



u^b

^b
UNIVERSITÄT
BERN

OESCHGER CENTRE
CLIMATE CHANGE RESEARCH

International Symposium on Climate Impacts on Low Flows and Droughts 1-2 March 2012, Vienna

The **implications** of projected climate change
on **summer low flow** in the **Swiss Plateau**
based on a **multi-variable calibration** of
the hydrological modeling system **PREVAH**

Meyer Raphael,

Schädler Bruno, Viviroli Daniel & Weingartner Rolf

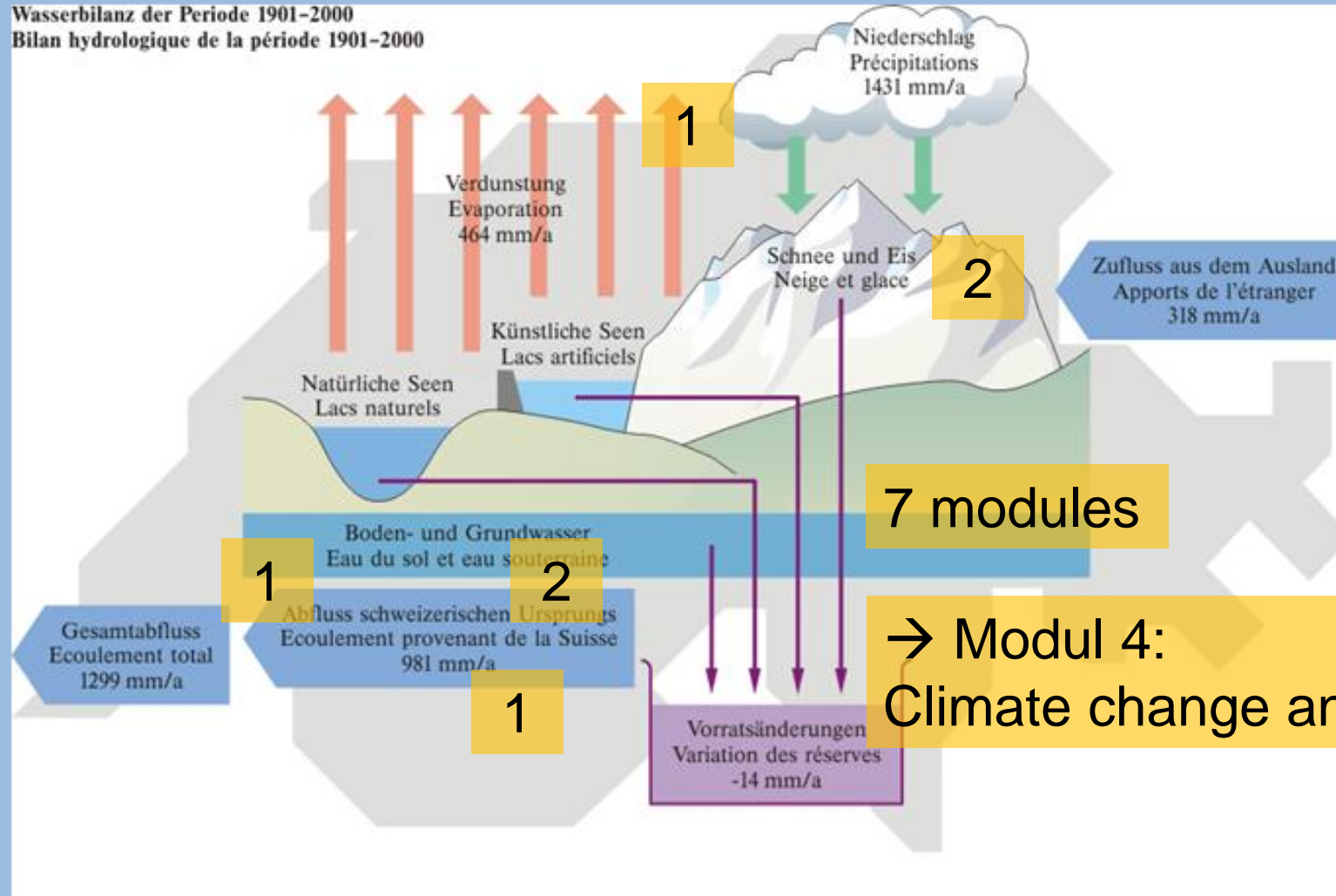
Oeschger Centre for Climate Change Research

University of Bern, Institute of Geography

Hydrology Group

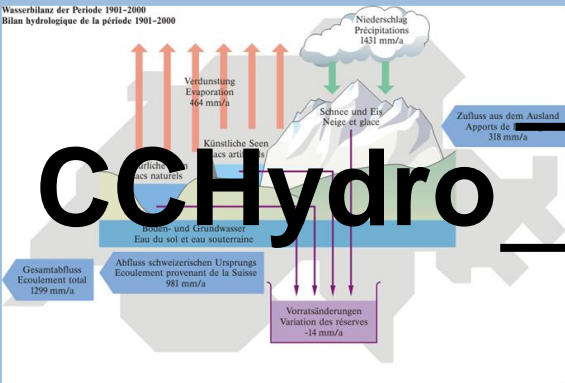
CCHydro – Climate Change Switzerland Hydrology

Wasserbilanz der Periode 1901-2000
Bilan hydrologique de la période 1901-2000



→ Modul 4:
Climate change and low flow

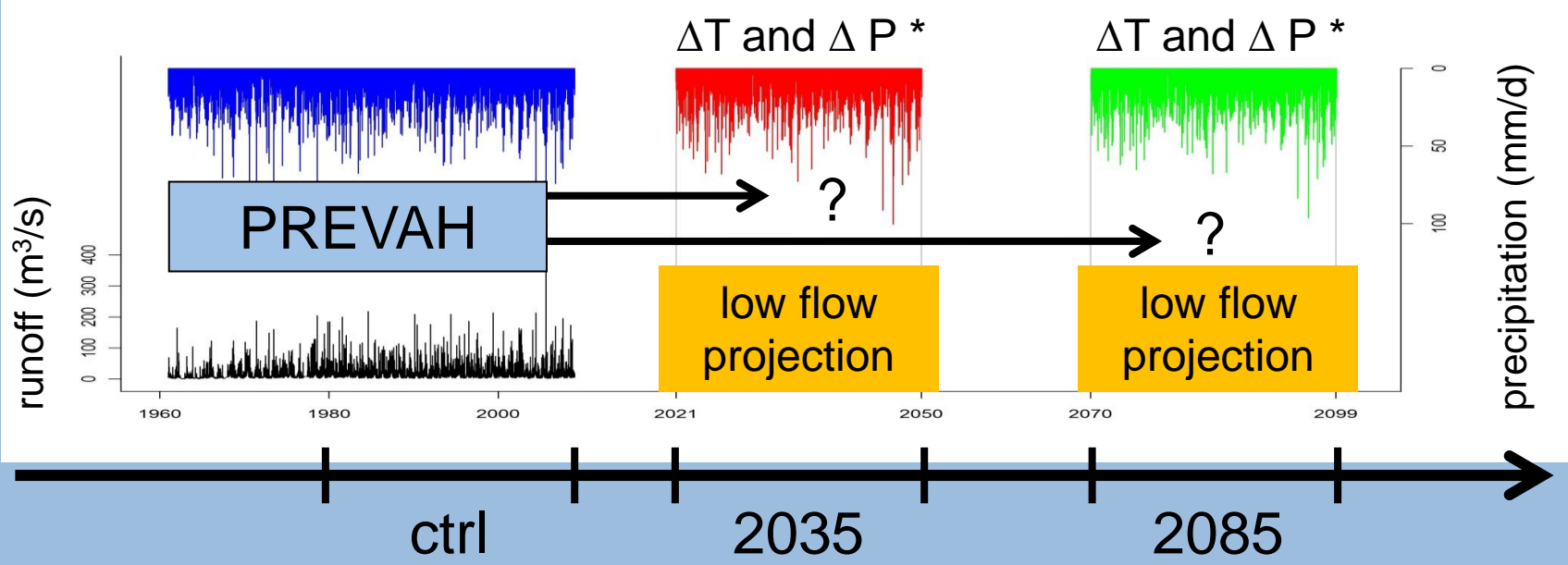
The project's target projections of future flow conditions



