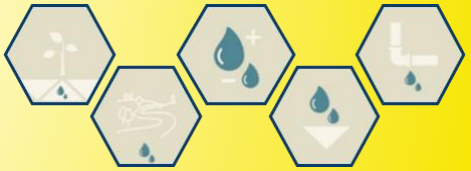
2nd International LIFE REWAT Summer School

Digital water management and water-related agroecosystem services: geostatistics, hydroinformatics and groundwater flow numerical modelling

September 9th—20th, 2019
Scuola Superiore Sant'Anna
Pisa, Italy



2nd FREEWAT International Workshop

Modeling the hydrological impact of land use change in karst systems using the LuKARS plugin for FREEWAT

Daniel Bittner

Technical University of Munich, Germany

Modeling the hydrological impact of land use change in karst systems using the LuKARS plugin for FREEWAT

Daniel Bittner, Technical University of Munich,
Chair of Hydrology and River Basin Management

LuKARS - Land use change modeling in KARSt systems)

- Conceptual, semi-distributed modeling approach suggested by Bittner et al. (2018)

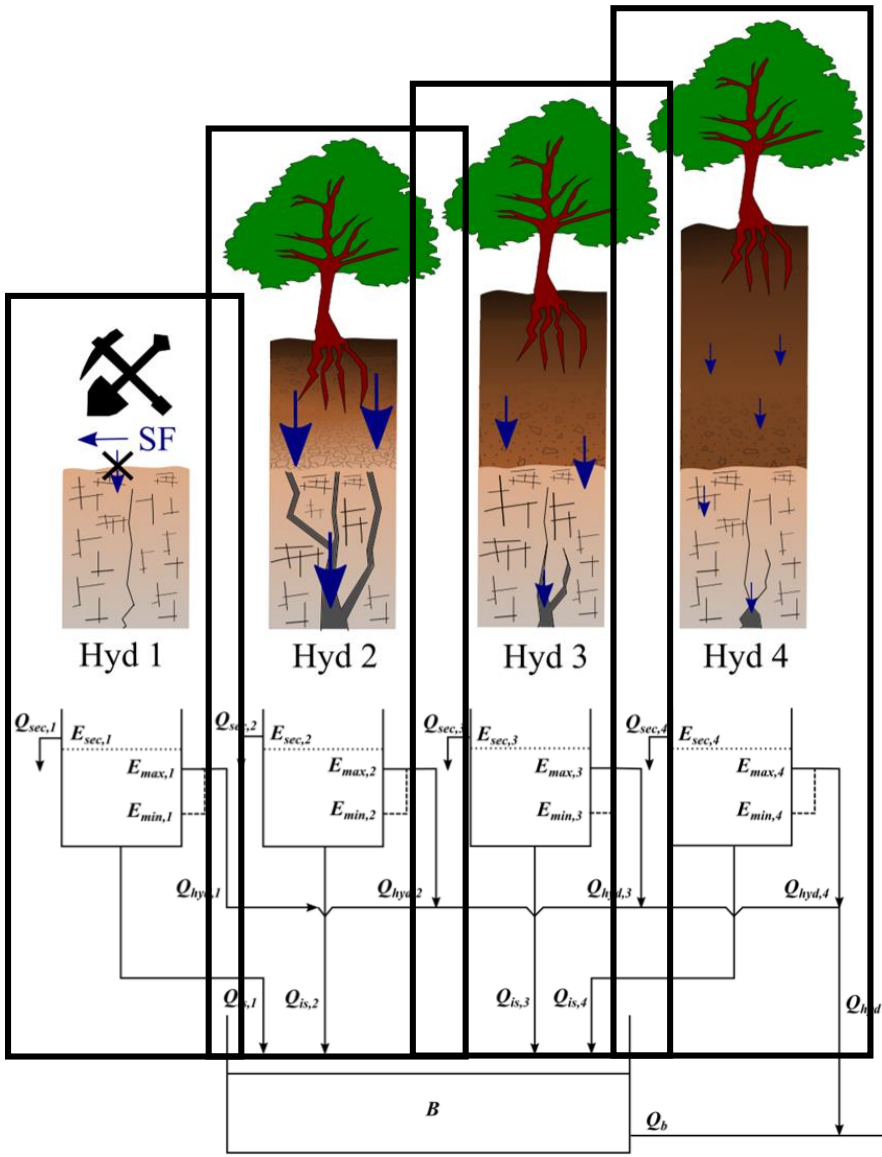
- Hydrotope-based (distinct landscape units characterized by homogeneous hydrological properties as a result of similar land use and soil types)

- Each hydrotope shows distinct hydrological responses to rainfall events depending on ist soil properties

