AARHUS UNIVERSITY
DEPARTMENT OF BIOSCIENCE,RKS

EGU 2015 HS1.4

Differences in rating curve and hydrograph uncertainty due to streamflow dynamics and number of discharge measurements

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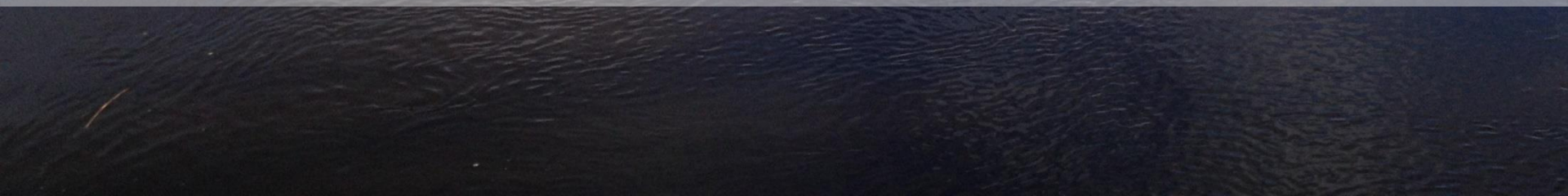
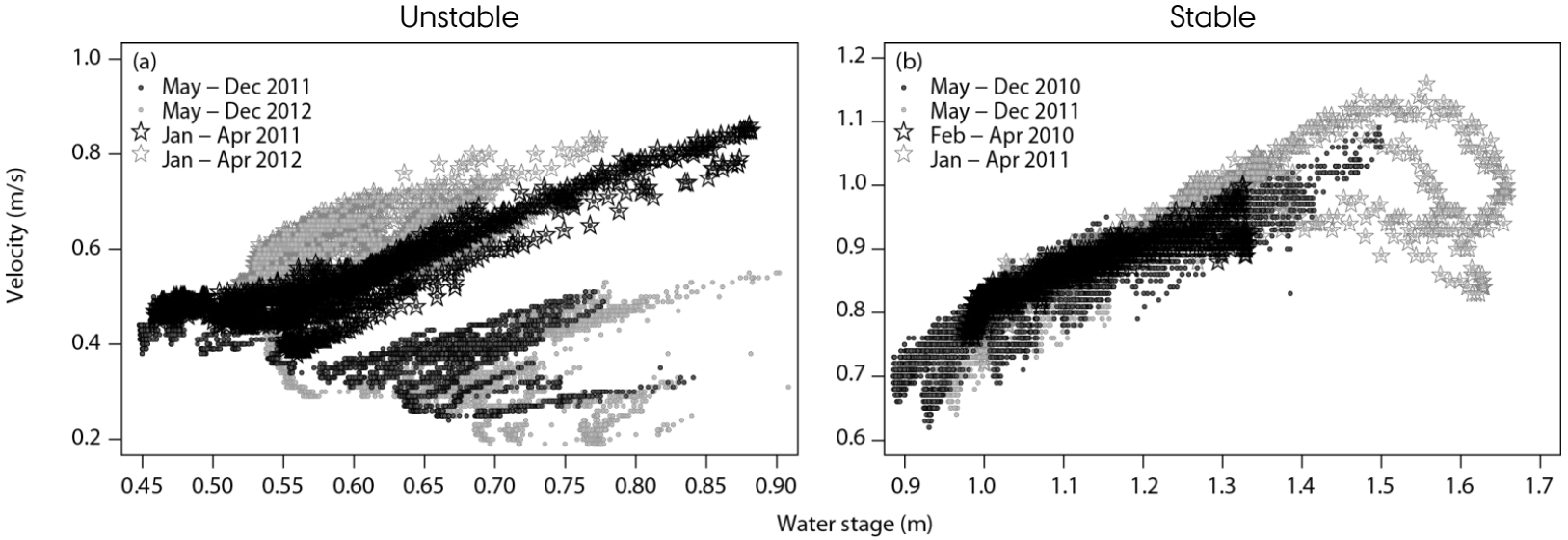


