



Grondwatertools: 4D information on heads and groundwater system characteristics for the Netherlands

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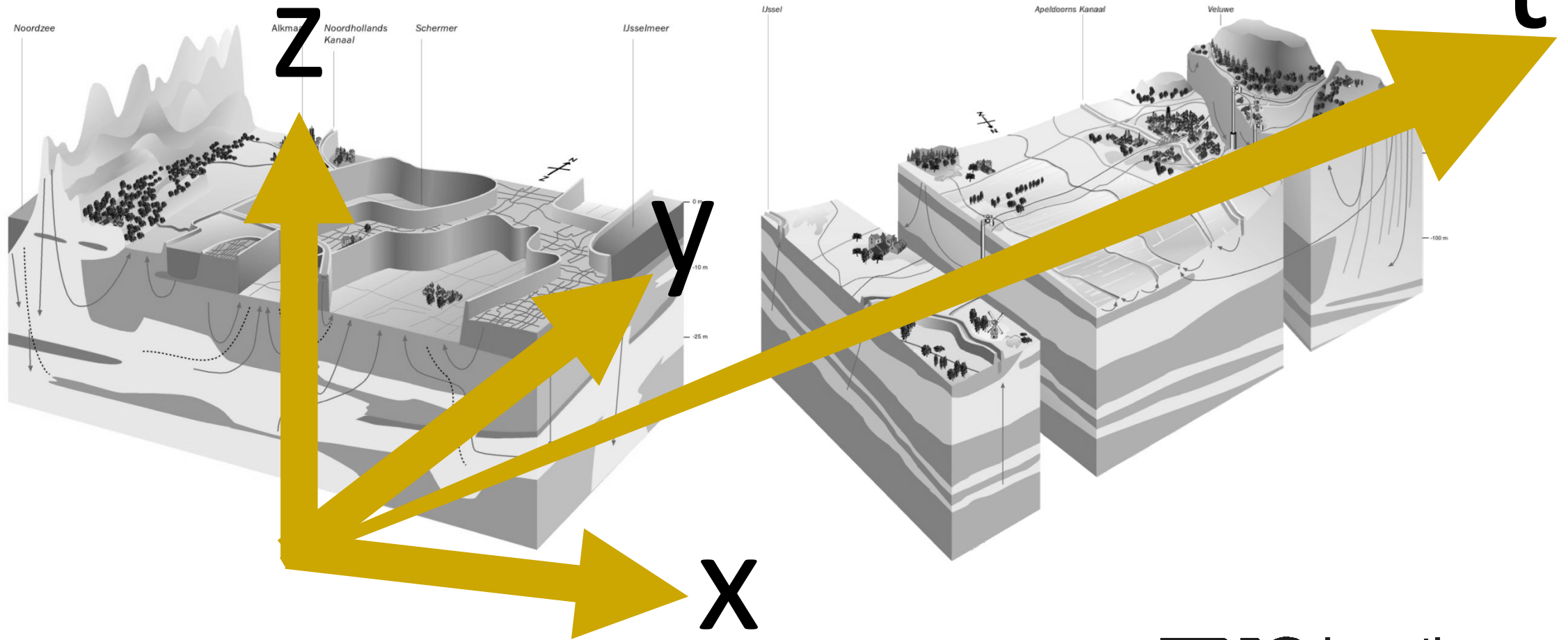
geohydrologist

TNO Geological Survey of the Netherlands – team geomodelling, Utrecht

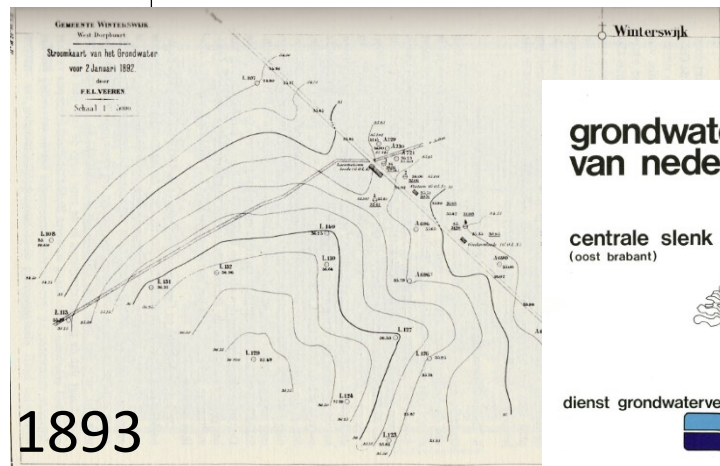
Delft University of Technology - Water Resources Section, Faculty of Civil Engineering and Geosciences



Geohydrology in the Netherlands



Head contours per layer - 2D



grondwaterkaart van nederland

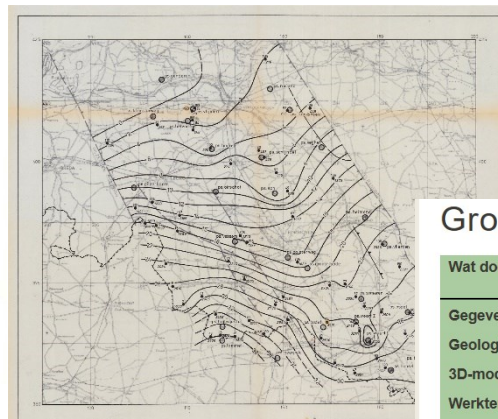
centrale slenk (oost brabant)



dienst grondwaterverkenning TNO



1970-1989



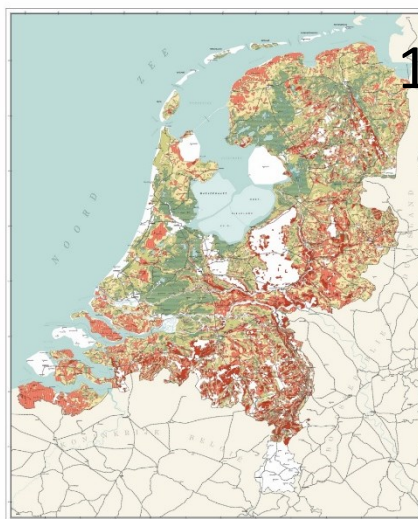
Since 2016: <http://www.grondwatertools.nl>

