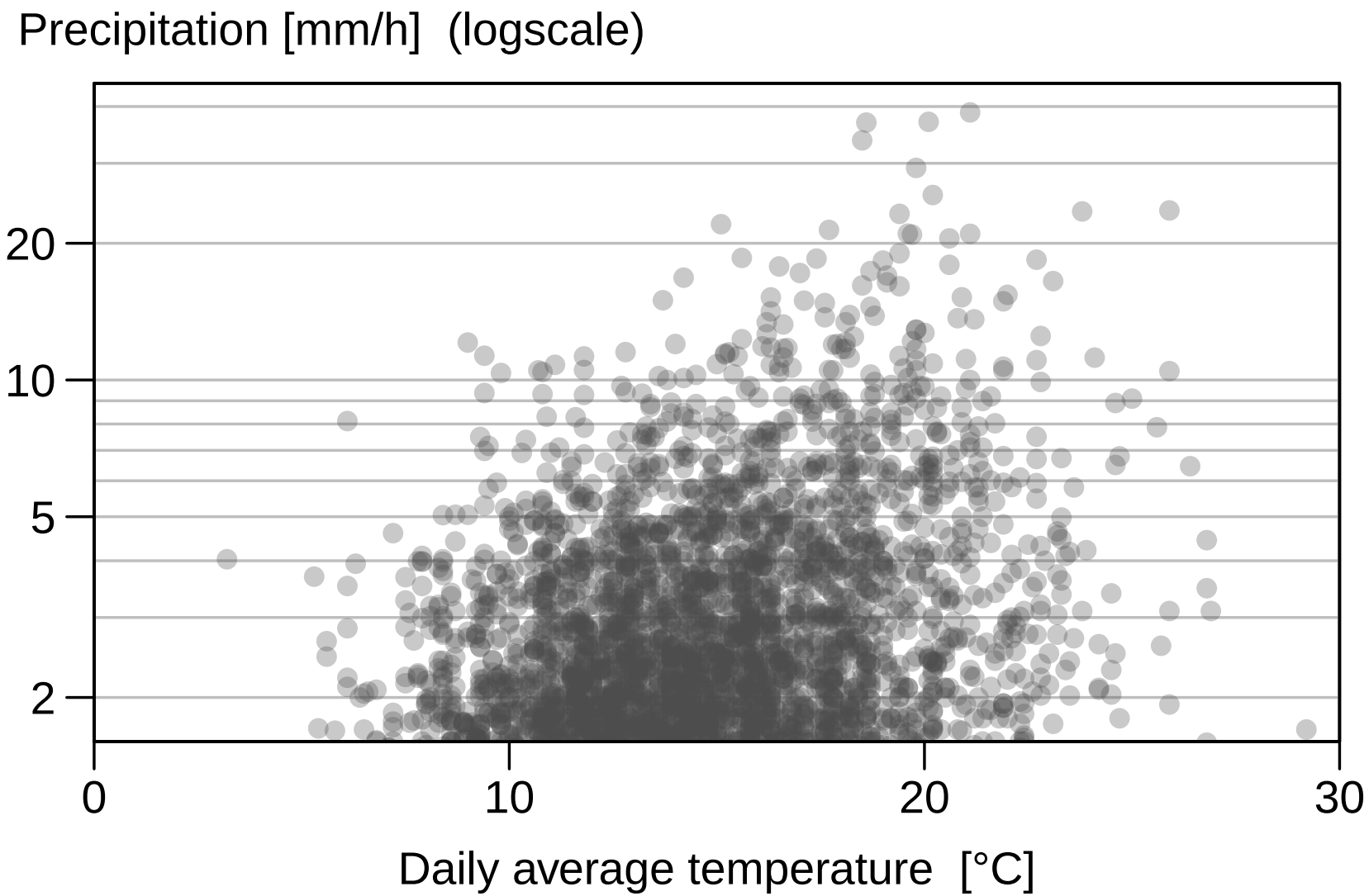
Why you need an umbrella on hot days

application of **extreme value statistics** to precipitation

Berry Boessenkool, uni-potsdam.de, June 2015

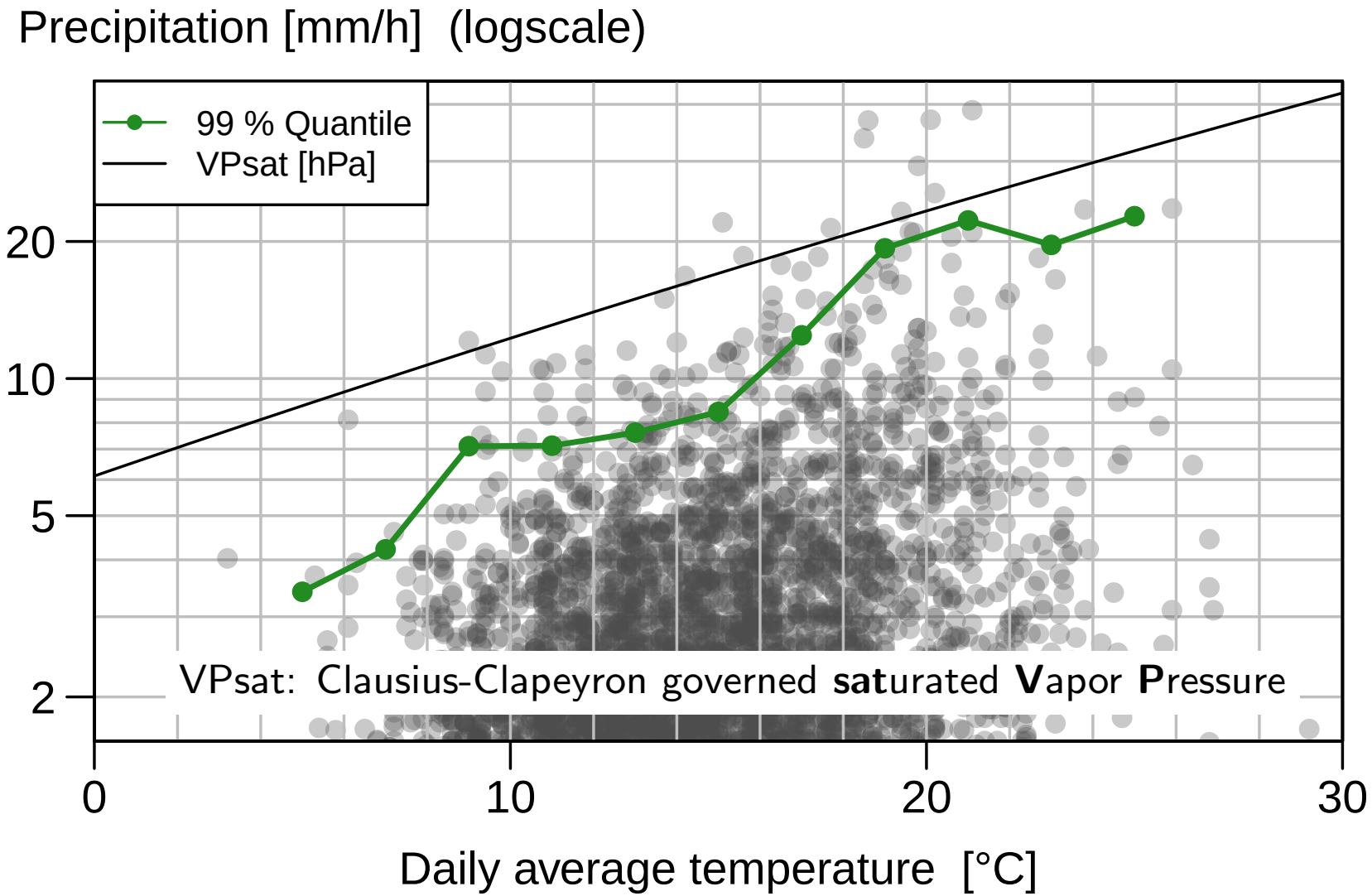