BACKGROUND

› The most common method for estimation of stream discharge is the assumption of a unique stage-discharge (**QH**) relation:

$$Q = A(H-H_0)^N \qquad \text{(the rating curve)}$$

› In natural streams changing flow conditions violate the assumption of a unique QH-relation



› **Standard procedure in Denmark:**
- 8 to10 gaugings/yr. and linear interpolation between direct measurements

OBJECTIVES

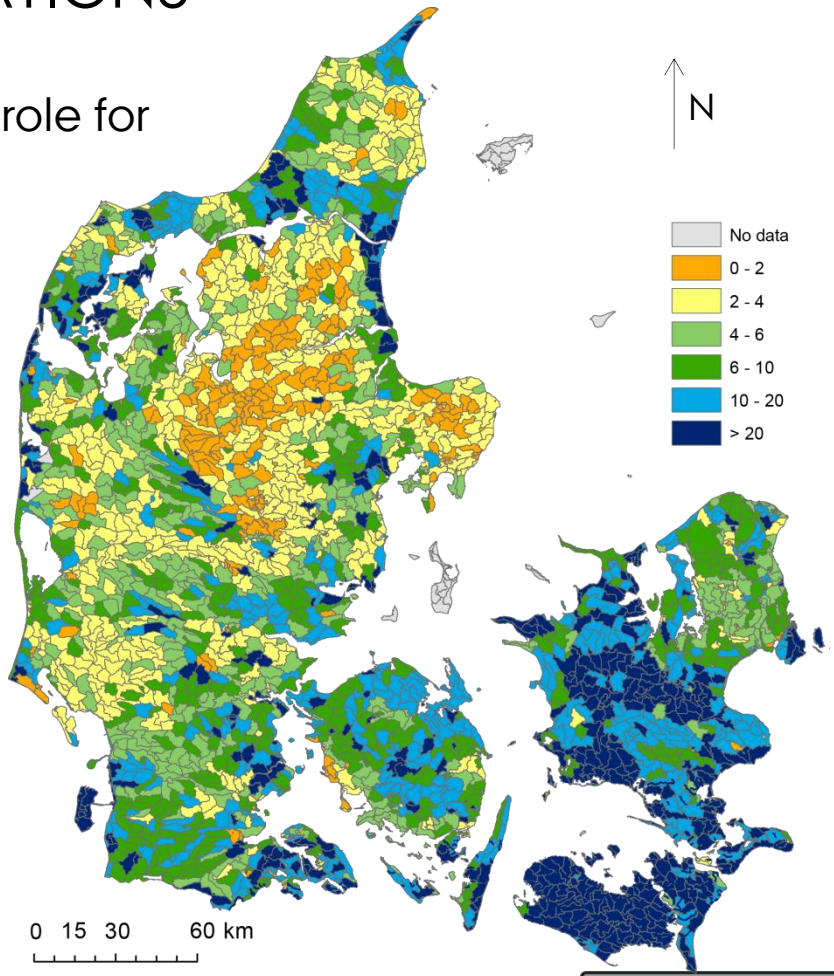
i) Test if calculated flow regimes can be used to classify streams according to hydraulic/hydrologic properties.

ii) Investigate which impact flow regime has on hydrograph uncertainty.

