STRESS-TESTING THE BUFFERING ROLE OF GLACIERS IN THE RHINE BASIN

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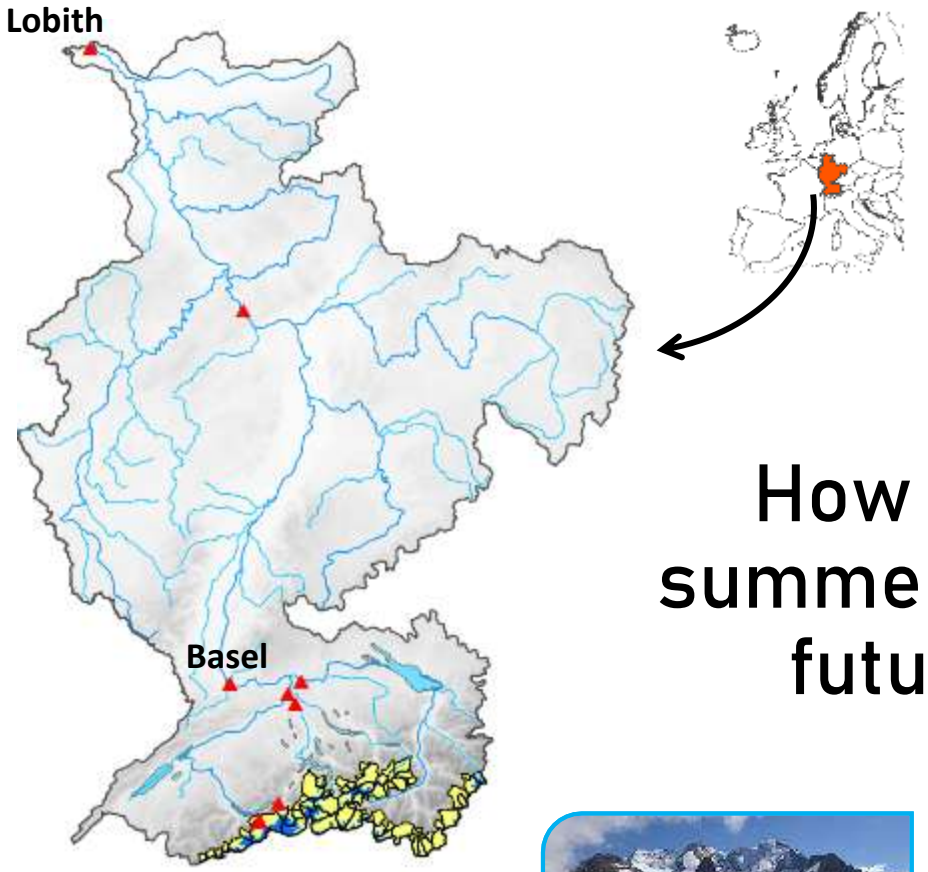


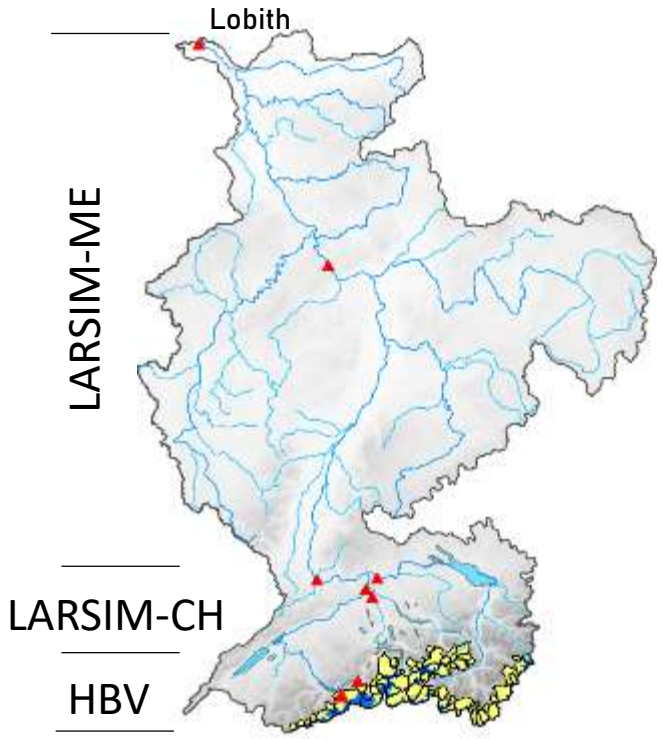
How much worse could summer low flows get under future glacier retreat?