github.com/brry

60 years of hourly records at 14 stations across Germany (figs: Potsdam)



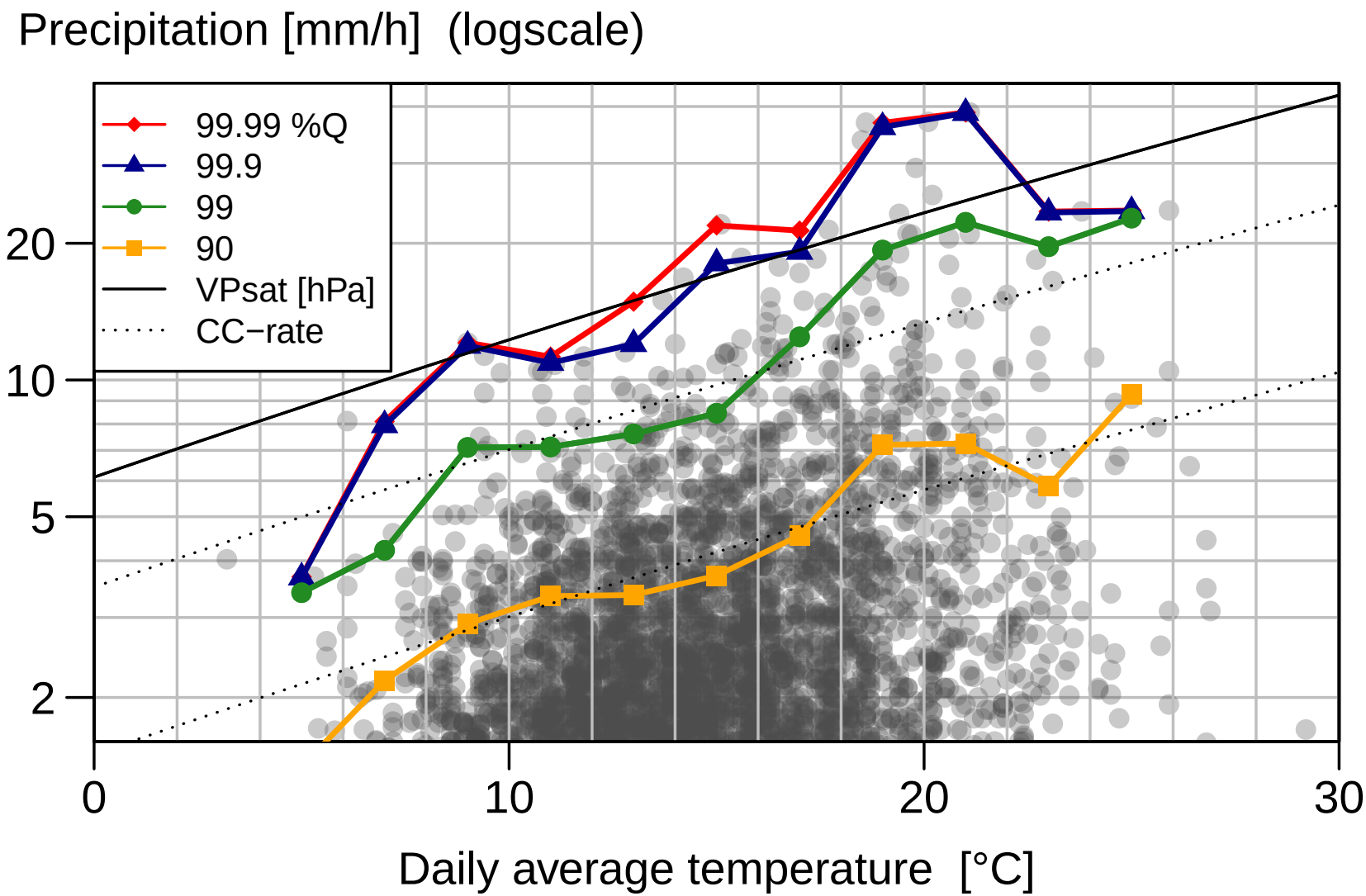
Boessenkool, useR!2015: precipitation intensity drop at high temperatures - a statistical artefact?

