HYDROLOGICAL SUBSURFACE PROPERTIES OBTAINED FROM TIME SERIES MODELING

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INTRODUCTION

- Geological Survey of the Netherlands
- Database
  - Borehole data
  - Geological and hydrogeological models
  - Groundwater head observations
  - …
- Online groundwater time series models
- Application of the results

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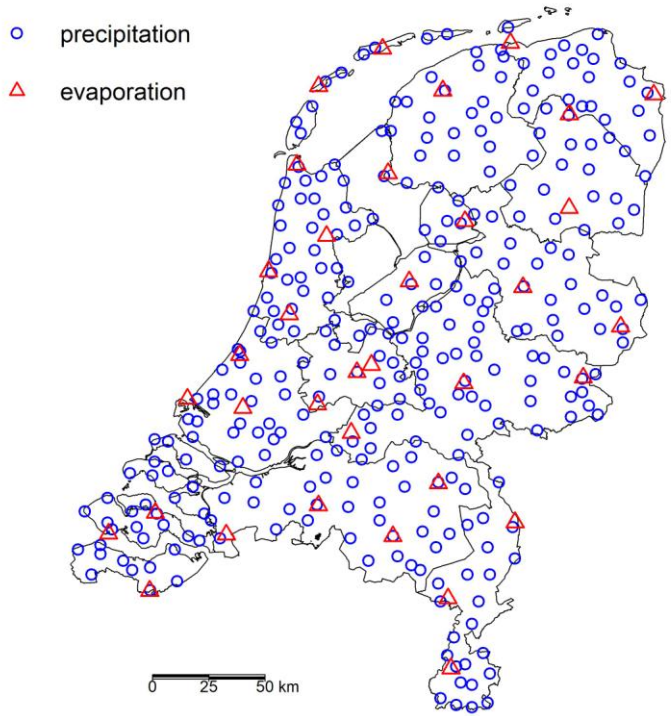
ONLINE TIME SERIES MODELS

Hydrological subsurface properties obtained from time series modeling

- 59,600 groundwater head observation wells

ONLINE TIME SERIES MODELS



- Transfer Noise model
- Explanatory variables
  - precipitation
  - evaporation
- Automated selection of nearby station
- 8 year model
- Automated quality assessment

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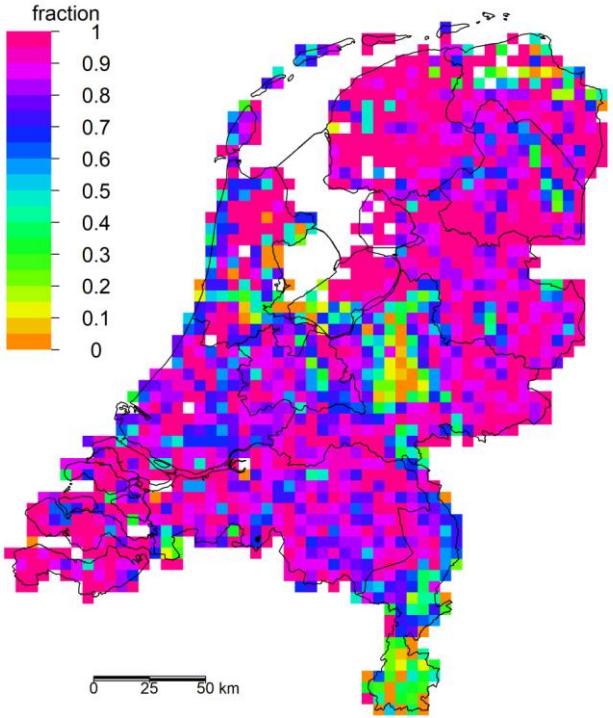
FRACTION ACCEPTED MODELS



- 59,600 head observation wells
- 35,100 time series OK
- 28,500 models OK
- Fraction OK in 5x5 km grid cell

