Hoe betrouwbaarheidsintervallen afhangen van de lengte van de reeks en de frequentie

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Verschillende soorten onzekerheid

- **Onzekerheid van de uitvoer reeks**
  (meetfouten in de stijghoogte)

- **Onzekerheid van de invoer reeksen**
  (fouten in de regen, verdamping, etc.)

- **Onzekerheid van het model**
  (model structural error - keuze van het model)

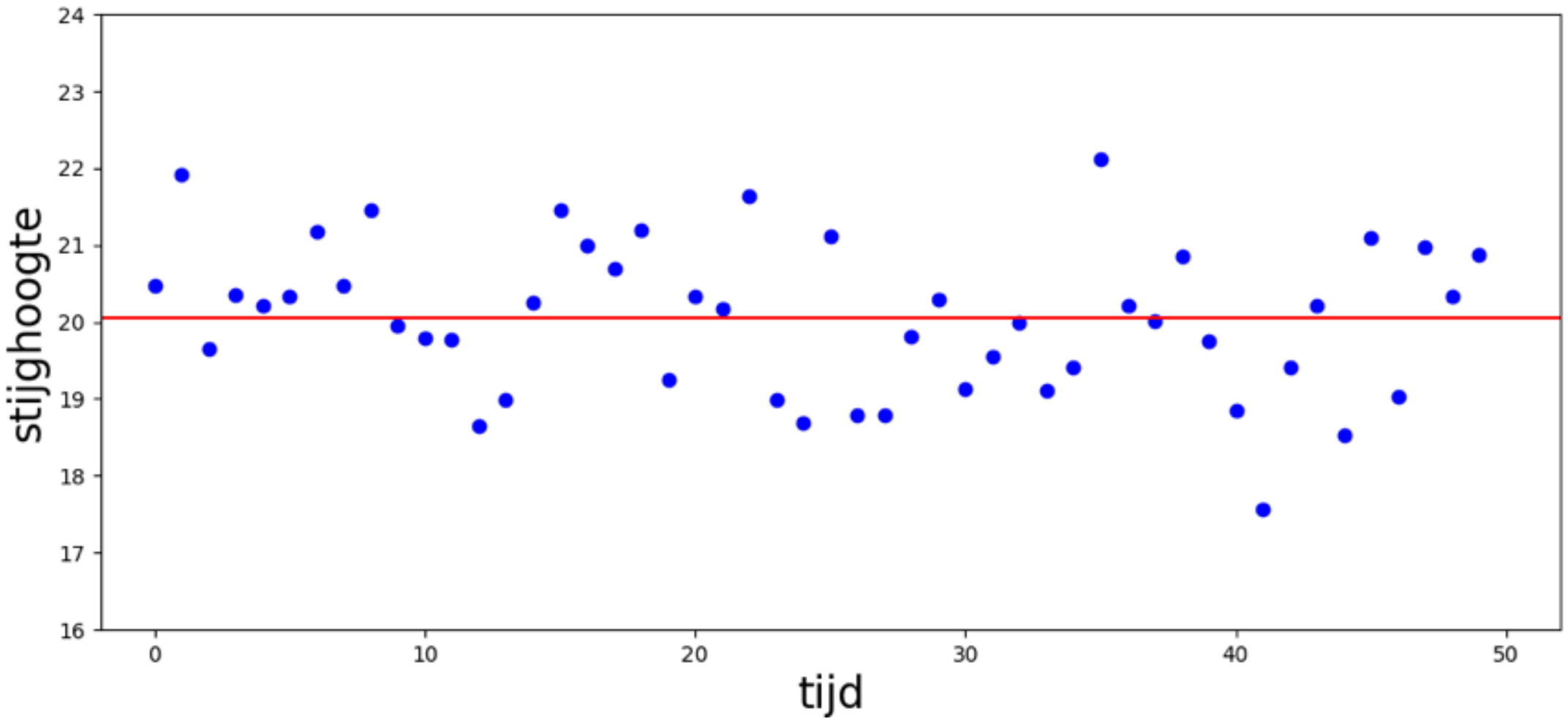
- **Onzekerheid in de modelparameters**
  (parameters zijn slechts schattingen gebaseerd op een idee wat optimaal is)

