Rainfall to reef: Event-driven groundwater recharge and seaward transport in Curaçao



Titus Kruijssen (WUR), Mike Wit (TU Delft), Boris van Breukelen (TU Delft), Martine van der Ploeg (WUR), Victor Bense (WUR)

TU Delft

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Introduction

- Curaçao: Fragile fresh groundwater storage
- Nutrient inputs from land impact coral reefs
- <u>Question:</u>
  - What amount of rainfall reaches the groundwater, as groundwater recharge?
  - When an at which rates does groundwater flow towards the reef?



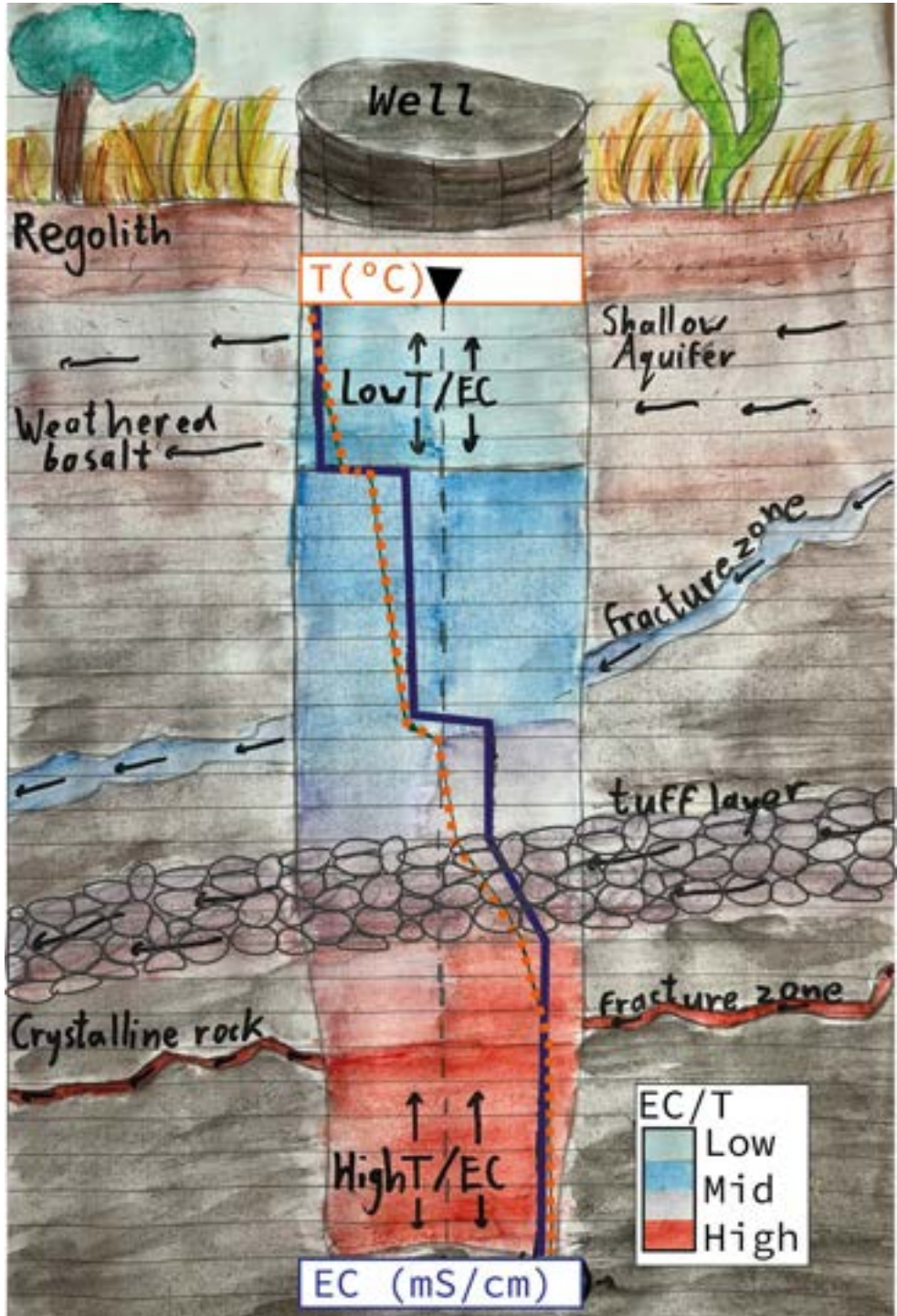
Photo: M. Rijk (2024)



Hydrogeological setting

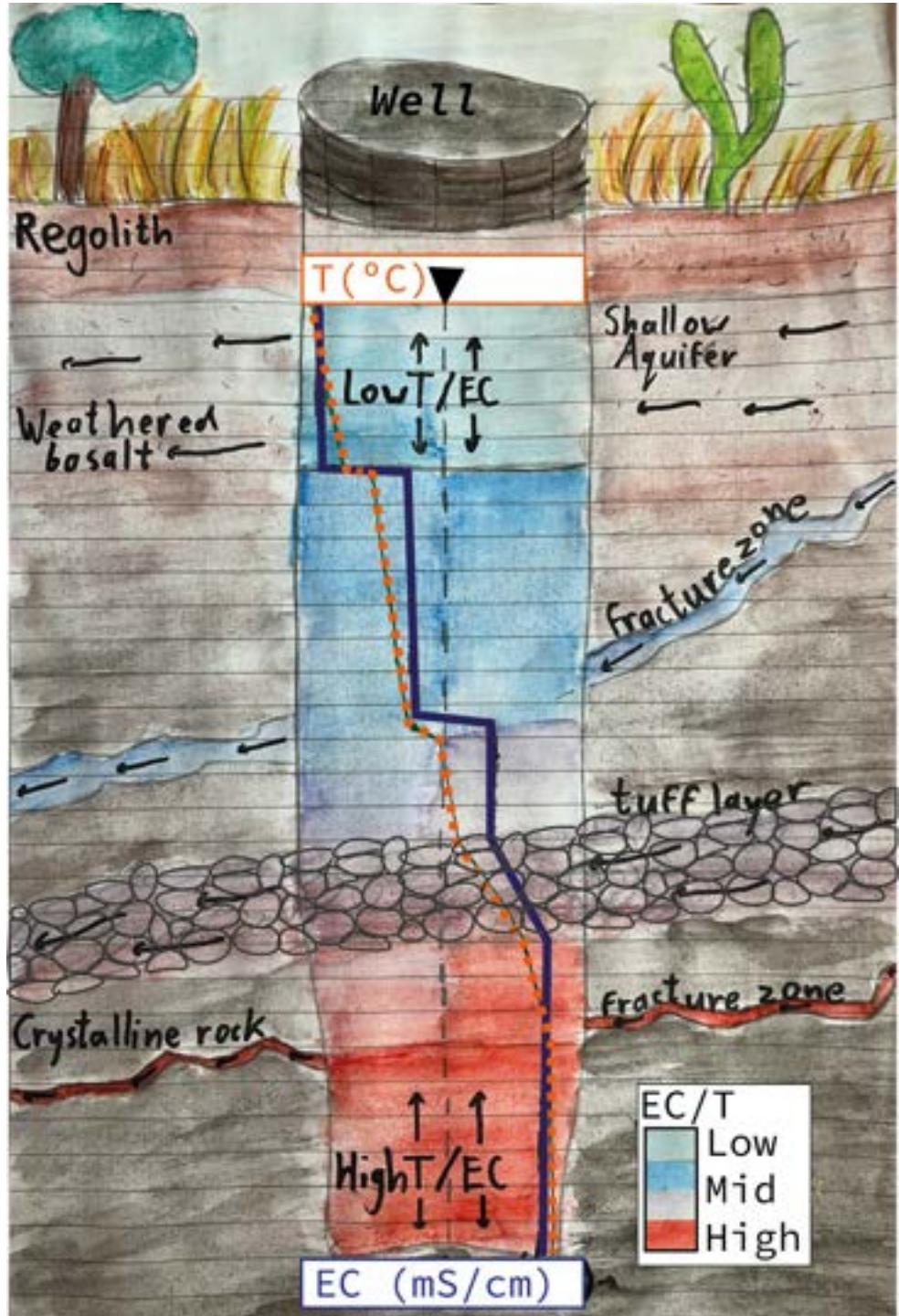
- Fractured rock geology
- Semi-arid climate
- Large seasonality in precipitation
  - Climate change: Droughts and more intense events





