

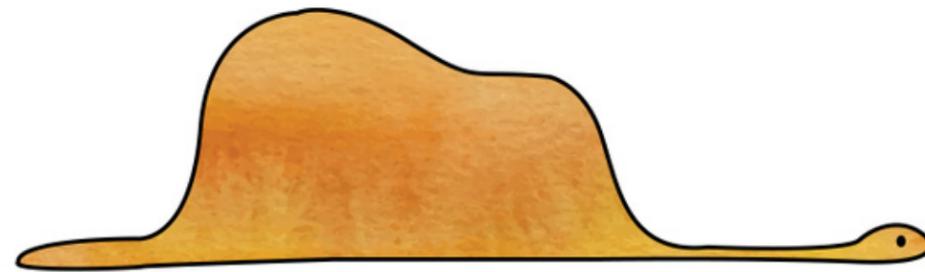
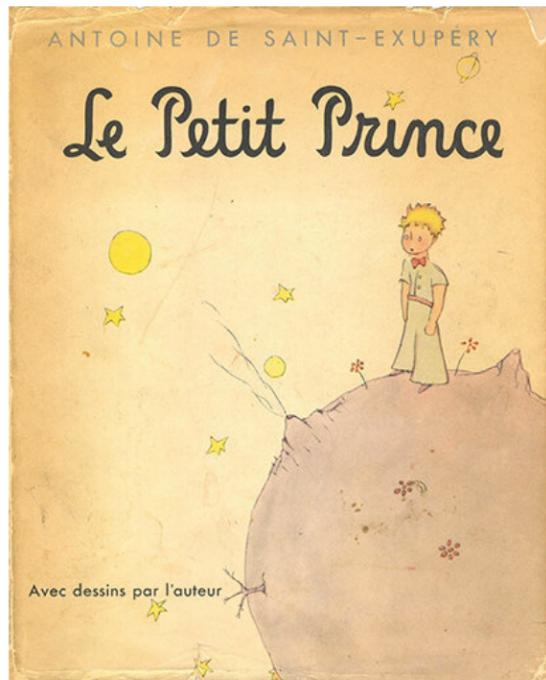


# **Technical limitations and recommendations for streamflow predictions in data-scarce regions using GloFAS-ERA5 reanalysis data**

**Anadyr River case study**

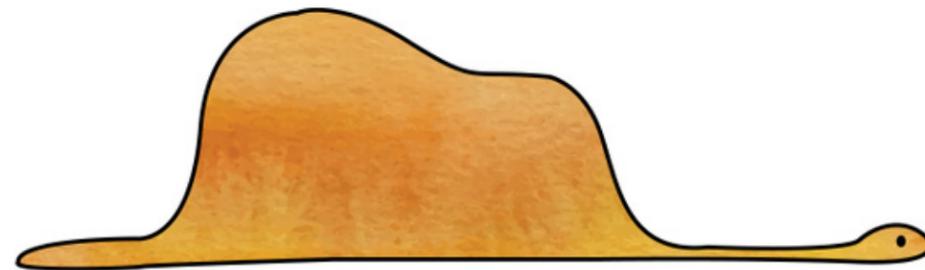
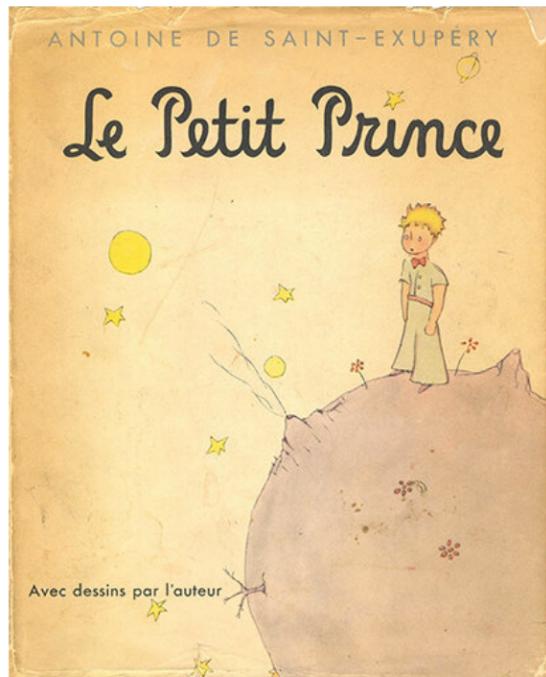
**Anatoly Tsyplenkov & Danila Shkolny**  
**Lomonosov Moscow State University**

# What does a boa constrictor that has eaten an elephant look like?

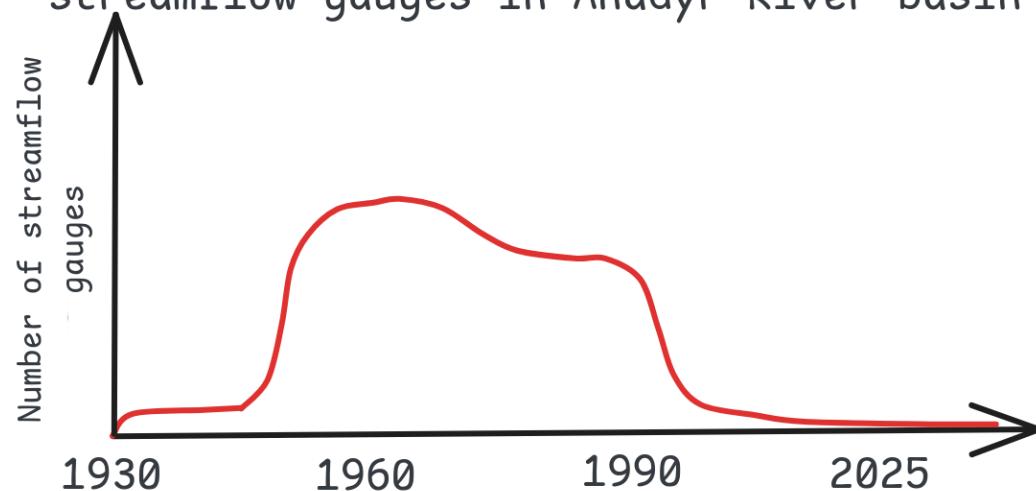


"My drawing was not a picture of a hat.  
It was a ..."

# What does a boa constrictor that has eaten an elephant look like?



"My drawing was not a picture of a hat.  
It was a graph showing temporal changes in  
streamflow gauges in Anadyr River basin"



# Anadyr River is the largest ungauged Russian River

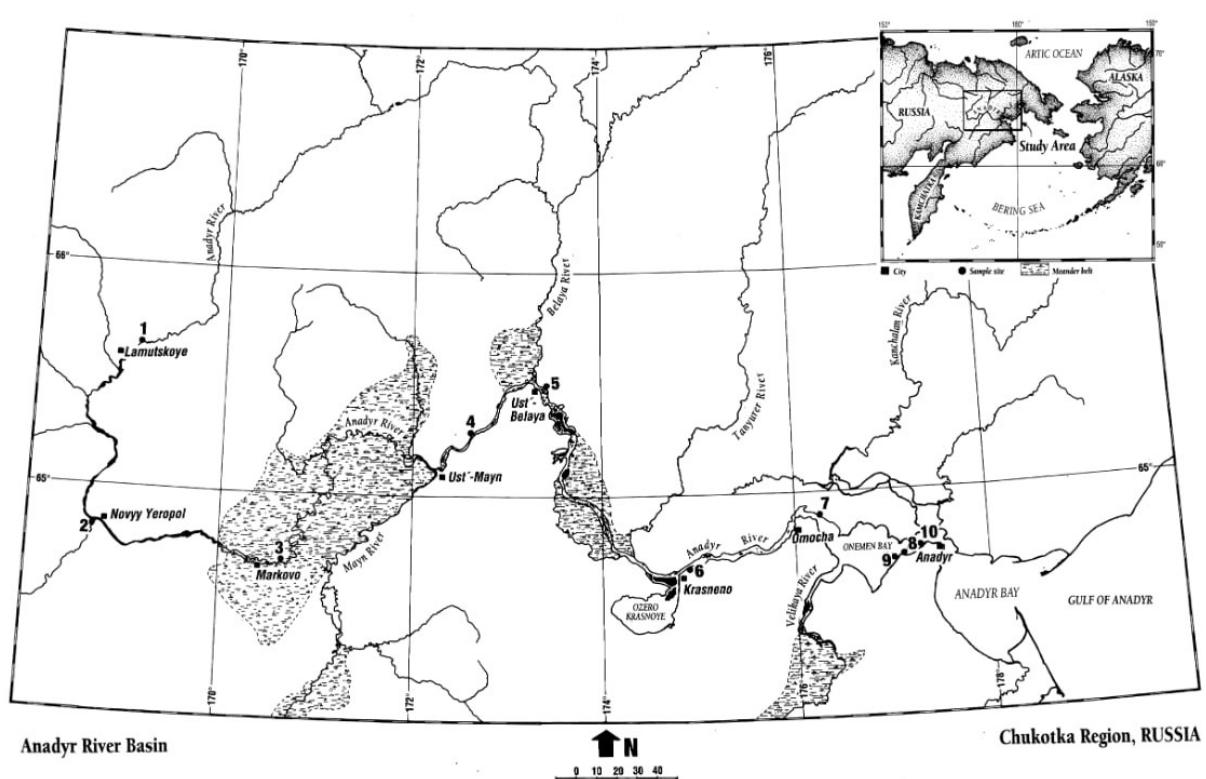


Fig. 1 Map of the study area showing the course of the river in relation to sample locations (scale bar in km). Stations indicated by numbered circles, cities indicated by squares, and meander belts in the river course indicated by marsh pattern. Stations 1 and 2 are in the well-confined, mountainous portions of the upper river, stations 3-5 are within the central meander belt, stations 6 and 7 are in the well-confined lower reaches of the river, and stations 8-10 are located in the shallow, nearshore regions of the inner estuary (Onemenn Bay).

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# Anadyr River is the largest ungauged<sup>1</sup> Russian River

*i* Nota bene

**No streamflow measurements** on the state gauging station network in the last 30 years!



<sup>1</sup>no streamflow gages since 1996

# Anadyr River is the largest ungauged<sup>1</sup> Russian River

What can we do?

How can we predict  
streamflow?

How accurate are our  
predictions?

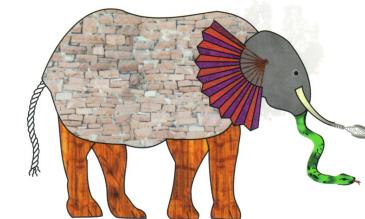
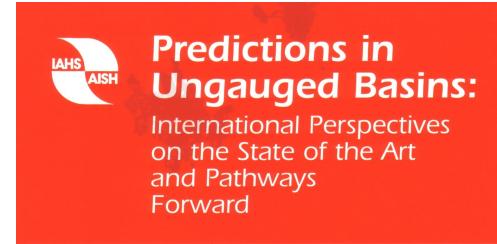
<sup>1</sup>no streamflow gages since 1996

# Anadyr River is the largest ungauged<sup>1</sup> Russian River

What can we do?

