Karlsruhe Institute of Technology

WaSiM simulations for the Ammer catchment driven by high resolution RCM data

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Institute for Meteorology and Climate Research (IMK-IFU)

CEDIM

CEDIM-Project „*Flood Hazards in a Changing Climate* "

CEDIM-Project „*Flood Hazards in a Changing Climate* "

KIT: **IMK-TRO: P. Berg, H. Feldmann, G. Schädler**
IWG: J. Ihringer, J. Liebert
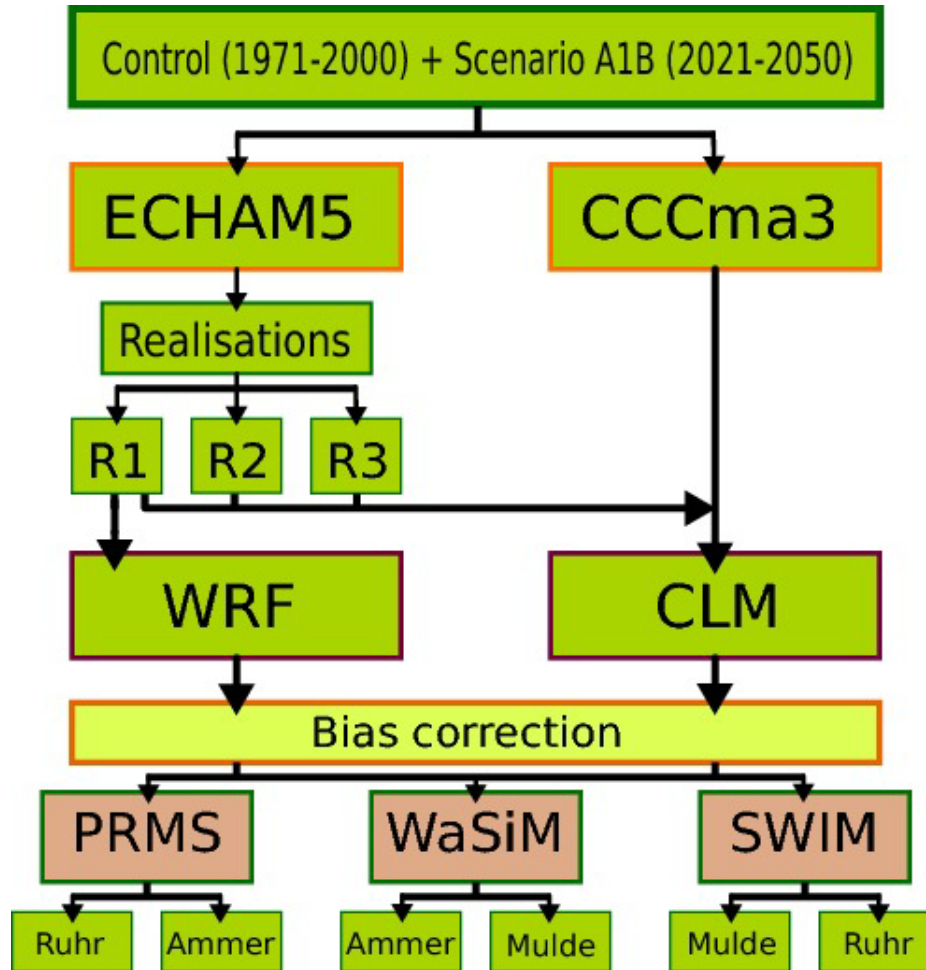**IMK-IFU: H. Kunstmann, I. Ott, S. Wagner**

GFZ: **Section 5.4: D. Duethmann, B. Merz**

Project Report: Flood Hazards in a Changing Climate
Schädler et al., 2012

CENTER FOR DISASTER MANAGEMENT AND RISK REDUCTION
TECHNOLOGY

www.cedim.de

Methodology: Schematic of model chain

Further Literature:

Berg P, Wagner S, Kunstmann H, Schädler G (2011) *High resolution regional climate model simulations for Germany: Part I - validation.* Climate Dynamics submitted.

Wagner S, Berg P, Schädler G, Kunstmann H (2011) *High resolution regional climate model simulations for Germany: Part II - projected climate changes.* Clim. Dyn. submitted.

Berg, P., H. Feldmann, and H.-J. Panitz (2012) *Bias correction of high resolution regional climate model data.* J. Hydrol., 448-449, 80-92.