precipitation intensities follow CC-scaling of air moisture with temperature

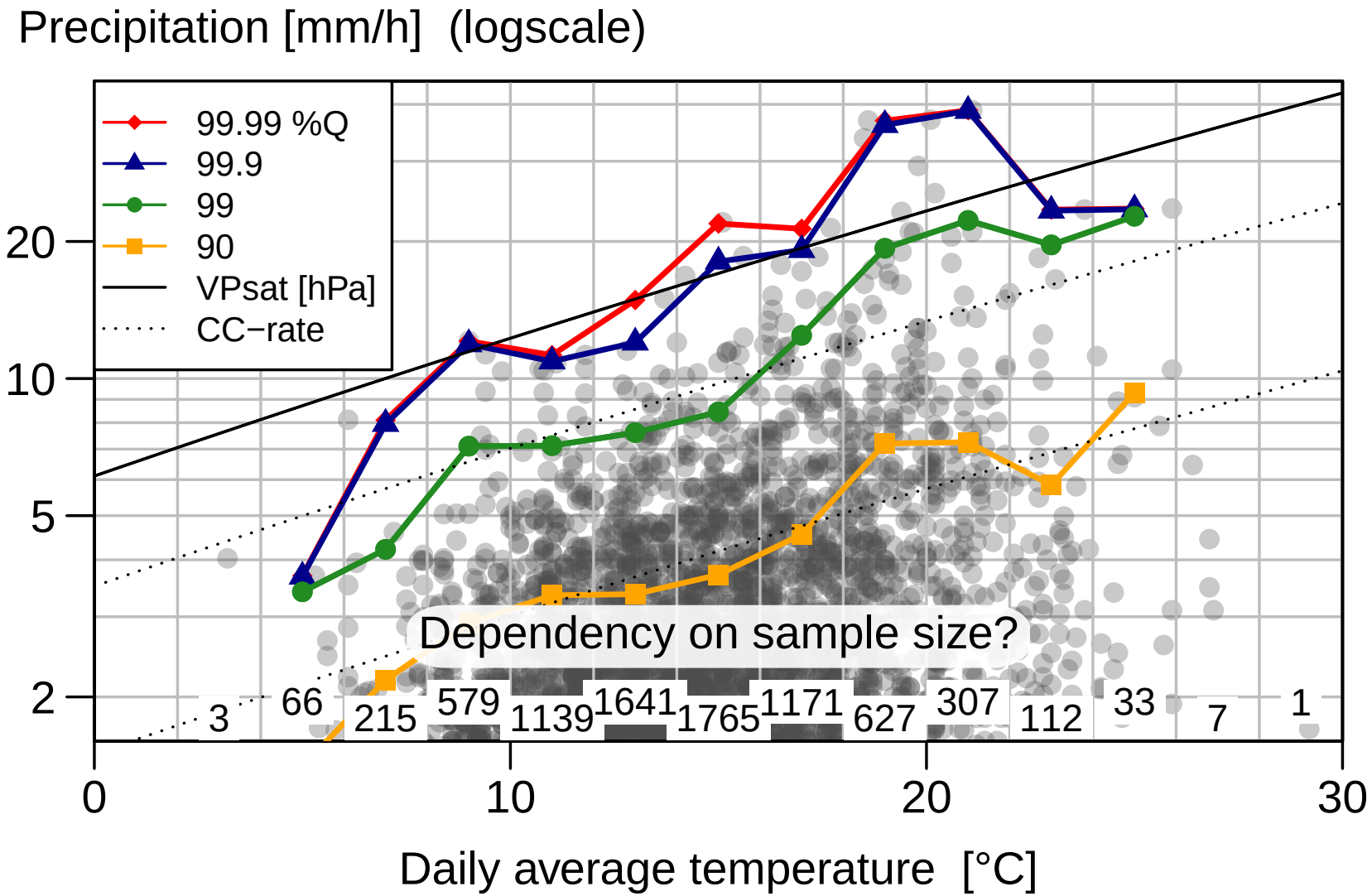


Boessenkool, useR!2015: precipitation intensity drop at high temperatures - a statistical artefact?

