



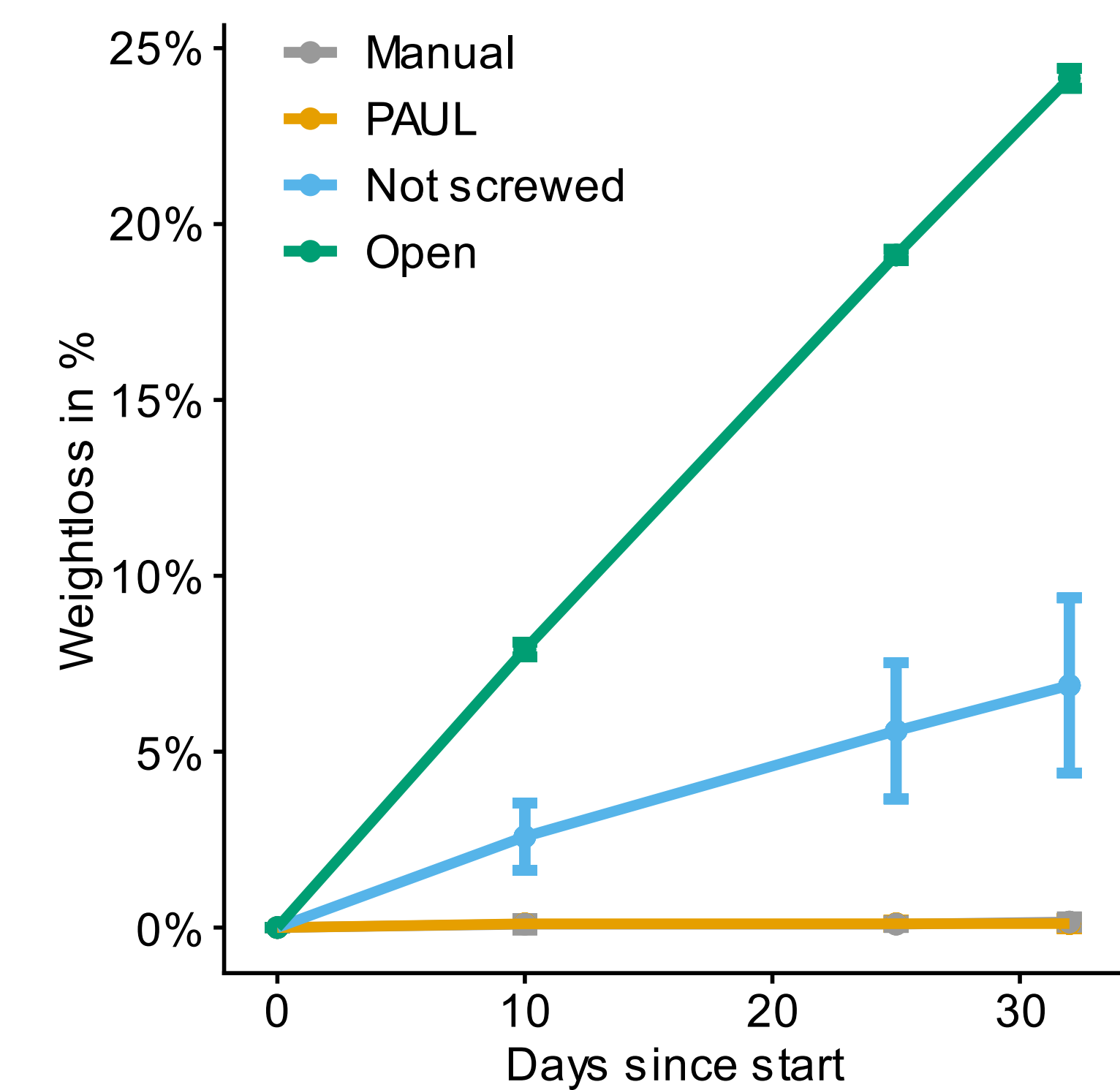
# PAUL: A Novel Autosampler for High-Resolution Isotopic Monitoring in Catchment Hydrology