Ott I, Düthmann D, Liebert J, Berg P, Feldmann H, Ihringer J, Kunstmann H, Merz B, Schädler G, Wagner S (2012) *High resolution climate change impact analysis on medium sized river catchments in Germany: an ensemble assessment*. Journal of Hydrometeorology, submitted.
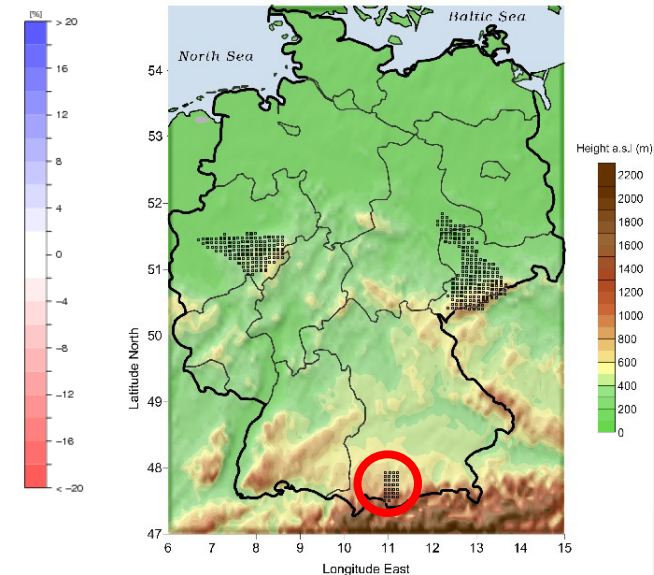
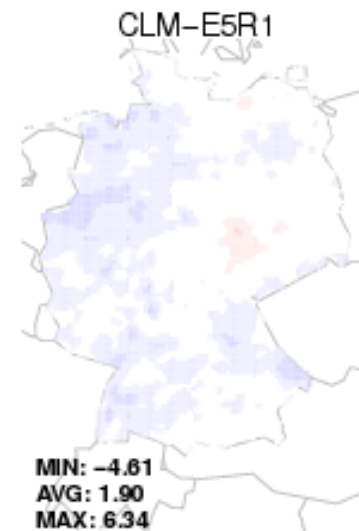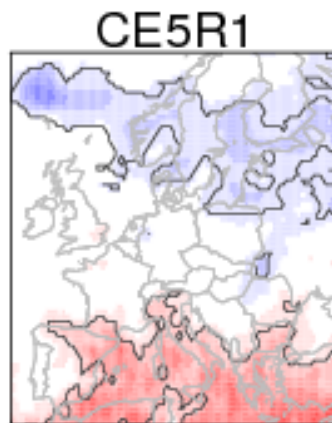# RCM simulations for Germany & target regions
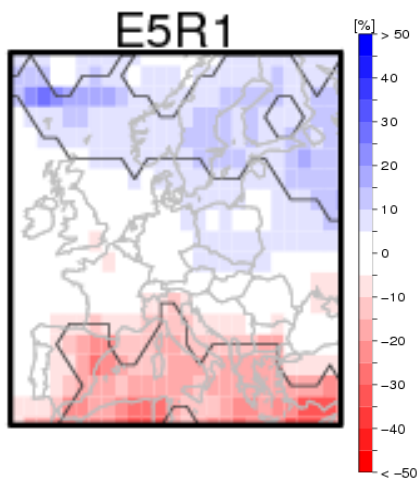
- Double nesting approach: coarse domain (~50km); fine domain (7km)

