Preliminary results of Rooftop Rainwater Harvesting and shallow well infiltration pilot project in the Danube-Tisza Interfluve, Hungary

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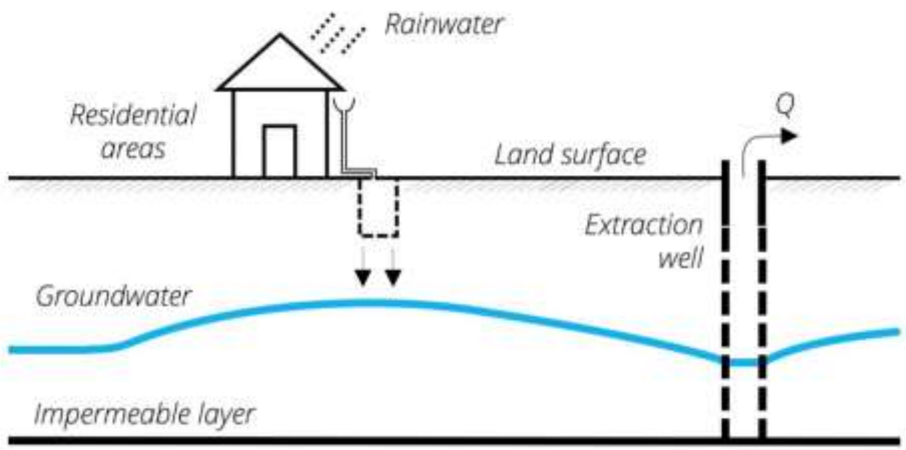
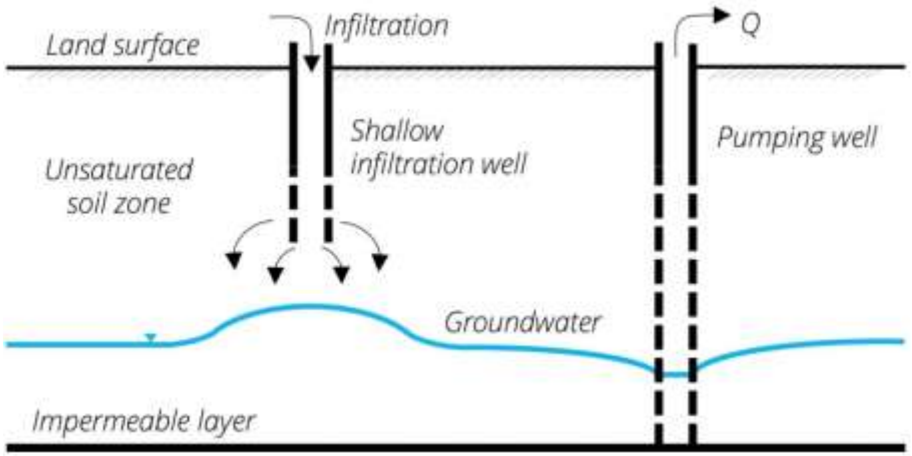
1. Introduction and aims

- Due to **climate change**, weather conditions are becoming more extreme, with longer periods of drought and flood causing environmental, agricultural and consequent social and economic problems.
- **Managed Aquifer Recharge** is a suitable way to reduce these inequalities and helps mitigating the related consequences.
- **The research aim** is to find local scale solutions to the water management problems of the Danube-Tisza Interfluve and evaluate how MAR can contribute to the water shortage of the area.

