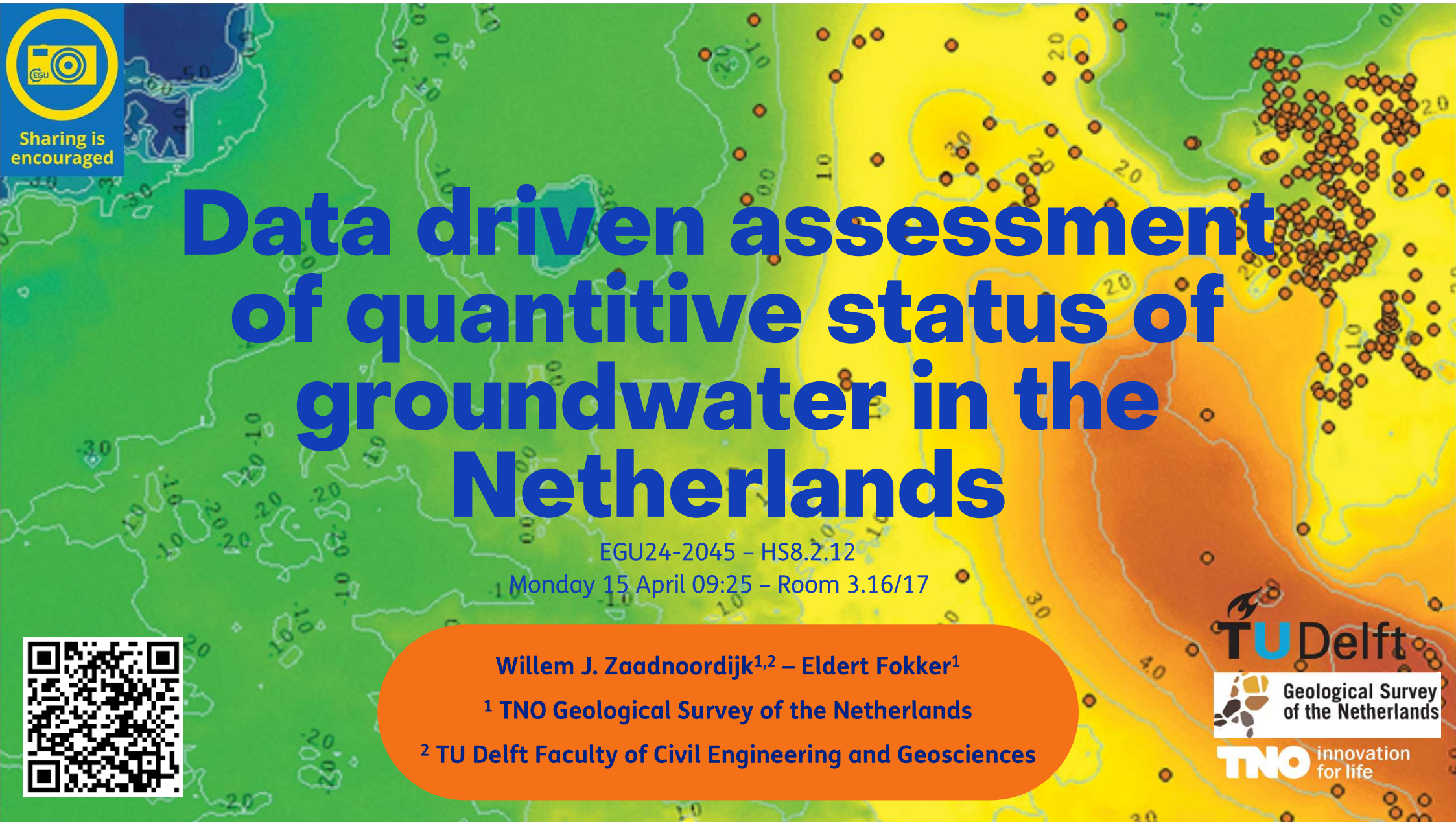

Sharing is encouraged

Data driven assessment of quantitive status of groundwater in the Netherlands

EGU24-2045 – HS8.2.12
Monday 15 April 09:25 – Room 3.16/17

Willem J. Zaadnoordijk[1,2] – Eldert Fokker[1]

[1] TNO Geological Survey of the Netherlands

[2] TU Delft Faculty of Civil Engineering and Geosciences

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Trigger

Paper

Water Accounts for the Netherlands

Compilation of Physical Supply and Use tables, Asset Accounts and Policy Indicators for Water 2018-2020

Water accounts of Dutch Central Bureau of Statistics (CBS)

Jocelyn van Berkel
Kees Baas
Patrick Bogaart
Laura Egelmeers
Roel Delahaye
Sjoerd Schenau

December 2022

Table 15. National water account 2018 additions minus reductions

billion m3	2018
Additions to stock - total	101.9
Returns	6.3
Precipitation	25.2
Inflows from other territories	70.4
Reductions in stock - total	99.8
Abstraction	8.5
Actual evapotranspiration	16.9
Outflows to other territories	0.0
Outflows to the sea	74.4
Balance: additions - reductions	2.1

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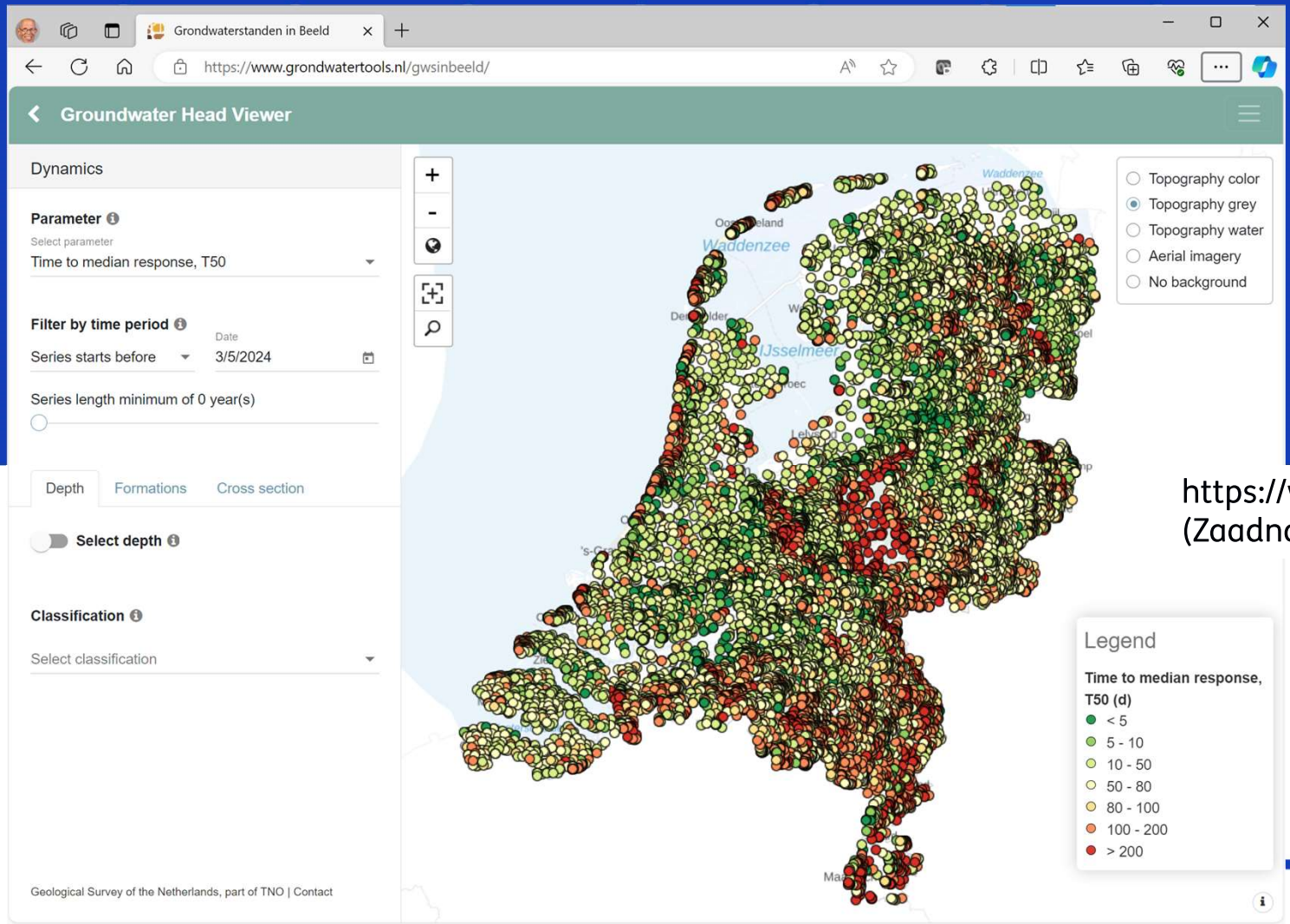
Groundwater levels in Dutch national database



https://www.grondwatertools.nl
(Zaadnoordijk et al., 2019)

