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Large-scale spatial characterization of a karst aquifer by combination of periodic and non-periodic hydrodynamic responses (Lez aquifer, France)

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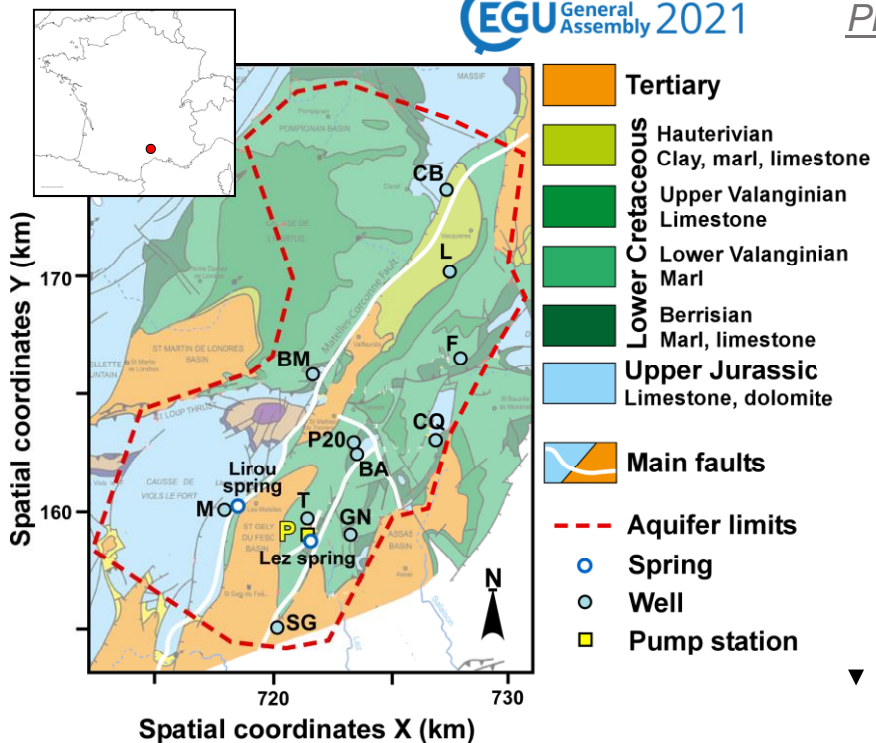
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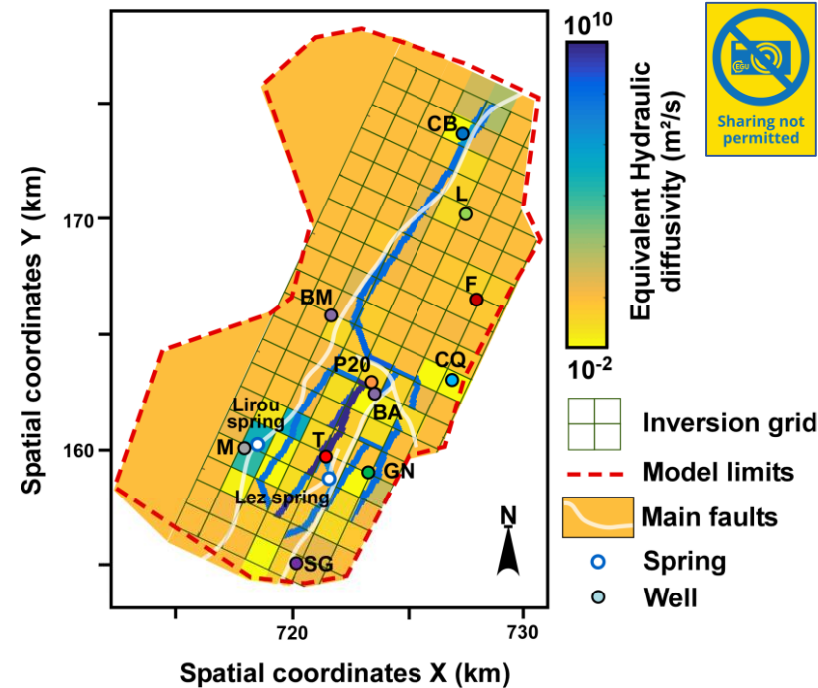
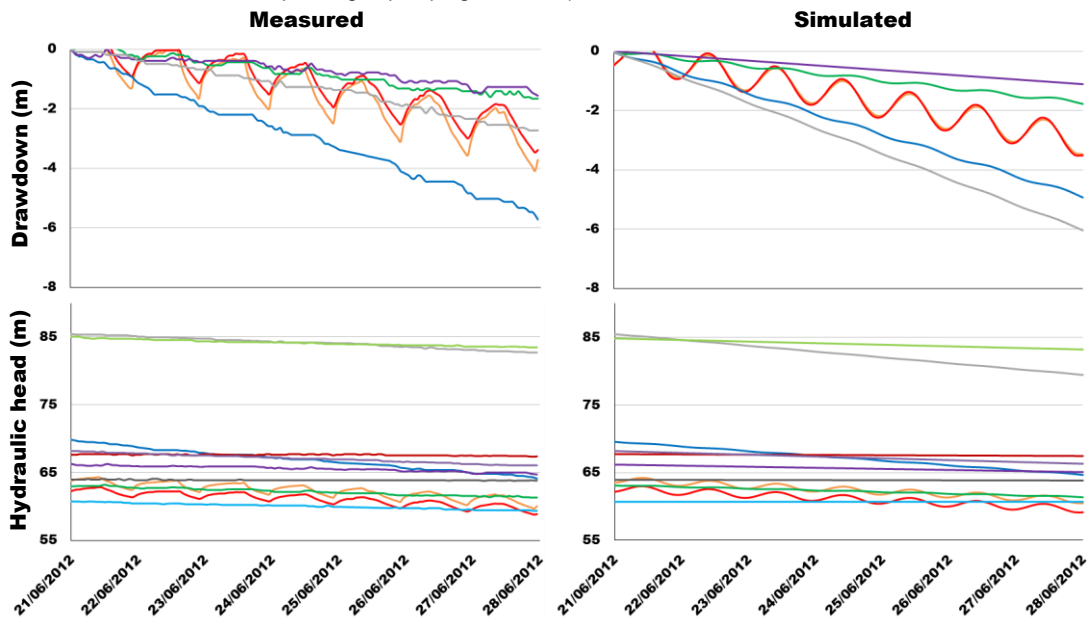
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We present a large-scale characterization of the hydraulic diffusivity field of the Lez karst aquifer (~350 km²) in southern France based on 1) measured hydrodynamic data, 2) a distributed physics-based model and 3) an inversion algorithm optimizing the hydraulic diffusivities in the model in order to match with the measured data.

- 1 Measured data:** Hydraulic heads in 11 locations during 7 days in June 2012
 - Periodic responses to daily pumping variations (Lez spring)
 - Non-periodic drawdown slopes
- 2 Model physics:** Darcy's law (confined aquifer)
 - Frequency domain (periodic responses)
 - Time domain (non-periodic drawdown slopes)
- 3 Inversion algorithm:** Cellular Automata-based Deterministic Inversion (Fischer et al. 2017)
 - Initial karst structure based on main faults

Comparison of measured and simulated responses (drawdowns only for wells responding to pumping variations)



Inverted hydraulic diffusivity field. Only point M shows a higher simulated slope (proximity of Lirou spring ?)

Geological map of the Lez aquifer showing the 11 monitoring wells and the pumping well

Methodology

- Pumping daily variations are assimilated to oscillations
- Karst conduits structure is optimized from the periodic oscillatory responses
- Diffusivities are optimized from periodic oscillatory and non-periodic drawdown slope responses

Results highlights & Next steps

- Complex karst responses can be reproduced with a distributed model
- Coupling periodic and non-periodic hydrodynamic responses allows generating a coherent hydraulic diffusivity field imagery
- Next > Validation with other measurement time windows, Uncertainties quantification, Tracer tests simulation