Rainwater harvesting

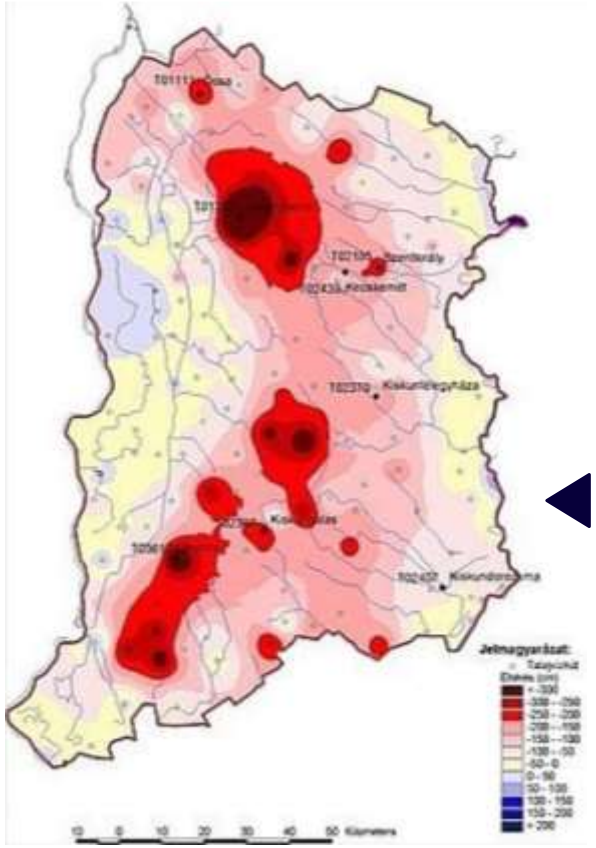


Shallow well infiltration

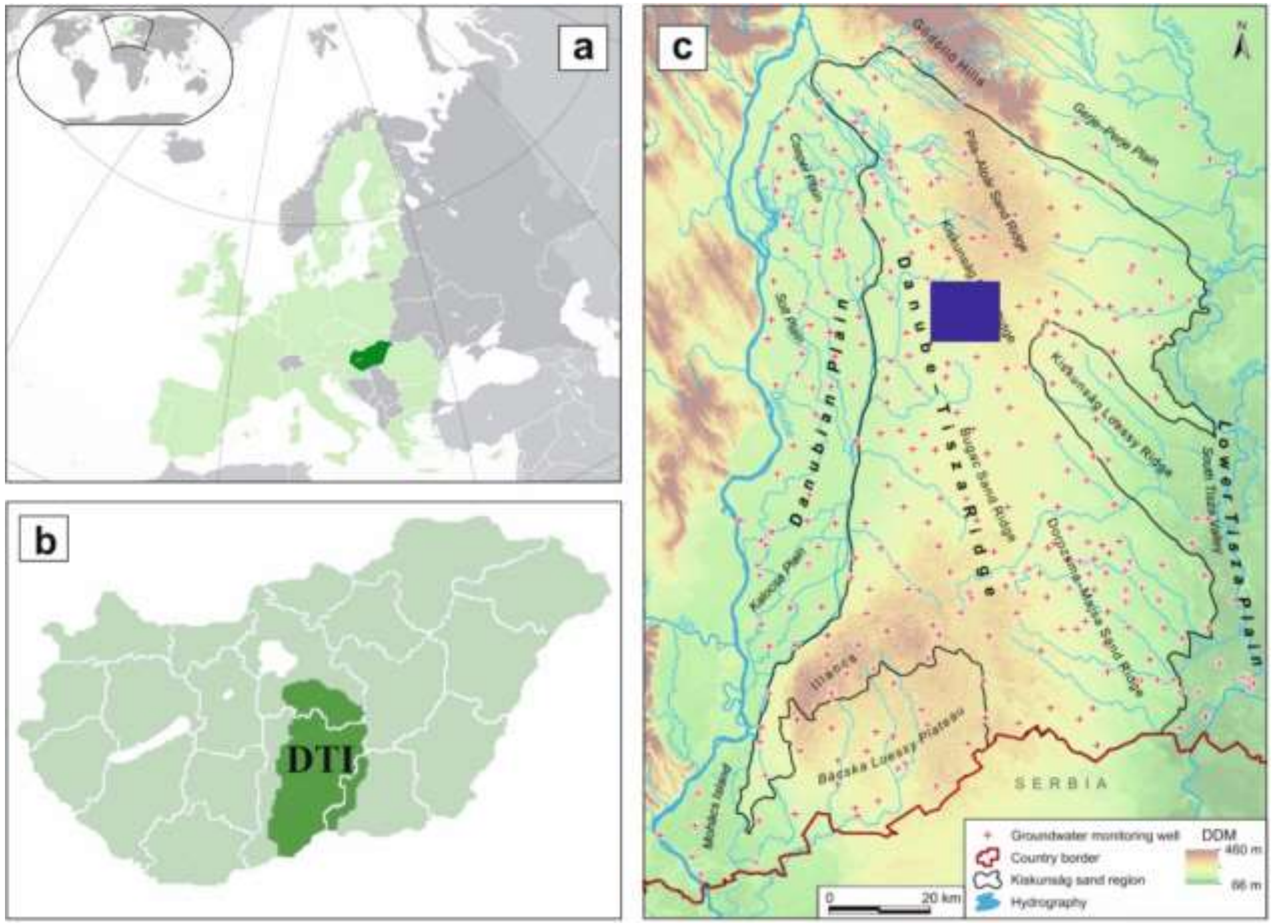


Schematic figure of rooftop rainwater harvesting and shallow well infiltration (https://inowas.com/mar/)