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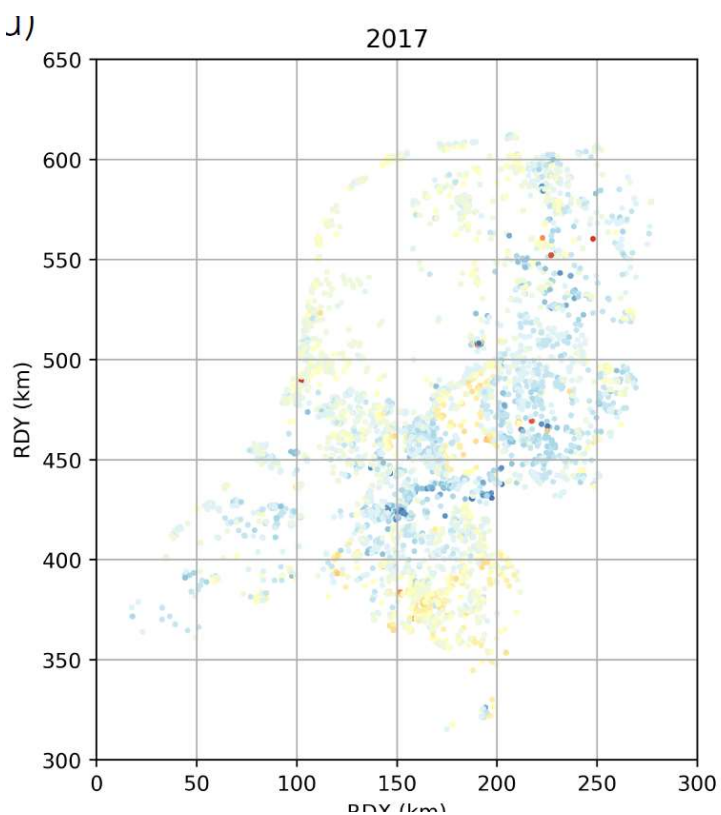
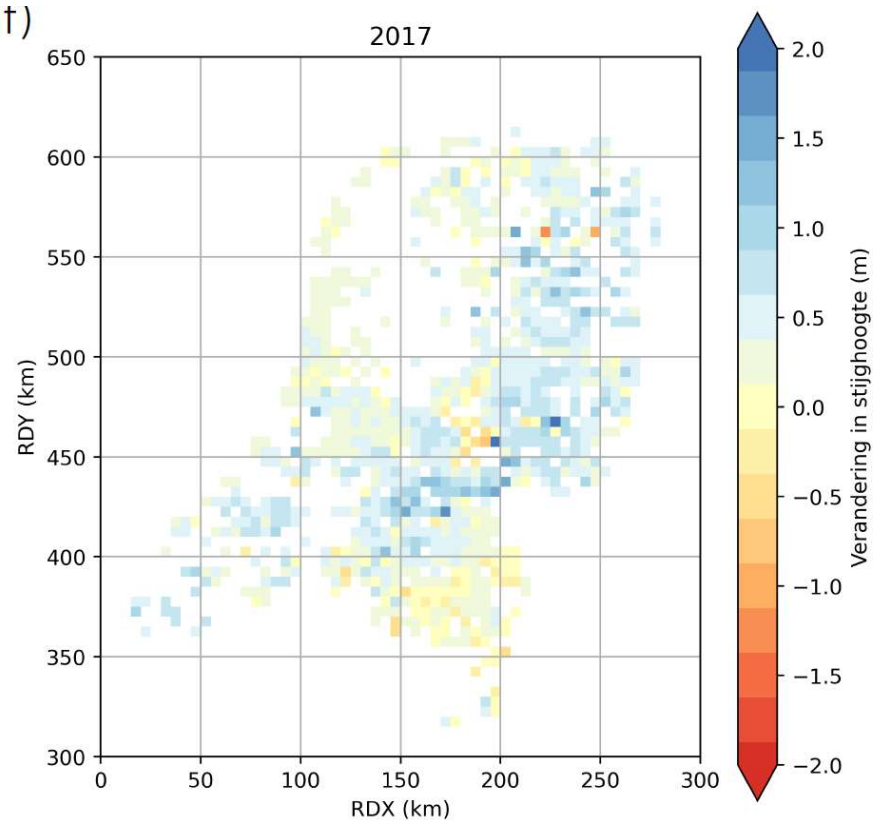
Groundwater volume change for calender year





- 2017
- Piezometers (left)
- Rasterized 10 x 10 km (right)

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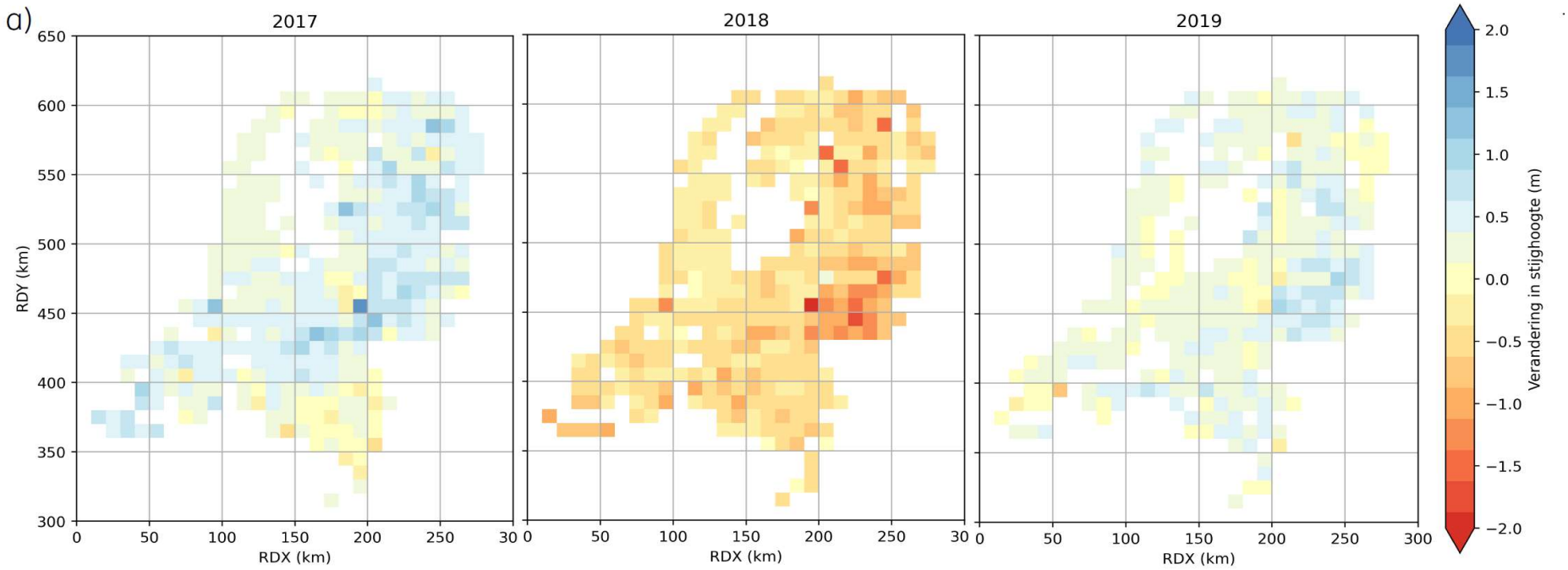
Results



Jaar	Verandering in stijghoogte (m)	Volumeverandering (10^9 m^3)
2017	0.39	2.0
2018	-0.53	-2.7
2019	0.29	1.5

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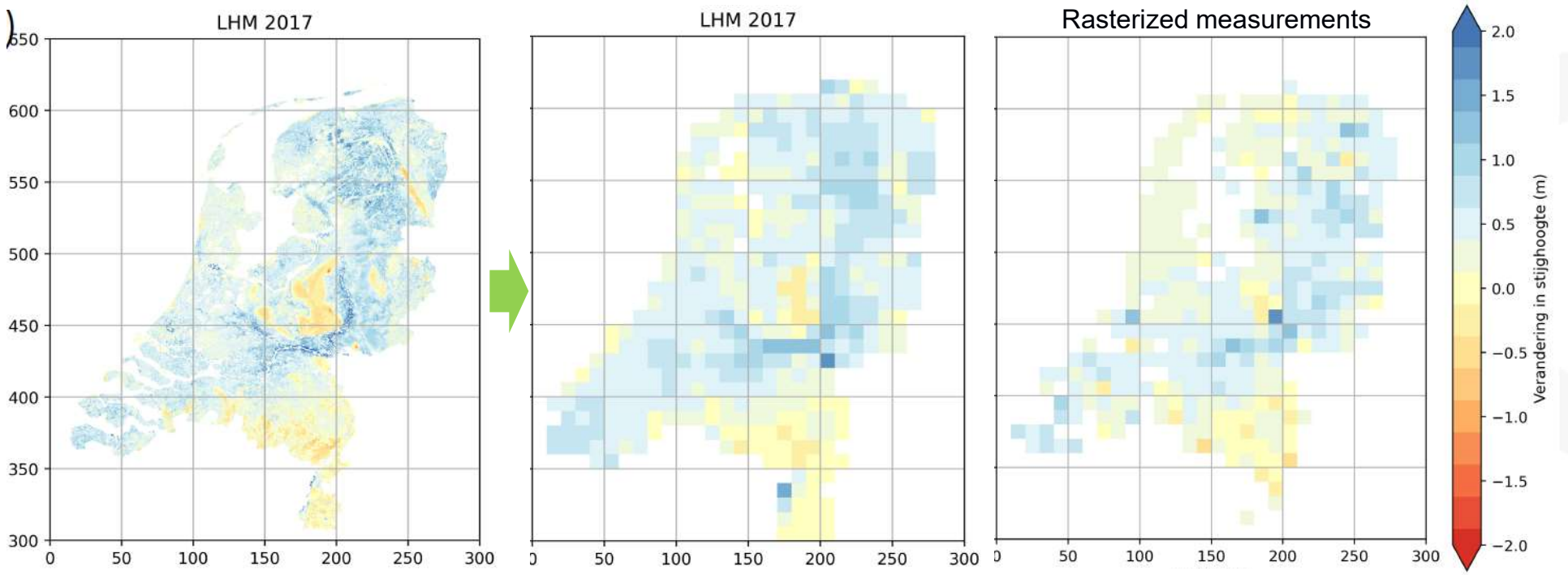
Comparison with National Hydrological Model (LHM)



