Mapping groundwater dynamics in the Netherlands

Three dimensional insight in groundwater systems based on the Dutch national database of suburface information (DINOloket.nl)

Zaadnoordijk, Willem Jan; Lourens, Aris

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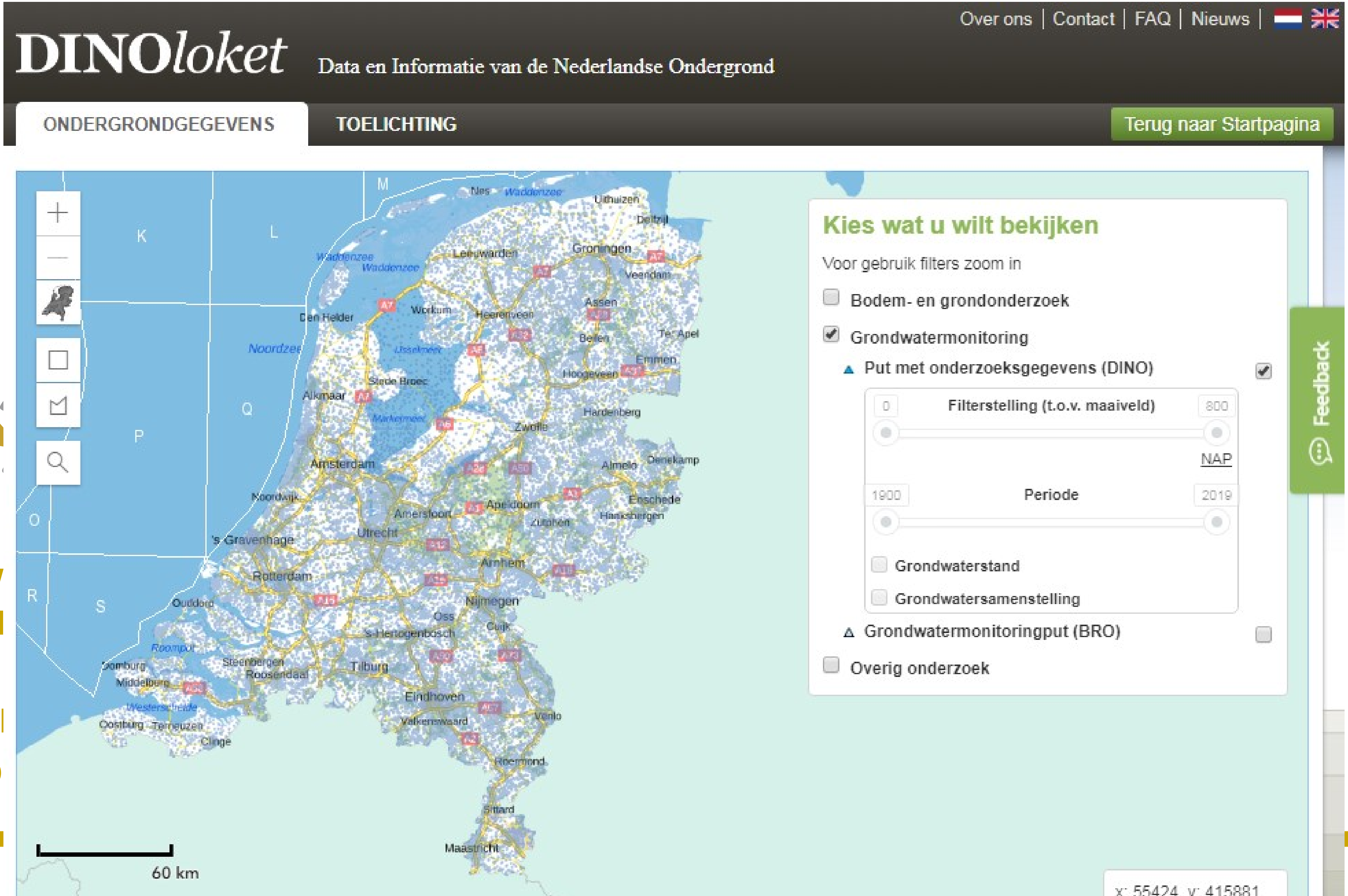

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DINOloket
Data en Informatie van de Nederlandse Ondergrond
ONDERGRONDGEGEVENS
TOELICHTING
Terug naar Startpagina
Kies wat u wilt bekijken
Voor gebruik filters zoom in
Bodem- en grondonderzoek
Grondwatermonitoring
Put met onderzoeksgegevens (DINO)
0
Filterstelling (t.o.v. maaiveld)
800
NAP
1900
Periode
2019
Grondwaterstand
Grondwatersamenstelling
Grondwatermonitoringput (BRO)
Overig onderzoek
Feedback
60 km
Noordzee
Leeuwarden
Groningen
Den Helder
Alkmaar
Zwolle
Amsterdam
Apeldoorn
Amersfoort
Utrecht
's Gravenhage
Rotterdam
Arnhem
Nijmegen
Tilburg
Eindhoven
Maastricht