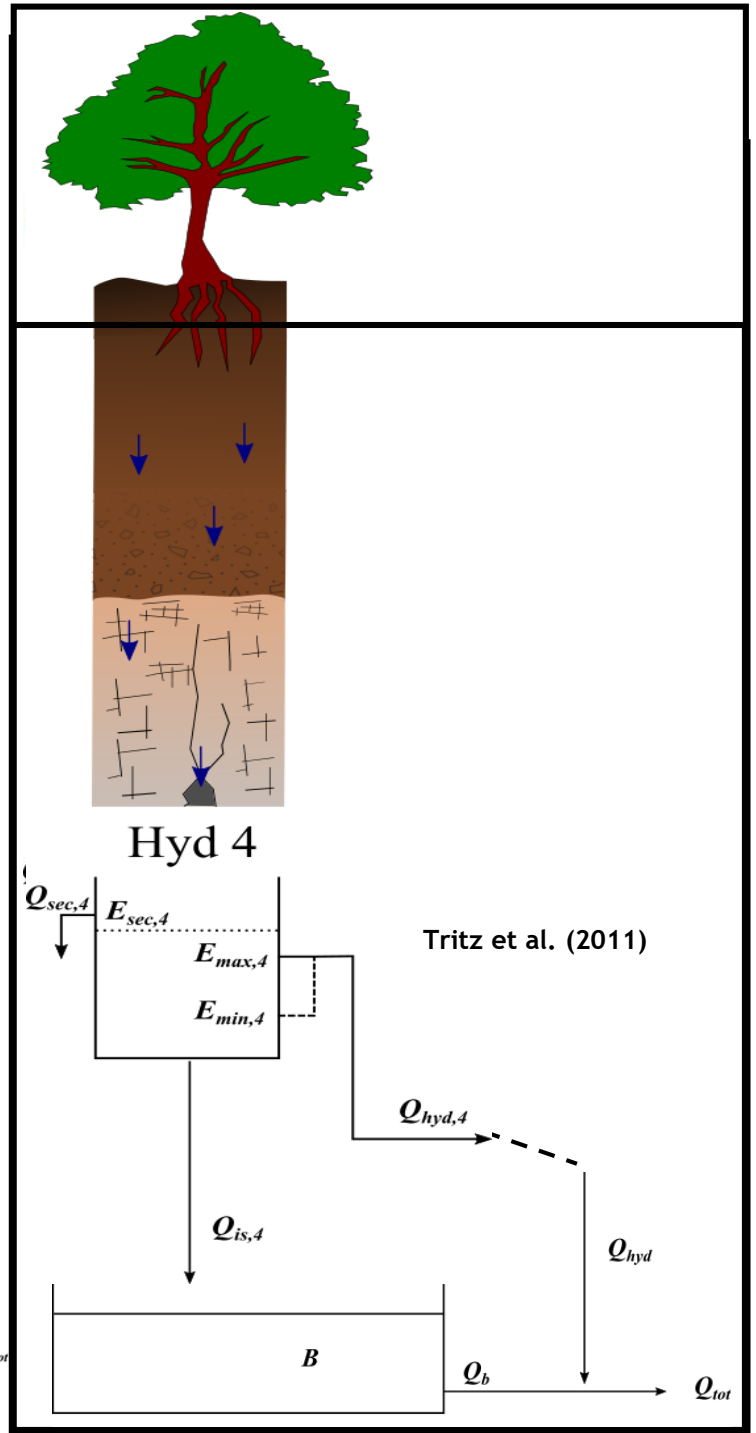
  → Separation of flows to gw recharge and quickflow

- Land use changes considered as changing hydrotope properties and/or varying evapotranspiration

Model concept

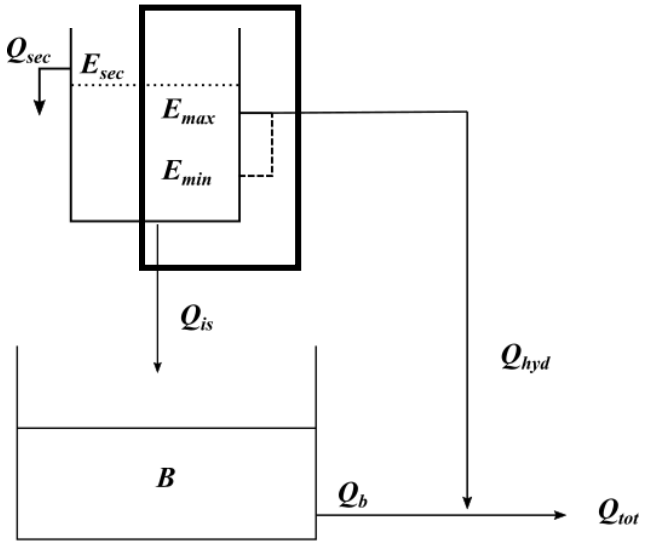


Bittner et al. (2018)