0.25 x 0.25 km

10 x 10 km

10 x 10 km

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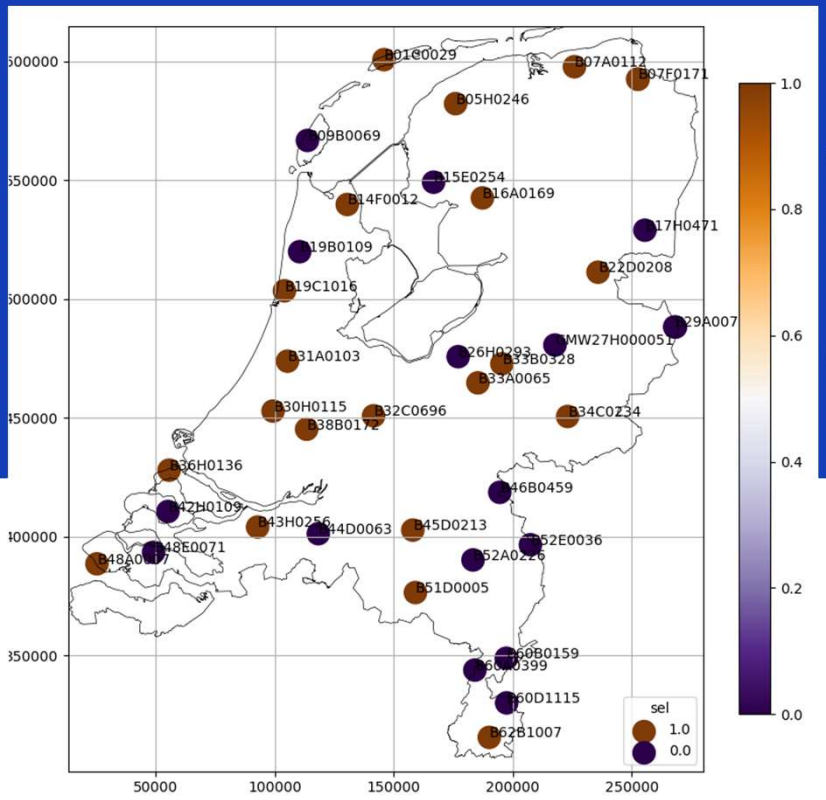
Representative set of piezometers



- Length of time series
- Measurement frequency
- Spatial distribution
- Variation in land use, precipitation response

- Together matching national volume change

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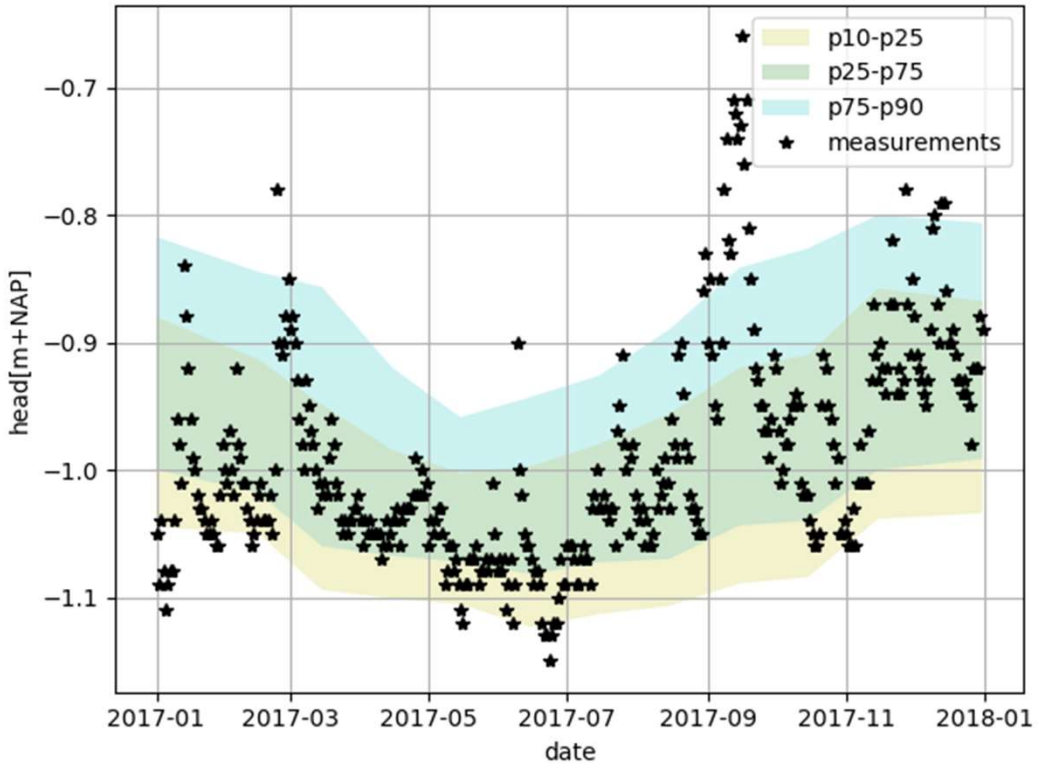
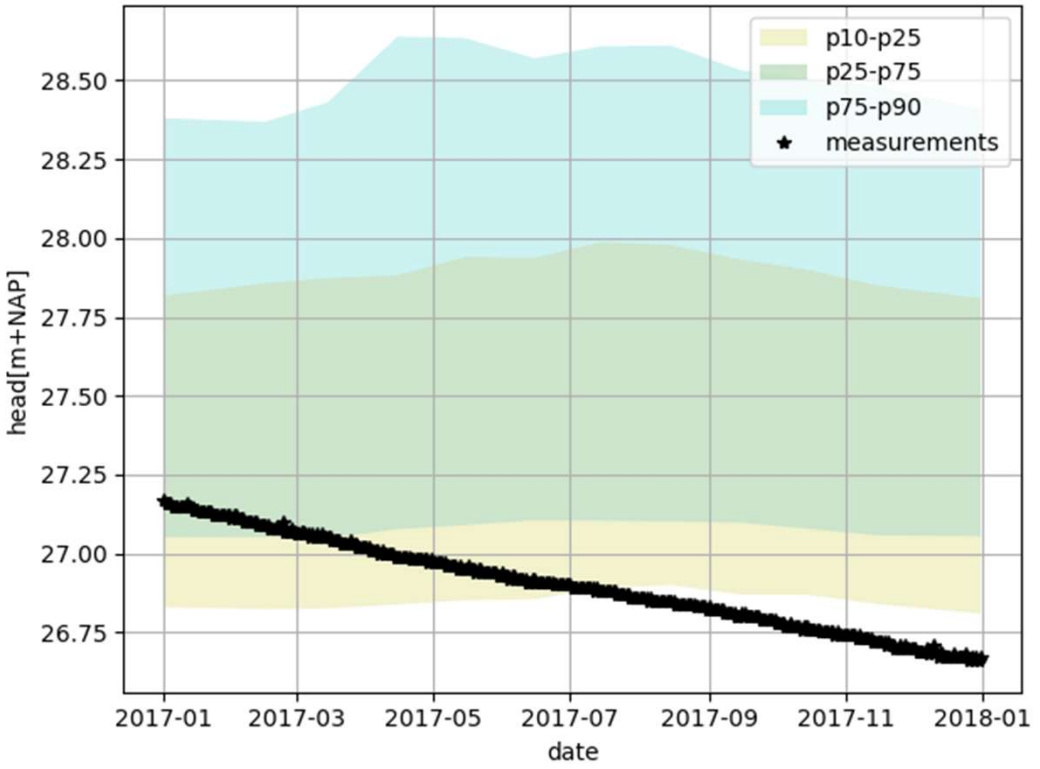
Variation in calendar year compared to normal





