The Rn-222 behaviour on hydrogeological systems – the importance of correctly access Rn-222 concentrations in surface waters

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INSTITUTO DOM LUIZ

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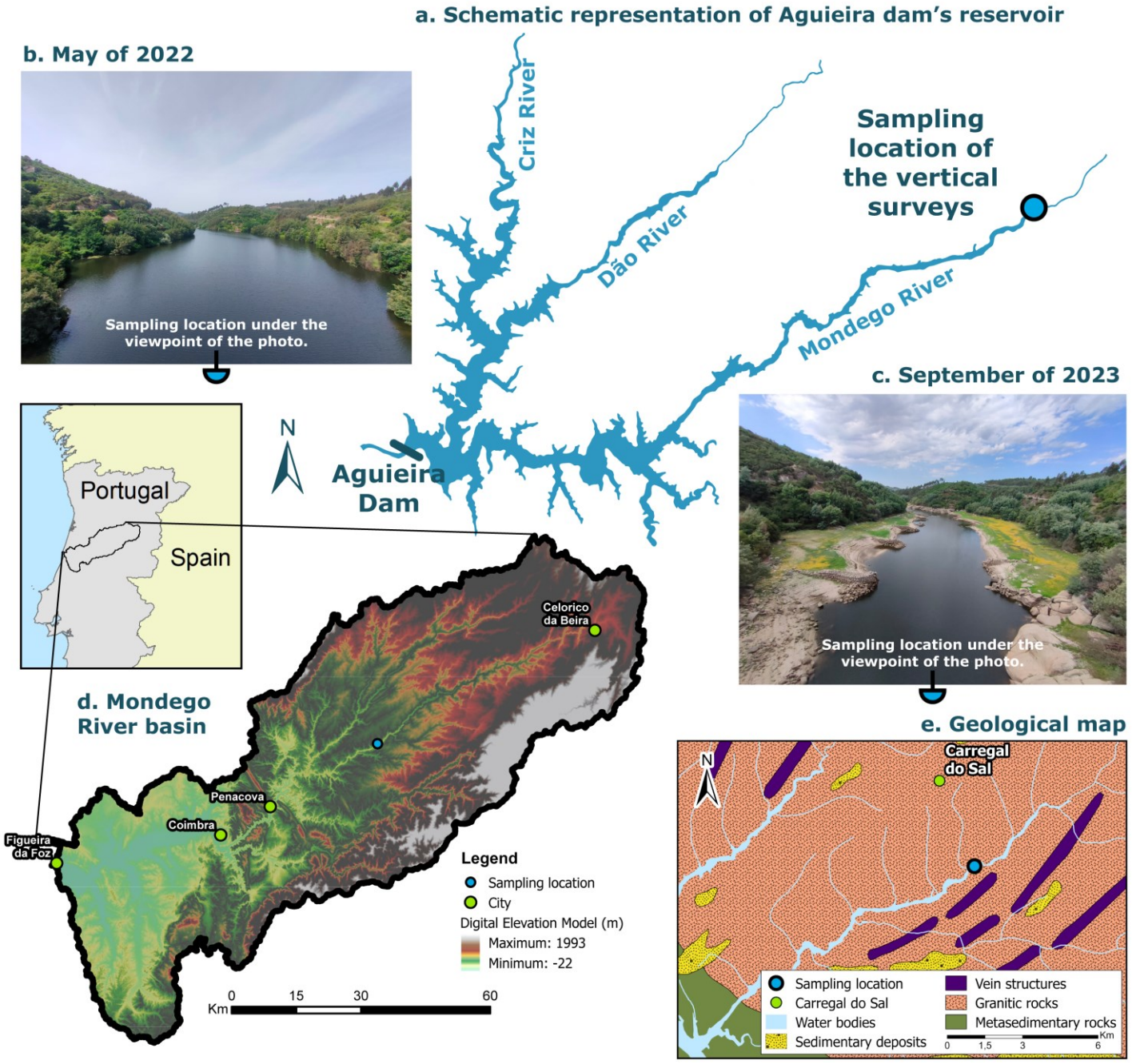
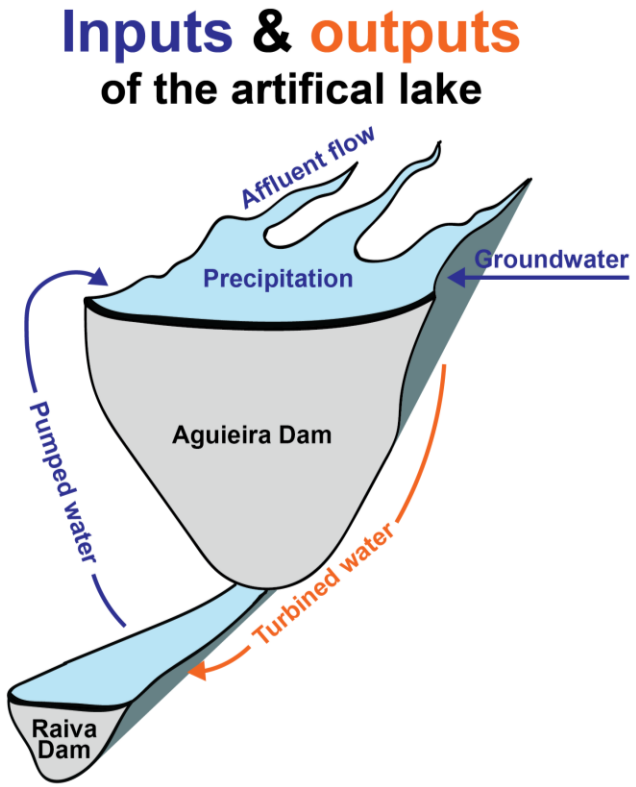
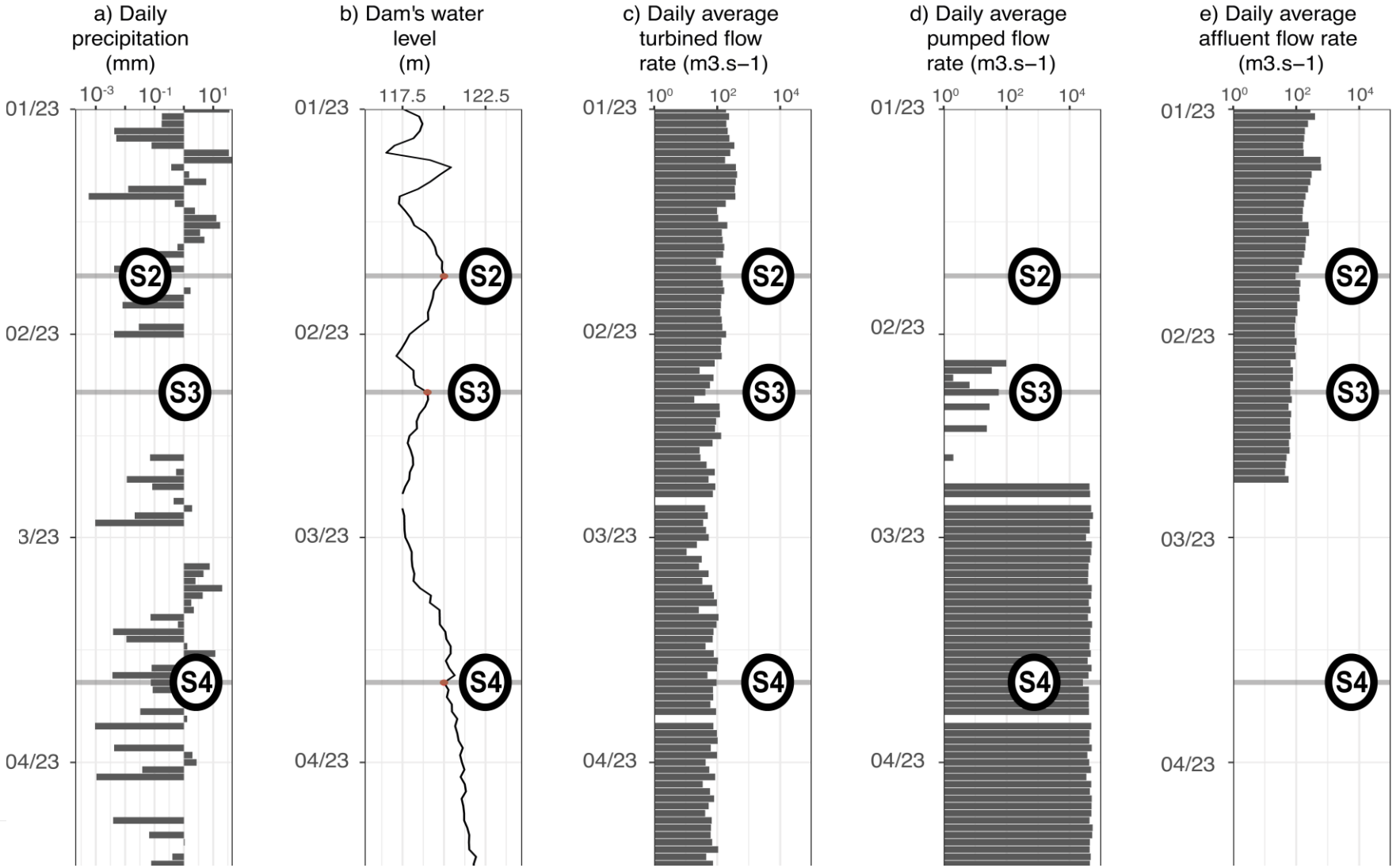
THE STUDY AREA