2. Study area

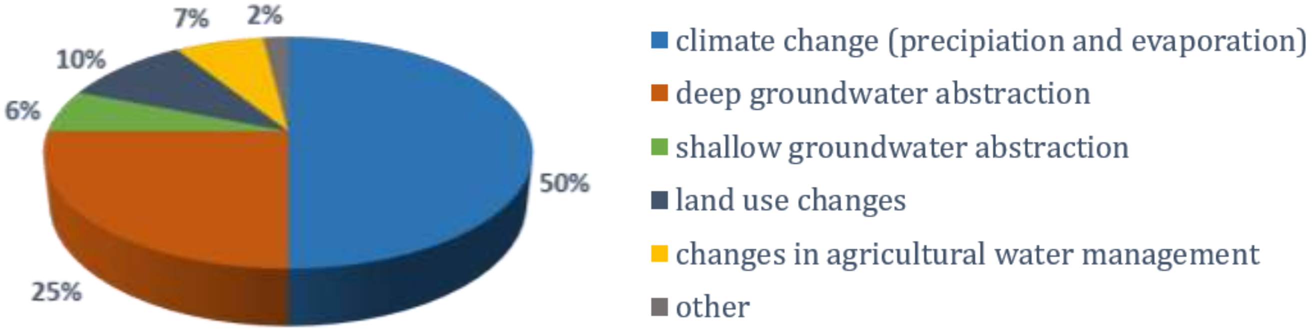


Location of the local study area around the town of Kerekegyháza
(modified from Kohán & Szalai, 2014)



Water level changes between 1956-60 and 2002
(VITUKI, 2002)

Reasons of groundwater level reduction
(based on Pálfai, 2010 and Nagy et al., 2016)

