

4rd Workshop on soil physics and landscape hydrology -
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WATER STABLE ISOTOPES AT SMALL AGRICULTURAL CATCHMENT NUCICE

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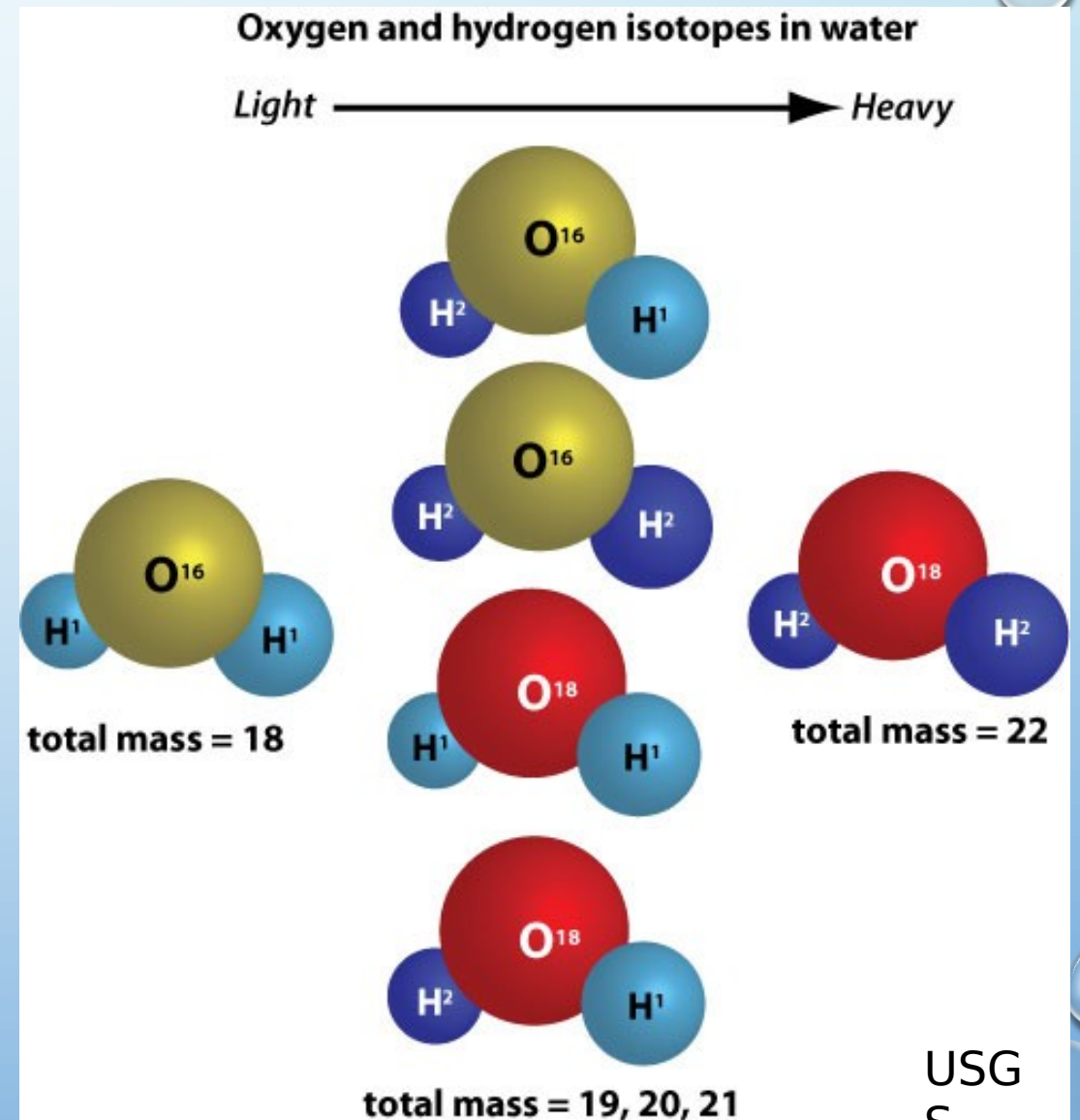