Tritz et al. (2011)

Physically-based parameters



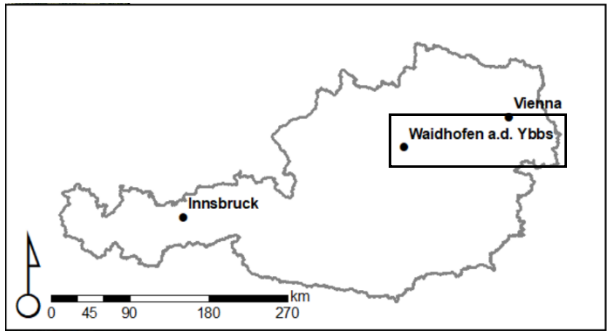
E_{min}, E_{max}

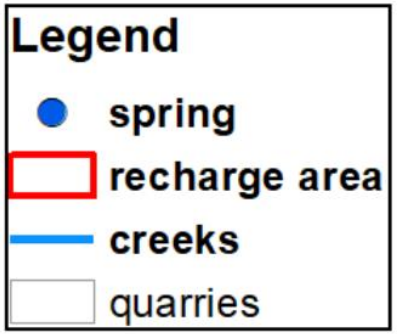
determined based on hydropedological fieldguide (DWA, *2019*)

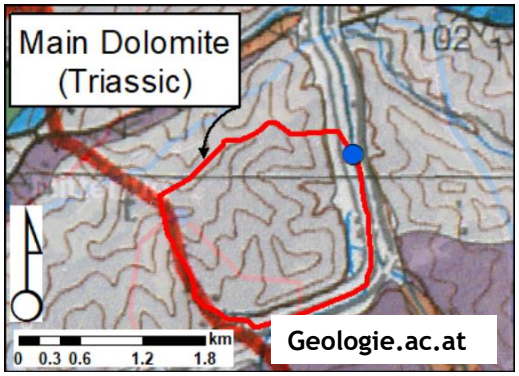
k_{hyd}

decreasing from high to low permeability

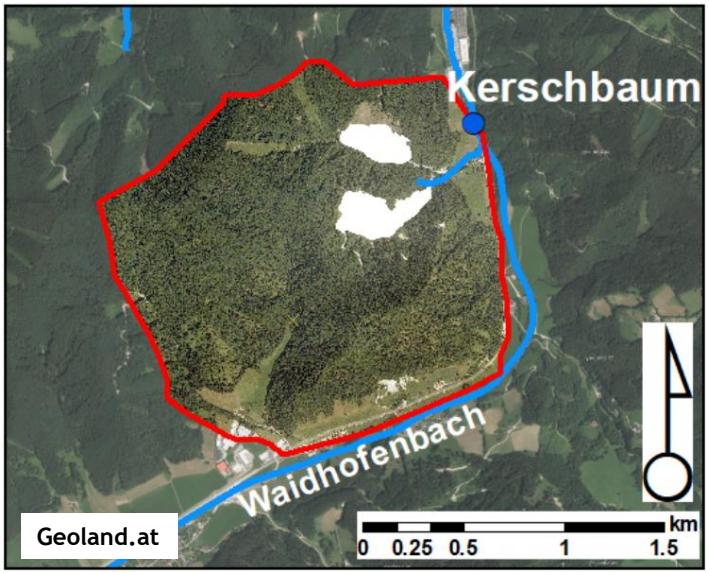
Case study



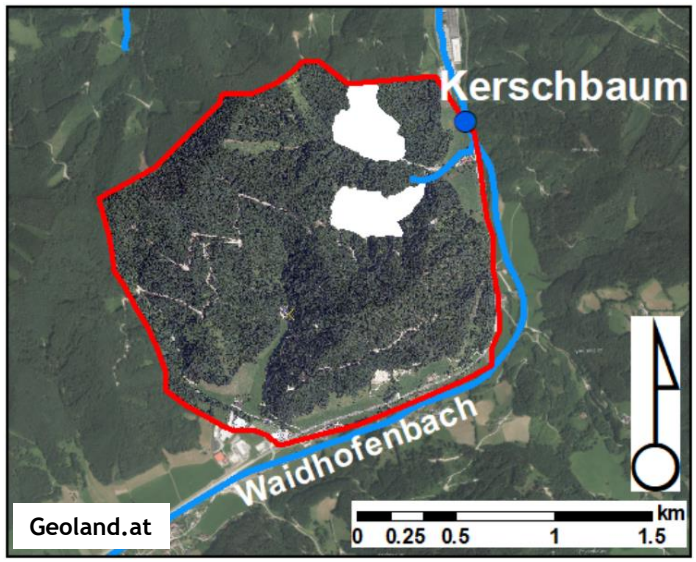




2007



2010 - 2013

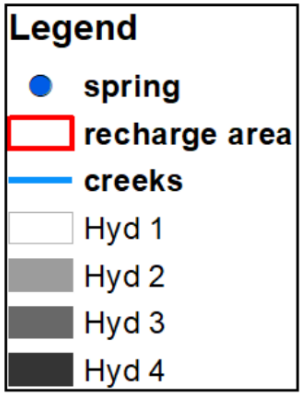


Case study

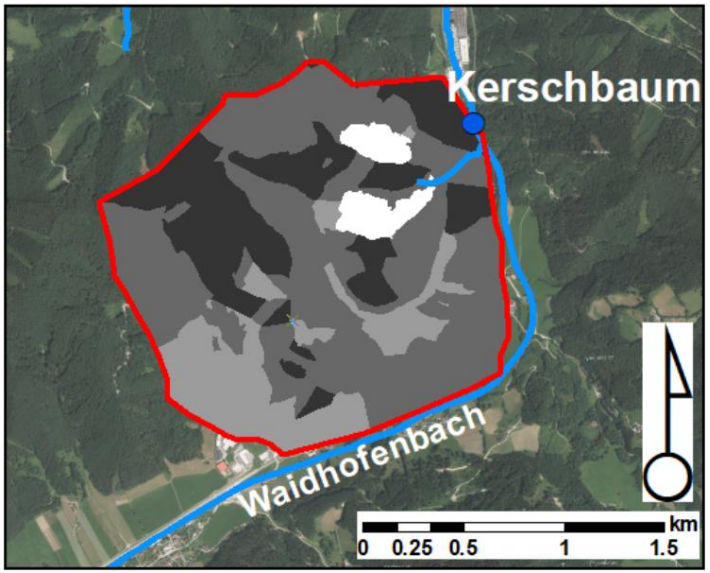
Required data:

Spatial data: detailed classification of the dominant hydrotopes in the recharge area

Time series: Q and P (optional: T and snow depth)

