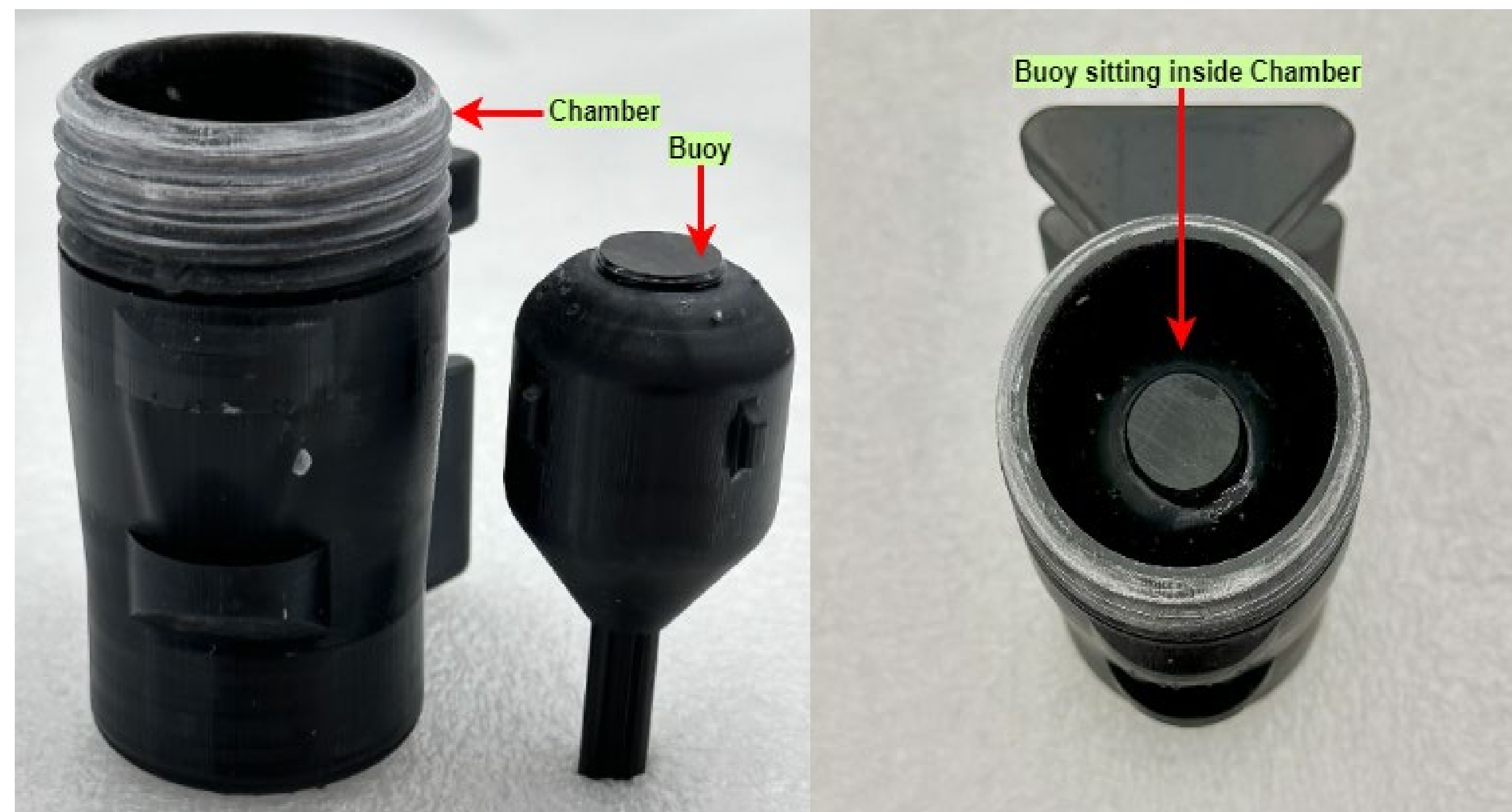


Figure 4. The lower chamber of the Isotopic Sampler screws to a 3-L collection bag. The buoy lets water enter the 3-L bag during rainfall and closes to prevent evaporation when there is no precipitation.