Grondwatertools

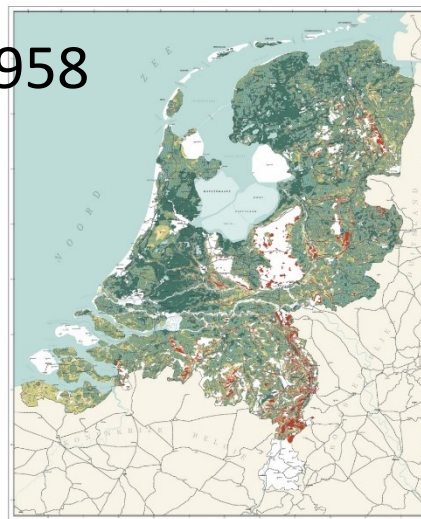
Zoeken

Wat doen wij	Wie zijn wij	Thema Grondwater	Thema Delfstoffen	Geologie van Nederland					
Gegevens	Geologische kaarten	3D-modellen	Werkterrein	Advies					

GEMIDDELDE GRONDWATERDIEPTE IN DE ZOMER 1950 - 1955



1958



Kies wat u wilt bekijken

isohypsen

Selecteer een laag, datum en gebied

LHM laag: WVP2

Datum: 01 | 04 | 011

Selecteer gebied

- Grondwaterputten
 - meetpunten
- Berekening
 - meetpunten
 - isohypsen (m+NAP)
 - berekende stijghoogte (m+NAP)

High: 6.18

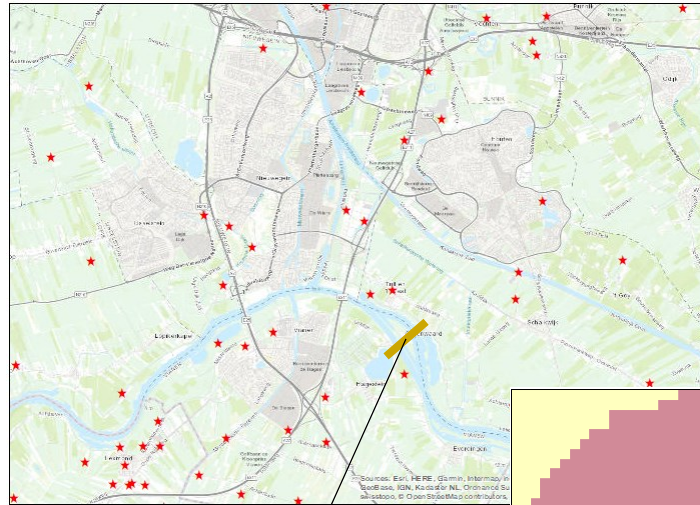
Low: -0.71

Download data

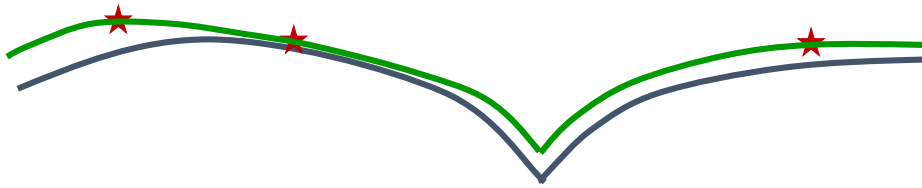
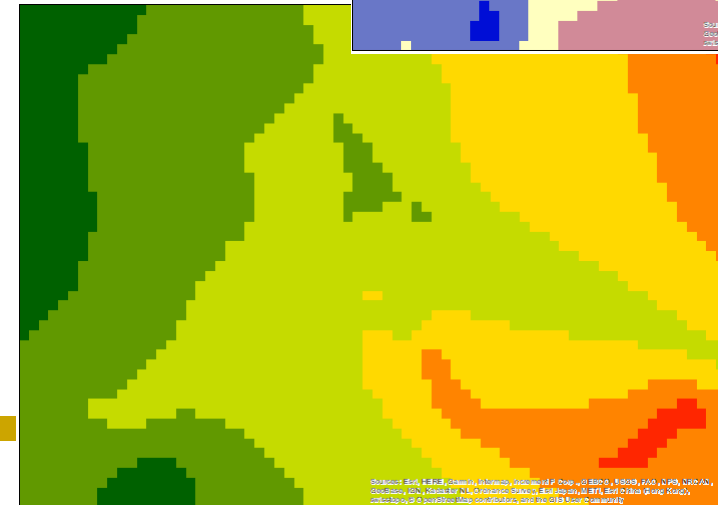
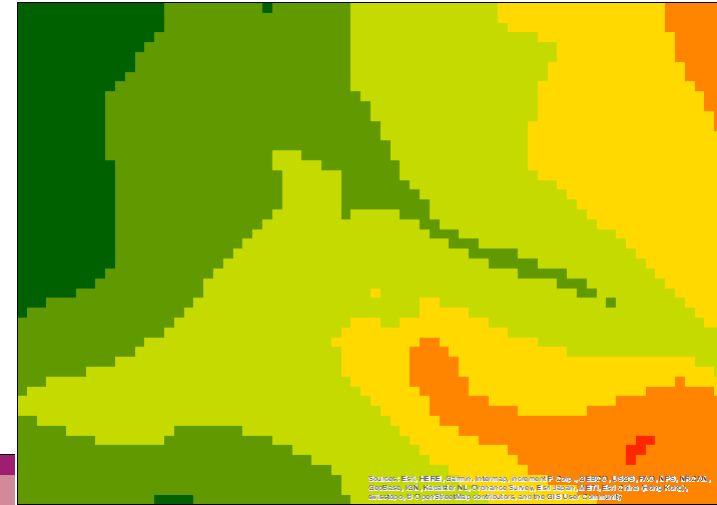
Grondwaterdynamiek

› Isohypsese tool

- ★ › interpolation measurements
- › Trend surface from NHI national groundwater model
- › Kriging of residues (measurement-model)
- › Add both to get map better taking into account surface water influences etc.