W

wil

[1]T

[2]D

Groundwater time series models

http://www.grondwatertools.nl/grondwatertools-viewer

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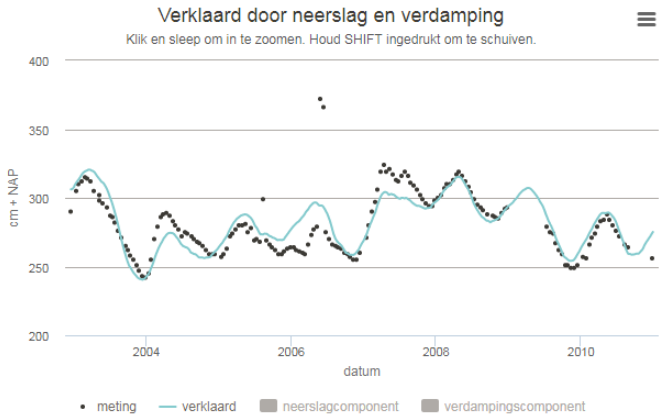
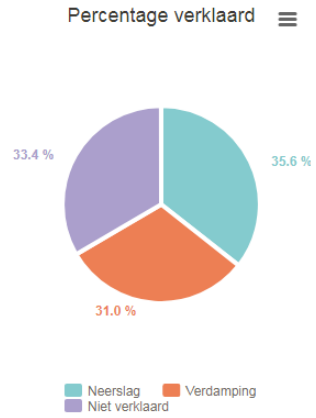
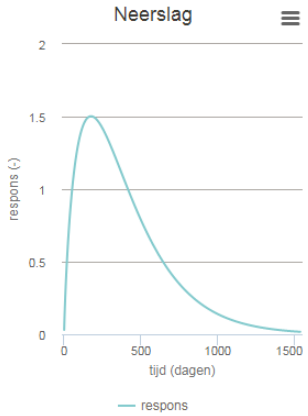
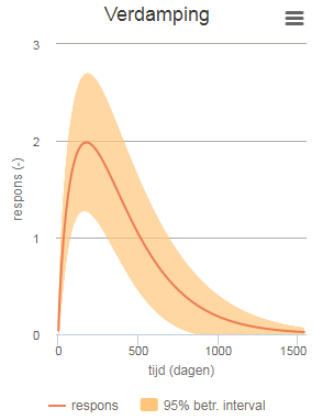
Putlocatie B32C0583

Analyse individuele filters





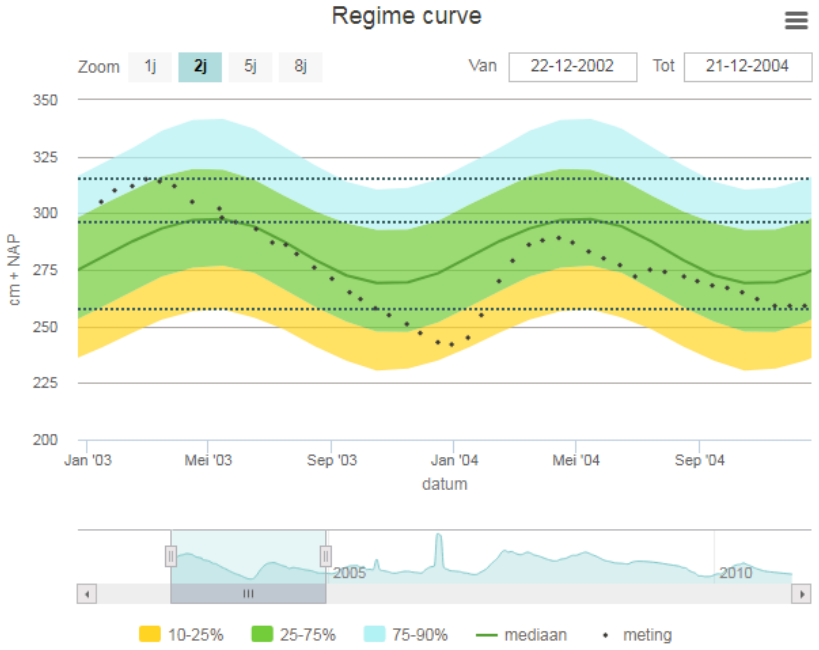




Karakteristieken responsfuncties	
Respons sterkte M_0 neerslag	815
Respons sterkte M_0 verdamping	1076
Gemiddelde responstijd	394.1
t_{50}	324
t_{90}	786
t_{piek}	175

De getoonde respons op neerslag heeft een aanzienlijk onzekerheid. Het betrouwbaarheidsinterval van de responsfunctie is niet beschikbaar.

Filters in peilbuis	Bovenkant filter cm + NAP	Onderkant filter cm + NAP
Filter 001	53	-47



Klimaatsrepresentatieve grondwaterdynamiek

	cm + NAP	cm - mv
GHG	315.0	680.0
GLG	257.6	737.4
GVG	296.1	698.9
RHG	310.1	684.9
RLG	260.9	734.1
Grondwatertrap	VIII	

Toon in grafiek:

- [x] GxG
- [ ] Maaiveld

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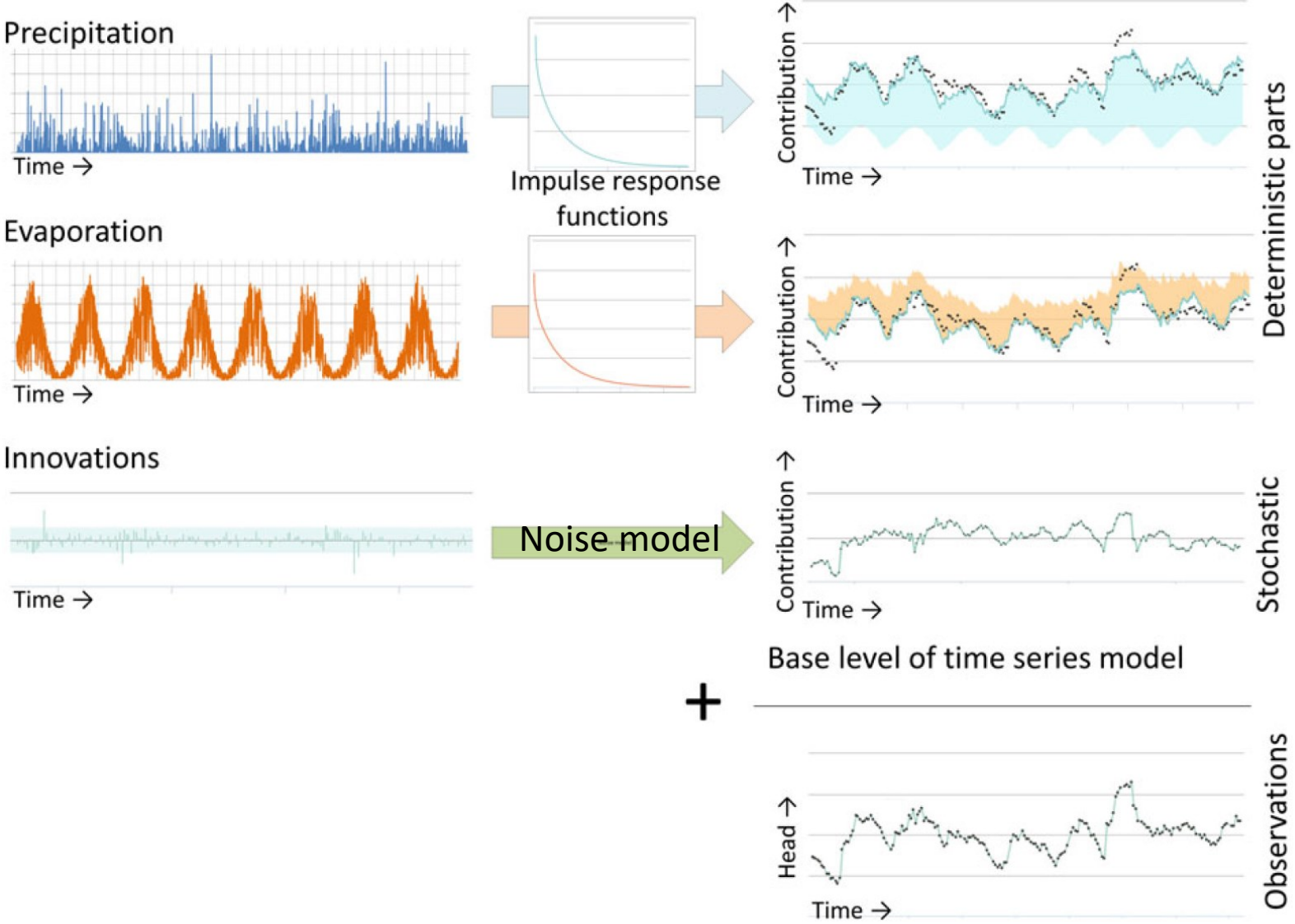
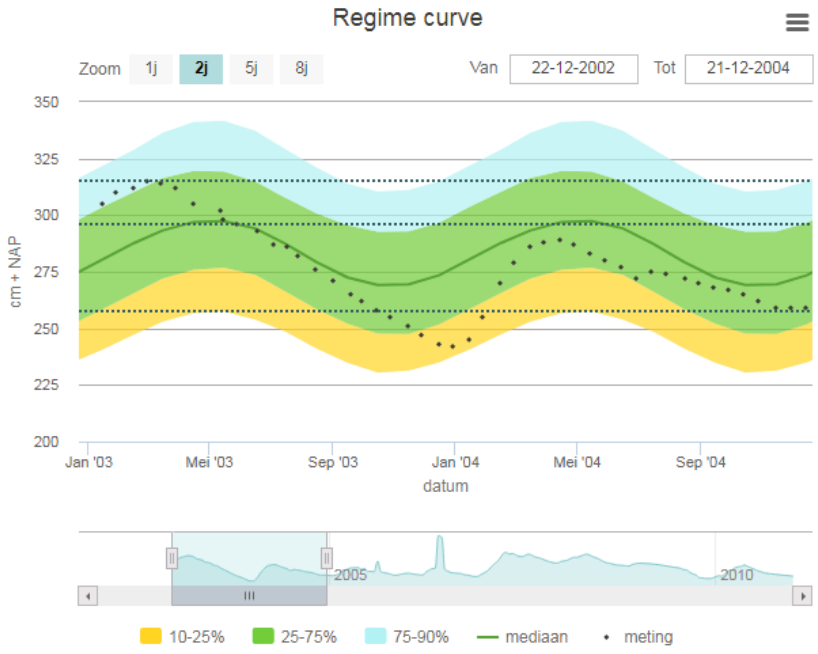
Decomposition of influences in time series model