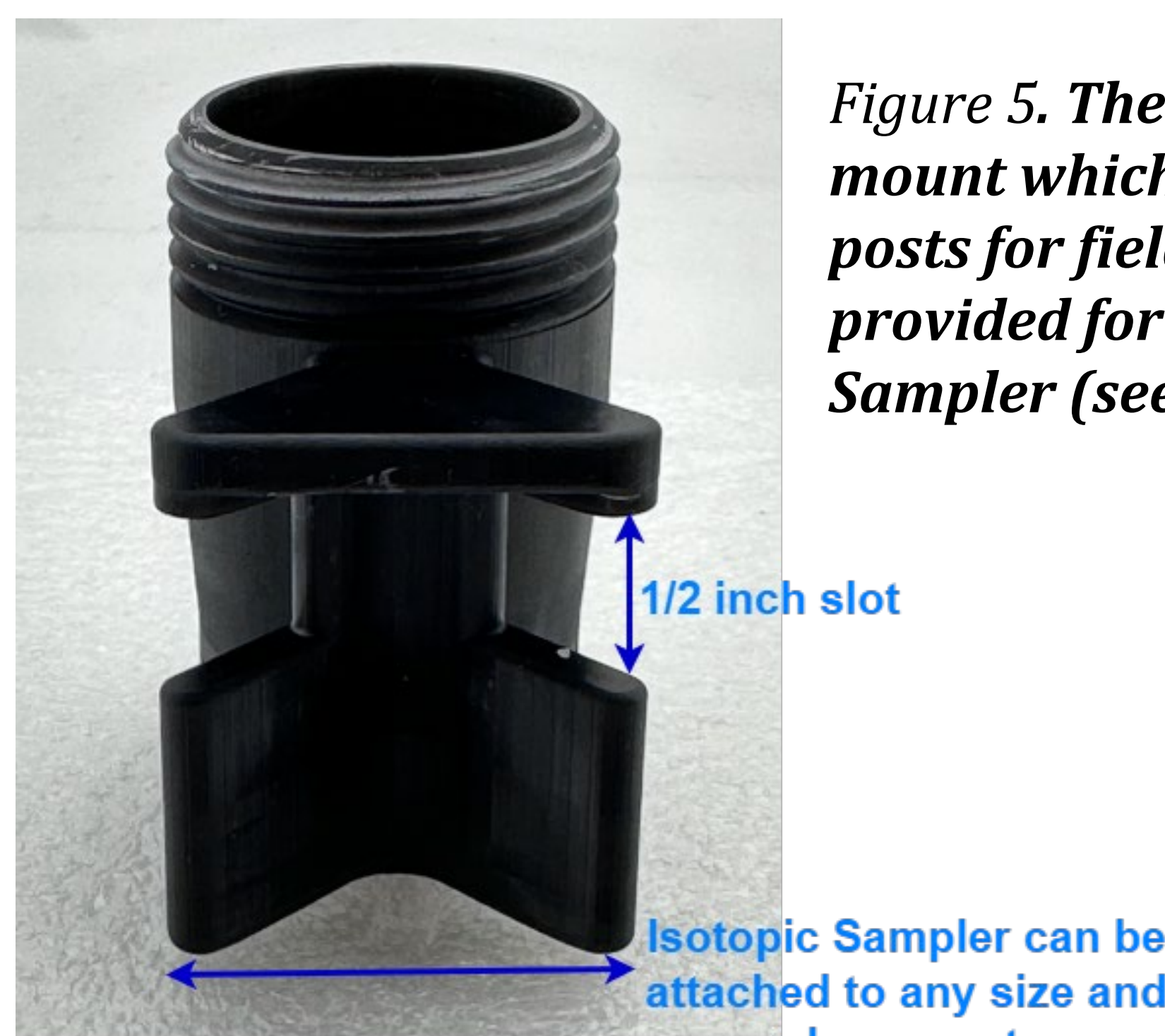


Figure 5. The collector has a built-in mount which fits a wide range of posts for field installation. A 1/2" slot is provided for fixing the Isotopic Sampler (see figure 2).