Twee soorten intervallen: Betrouwbaarheidsinterval en Voorspellingsinterval

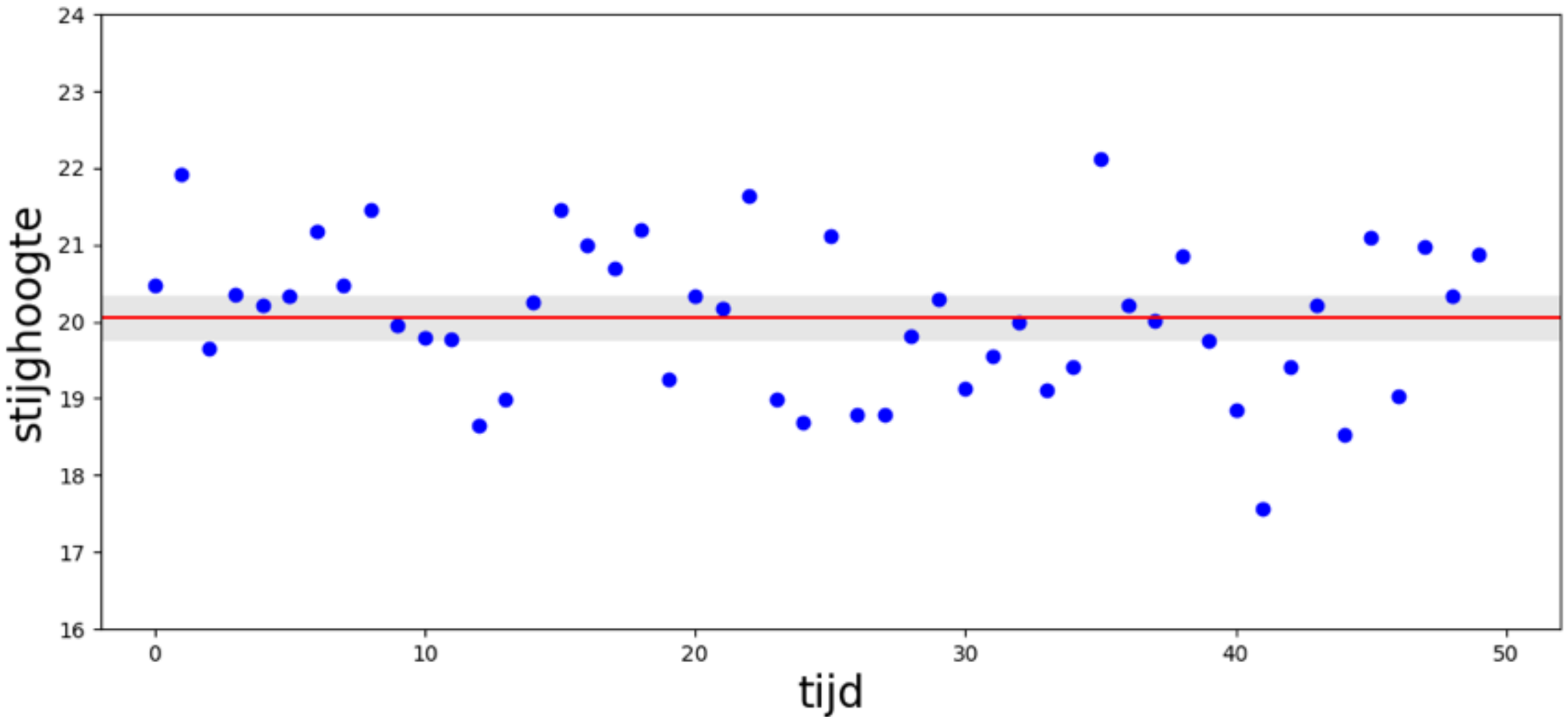
- **Betrouwbaarheidsinterval**
  Modelonzekerheid door de onzekerheid van de parameters

- **Voorspellingsinterval**
  Nieuwe meting ligt met XX% waarschijnlijkheid
  binnen het XX% interval