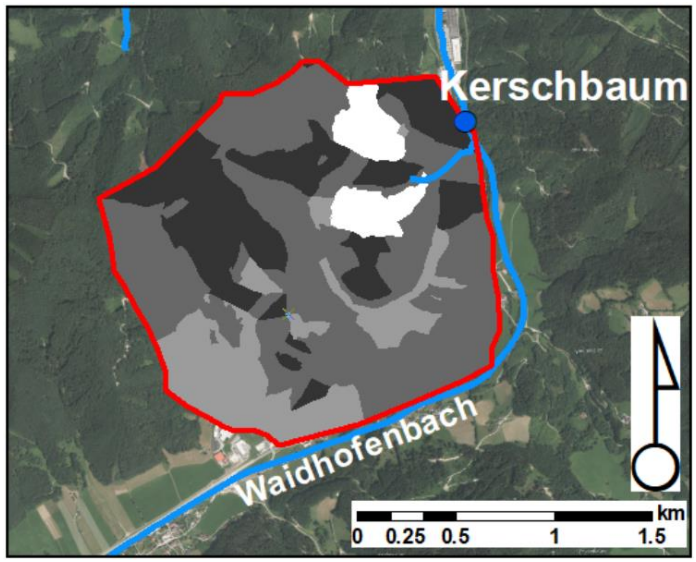


2007



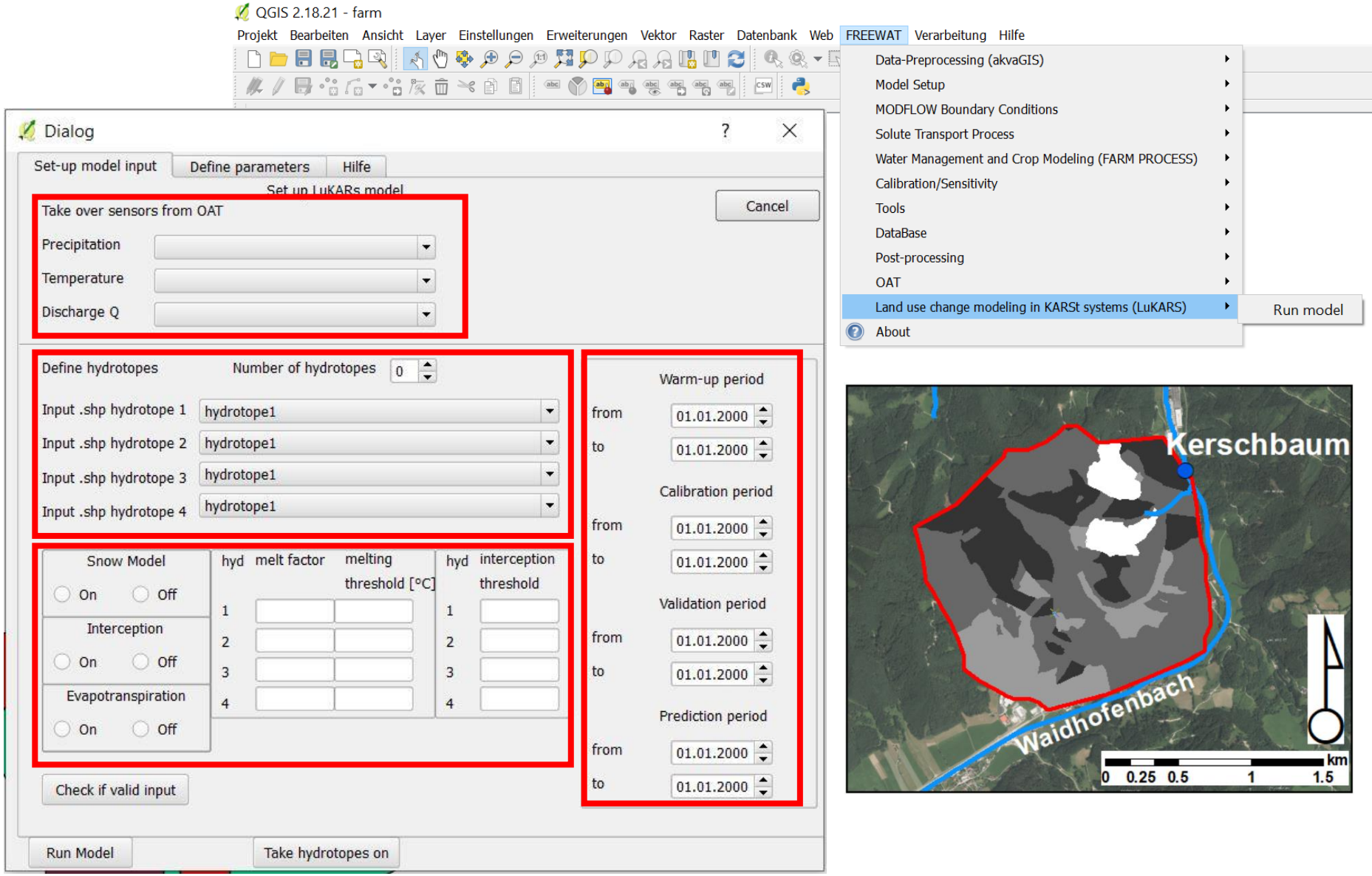
Bittner et al. (2018)