Field Test Measurements

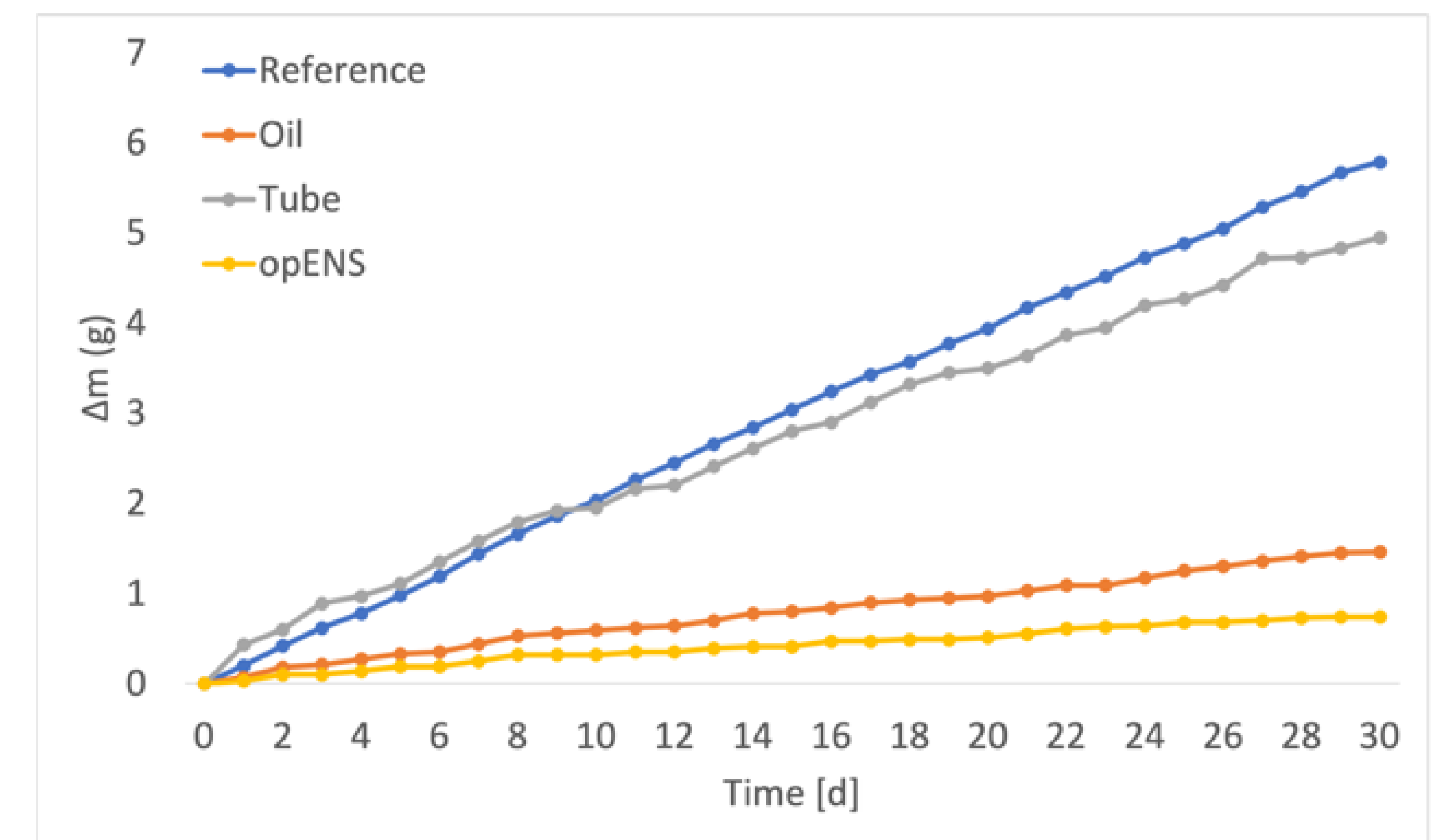


Figure 6. OPeNS Isotopic sampler showed the smallest monthly evaporation loss (less than 1 gram) as compared to other samplers in the oven experiment (over 5 grams) which was started with each 3L collector filled to 15% of its volume to mimic dry conditions (worst case).