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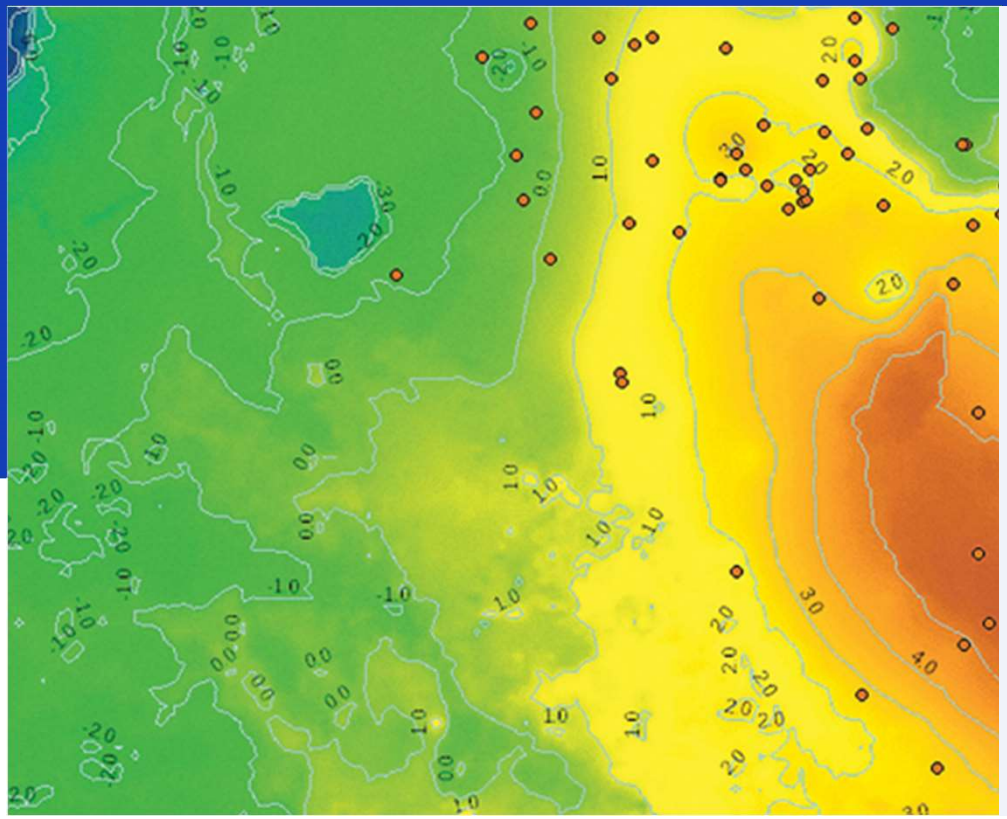
Conclusions



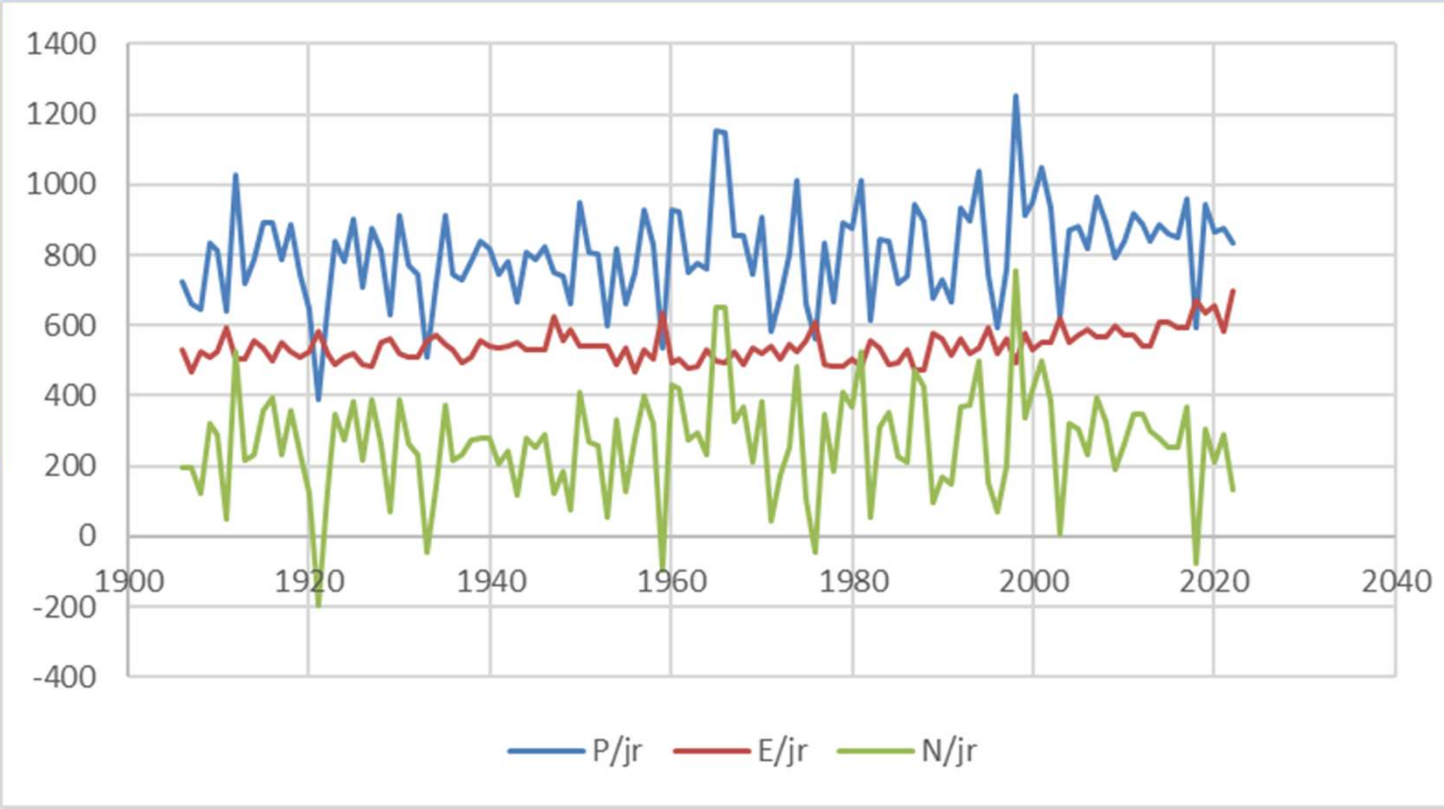
- Groundwater volume change from all measured heads at beginning and end of year
- Use this for selection of representative set consisting of few piezometers
- Basis for further status evaluations

Contact: willem_jan.zaadnoordijk@tno.nl

Thank you for your attention!

Questions?

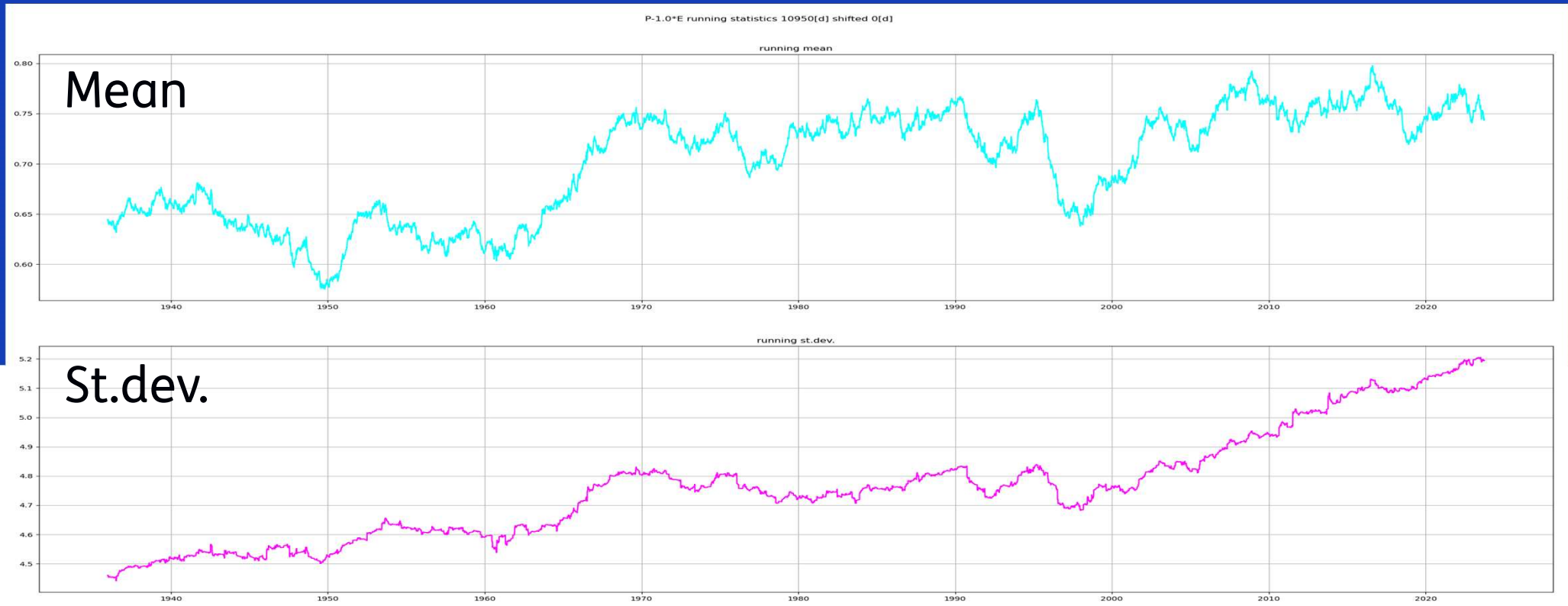
Meteorology past century: yearly totals



P	Precipitation
E	Evaporation
N	Potential recharge (= P-E)