Aspects groundwater dynamics

1. Response time of precipitation response
2. Yearly fluctuation - regime curve
3. Long term trends



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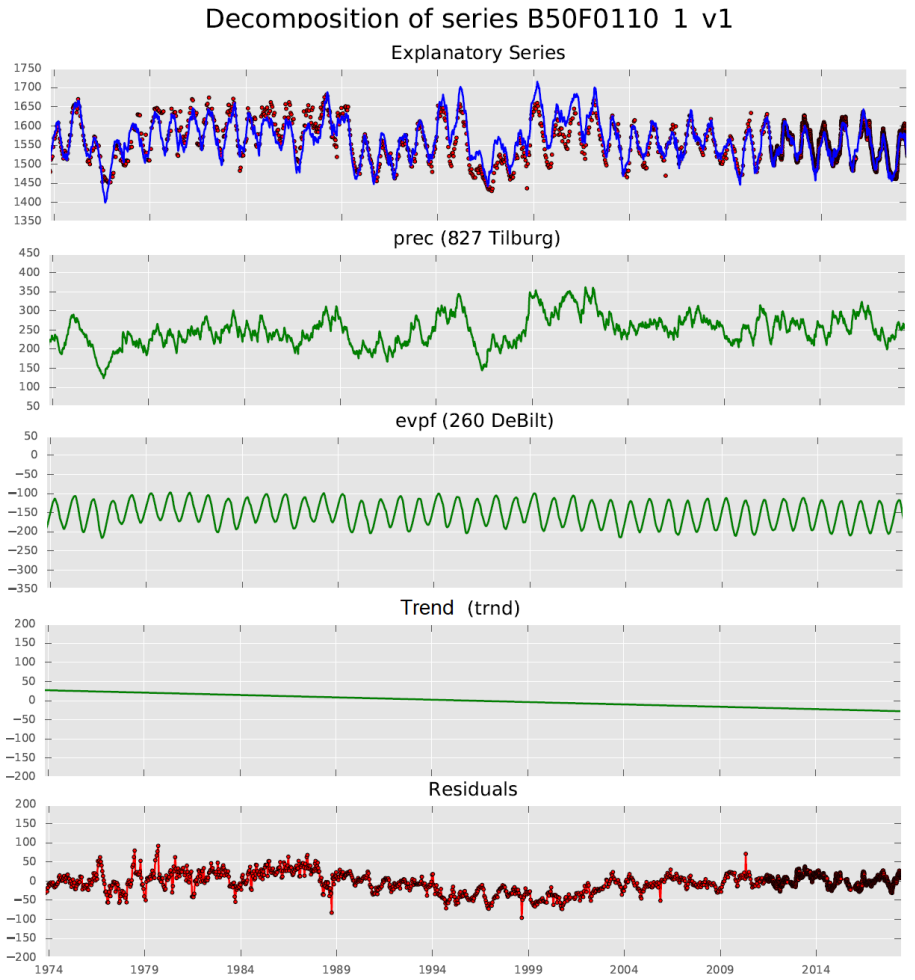

Characterization impulse response

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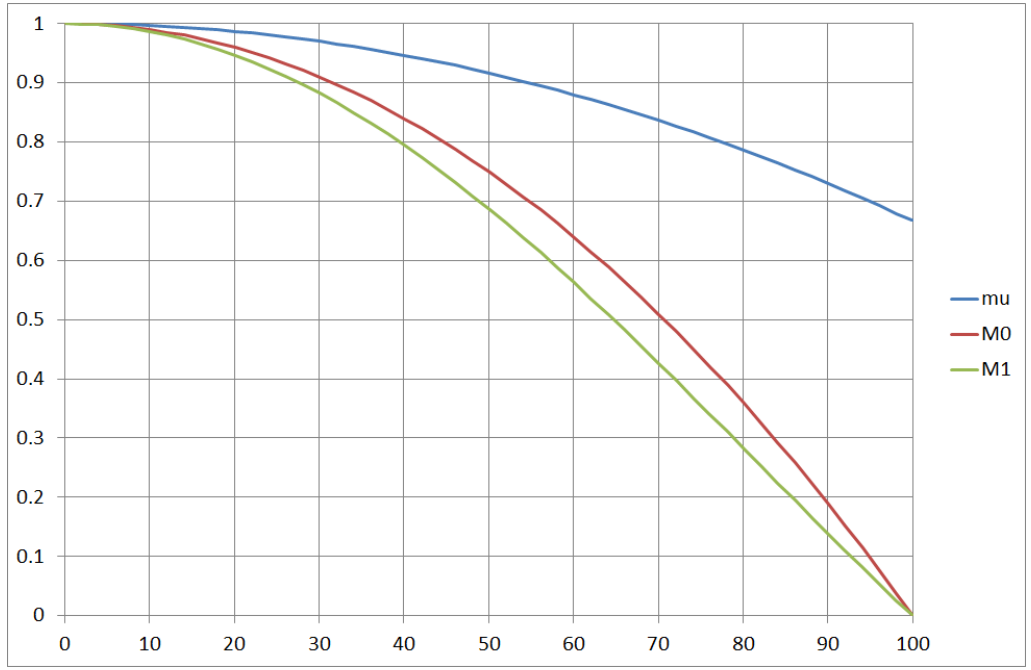
- Temporal moments (raw moments M_k)
  - M_0 – total response
  - $\mu = M_1/M_0$ – average response time
- Physical meaning – M_k fulfills differential equation similar to groundwater head
  - Analytic solutions for simple situations like circular island
- Useful characteristics of impulse respnse



