## An easy-to-use, low-cost evaporation protection to collect more reliable stable water isotope data with Teledyne ISCO portable samplers

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### QUESTIONS

- How large are the effects of evaporation and vapor exchange on the isotopic composition of automatically collected water samples?
- 2) How can these isotope effects in the automatic water

### **OUR SOLUTION**

Our evaporation protection design modifies the ISCO autosampler bottles using a 100-ml syringe housing and a



### **EXPERIMENTS**





### ANALYSIS

calculated for ve to the isotopic reference water on the day the in the storage ta bottle was filled

#### THE PAPER

J., Knapp, J. L. A., Rücker, and Kirchner, J. W.: e: Evaluation of a low-cost rotection method for







eraporative ctionation Pa 8 0 fractionation: Outdoors, open bottle 🔿 🛇 : fractionation effects >> mixing effects (a vs. b) ۰, evaporative actionation field Indoors, open bottle OO: Mixing dominated over aporative fractionation (c vs. d) retrofitted open sample volume: 
\$\log 200 ml
\$\log 400 m

nple water in bottles with evaporation protection remained unaffected by or mixing and evaporative fractionation, independent of sample volume and /ap npler setting.

#### Experiment C



Stronger isotopic enrichment of the sample water (up to 9.7 ‰) when → Sample bottles were open (blue vs. red symbols) → Vapor pressure deficit (VPD) and air temperature were higher → Variations in VPD and air temperature increased

- Negative effects of sample storage will be largest summer.

Sample water in bottles with evaporation protection remained unaffected by vapor mixing and evaporative fractionation, even in warm summer months.

#### **SUMMARY**

1) How large are the effects of evaporation and vapor exchange on the isotopic composition of automatically collected water samples?

For open bottles, storage durations of >10 days can substantially alter the isotope values in the water samples due to evaporative fractionation and vapor exchange.

The isotope effects can be much larger when ambient conditions are variable and when sample volumes are small

#### 2) How can these isotope effects in the automatic water sampler be reduced?

Our evaporation protection design worked well even under very warm and dry conditions (A, C) because it significantly reduces the contact area between the liquid and vapor phases in the ISCO bottles so that isotopic fractionation is much smaller compared to open bottles.