near
future

far
future

CCHydro low flow

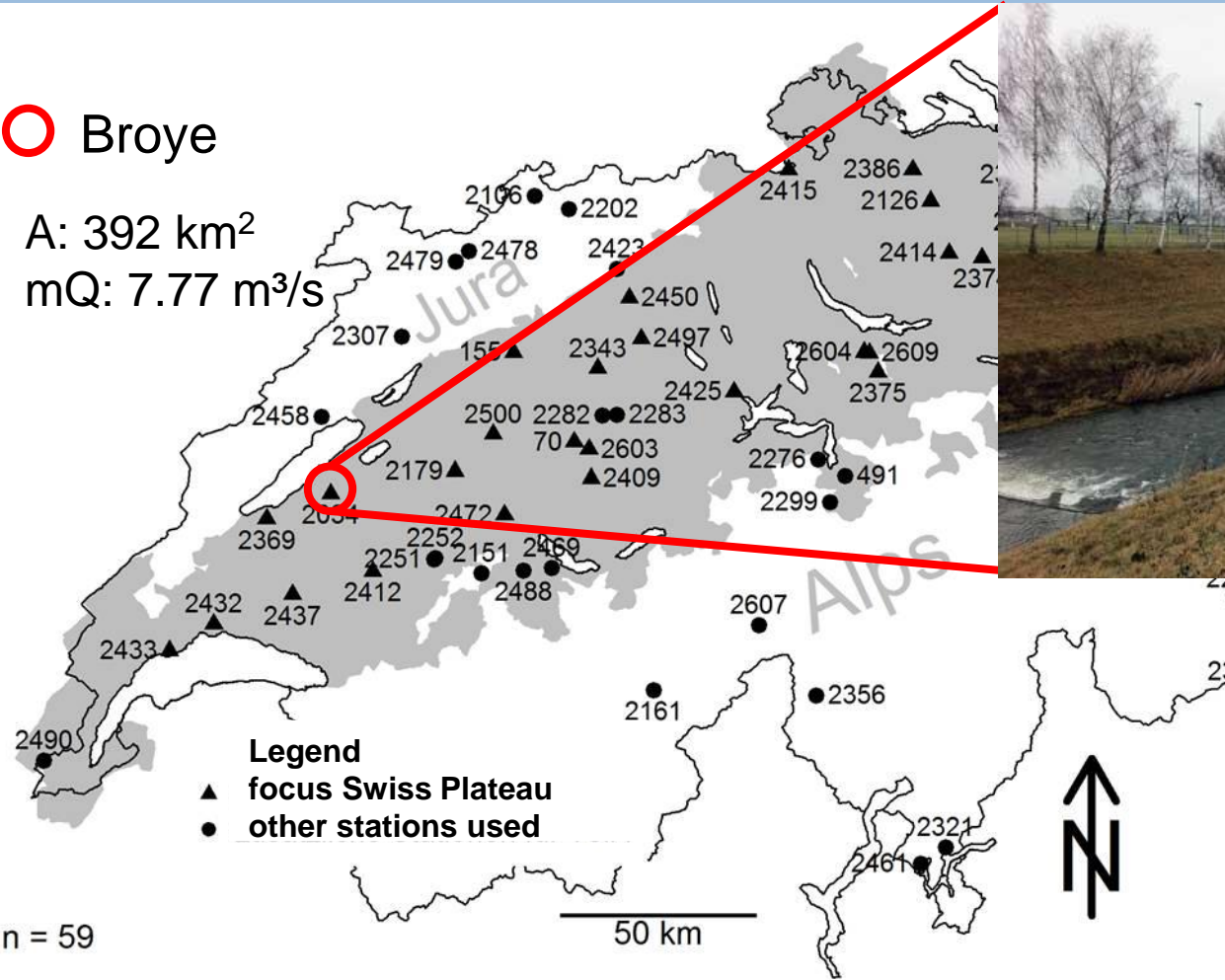


Study site

The Swiss Plateau

○ Broye

A: 392 km²
mQ: 7.77 m³/s

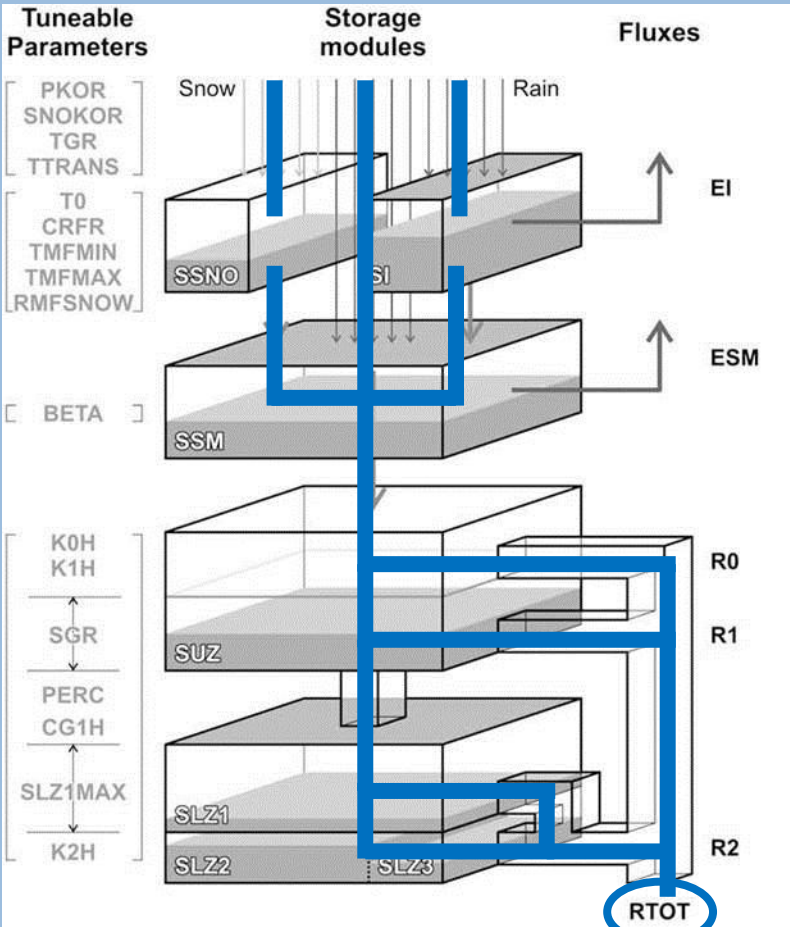


(BAFU, 2012)

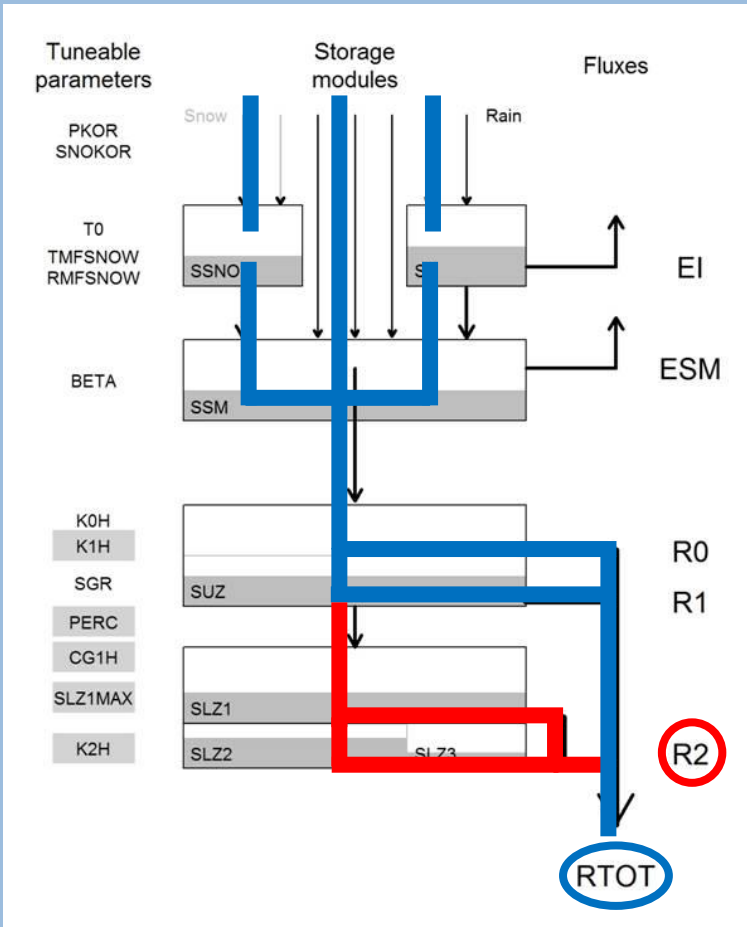
(Meyer, 2012)

New specification of PREVAH – Precipitation Runoff Evapotranspiration Hydrotope model