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## Background

- Reliable water samples are necessary for sound water science, however most autosamplers are not evaporation safe, and therefore may distort sample concentrations

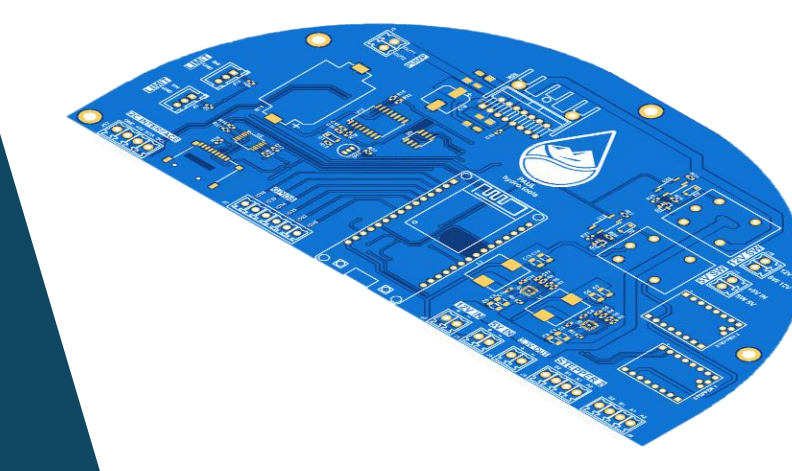
## Evaporation Test



## Portable AUtosampler for Liquids

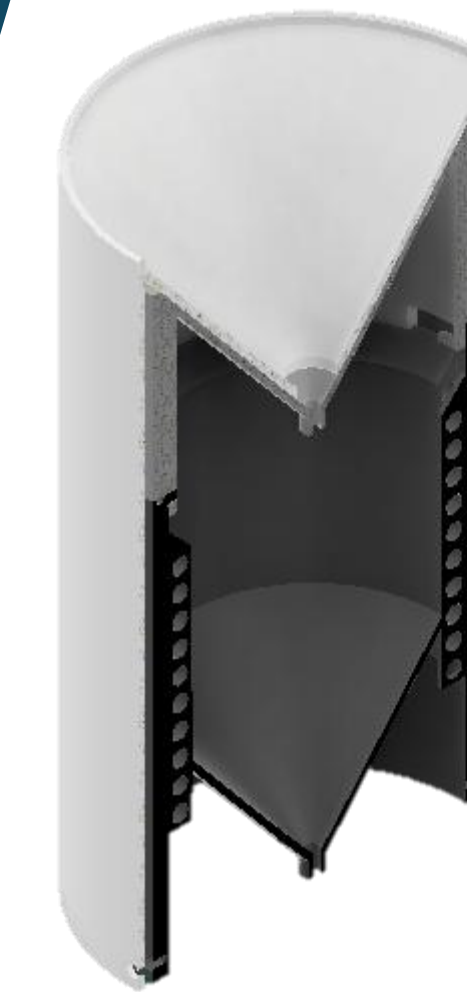
- 22 x 20 ml brown glass bottles being sealed, then fully evaporation save
- Low Power Consumption & Solar Chargeable for longer sampling campaigns
- Programmable filling interval
- Low Cost Production

## Components



- Main parts 3D-printed with PETG
- PCB with microcontroller
- Peristaltic Pump for sample retrieval
- Geared NEMA 17 for movements