2010 - 2013

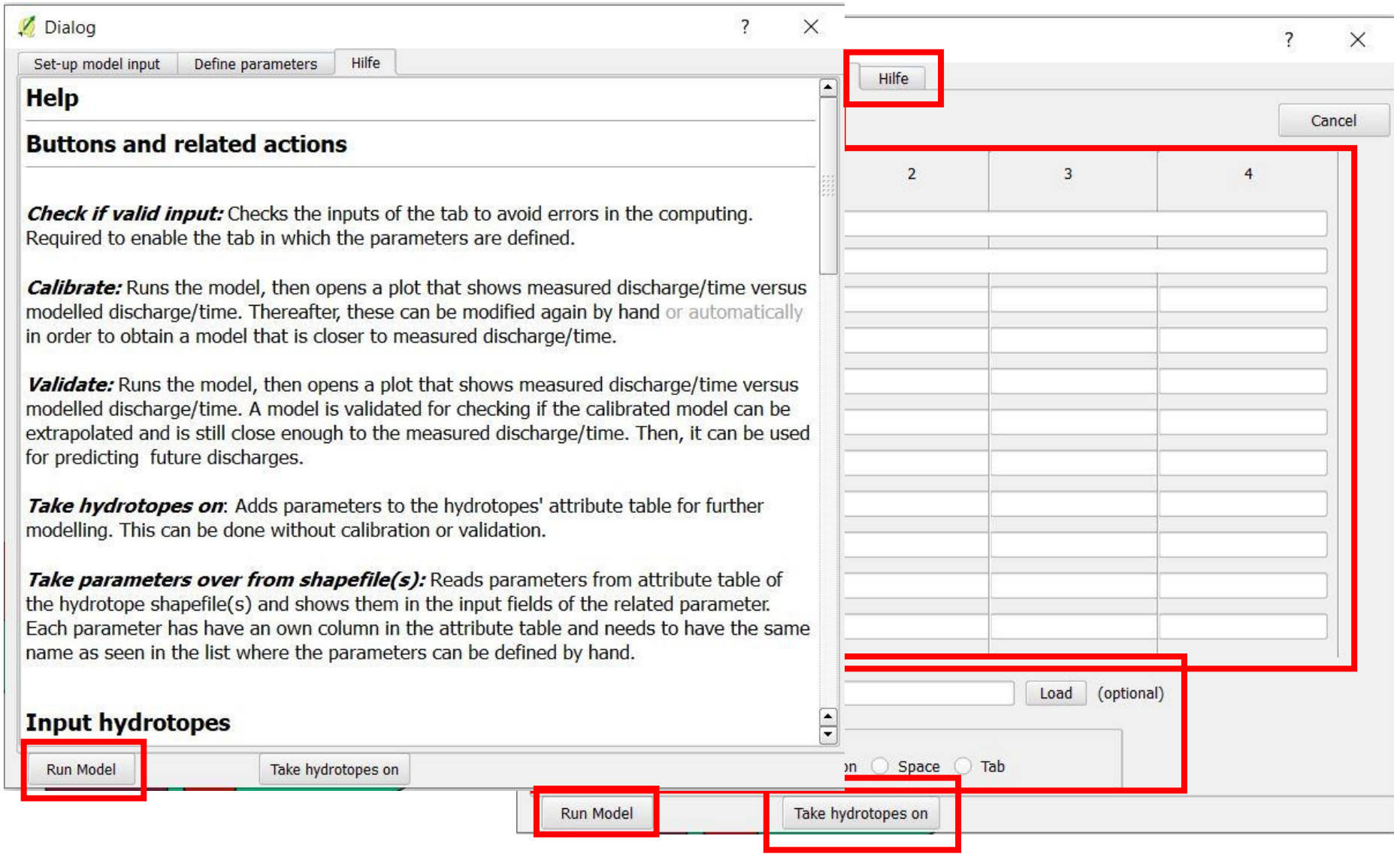


Bittner et al. (2018)