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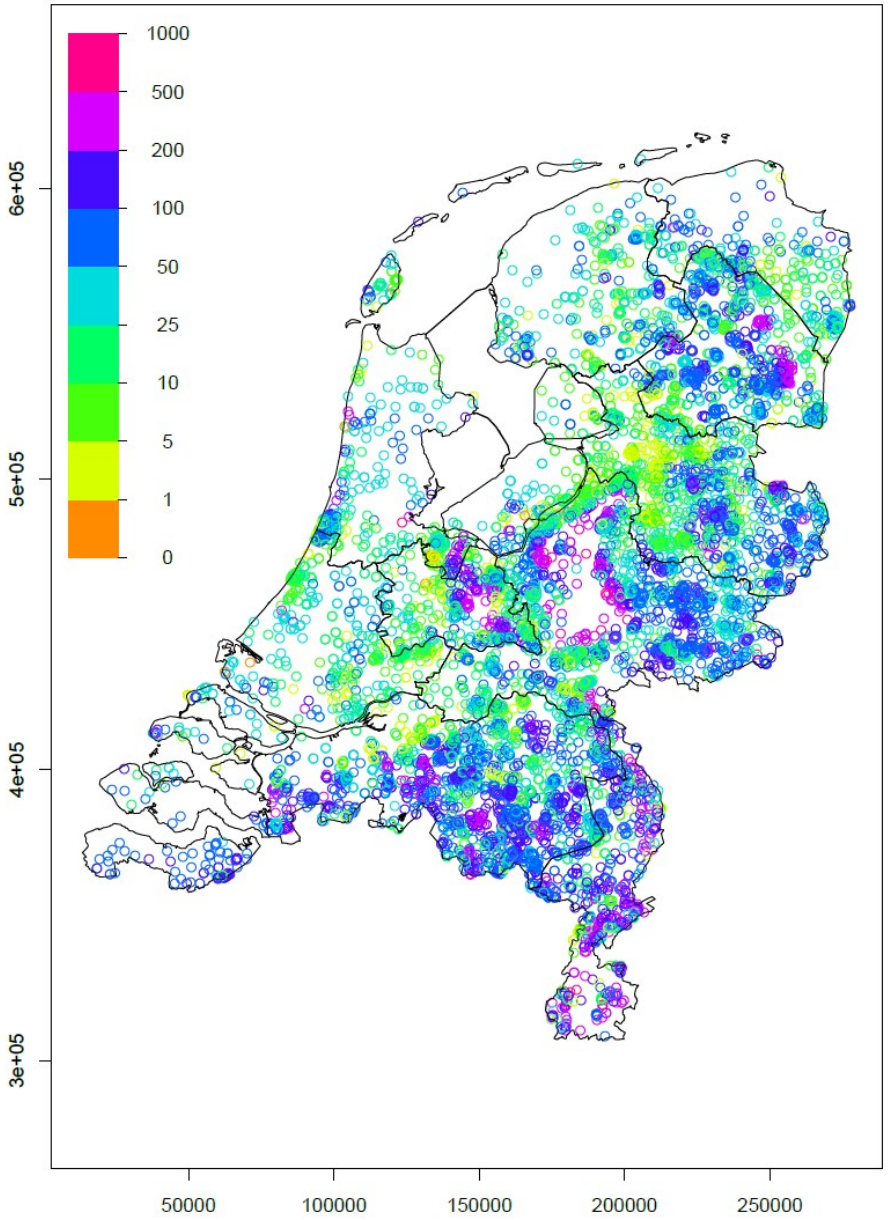
Lateral variation response time

