



# **A lumped parameter modeling approach considering land-cover and land-use (LCLU) for the simulation of karst spring hydrological functioning.**

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# Introduction

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- Climate Change (CC) and anthropogenic pressures impact groundwater resources.
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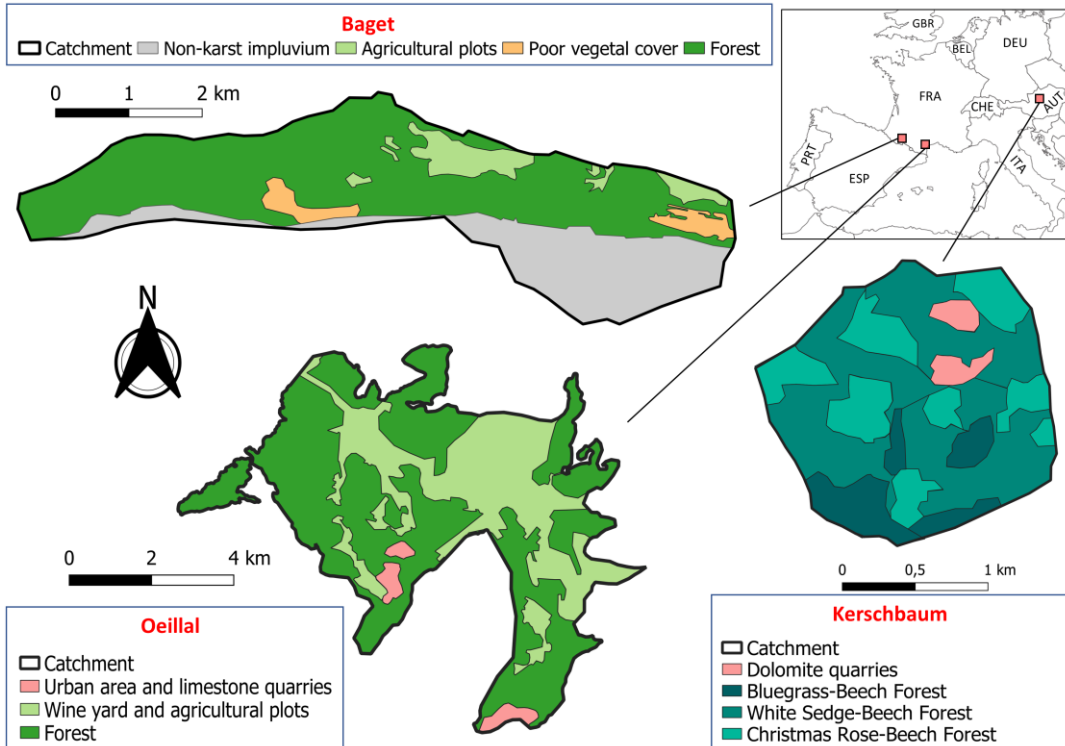
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- ➔ Needs for prediction tools accounting for both CC and LCLU changes to properly assess impacts of global change.
- ➔ **Added value to consider LCLU in lumped parameter modeling?**
- ➔ **Trade-off between model complexity and model performance?**

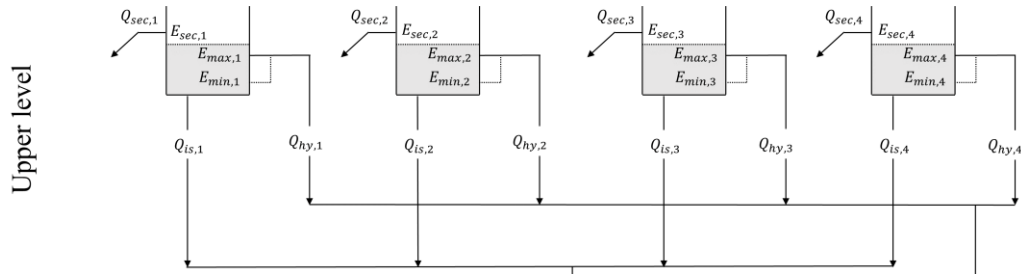
# Study sites

**Karst catchment of (a) Kerschbaum, (b) Oeillal and (c) Baget and associated land use.**  
**Forest dominated LC and recharge area < 50 km<sup>2</sup>**