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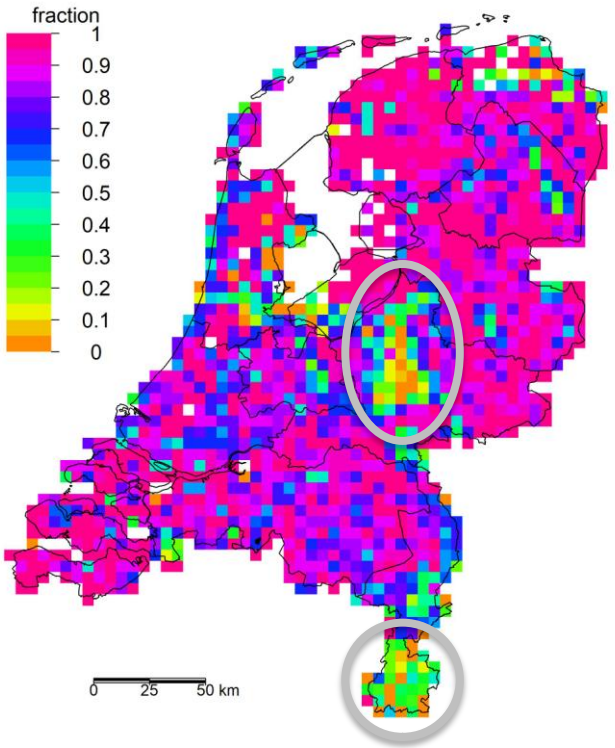
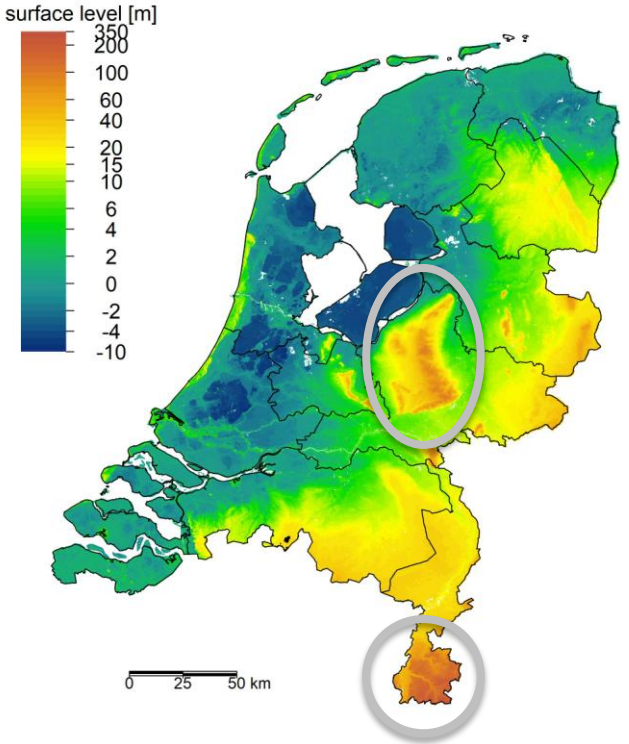
FRACTION ACCEPTED MODELS





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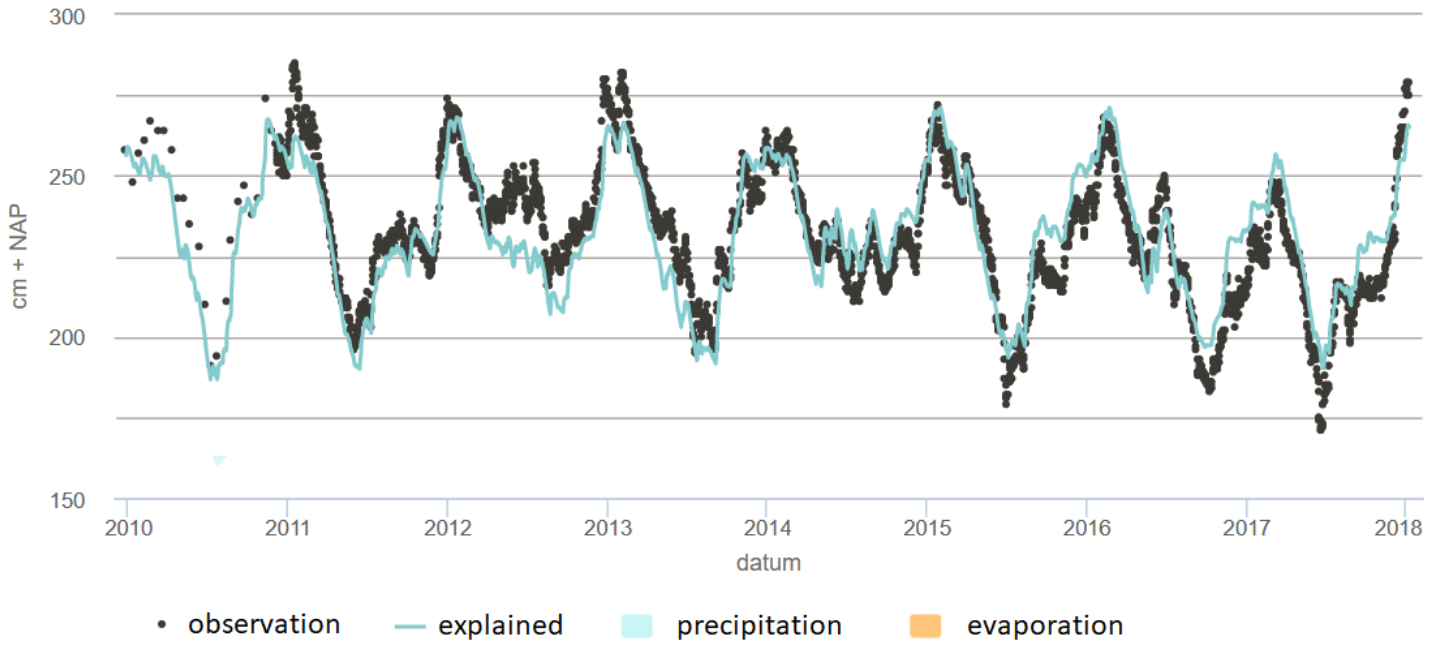
TIME SERIES MODEL