High precipitation quantiles drop at high temperatures

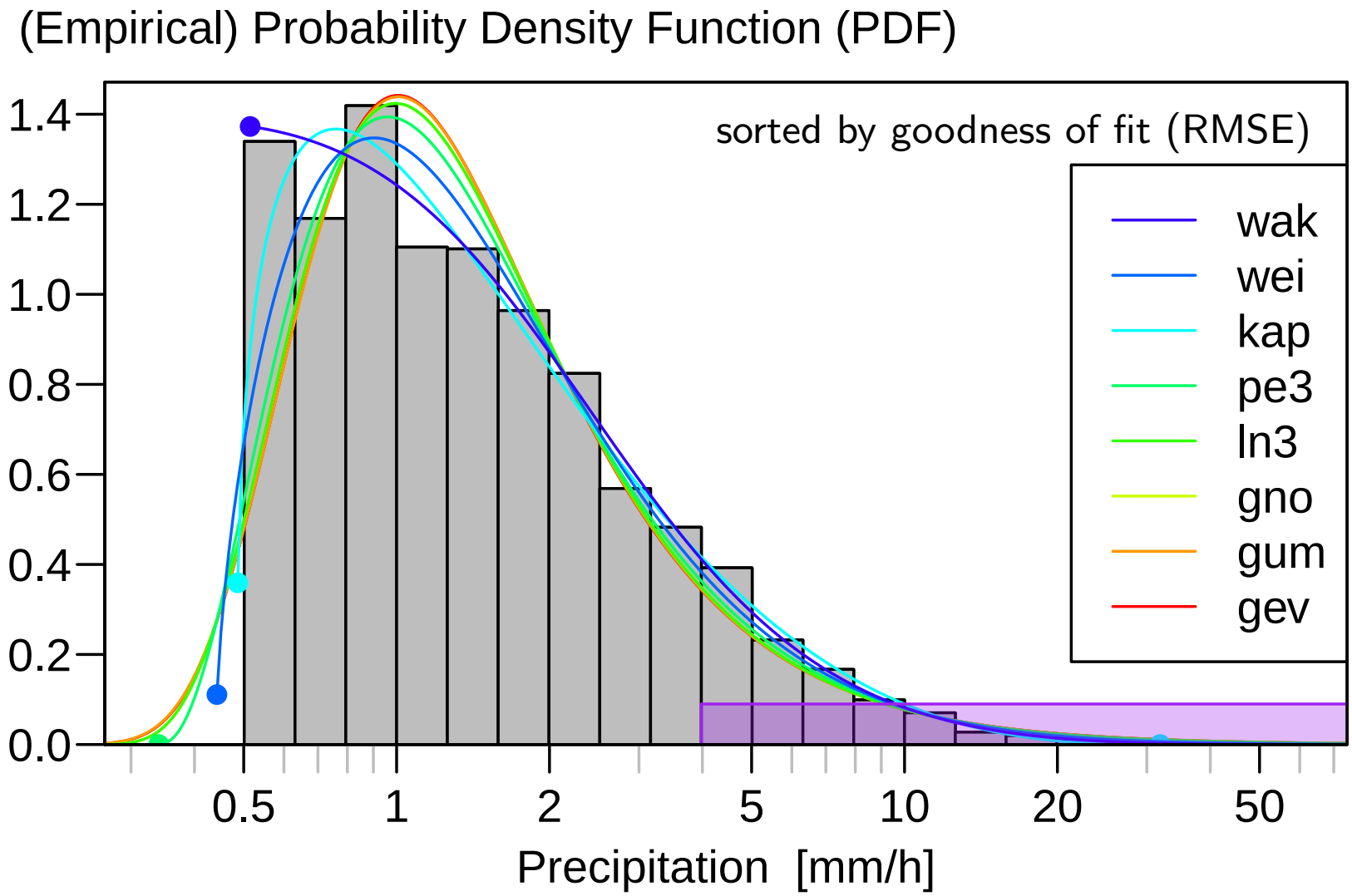


High precipitation quantiles drop at high temperatures



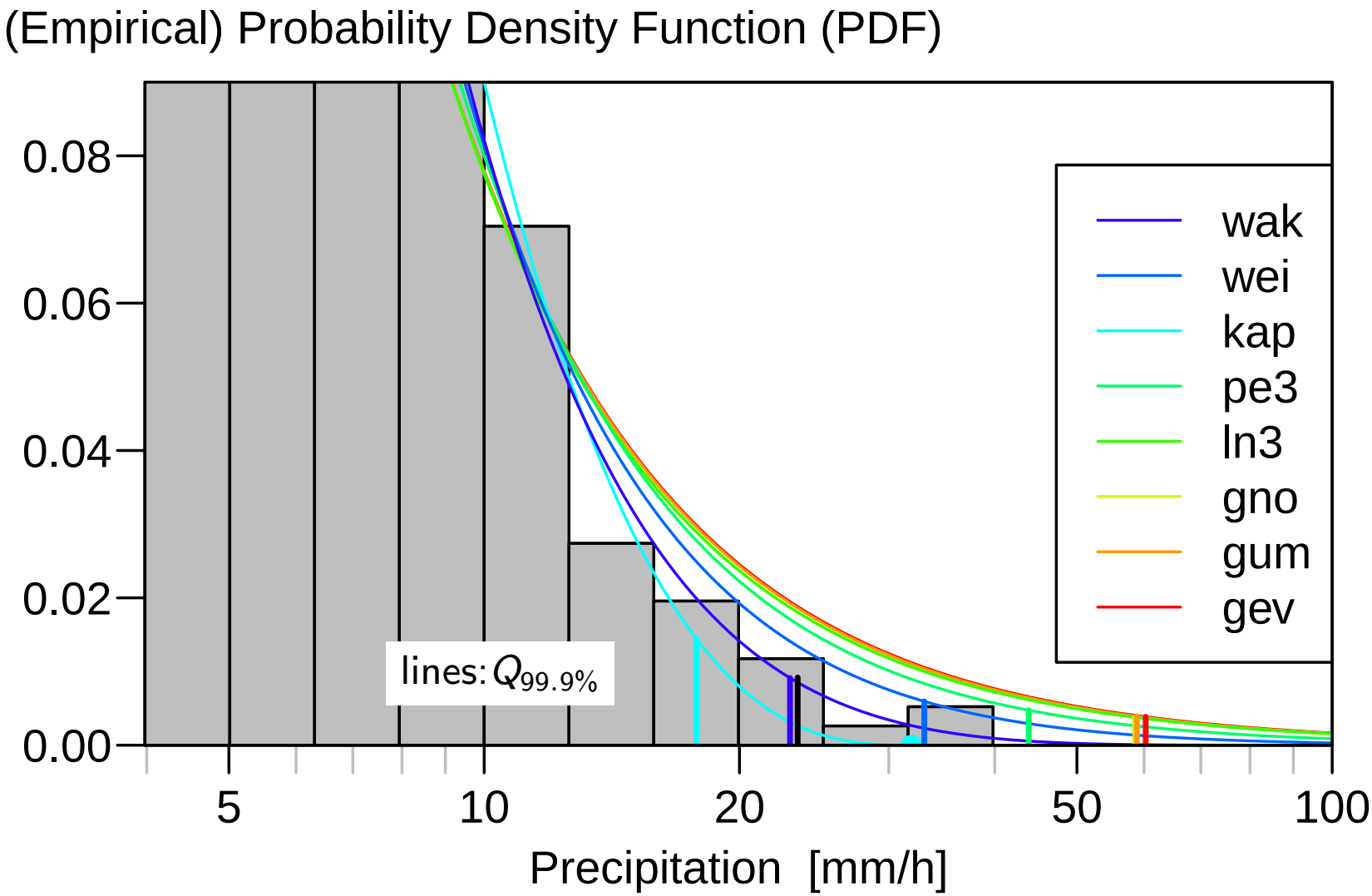
Fit distribution functions (available in `lmomco`)

