

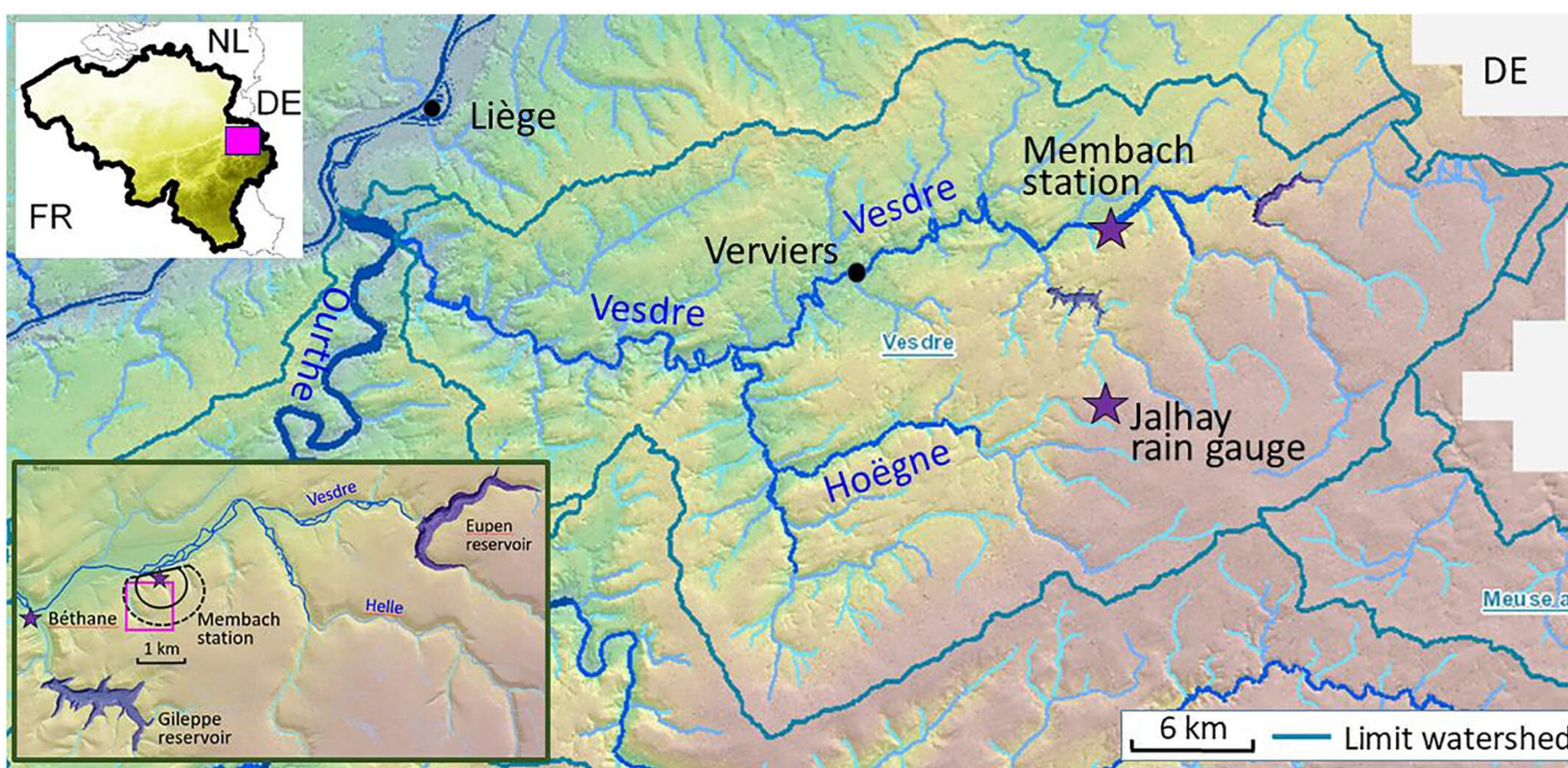
Context

The water cycle exerts a significant influence on geophysical signals. Through an extensive hydrogeophysical investigation at the geodynamic station in Membach, Belgium, we aim to estimate hydrological variations in the surrounding area. Our focus is on integrating gravity and ambient seismic noise measurements to develop a detailed hydrological numerical model at a local scale.