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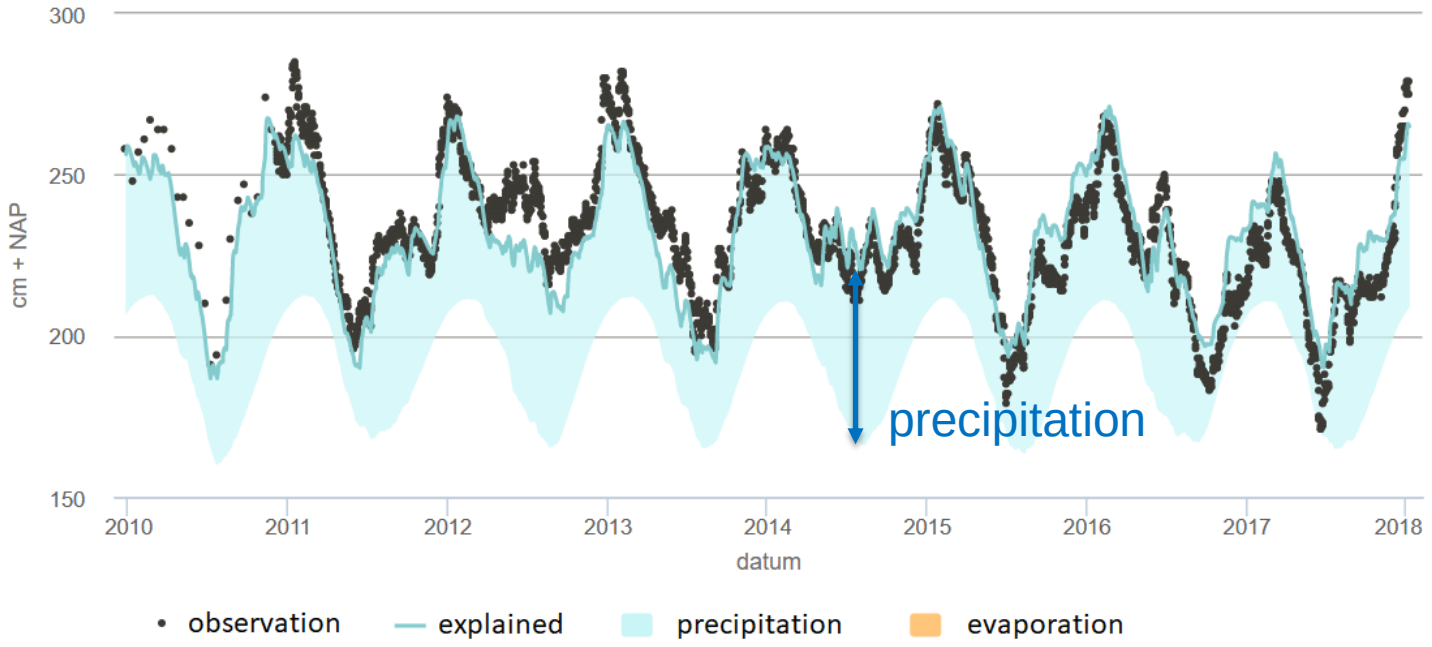
TIME SERIES MODEL



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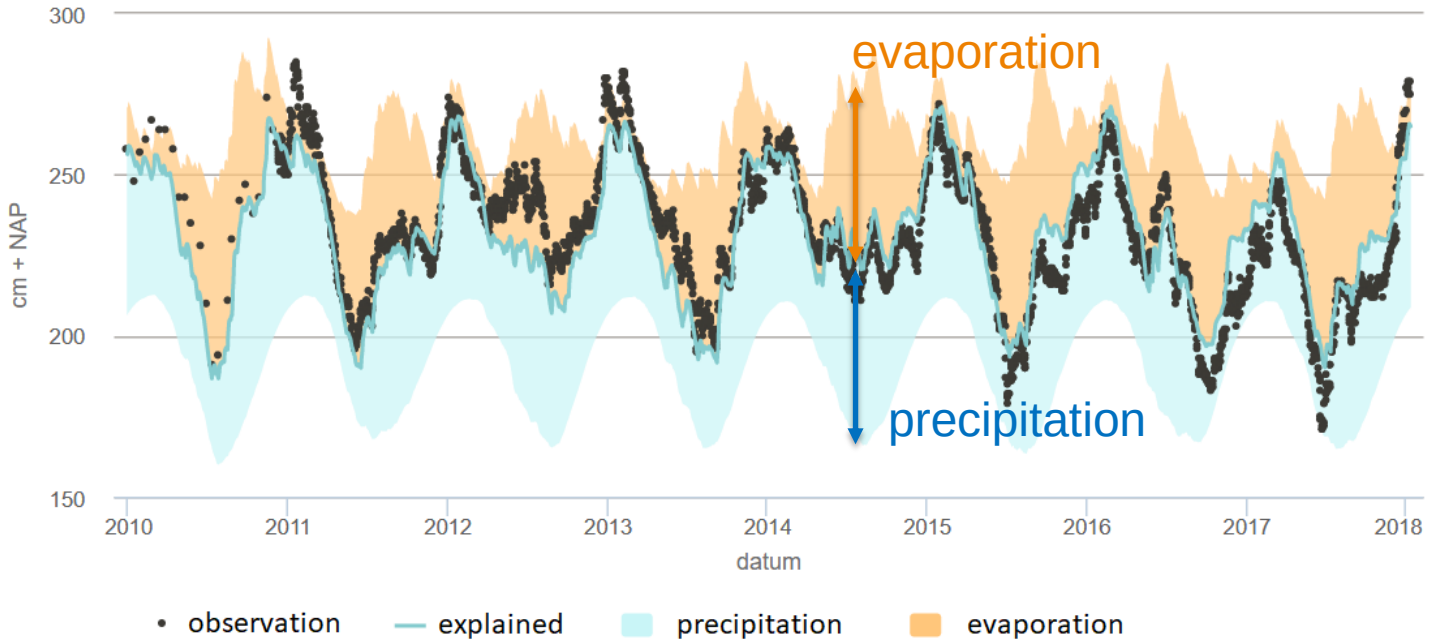
TIME SERIES MODEL