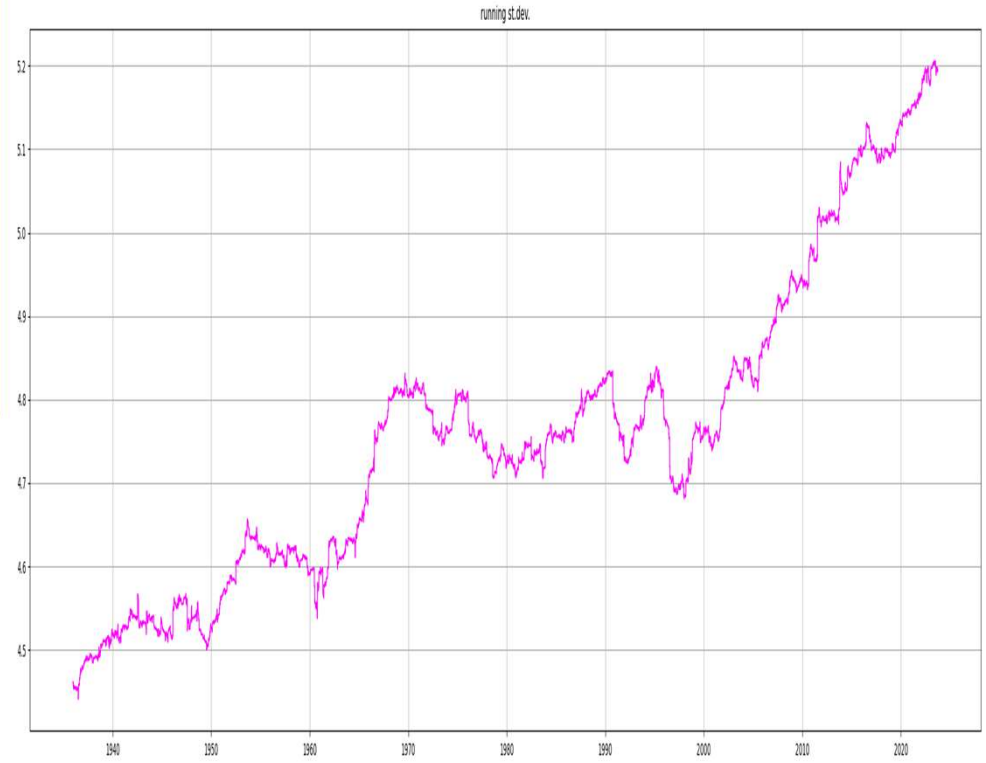
Sources:
Bartholomeus et al. (2015), KNMI (de Bilt)

Daily potential recharge: 30 y running statistics



Sources: Bartholomeus et al. (2015), KNMI (de Bilt)

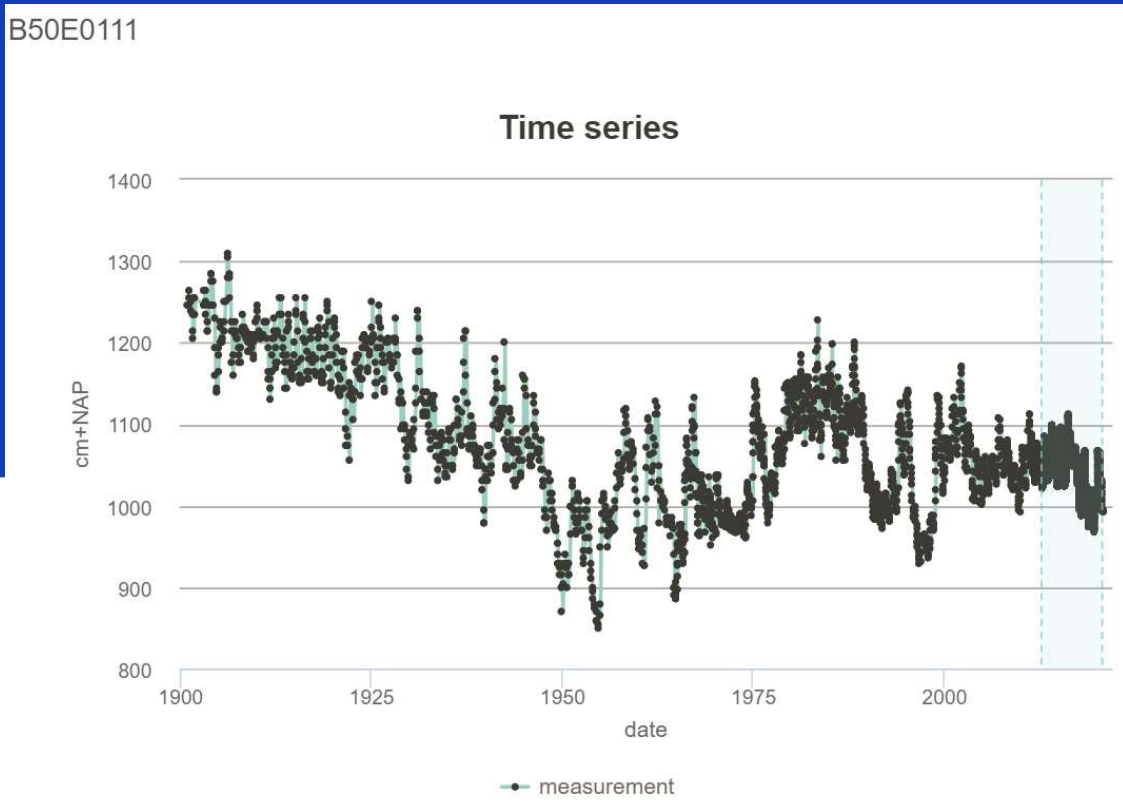
Propagation potential recharge variability?



Increasing variability in potential recharge

Does variability in groundwater levels increase also ?

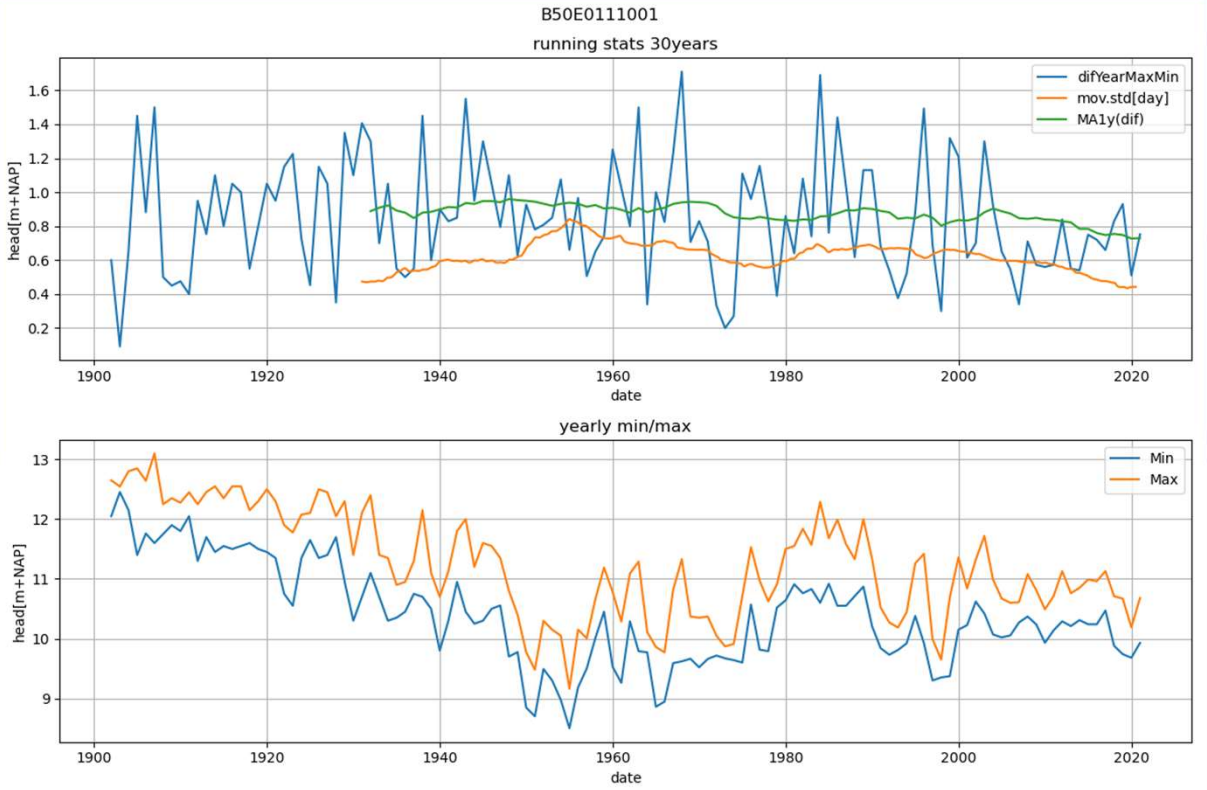
Look at longest series in national database