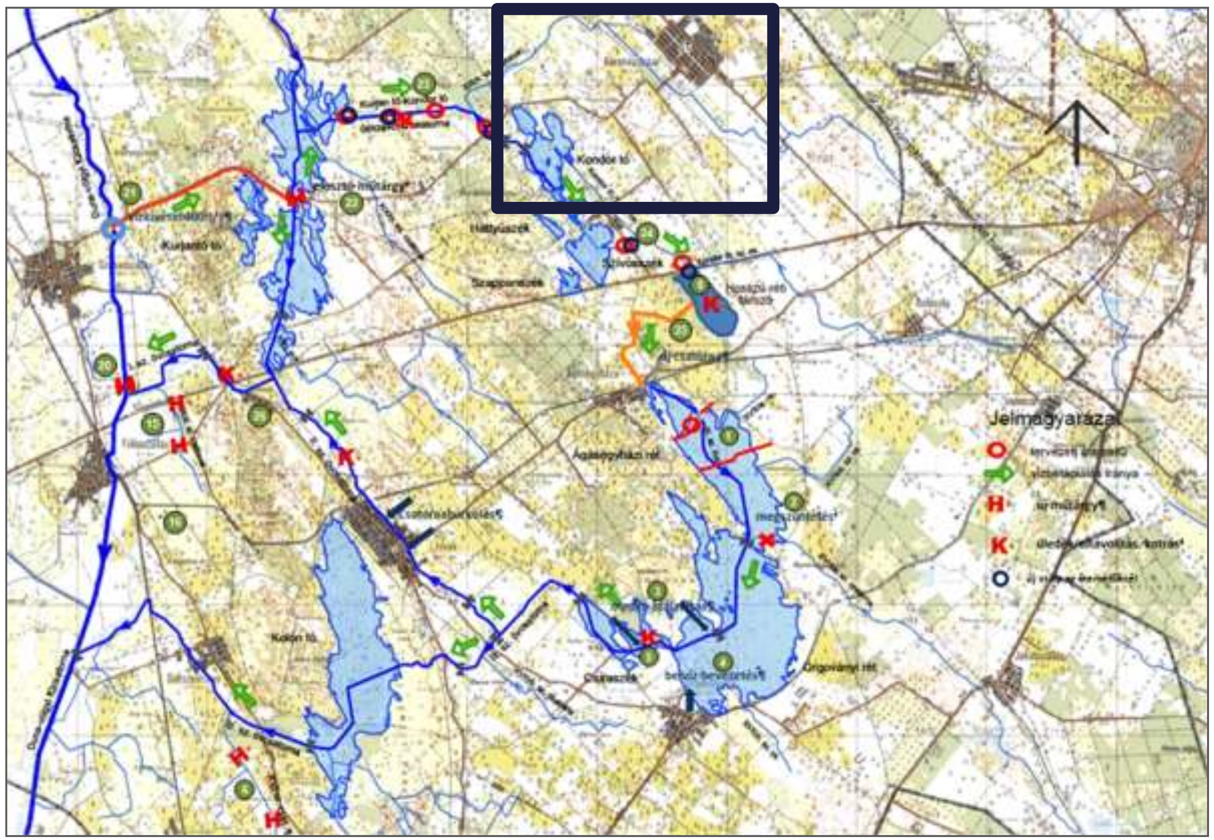


3. Research background

- Water management problems in the broader area have been known for decades
- One of the most recent plans was to move water from the Danube Valley Channel to the center of the ridge, through existing channels and lakes (Nagy et al., 2016)
- Too expensive and not effective enough as the water can easily infiltrate from the channels and it would not reach the higher regions in sufficient amount
- Water chemical considerations, groundwater dependent ecosystems

▼ Lake Kondor

Western Water Supply Plan (Nagy et al. 2016) ▼



4. Experimental pilot site

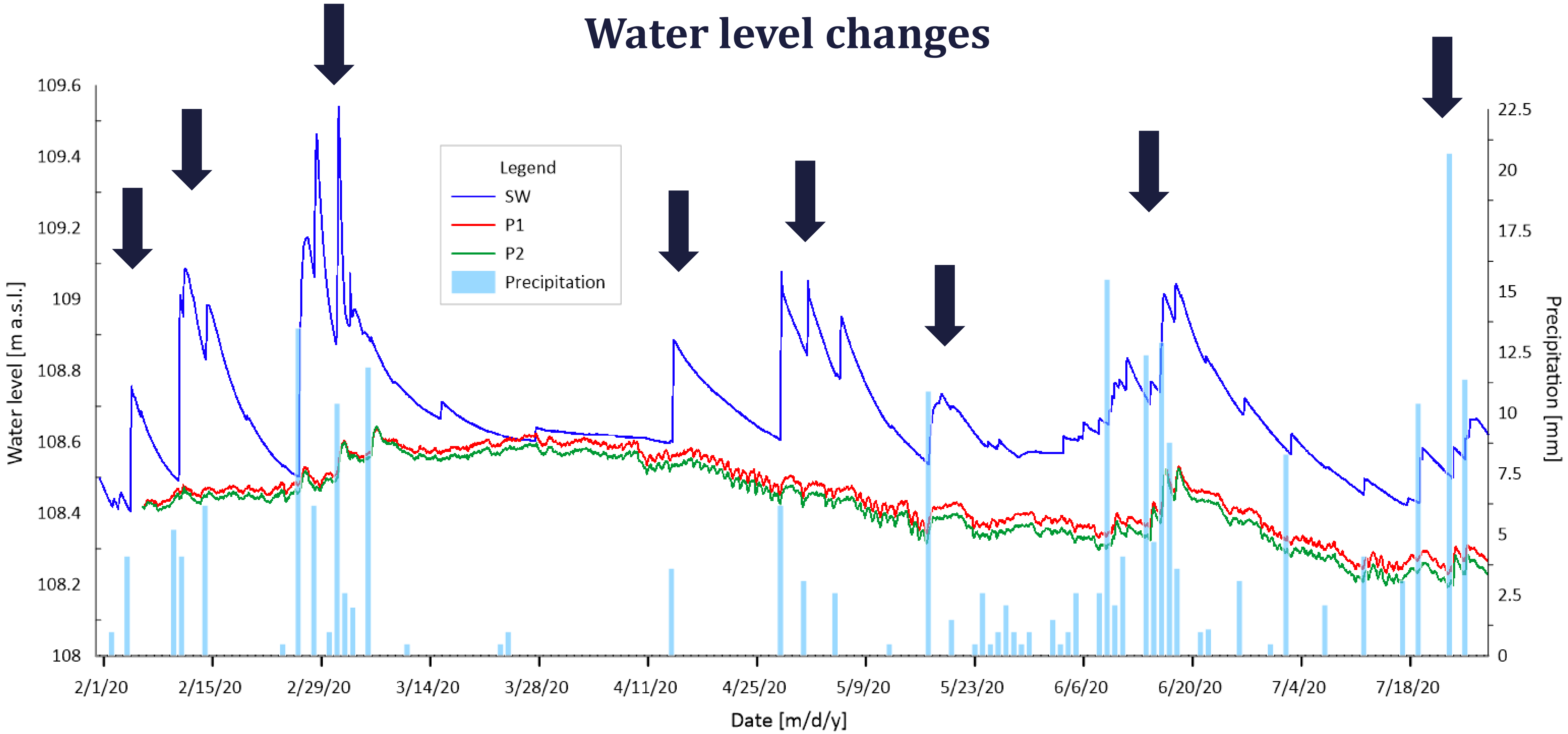
Source water
rainwater collected from the roof of a family house (in an agricultural small town)