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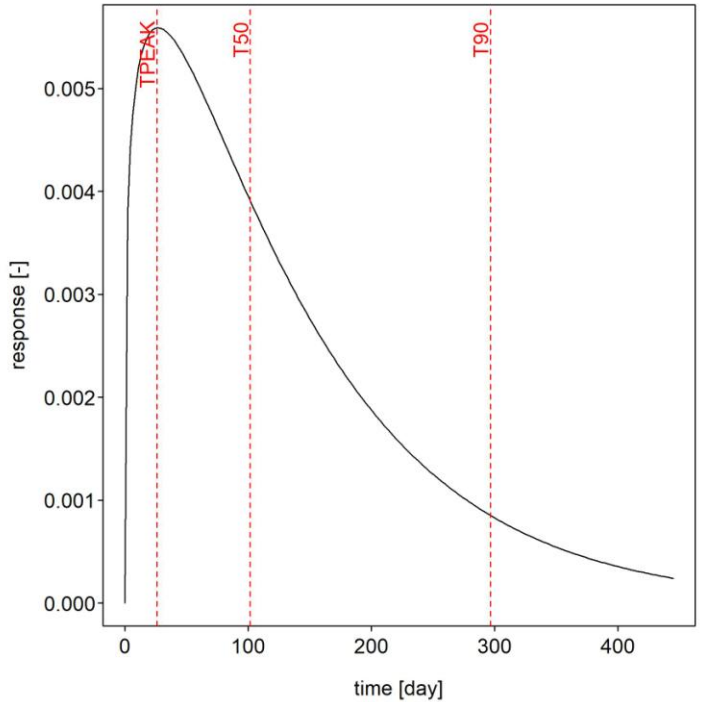
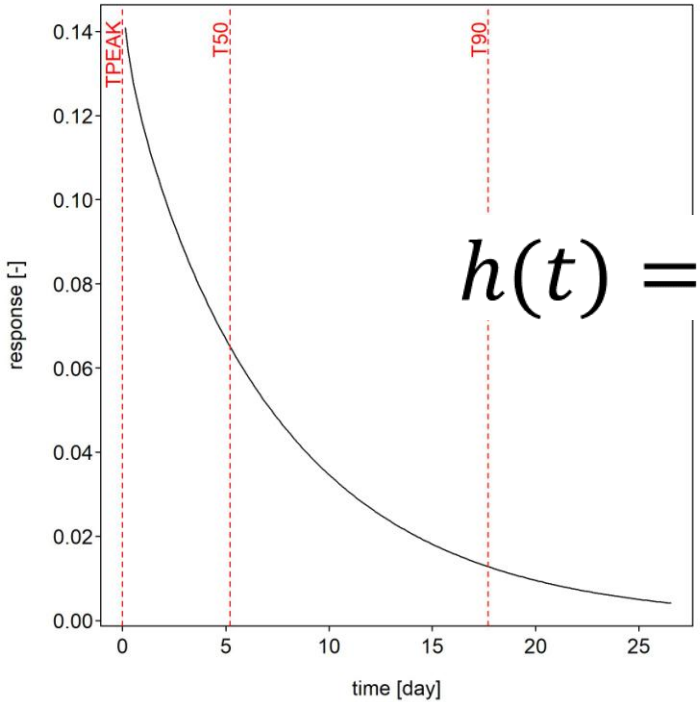
RESPONSE FUNCTION