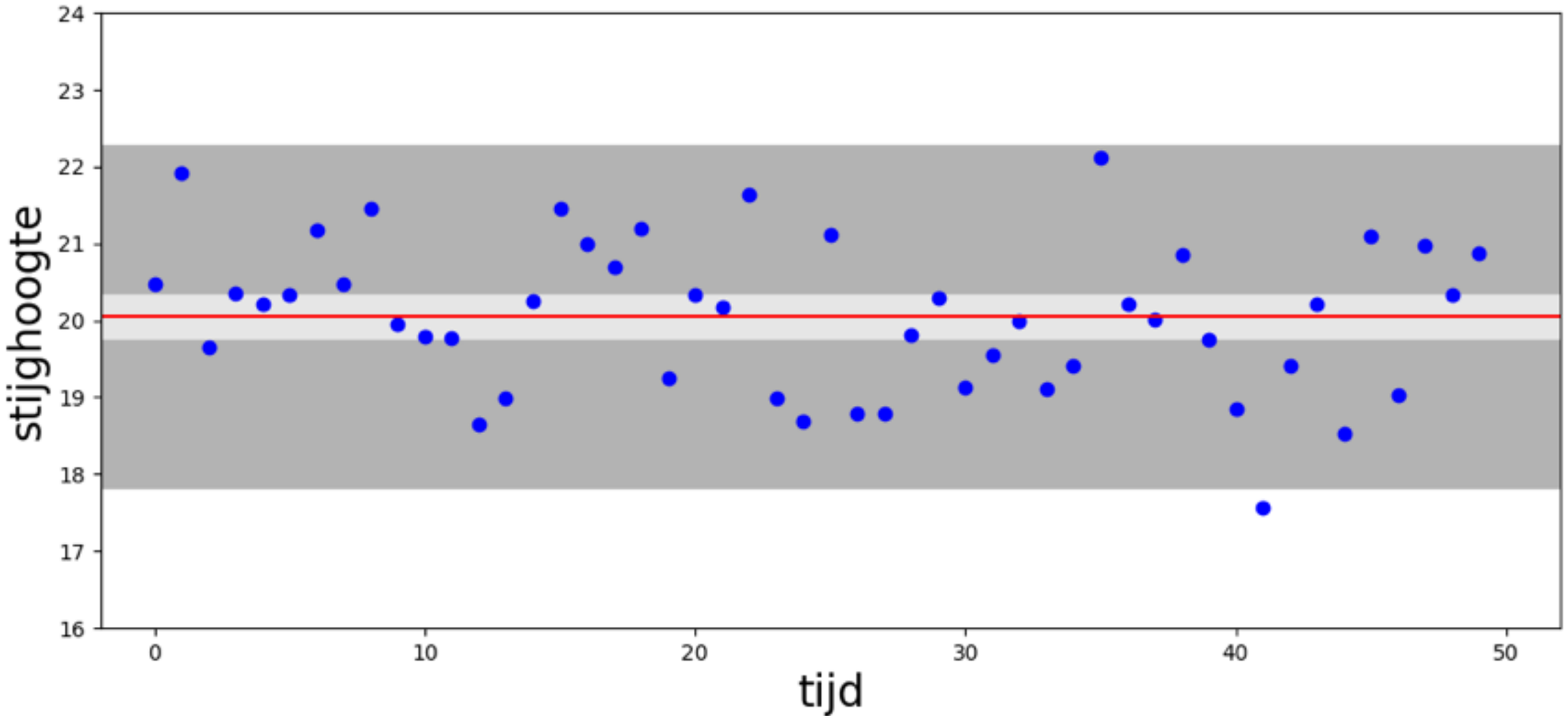
Eenvoudig voorbeeld:
Model van de grondwaterstand is het gemiddelde