- Projected precipitation changes for 2021-2050:
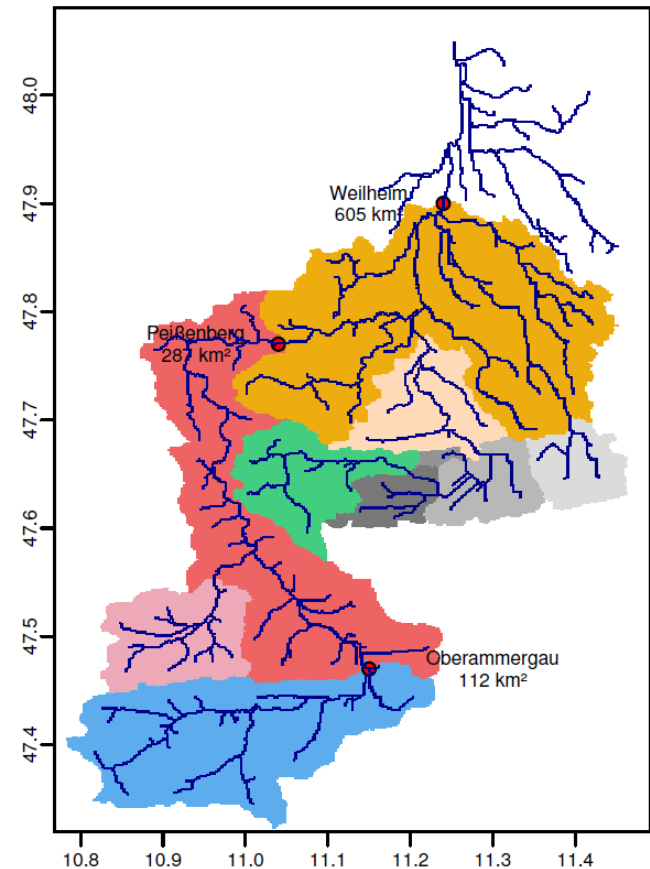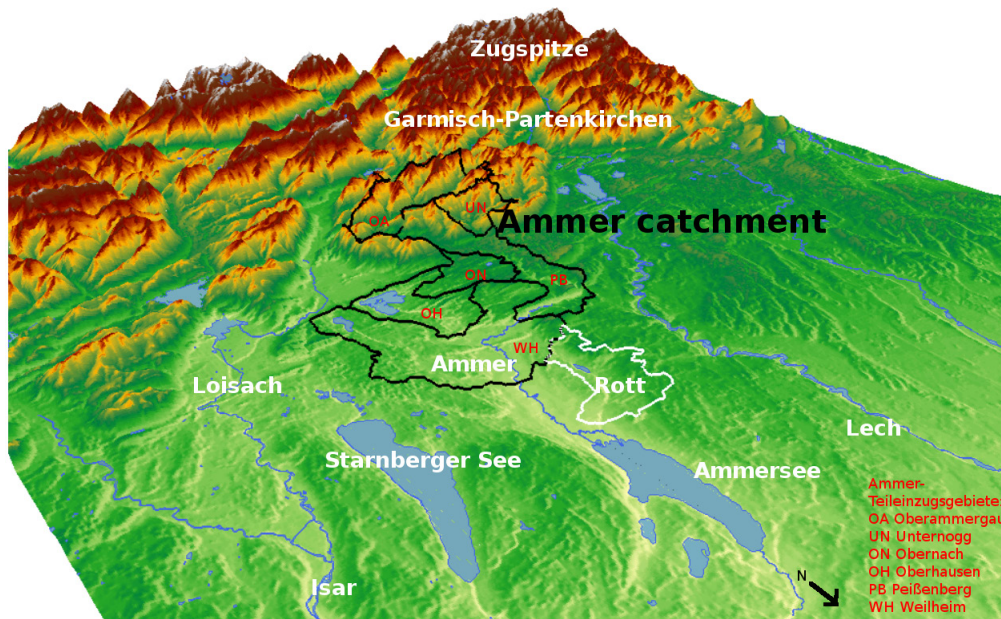
GCM: ECHAM5   RCM@50km   RCM@7km   Catchments

Focus of this presentation: WaSiM simulations for the Ammer catchment driven by high resolution RCM data

WaSiM Ammer: Setup

- Size: 710 km²
- Elevation: 533 – 2185 m
- Main Landuse: 49% grassland; 41% forest
- Mean Temperature: 7°C
- Mean Precipitation: 1000-2000 mm/a
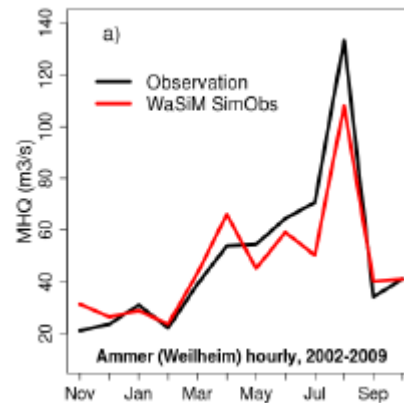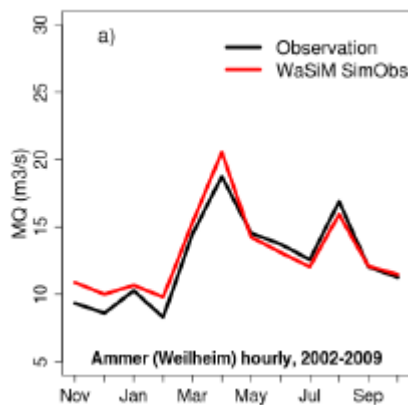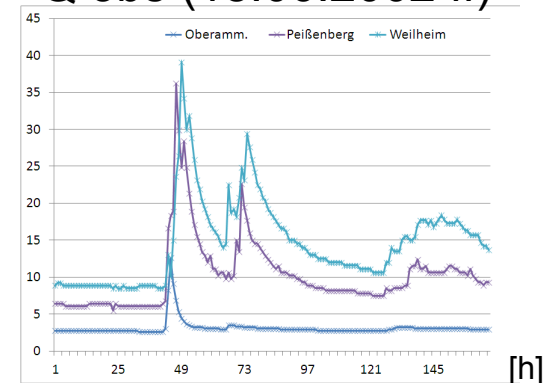- MQ @ Weilheim: 15 m³/s