singlePREVAH

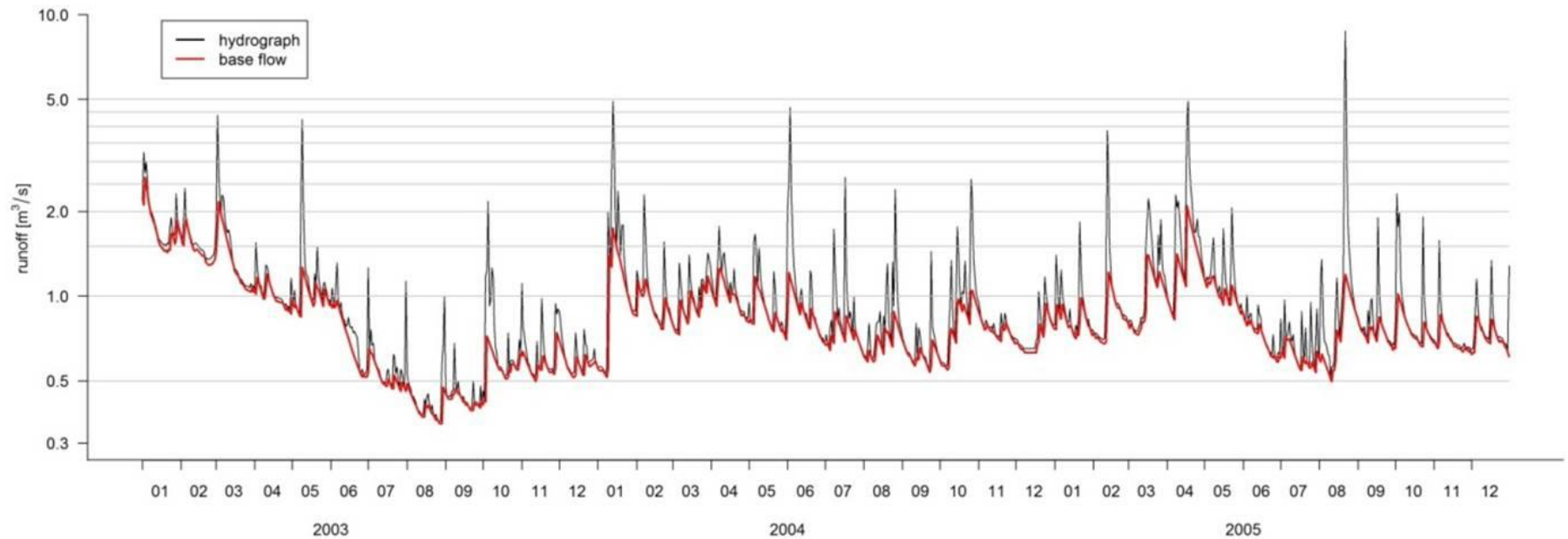


multitPREVAH

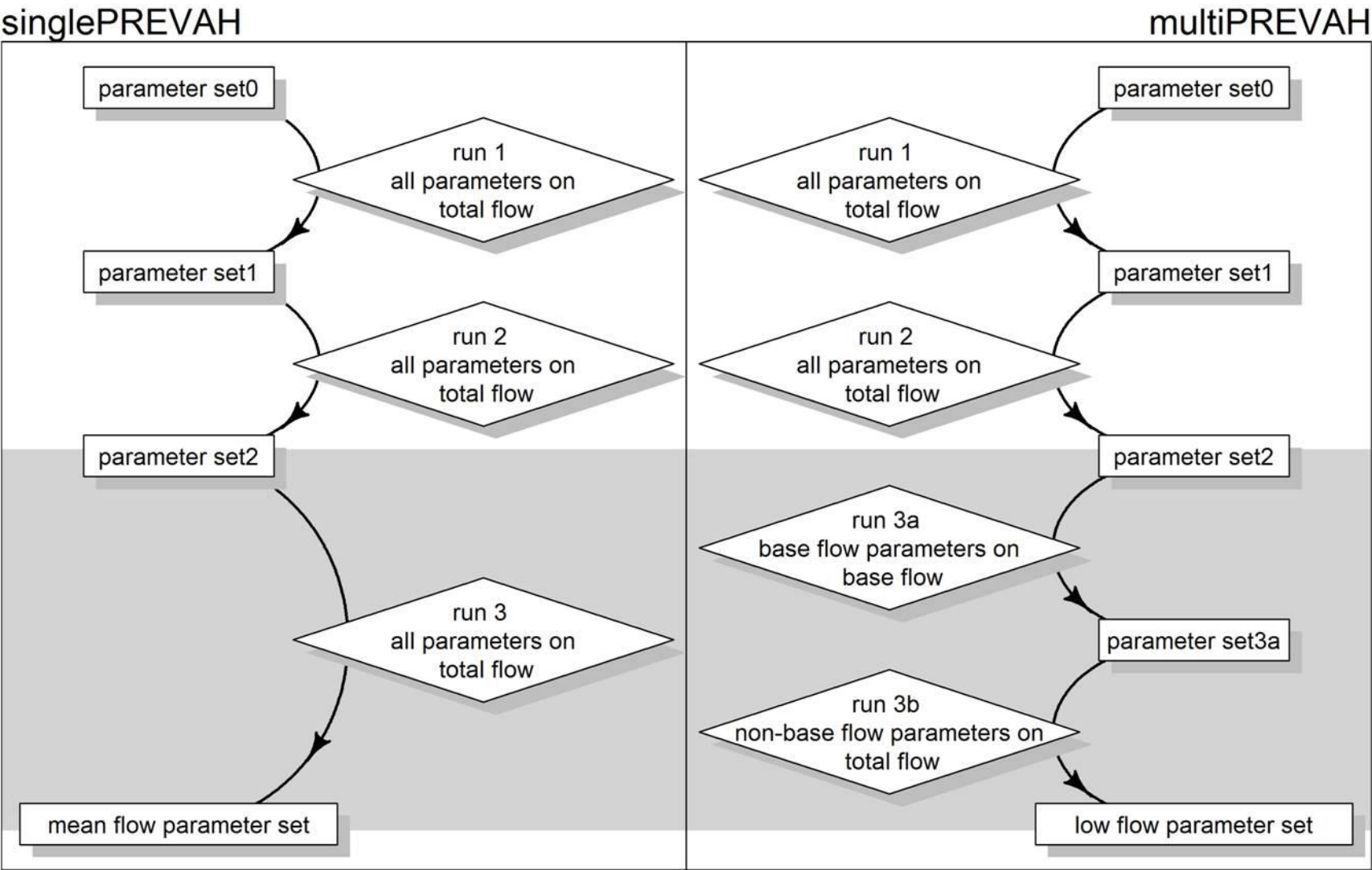


Second variable

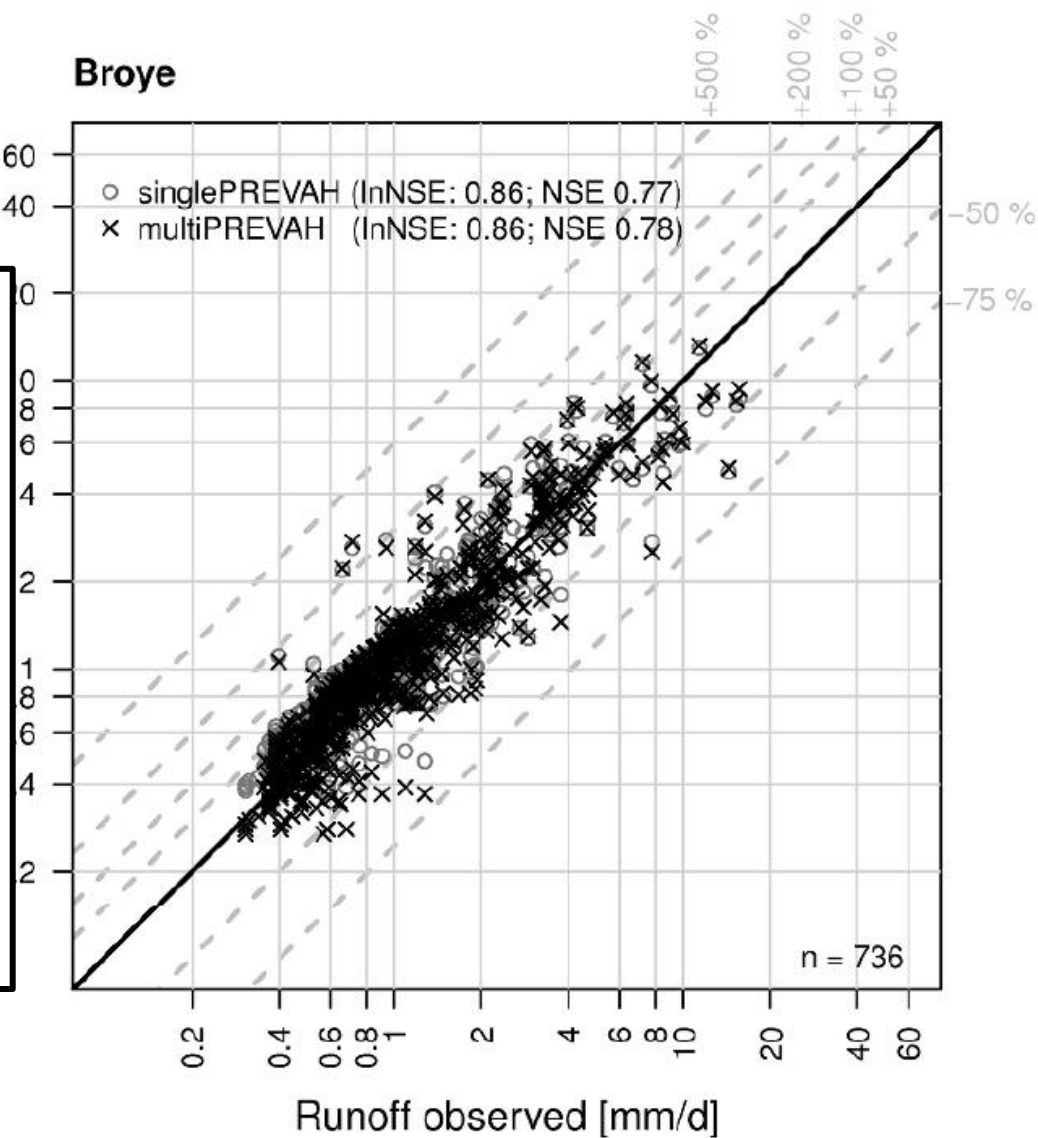
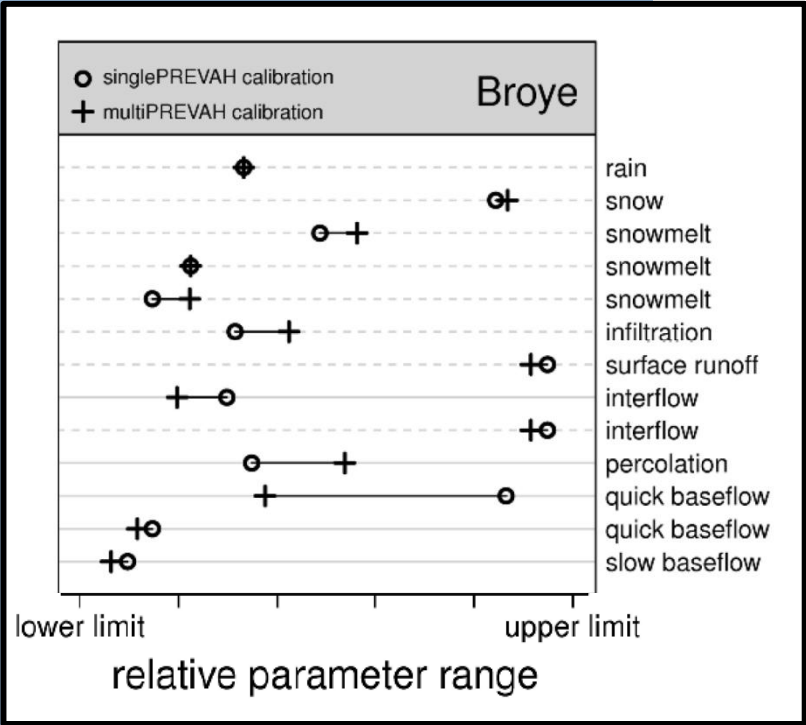
Base flow Wittenberg