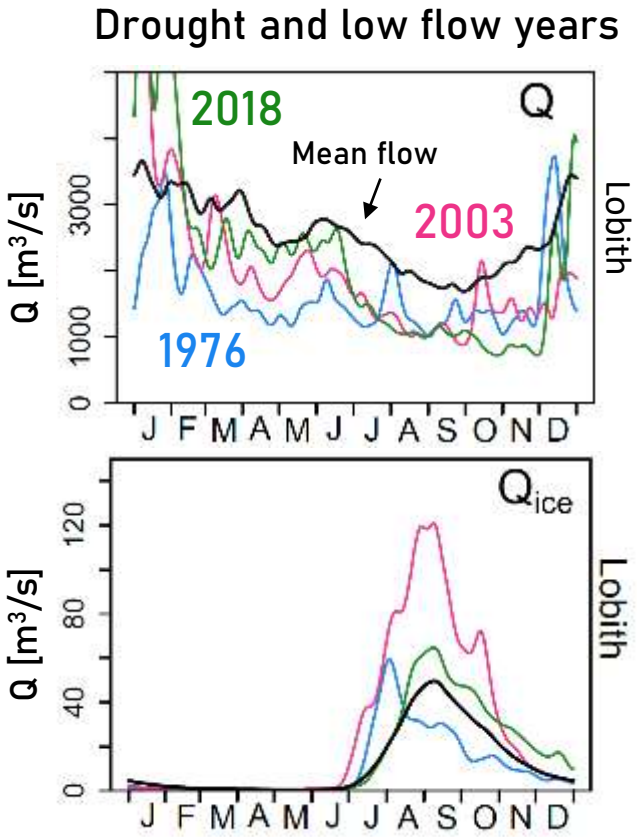
EGU
HS2.4.4

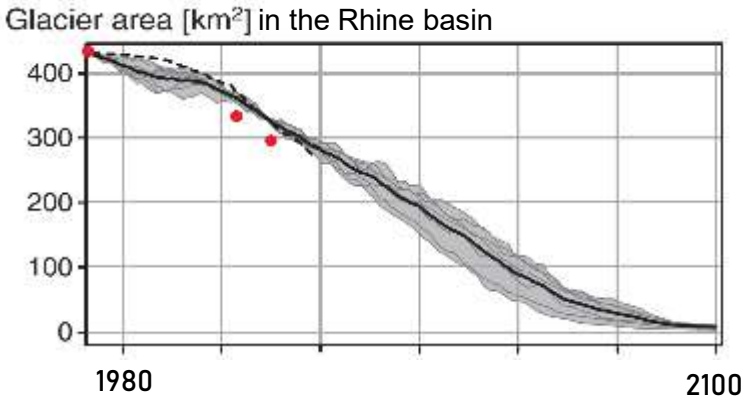
27-5-22

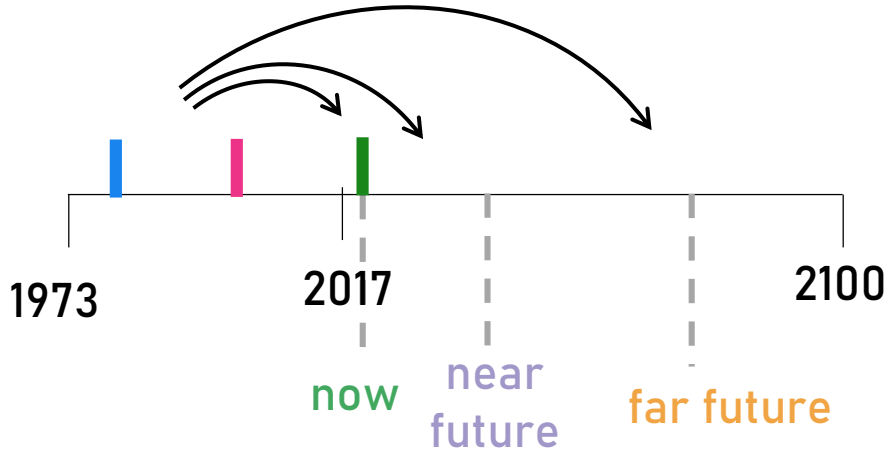
Rhine low flow photo credit: Thomas Frey/dpa/picture-alliance/Newscom

Buffering role of glaciers and stress-test model experiment









meteorological conditions of past low flow years → future conditions

European Alps – mountain water towers:

Melt from snow and glaciers provide water during meteorological **drought** → What if glaciers further retreat?

Drought and low flow years….