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WaSiM Ammer:
Calibration & Validation

• Calibration process showed better performances using hourly compared to daily time step

• Meteorological data with hourly time step only available for 2002-2009

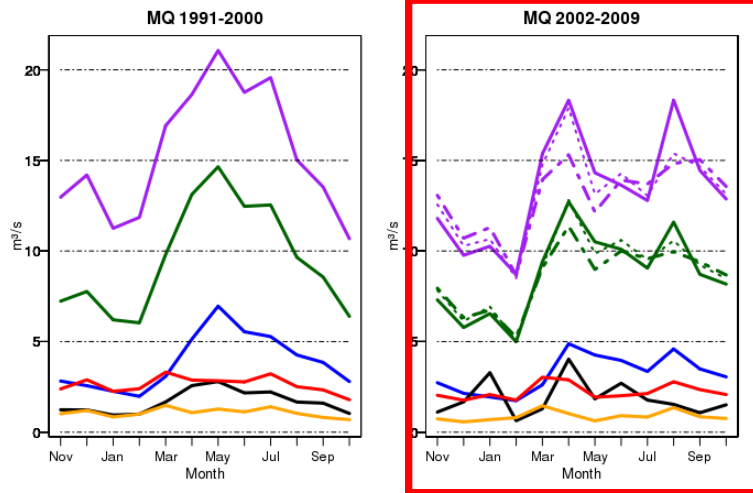→ calibration/validation period:
  2003-2006/2007-2007

Q obs (18.06.2002 ff)

	NSE	VB [%]
Oberammergau	0.54	16
Peißenberg	0.75	0
Weilheim	0.84	3

	NSE (daily)
OG	0.27
PB	0.52
WH	0.55

WaSiM-Ammer:
Results for 1971-2000 driven by daily OBS

MQ observed [m3/s]
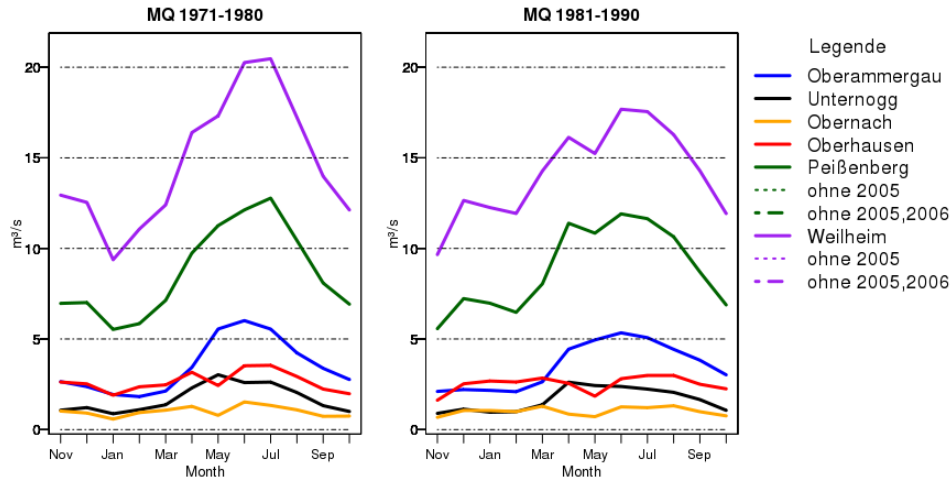
Simulation results for 1971-2000
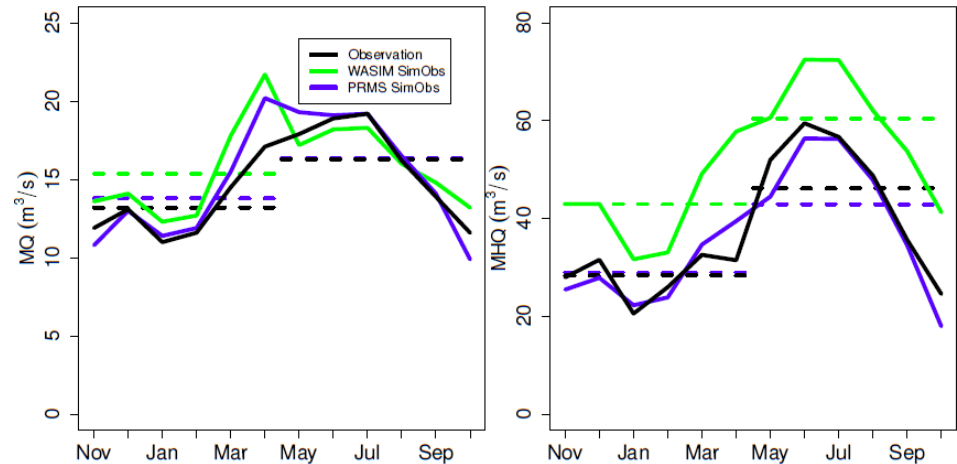
WaSiM Ammer:
RCM results (7km) as driving data