Calibration procedure



Calibration (1994-1997)



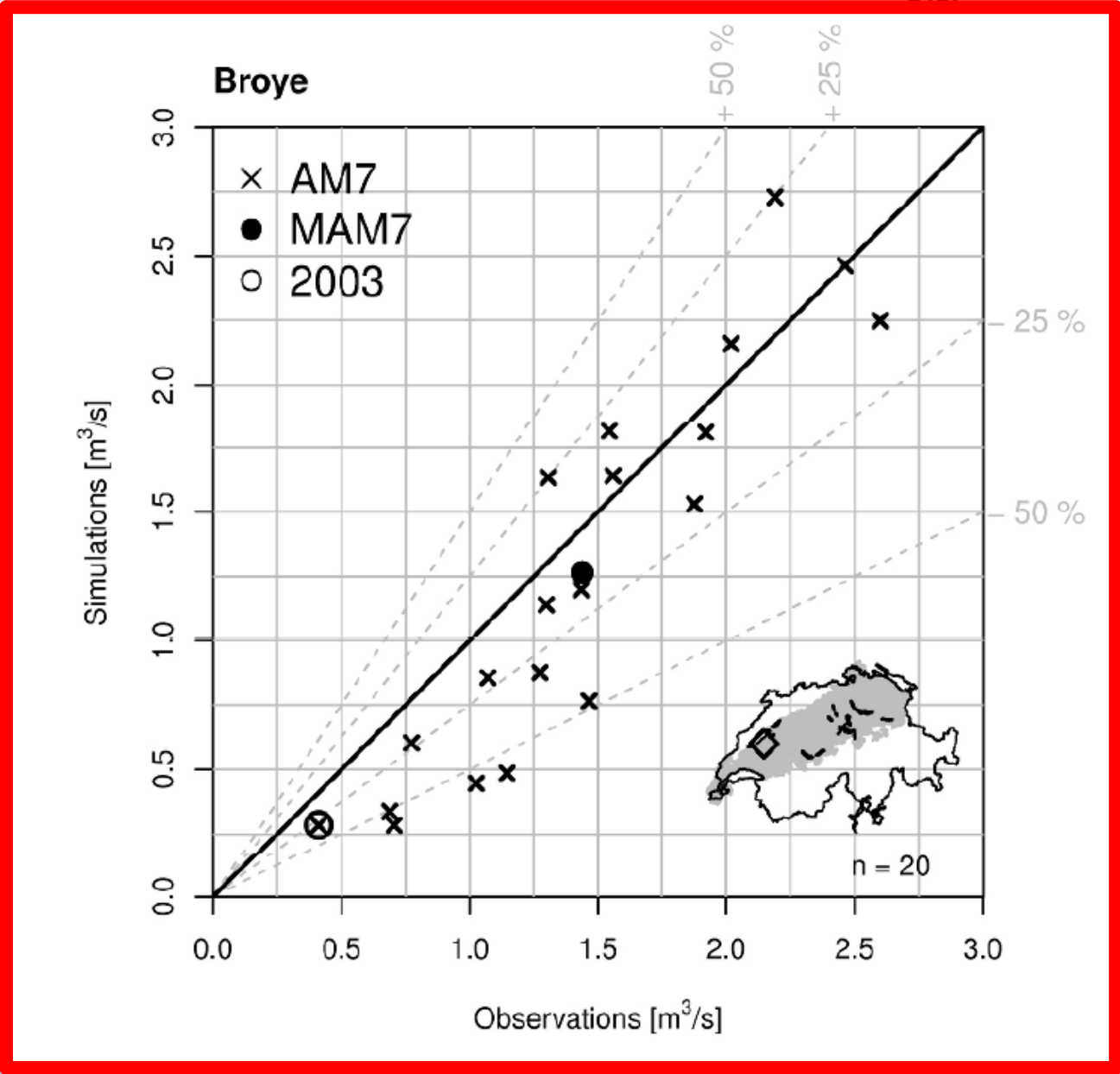
Validation (1984-2009)

strong

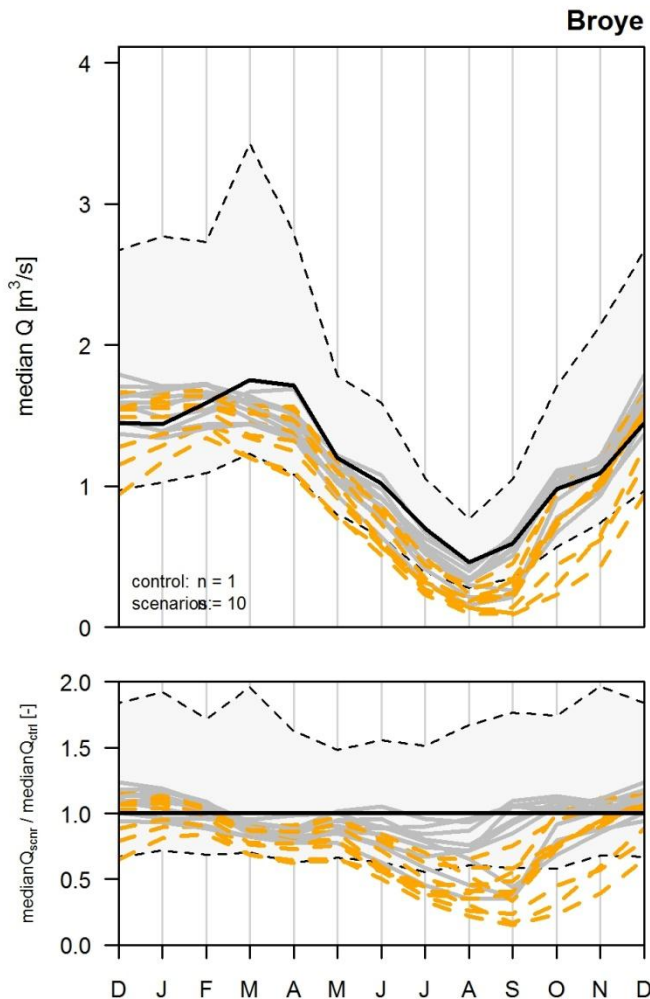
intermediate

weak

(Schöner et al., 2011)