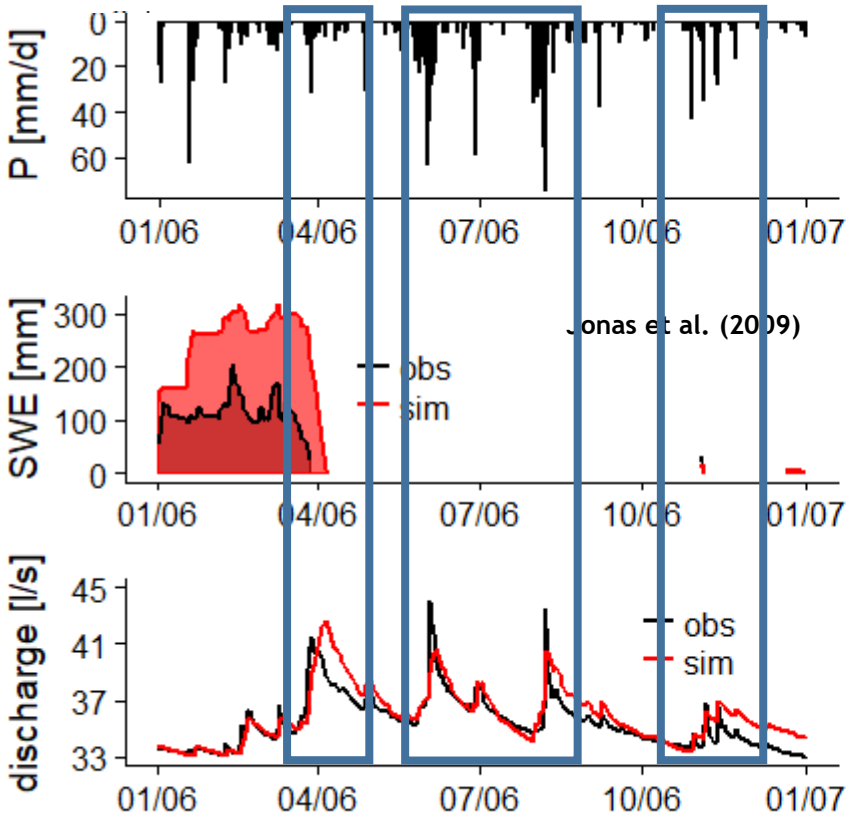
Freewat implementation

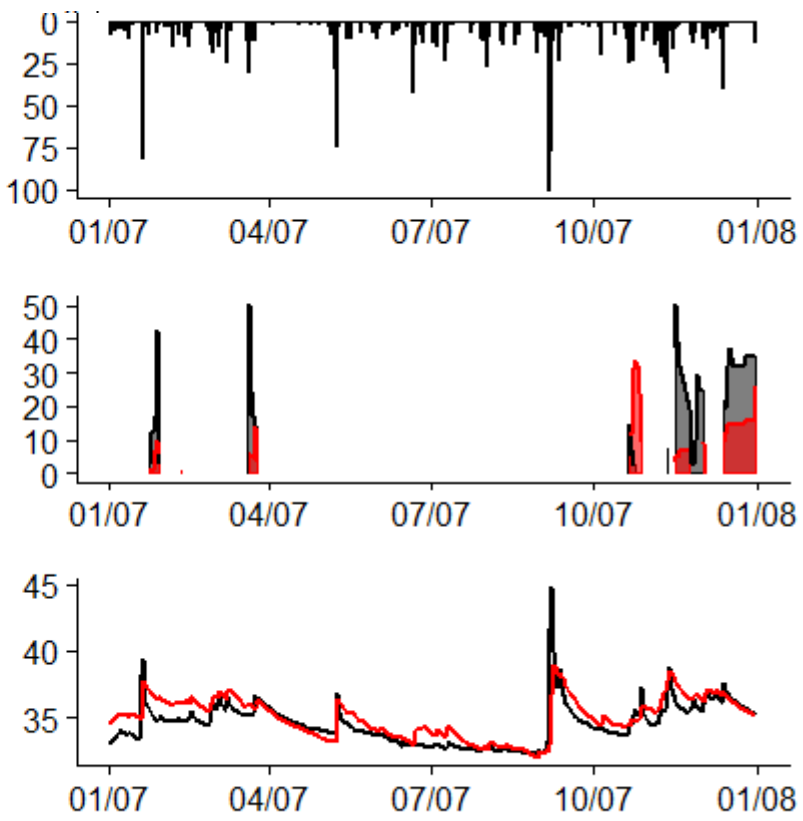


