

Group presentation WP 3

Quantify temporal changes in subsurface water content and fluxes distributions



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- Activities

- investigate the potential of seismic methods and V_p/V_s for monitoring temporal changes in water content distribution (ESR5)
- design quantitative multi-scale thermal imaging techniques for characterizing fluid flow distributions based on passive and active fiber optic DTS, unmanned aerial vehicles (ESR 6,7)
- validate the first prototype of portable absolute gravimeter for monitoring water content distributions at different times without the need for a fixed reference (ESR 8)

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- Common main questions:
 - Quantify amount and fluxes of groundwater “stored” and how it evolves (seasonal changes).
 - Characterize the hydromechanical behavior of the media (FO-DSTS), to better quantify the amount of groundwater (with, e.g., VP/VS from the seismic).
 - Time-lapse measurements of gravity, seismic velocities, temperature profiles.
 - Pumping tests and corresponding monitoring.

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- Possible joint experiments or actions :
 - Application of the different methodologies (seismic, gravity, temperature) to a common site to quantify (for example) soil moisture in order to see whether we obtain similar results with all of them.
 - Couple seismic, thermal imaging techniques and gravimetry to better represent/characterize the medium and the groundwater and flow behavior over time.

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- Existing reviews, ex:

- For gravity in hydrogeology : Van Camp, M., Viron, O., Watlet, A., Meurers, B., Francis, O., & Caudron, C. (2017). Geophysics From Terrestrial Time-Variable Gravity Measurements. Reviews of Geophysics.
- Heat as a Ground Water Tracer. Anderson, M. P. (2005). Ground Water.
- Review: Geothermal heat as a tracer of large-scale groundwater flow as a means to determine permeability fields. Saar, M.O. (2011). Hydrogeology Journal.
- Active-distributed temperature sensing to continuously quantify vertical flow in boreholes. Read, T., et al. (2014). Water Resources Research.
- Socco, L. V., Foti, S., & Boiero, D. (2010). Surface-wave analysis for building near-surface velocity models—Established approaches and new perspectives. Geophysics.

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- Possible ideas of “reviewlets”:
 - **New methods for monitoring dynamics in subsurface water**
 - probably narrowing the topic to : ***Quantifying soil moisture storages and fluxes***
 - not only including temperature, seismic and gravity
 - up to 10-12 methods that had been developed during the last ~10 years
 - resolution of the method (scale of applicability of each method and ways to combine them to have a multi-scale methodology)
 - How can these geophysical methods provide hydrological models with better parameter estimations?
 - Pros and cons of each hydrogeophysical methods (limitations, applicability, which environments?)