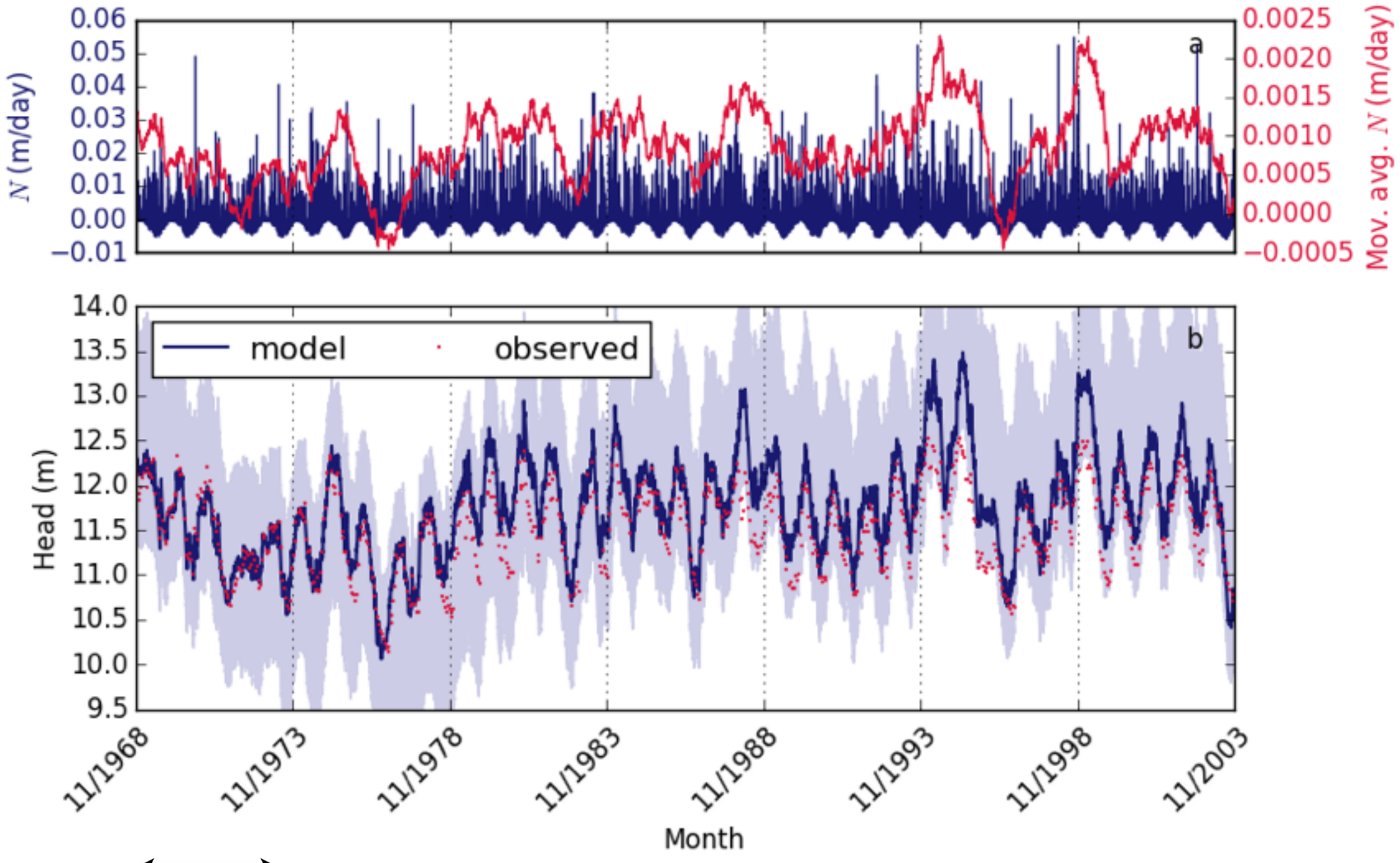
Eenvoudig voorbeeld: Betrouwbaarheidsinterval