Hydrogeological setting

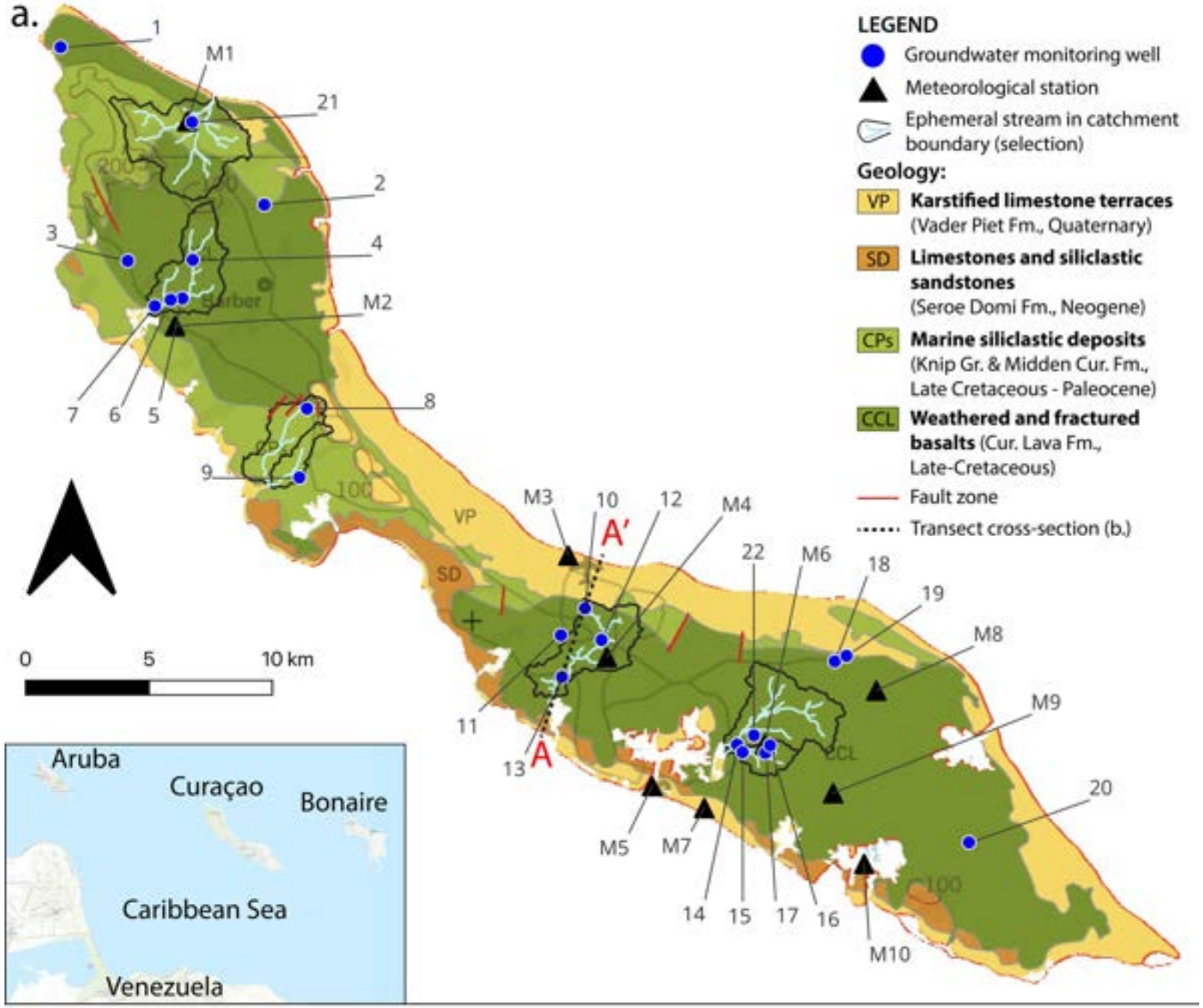
- Fractured rock geology
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Methods

- Multi-parameter field monitoring
  - Water table
  - Water temperature and EC
    - In time
    - With depth
- Hydrogeological model simulations



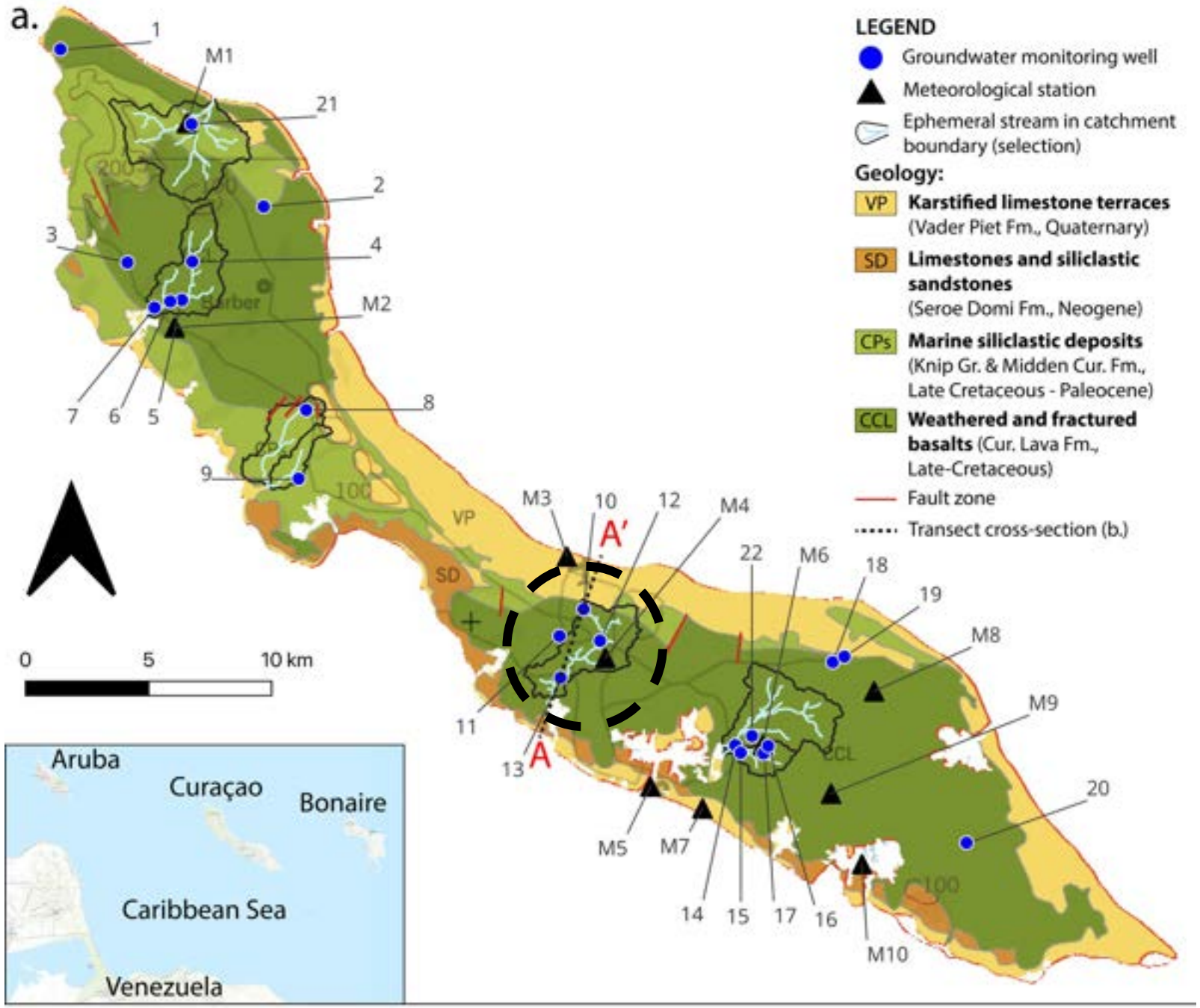


Geological map: TNO-GDN (2023)