`extremeStat::distLfit`



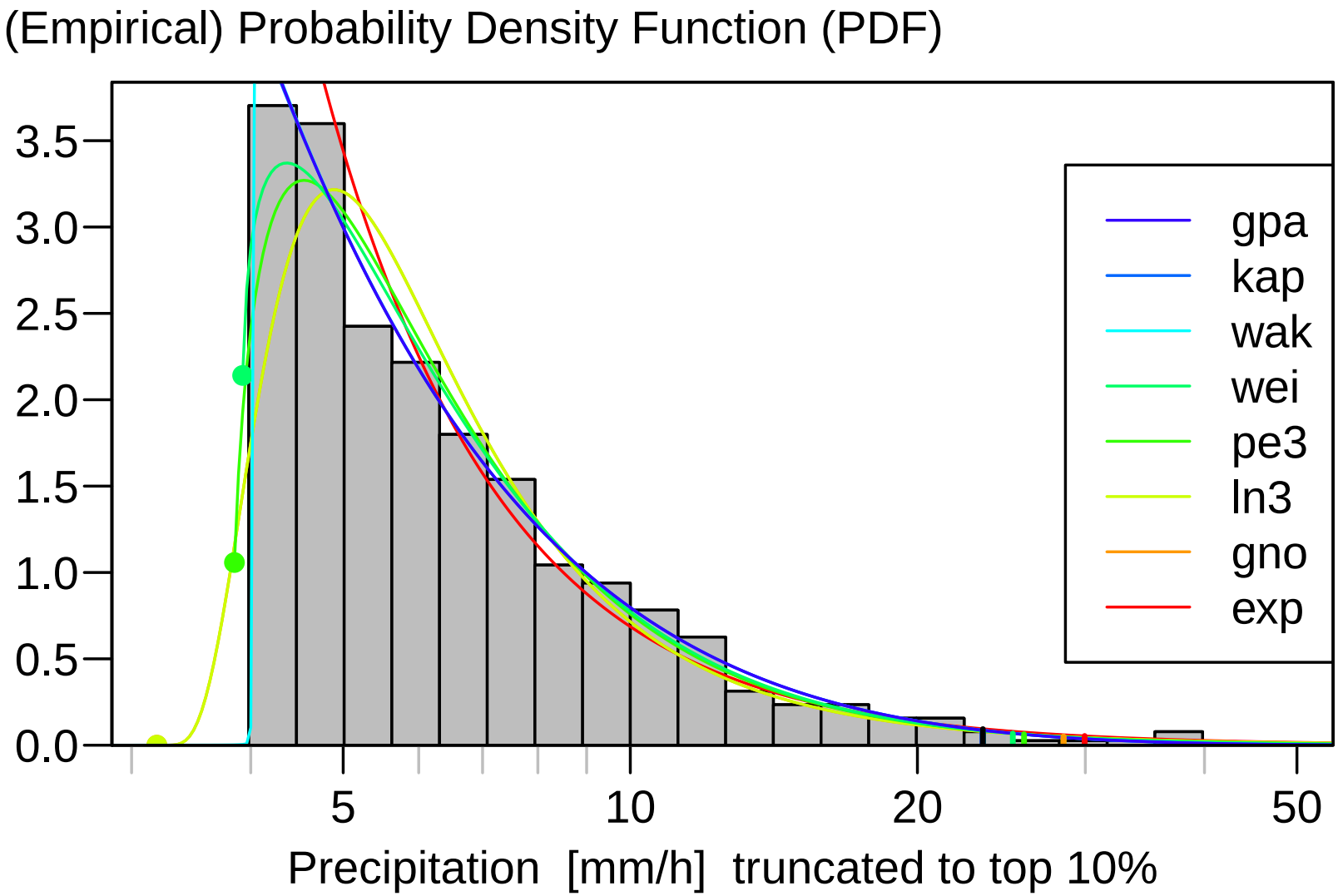
Distribution quantiles differ a lot

`extremeStat::distLquantile`



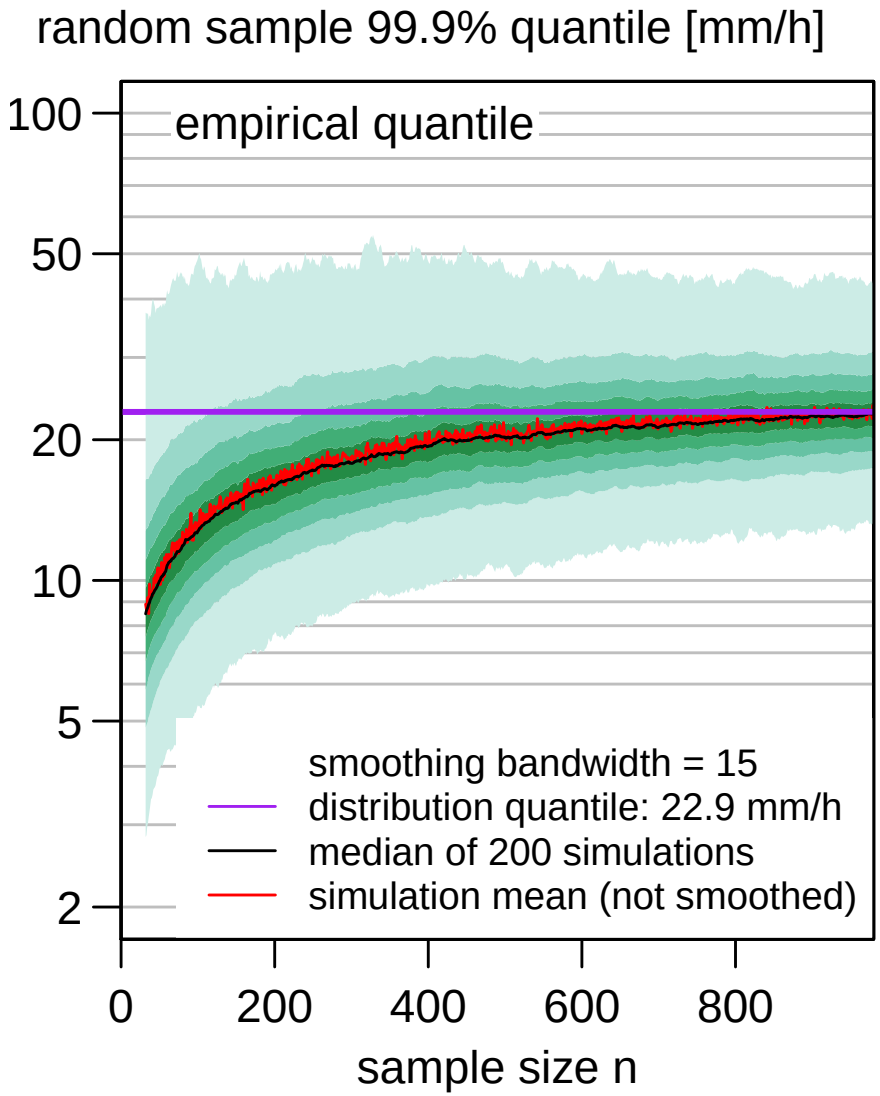
Censored quantiles (of the highest values of a sample) are robust