gamma distribution





$$h(t) = M_0 \phi(t)$$

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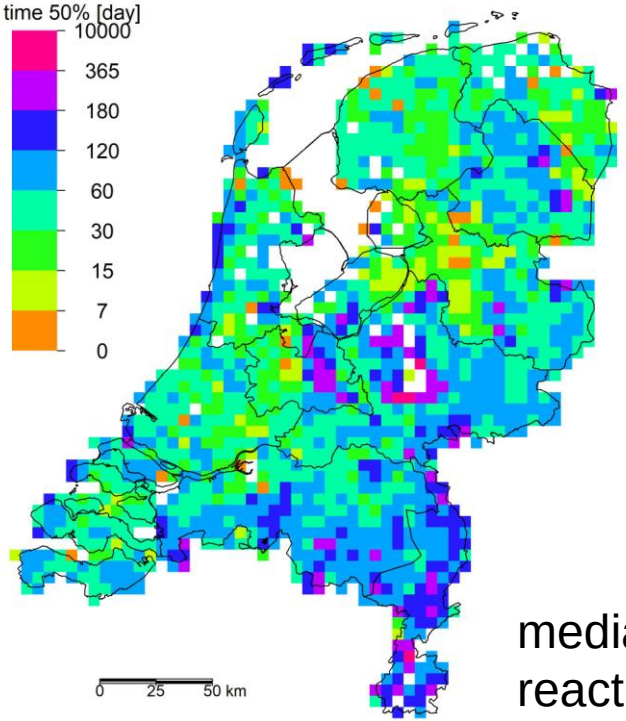
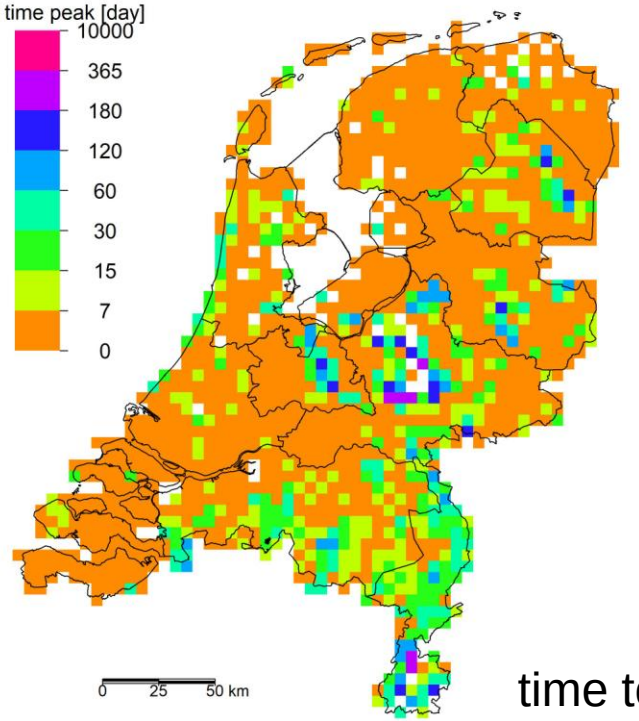
REACTION TIME IN MODEL



median
reaction time



time to peak

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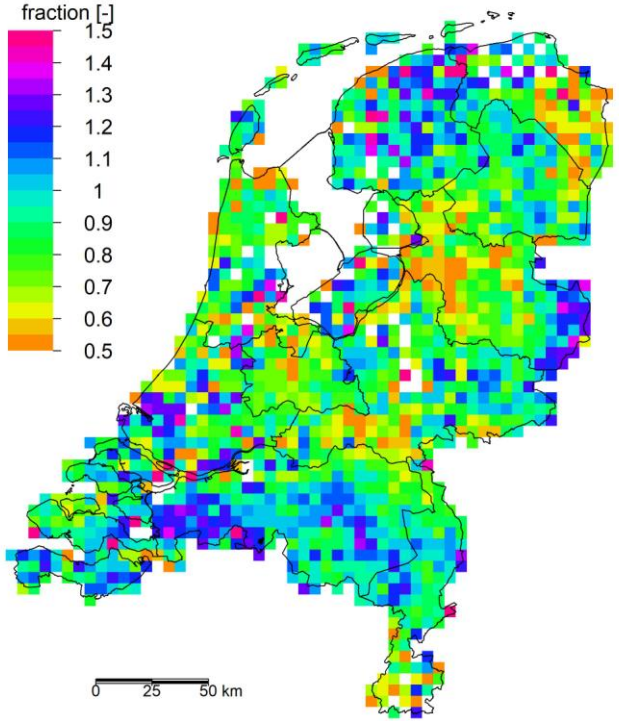
EVAPOTRANSPIRATION FACTOR