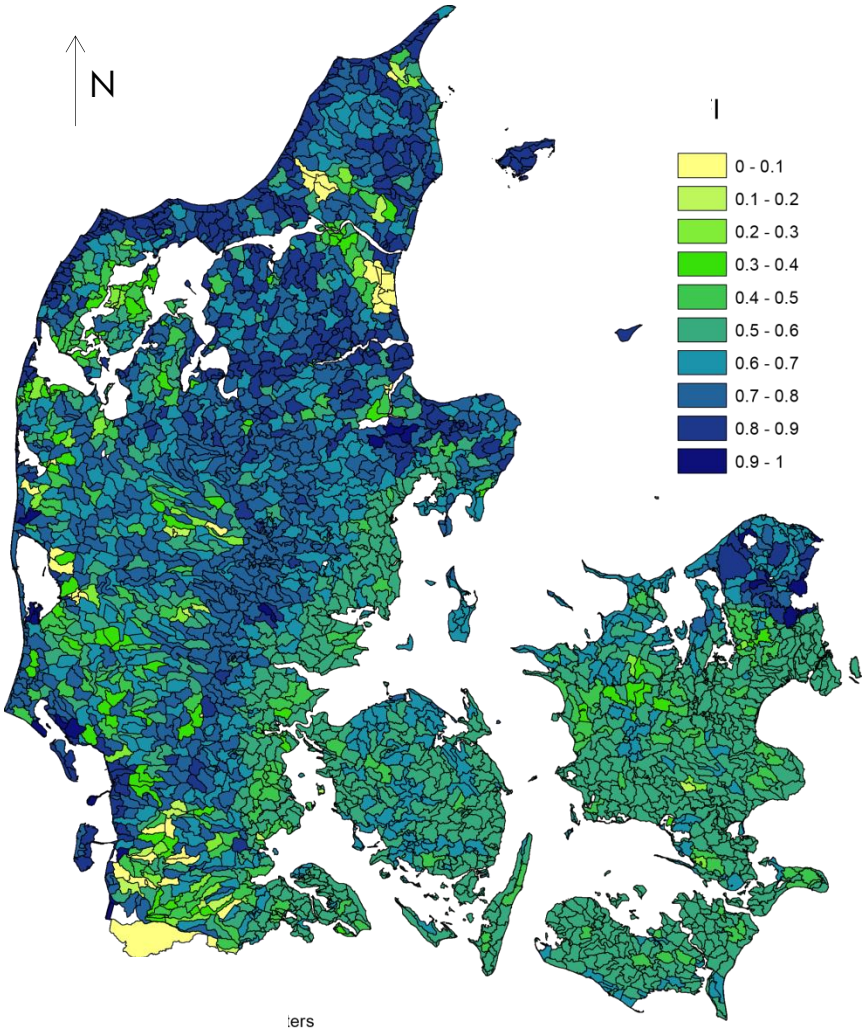
iii) Investigate uncertainties on the yearly average stream discharge estimates due to number of direct discharge measurements and flow regime.

CALCULATION OF FLOW REGIMES
BASIS FOR SELECTION OF TEST STATIONS

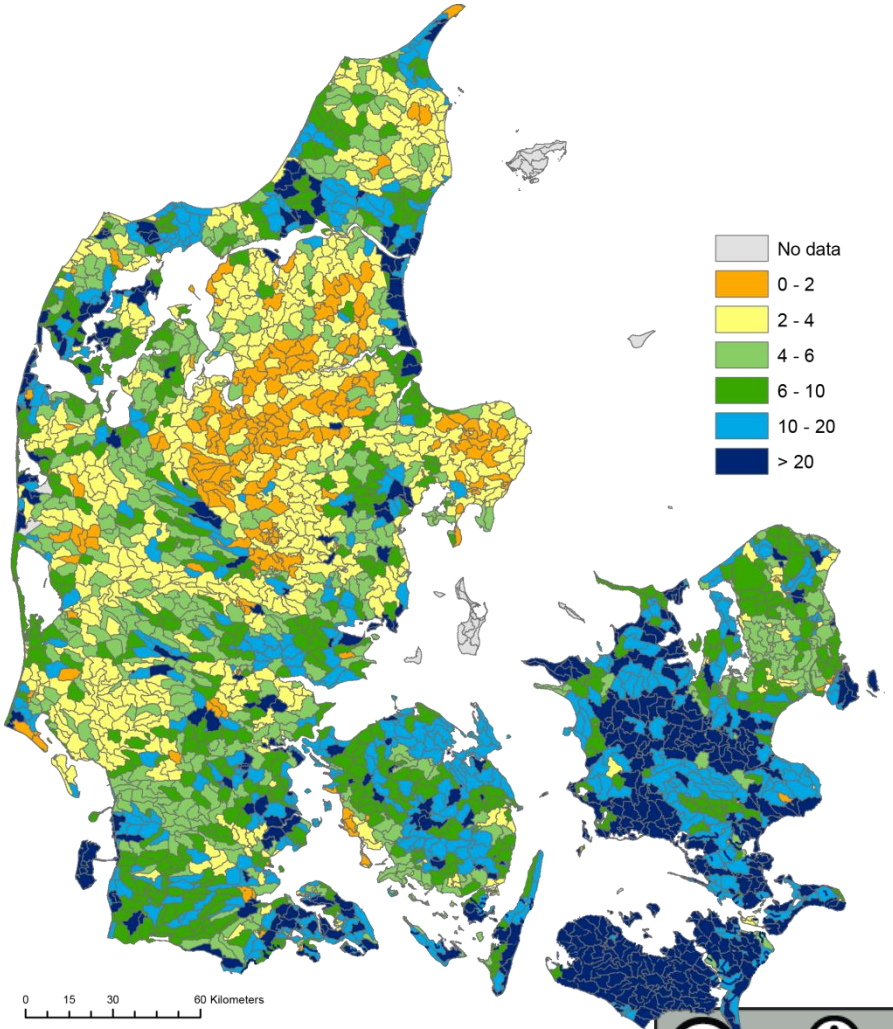
- Flow regime is expected to play a governing role for hydrograph uncertainty.
- Flow regime is defined by the relationship:
- $Flow\ regime = \frac{Q_{med.max}}{Q_{med.min}}$
- $Q_{med.}$:
  yearly runoff (20 years avg.) modelled by the DK national rainfall-runoff model for sub-catchments of avg. 15 km^2