|	Precipitation [mm/month]			Temperature [°C]			ΔPrecipitation [%]			ΔTemperature [°C]		
	Ann.	WH	SH	Ann.	WH	SH	Ann.	WH	SH	Ann.	WH	SH
DWD/PIK	104	77	132	7	1	13	NA	NA	NA	NA	NA	NA
REGNIE	120	91	149	NA	NA	NA	NA	NA	NA	NA	NA	NA
WRF-E5R1	121	89	153	6	0	11	7.3	6.3	8.3	0.8	0.9	0.8
CLM-E5R1	119	90	148	7	1	12	1.6	6.8	-3.7	1.1	1	1.1
CLM-E5R2	125	95	154	6	1	12	0.7	11.7	-10.4	1.4	1.5	1.2
CLM-E5R3	122	95	150	7	1	12	-2.6	-3.4	-1.7	0.9	1	0.9
CLM-C3	122	93	152	7	1	12	1.7	8.3	-4.9	1.3	1.1	1.5
Ens.	122	92	151	7	1	12	1.7	5.9	-2.5	1.1	1.1	1.1

	RH [%]			SW radiation [J/cm^2]			ΔRH [%]			ΔSW radiation [%]		
	Ann.	WH	SH	Ann.	WH	SH	Ann.	WH	SH	Ann.	WH	SH
DWD/PIK	80	82	78	1104	710	1498	NA	NA	NA	NA	NA	NA
WRF-E5R1	69	75	63	1253	776	1730	-0.2	-1.1	0.7	-2.3	-3	-1.6
CLM-E5R1	83	84	83	893	647	1140	-0.5	0	-0.9	-2	-5	1
CLM-E5R2	84	84	83	889	633	1145	-0.4	-0.3	-0.6	-1.8	-3.8	0.3
CLM-E5R3	83	84	83	895	626	1164	0	-0.2	0.1	-0.9	-0.3	-1.4
CLM-C3	84	85	84	870	647	1093	-0.4	-0.4	-0.5	-0.6	-2.4	1.1
Ens.	81	82	79	960	666	1254	-0.3	-0.4	-0.2	-1.5	-2.9	-0.1