DEPARTMENT OF LANDSCAPE
WATER CONSERVATION

WATER STABLE ISOTOPES IN HYDROLOGY

- STABLE ISOTOPES OF HYDROGEN AND OXYGEN
 - GOOD TRACER
 - HAVE VERY SIMILAR PROPERTIES
 - EXCEPT **ATOMIC WEIGHT**

HEAVIER MOLECULES ARE LESS PRONE TO EVAPORATE



WATER STABLE ISOTOPES IN HYDROLOGY

THE DELTA VALUE

$$\delta^{18}\text{O} = \left(\frac{\left(\frac{^{18}\text{O}}{^{16}\text{O}} \right)_{\text{sample}}}{\left(\frac{^{18}\text{O}}{^{16}\text{O}} \right)_{\text{standard}}} - 1 \right) \times 1000$$

- VIENNA **STANDARD** MEAN OCEAN WATER (VSMOW)
- WORKS THE SAME FOR OTHER ISOTOPES E.G. HYDROGEN

WATER STABLE ISOTOPES IN HYDROLOGY

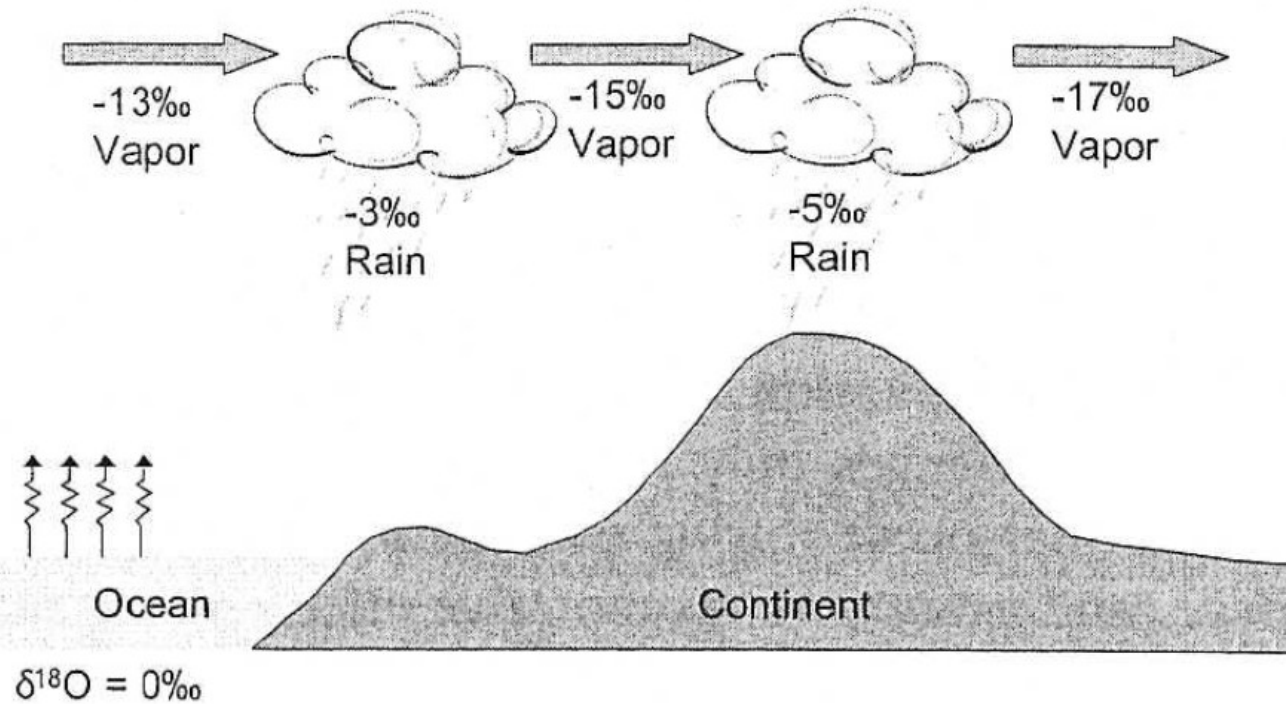


Figure 11.2 The diagram of isotopic composition of atmospheric water vapor over an ocean showing the processes of evaporation and rainout as the air mass proceeds over a continent. (Modified from Siegenthaler 1979.)

WATER STABLE ISOTOPES IN HYDROLOGY

- WHY IS THIS USEFUL?