Eenvoudig voorbeeld: Voorspellingsinterval

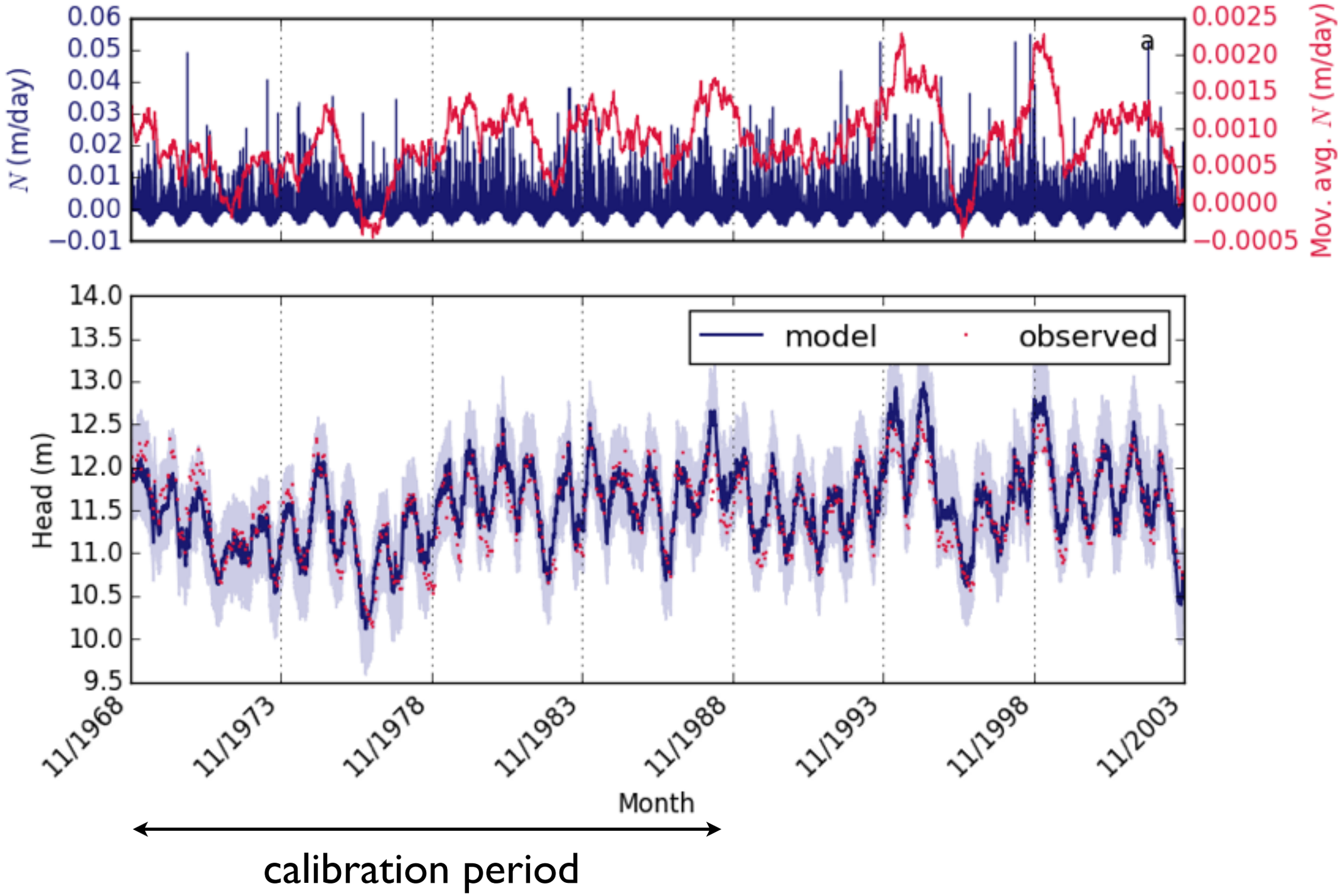


Model gefit op eerste 5 jaar van de data