Methods

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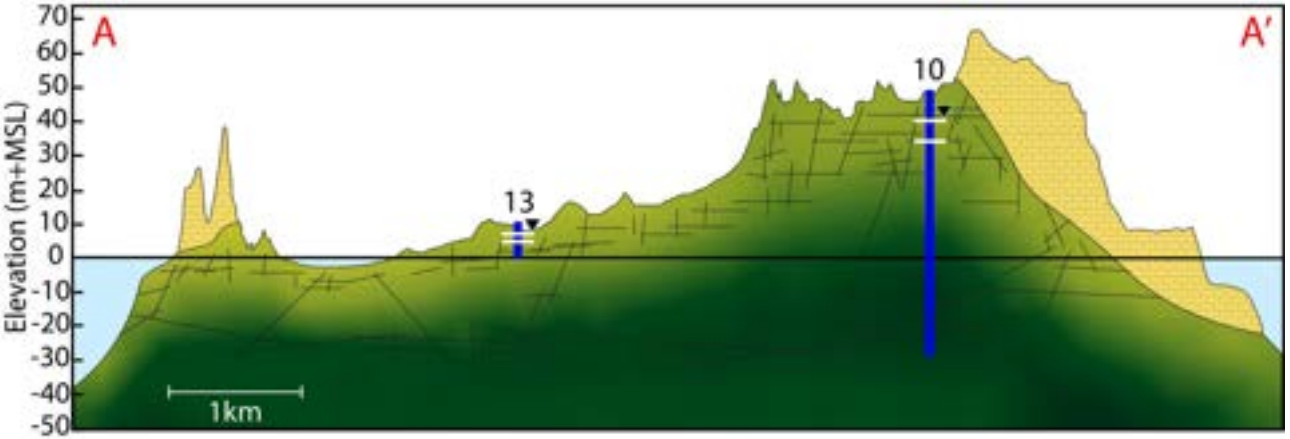


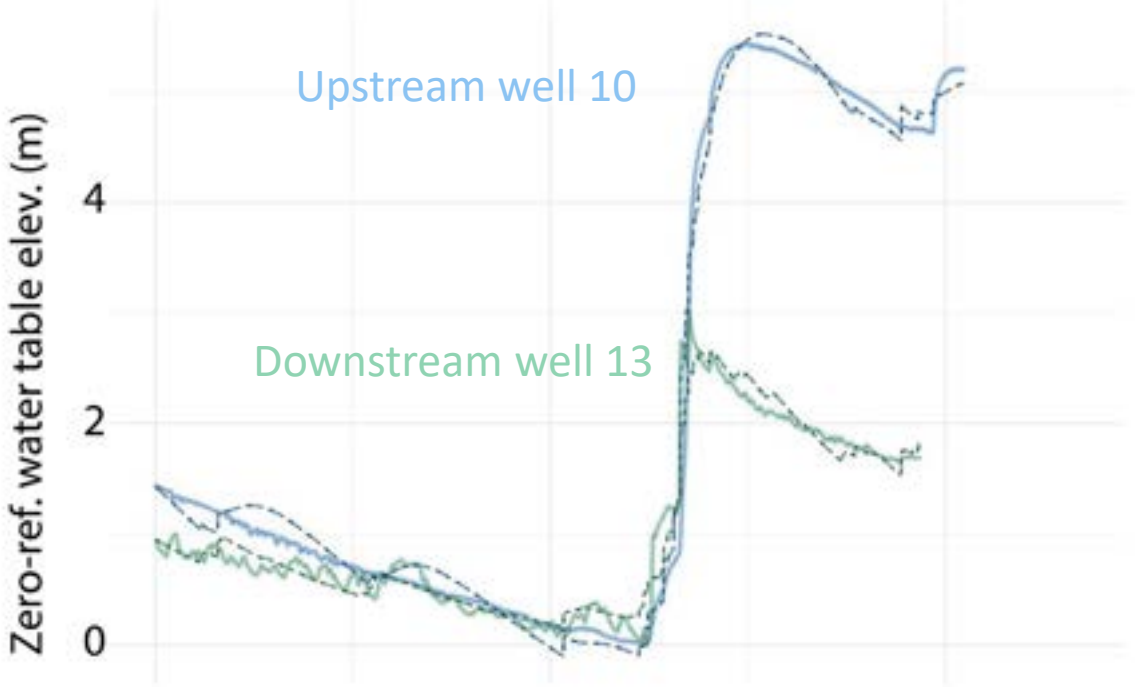


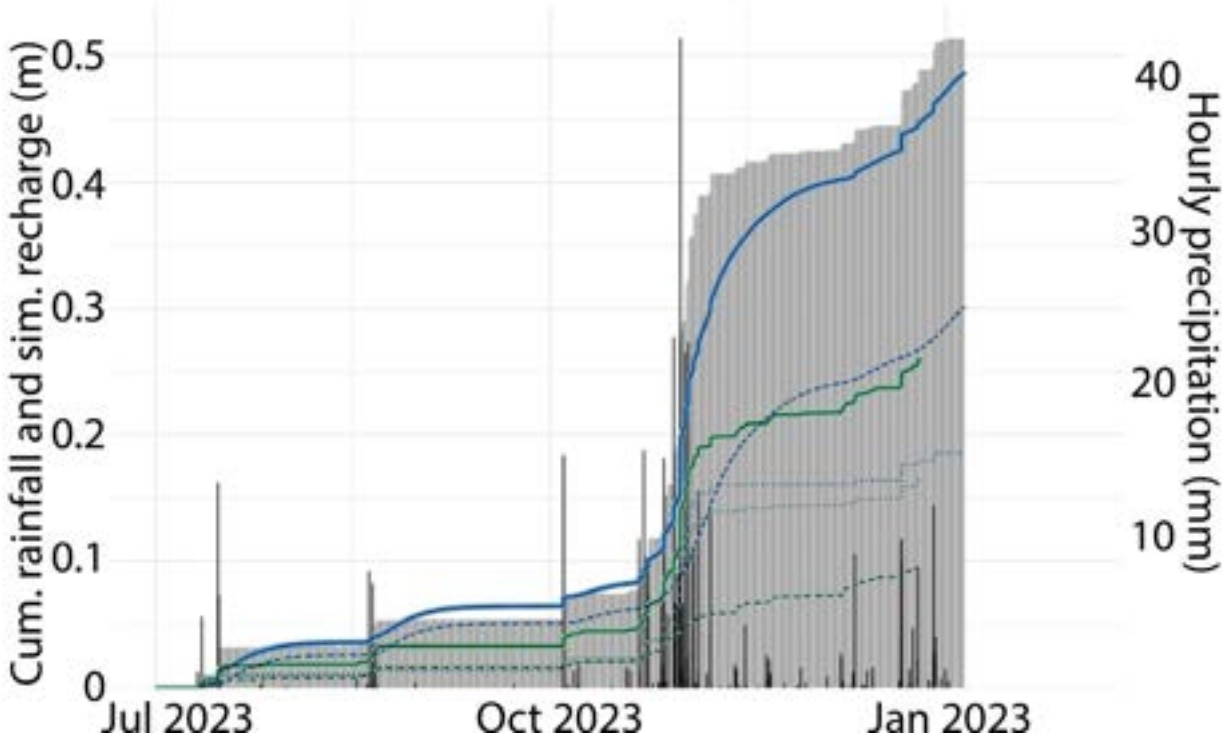
Geological map: TNO-GDN (2023)

Results – Rainfall season

- Water table rise
- Different patters
  - Upstream: Long term rises
  - Downstream: Spiky peaks