- In the Mondego River Basin (Portugal)
- Surface water from a single location
- Granitic outcrop
- Strongly influenced by Aguieira Dam



How strong?


Inputs & outputs
of the artifical lake
Affluent flow
Precipitation
Groundwater
Aguieira Dam
Pumped water
Turbined water
Raiva Dam


a) Daily precipitation (mm)
b) Dam's water level (m)
c) Daily average turbined flow rate (m3.s–1)
d) Daily average pumped flow rate (m3.s–1)
e) Daily average affluent flow rate (m3.s–1)
01/23
02/23
3/23
03/23
04/23
S2
S3
S4

What was done...

1 Sampling location

May22

Sep23

130 Samples at different depths

5 variables

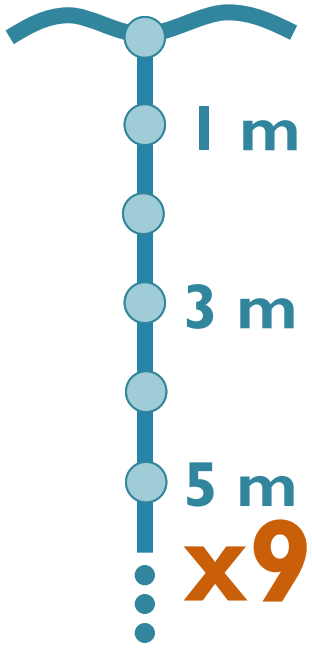
in 9 surveys

pH, EC, ORP & temperature – *in situ*