Freewat implementation



Modeling results

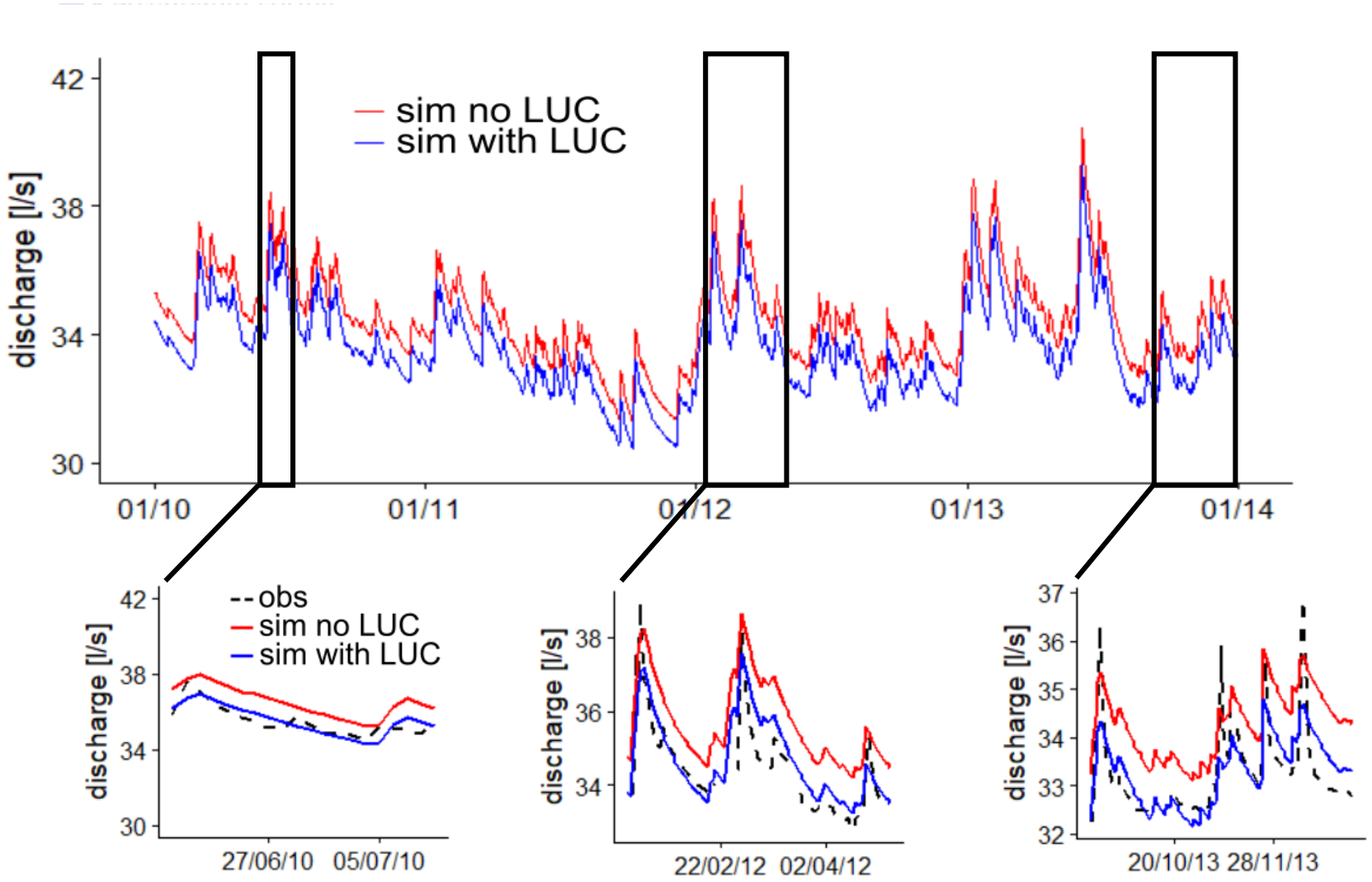




NSE: 0.66
MAE: 0.78 [l/s]