Weir



Groundwater level time series - 1D



Ondergrondgegevens n x +
dinoloket.nl/ondergrondgegevens-nieuwbouw
Over ons | Contact | FAQ | Help | Nieuws

DINoloket

Data en Informatie van de Nederlandse Ondergrond

Grondwaterstanden

Identificatie: B58G0045
Identificatie buis: B58G0045001
Coördinaten: 207440, 354500 (RD)
Maaiveld: 58.1 m t.o.v. NAP

Opslaan grafiek

Buizen met metingen

Id	Druk	Boven NAP	Onder NAP	Boven MV	Onder MV	Begin	Eind	Aantal
001	nee	51.44 m	50.48 m	6.66 m	7.62 m	28-01-1955	17-07-2006	1191
002	nee	38.28 m	37.35 m	19.82 m	20.75 m	28-01-1955	17-07-2006	1191

Kies wat u wilt bekijken

- Bodem- en grondonderzoek
- Grondwatermonitoring
- Overig onderzoek

x: 200786, y: 346579

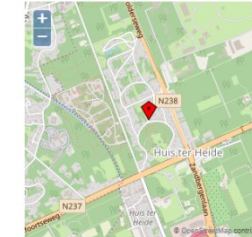
Groundwater time series models



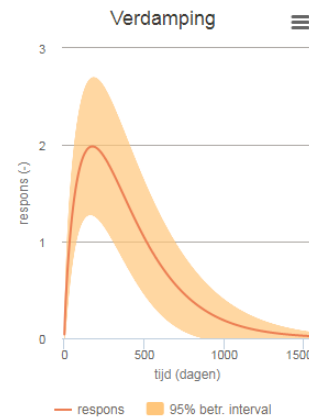
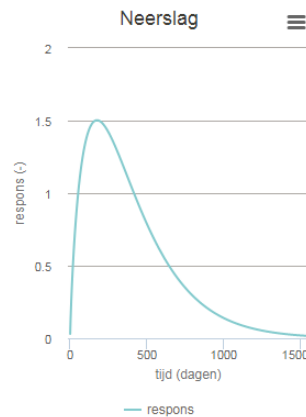
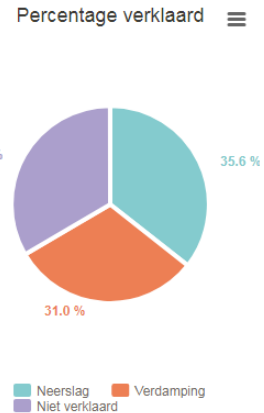
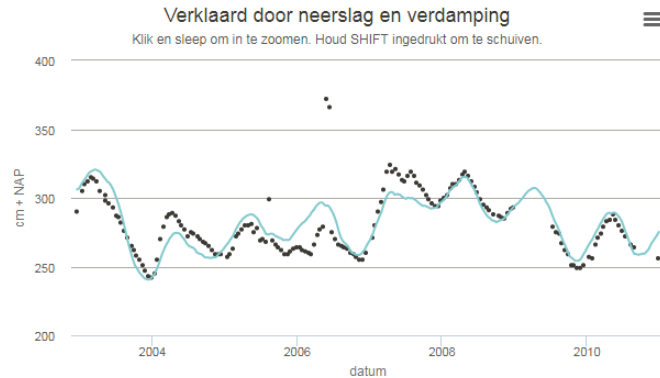
Putlocatie B32C0583

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

Analyse individuele filters



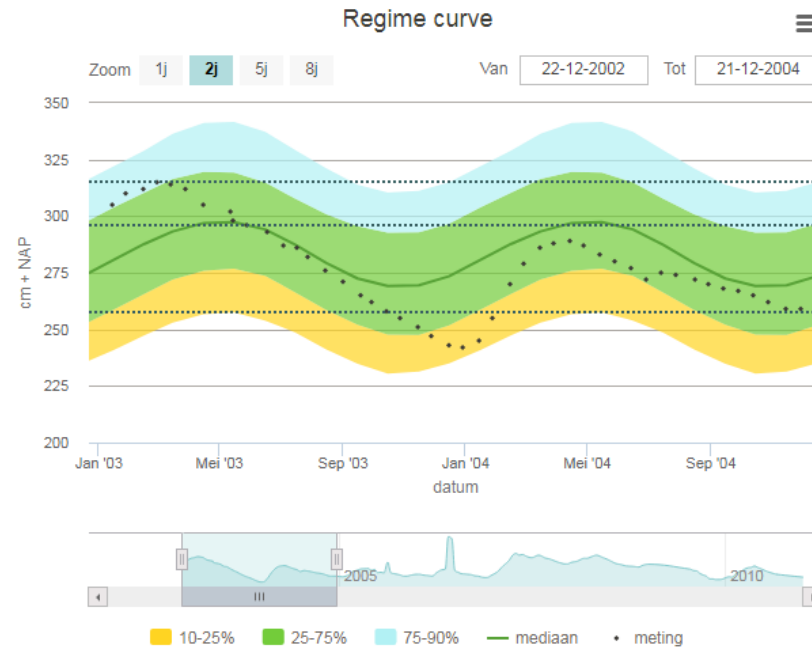
Filters in peilbuis	Bovenkant filter cm + NAP	Onderkant filter cm + NAP
Filter 001	53	-47



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.



Klimaatrepresentatieve 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	

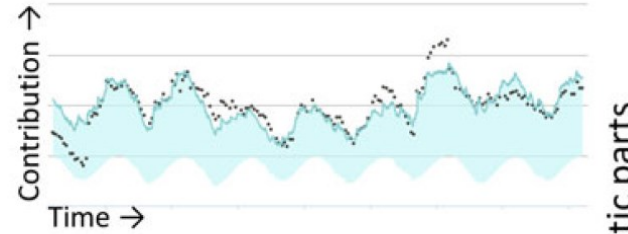
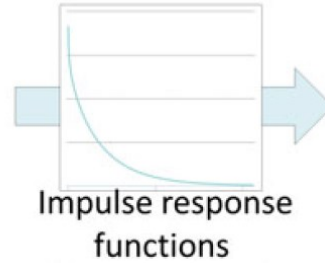
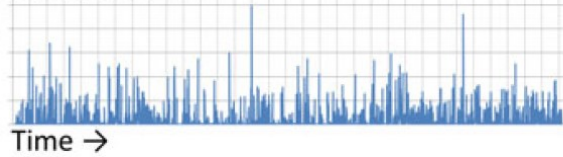
Toon in grafiek:

- GxG
- Maaiveld

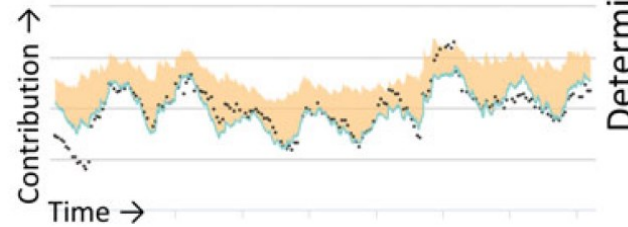
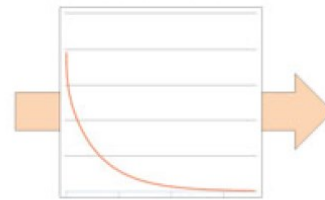
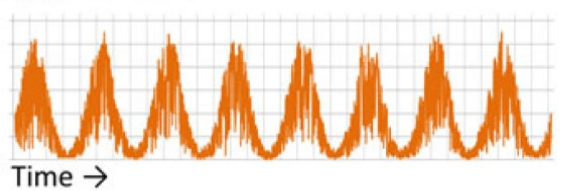
Decomposition of influences in time series model



Precipitation



Evaporation



Innovations

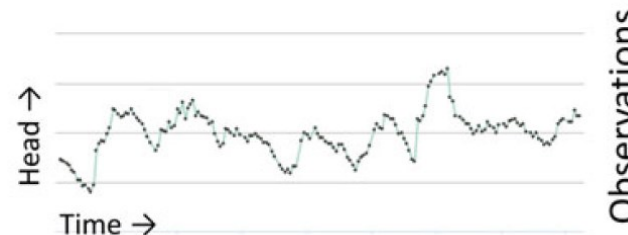


Noise model



Base level of time series model

+

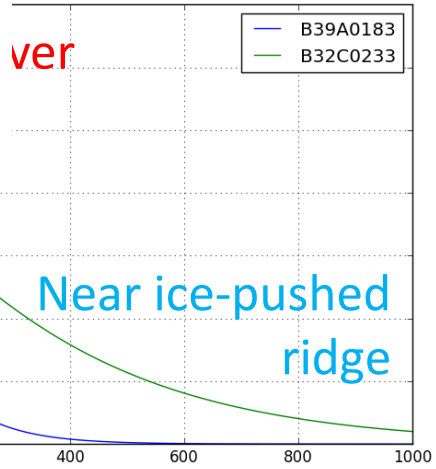
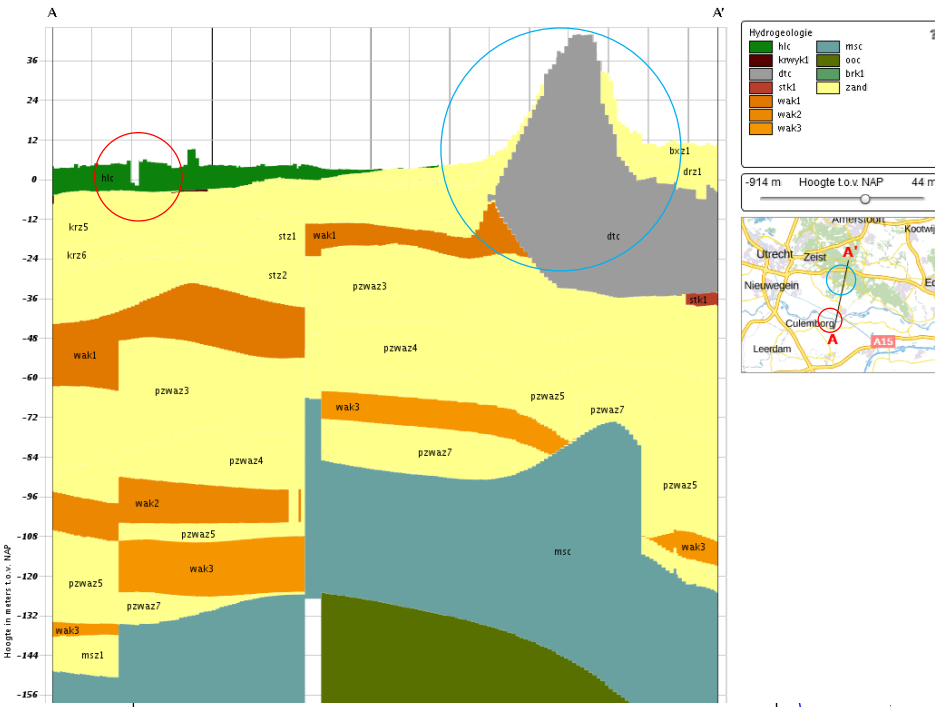