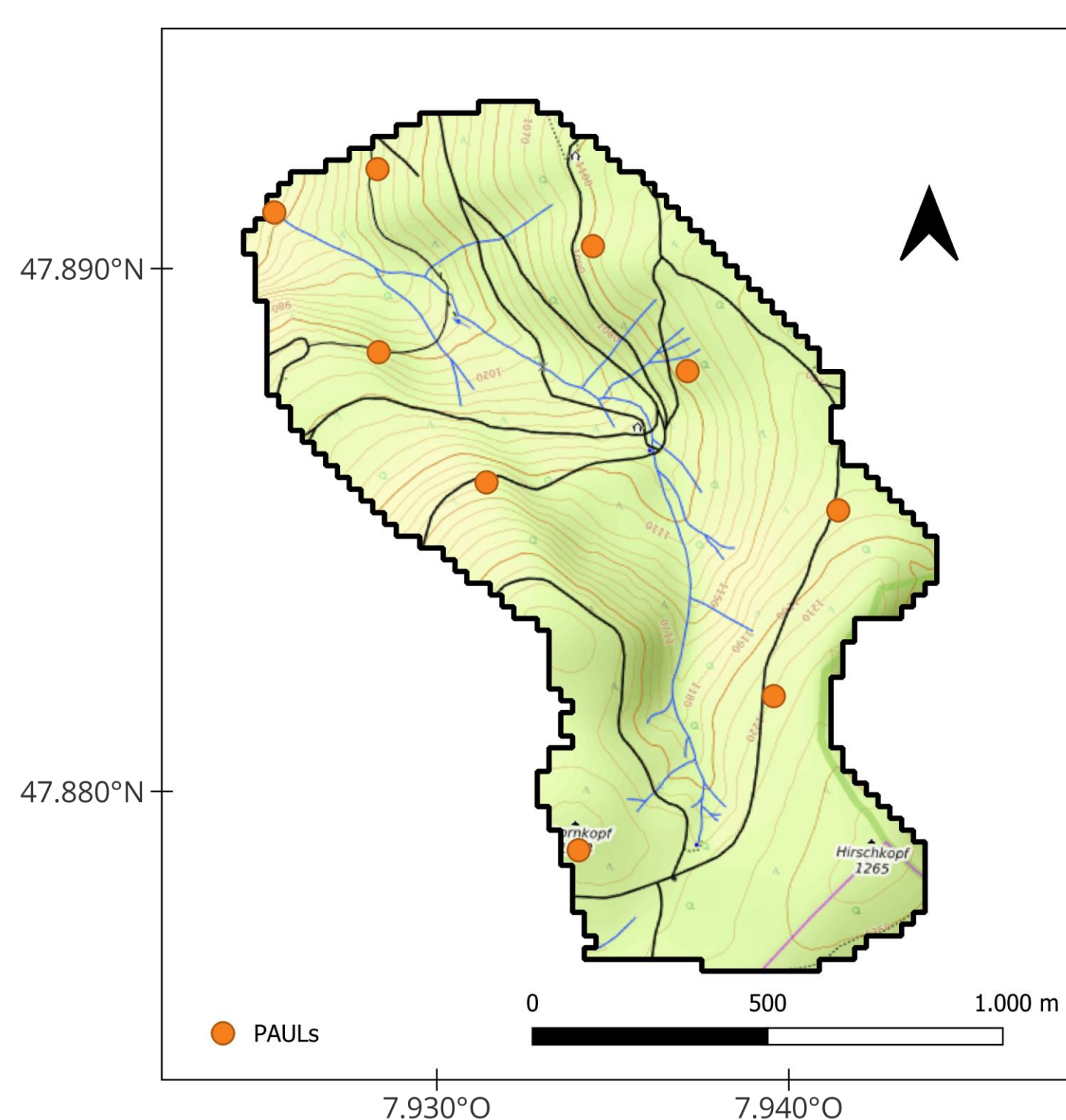
## Precipitation Sampler



- Fully PETG 3D Printed
- Pipe-In-Water & 3 m pressure equilibration coil for evaporation protection
- 750 ml sampling capacity
- White radiation coat