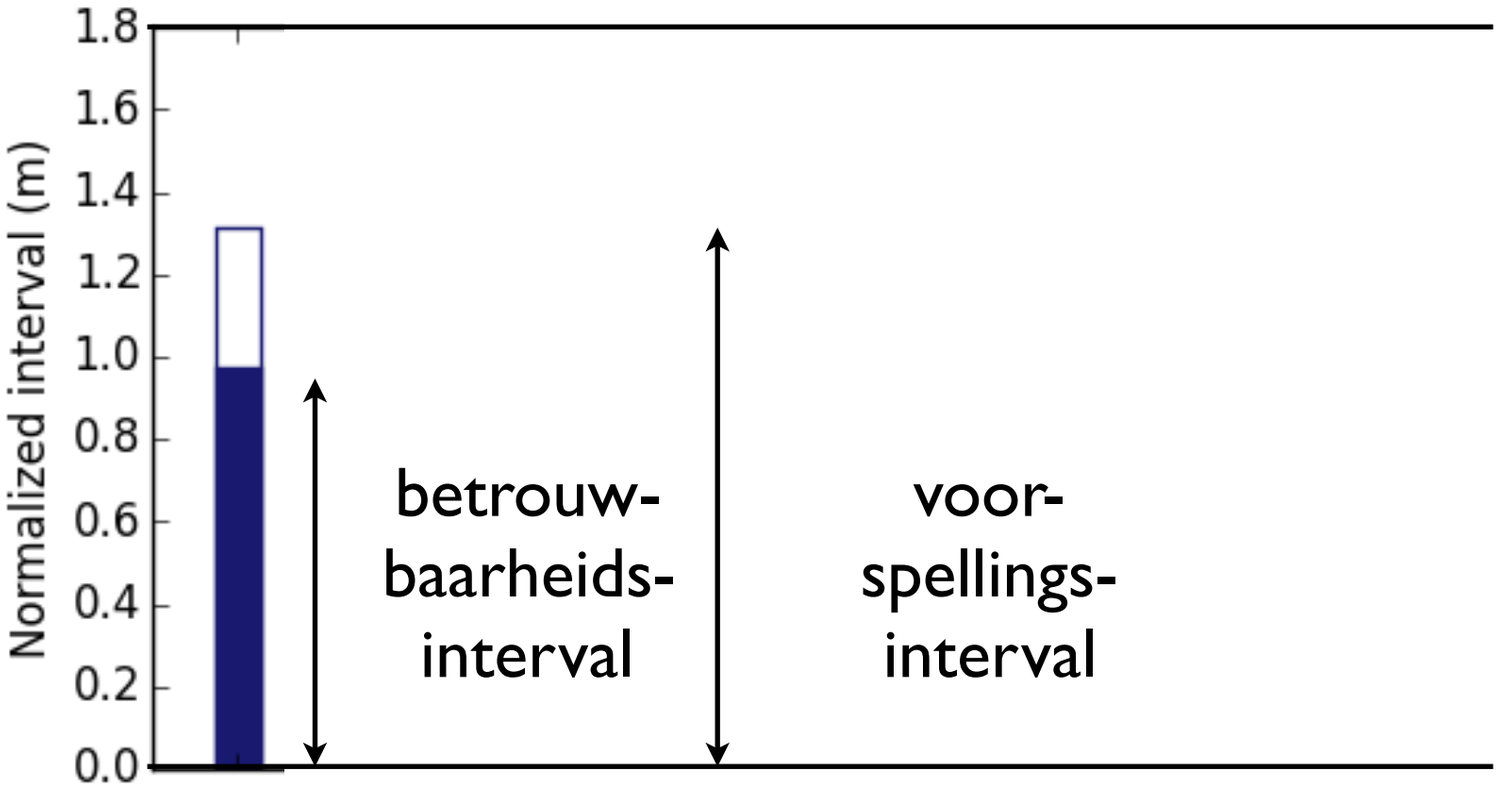


calibration period

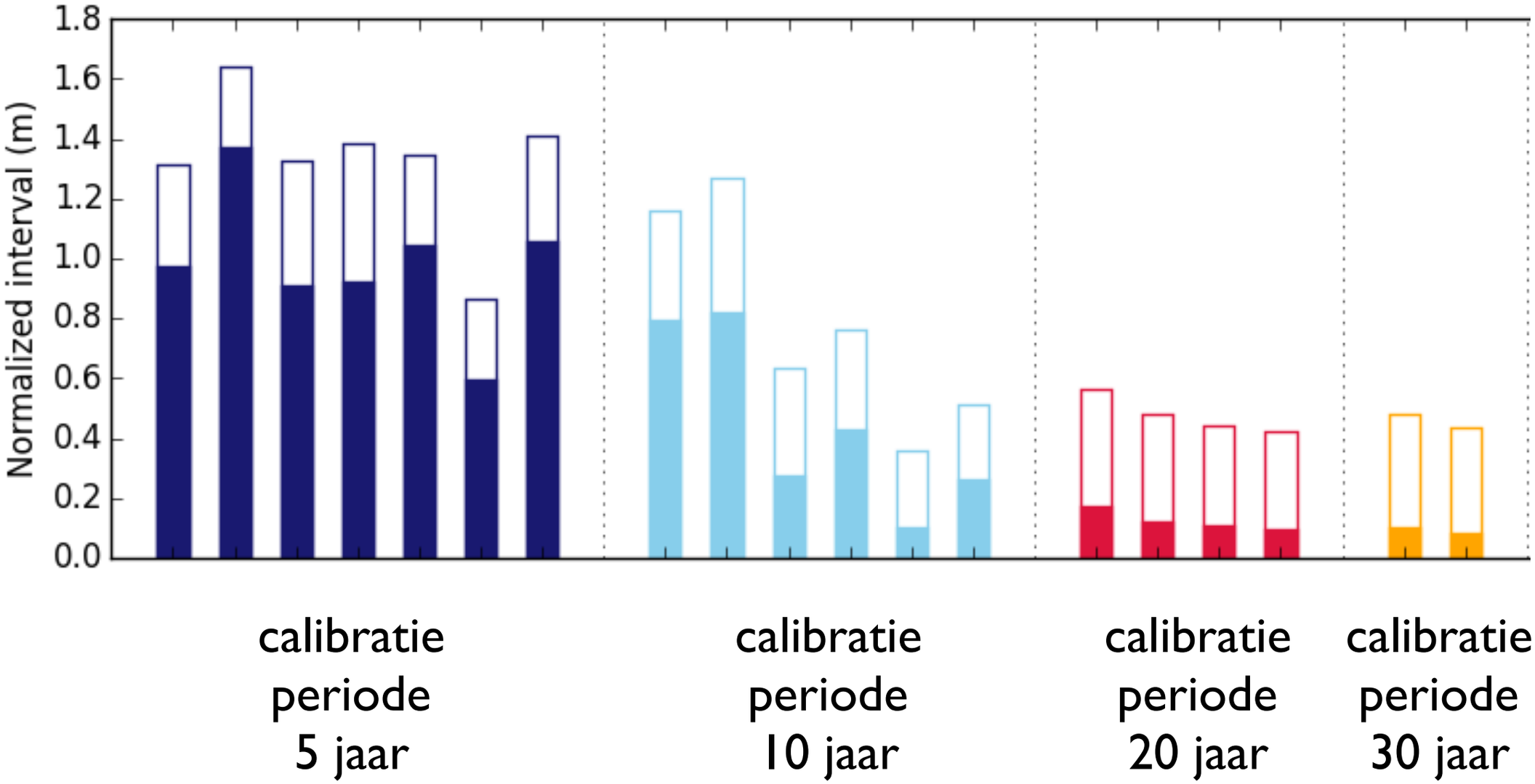
Model gefit op eerste 20 jaar van de data