Baseflow index



Flow regime



ANALYSIS OF HISTORICAL Q DATA

- **Selecting the Q data series**

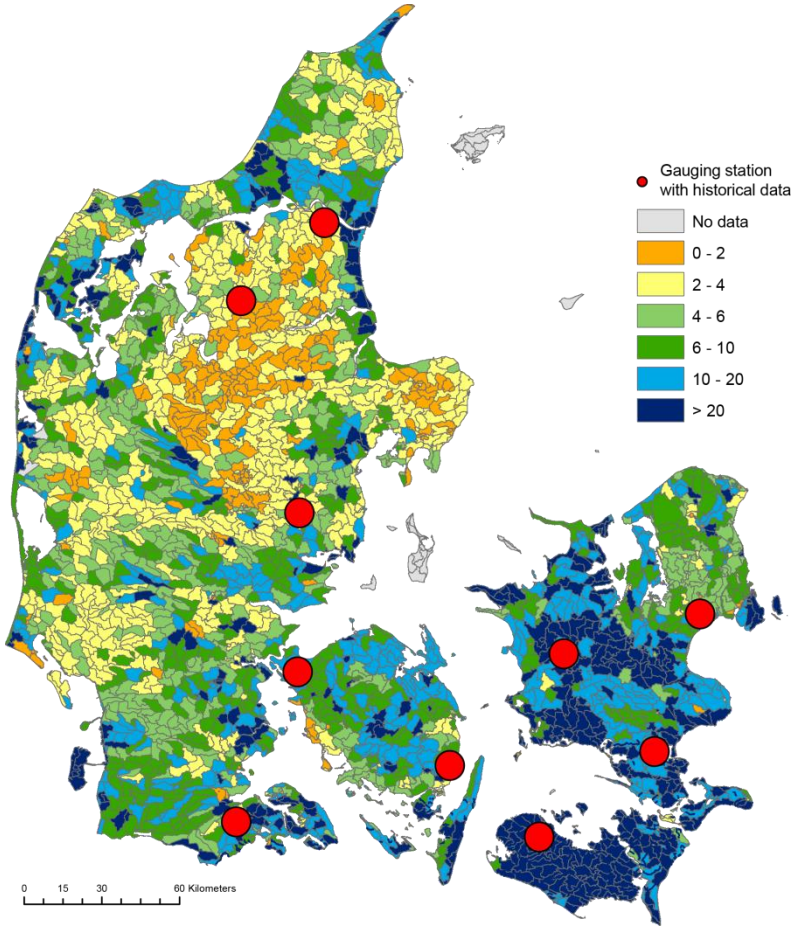
- Ten gauging stations selected (med_{max}/med_{min}):

- **0 – 6**: Two stations
- **6 – 10**: Three stations
- **10-20**: Three stations
- **>20**: Two stations

- All stations: 22 to 35 Q measurements/yr.
- Catchment sizes between 10 and 30 km^2