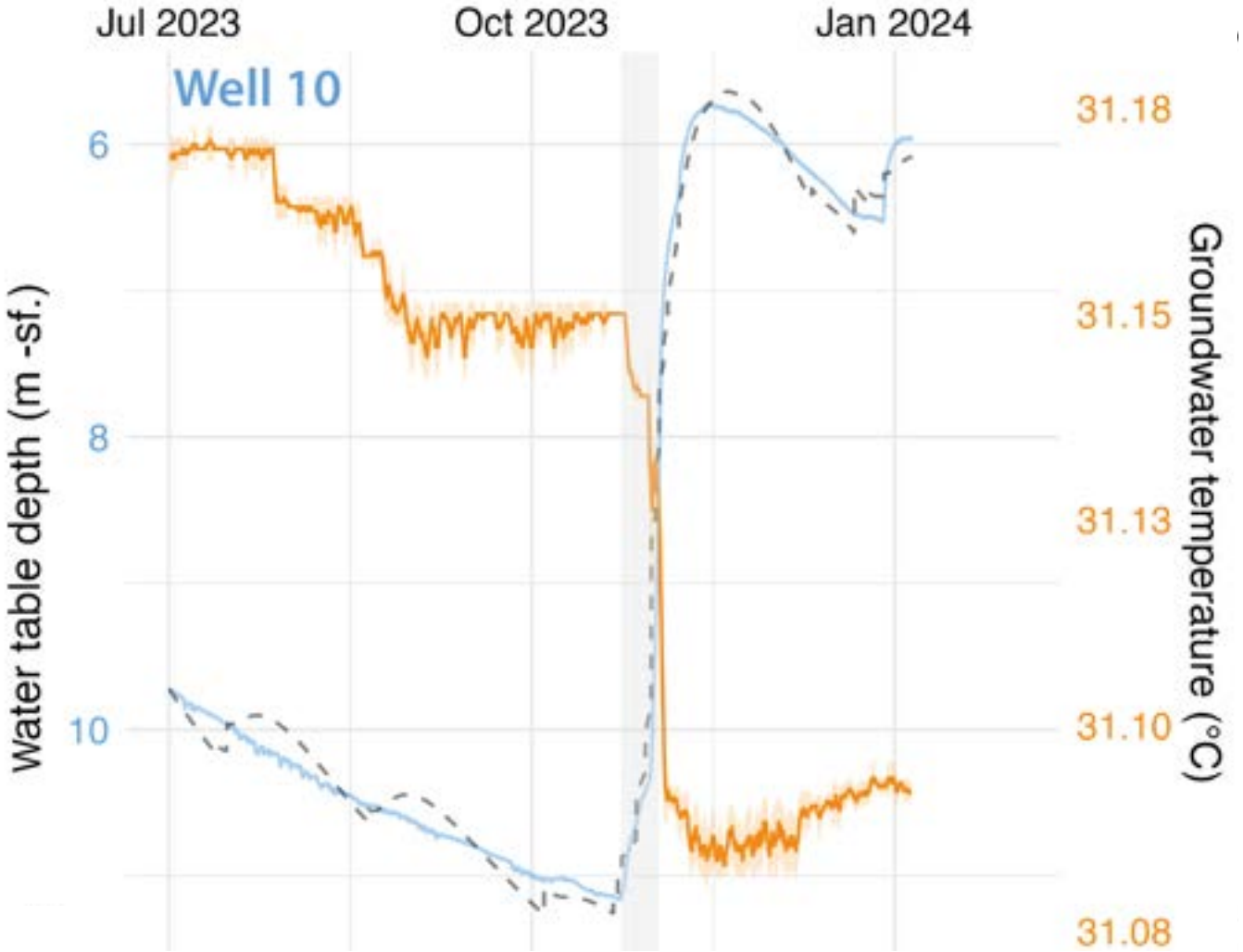


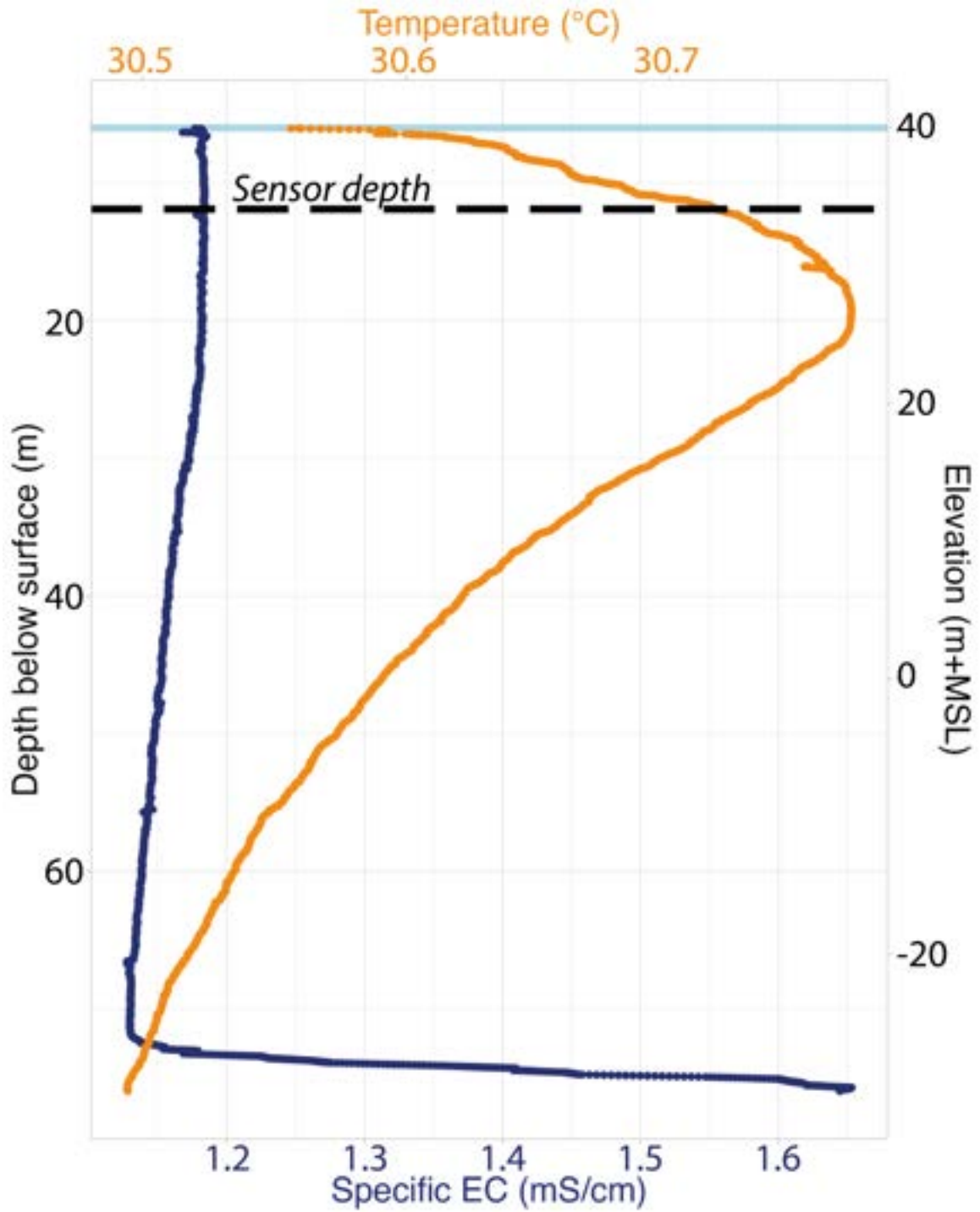


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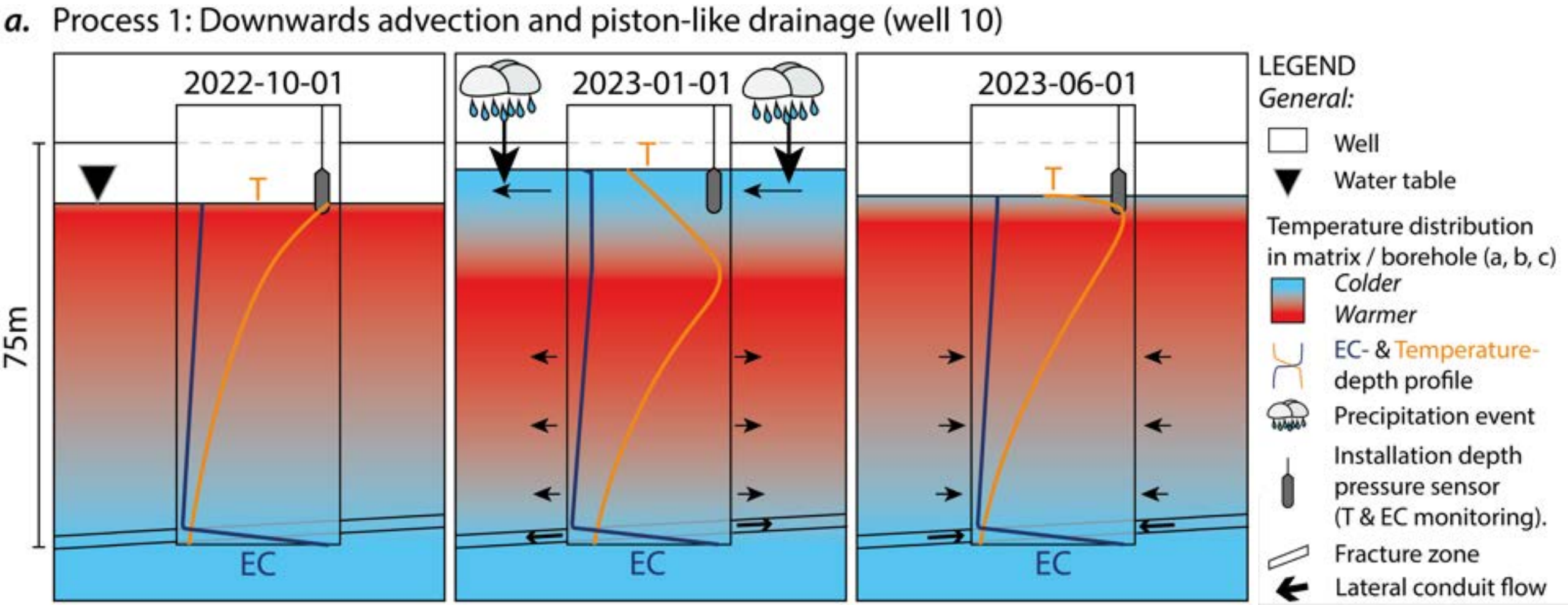
Results – Rainfall season