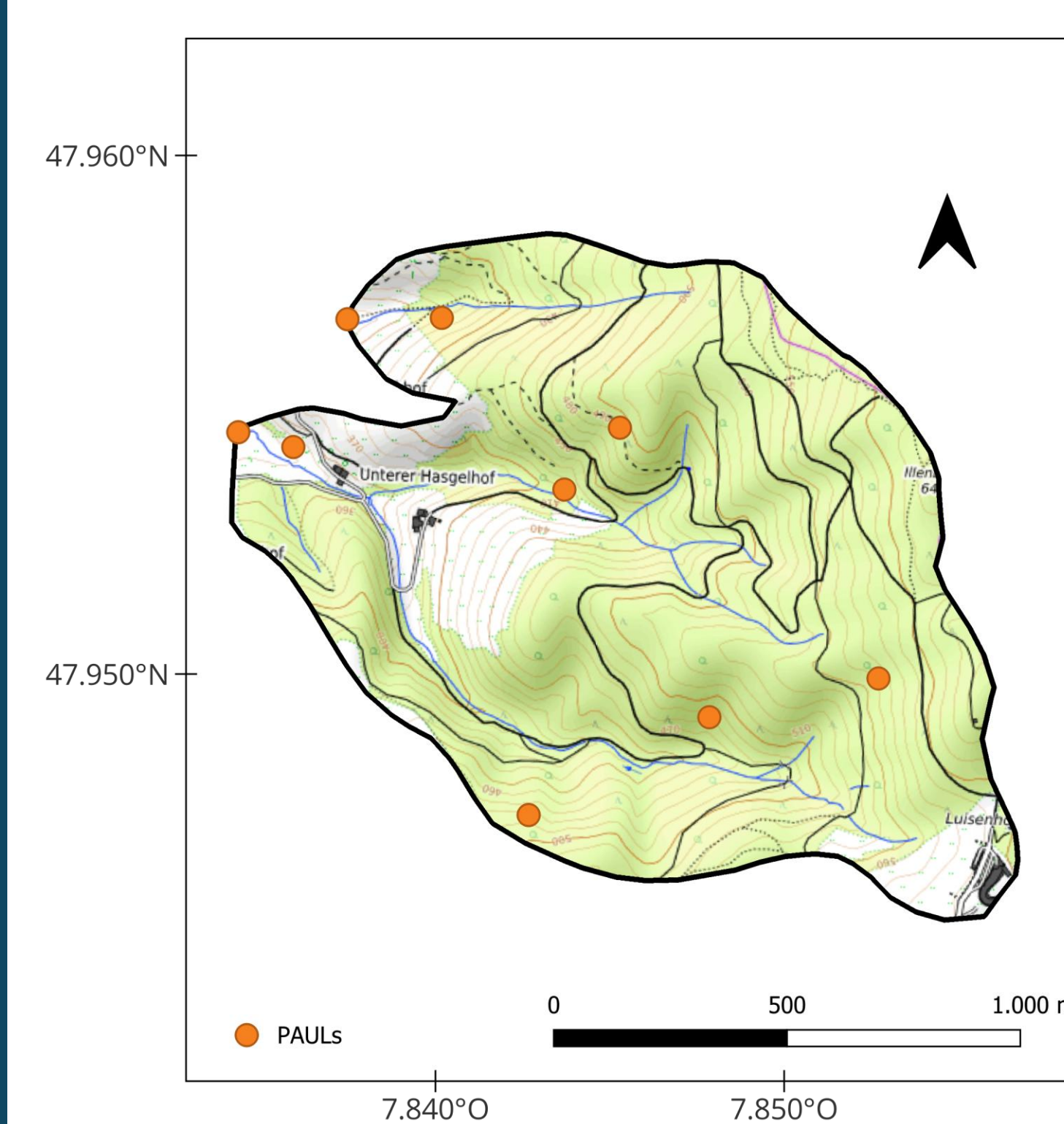
How large is the isotopic variability in of precipitation in small catchments?  
What best explains the variability?

### Krummenbach Catchment



- 9 PAUL Samplers
- 8x Rainfall,
- 1x Streamflow
- Catchment 1.5 km<sup>2</sup>
- Elevation: 895 – 1275 m a.s.l. Gradient Δ 380 m
- Landuse: Mixed & Coniferous Forest
- Sampled Nov.-Dec. 2025