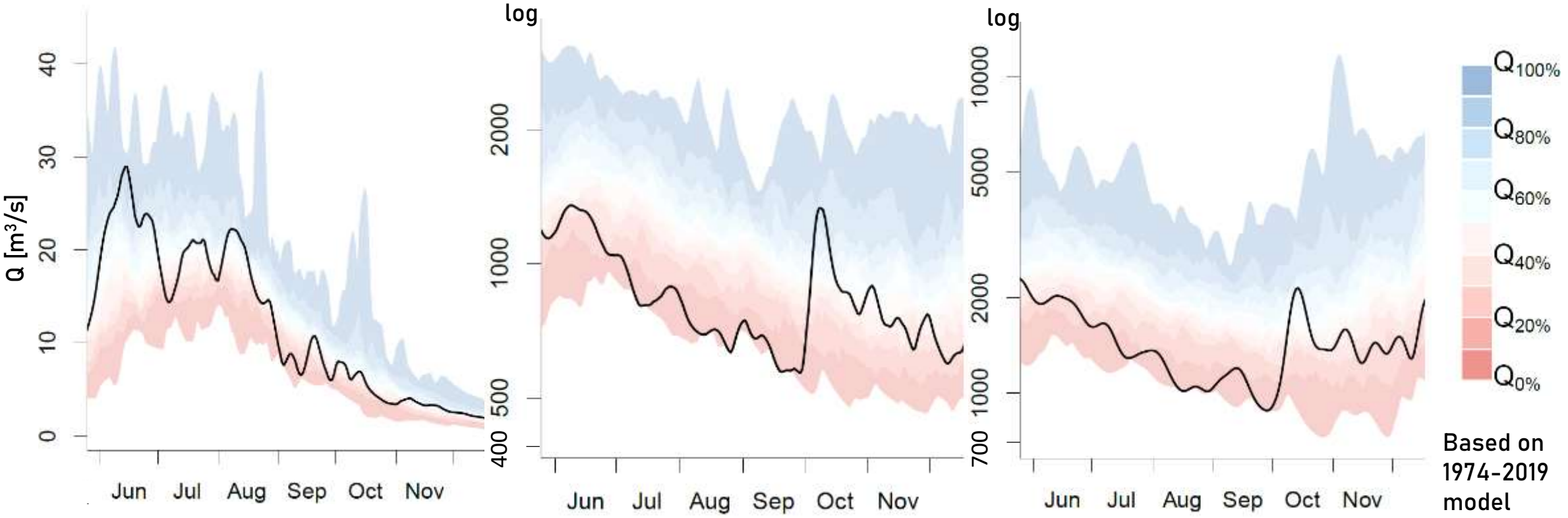
2003

Upstream to downstream along the Rhine

Weisse Luetschine

Basel

Lobith



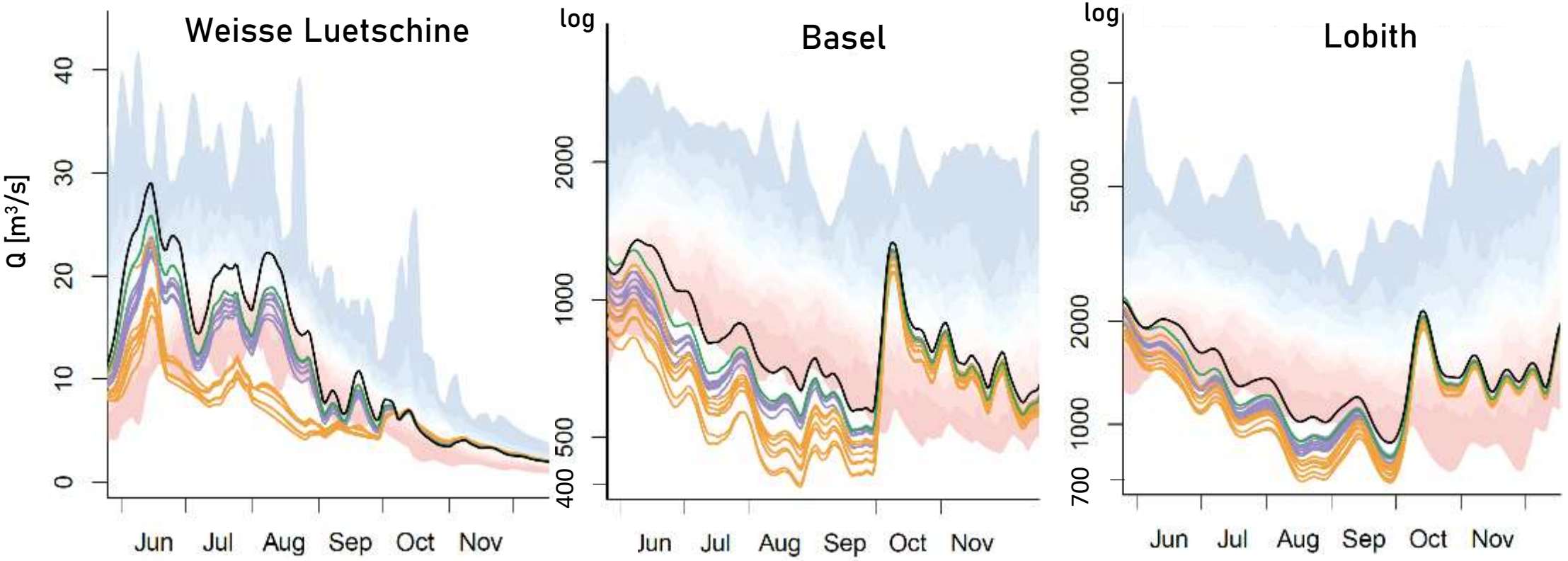
Based on 1974-2019 model simulations

Drought and low flow years…. in different future conditions

Upstream to downstream along the Rhine

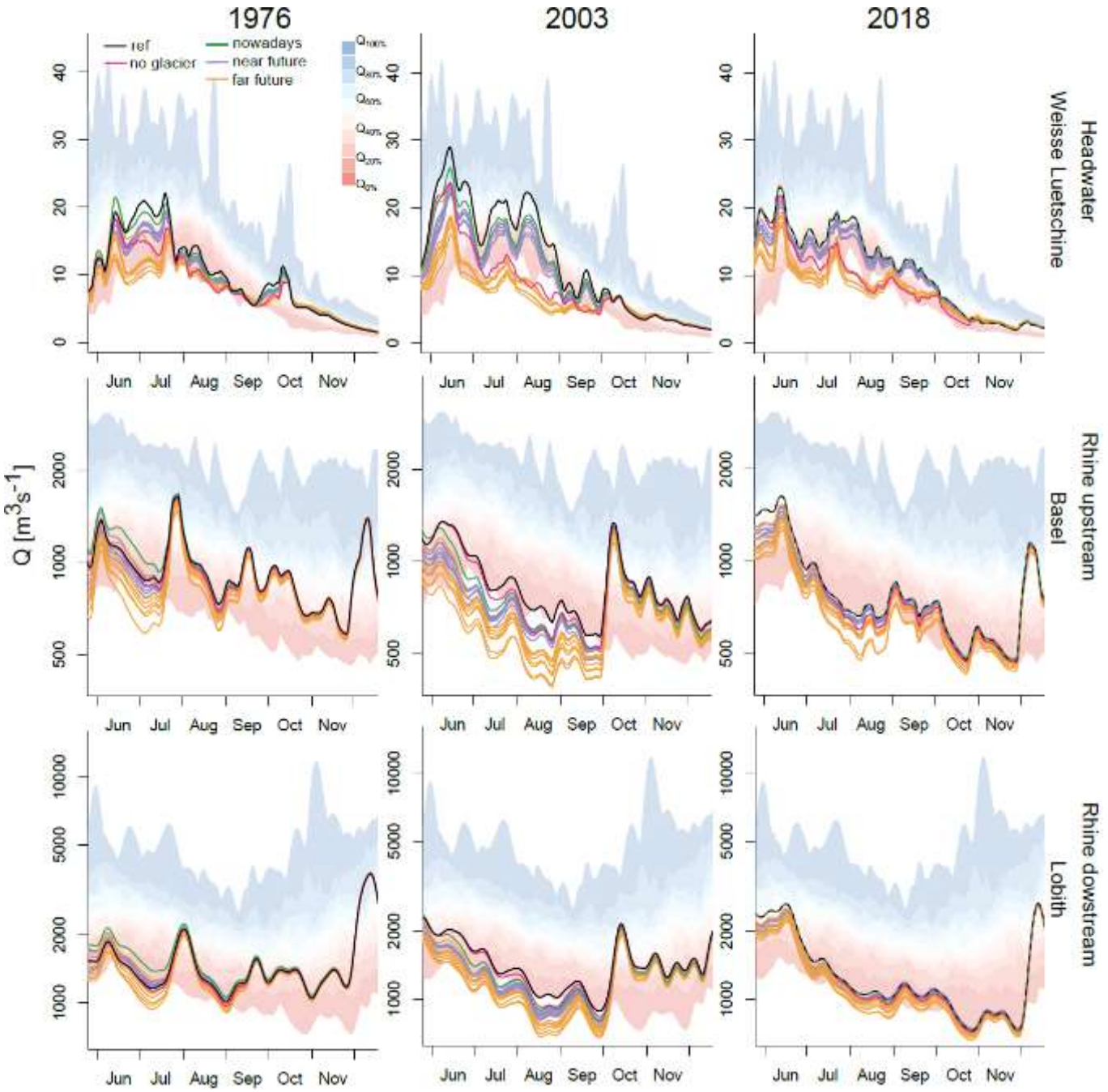
Nowadays
Near future
Far future

7 climate model states