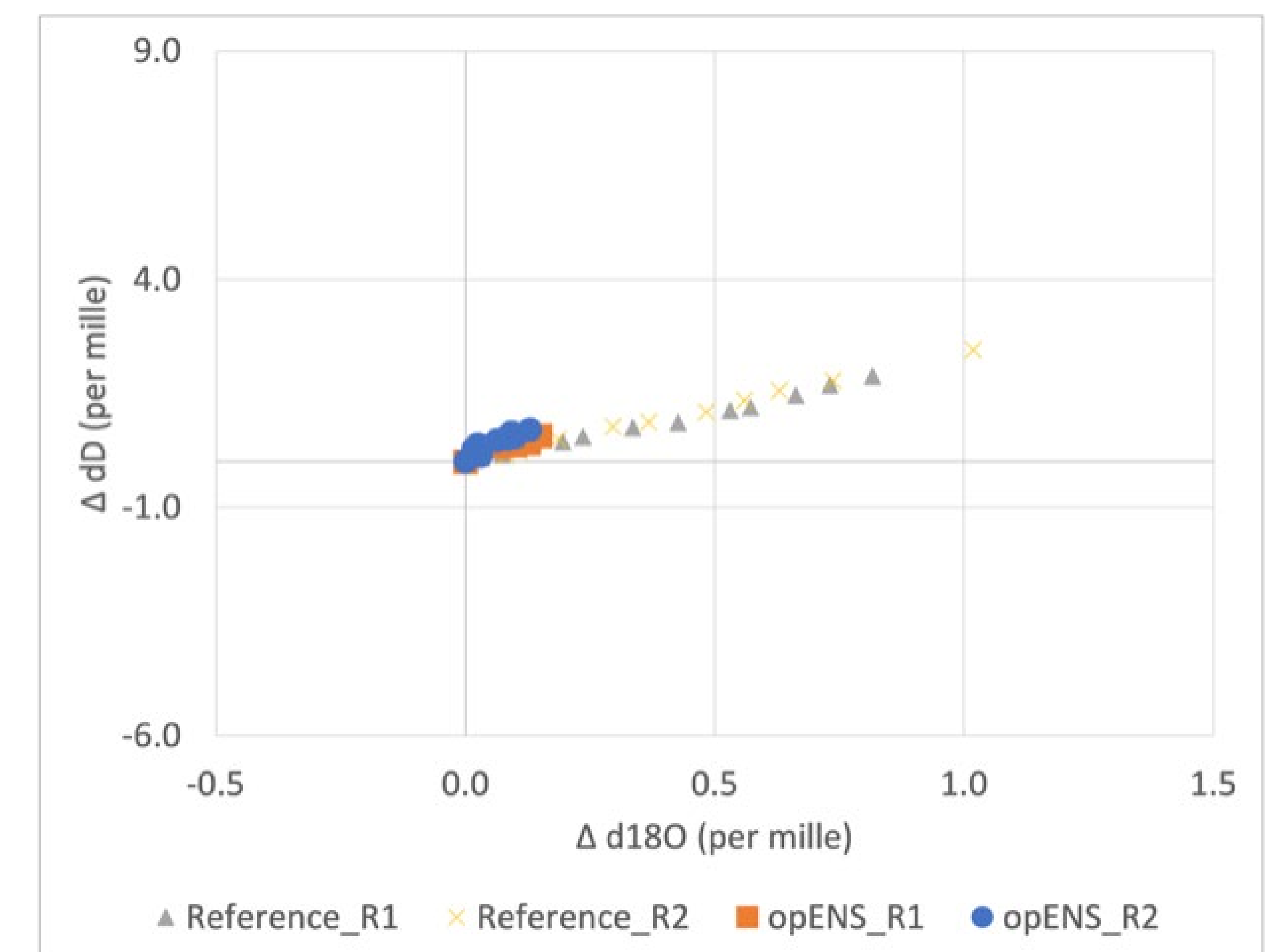


Figure 7. OPeNS Isotopic sampler had 1/5th the change in isotopes in stored water compared to the standard methods (oven experiment)

Conclusion

The Isotopic Sampler has been tested outdoors and in the lab:

- Cost less than 1/10th of standard device
- Effective at collecting precipitation with minimal evaporation (five times better than current standard)
- Easy to deploy at remote locations
- Easy to maintain for longer periods of use (captures up to 1/2 m of rain).

Contact Information

Presenter: Gurpreet Singh
(gurpreet.singh@oregonstate.edu)