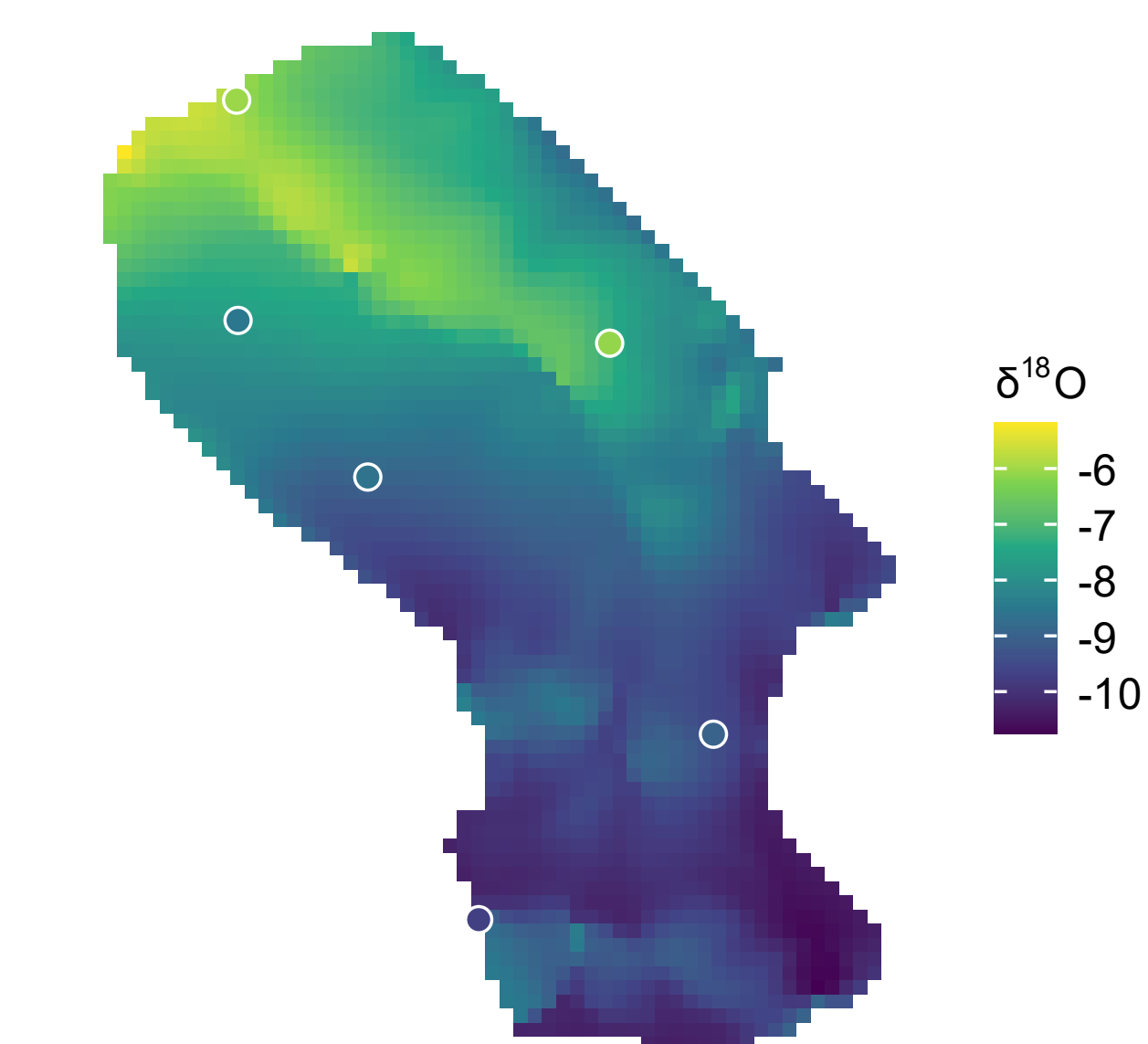
### Ruetlidobel & Eberbach Catchment



- 9 PAUL Samplers
- 7x Rainfall,
- 2x Streamflow
- Catchment 1.8 km<sup>2</sup>
- Elevation: 340 - 585 m a.s.l. Gradient Δ 245 m
- Landuse: Grassland, Mixed & Coniferous Forest
- Sampled Mar. 2026