- estimated as part of the transfer model

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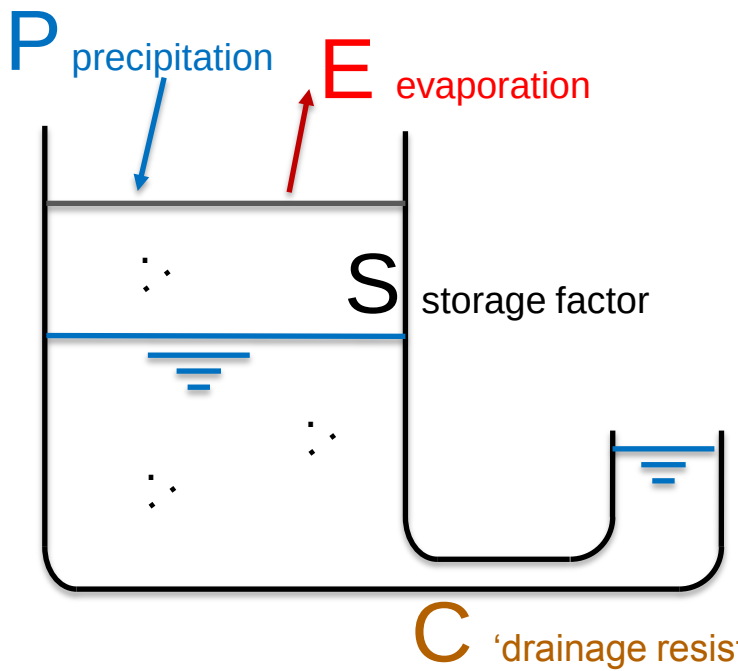
SIMPLE MODEL FOR PHYSICAL INTERPRETATION



- Extraction of model parameters
- Differential equation

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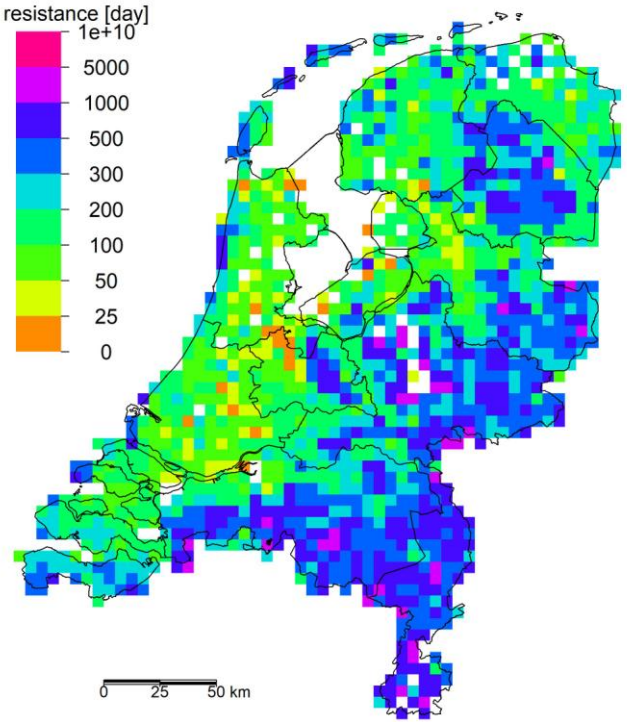
DRAINAGE RESISTANCE



$$h(t) = M_0 \phi(t)$$

- derived from model parameters
- depends heavily on assumptions

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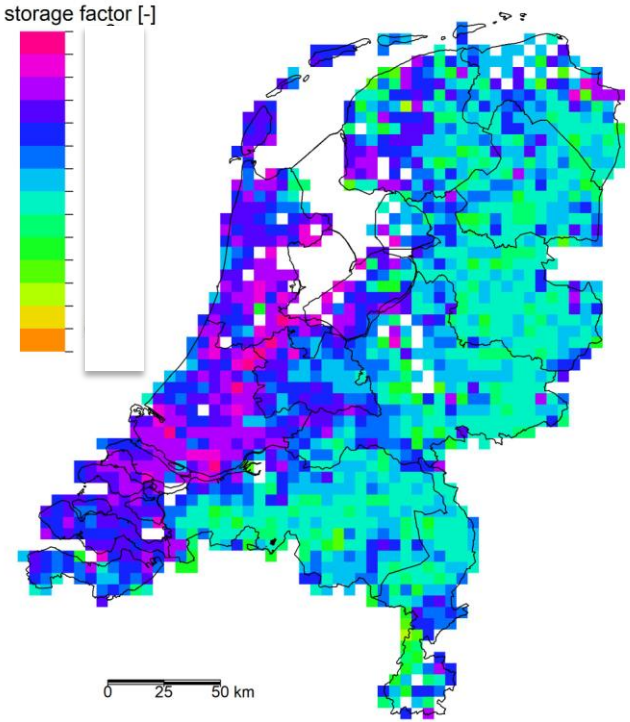
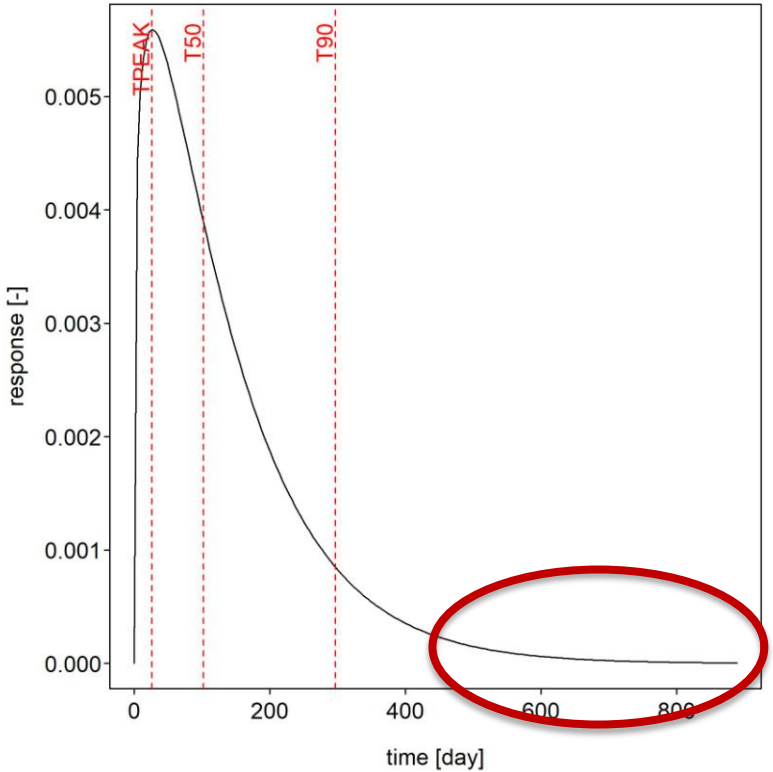
STORAGE FACTOR