Running statistics not appropriate because of low or varying frequency

Look at difference between yearly minimum and maximum

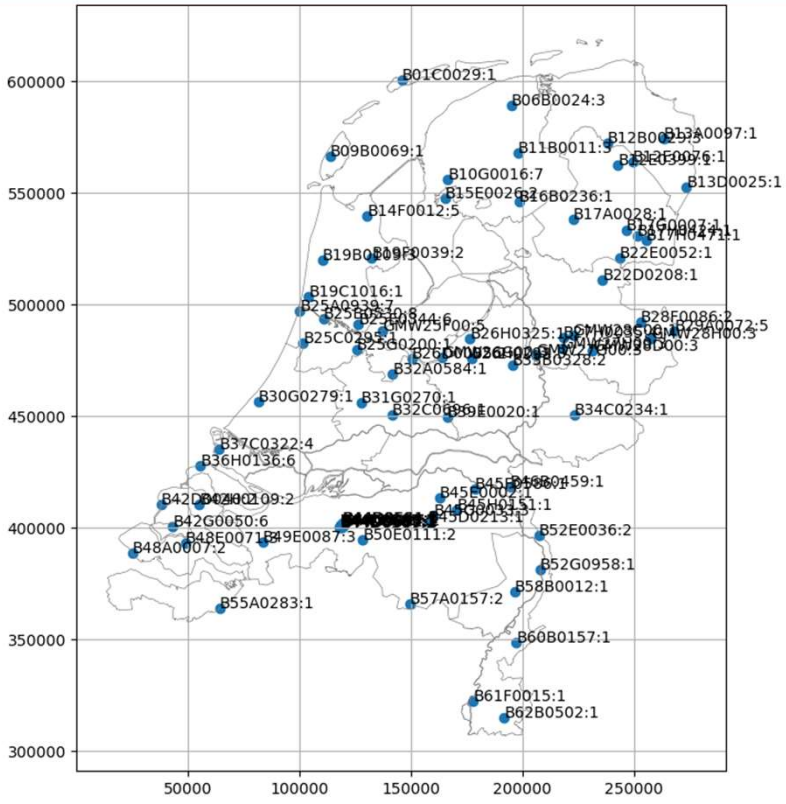
Difference yearly minimum and maximum



MA1y = moving average of difference 30y

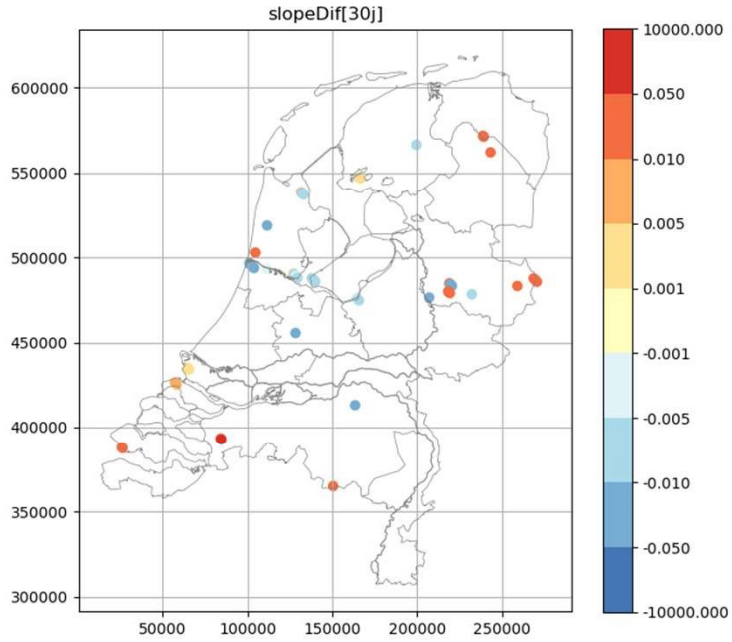
Mov.std[day] on original time series

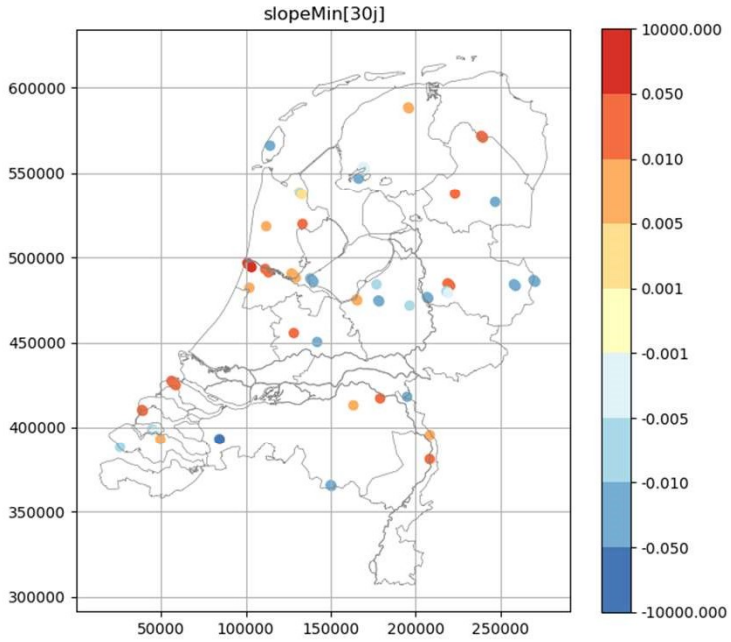
Selection piezometers for spatial pattern

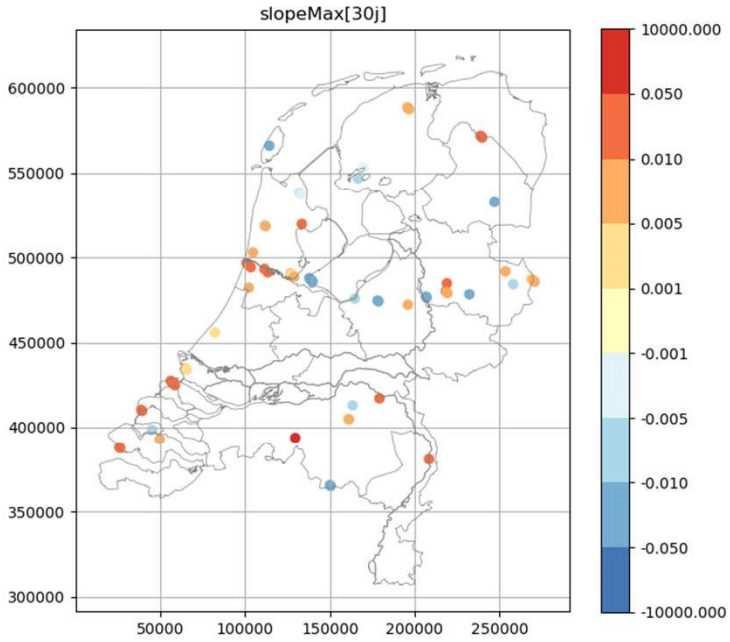


- Series longer than 100 years
- Selected piezometers from Rolf (1989) that are still active
- West-East transect multi-level wells with series at least 30 y