Research objectives:

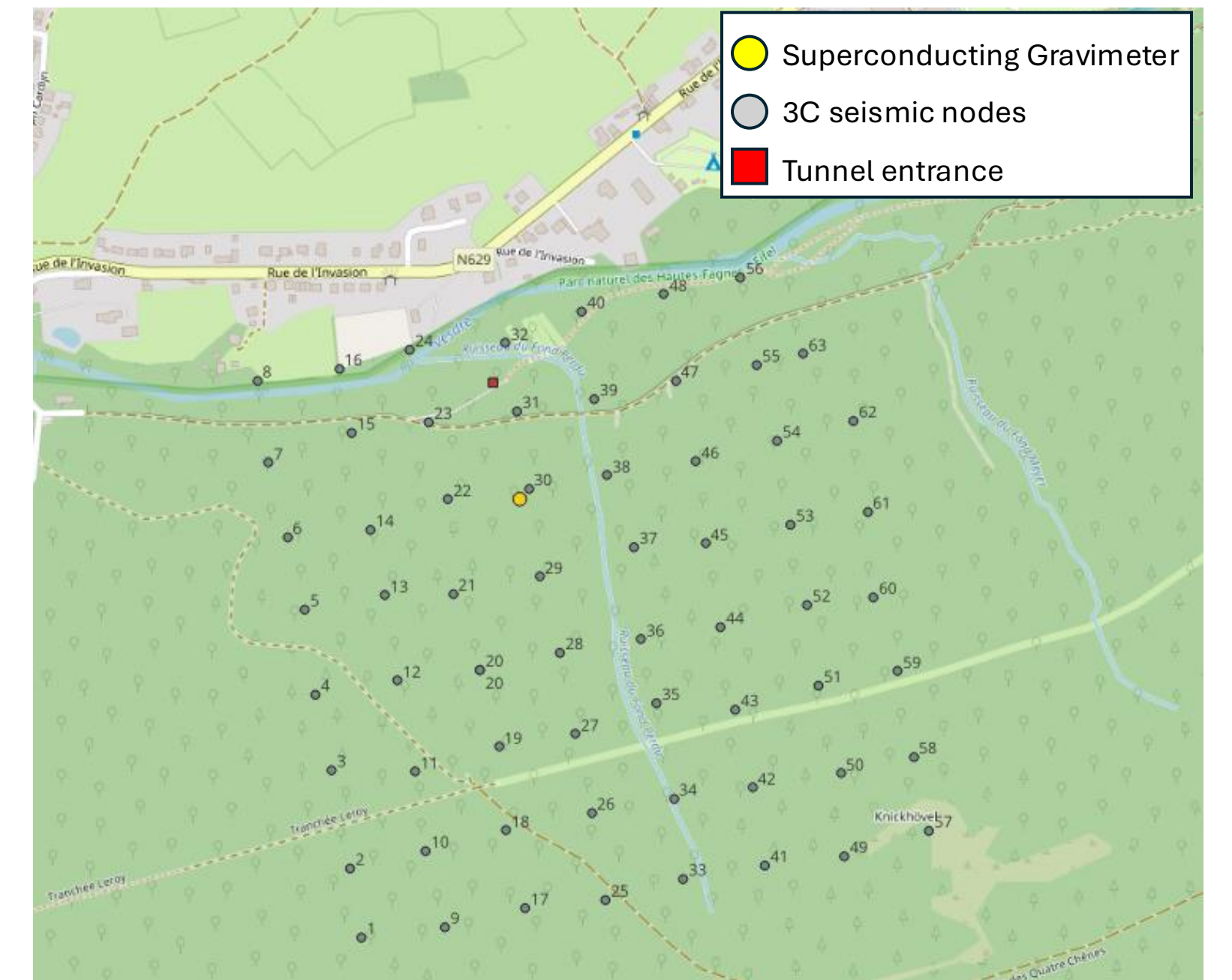
- Investigate the correlations between the geophysics and hydrological observations in Membach.
- Understand the influence of water saturation in relative seismic velocity changes