Impact on flow regime

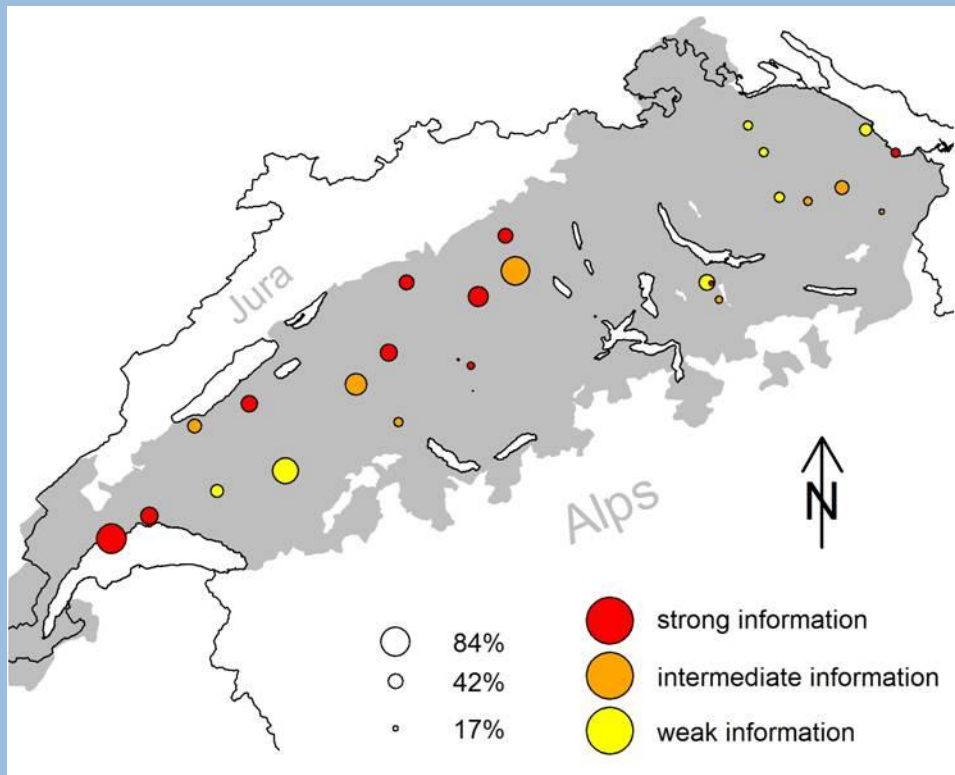


— control 1995
— scenarios 2035
— scenarios 2085
--- interquartile range

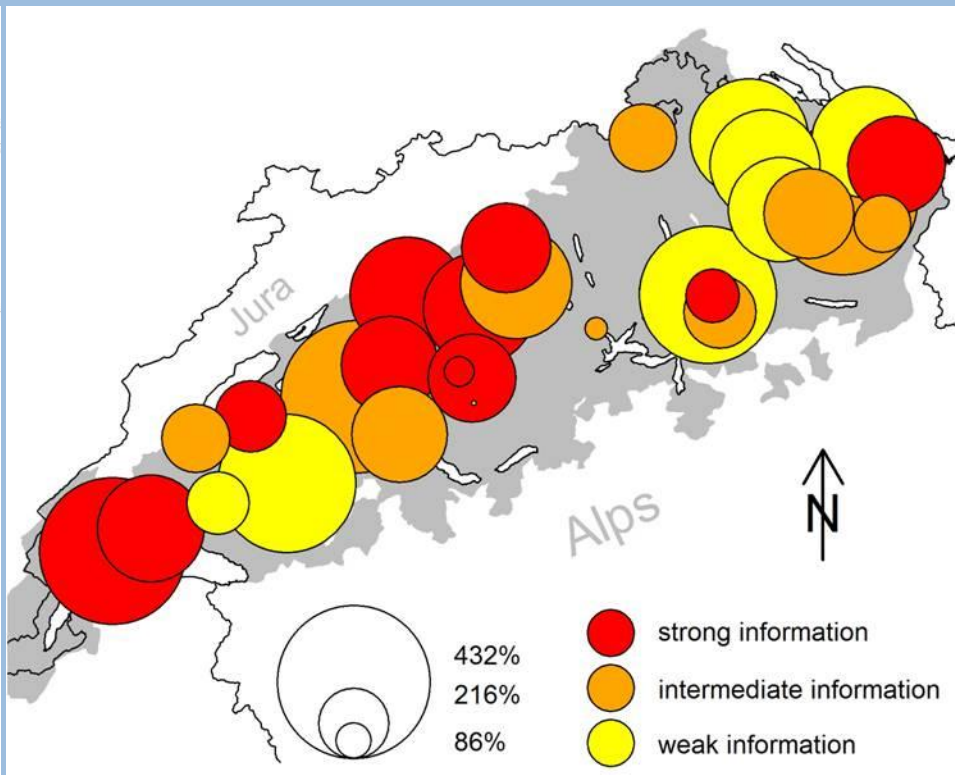
- > Decrease in JJA
- > Possible decrease in SON
- > Envelope of IR is possibly abandoned from May to November

Impact on deficit volume (volume below MAM7_{ctrl})

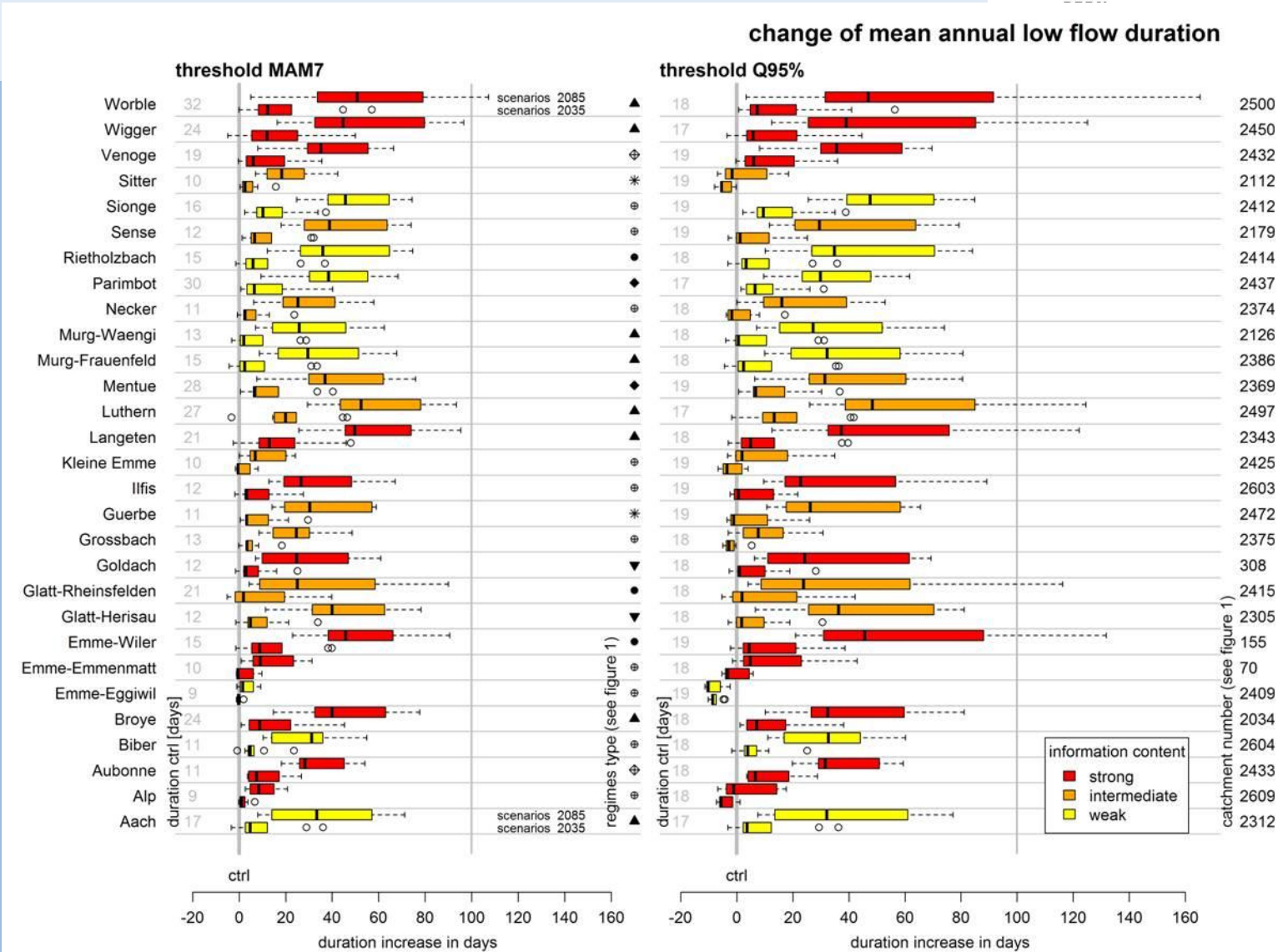
near future (2035)



far future (2085)