How can we predict streamflow?

How accurate are our predictions?



We are probably late with this presentation for  
10 years because IAHS PUB Decade was in  
2003-2012...

<sup>1</sup>no streamflow gages since 1996

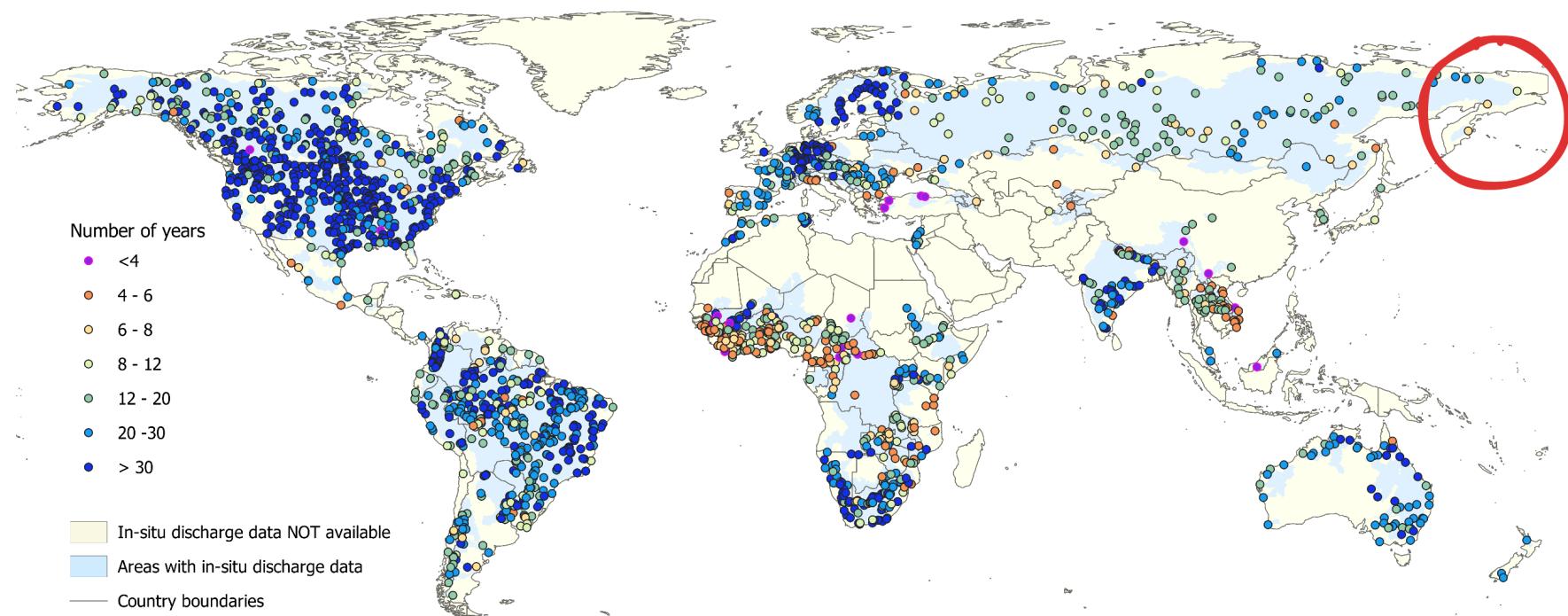
# GloFAS-ERA5 quick overview

- Current version GloFAS-ERA5 v4.0 (June 2025 release)
- Global hydrological models HTESSEL<sup>1</sup> and LISFL00D v4.1.3
- Mean daily discharge in ( $\text{m}^3/\text{s}$ ) at 0.05° spatial resolution ( $\approx 5 \text{ km}$ ) since 1980

<sup>1</sup>Hydrology Tiled ECMWF Scheme for Surface Exchanges over Land

# GloFAS-ERA5 calibration

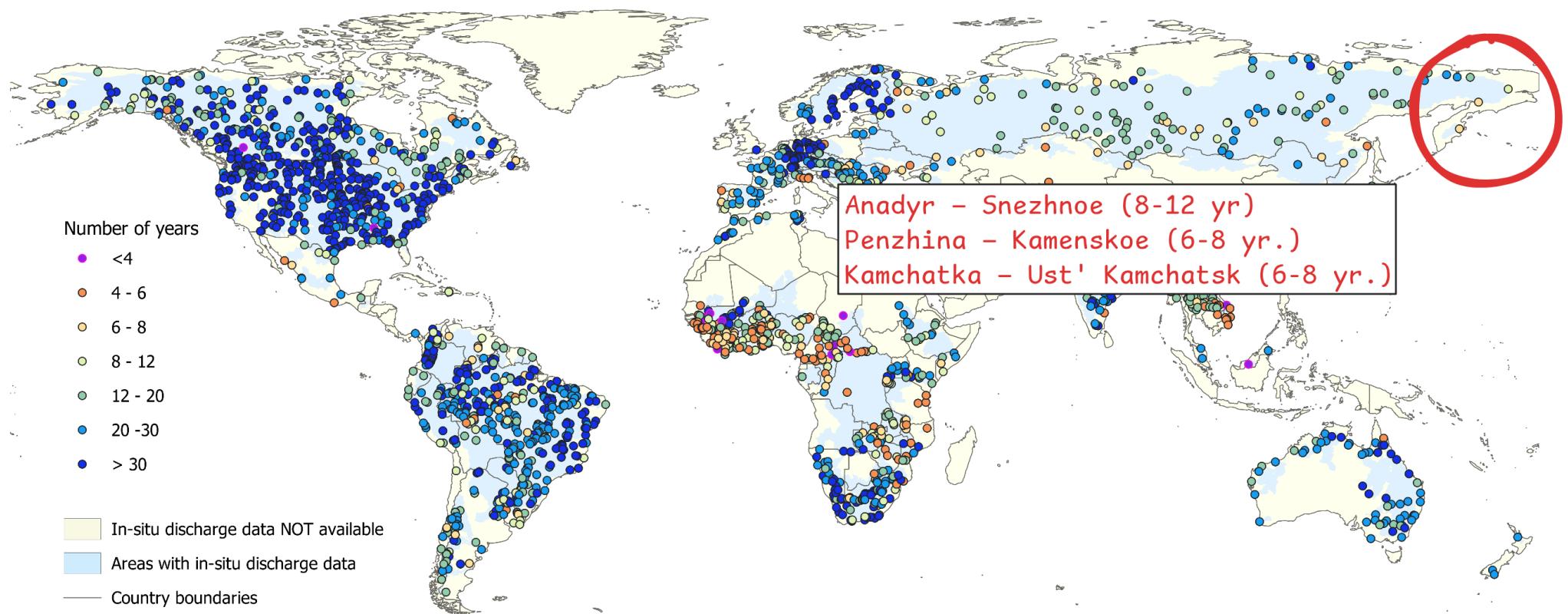
Nearly 2,500 gauging stations used for calibration in v4.0. Global median KGE<sup>1</sup> is 0.7



# GloFAS-ERA5 calibration

Median KGE' for Chukotka and Kamchatka rivers –

**0.9-1.0**



# GloFAS-ERA5 calibration

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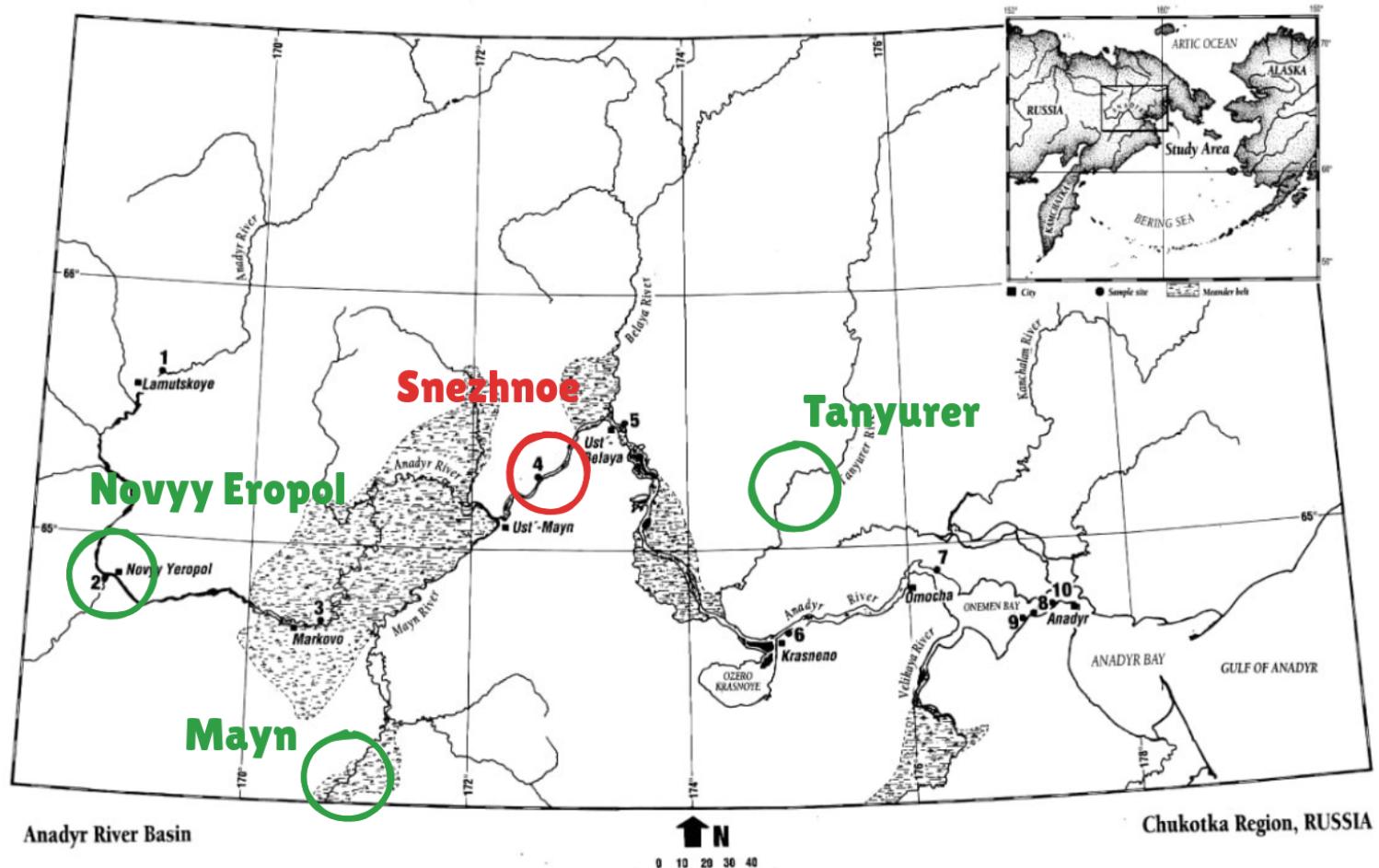


Fig. 1 Map of the study area showing the course of the river in relation to sample locations (scale bar in km). Stations indicated by numbered circles, cities indicated by squares, and meander belts in the river course indicated by marsh pattern. Stations 1 and 2 are in the well-confined, mountainous portions of the upper river, stations 3–5 are within the central meander belt, stations 6 and 7 are in the well-confined lower reaches of the river, and stations 8–10 are located in the shallow, nearshore regions of the inner estuary (Onemen Bay).