- First regional aquifer



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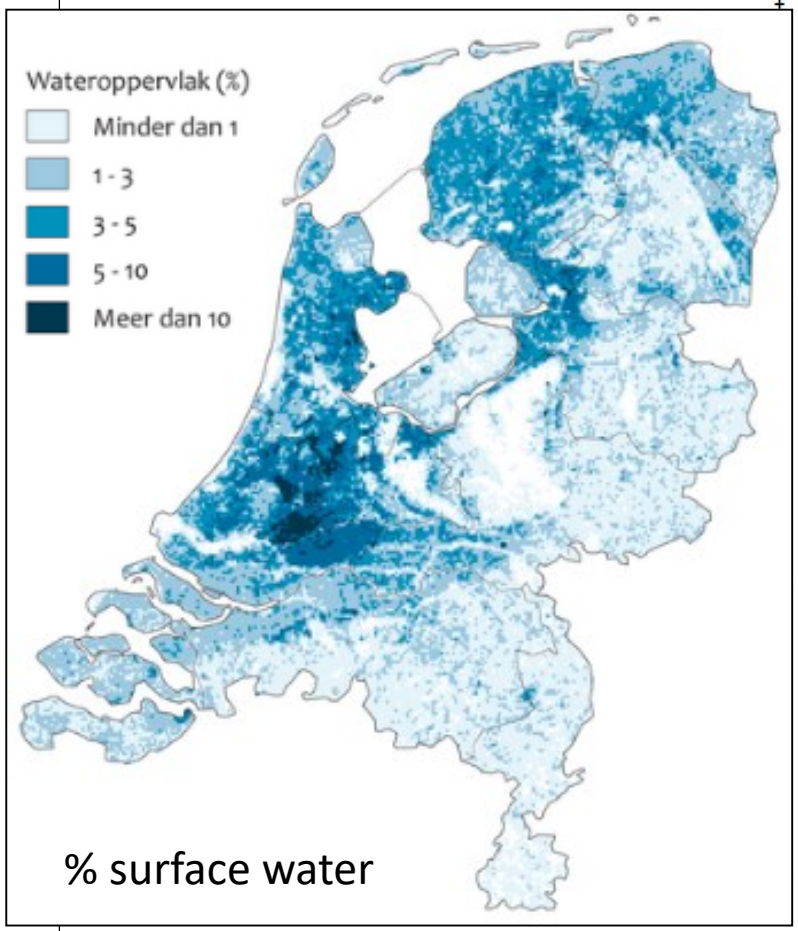
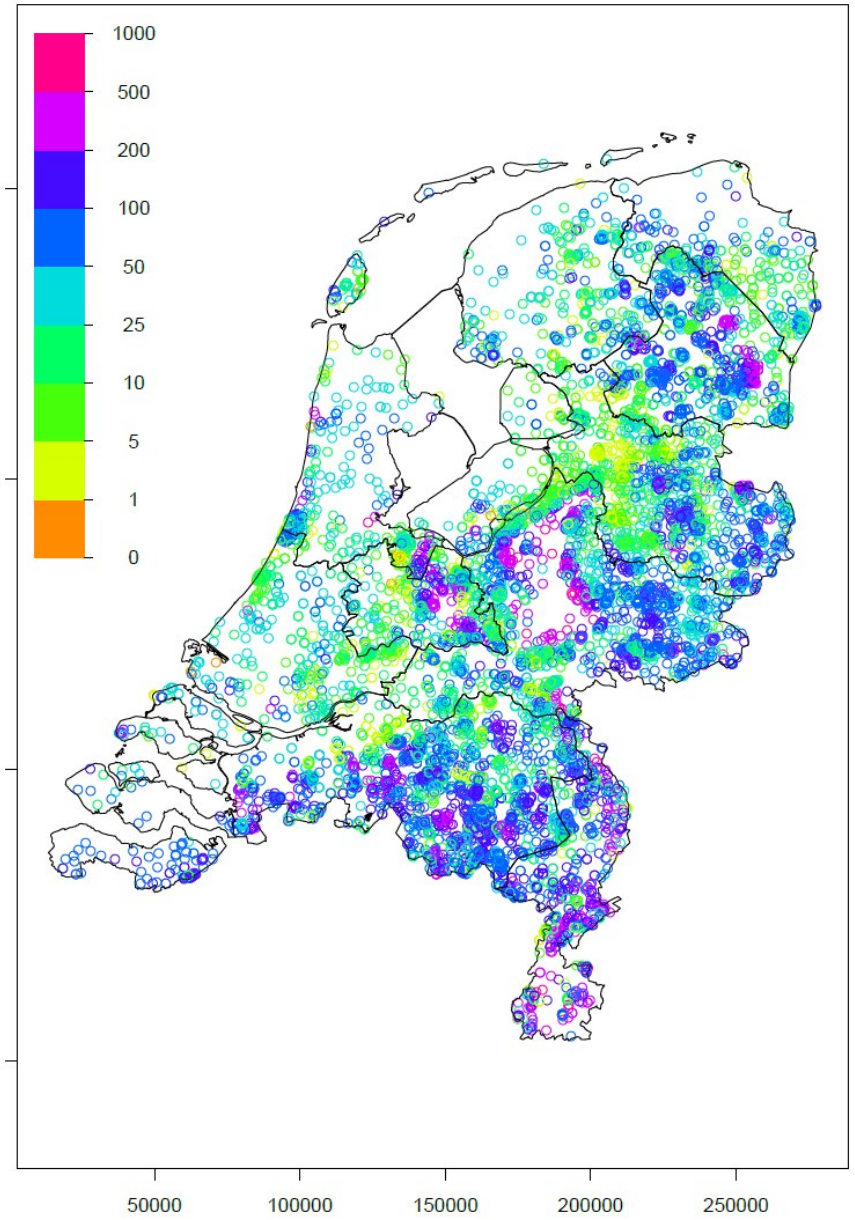
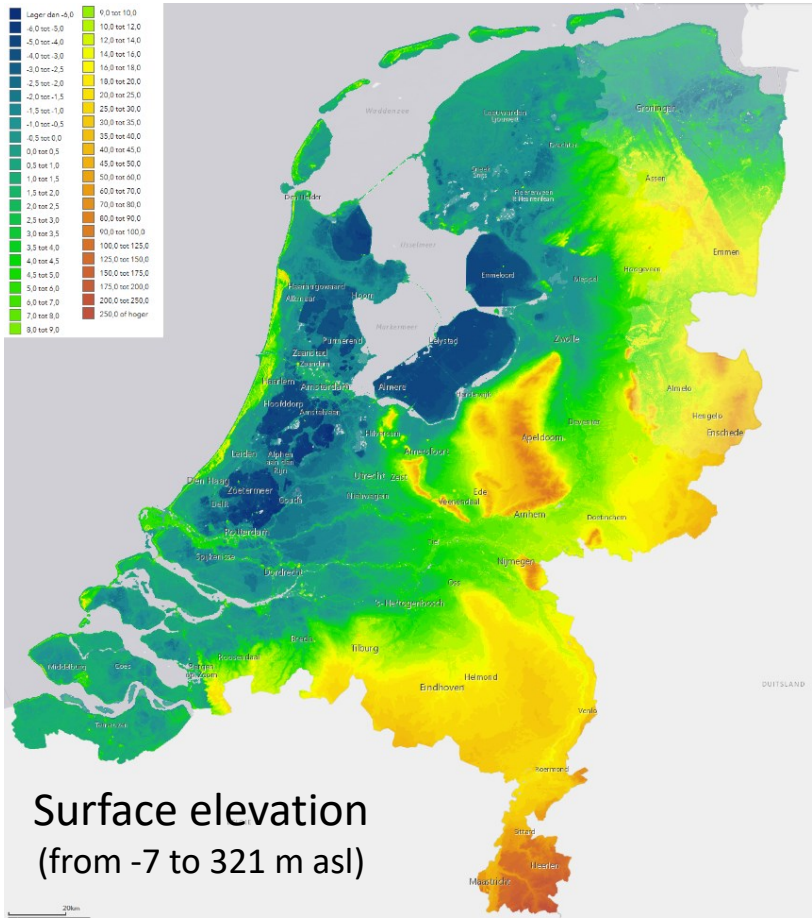