Pretreatment
filtration before the water reaches the tube system

Aquifer
unconfined shallow aquifer, consisting of sand, with low water table and high TDS, not used by the residents anymore

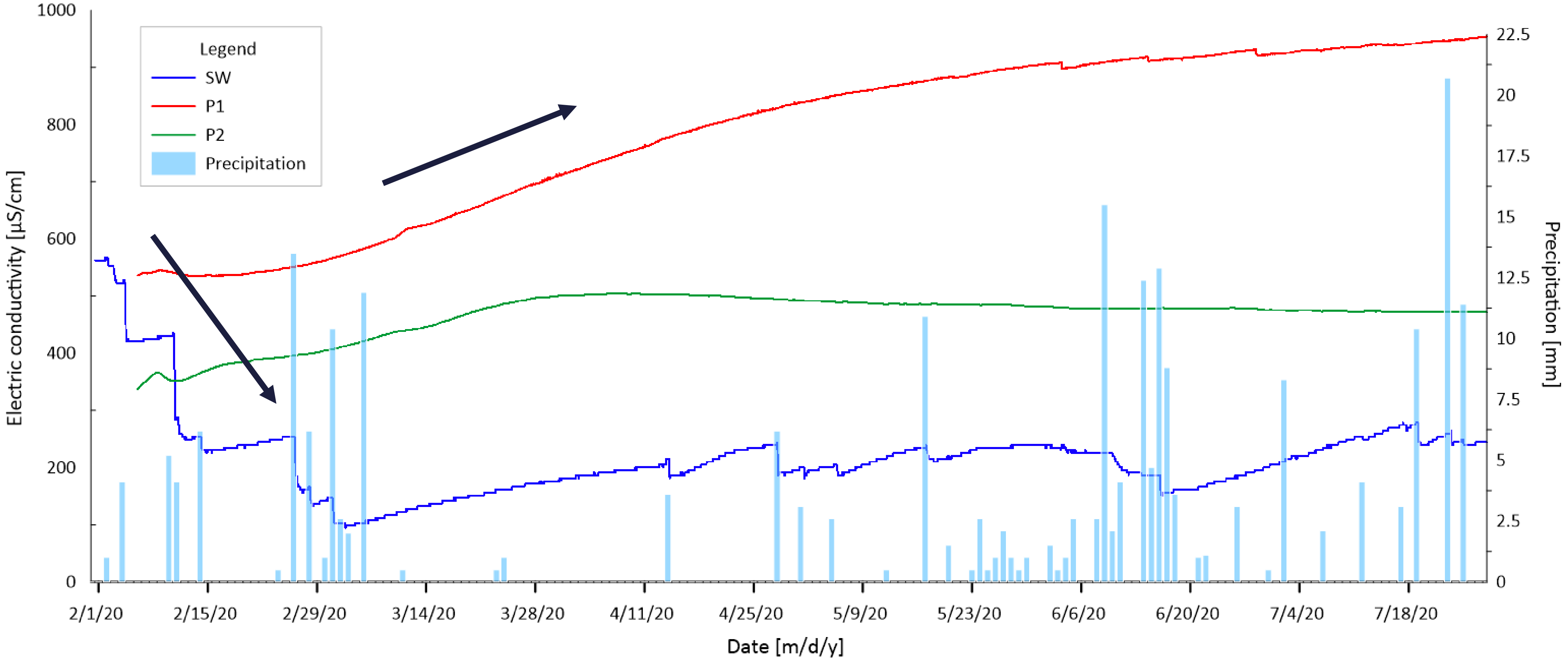
MAR method
shallow well of 6.3 m depth, reaching the water table (water level is around 0.5 m in the well)