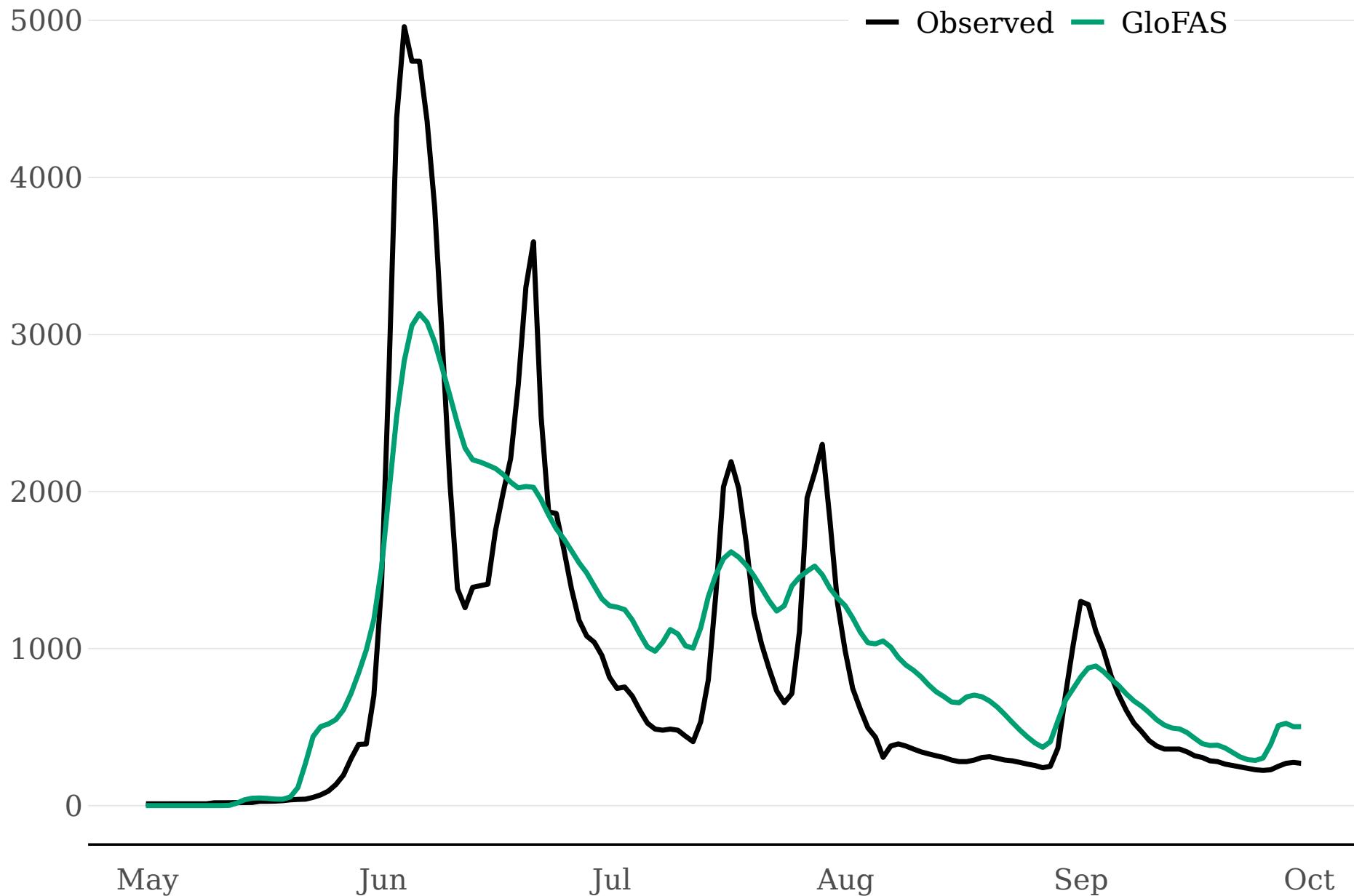
Red – EMCWF calibration    Green – this study