Rn-222 – by Liquid Scintillation Counting

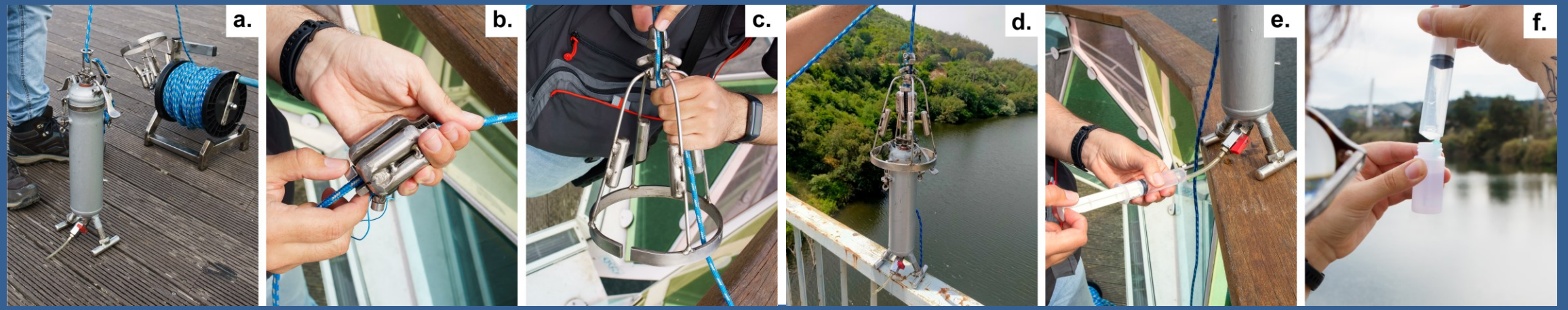
prepared *in situ*

& analysed at the laboratory

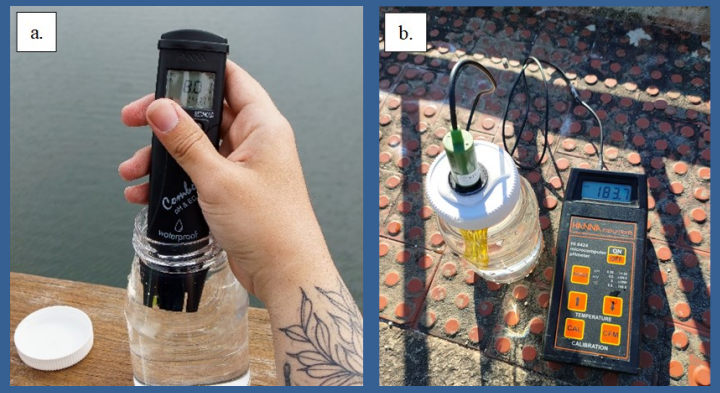


Methods and Techniques

Water sampling and Rn-222 vial preparation



Physicochemical parameters



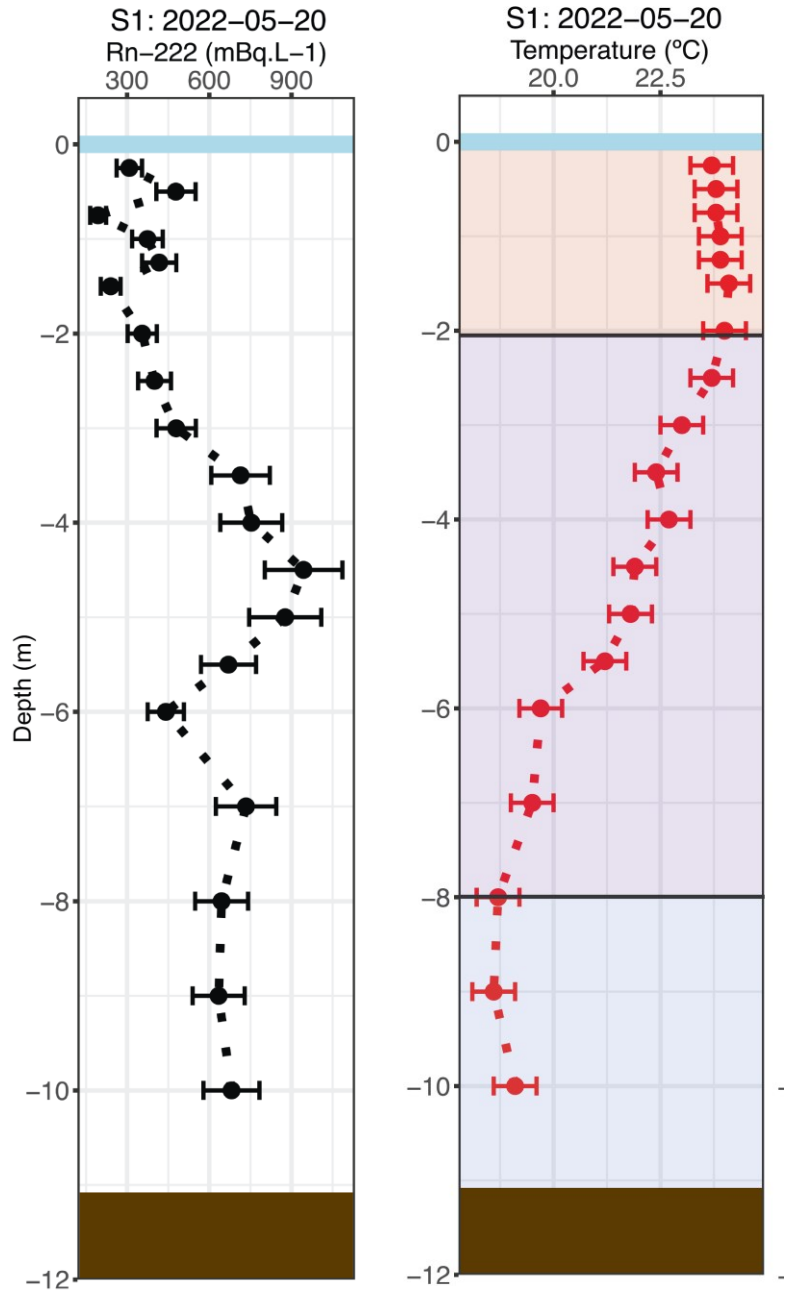
Laboratory analysis

Laboratory of Natural Radioactivity of the University of Coimbra

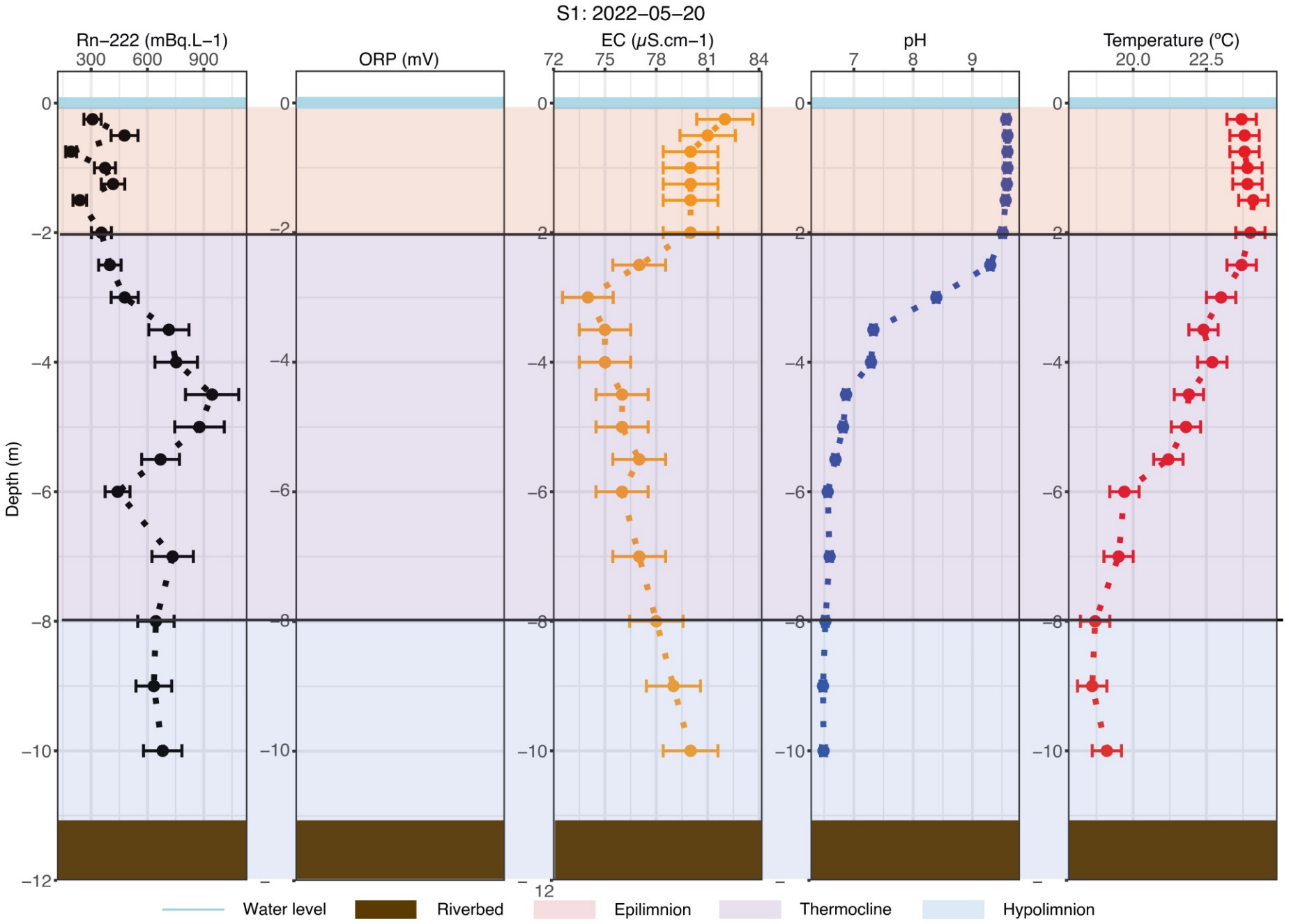
ISO/IEC 17025

Results – preliminary survey

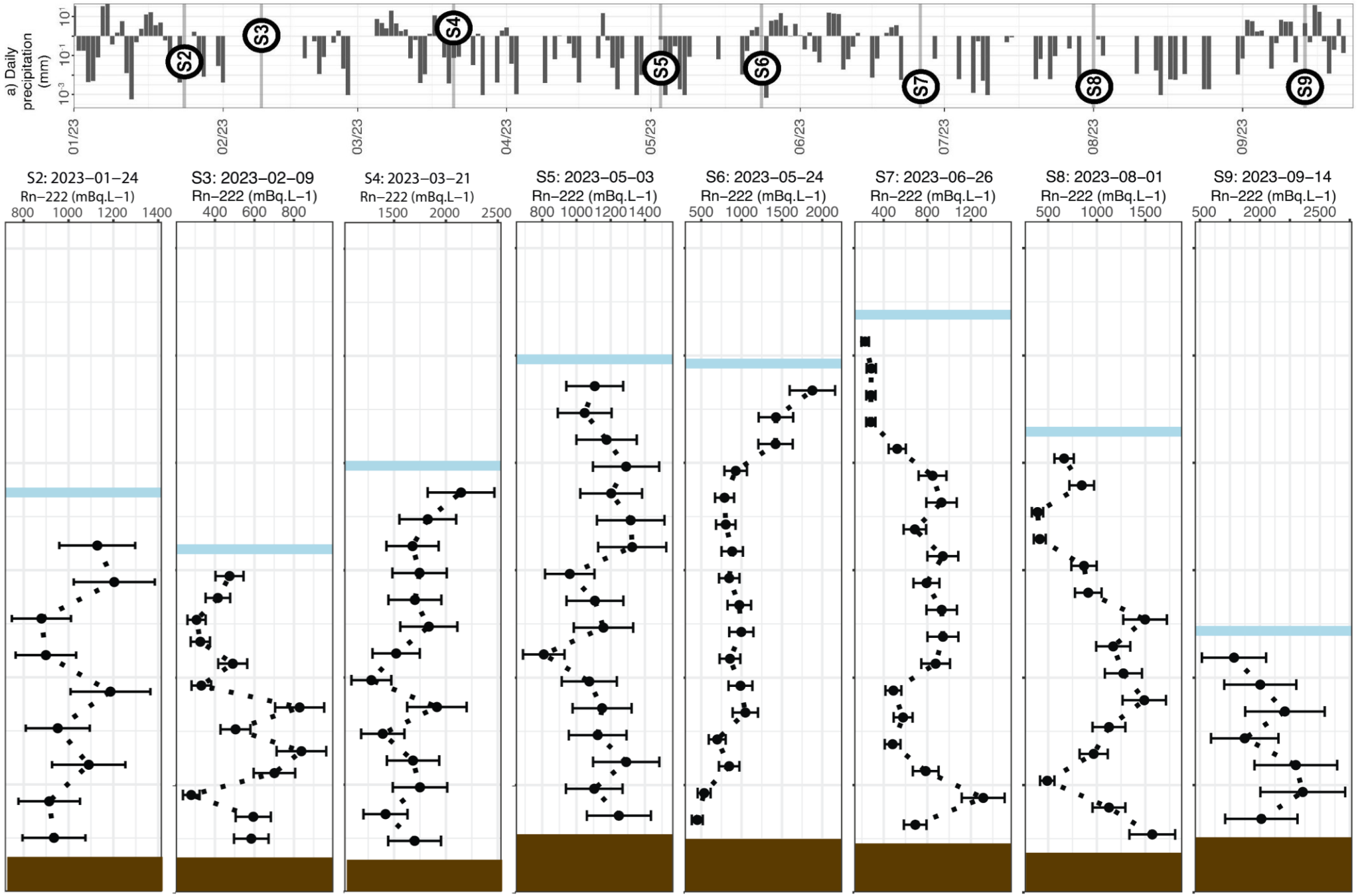
- Rn-222 is not homogeneously dispersed;
- Water column is thermally stratified:
  - Epilimnion – lower Rn-222
  - Thermocline – Rn-222 peak
  - Hypolimnion – homogeneous Rn-222