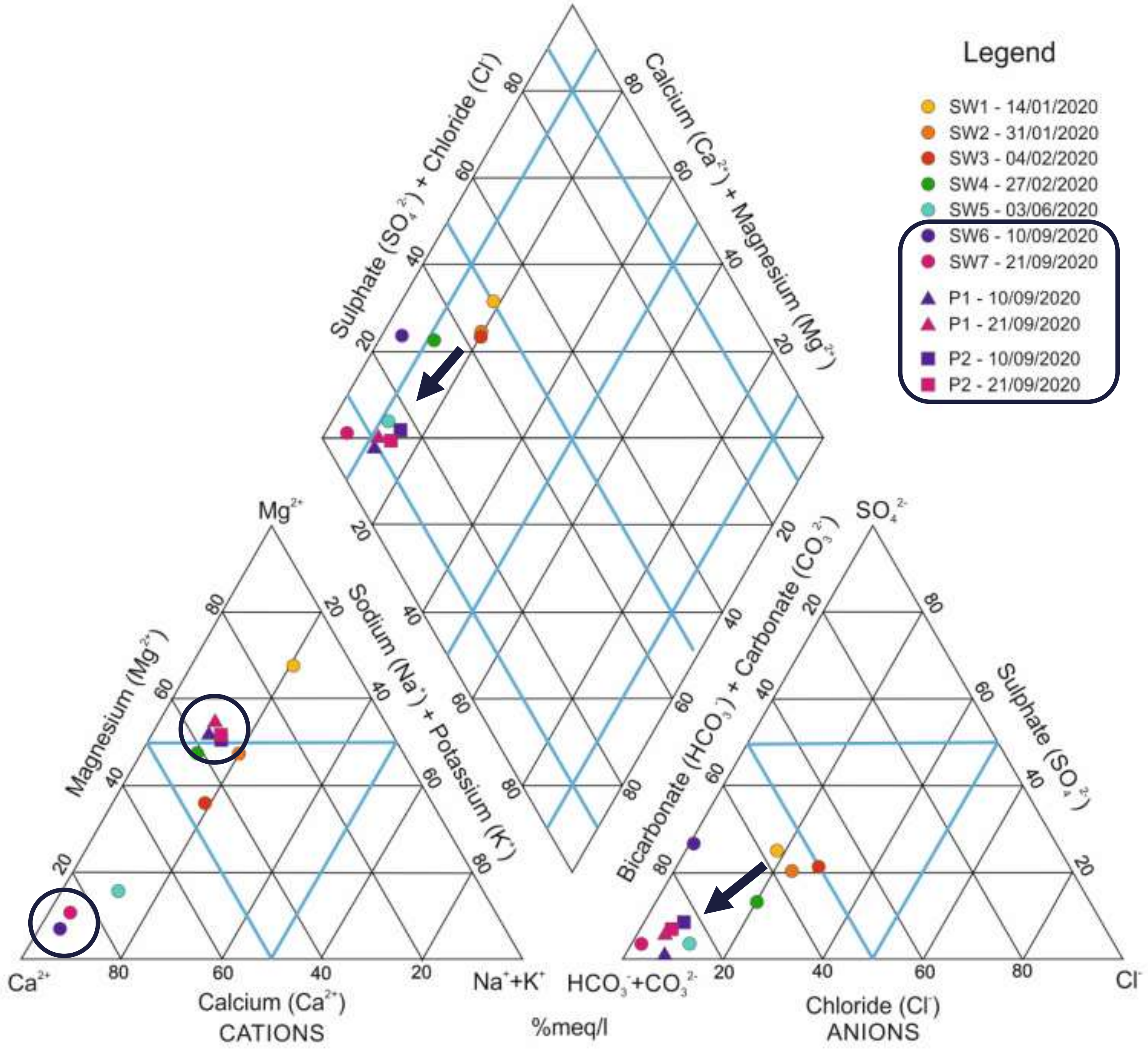
5. Preliminary results



5. Preliminary results

Changes in specific electrical conductivity



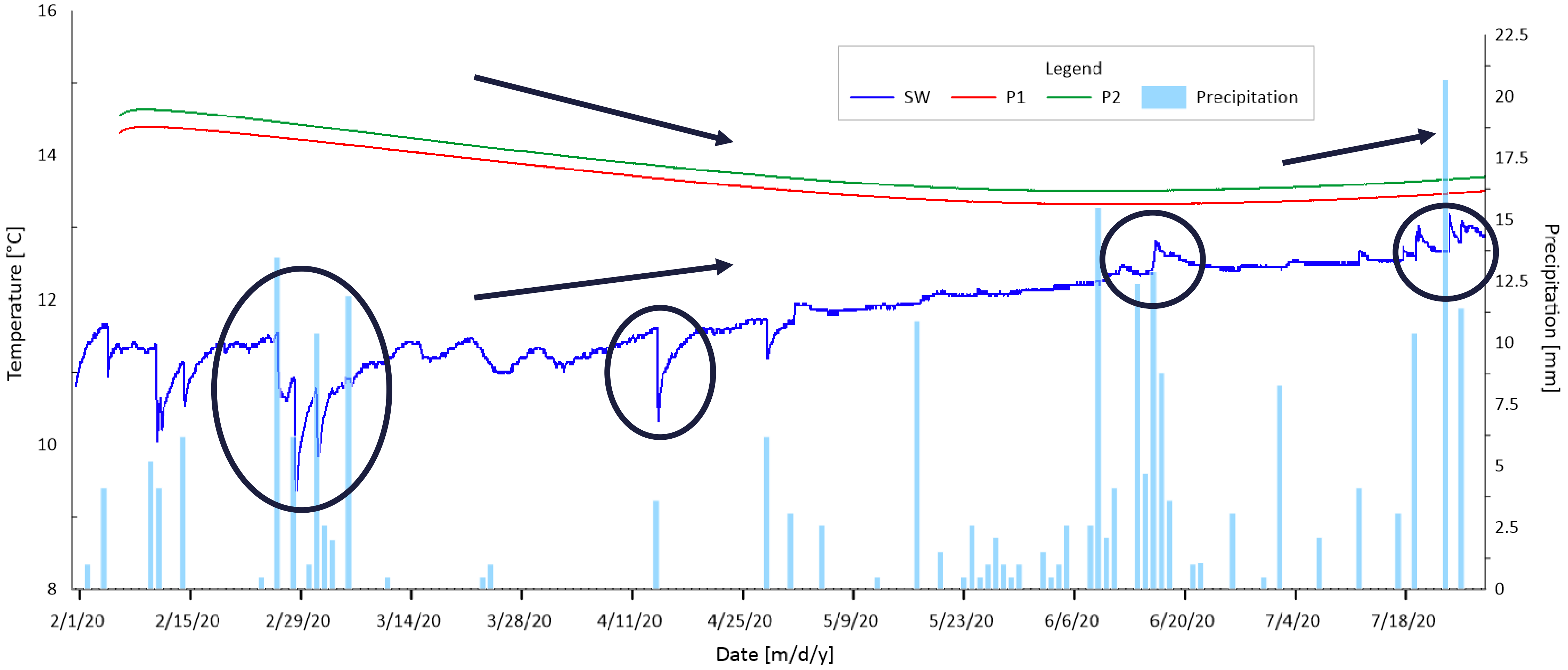


Water chemistry

- Decreasing TDS, Cl^-, SO_4^{2-} and NO_3^- content in the shallow well
- Last sampling time: hydrochemical facies is very similar in the shallow well and the monitoring wells, however **in P1 and P2, TDS is higher** (twice the amount) and **Mg^{2+} content is also significant** (similar to the first samples from the shallow well)

5. Preliminary results

Changes in temperature



6. Conclusions

- The **water table increased** 20 cm in the first two month due to only 10 m^3 of infiltrated water, however water level decreased ~20-40 cm due to a **longer drought in spring**
- The infiltration events are also detectable in the monitoring wells → **good communication** (~3.5 days of travel time)
- **TDS, Cl-, SO_4^{2-} and NO_3^- content decreased** in the shallow well, however the monitoring wells are indicating TDS increase (dominantly Mg^{2+} and HCO_3^-)

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- **Continuing the pilot project for at least one hydrological year**
- More detailed hydrochemical measurements of the shallow well and monitoring wells
- Sampling of the rainwater and the water reaching the well from the PVC hoses
- **Flow and transport modeling** to understand the processes occurring underground

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Final aim

Extending the results of the pilot to the whole town **to increase the water table without any negative side effects** (settlement scale modeling + feasibility study)

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Thank you for your kind attention!