# Is it really that good?



# Anadyr – Novyy Eropol (1981)

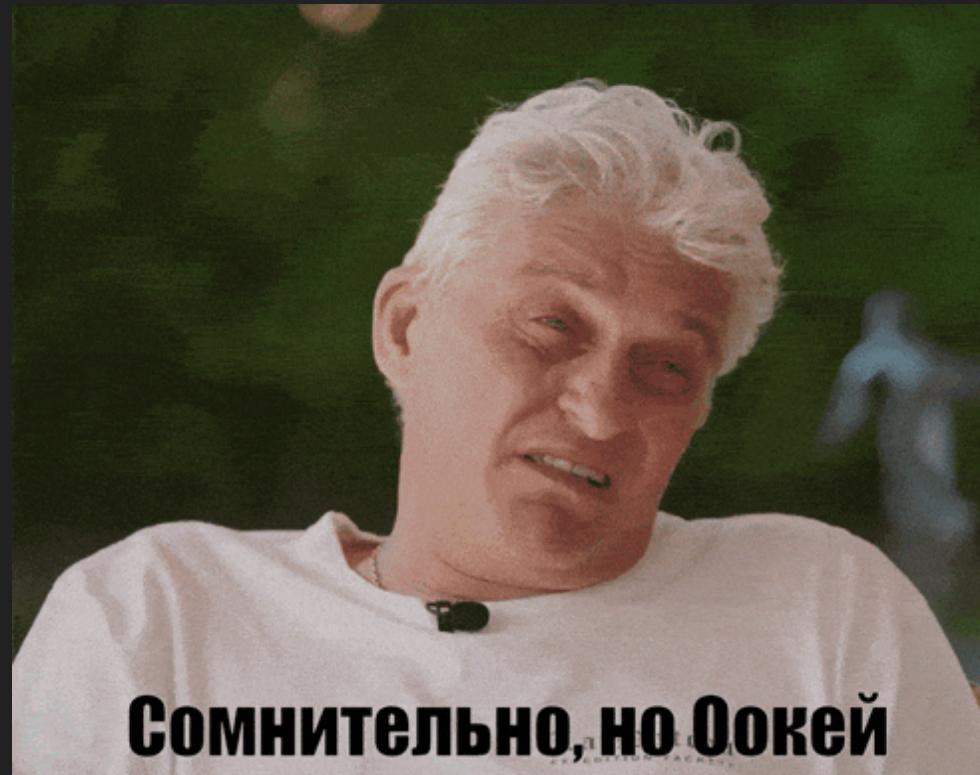
Mean daily streamflow, m<sup>3</sup>/s





# KGE' = 0.53

«*Doubtful, but okay...»*©

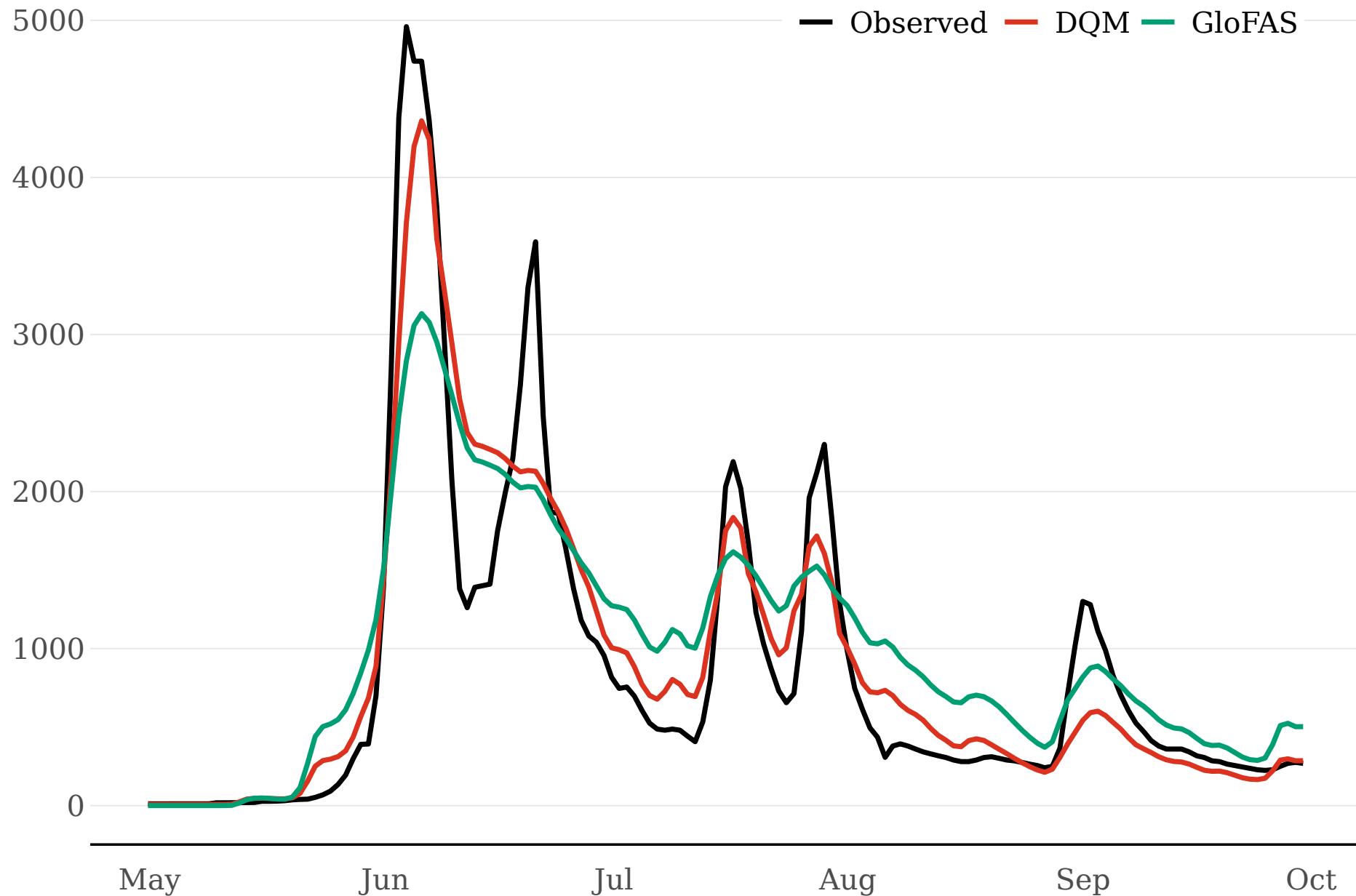


**Сомнительно, но Окей**

**Introducing ... bias-corrected hydrograph**

# Anadyr – Novyy Eropol (1981)

Mean daily streamflow, m<sup>3</sup>/s



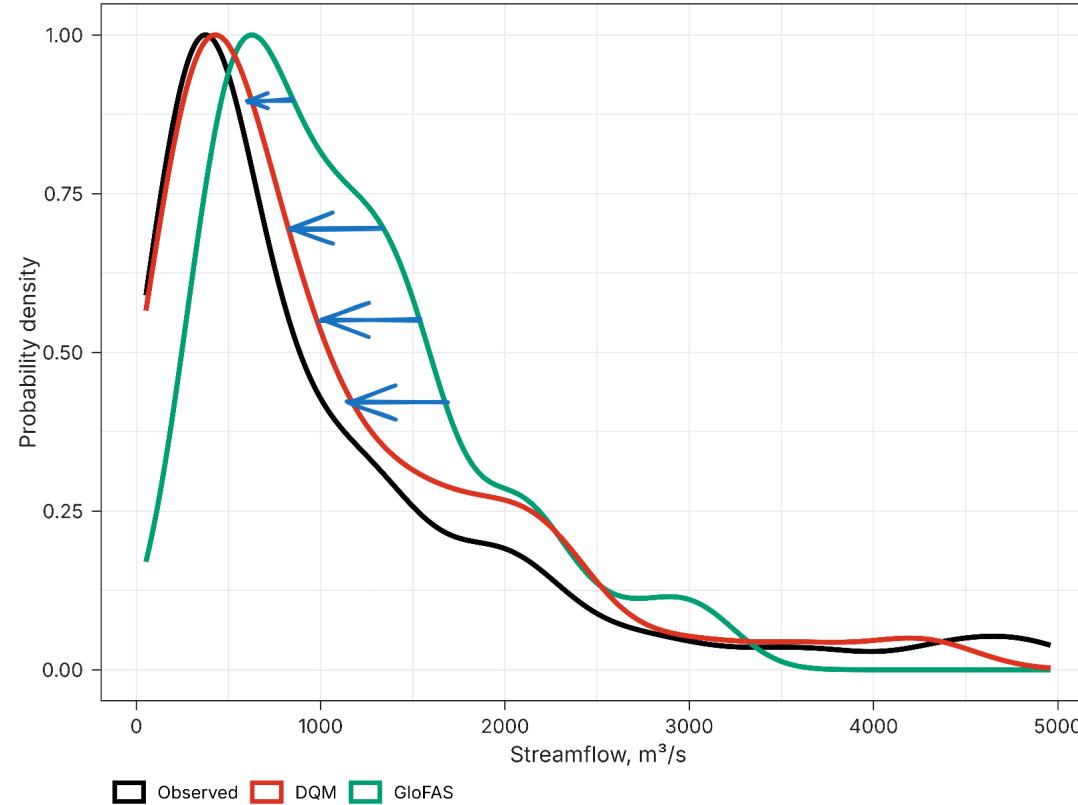


# KGE' = 0.86



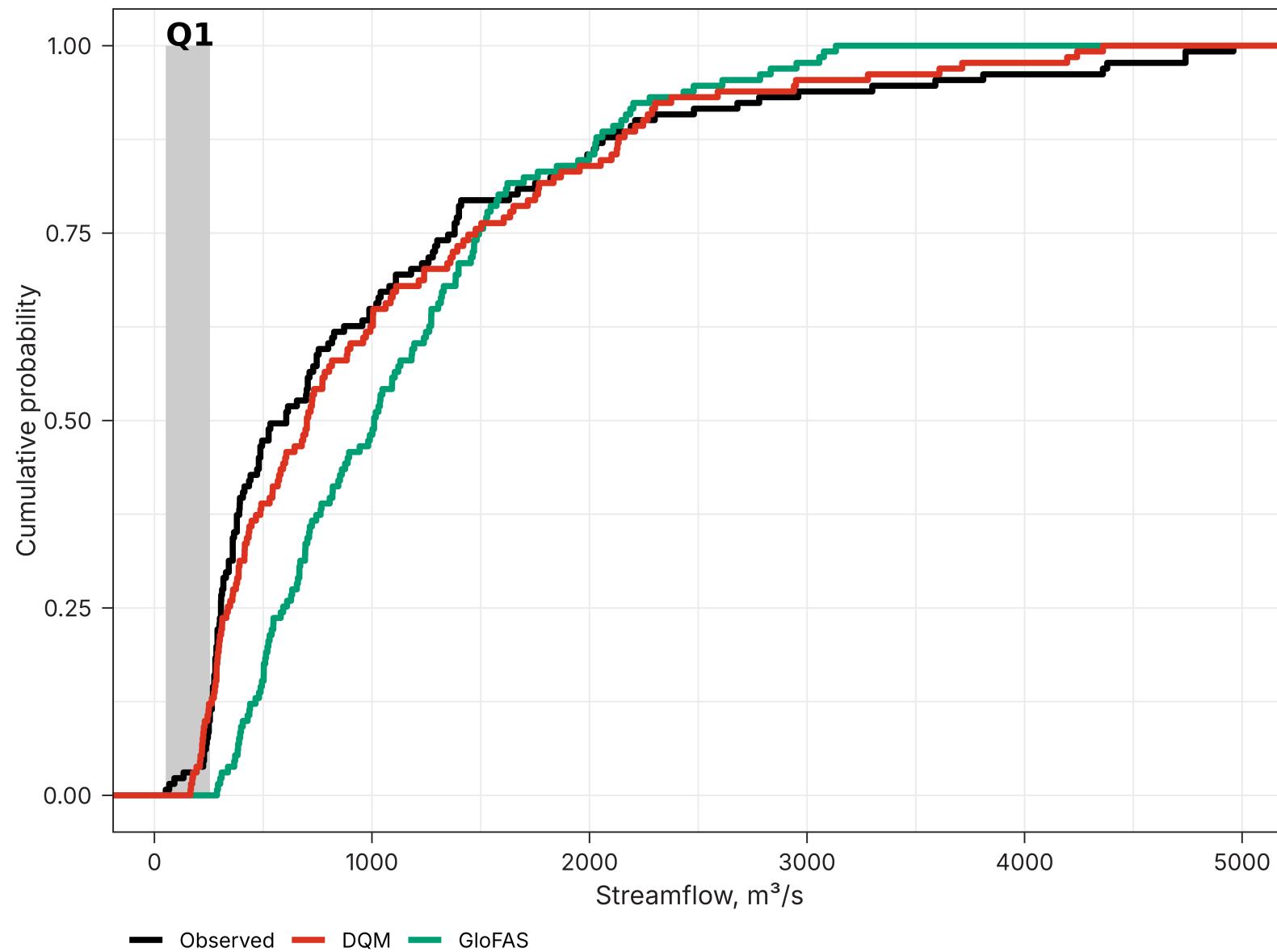
это же круто

# Detrended Quantile Mapping (DQM)

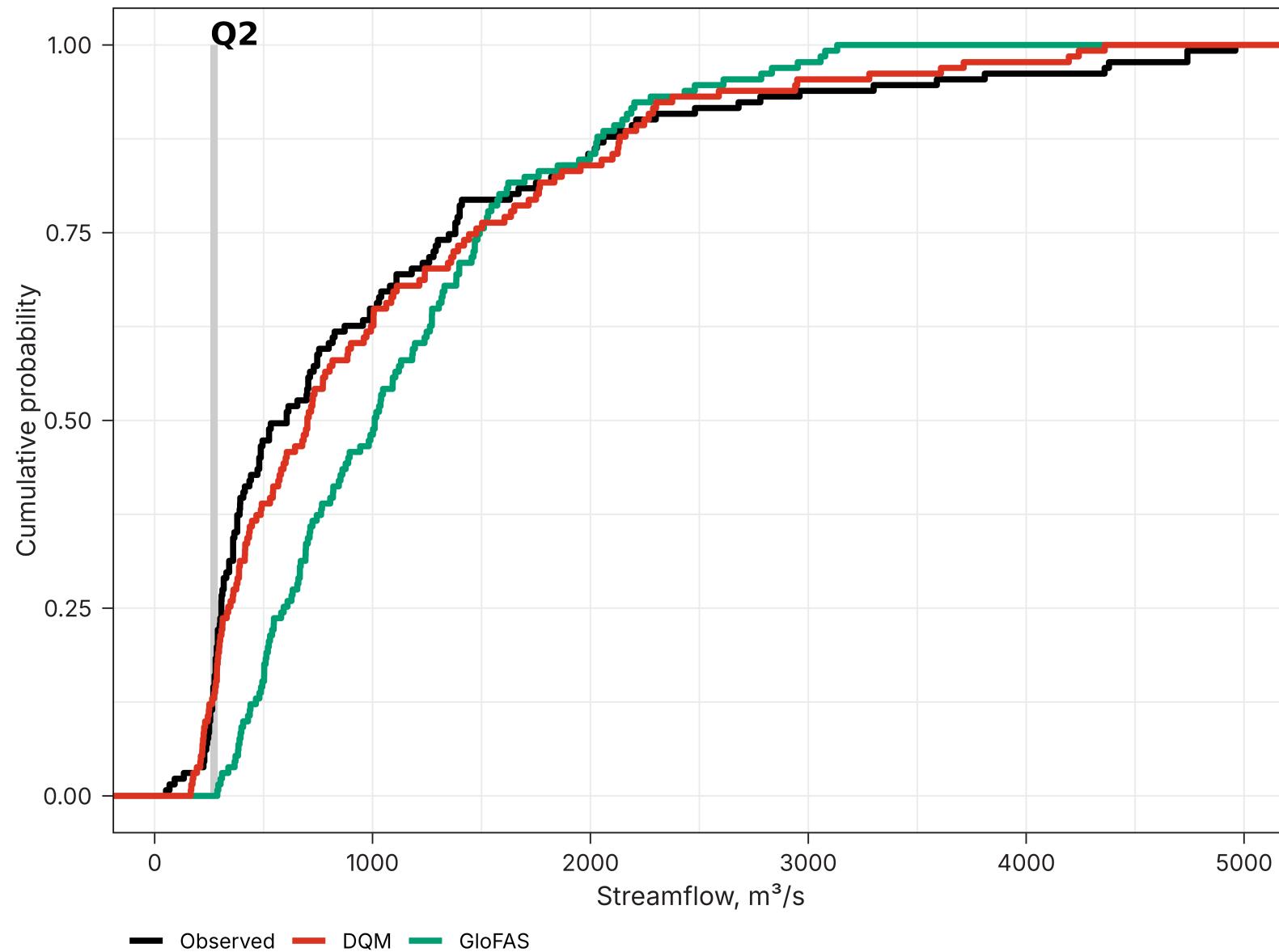


$$Q_{corr} = Q_{OBS}^{-1} \left[ F_{GloFAS} \left( x_{GloFAS}^{proj}(t) - \overline{x_{GloFAS}^{proj}} + \overline{x_{GloFAS}^{hist}} \right) \right] - \overline{x_{GloFAS}^{hist}} + \overline{x_{GloFAS}^{proj}}$$