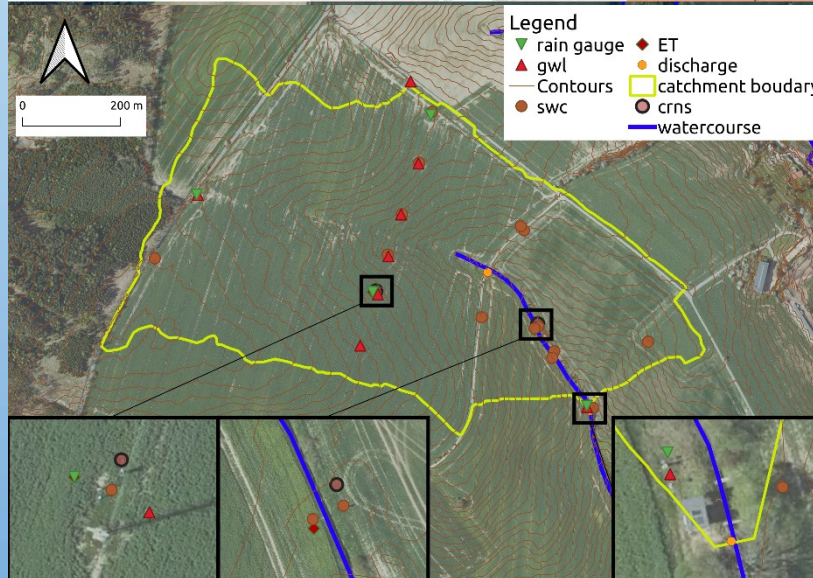
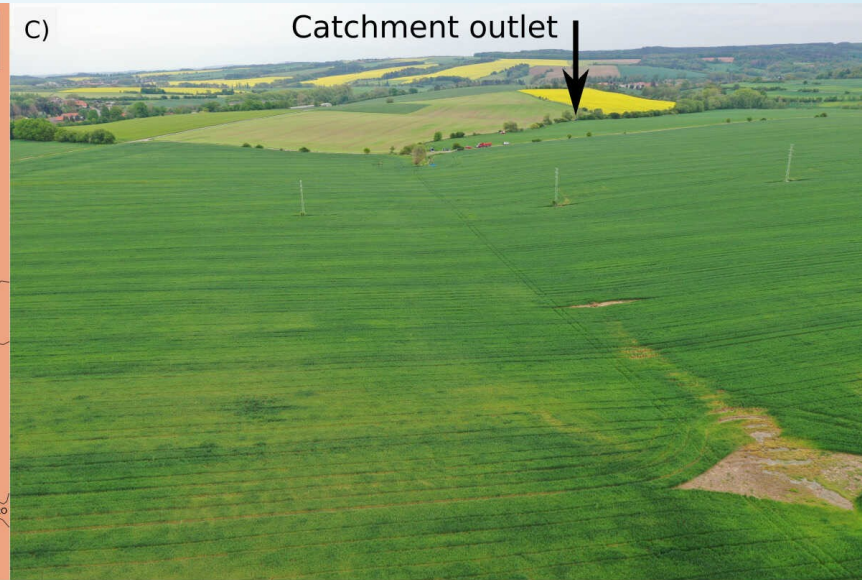
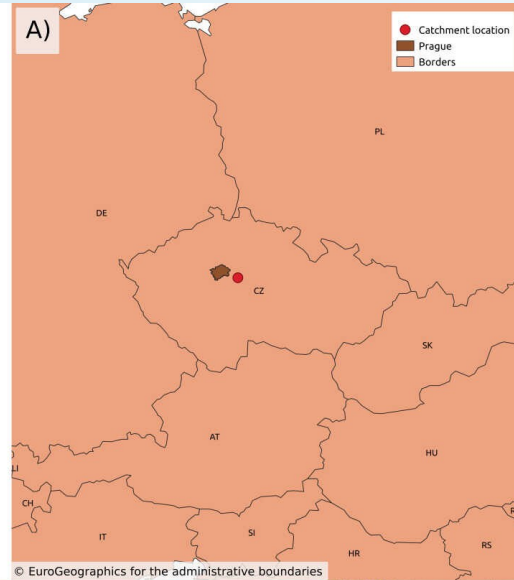
- HYDROGRAPH SEPARATION – DISTINGUISH EVENT AND PRE-EVENT WATER
- TRAVEL TIME DISTRIBUTION – HOW LONG WATER FLOW THROUGH SOILS
- IDENTIFYING WATER SOURCES – WHERE THE WATER COMES FROM
- HYDROLOGIC CONNECTIVITY