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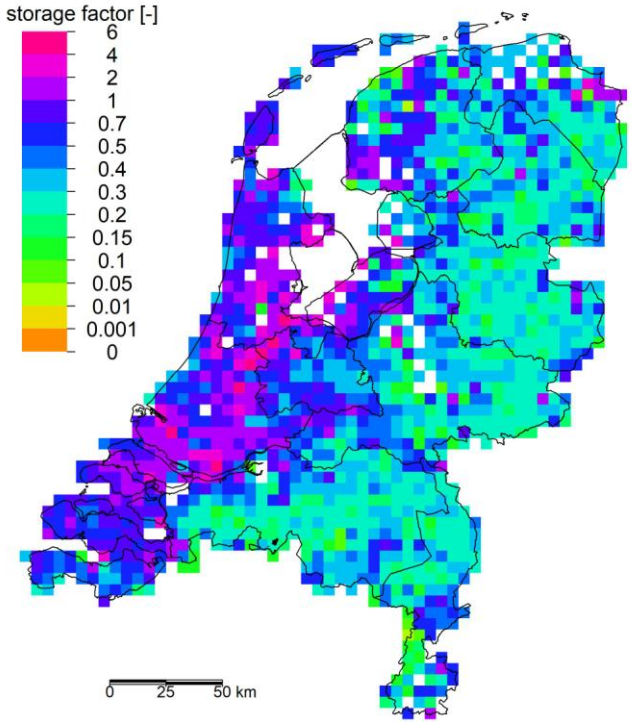
STORAGE FACTOR



- storage factor in area with regulated surface water is too high

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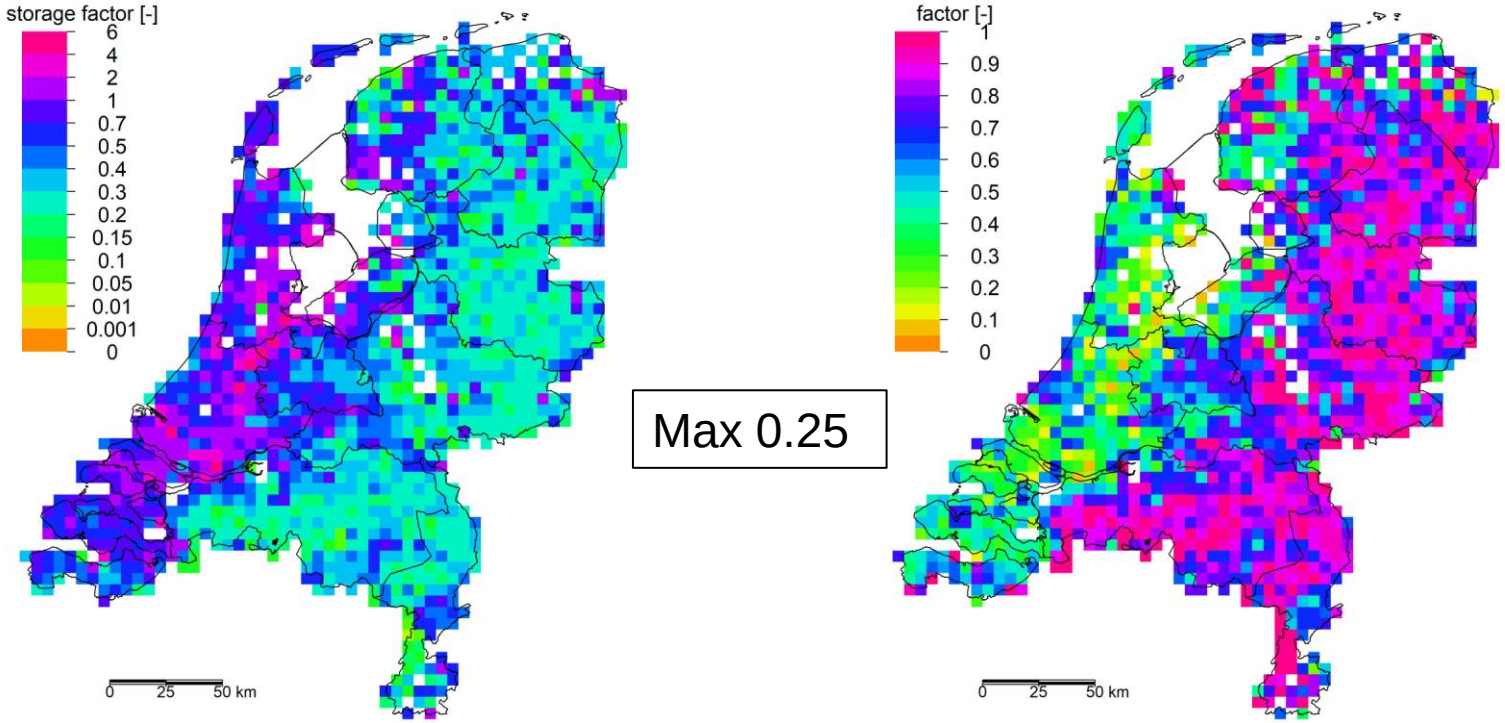
STORAGE FACTOR ADAPTATION