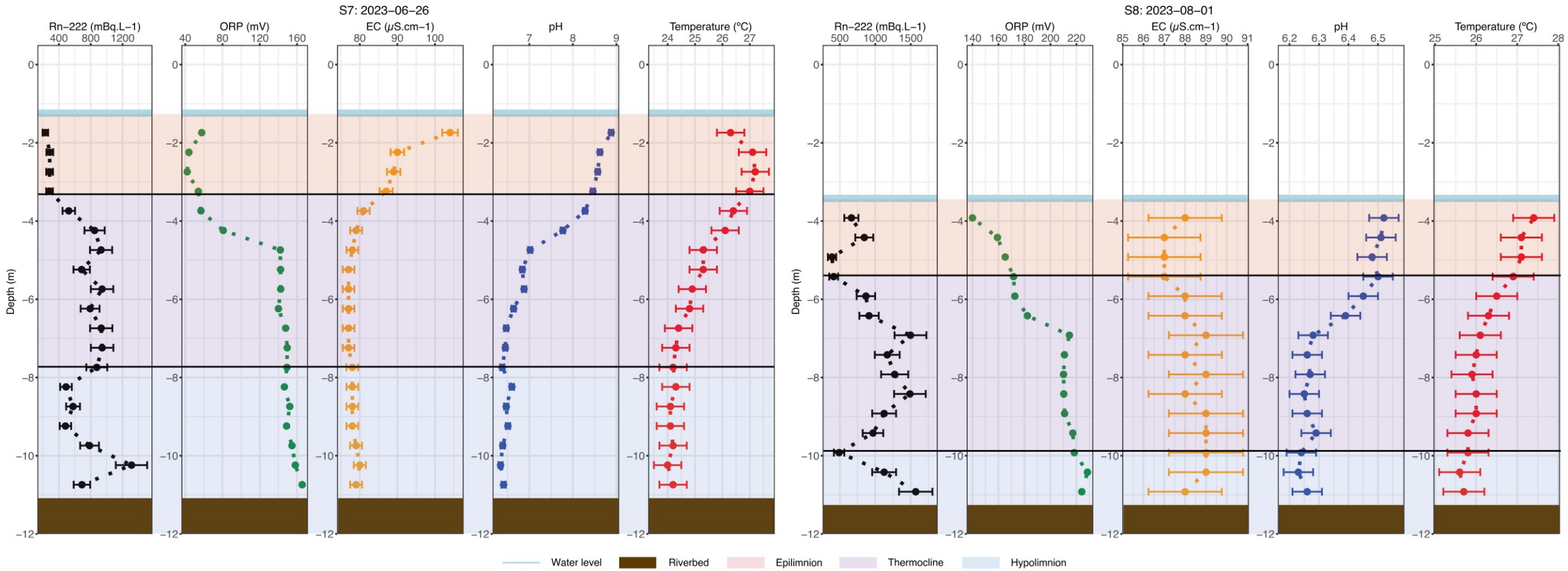
Results


S1: 2022–05–20
Rn–222 (mBq.L–1)
300
600
900
ORP (mV)
EC (µS.cm–1)
72
75
78
81
84
pH
7
8
9
Temperature (°C)
20.0
22.5
Depth (m)
0
–2
–4
–6
–8
–10
–12
Water level
Riverbed
Epilimnion
Thermocline
Hypolimnion

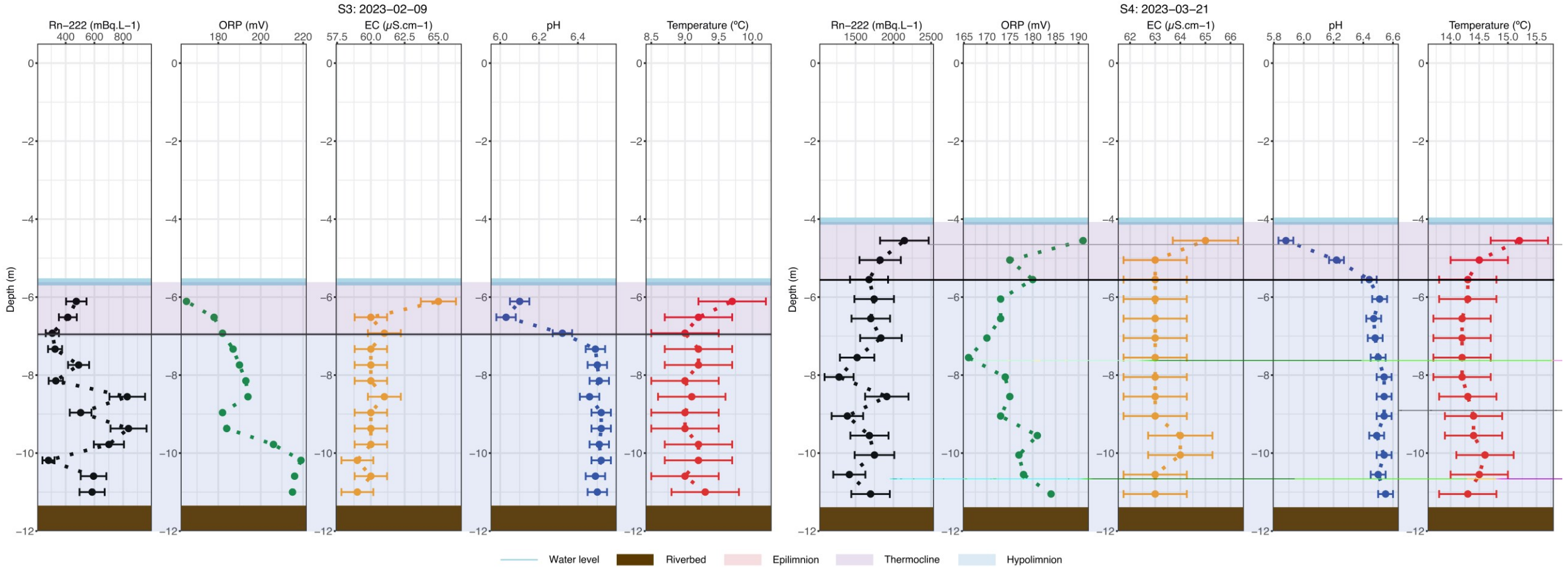
Results


a) Daily precipitation (mm)
S2
S3
S4
S5
S6
S7
S8
S9
01/23
02/23
03/23
04/23
05/23
06/23
07/23
08/23
09/23
S2: 2023–01–24
S3: 2023–02–09
S4: 2023–03–21
S5: 2023–05–03
S6: 2023–05–24
S7: 2023–06–26
S8: 2023–08–01
S9: 2023–09–14
Rn–222 (mBq.L–1)