WaSiM Ammer:
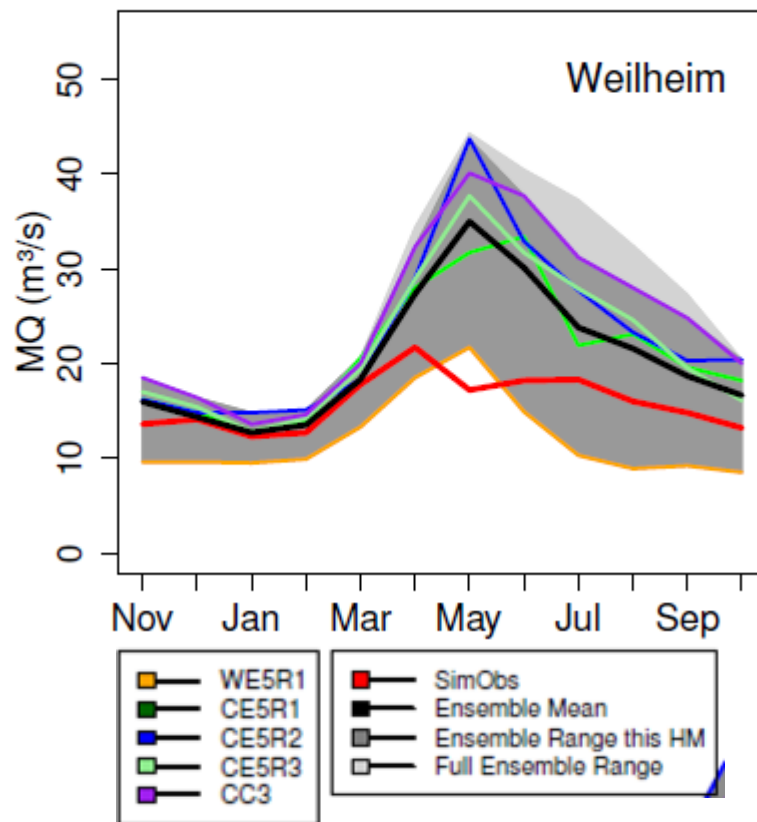# RCM results (7km) as driving data
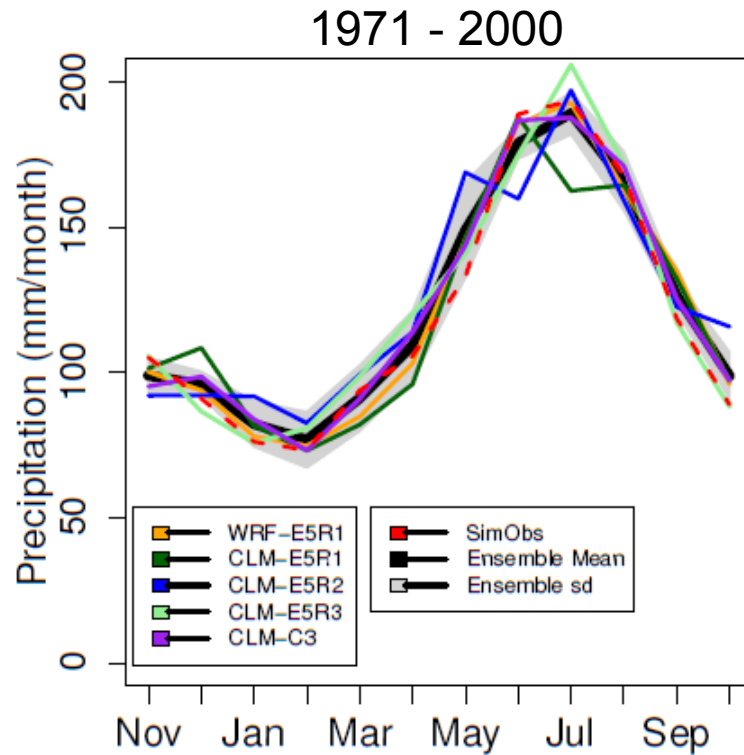
1971 - 2000