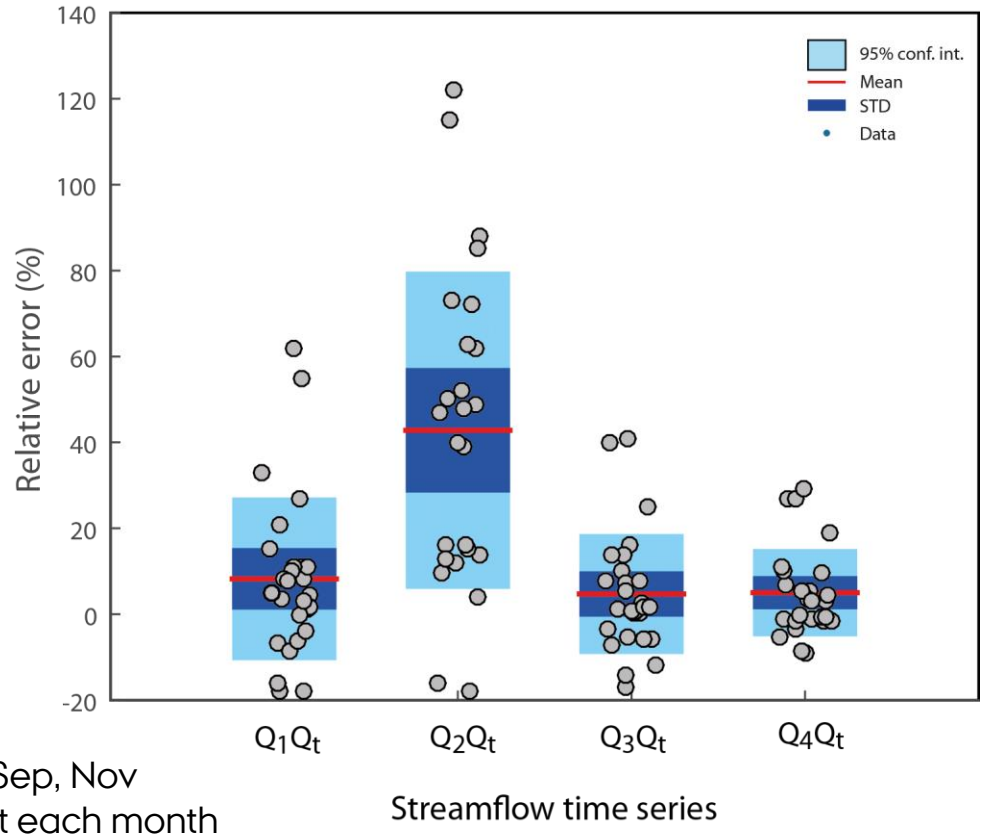
- **Constructed Q data series**

- **Q1** =Jan, Jul, Nov
- **Q2**= Feb, Mar, Apr
- **Q3**=Jan, Mar, May, Jul, Sep, Nov
- **Q4**= One measurement each month
- **Qt**= All data points (the "true" discharge time series)