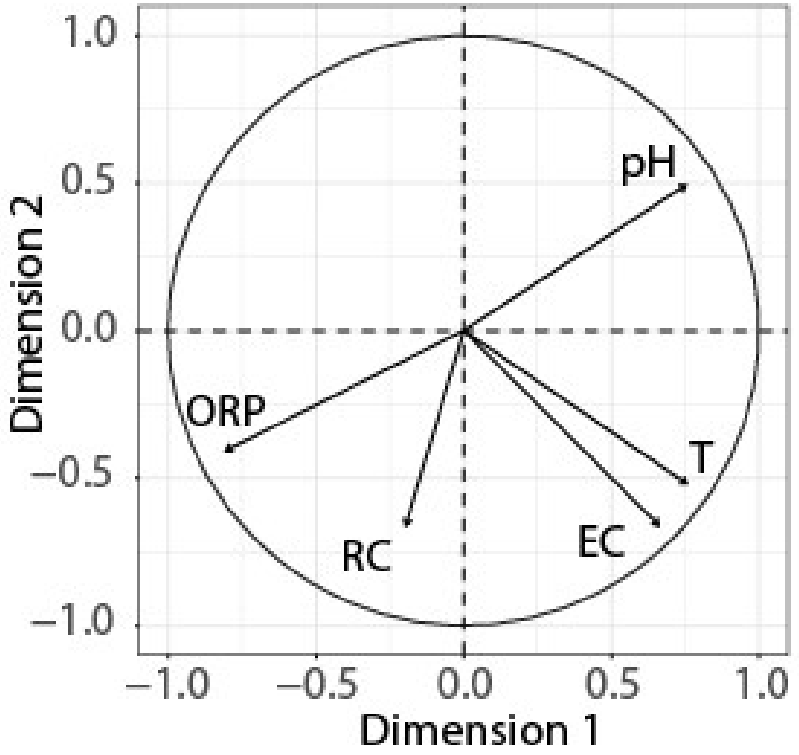
Results – Stratified period

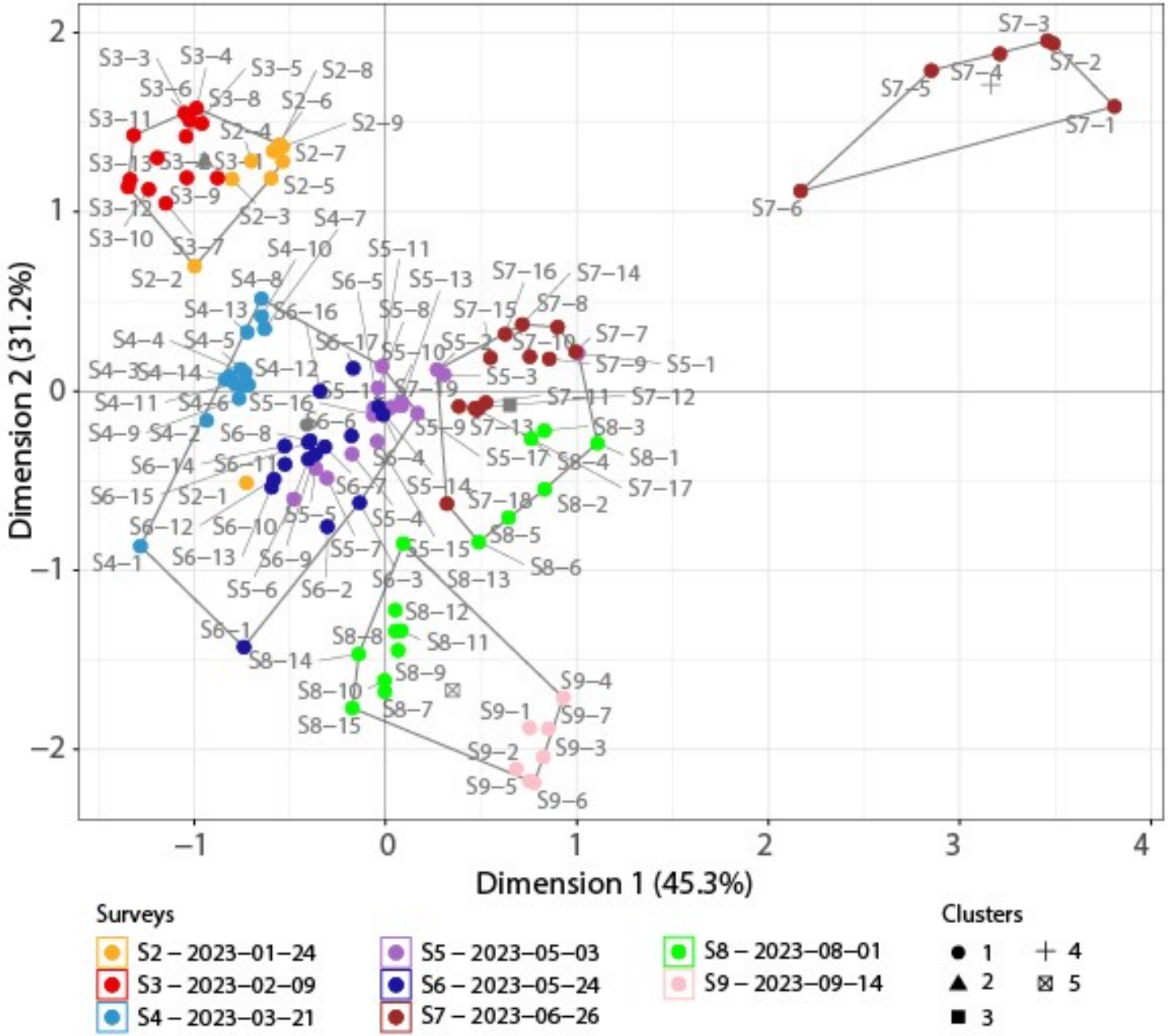


Results – Uncomplete stratification period



Results – Seasonal Variability





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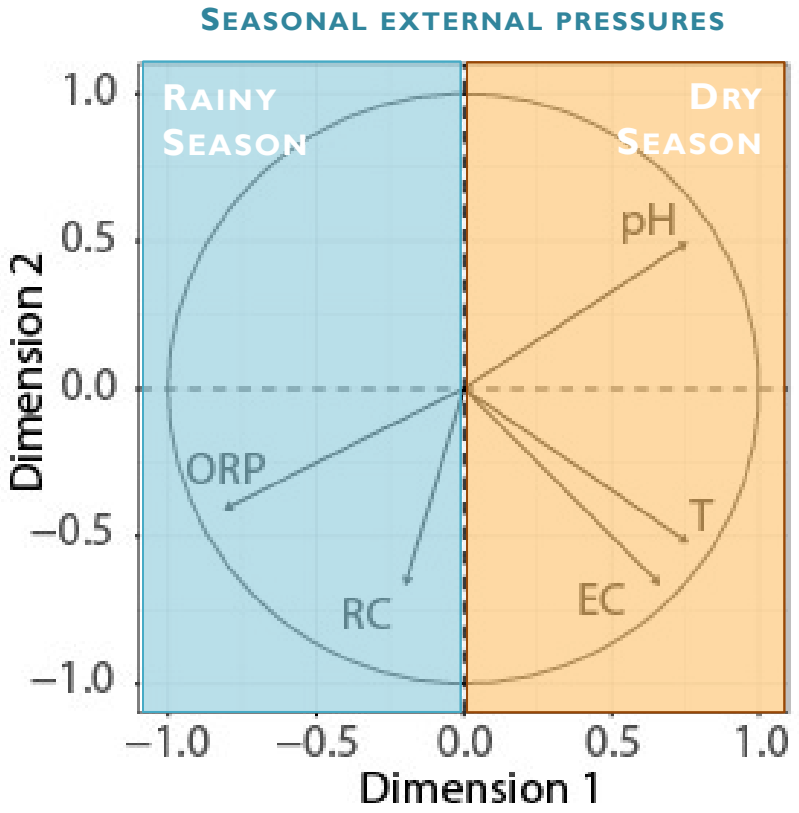