WATER STABLE ISOTOPES IN HYDROLOGY

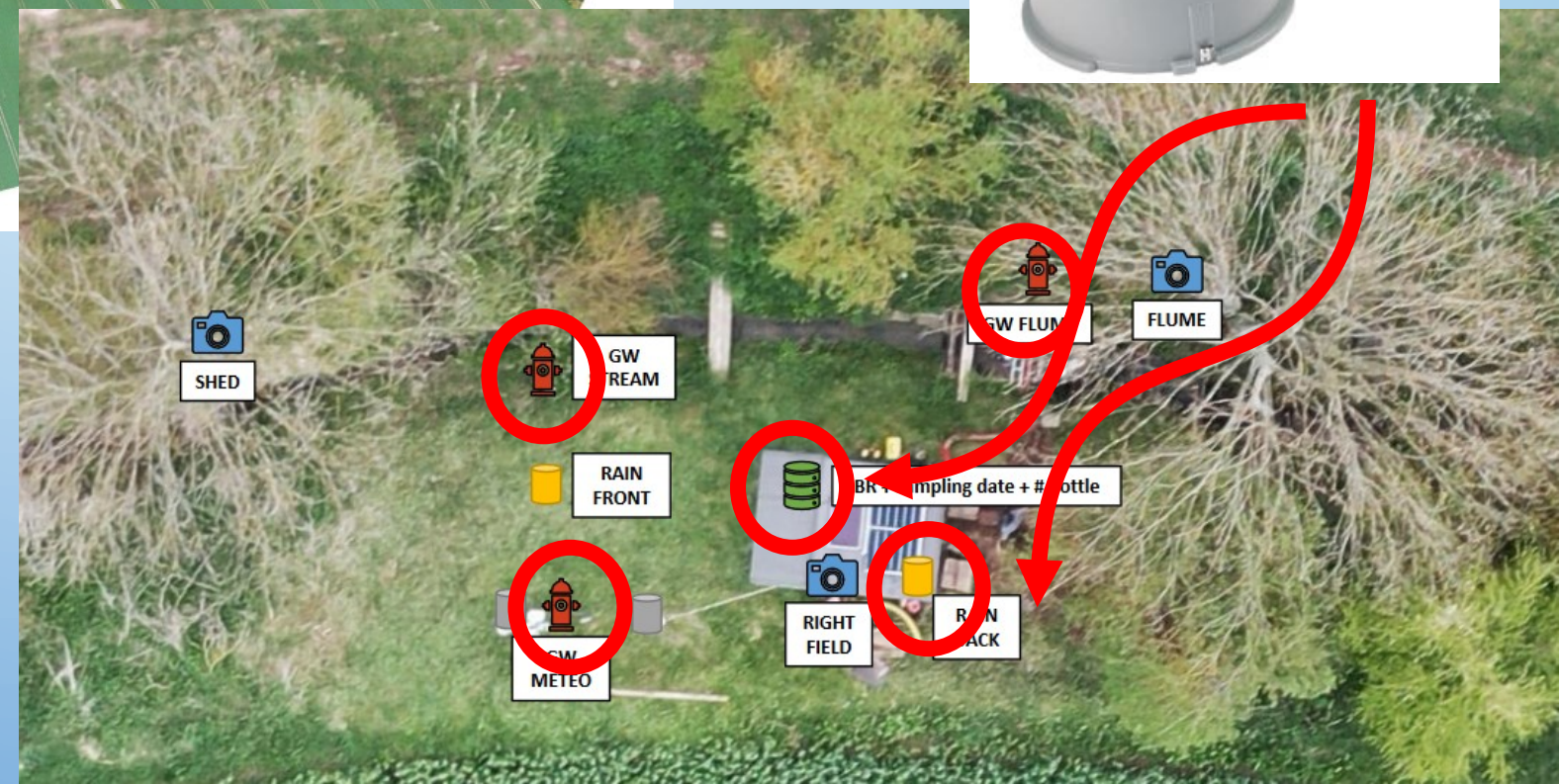
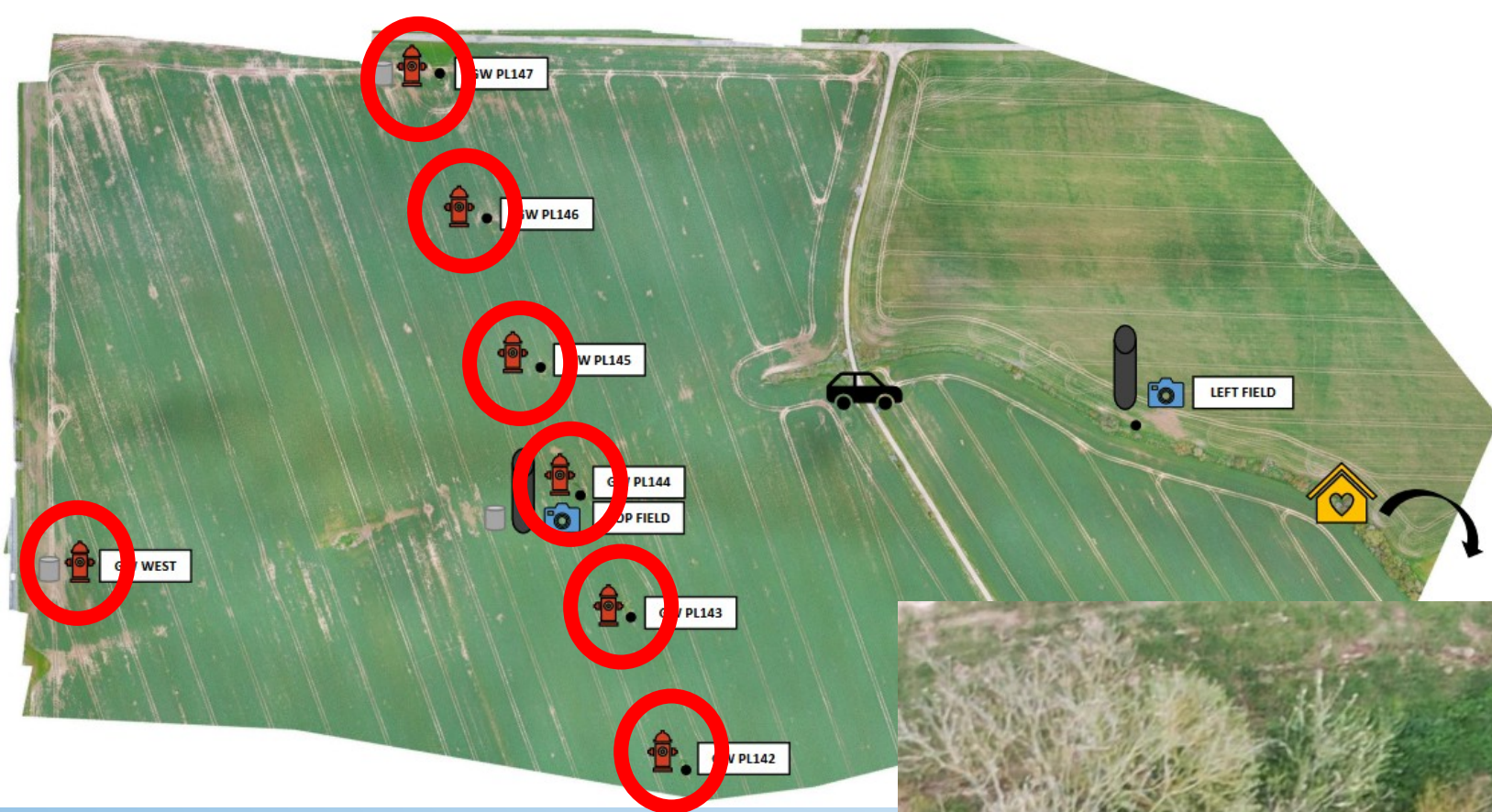
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 - IDENTIFYING WATER SOURCES – WHERE THE WATER COMES FROM
 - **ONLY ON SEASONAL SCALE**
 - HYDROLOGIC CONNECTIVITY