Site overview

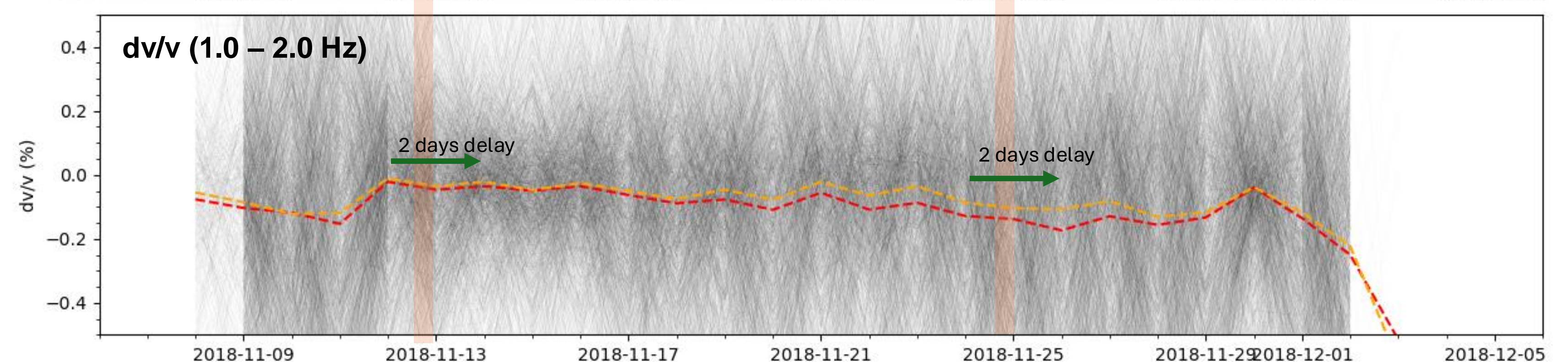
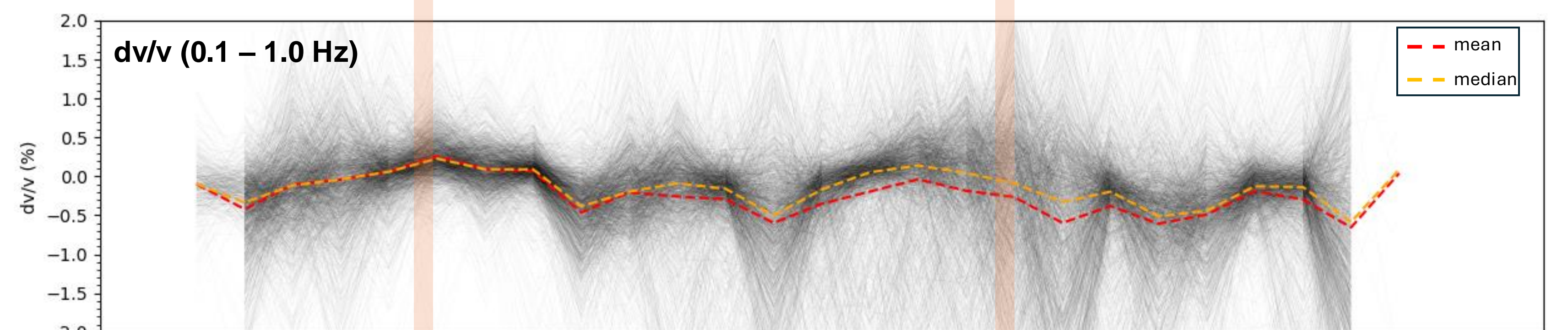