- Temperature response





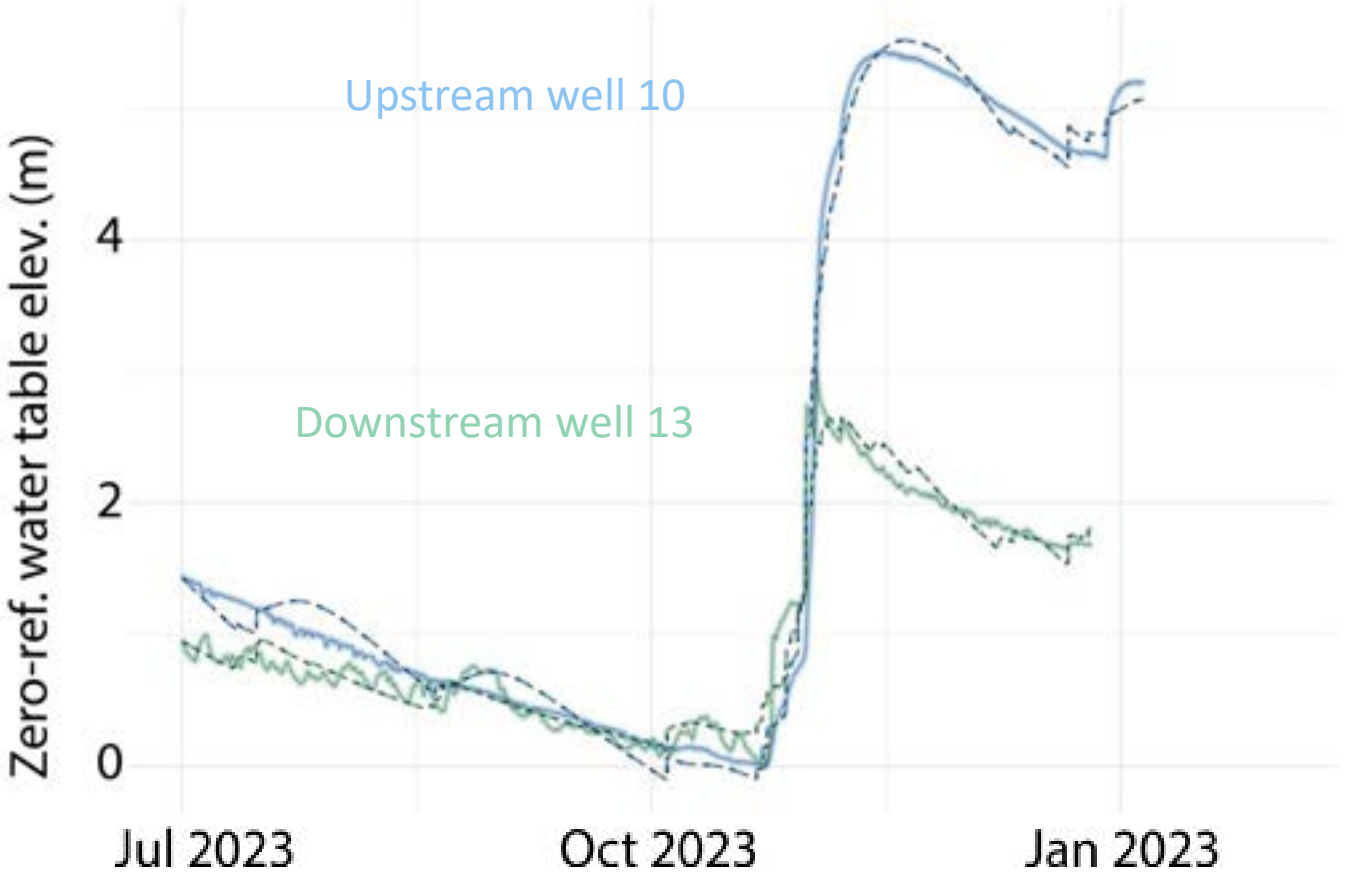
Results – Rainfall season

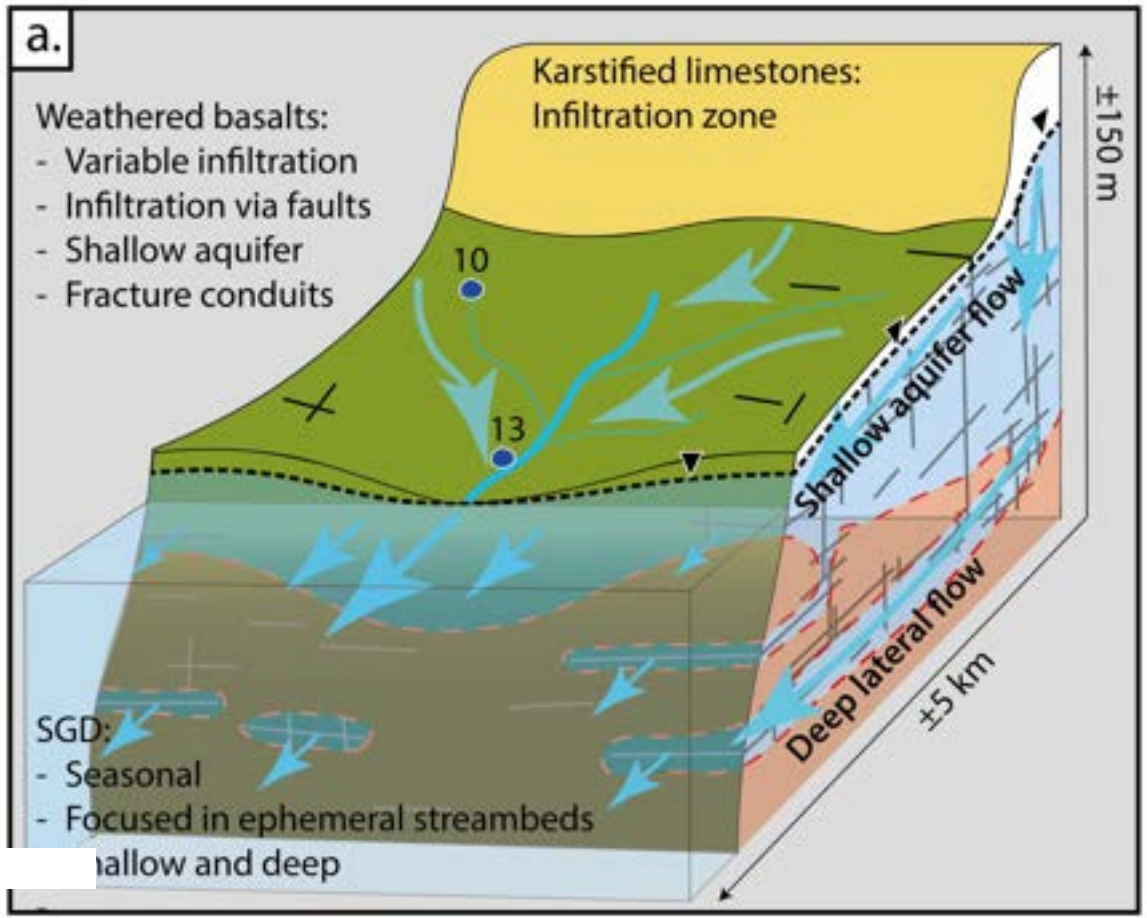


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Conclusions – Rainfall season

- Rapid groundwater recharge in response to events
- Major dewatering through ephemeral streams (Rooien)