CATCHMENT NUCICE

- A) location of the catchment
- B) catchment overview
- C) view from the upper part of the catchment
- D) view from the lower part of the catchment



CATCHMENT NUCICE



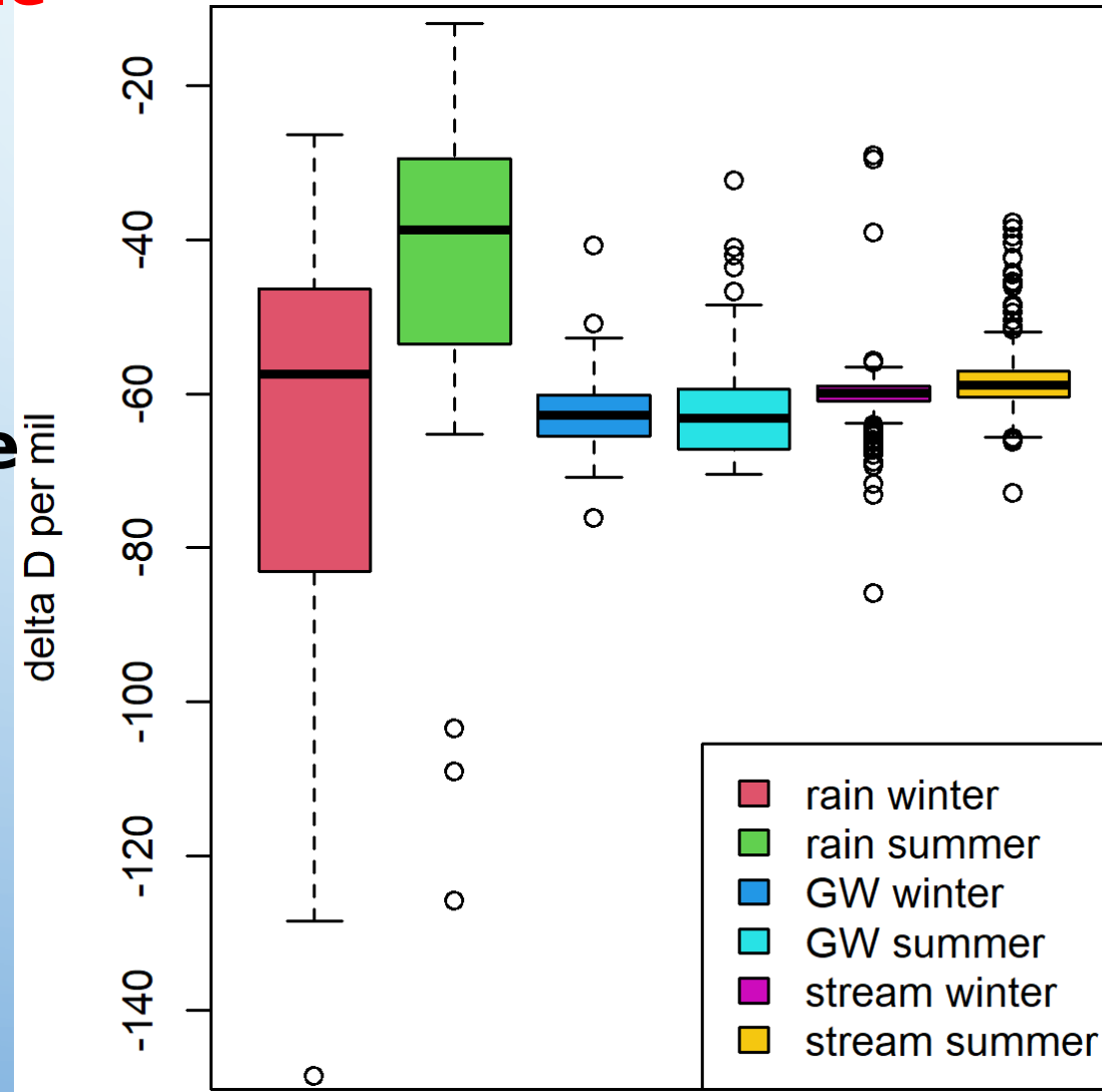
- GW MONTHLY
- BROOK DAILY
- RAINFALL DAILY