Deterministic parts

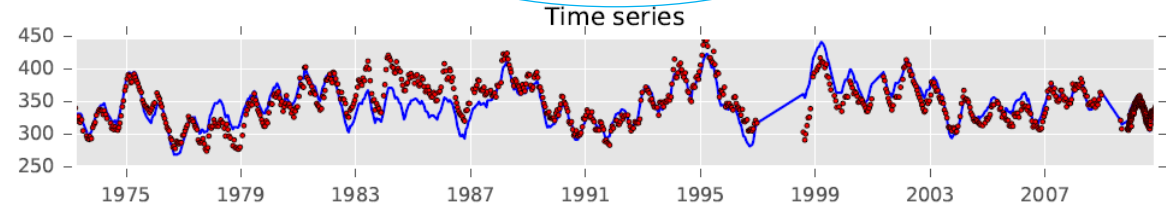
Stochastic

Observations

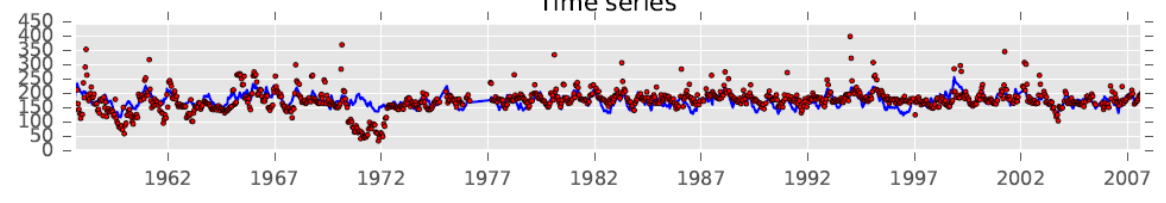
Response as system signature



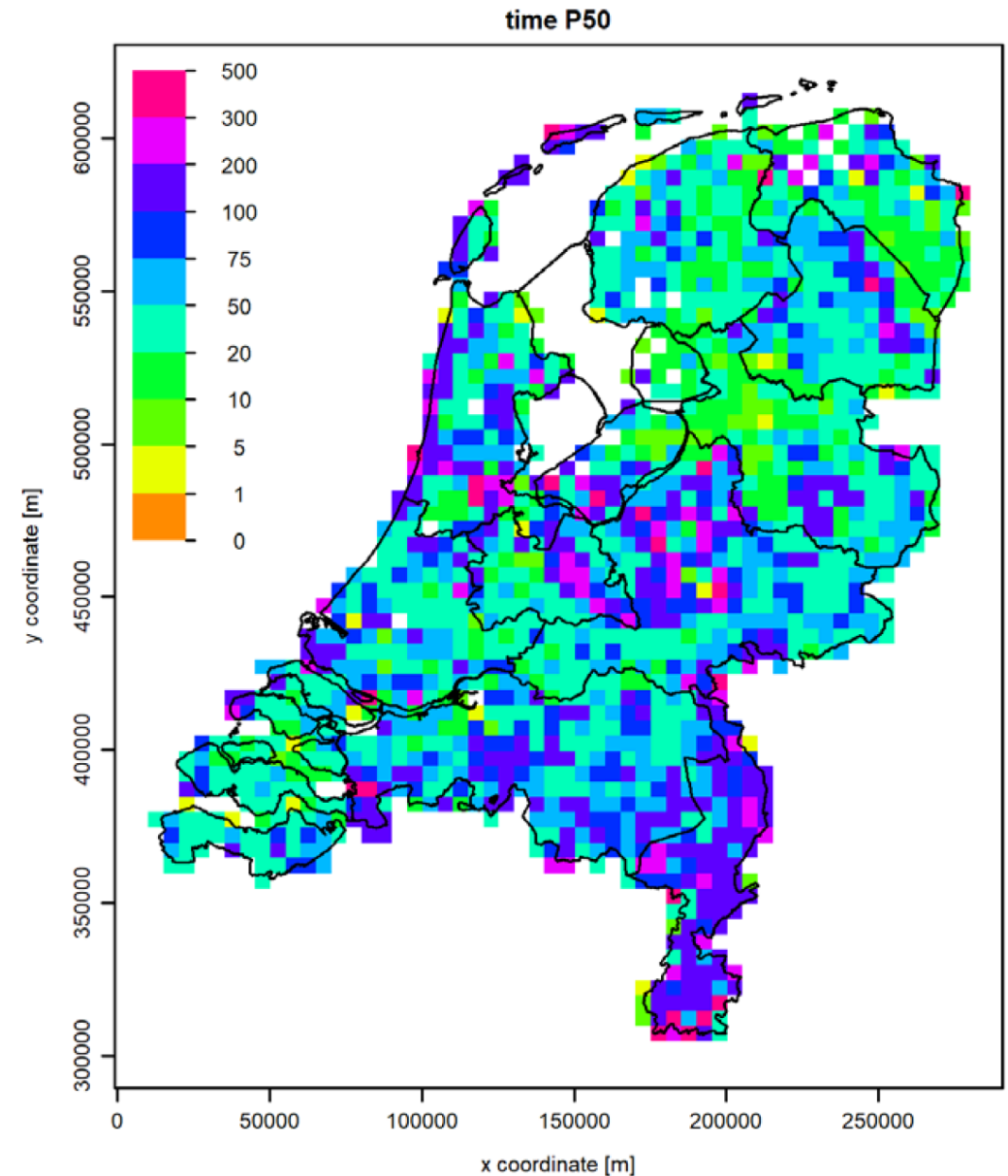
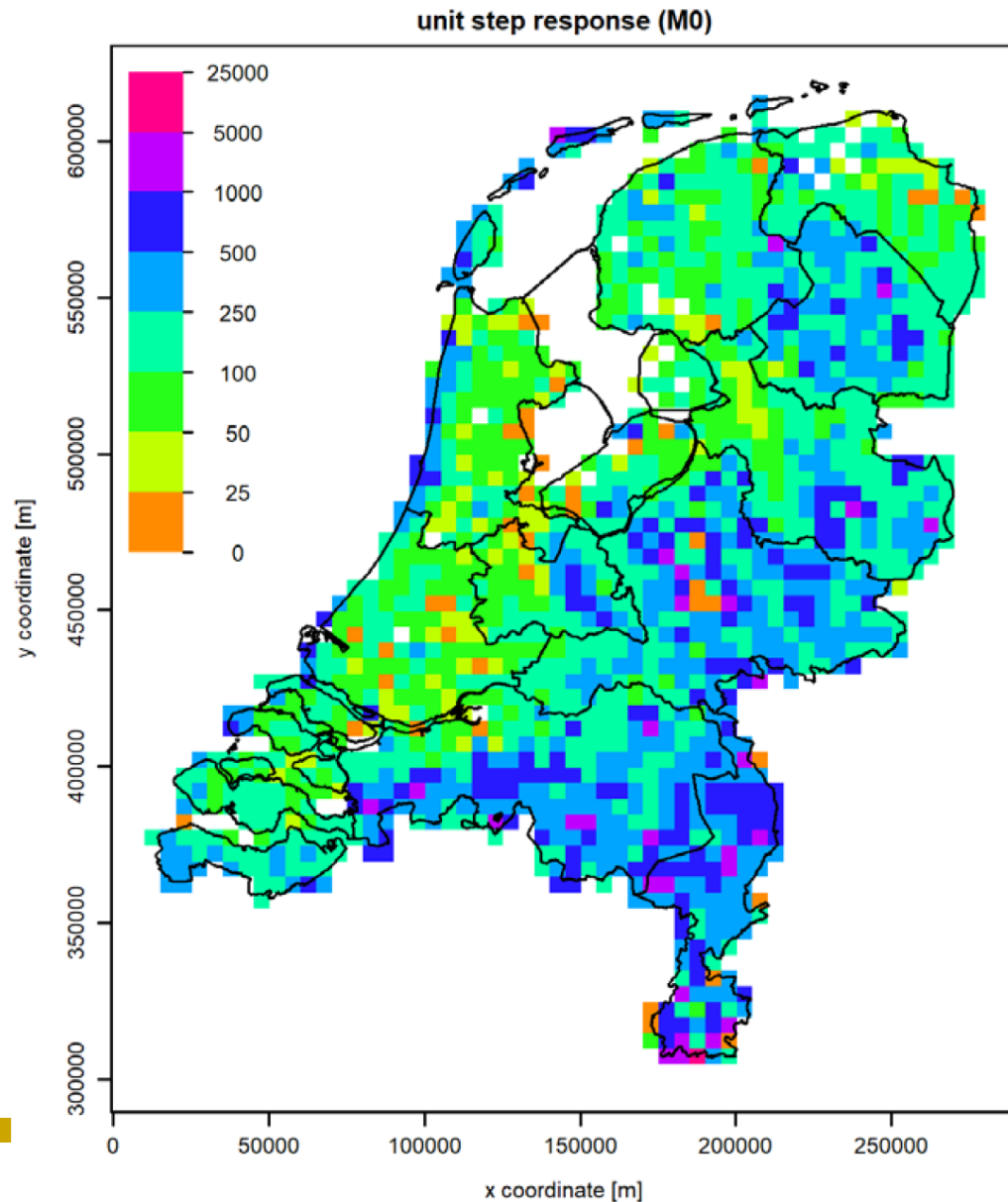
B32C0233001_1