% surface water

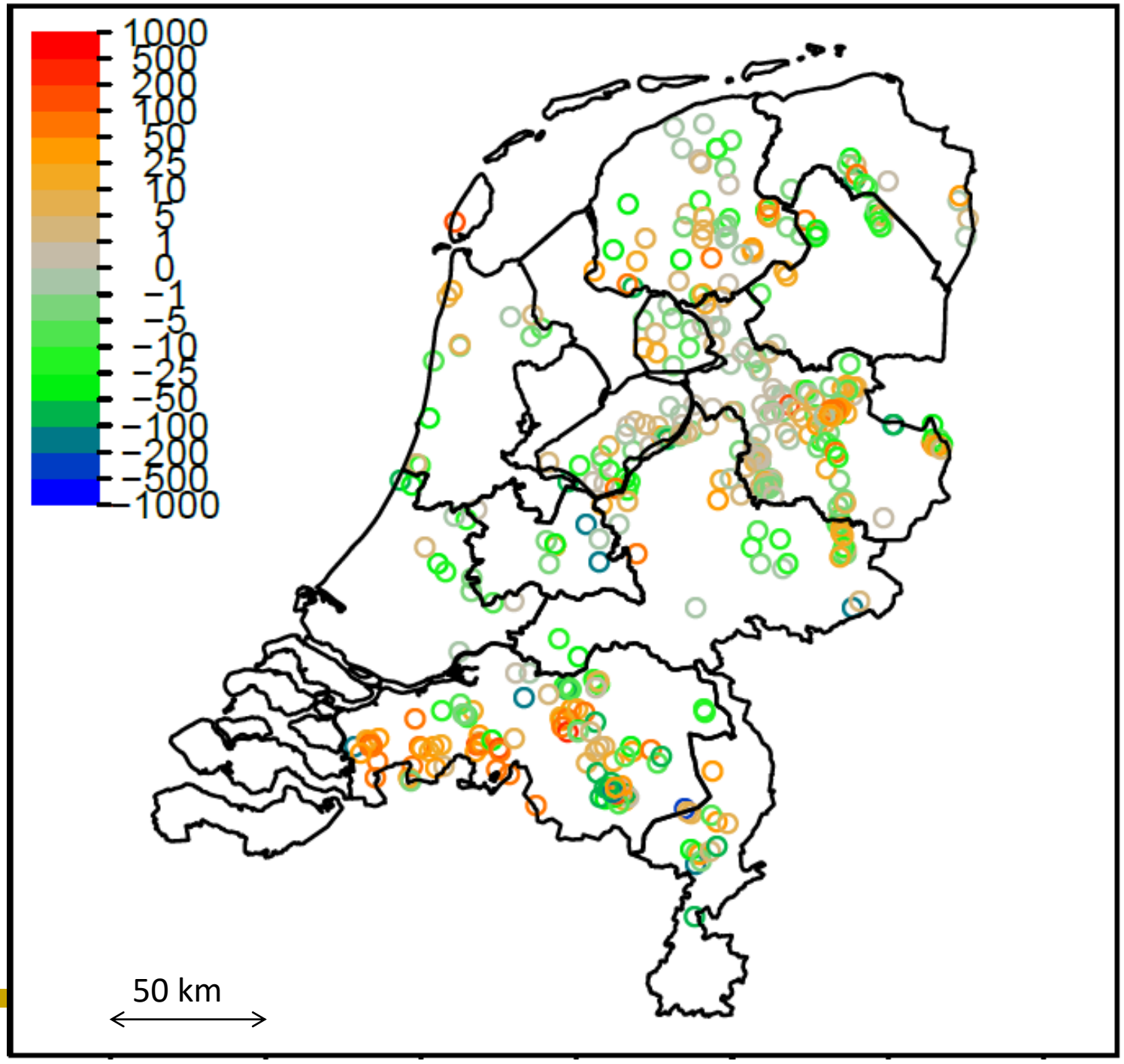




Surface elevation
(from -7 to 321 m asl)