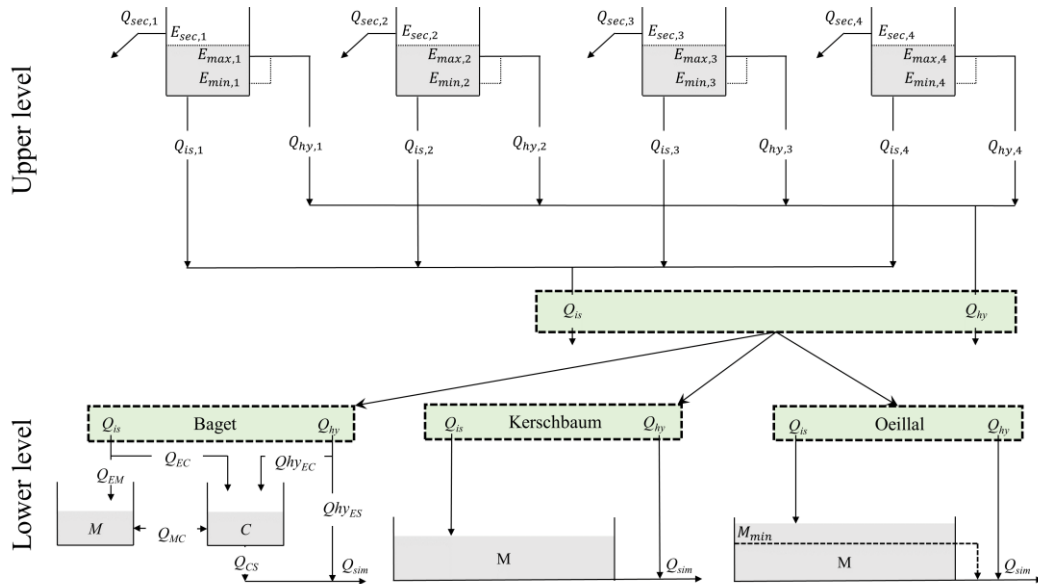
# Model structures for each karst catchment

- The upper level is based on the LuKARS model (Bittner et al., 2018)