WaSiM Ammer:
RCM results (7km) as driving data
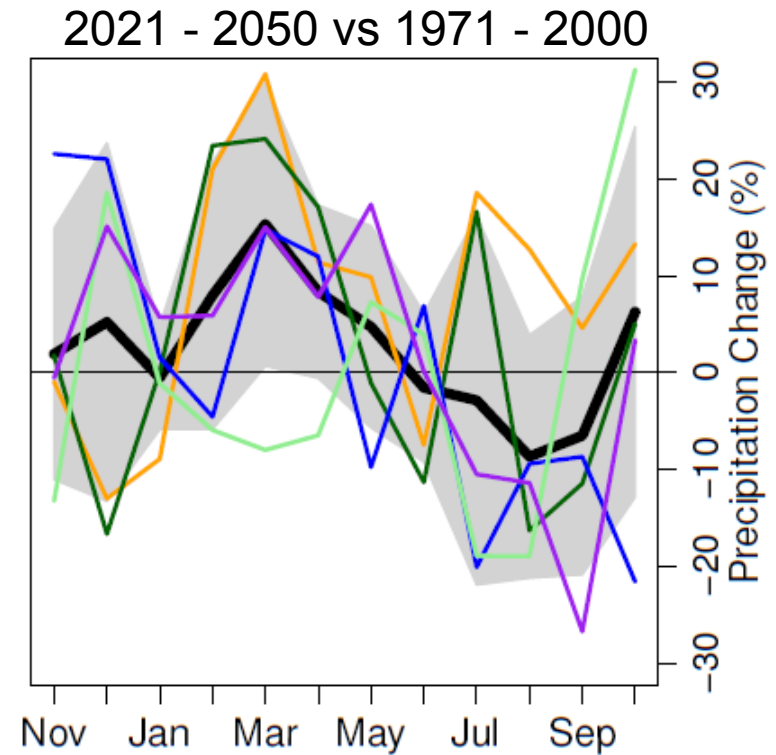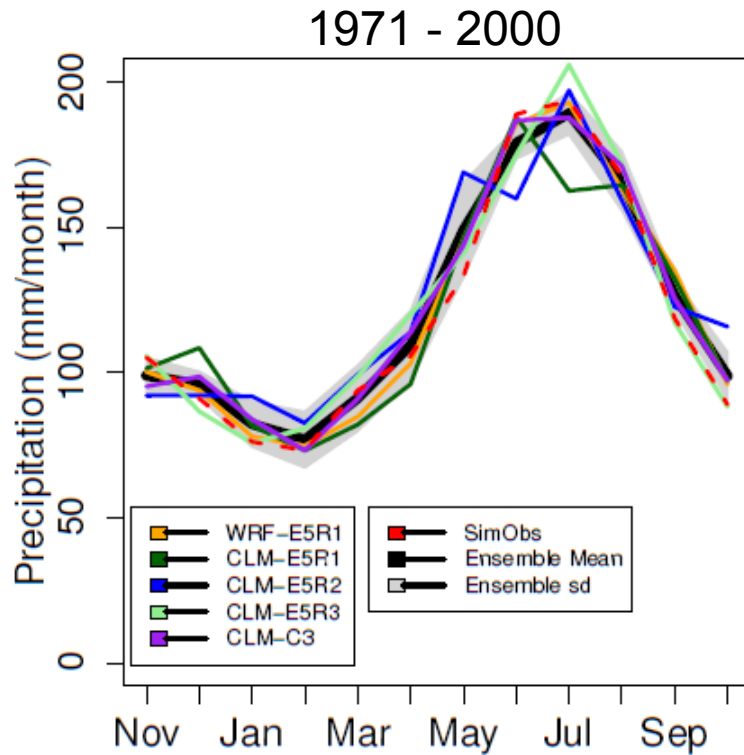
WaSiM Ammer:
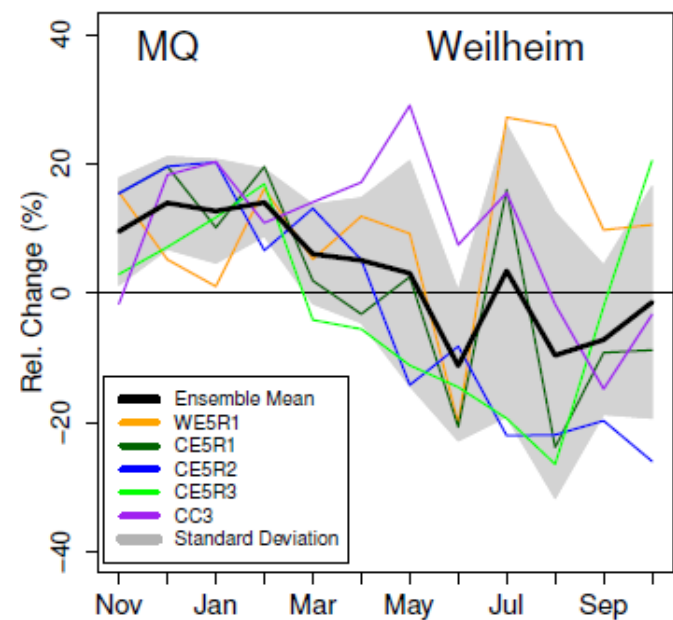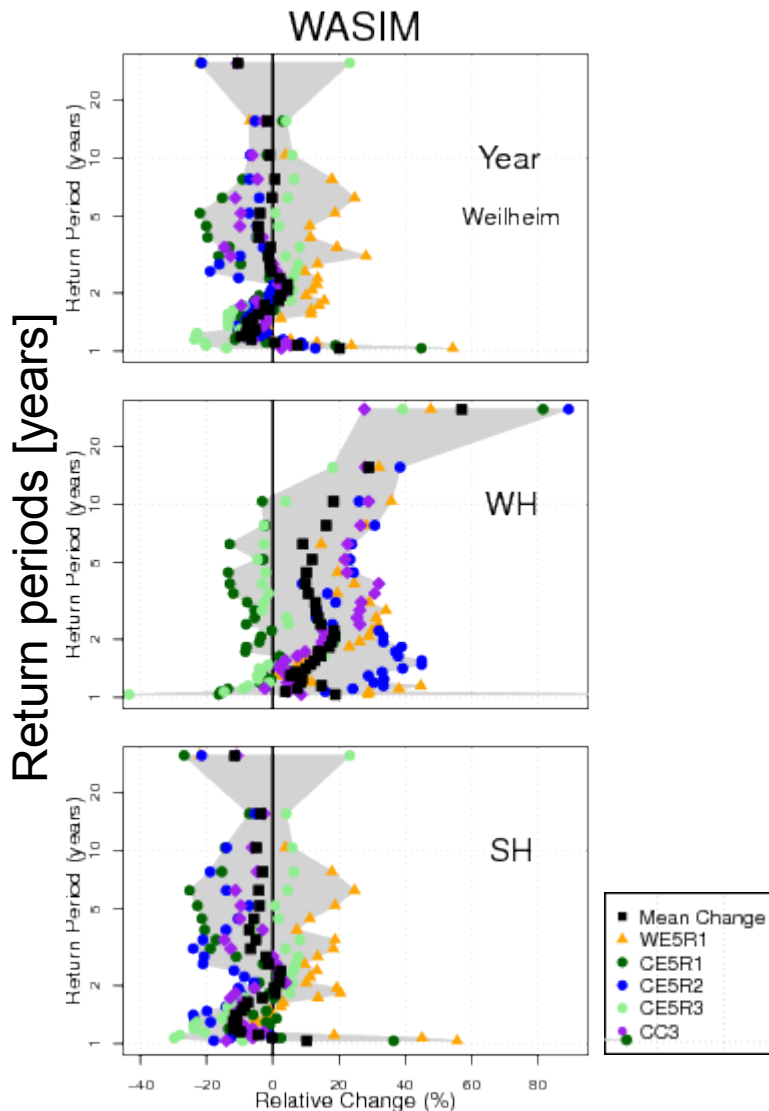# Simulation results driven by RCM data