B39A0183002_1



Characteristics precipitation response

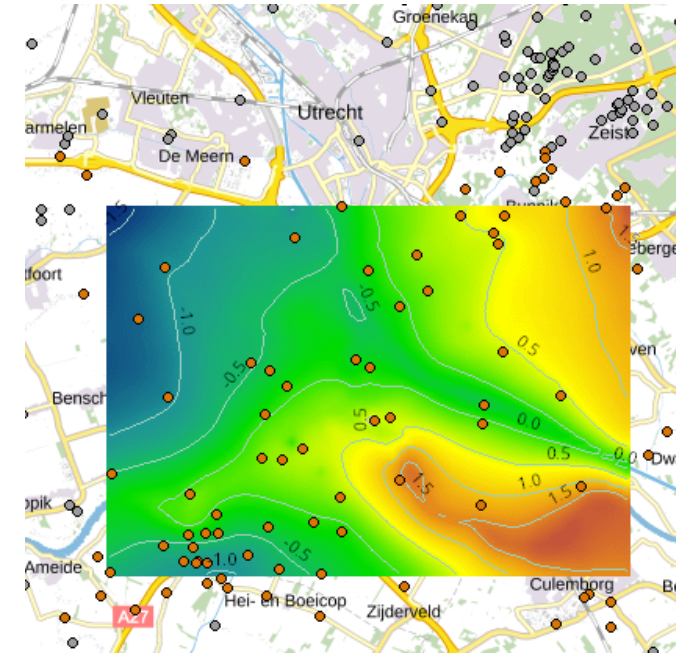
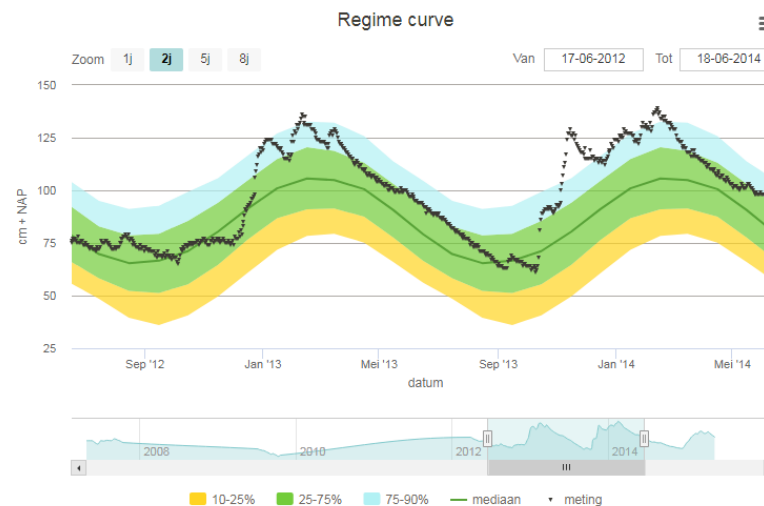


› Groundwater level measurement in 4 D



- › <https://www.grondwatertools.nl/grondwatertools-viewer>
provide additional information for the head measurements available at <https://www.dinoloket.nl/ondergrondgegevens>
- › Contours:
 - › showing flow directions at various depths
- › Time series models:
 - › Impulse response functions for precipitation
 - › Separation of meteorological and other influences
- › Opportunities for further analysis:

- › Long term trends
- › System changes
- › Linking patterns in precipitation response to hydrogeology