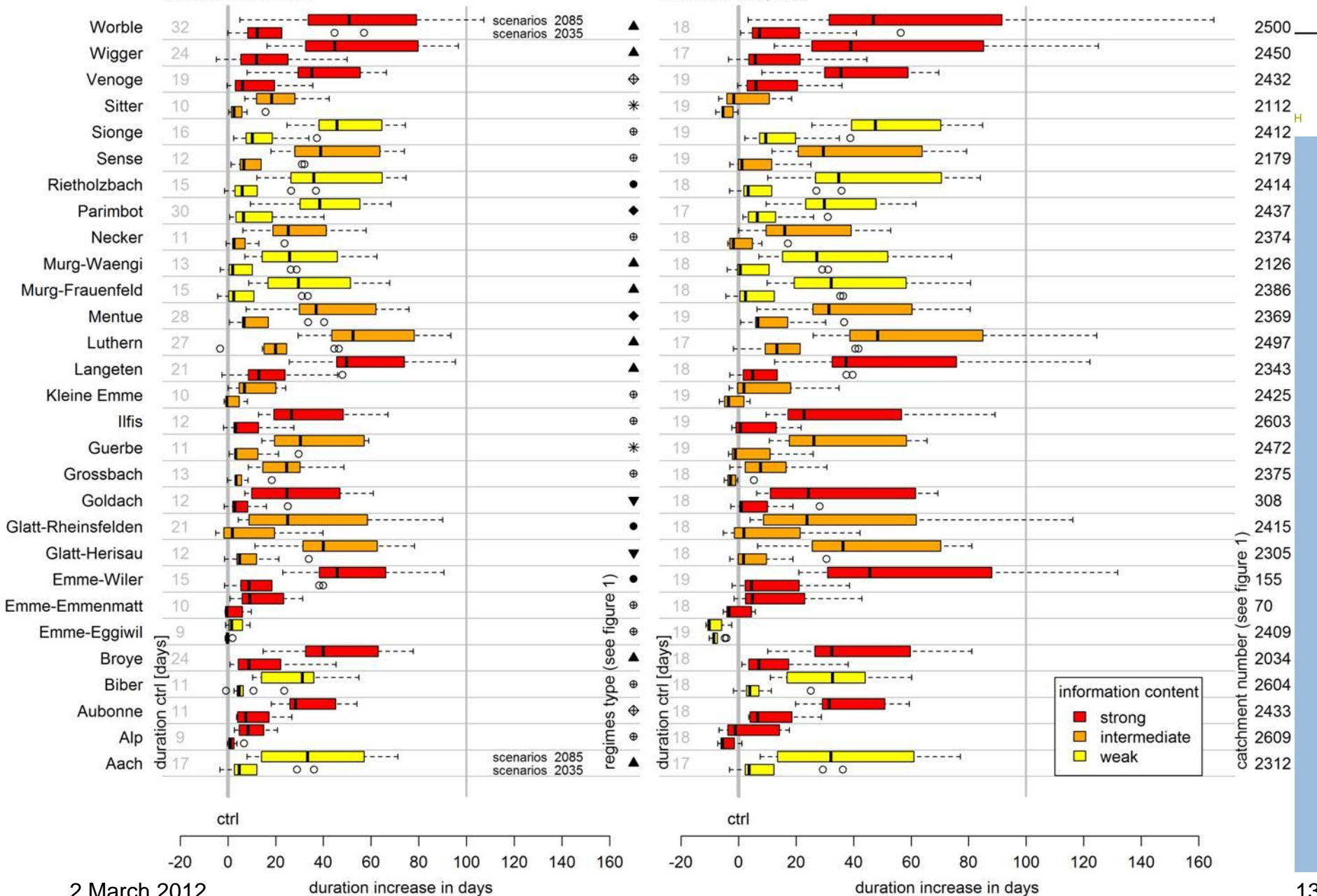


Impact on duration



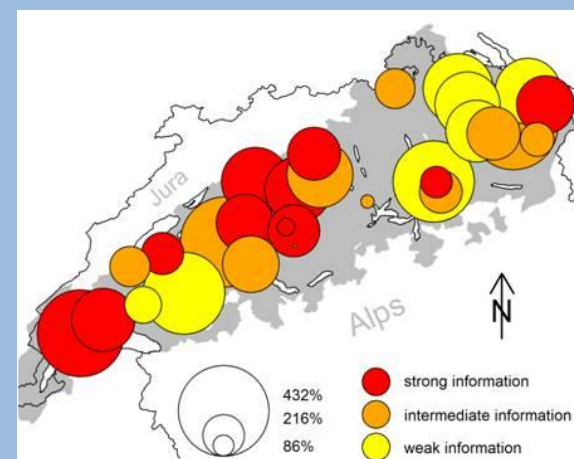
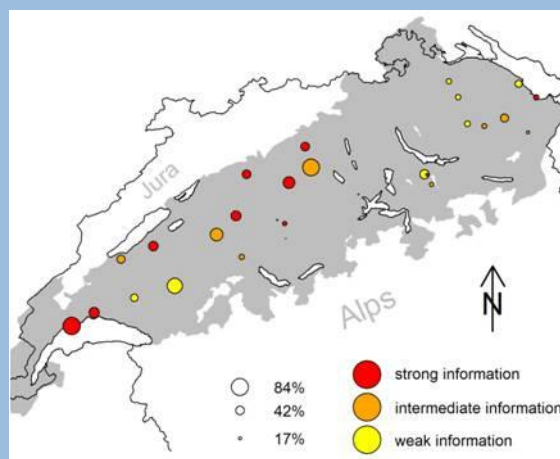
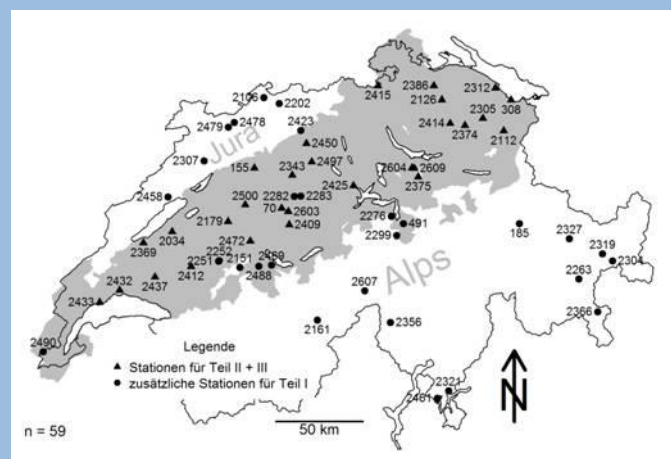
threshold MAM7

threshold Q95%



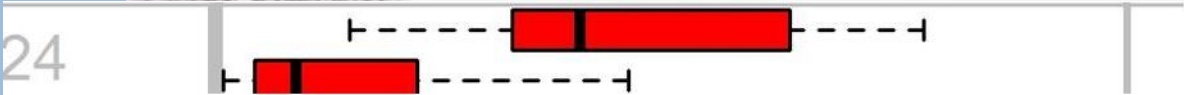
Impact – short summary

- > Impact is stronger for the far future
- > In all catchments duration of summer low flow increases
- > In the near future the eastern part of the Swiss Plateau is least affected by a deficit volume increase

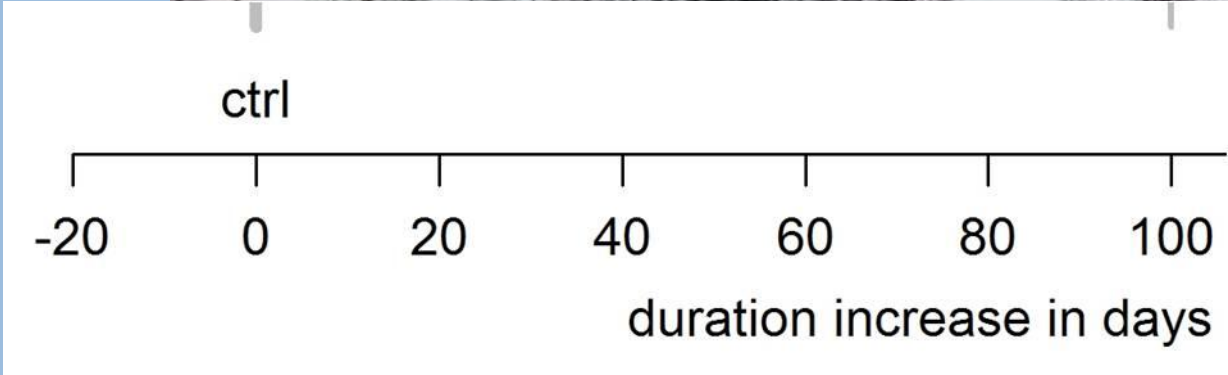


But are there implications?