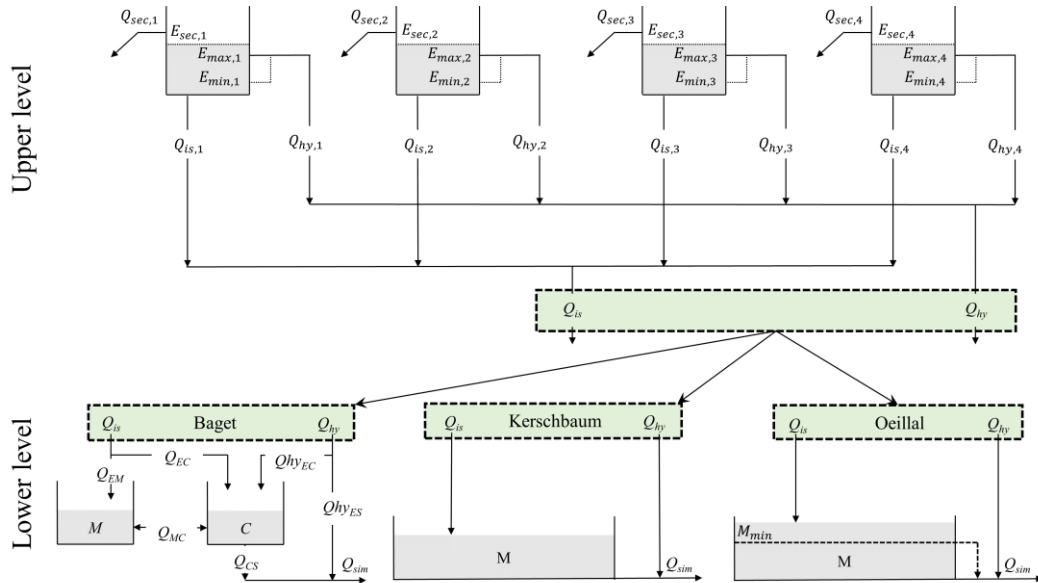
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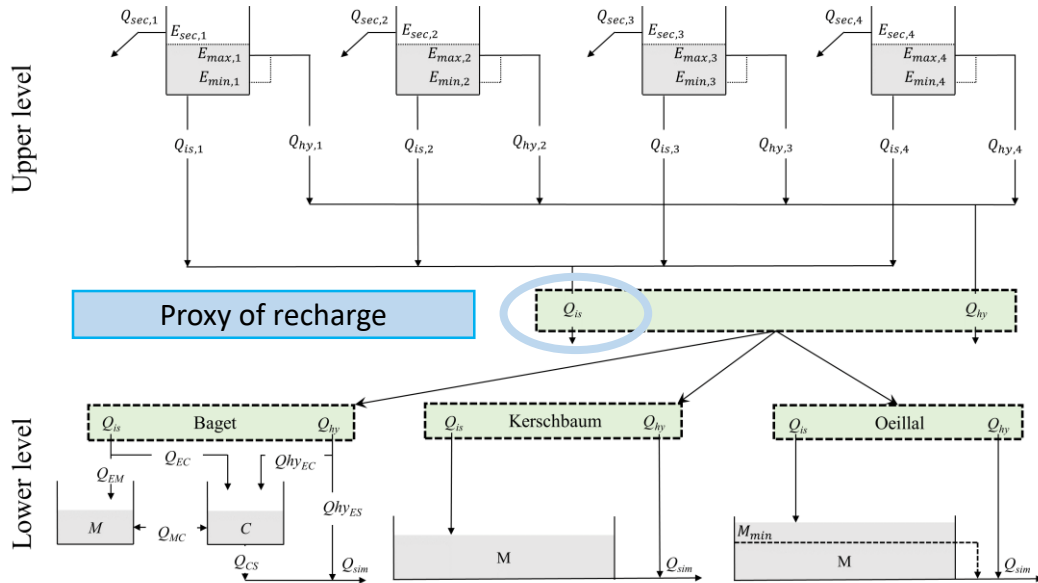


→ Model performance are evaluated for different number of compartment in upper level  
 LK\_01, LK\_02, LK\_03, LK\_04 refer to model with 1 to 4 compartment in the upper level respectively.