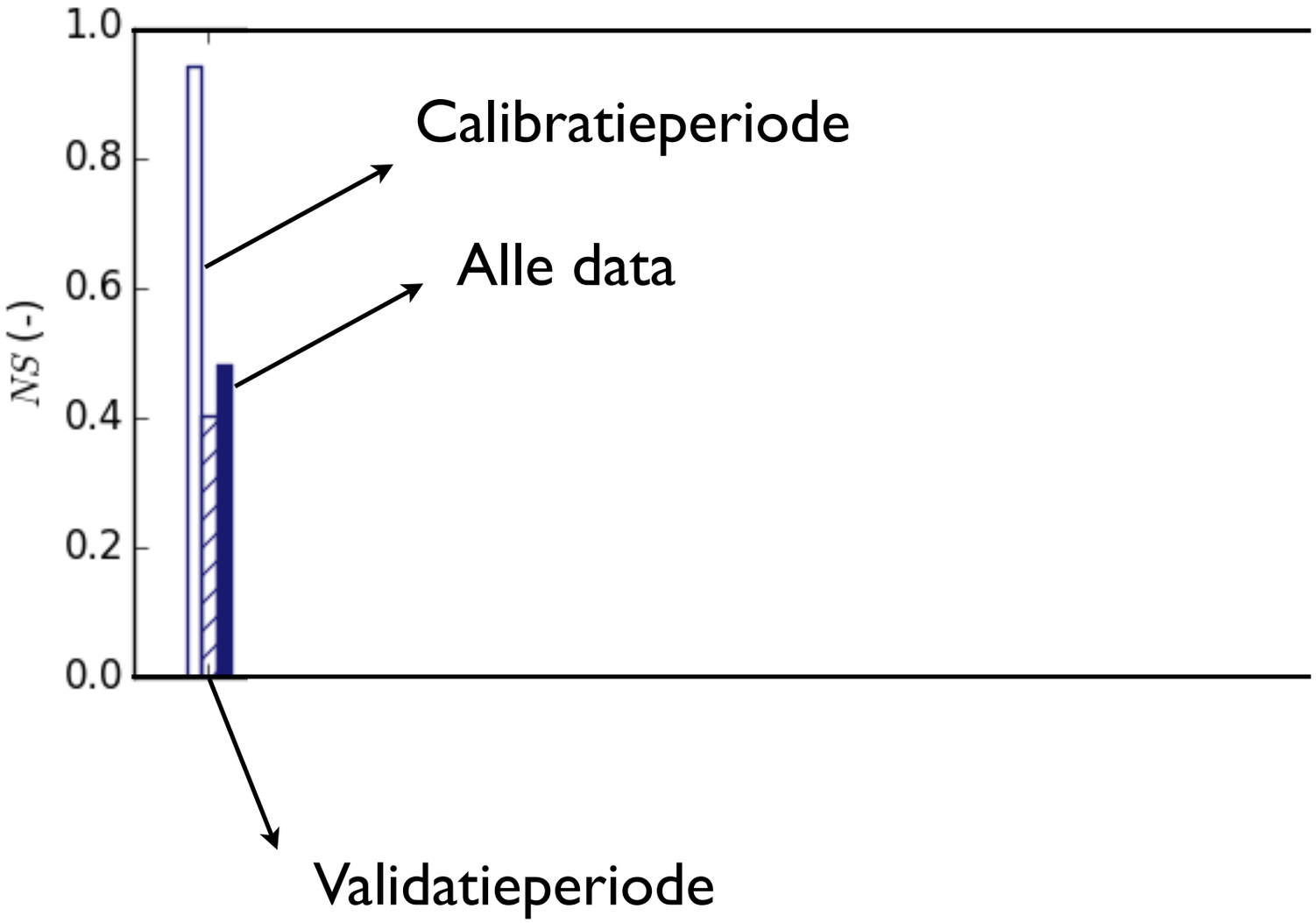
Gemiddelde breedte van interval



Gemiddelde breedte voorspellingsinterval



Nash Sutcliffe Coefficient (~verklaarde variantie)



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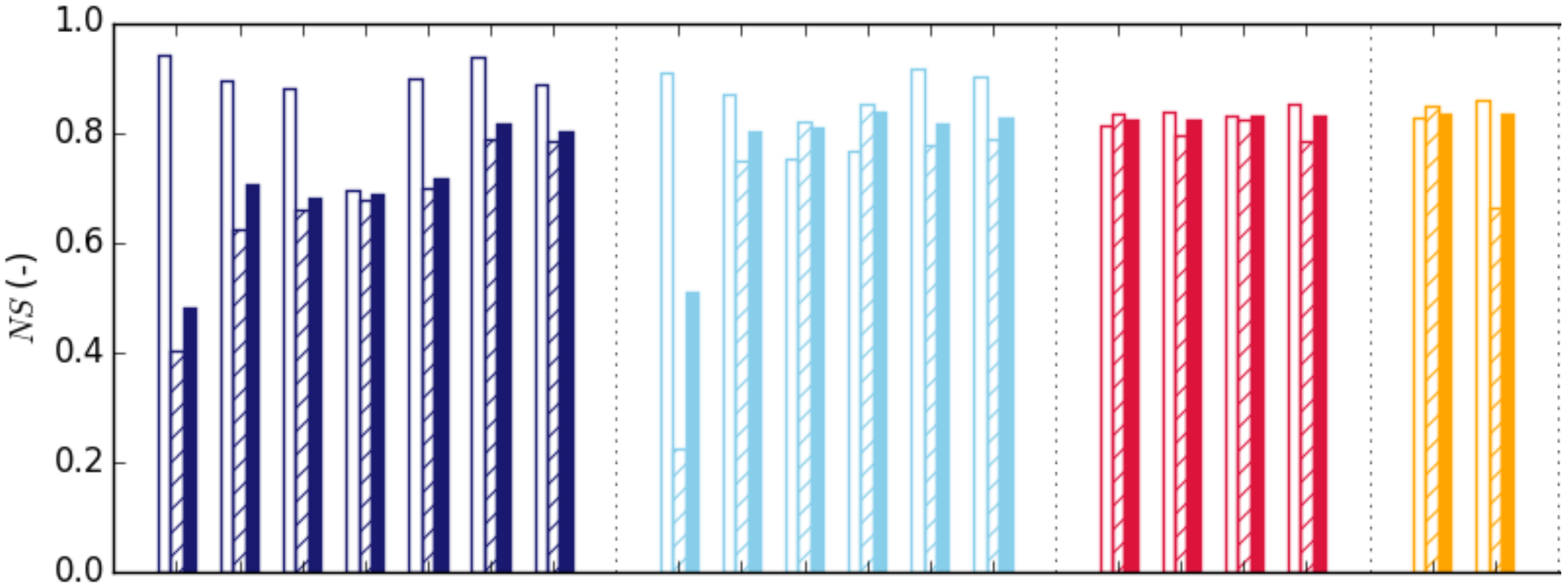