`extremeStat::distLquantile(..., truncate=0.9)`

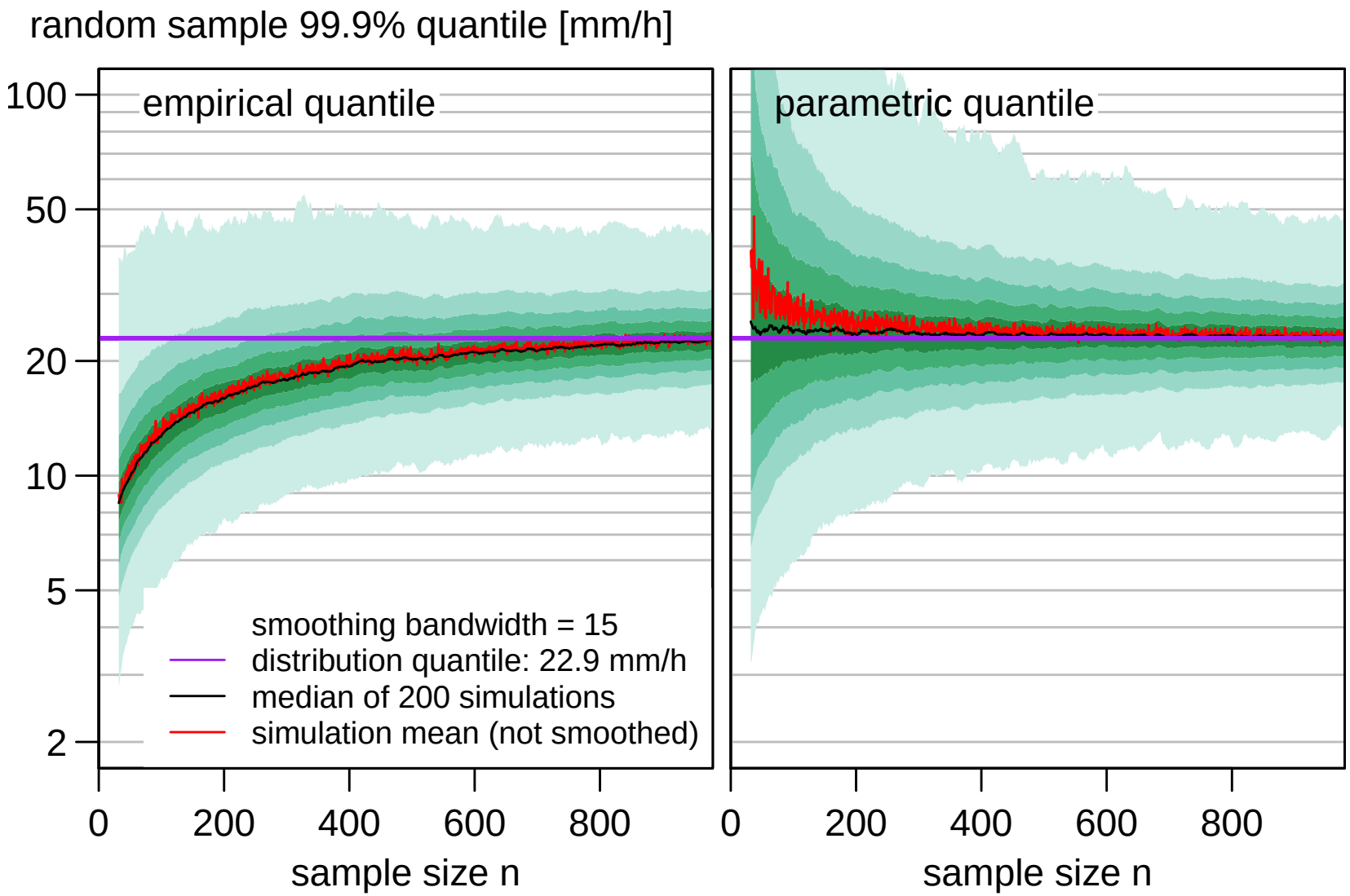


Low sample size underestimates high quantiles

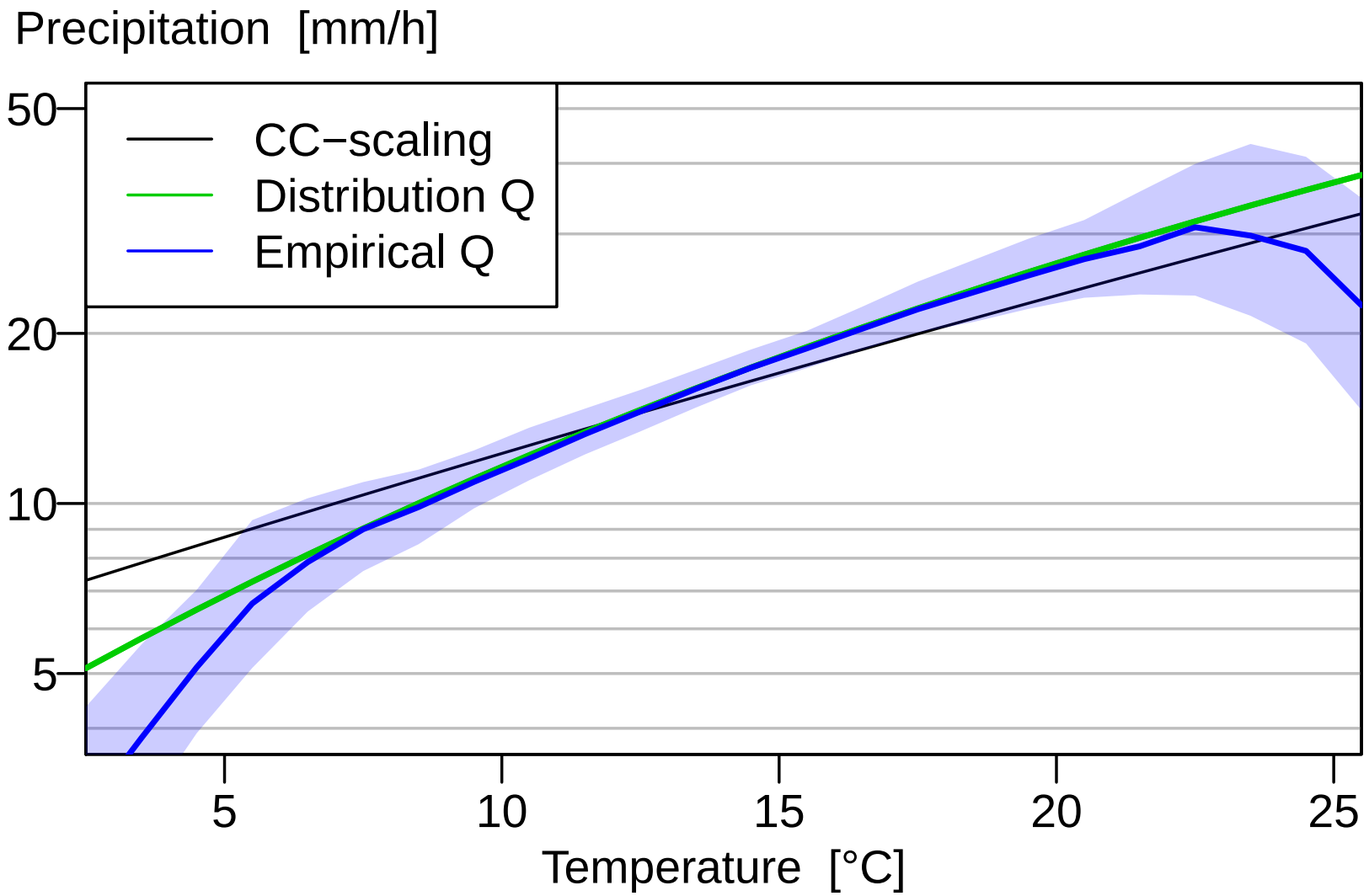