NSE: 0.53
MAE: 0.78 [l/s]

Modeling results



NSE	**-1.1**	**0.65**	**-0.41**	**0.70**	**-0.78**	**0.58**
MAE [l/s]	**1.0**	**0.36**	**1.2**	**0.46**	**1.1**	**0.39**

Open questions – next steps

- So far only diffuse recharge is considered – next step is to account for concentrated recharge as typical in (limestone) karst, ideas?

- Any important thing missing in FREEWAT implementation?

- Suggestions for further linking existing FREEWAT features with LuKARS?

- Any further ideas?

Thanks for your attention

LIFE REWAT project partners

Supported by

LIFE REWAT project co-financers

Patronage

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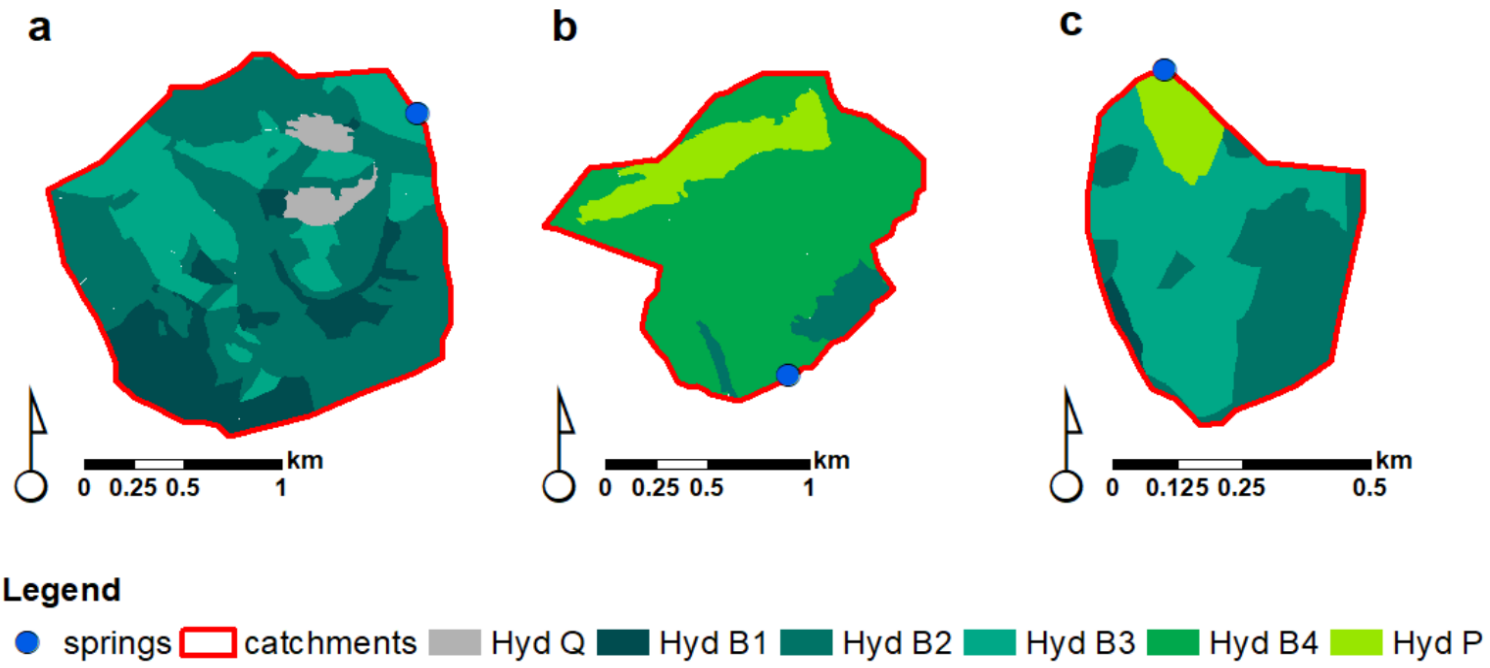
Hydrotopes in recharge areas



a → Kerschbaum
b → Hinterlug
c → Mitterlug

Hinterlug application