calibratie periode 5 jaar

calibratie periode 10 jaar

calibratie periode 20 jaar

calibratie periode 30 jaar

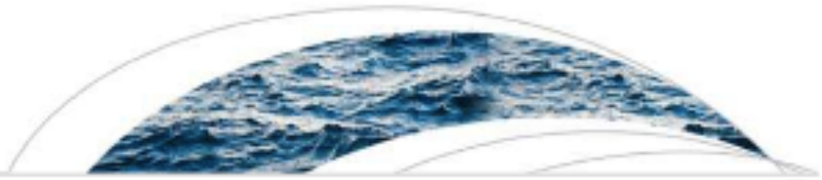
Effect van de meetfrequentie op het betrouwbaarheidsinterval

	Gemiddeld genormaliseerd betrouwbaarheids-interval	Gemiddeld genormaliseerd voorspellings-interval
10 jaar, 2 keer per maand	0.28	0.63
20 jaar, 1 keer per maand	0.15	0.54
20 jaar, 1 keer per kwartaal	0.21	0.59

Genormaliseerd door te delen door totale stijghoogte fluctuatie
Samenvatting van 18 buizen

AGU PUBLICATIONS

Water Resources Research



RESEARCH ARTICLE

10.1002/2016WR019704

The influence of the length of the calibration period and observation frequency on predictive uncertainty in time series modeling of groundwater dynamics

Joanne E. van der Spek[1] **and Mark Bakker**[1]

[1]Water Resources Section, Faculty of Civil Engineering and Geosciences, Delft University of Technology, Delft, the Netherlands

Key Points:
- Length calibration period more important than number of observations for calibrating time series models of groundwater dynamics
- Credible intervals can be reduced to 10% and prediction intervals to 50% of head range with 10–20 years of observations
- Required length calibration period stronger related to decay time of noise than to response time of system

Supporting Information:
- Supporting Information S1

Correspondence to:
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Citation:
van der Spek, J. E., and M. Bakker (2017), The influence of the length of the calibration period and observation frequency on predictive uncertainty in

Abstract The influence of the length of the calibration period and observation frequency on the predictive uncertainty in time series modeling of groundwater dynamics is investigated. Studied series are from deltaic regions with predominantly shallow groundwater tables in a temperate maritime climate where heads vary due to precipitation and evaporation. Response times vary over a wide range from ~60 to ~1200 days. A Transfer Function-Noise model is calibrated with the Markov Chain Monte Carlo method to both synthetic series and measured series of heads. The model fit and uncertainty are evaluated for various calibration periods and observation frequencies. It is often assumed that the required length of the calibration period is related to the response time of the system. In this study, no strong relationship was observed. Results indicate, however, that the required length of the calibration period is related to the decay time of the noise. Furthermore, the length of the calibration period was much more important than the total number of observations. For the measured series, the credible intervals could commonly be reduced to ~10% of the measured head range and the prediction intervals to ~50% of the measured head range with calibration periods of 20 years with approximately two observations per month.

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Conclusie van 18 buizen in Nederland

(die goed gemodelleerd kunnen worden met regen en verdamping als verklarende reeksen)

- **Betrouwbaarheidsinterval kan gereduceerd worden to 10% van de stijghoogtevariatie met 10-20 jaar calibratiedata**
- **Voorspellingsinterval kan gereduceerd worden tot 50% van de stijghoogtevariatie met 10-20 jaar calibratiedata**
- **Lengte calibratieperiode belangrijker dan frequentie**

Referentie

J. van der Spek and M. Bakker (2017), The influence of the length of the calibration period and observation frequency on predictive uncertainty in time series modeling of groundwater dynamics. *Water Resources Research*.