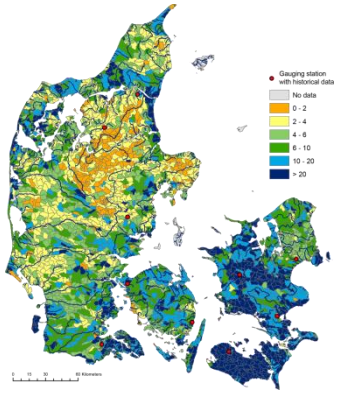
RESULTS
UNCERTAINTY RELATED TO NUMBER OF Q MEASUREMENTS

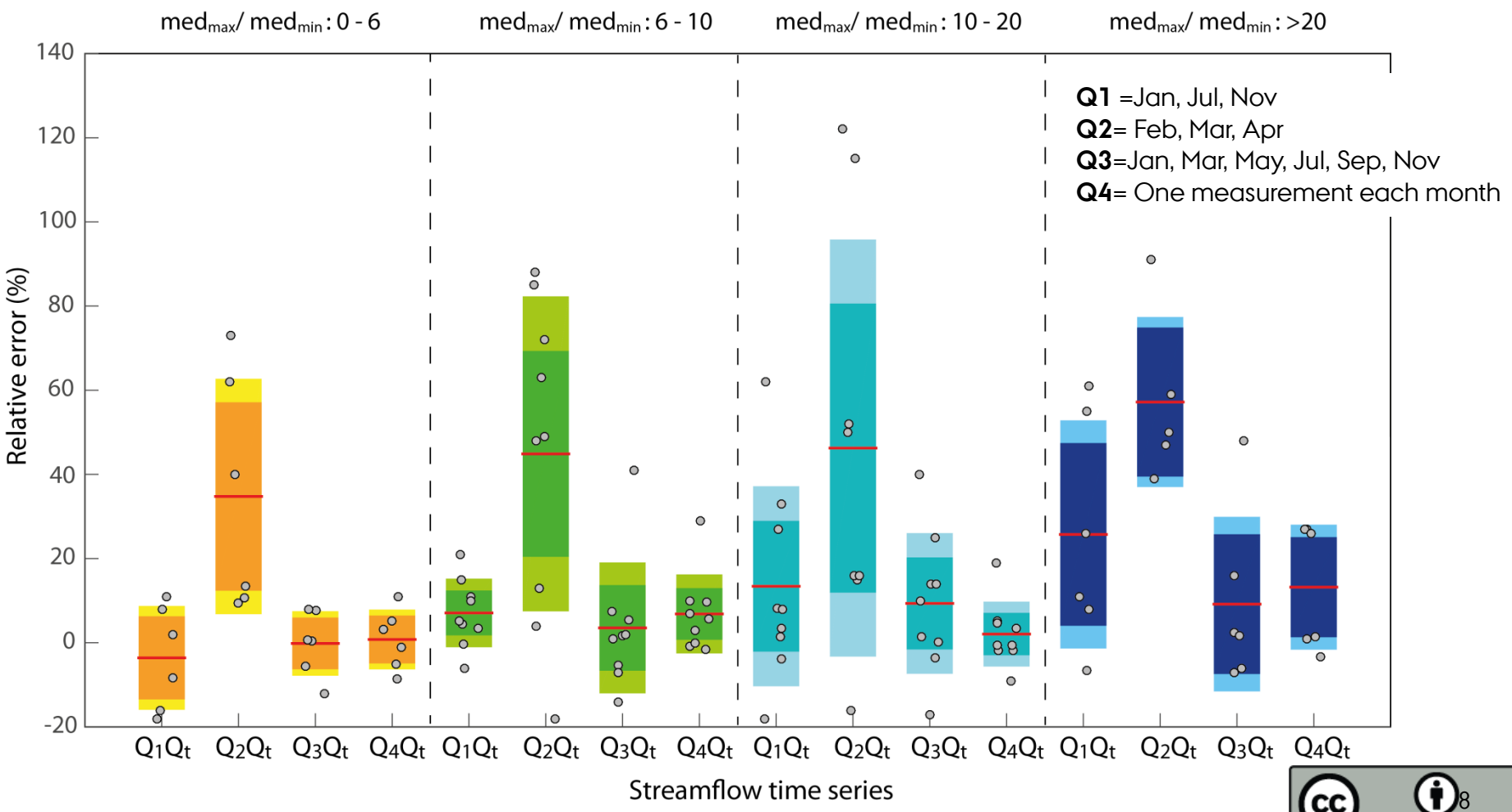
› Data from all hydrologic years and all flow regimes



› **Q1** =Jan, Jul, Nov
› **Q2**= Feb, Mar, Apr
› **Q3**=Jan, Mar, May, Jul, Sep, Nov
› **Q4**= One measurement each month

RESULTS
UNCERTAINTY RELATED TO FLOW REGIME





CONCLUSIONS

› Flow regime seemed useful for classifying streams as stable/non stable.

› Relative error on hydrographs increased with increasing flow regime and decreasing number of direct Q measurements.

› High flow regimes were more sensitive to number of discharge measurements.

› To lower uncertainties one approach could be to differentiate, so hydrographs in unstable streams are based on more frequent discharge gaugings.

› Hydrograph calculation should be adapted to the particular stream (with risk of less standardised procedure, higher uncertainty?).

Thank you for your attention!