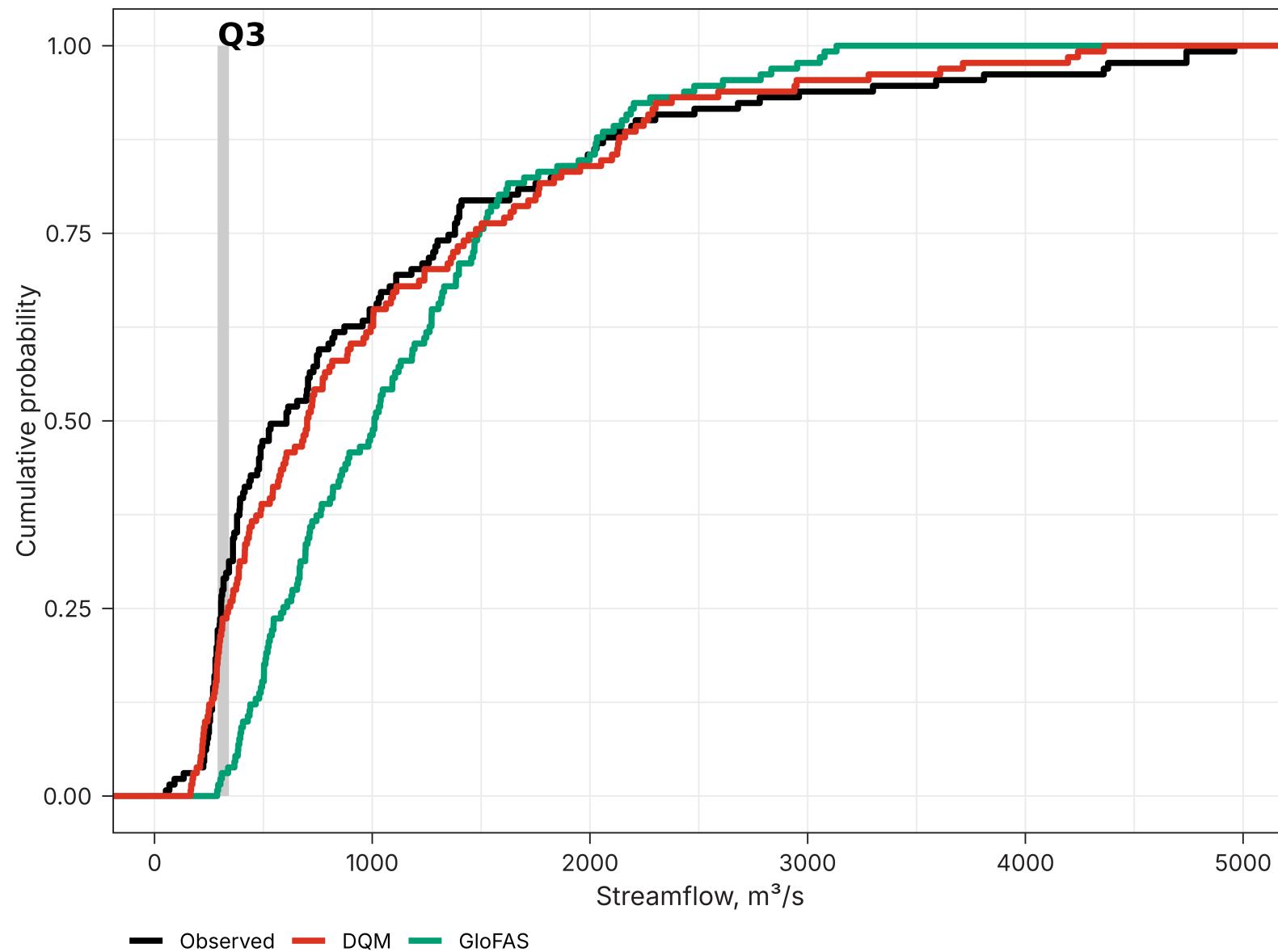
# Detrended Quantile Mapping (DQM)



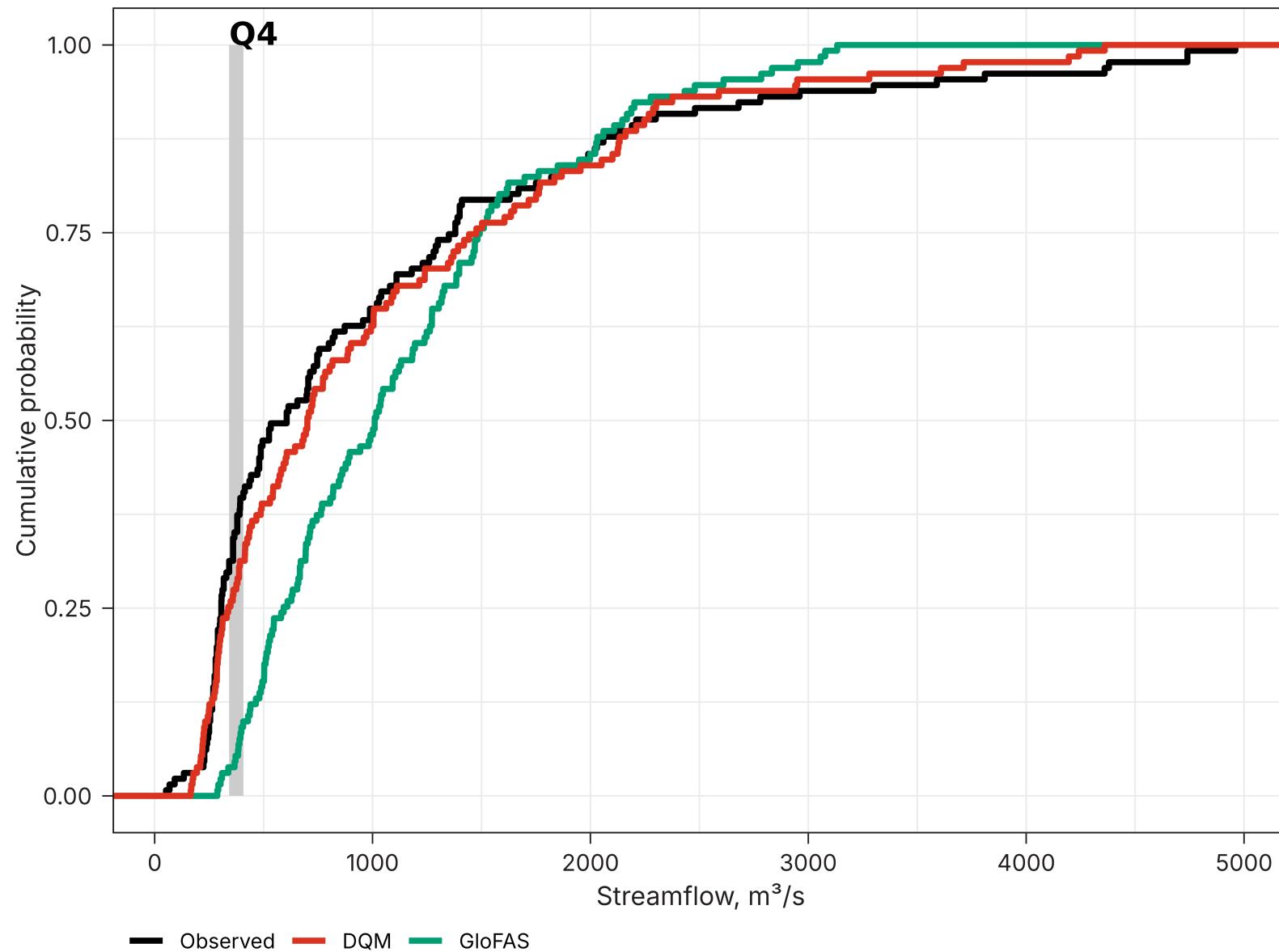
# Detrended Quantile Mapping (DQM)