Vertical variation

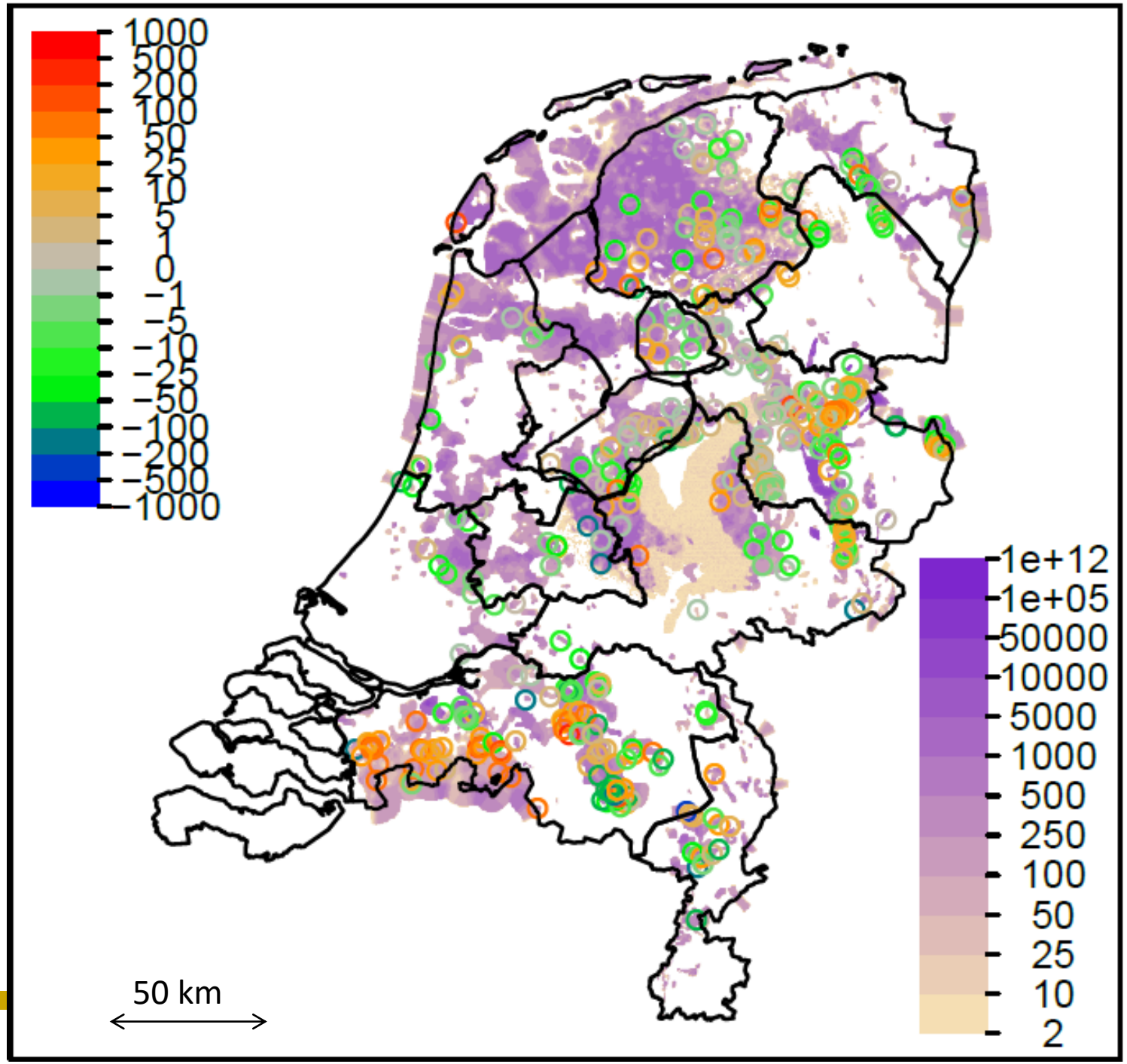
- Difference between first and second regional aquifer



Vertical variation

- Difference between first and second regional aquifer

  with hydraulic resistance of aquitard



Concluding remarks

- Groundwater head time series show system characteristics in head response to precipitation
- Mapping response time in three dimensions provides insight
- Response function may differ even if no head difference
- Response integrates over larger area than bore log → → additional information for delineating aquitards
- System changes in time so use only last 8 years

Thank you for your attention

Check out:

https://www.dinoloket.nl/ondergrondgegevens

https://www.grondwatertools.nl/grondwatertools-viewer

Contact: willem_jan.zaadnoordijk@tno.nl