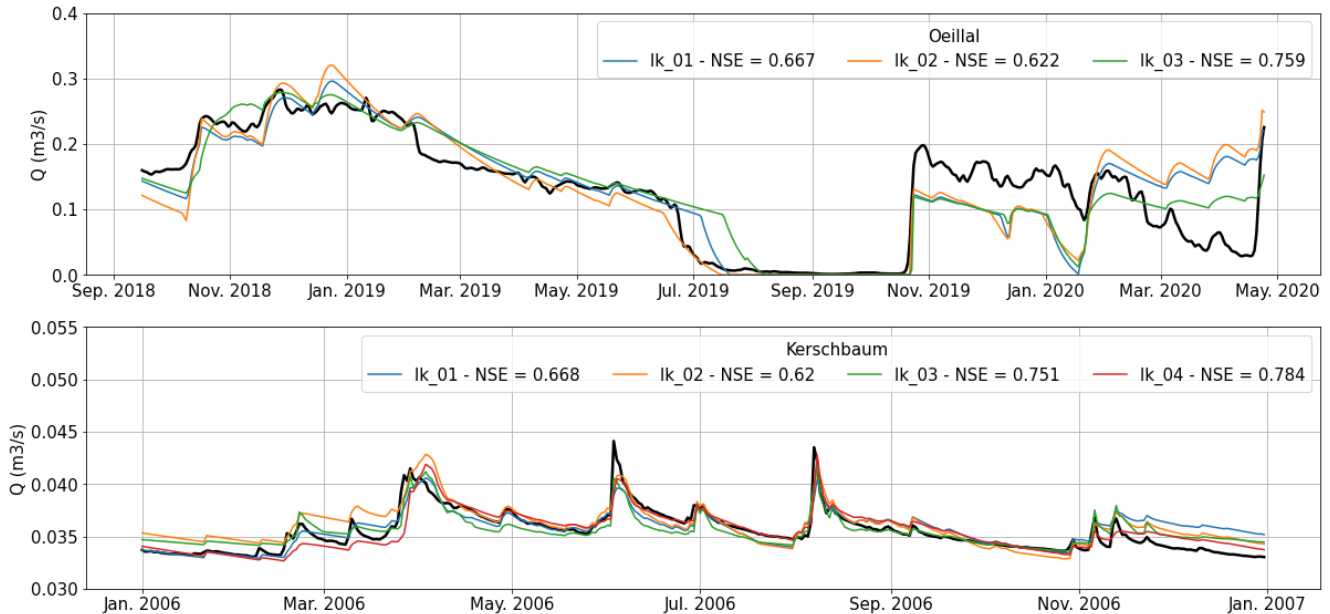
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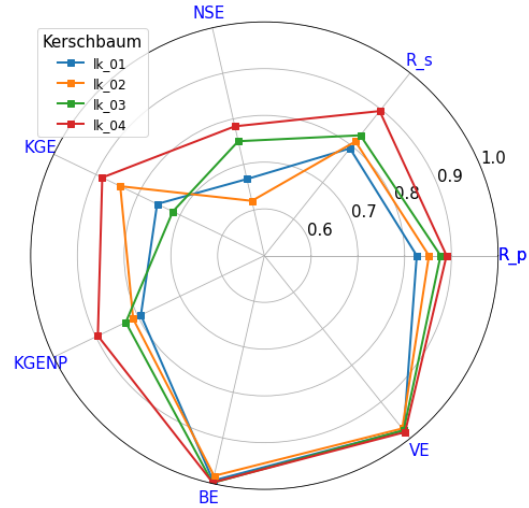
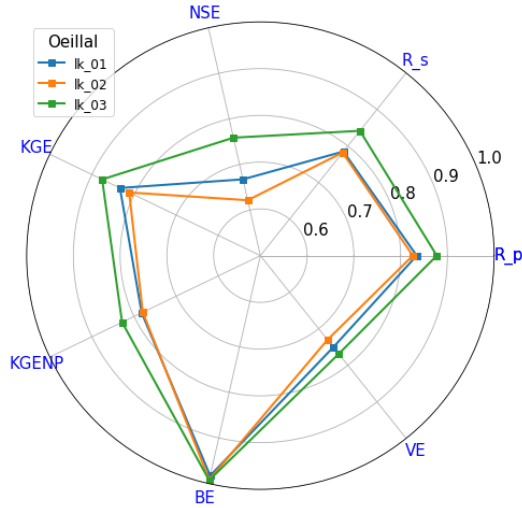
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# Model performance vs. model structure