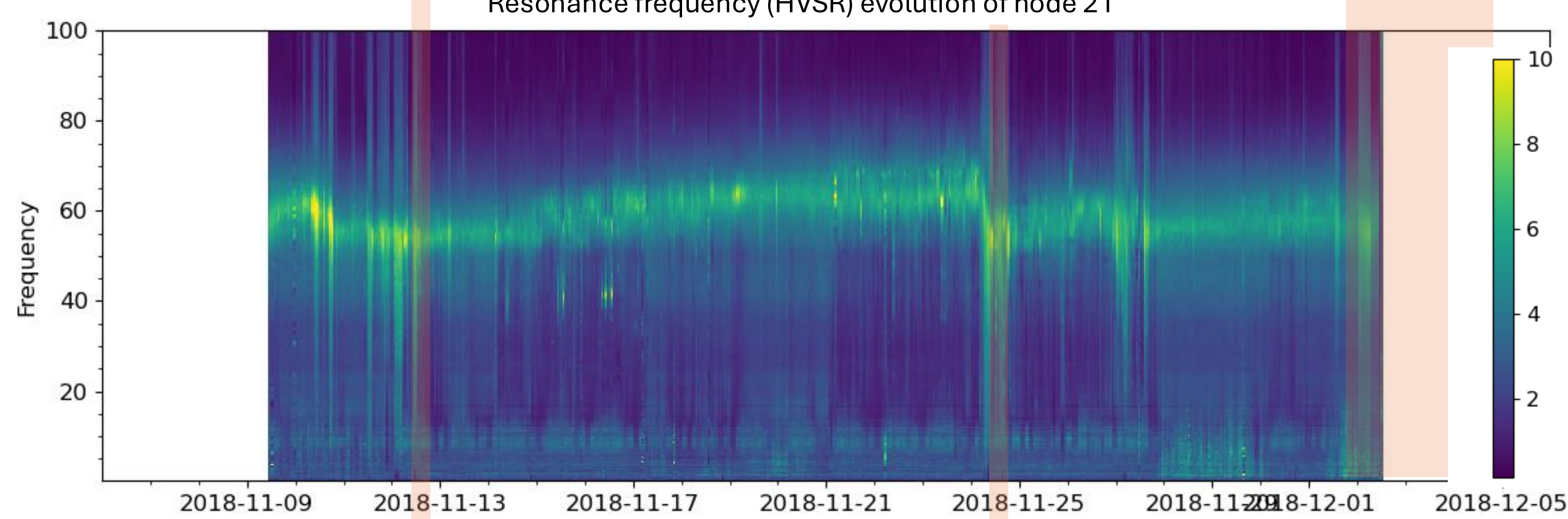
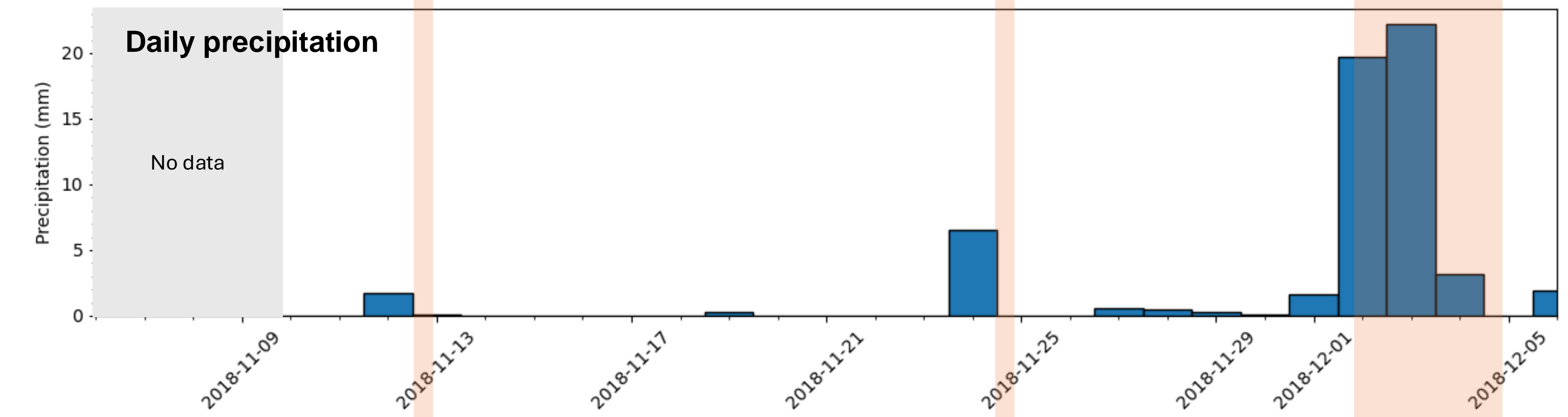
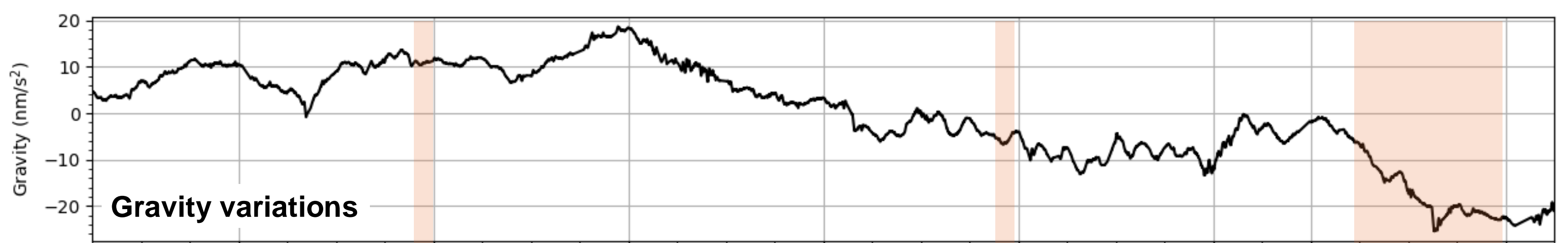