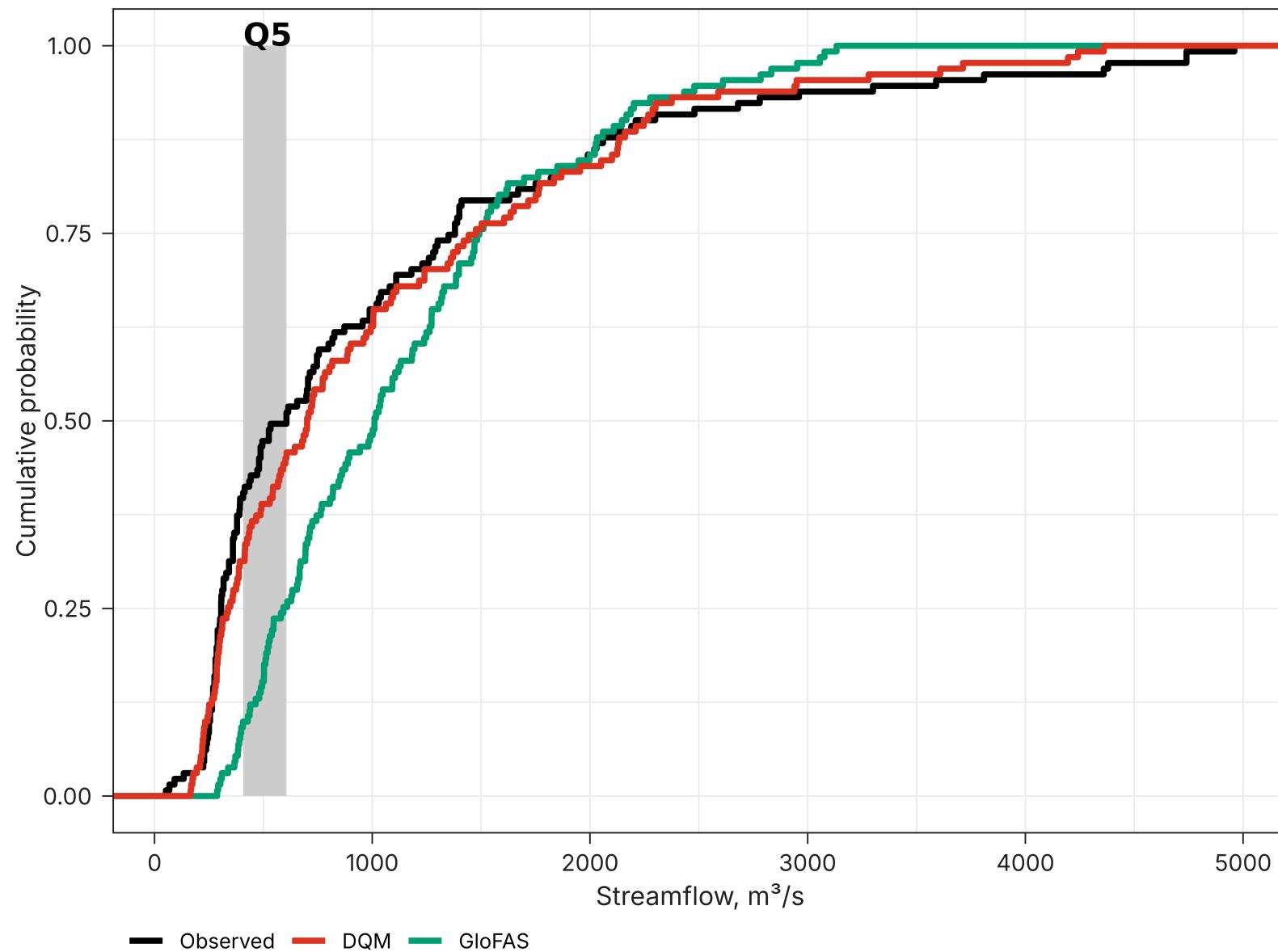
# Detrended Quantile Mapping (DQM)



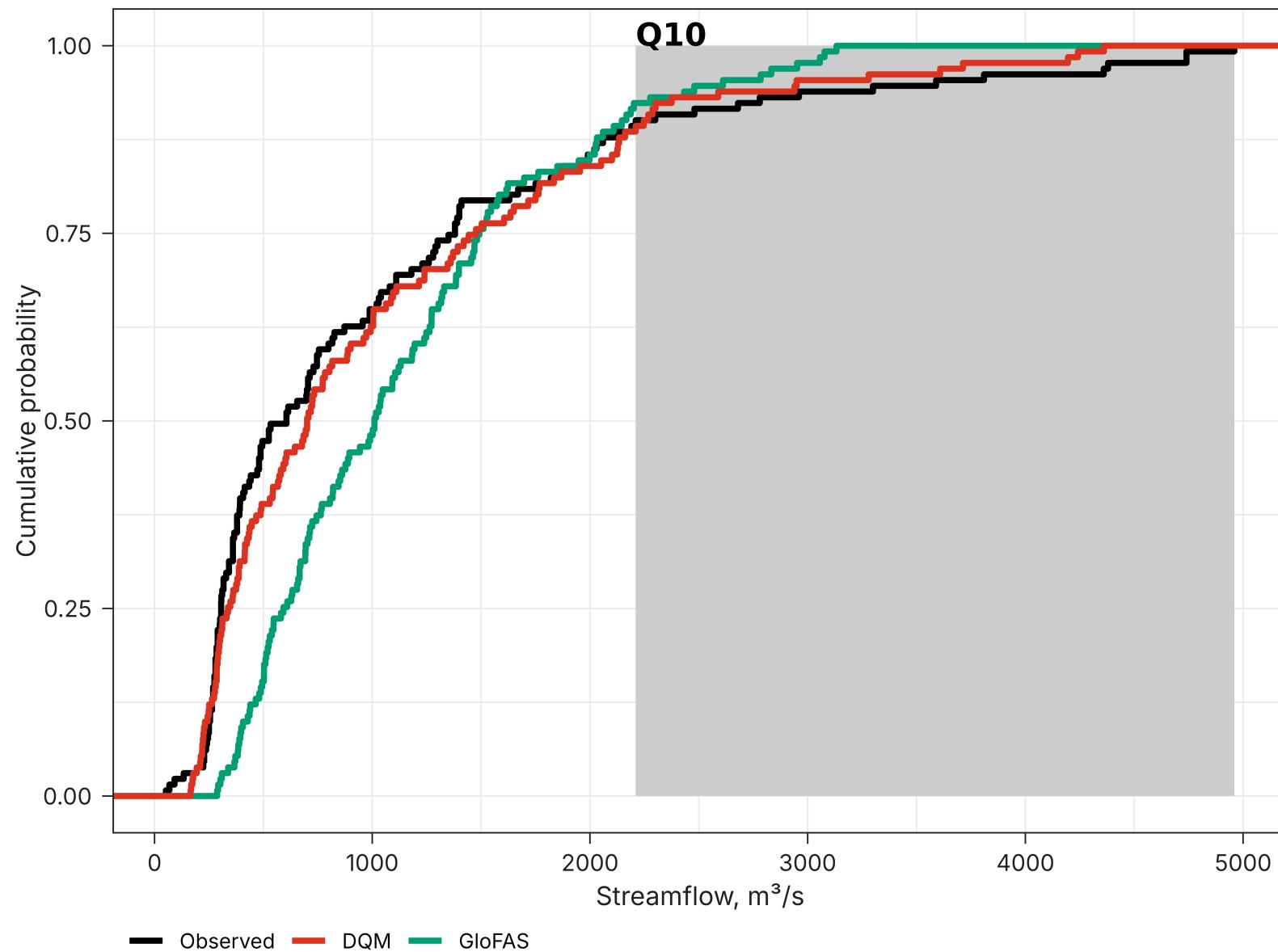
# Detrended Quantile Mapping (DQM)



# Detrended Quantile Mapping (DQM)



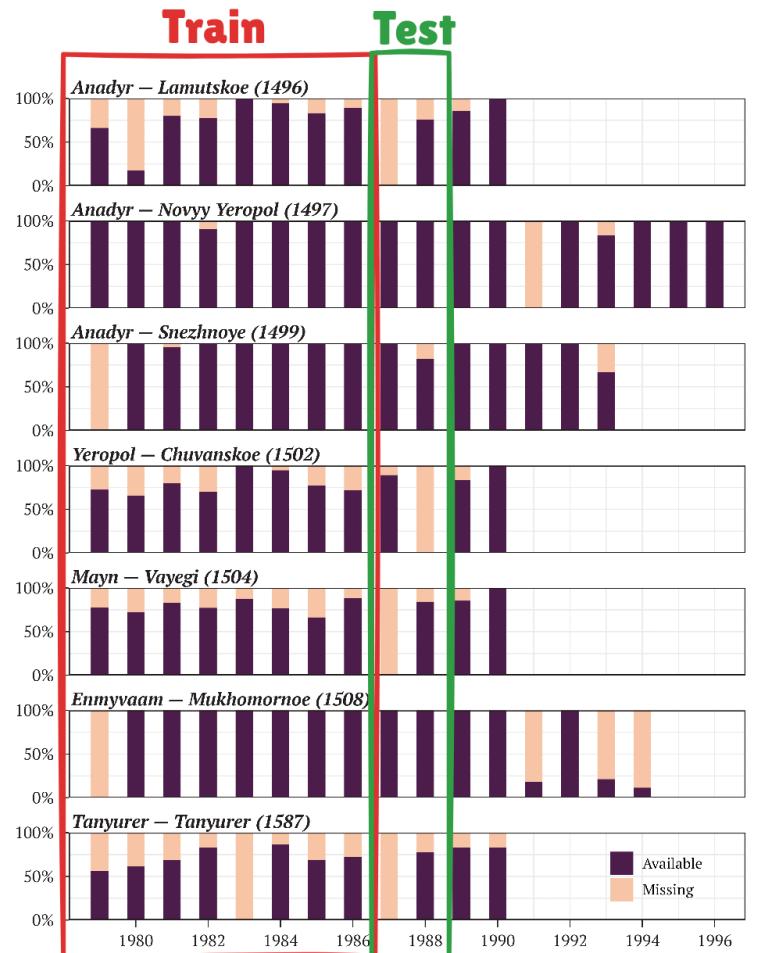
# Detrended Quantile Mapping (DQM)



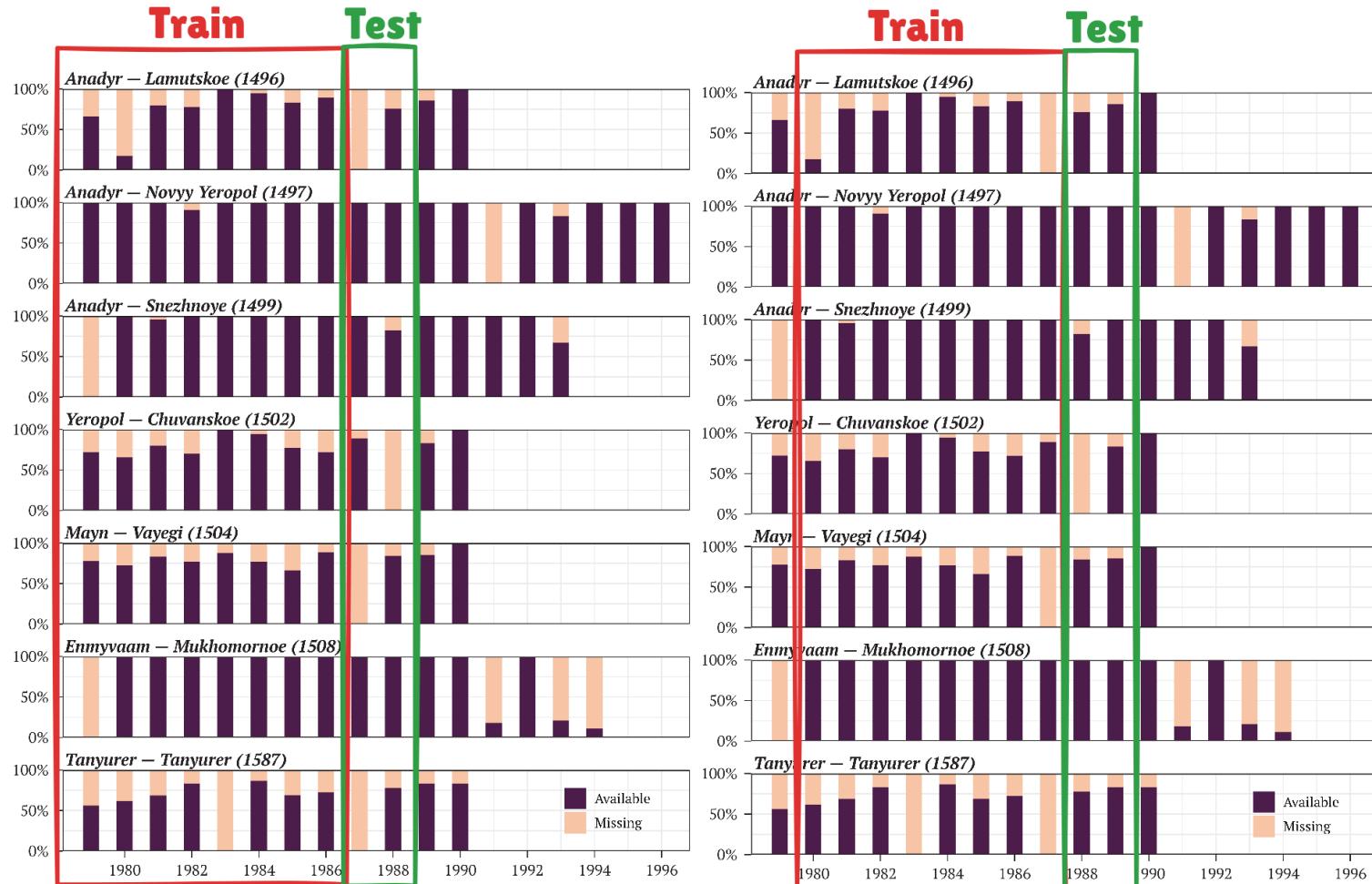
# How to choose optimal number of quantiles?