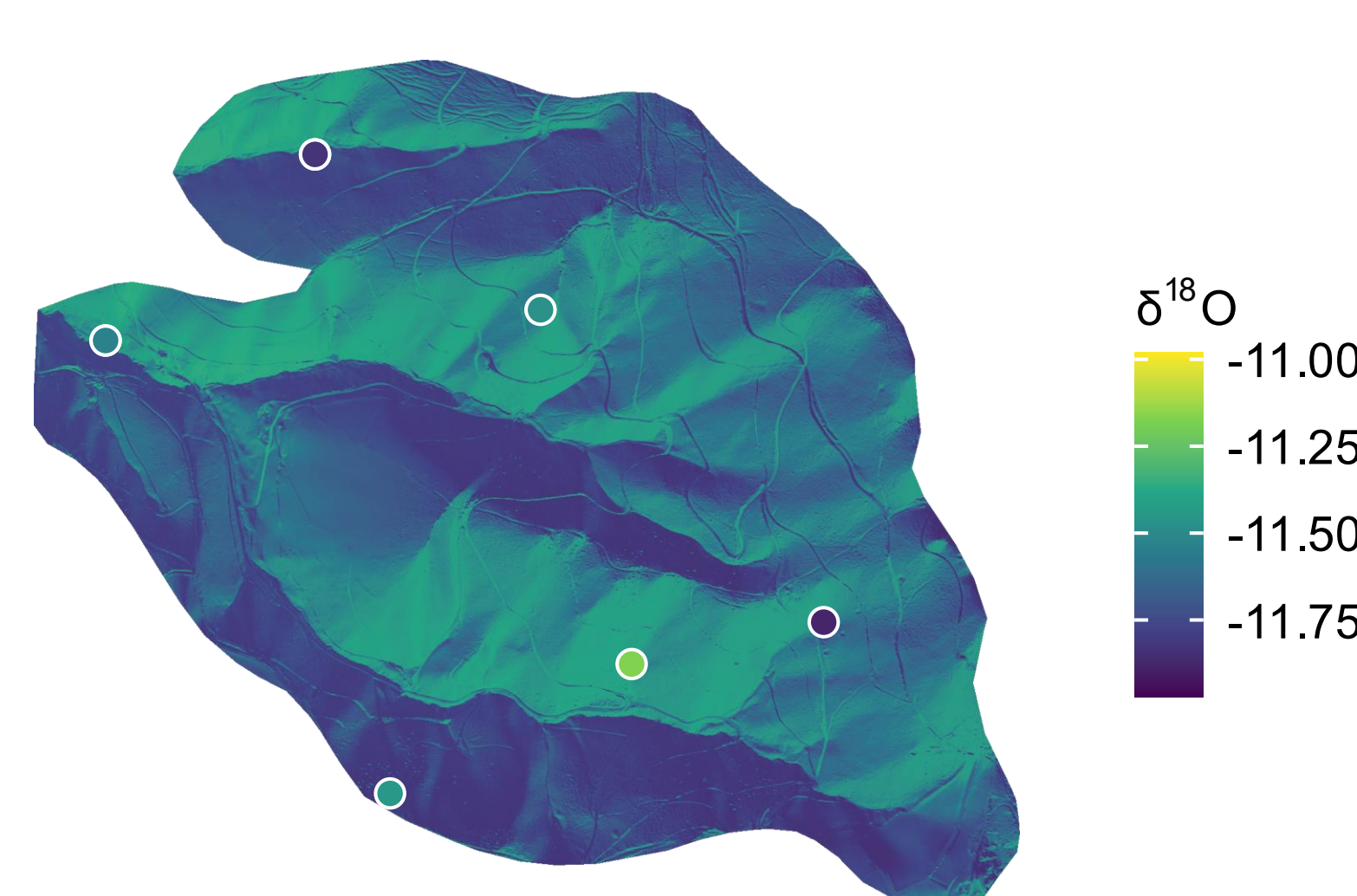
## Predict catchment wide isoscape over elevation and aspect