Empirical quantile: order based `quantile` function in `R::stats`



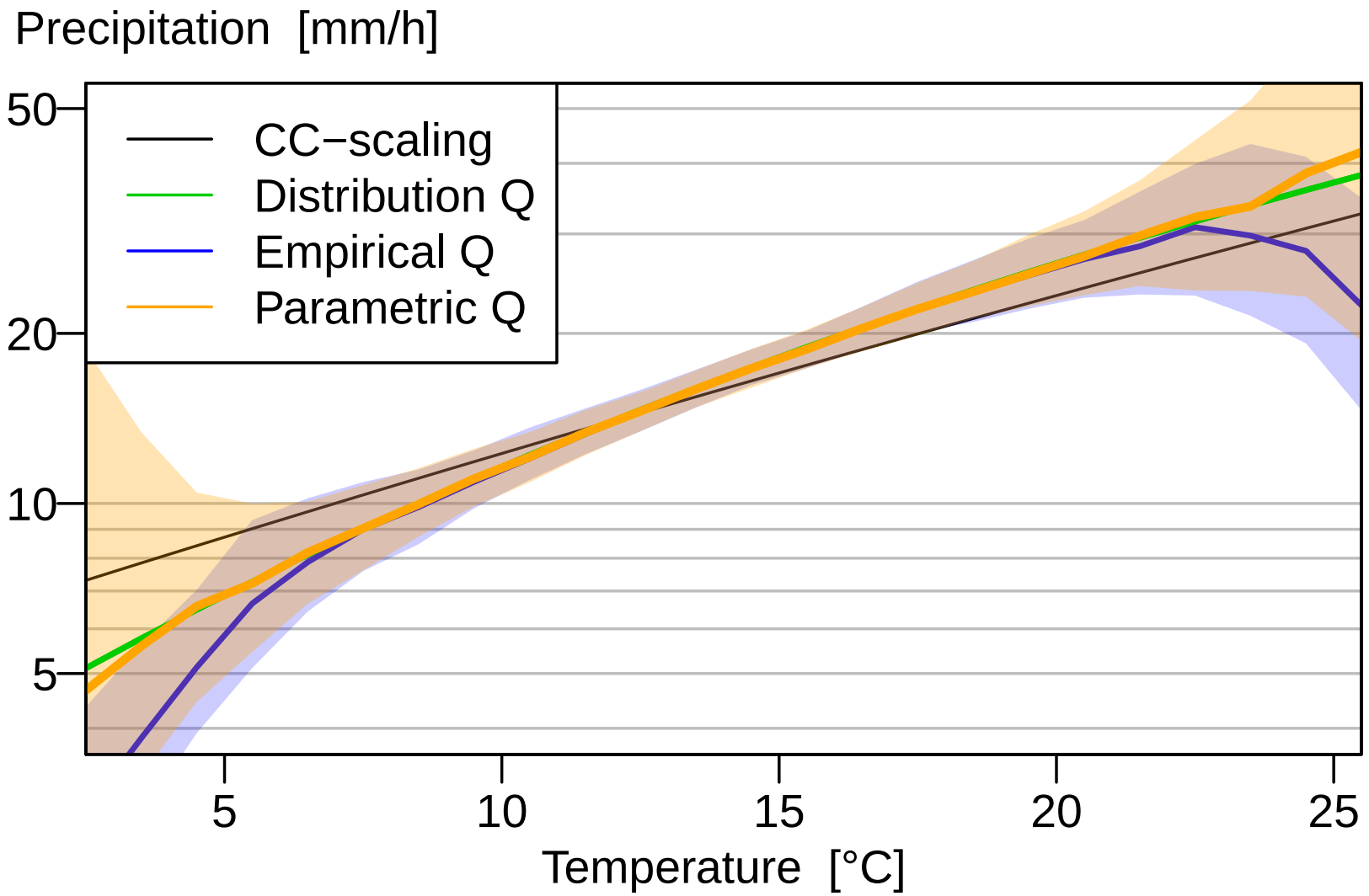
Low sample size does not underestimate high quantiles if you use
Parametric quantile: quantile from distribution fitted to sample