RESULTS

Identifying water sources - where the water comes from

Only on seasonal scale

**Winter precipitation flows
in base flow all through the
year.**

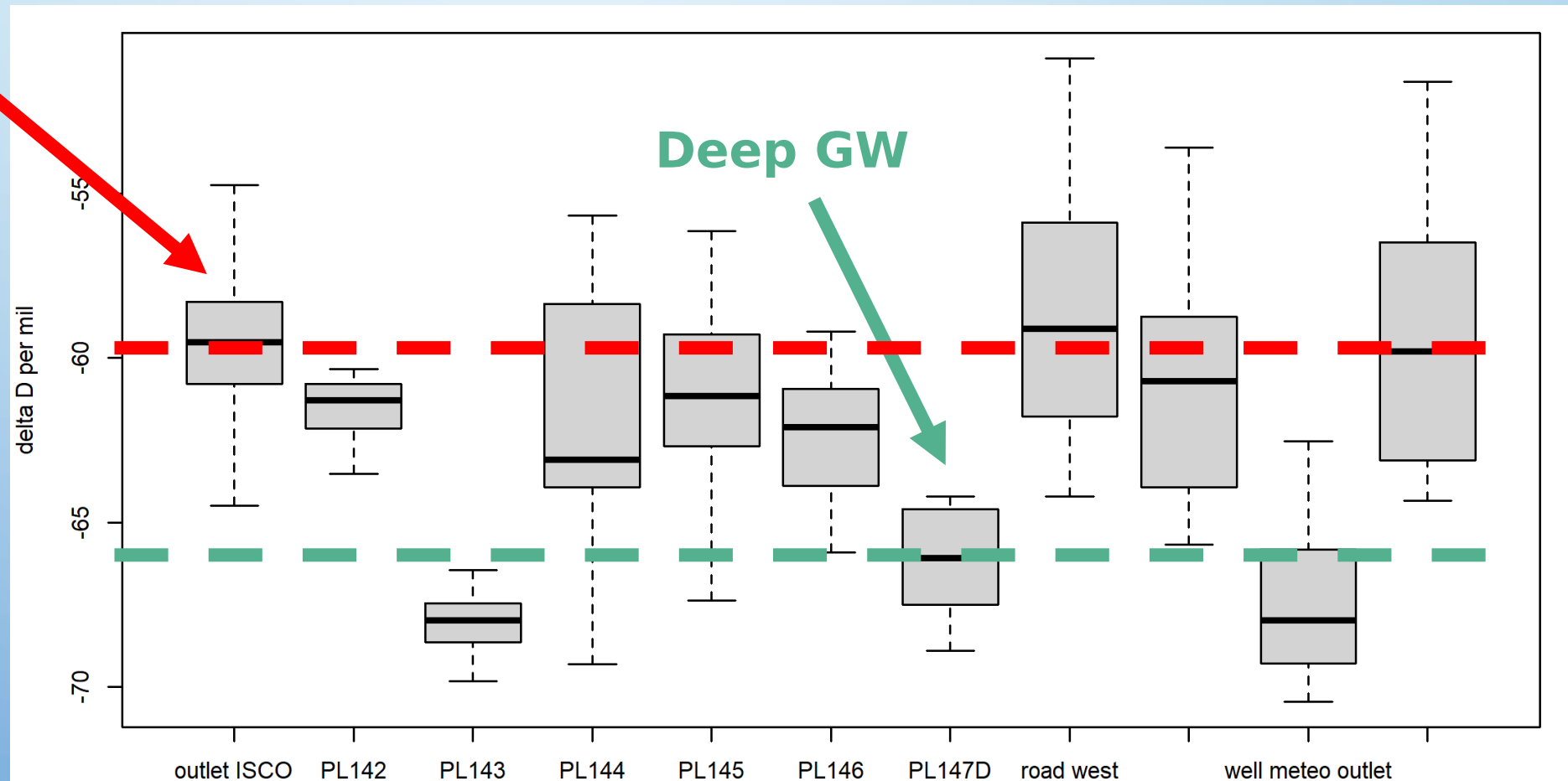


RESULTS

Identifying water sources – where the water comes from
Only on seasonal scale

**Stream
water**

**Water in
stream only
from some
wells**



PROBLEMS AND SOLUTIONS

- HYDROGRAPH SEPARATION – **SUB DAILY MEASUREMENT**
 - TRAVEL TIME DISTRIBUTION – **CONTRASTING RAINFALLS + LUMPED MODEL**
 - IDENTIFYING WATER SOURCES – **WORKS ON SEASONAL SCALE**
 - HYDROLOGIC CONNECTIVITY – **CALIBRATION OF DISTRIBUTED MODEL FOR WATER AND ISOTOPE TRANSPORT**
- + PRACTICAL PROBLEMS**

EVAPORATION OF SAMPLES BEFORE COLLECTION

STREAM WATER SAMPLING FROM TANK BELOW FLUME

SAMPLE THE RIGHT SPOT DURING THE EVENT