- Additional discharge via deep fractures (piston flow)





Results – Intense rainfall event

NOODWEER

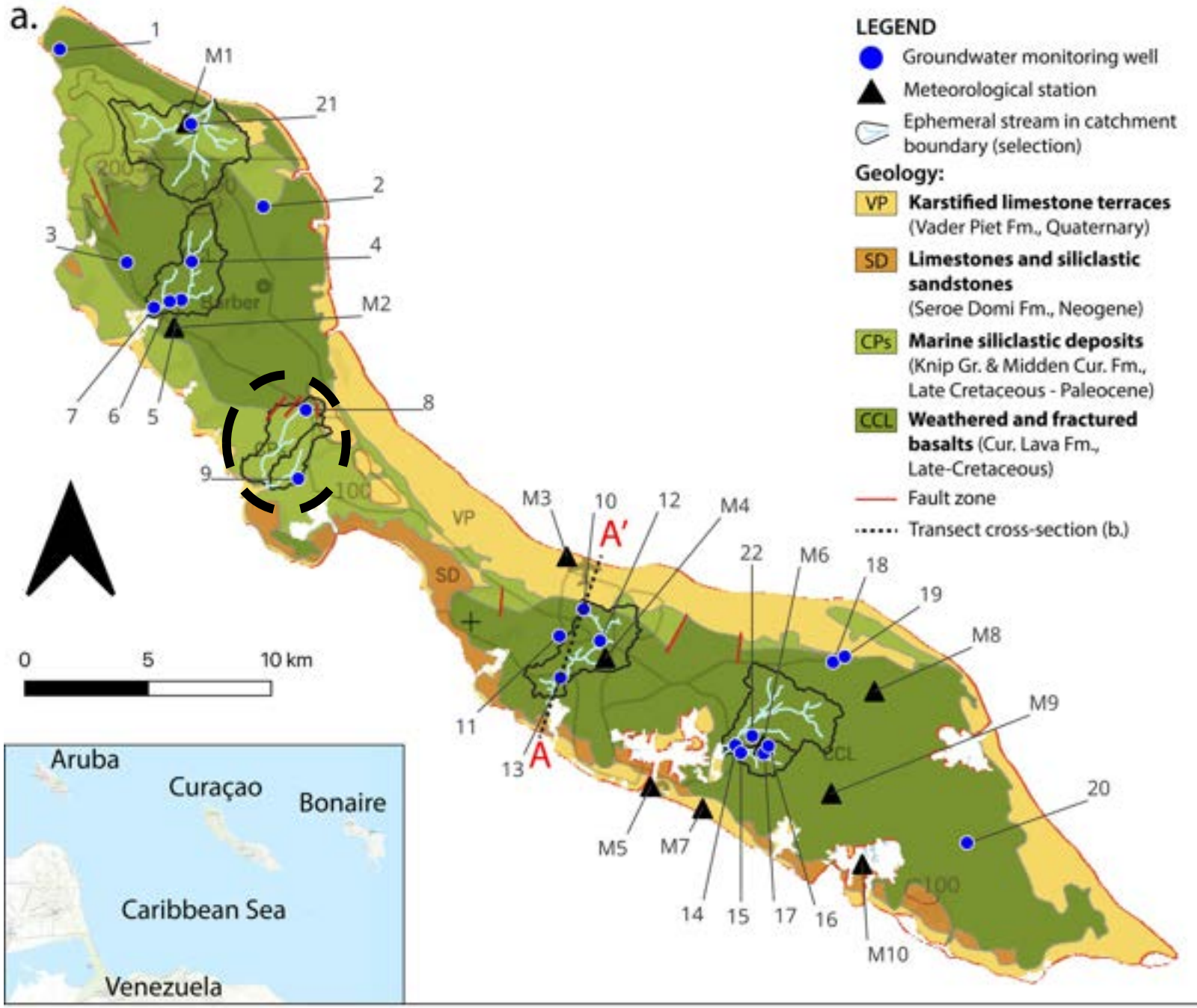
Veel schade in westen van Curaçao na overstromingen

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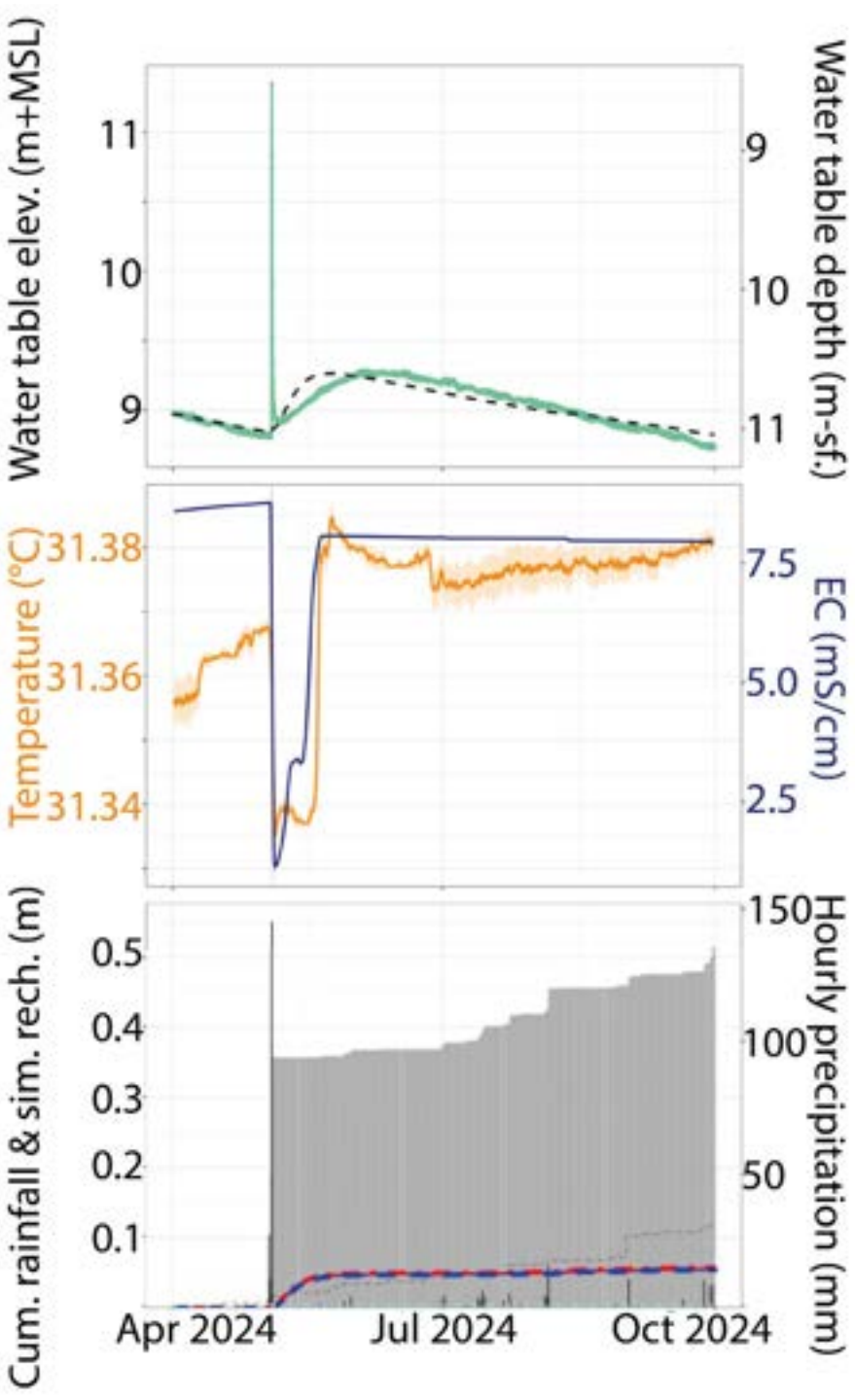
Photo: Max (2024)