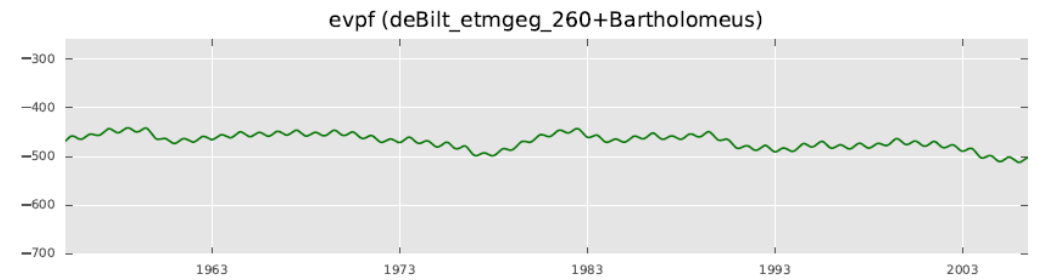
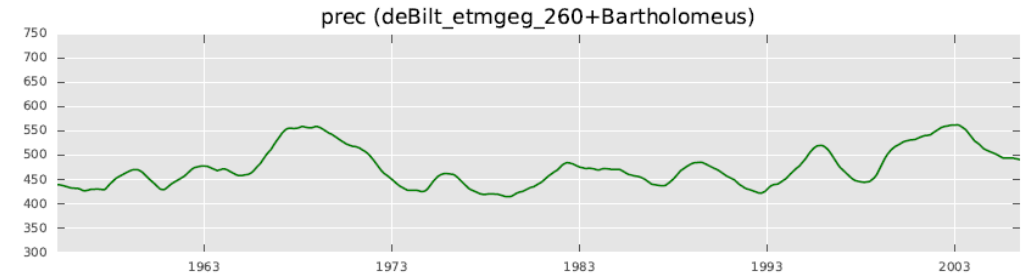
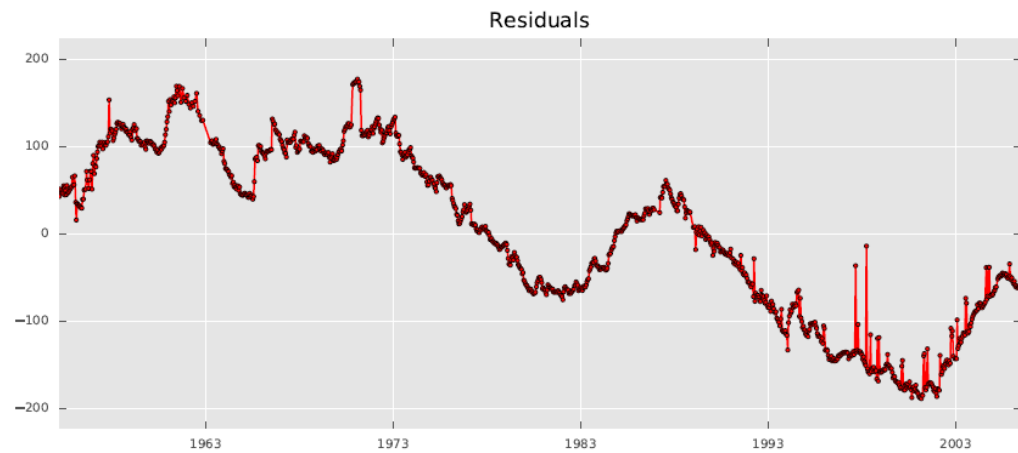
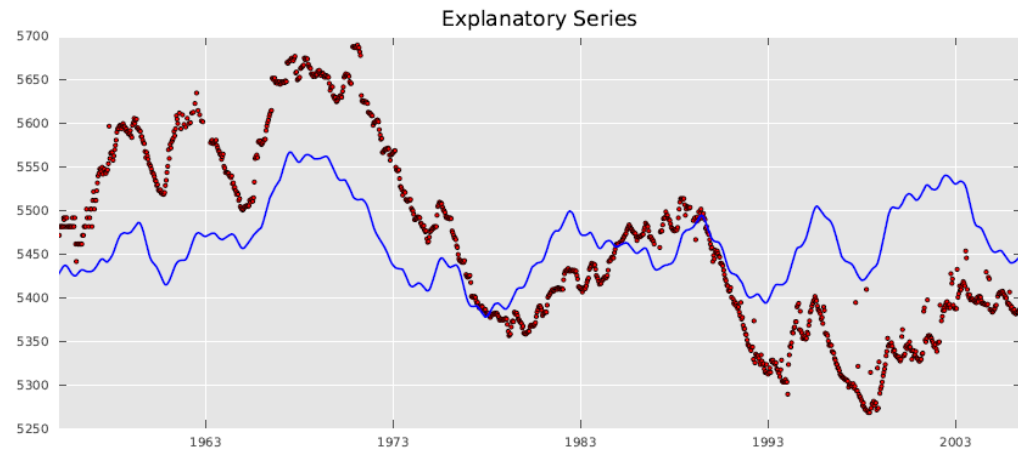