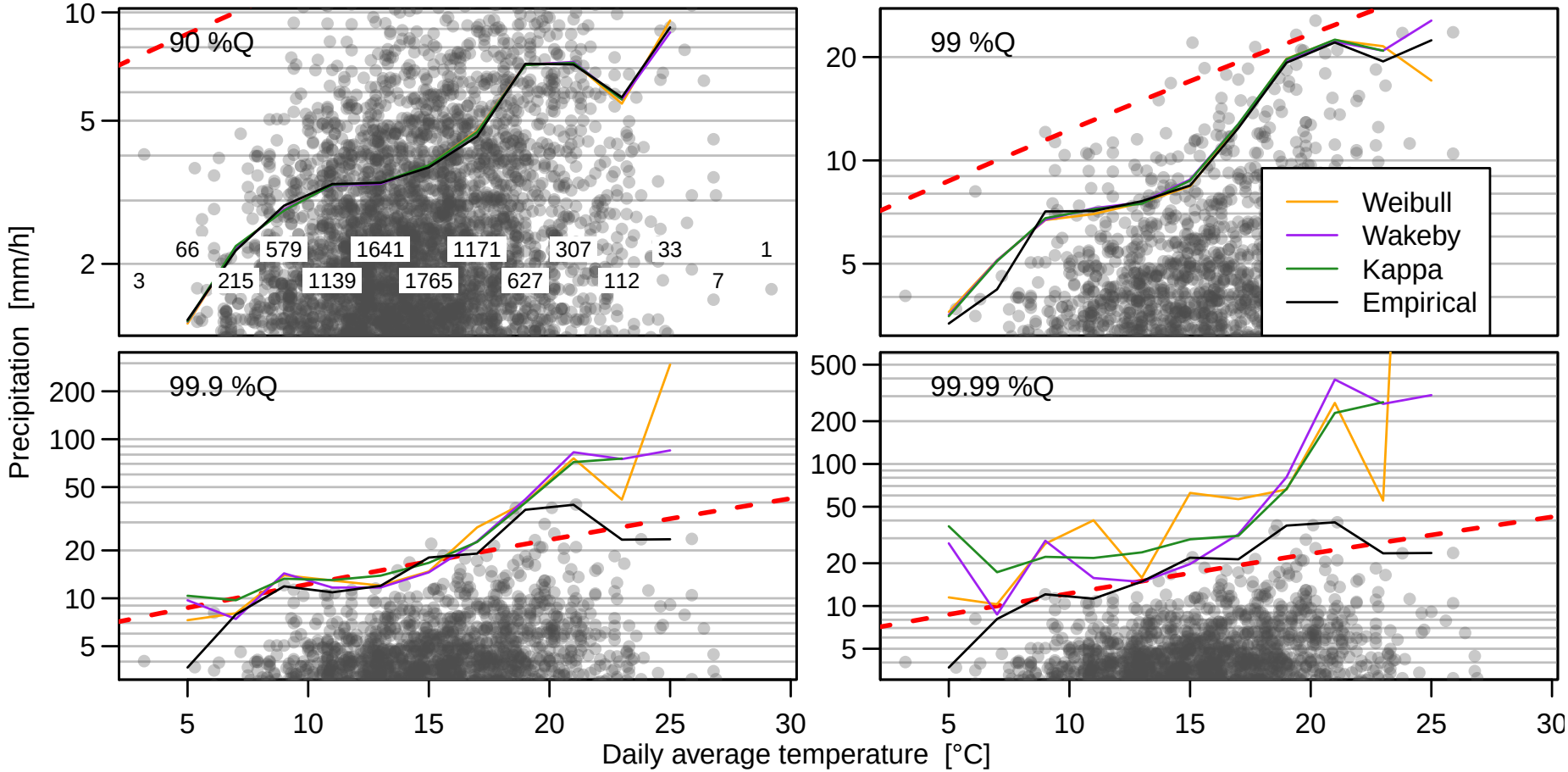
In a synthetic, continuously rising PT-relationship, simulated empirical quantiles show observed drop



In a synthetic, continuously rising PT-relationship, parametric quantiles do not drop at high temperatures



parametric truncated quantiles applied to original dataset: very high quantiles might actually continue to rise with temperature



That's why you need an umbrella on hot days

precipitation intensity drop at high temperatures
may be an effect of sample size
and not an actual meteorological boundary

use parametric quantiles for extreme rainfall intensity estimation

github.com/brry/prectemp

berry-b@gmx.de

```
devtools::install_github("brry/extremeStat")
distLquantile(x, probs=0.999, truncate=0.8, plot=TRUE)
```

Distribution	Q 99.9%
wak	23.903843
kap	23.857294
wei	25.809802
gpa	21.305499
pe3	27.480982
ln3	32.388869
gno	32.388869
gev	35.685466
gum	23.770059
glo	45.456163
exp	36.798357
ray	17.076555
gam	17.612948
lap	19.765904
rice	13.889985
nor	13.746608
revgum	9.940204
quantileMean	23.424439