Membach geophysical station

- No presence of aquifer around the station
- The thickness of weathered zone covering the bedrock varies between 0 and 10 m
- The area is covered by primarily a deciduous forest canopy
- The Supraconducting Gravimeter (SG):
 - installed at the end of a 130 m long tunnel excavated in low-porosity argillaceous sandstone, 48.5 m below the surface (since 1995)
 - 63 ground 3-C nodes deployed in winter 2018 (Nov – Dec 2018) in the frame of LARGE-MEM project



Hydrological induced signals



Gravity residuals and precipitation variations

- Gravity residuals: gravity corrected from tides and atmosphere
- The precipitation measured by pluviometer outside the Membach geophysical station
- The gravity residuals decrease while soil saturation increases (hydrological changes occur above the gravimeter)
- Gravity variations provides insight of total water storage changes in the area

Seismic velocity changes:

- Decrease in HVSR while the saturation of the soil increases
- Delayed decrease in dv/v after rainfall events
 - Higher frequency range has smaller dv/v amplitude changes
 - Higher frequency range \rightarrow deeper water storage
- Seismic velocity changes provides insight of the infiltration time and the depth of the water storage

Discussion and Perspectives

- Soil moisture changes influence the geophysical measurements at the Membach station
- Further modellings and detailed processes are needed to quantify water storage changes that influence the geophysical observables
- Detail petrophysical parameters need to be investigated in order to obtain a better parameterization

Acknowledgments

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