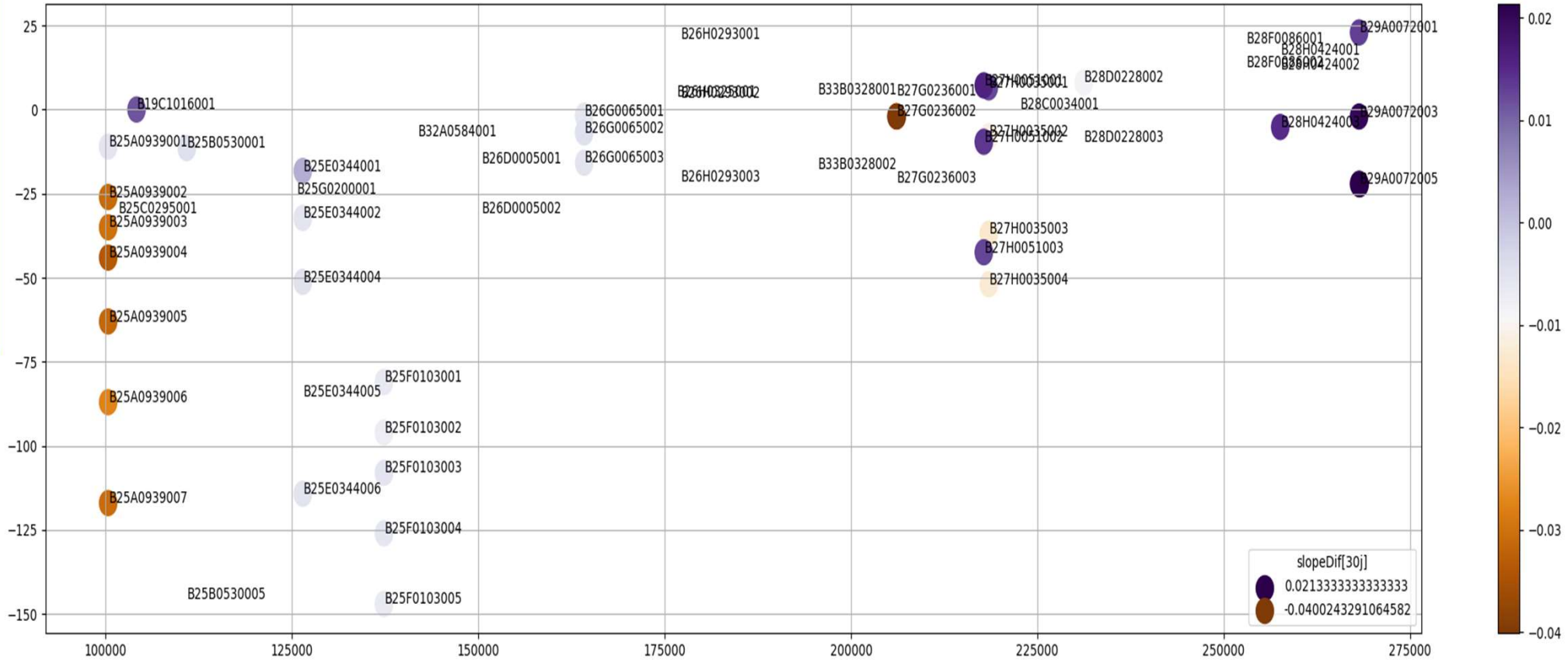
Significant trends (Mann-Kendall / Sen's slope)







Significant trends (Mann-Kendall / Sen's slope)
West-East cross section



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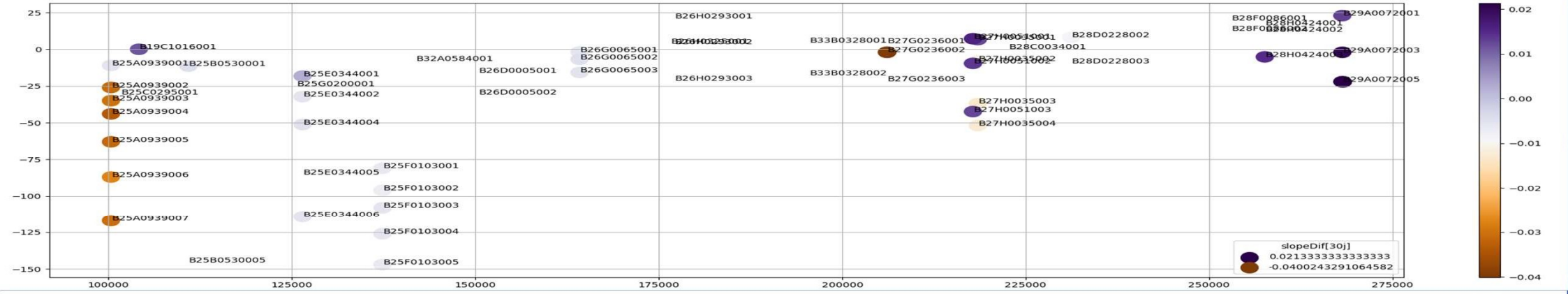
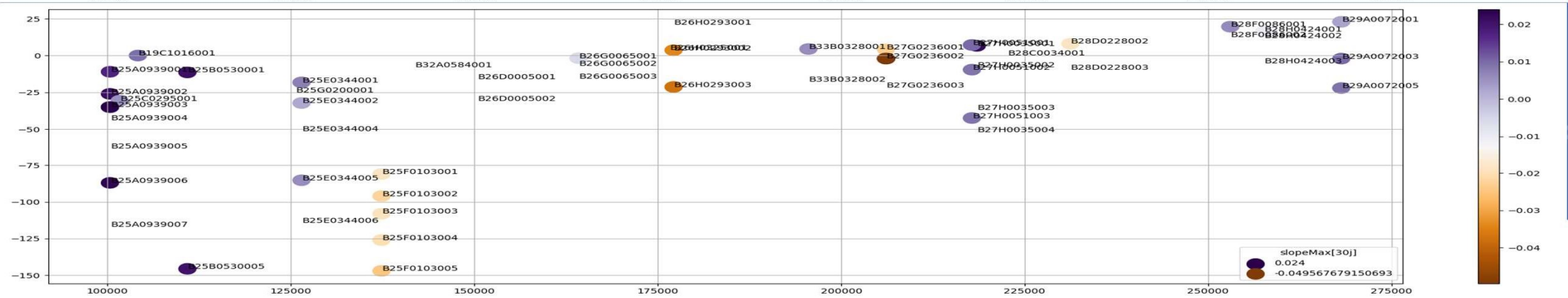
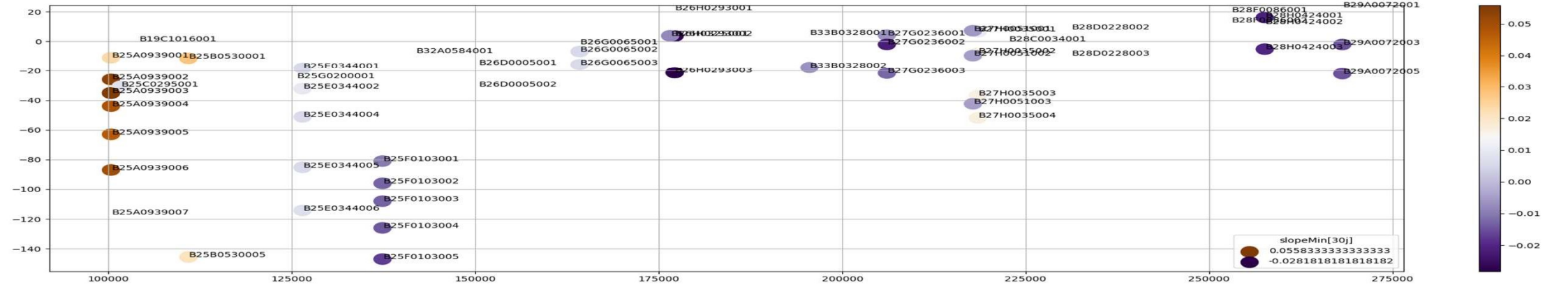
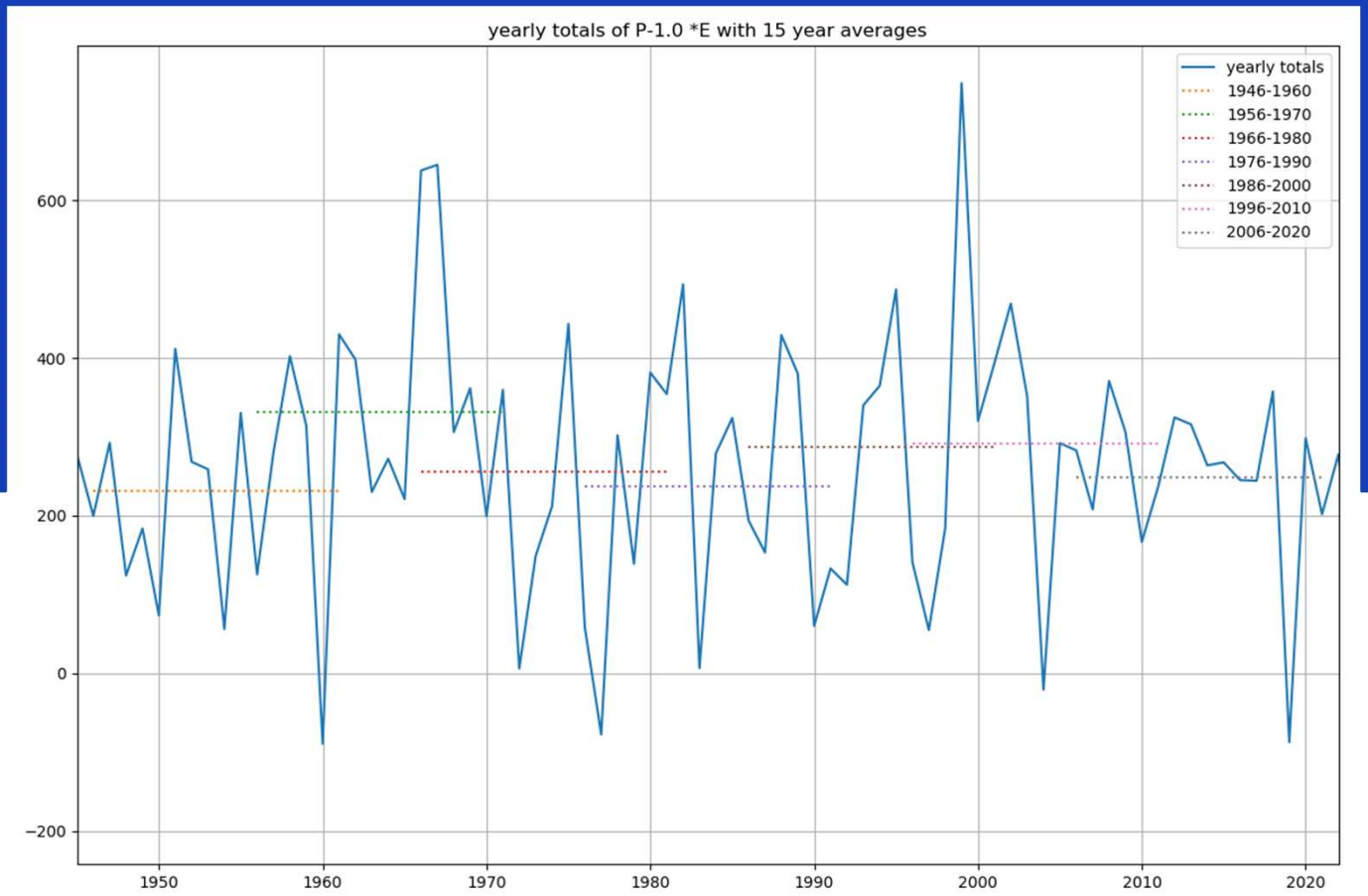