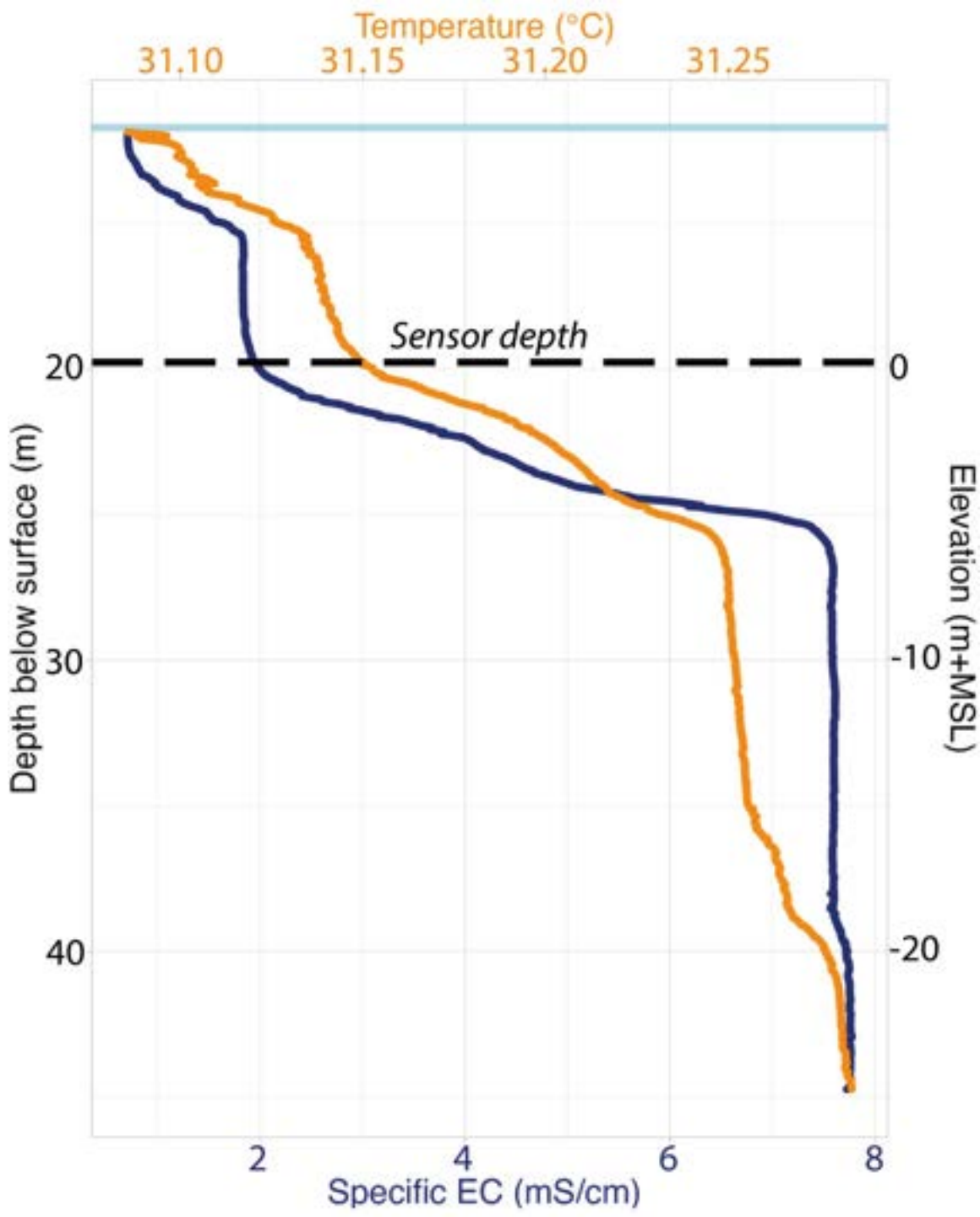
Results – Intense rainfall event



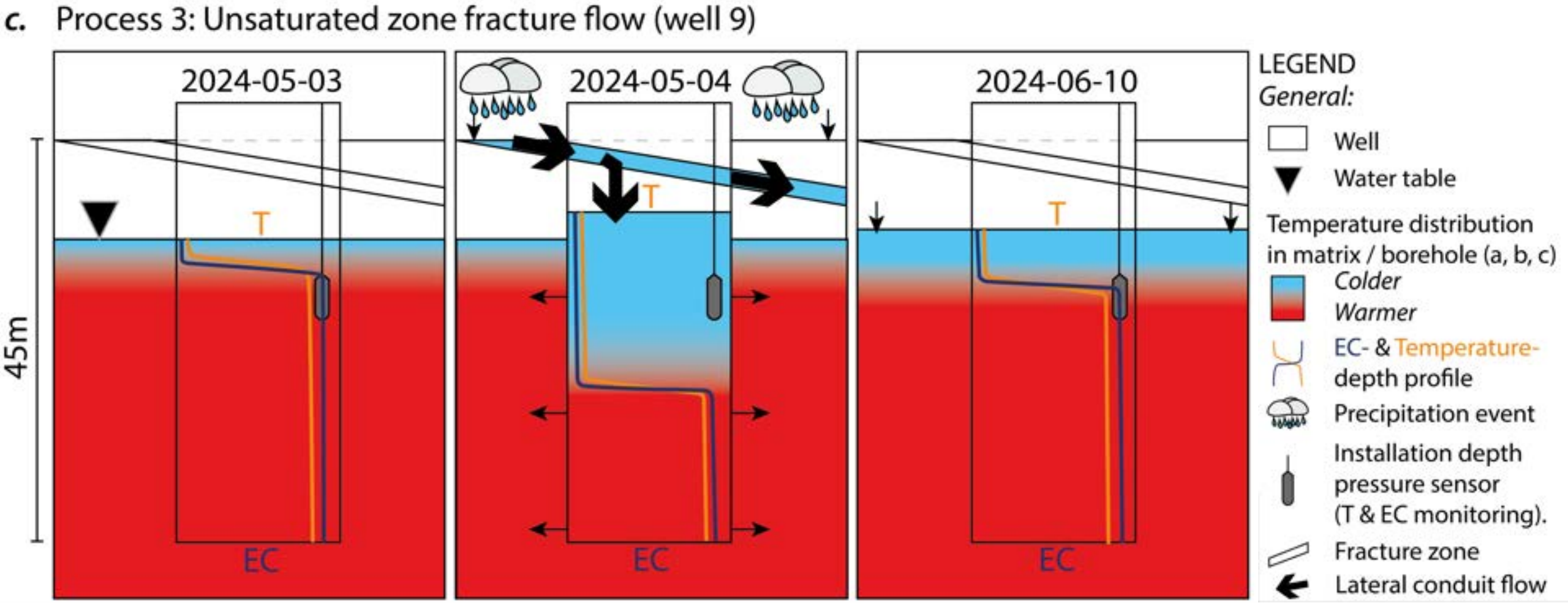
Geological map: TNO-GDN (2023)