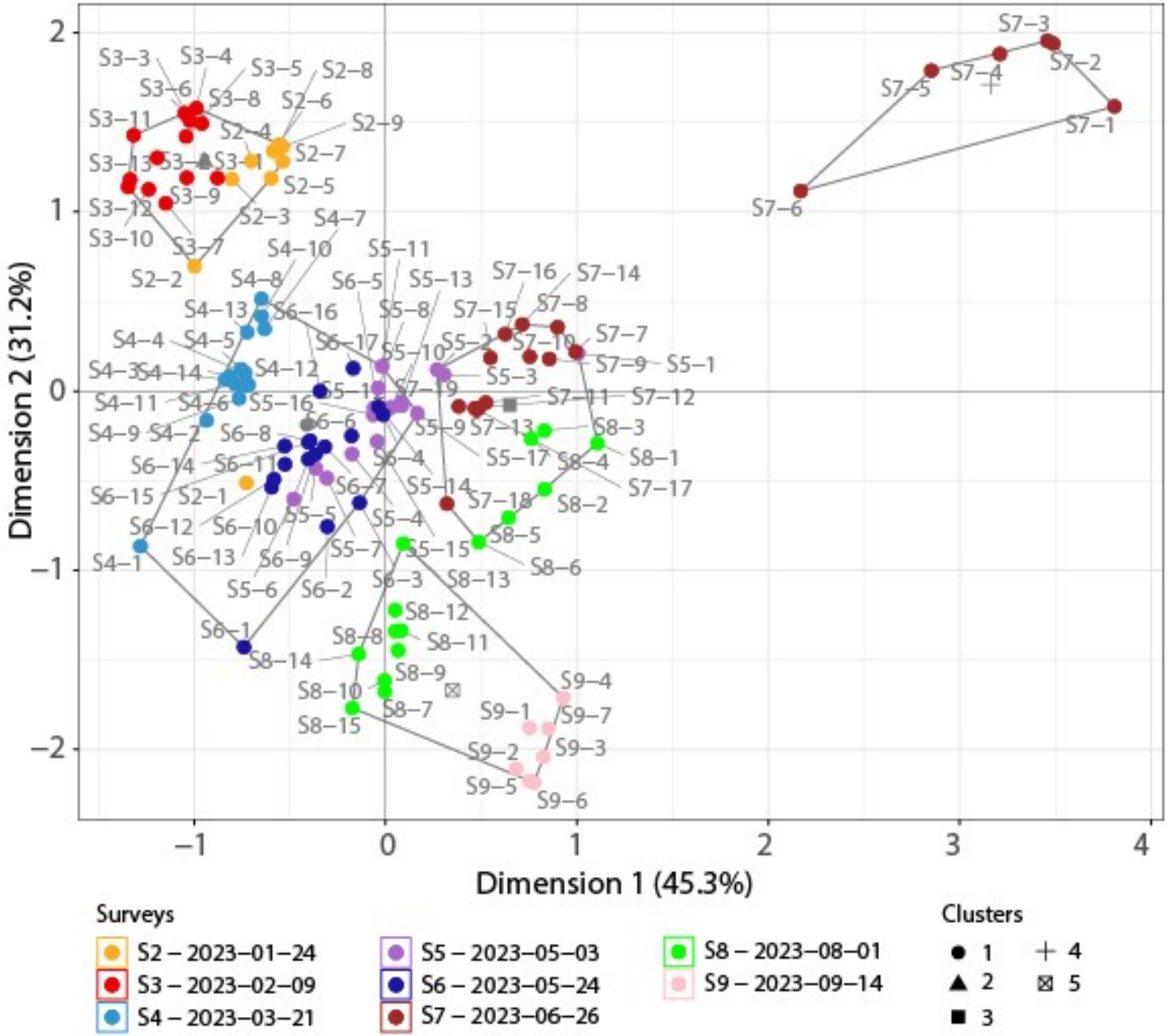

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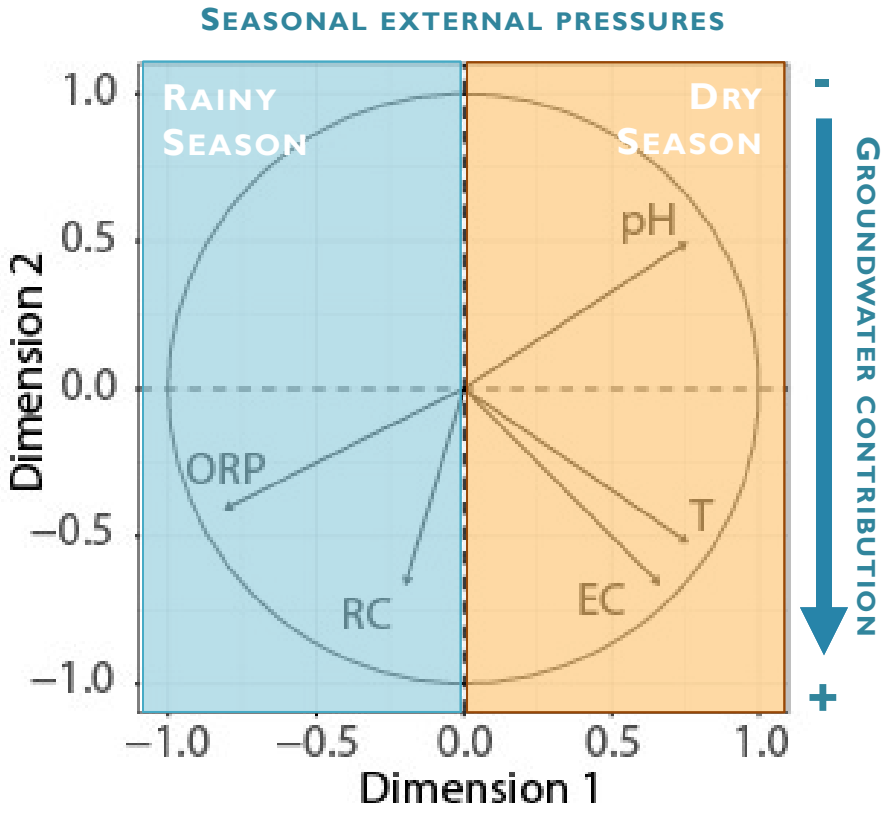

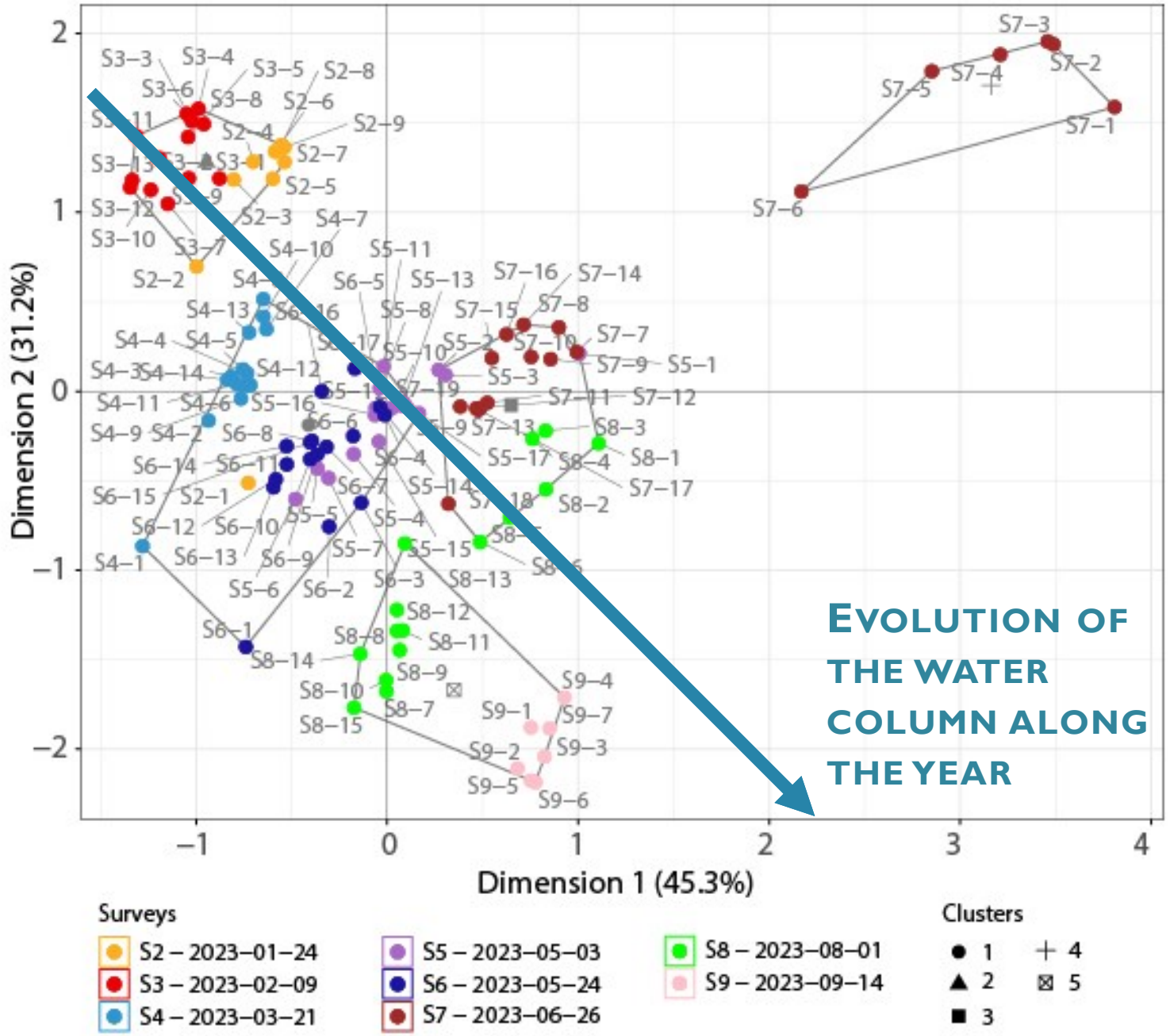

Wrap-up, Conclusions, and Final Remarks

- The water column is influenced in time by seasonal variability;
- It has shown different vertical structure and patterns;
- After heavy rains, Rn-222 signal incremented;
- Towards the summer, each of the layers of the developing vertical structure preserved its characteristic Rn-222 signal;
- Rn-222 proved to be a good tracer of groundwater inputs;
- Altough, it was crucial an in-depth analisys of the water column;
- Major concerns are due to the undersampling of the water column.

THE AUTHORS WOULD LIKE TO

THANK YOU FOR YOUR ATTENTION,

AND ACKNOWLEDGE THE FINANCIAL AND TECHNICAL SUPPORT PROVIDED BY THE LABORATORY OF NATURAL RADIOACTIVITY OF THE DEPARTMENT OF EARTH SCIENCES (UNIVERSITY OF COIMBRA, PORTUGAL) AND IATV - INSTITUTO DO AMBIENTE TECNOLOGIA E VIDA (PORTUGAL).

G. L. WISH TO THANK THE FOUNDATION FOR SCIENCE AND TECHNOLOGY (FCT, PORTUGAL) FOR THE PH.D. GRANT UI/BD/151293/2021 THROUGH NATIONAL FUNDS.

CITEUC IS FUNDED BY NATIONAL FUNDS THROUGH FCT (PROJECTS UIDB/00611/2020 AND UIDP/00611/2020).

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