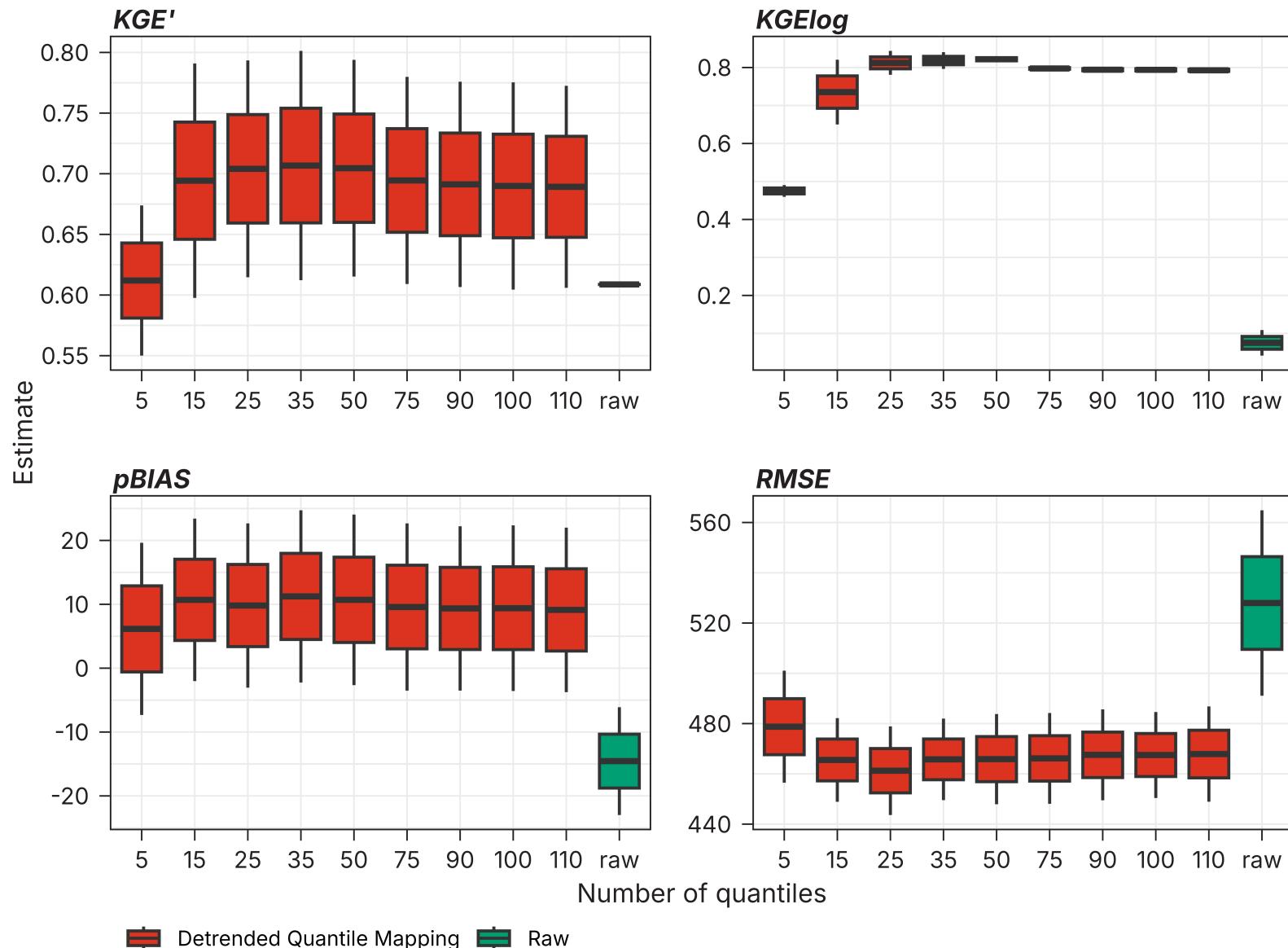
# How to choose optimal number of quantiles?



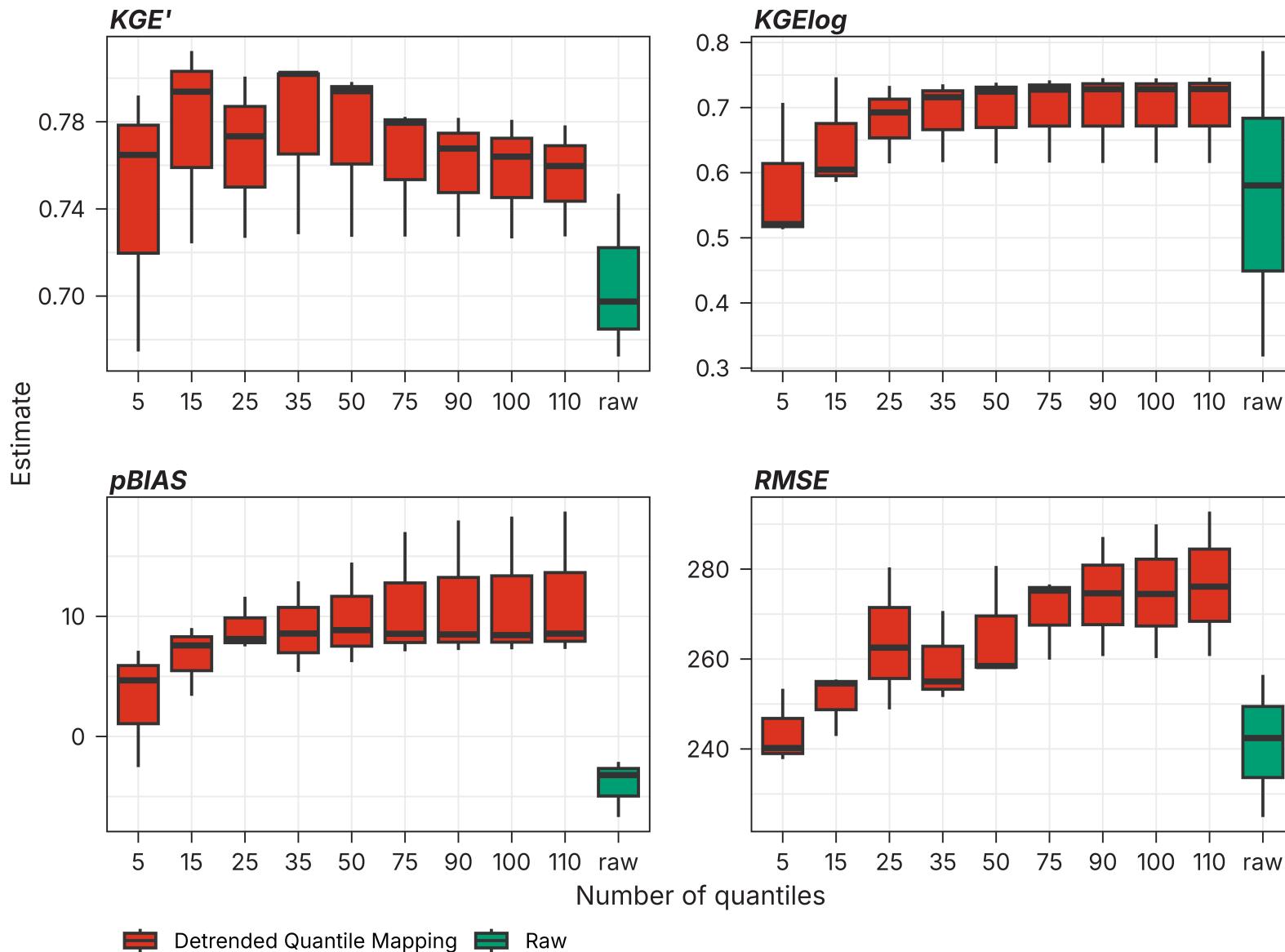
# How to choose optimal number of quantiles?