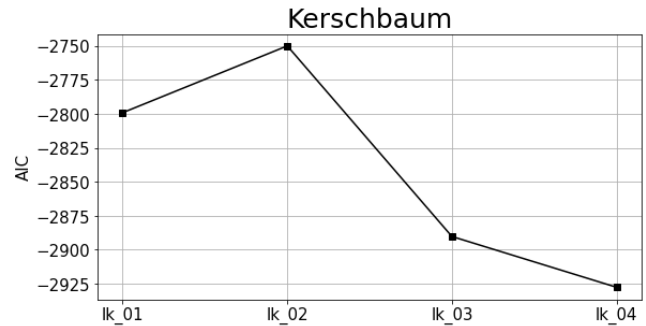
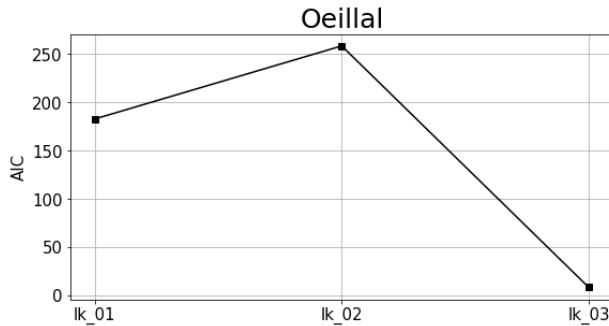
- ➔ Good model performance when considering 1 compartment in the upper level.
- ➔ Nonetheless better model performance when considering various compartments.

# Model performance vs. model structure



➔ Overall better performance for the model with higher number of compartments in the upper level.

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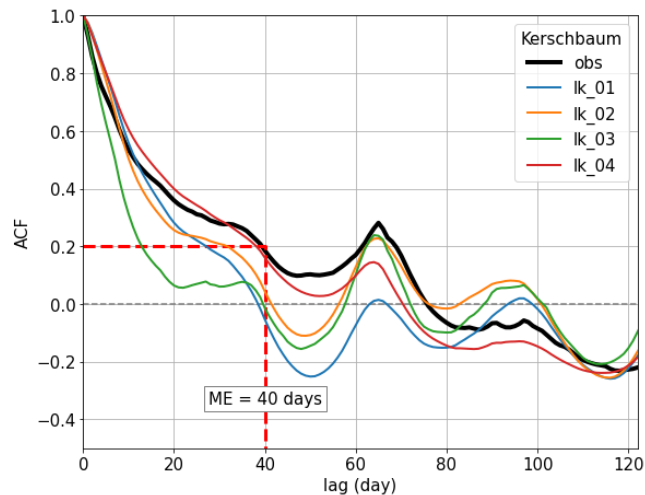
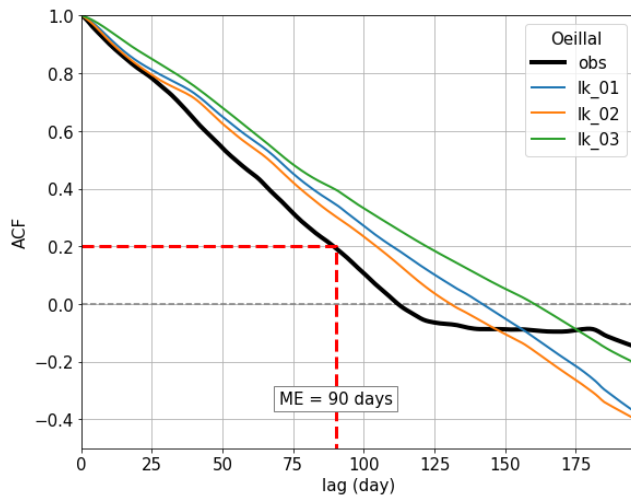


**AIC : Akaike Informative Content**

**The lower AIC value the better compromise between model performance and number of parameters.**

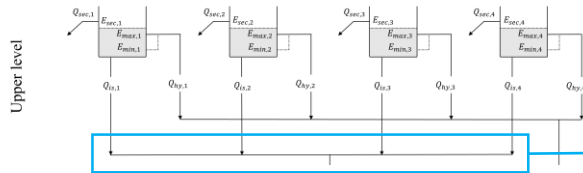
**→ For both Oeillal and Kerschbaum, considering various compartment in the upper level gives better model performance with a suitable compromise between model complexity and performance.**

# ACF of observed and simulated spring discharge



- ➔ For Oeillal, all model structure overestimate the memory effect (ME)
- ➔ For Kerschbaum, better estimation of the ACF and memory effect (ME) for the model considering various compartments in the upper level.