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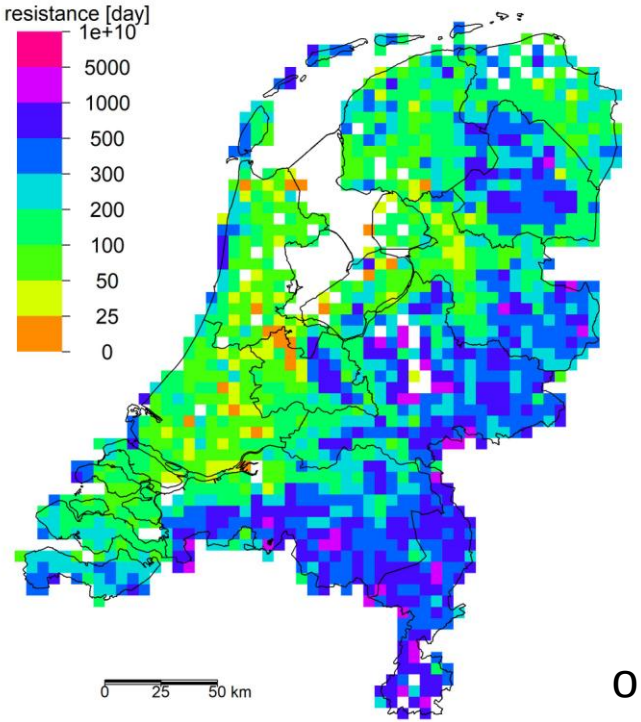
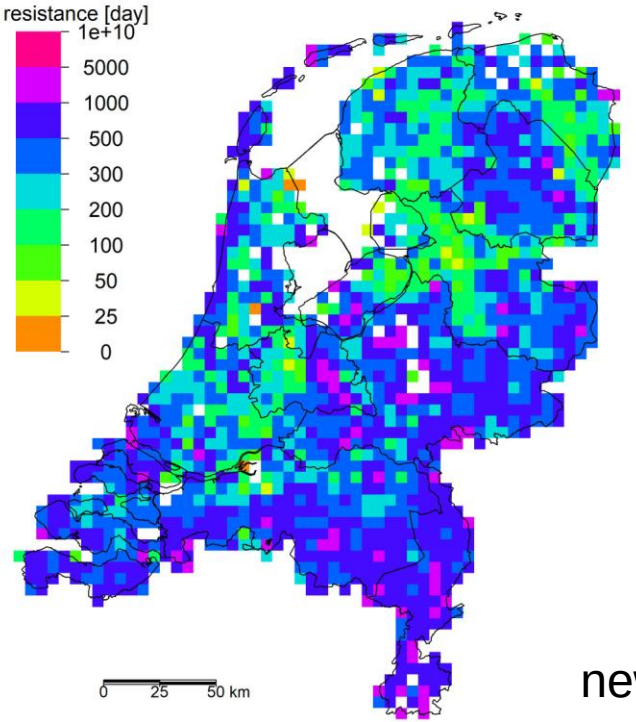
RESISTANCE ADAPTED



old



new

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SUMMARY AND OUTLOOK

- Insight in country wide hydrological system
- The results give confidence in the transfer models
- Results might be used for characterization of the hydrological system

- Models are stochastic
- The simple model is too simple
- Assumptions have to revisited
- Add physical information


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