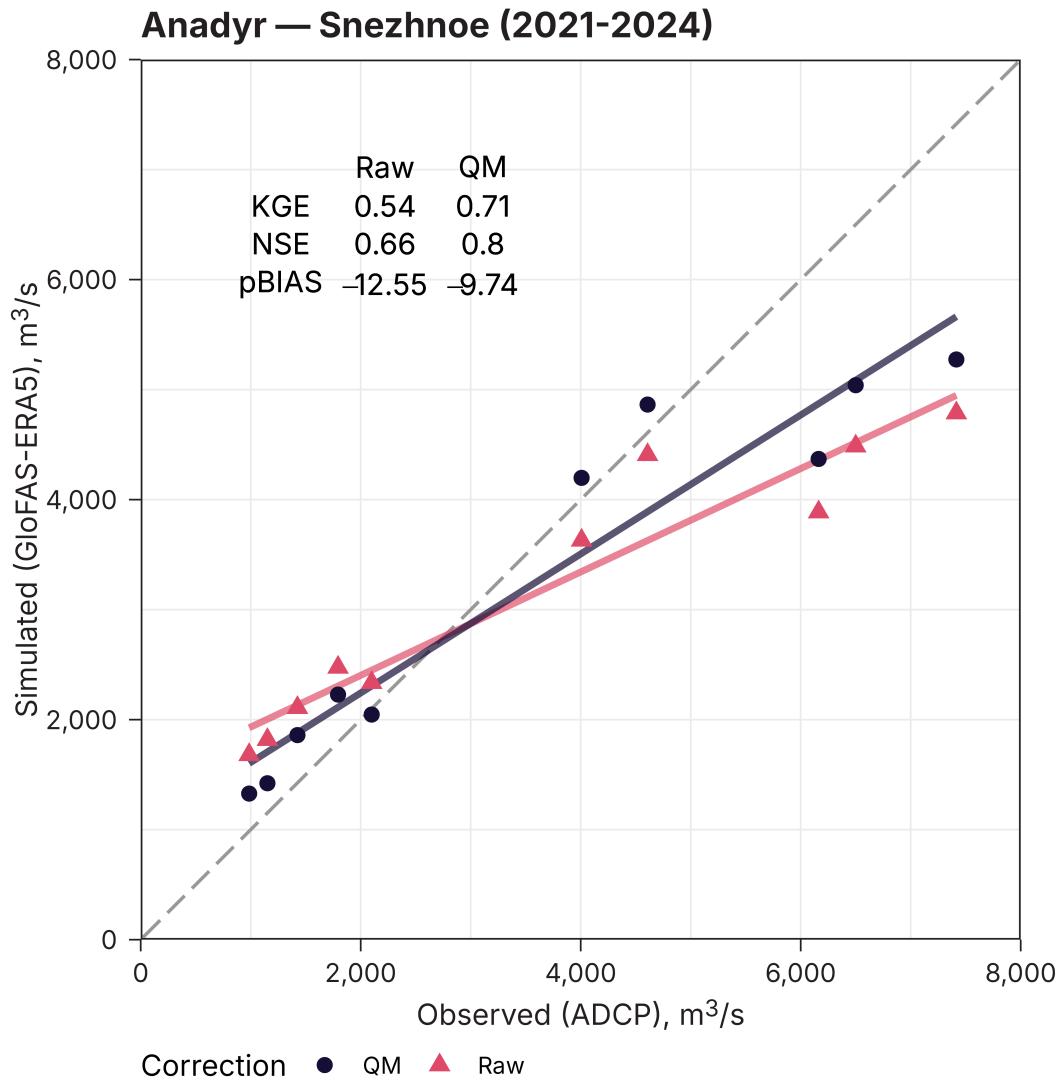
# CV: Tanyurer–Tanyurer



# CV: Mayn–Vaegi



# 2021–2024 ADCP measurements



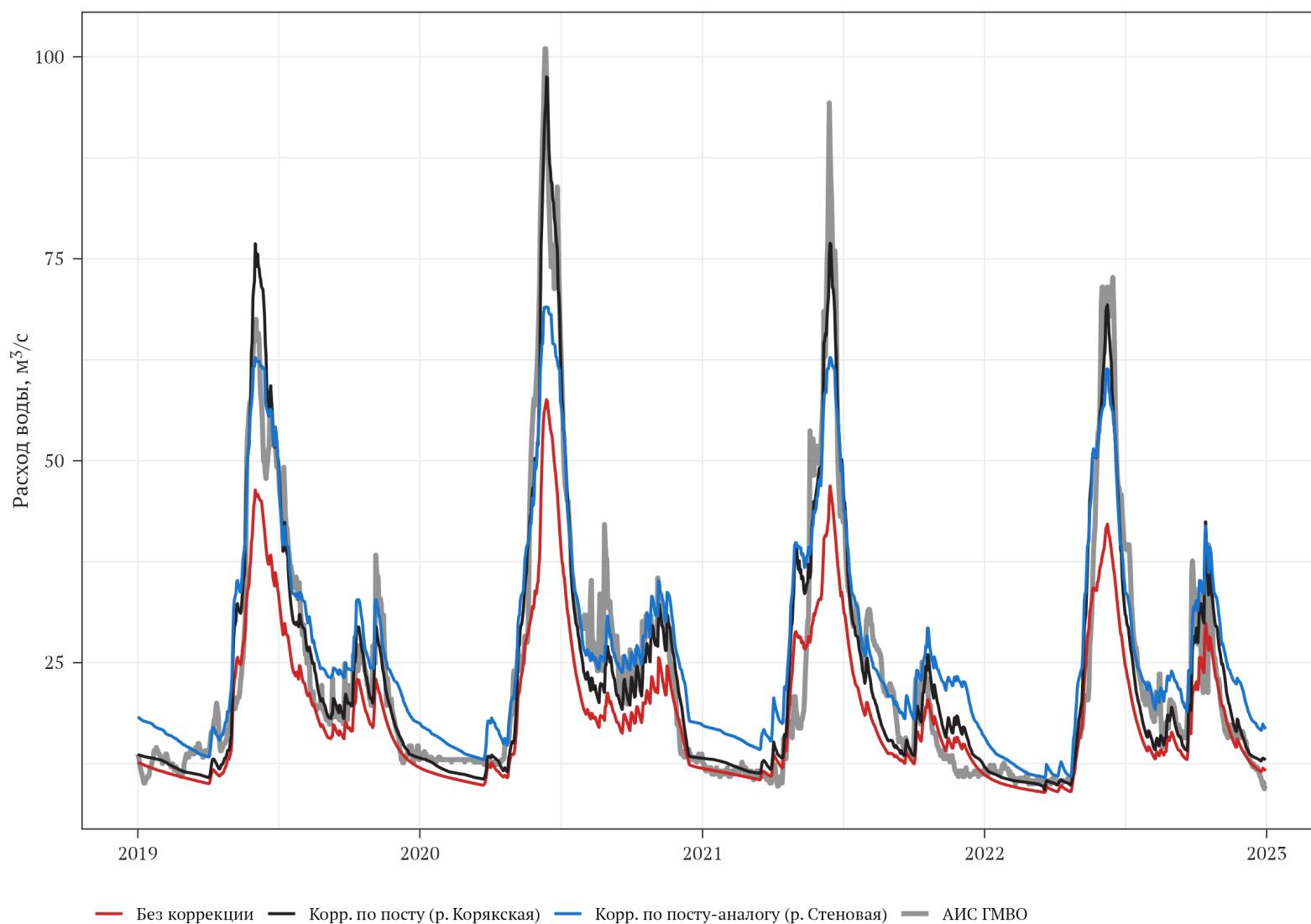
**If I haven't convinced  
you yet...**

# Koryakskaya River example (Kamchatka)



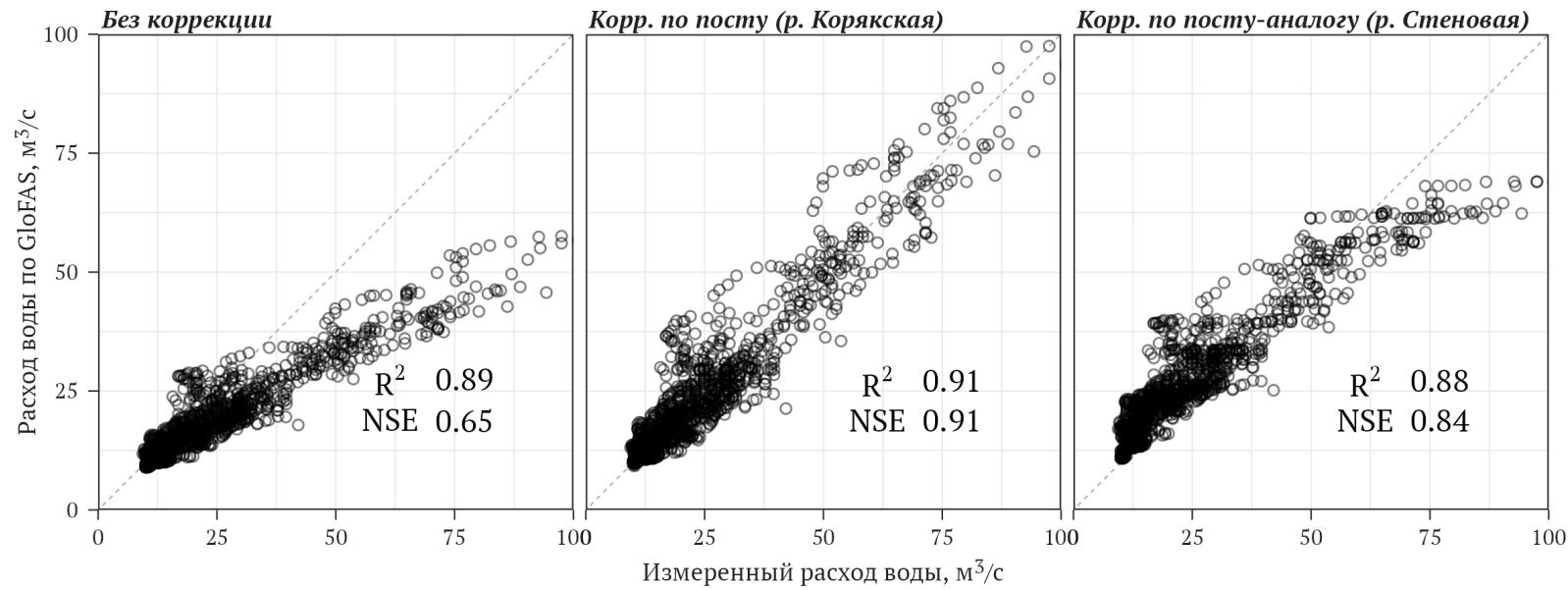
**р. Корякская – с. Коряки**

2019–2022



**р. Корякская – с. Коряки**

2019–2022



# Take home message

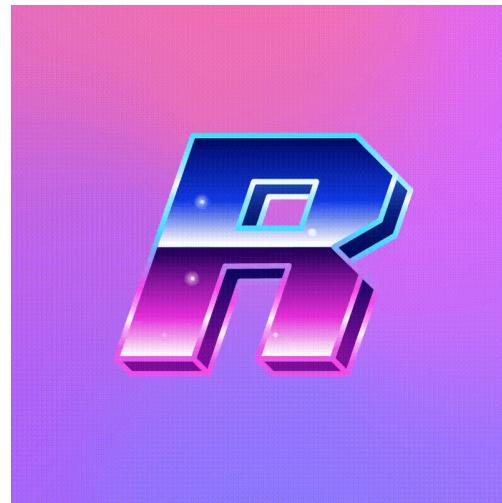


**Friends don't let  
friends use *uncorrected*  
reanalysis data**

# Take home message v1.1

- GloFAS-ERA5 v4.0 has potential for a bish-bash-bosh streamflow assessment
- Bias correction is necessary for GloFAS-ERA5
- Detrended Quantile Mapping can increase GloFAS-ERA5 accuracy by  $\approx 20\%$
- DQM is sensitive to the number of quantiles and requires tuning.

# Take home message v1.2



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