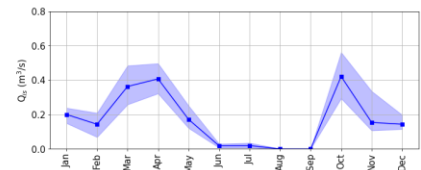
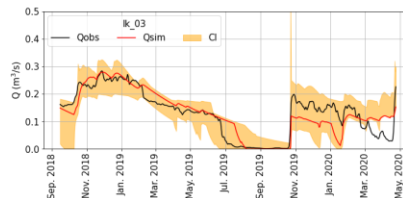
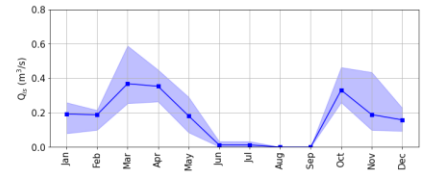
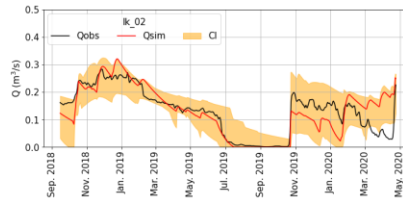
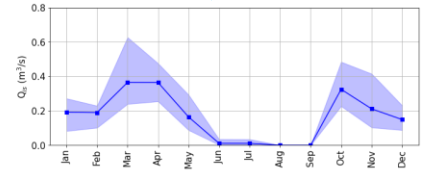
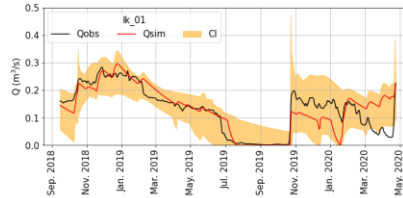
# Conclusion



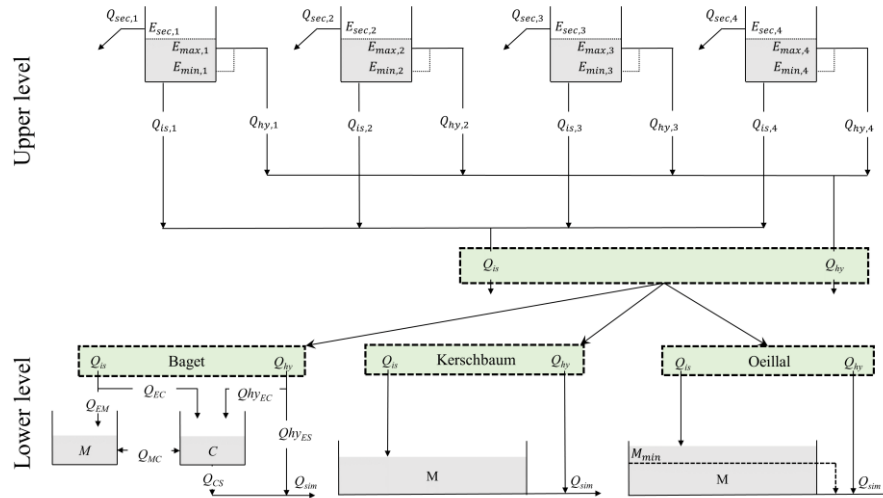
- Latin Hypercube Sampling (LHS) of the parameter space
- Quantile 0.99 to compute the confidence interval (CI)

## Oeillal

- Same dynamics of intra-storage fluxes for all model structure.
- Lower uncertainties in the estimation of Qis (proxy of the recharge) for higher number of compartment in the upper level.
- But significant uncertainties on simulated spring hydrograph



# Perspectives



- ➔ Assessing both structural and parametric uncertainties.
- ➔ Application on study site with observation on a longer period of time.
- ➔ Assessing the sensitivity of projection under CC conditions to potential LCU changes (anthropic pressure, vegetation adaptation)

Thanks for your attention