16-18 December  
R<sup>2</sup> = 0.69



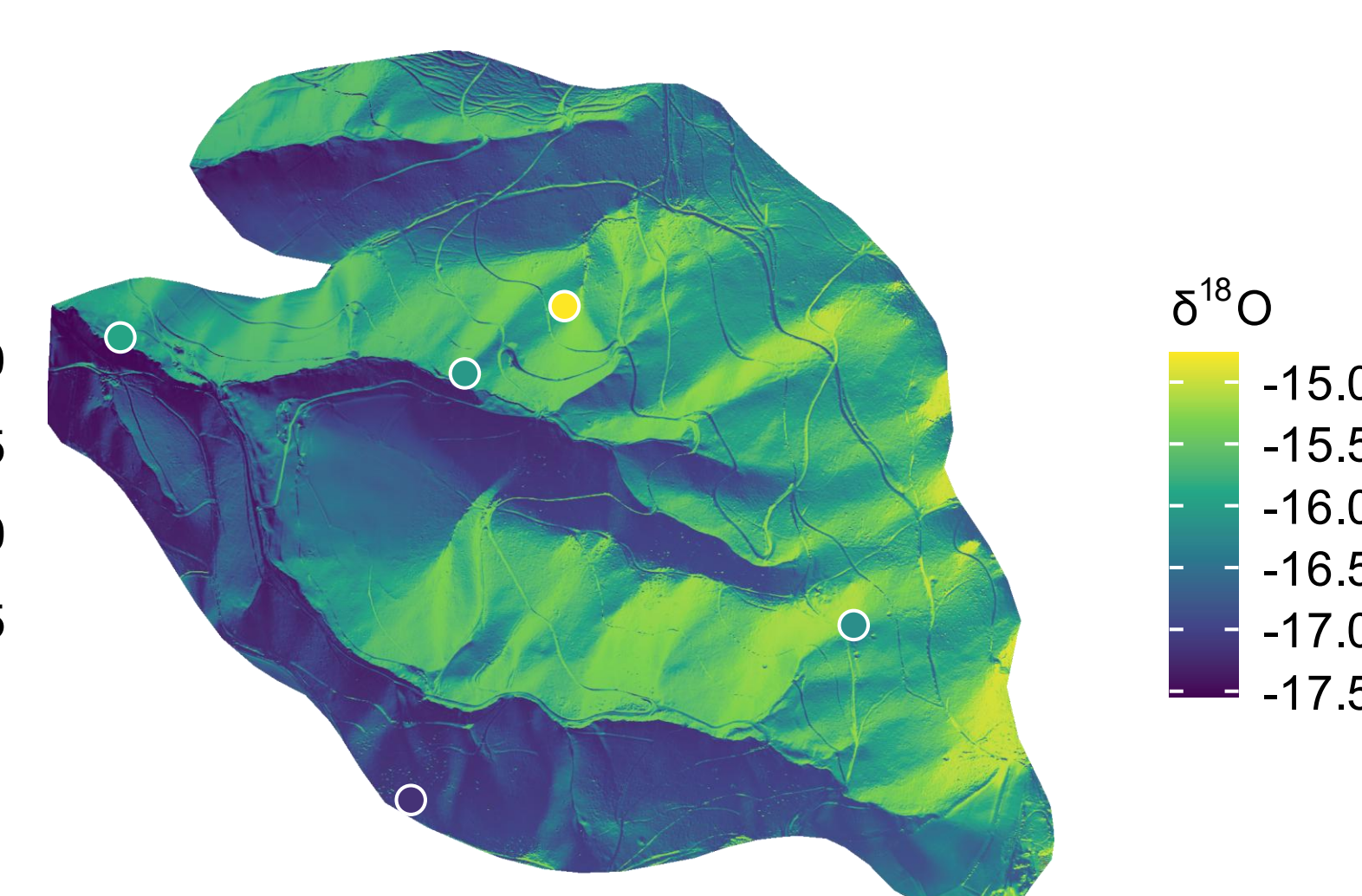
12-13 March  
R<sup>2</sup> = 0.21

☁️ 15.5 mm



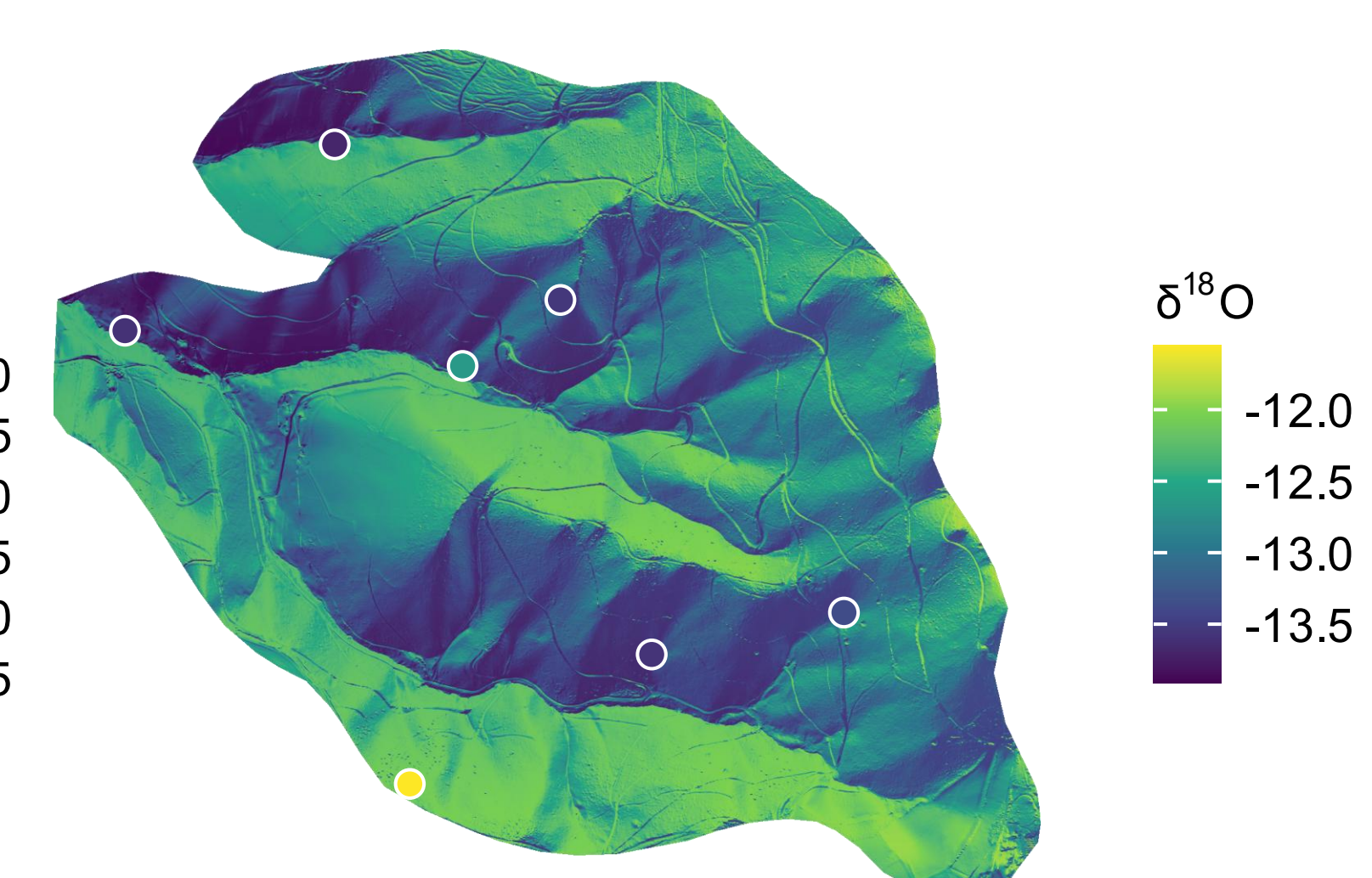
15-16 March  
R<sup>2</sup> = 0.52

☁️ 15.9 mm



26 March  
R<sup>2</sup> = 0.52

☁️ 21.8 mm



- Large spatiotemporal isotopic variability without consistent patterns
- Elevation and aspect partially explain isotopic variability, but more factors need to be included in a model

## Conclusion

- Multiple samplers are needed to adequately capture the isotopic signature of catchment precipitation
- PAUL's low cost enables multi-sampler deployment, ideal for long-term campaigns