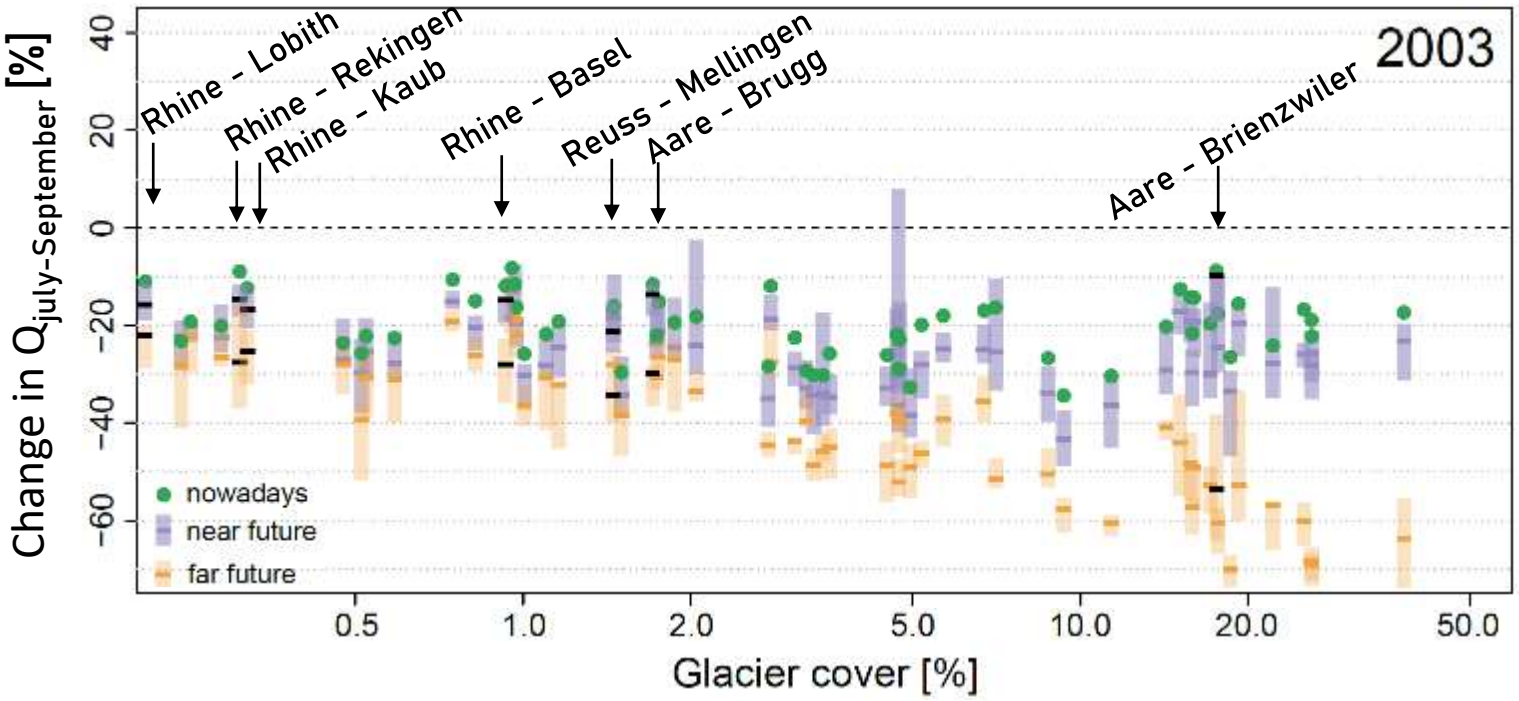


Drought and low flow years…. in different future conditions

- Different drought years → different timing of streamflow changes
- ‘no-glacier’ scenario not worst case scenario due to combined effect of changes in both snow- and glacier melt and changed catchment conditions in the future condition stress-test scenarios



Changes in summer (low) flows



Conclusions

- Low flow years aggravate in future conditions with retreated glaciers
- Streamflow changes are strongest in far future conditions
- Differences between up- and downstream impacts on streamflow

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Van Tiel et al. (ERL, in review)

Stahl et al. (2022) – Impact of climate change on the rain, snow and glacier melt components of streamflow of the river Rhine and its tributaries – CHR report