MAM7_{ctrl}



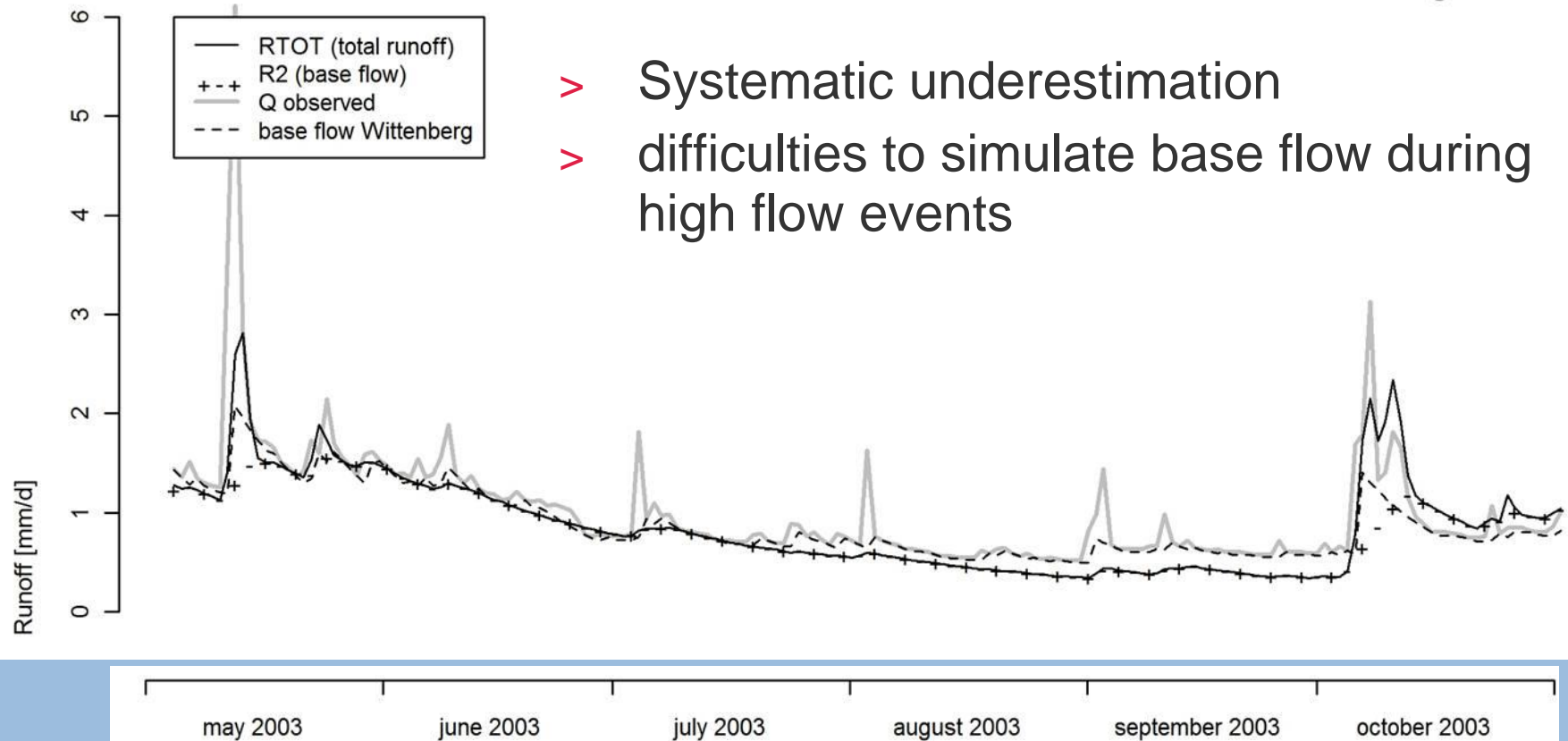
Q_{95ctrl}



Broye

Open research questions

Langeten



References

BAFU [Bundesamt für Umwelt] (2012): <http://www.hydrodaten.admin.ch/de/index.html?lang=de>.

Bosshard, T., Kotlarski, S., Ewen, T. & Schär, C. (2011): Spectral representation of the annual cycle in the climate change signal. *Hydrology and Earth System Sciences*, **15**.

Hubacher und Schädler, 2010

Meyer, R., Schädler, B., Viviroli, D. & Weingartner, R. (submitted): Multi-variable calibration for a sound modeling of low flow under future climate. *Hydrological Processes*.

Meyer, R., Schädler, B., Viviroli, D. & Weingartner, R. (to be submitted): The implications of projected climate change on summer low flow in the Swiss Plateau.

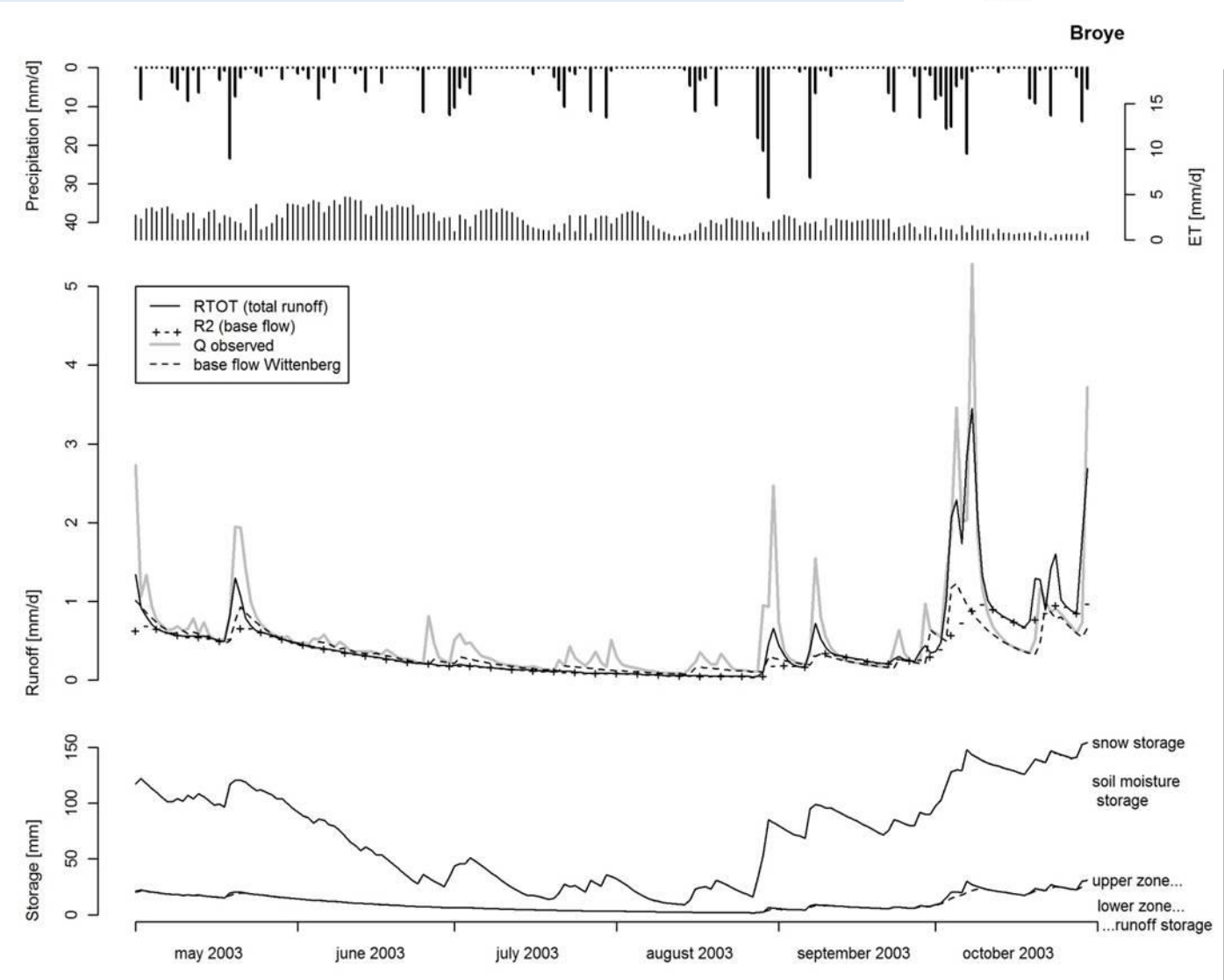
Meyer, R., Viviroli, D., Schädler, B. & Weingartner, R. (2011): Die Rolle des Basisabflusses bei der Modellierung von Niedrigwasserprozessen in Klimaimpaktstudien. *Hydrologie und Wasserbewirtschaftung*, **55**.

Meyer R. (2012) Die Auswirkungen der projizierten Klimaänderung auf Sommerniedrigwasser im Schweizer Mittelland basierend auf einer multi-variablen Kalibrierung des hydrologischen Modellsystems PREVAH. Dissertation, Universität Bern.

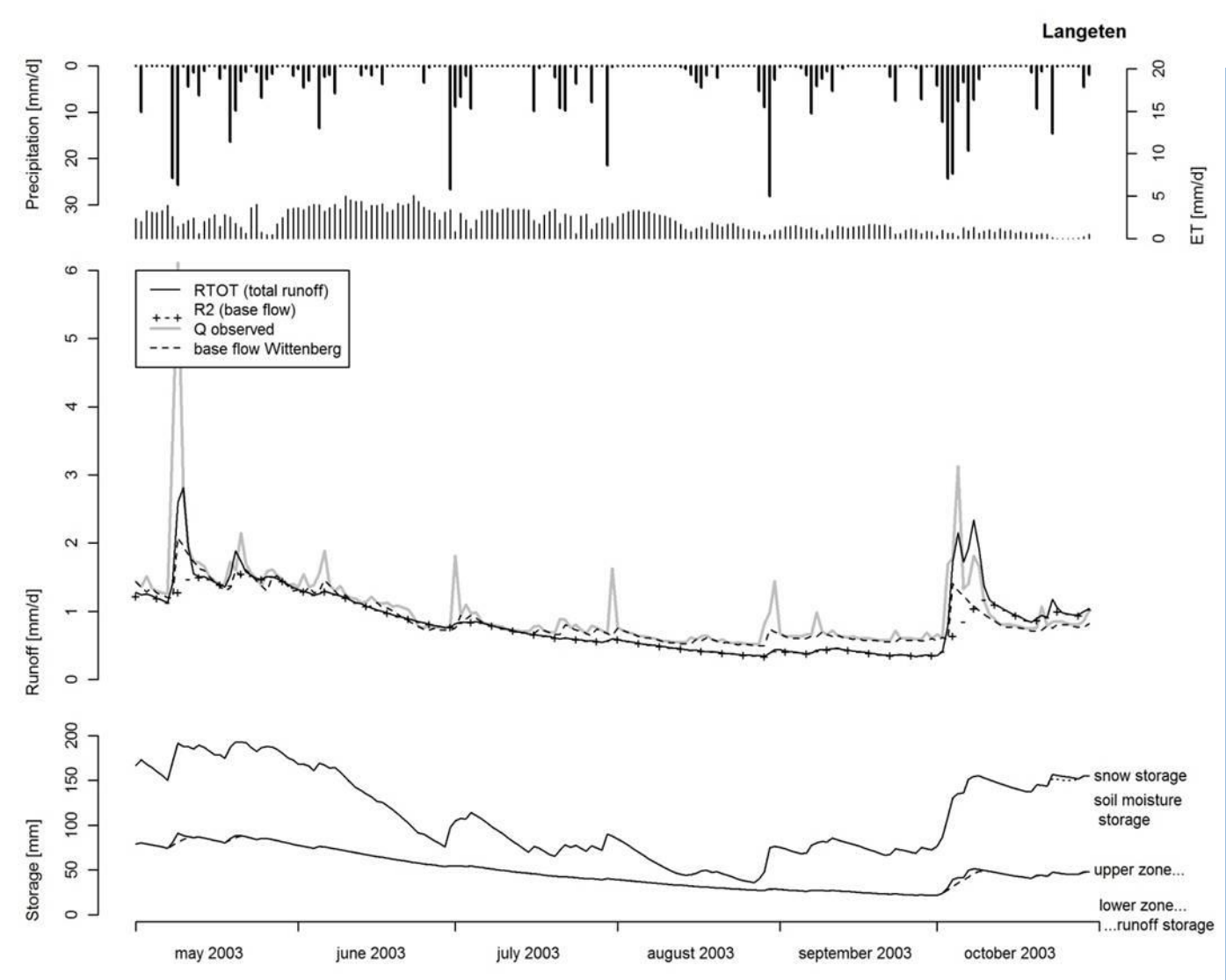
Schöner, W., Böhm, R. & Haslinger, K. (2011): Klimaänderung in Österreich – hydrologisch relevante Klimaelemente. *Österreichische Wasser- und Abfallwirtschaft*, **63**.