slopeDif[30j]
0.0213333333333333
-0.0400243291064582


slopeMax[30j]
0.024
-0.049567679150693

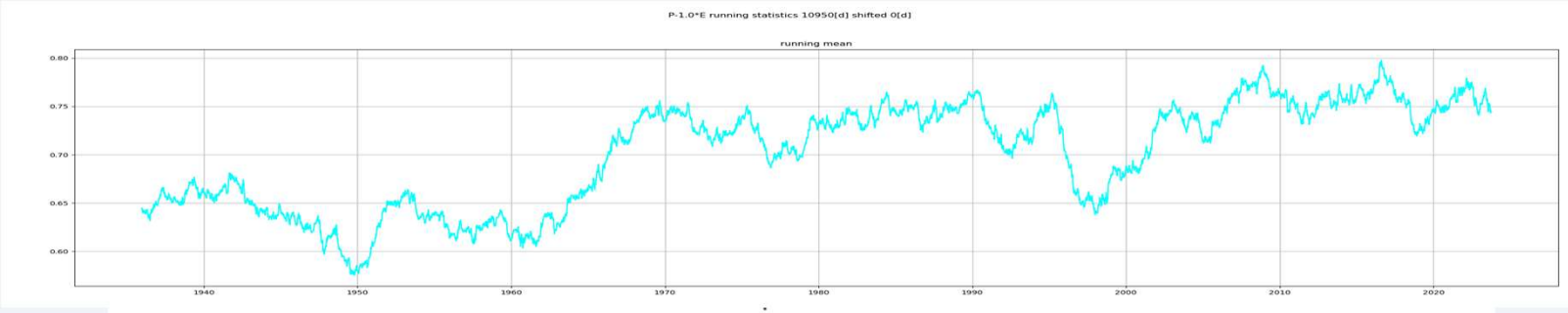

slopeMin[30j]
0.0558333333333333
-0.0281818181818182

Potential recharge variation 15 year periods

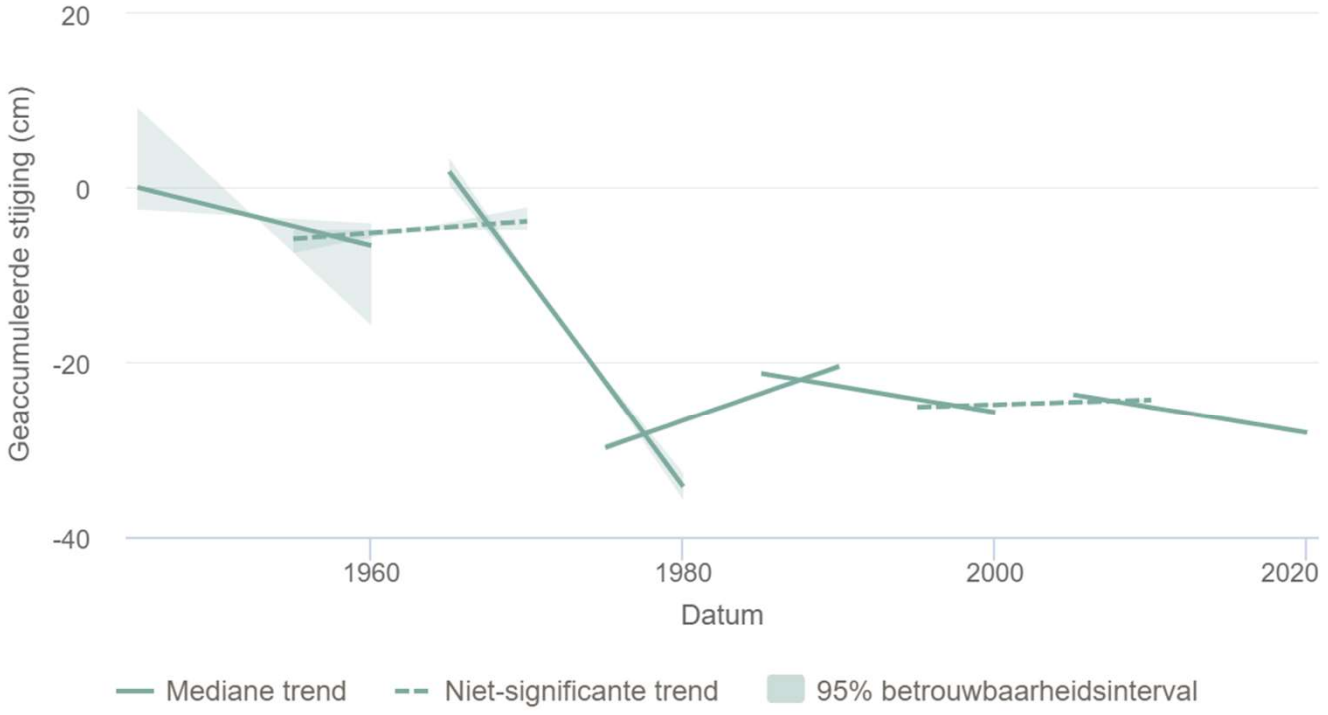


Trends

- Neerslag – verdamping 30 jaars gemiddelden



- Gecombineerde trends voor periodes van 15 jaar voor alle DINO-reeksen in Nederland



Yearly overviews

Paper

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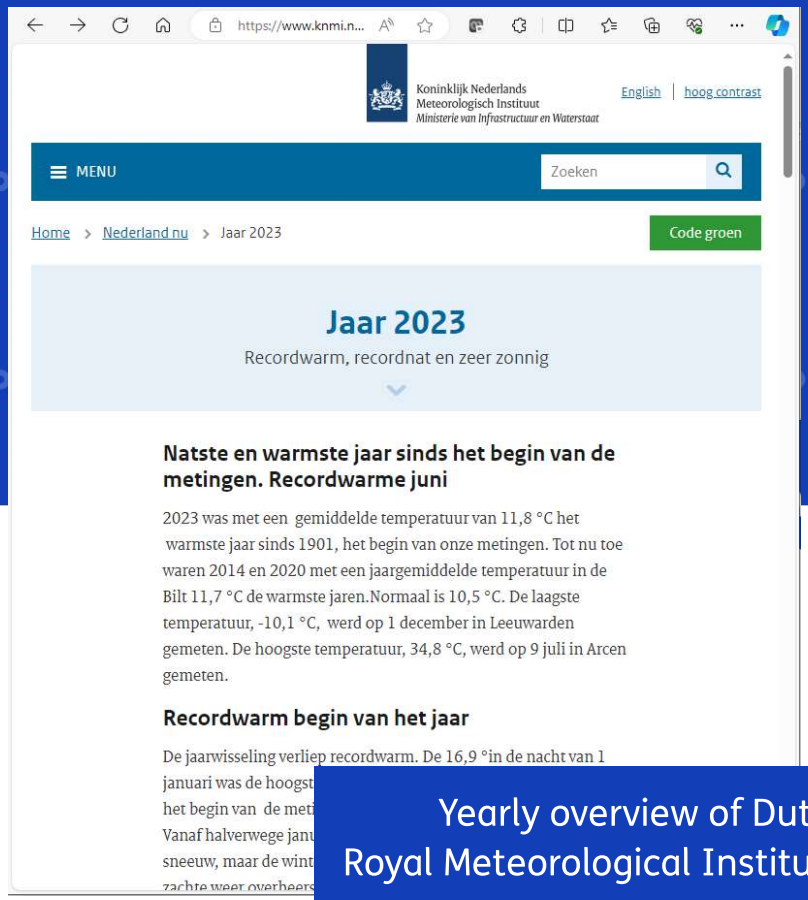

Yearly overview of Dutch Royal Meteorological Institute KNMI