Thank you for your attention

**Grondwatertools: 4D information
on heads and groundwater
system characteristics for the
Netherlands**

Guided by geology

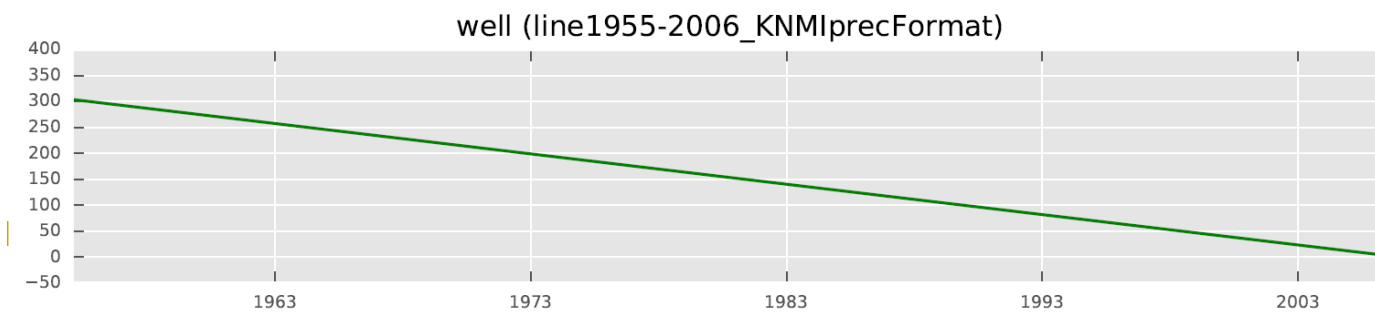
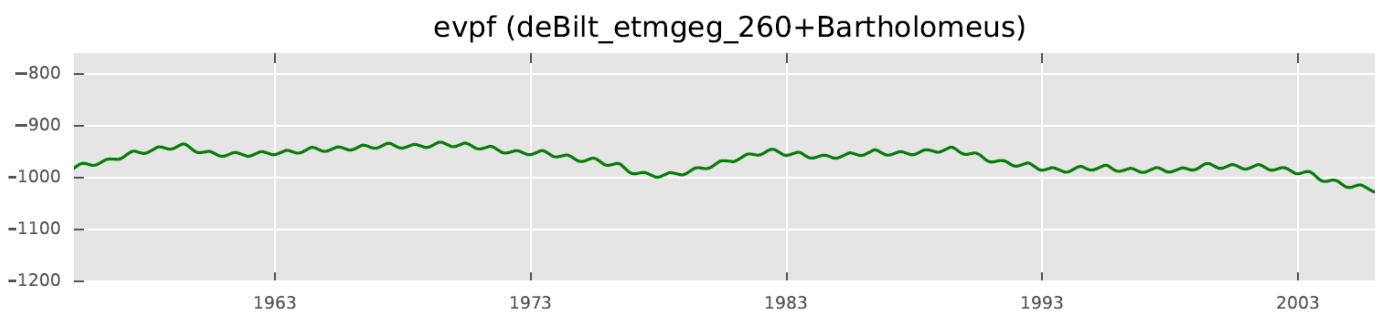
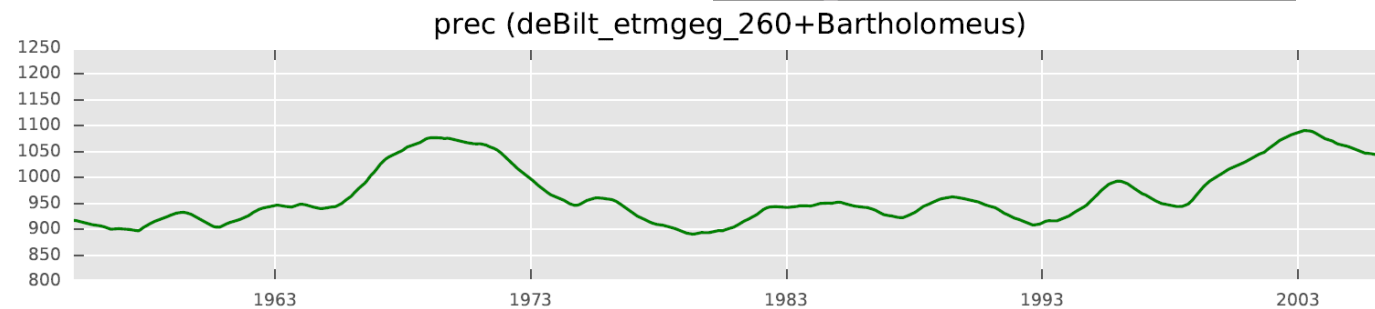
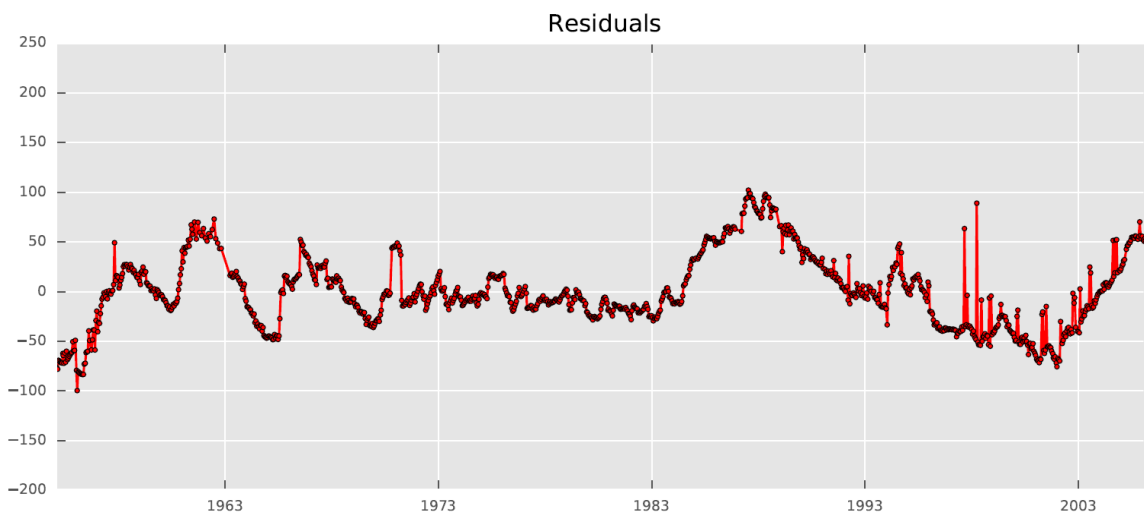
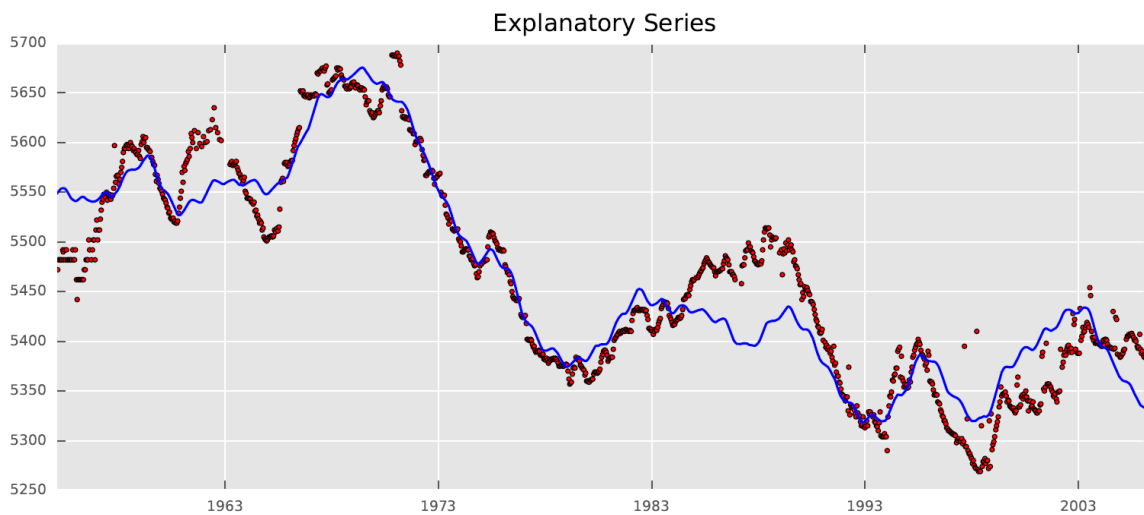
› Trend in residuals



Trend as explanatory variable



Output for series B58G0045002_1_v1



› Institutes and Groundwater in NL



› TNO Geological Survey of the Netherlands

Groundwater levels and flow

Fresh and saline groundwater

Groundwater quality

Data



Geohydrology in the Netherlands