Viviroli, D., Zappa, M., Gurtz, J. & Weingartner, R. (2009): An introduction to the hydrological modelling system PREVAH and its pre- and post-processing-tools. *Environmental Modelling & Software*, **24**.

Appendix

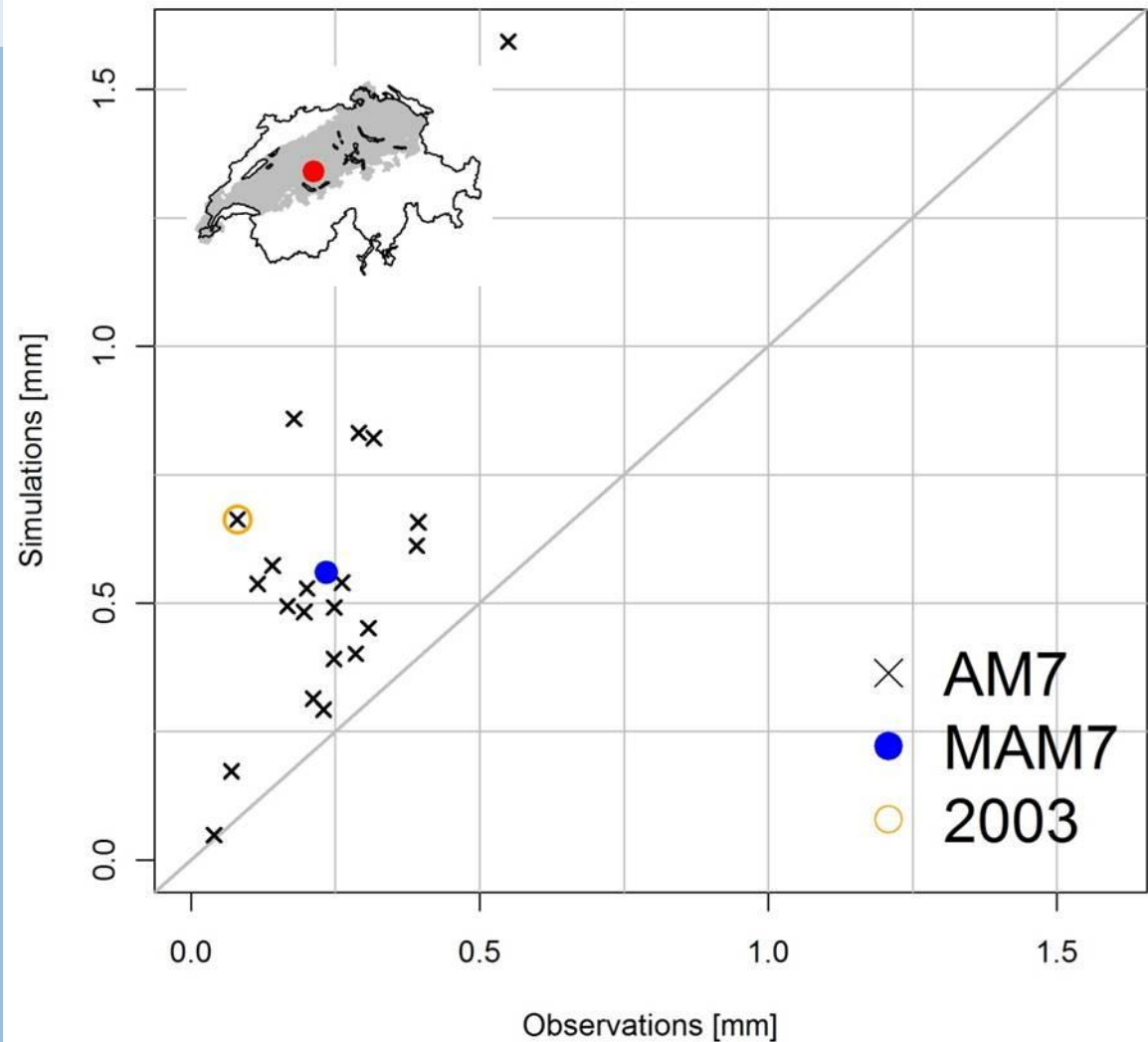


Appendix



Appendix

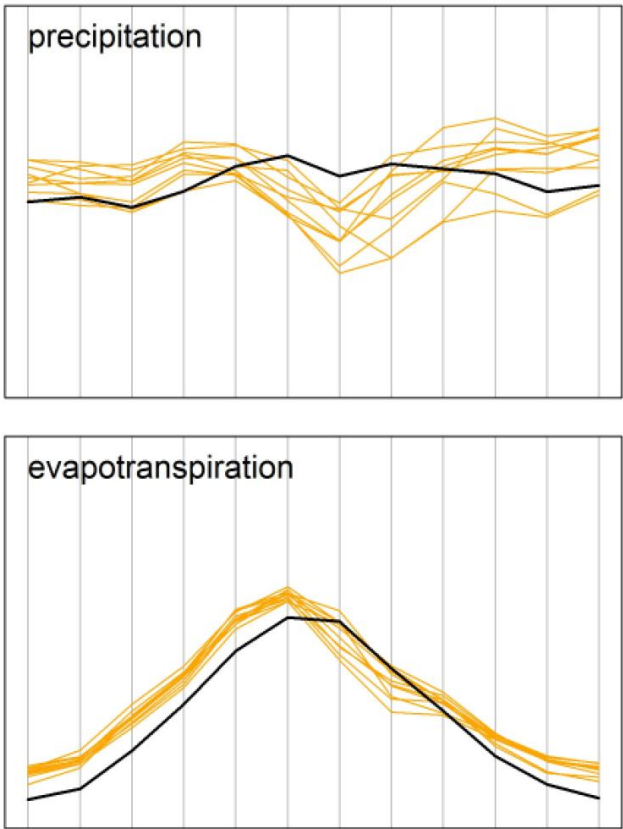
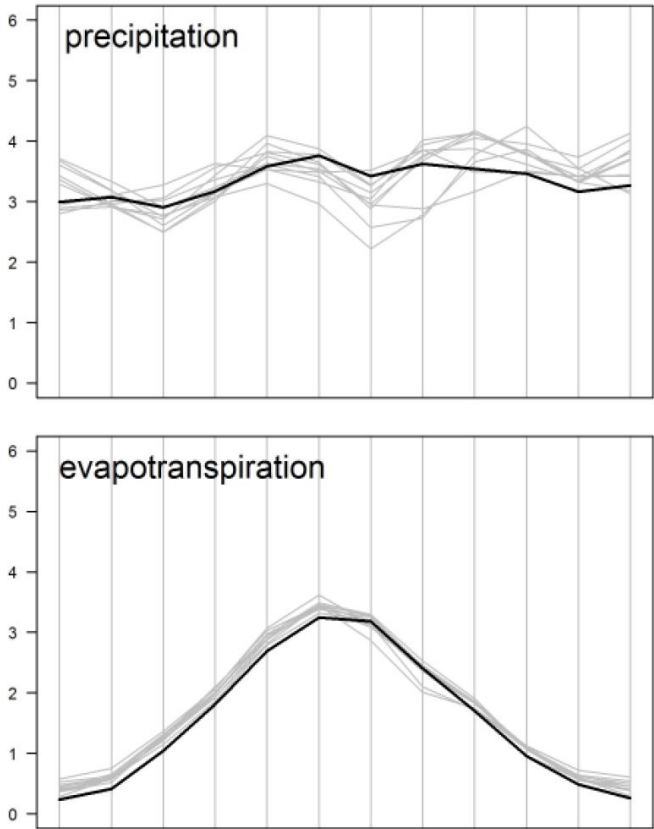
Emme-Eggiwil - AM7 during validation



m ³ /s	control period		2035 period		2085 period	
	MAM7	Q ₉₅	MAM7	Q ₉₅	MAM7	Q ₉₅
Aach	0.08	0.08	0.07	0.07	0.03	0.03
Alp	0.52	0.40	0.51	0.44	0.42	0.41
Aubonne	0.34	0.42	0.26	0.33	0.13	0.16
Biber	0.13	0.14	0.11	0.12	0.06	0.07
Broye	1.26	1.00	1.01	0.77	0.54	0.45
Emme Eggivil	0.80	0.37	0.81	0.52	0.72	0.55

Appendix

Broye



Appendix