Results – Intense rainfall event





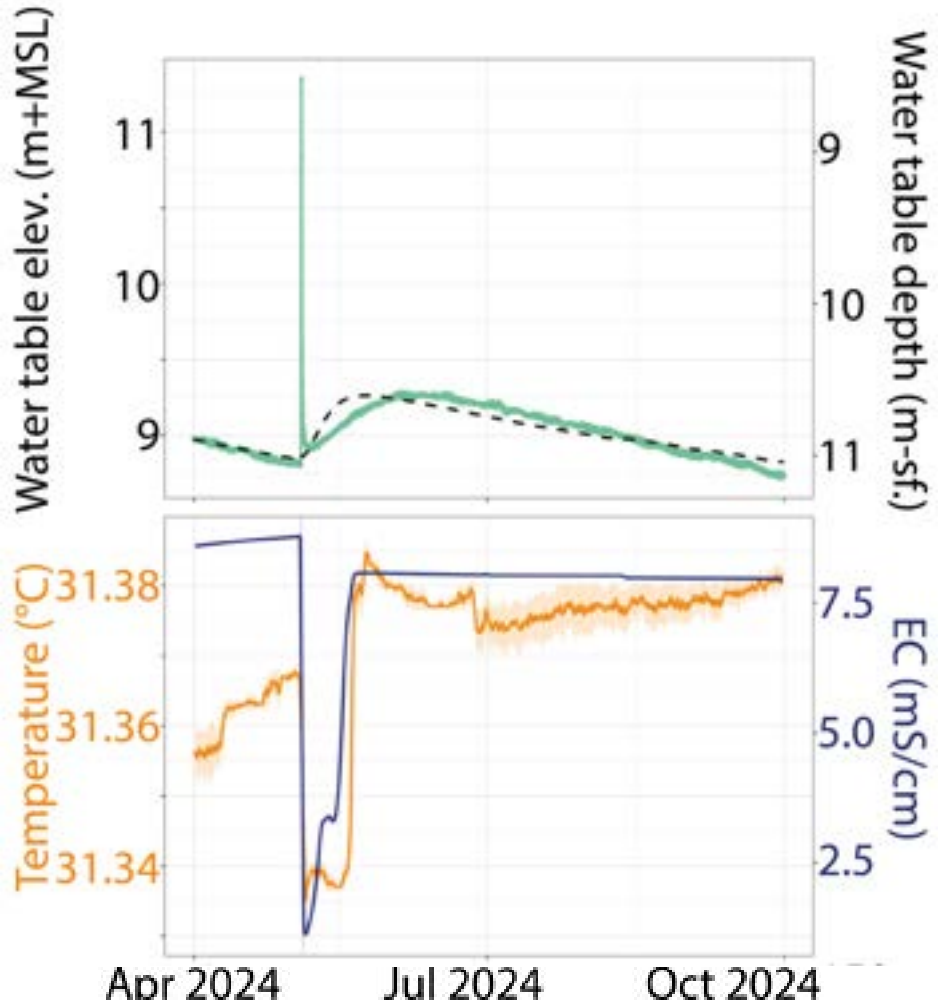
Results – Intense rainfall event

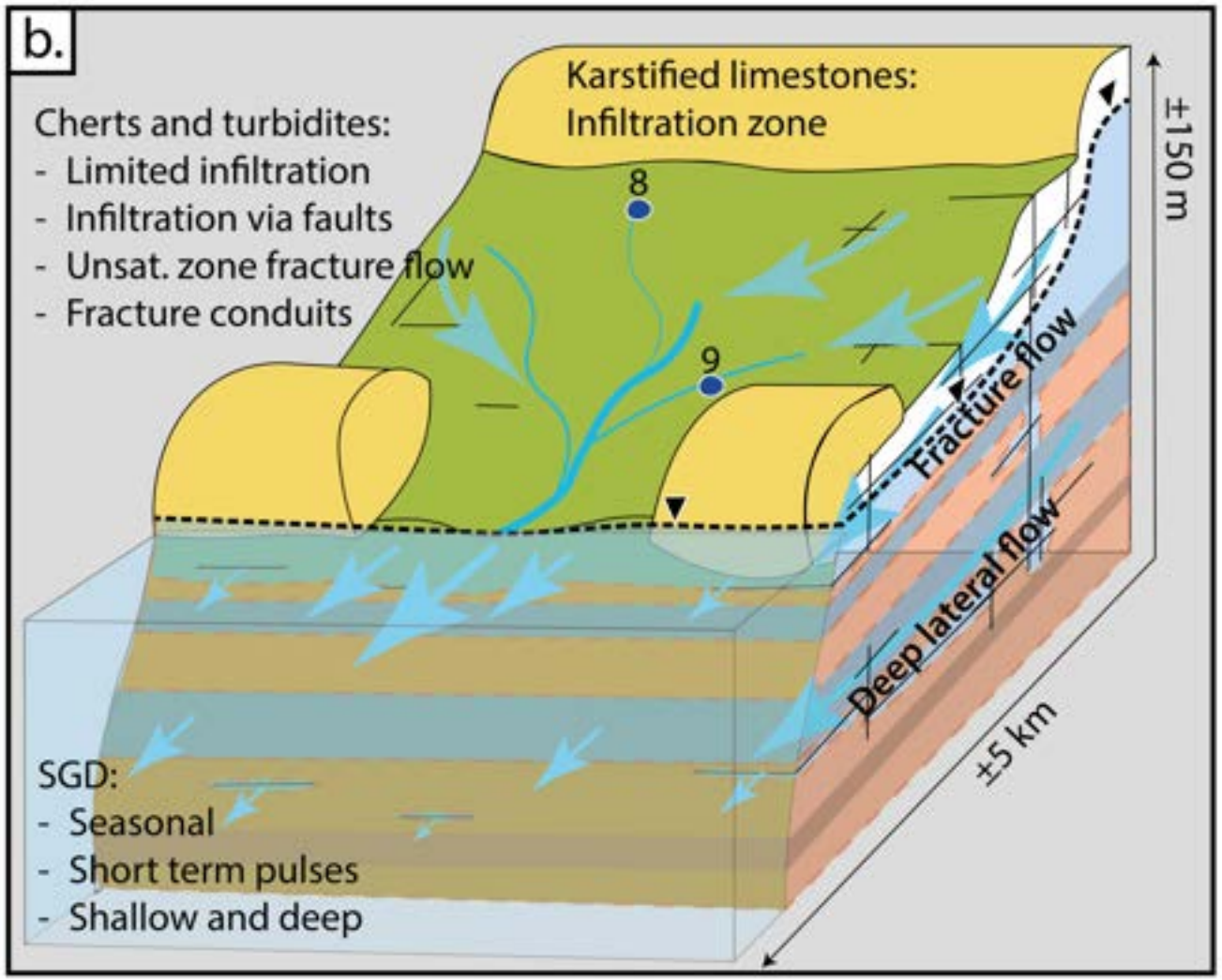


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Conclusions – Intense rainfall event

- Rapid infiltration via preferential flowpaths
- Implication for seaward groundwater discharge





Implications and outlook

- Implications for short-lived “pulses” of seaward groundwater discharge
- Next: quantification of temporal variation in seaward groundwater flow using historical and recent pumping test data





Thank you!

- Questions?
- tituskruyssen@live.nl
- victor.bense@wur.nl



Acknowledgements

- NWO *(SEALINK project)*
- Curaçaoan ministry GMN
- Meteorological department Curaçao (MDC)
- Carmabi research institute Curaçao

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