1971 - 2000

2021 - 2050 vs 1971 - 2000

WaSiM Ammer:
Simulation results driven by RCM data

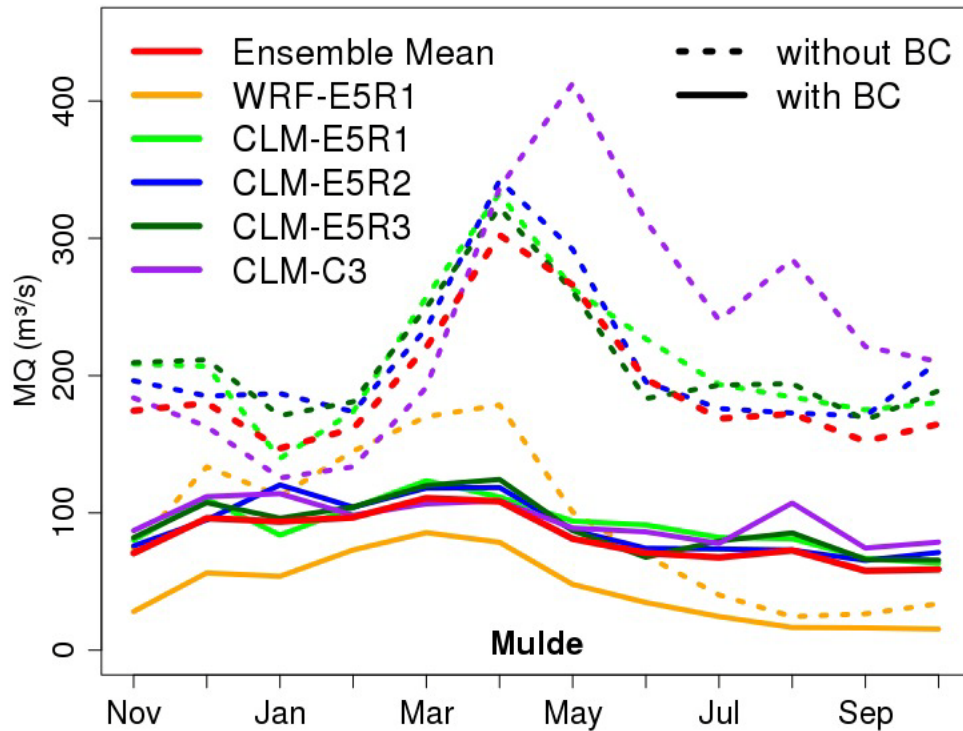

Projected Change of MHQ for 2021-2050:

(%)		Winter	Summer	Year
Ammer	WaSiM-ETH	15.9	-6.9	-3.8
(Weilheim)	PRMS	5.8	-6.1	-3.1
	ENSEMBLE	11.0	-6.6	-3.5
Mulde	SWIM	6	8.4	9.1
(Bad Düben)	WaSiM-ETH	2	5.2	1.8
	ENSEMBLE	3.9	6.8	5.1
Ruhr	PRMS	9.6	9.7	11.6
(Wetter)	SWIM	5.4	12.1	9.3
	ENSEMBLE	7.7	10.6	9.3

Uncertainties within model chain:

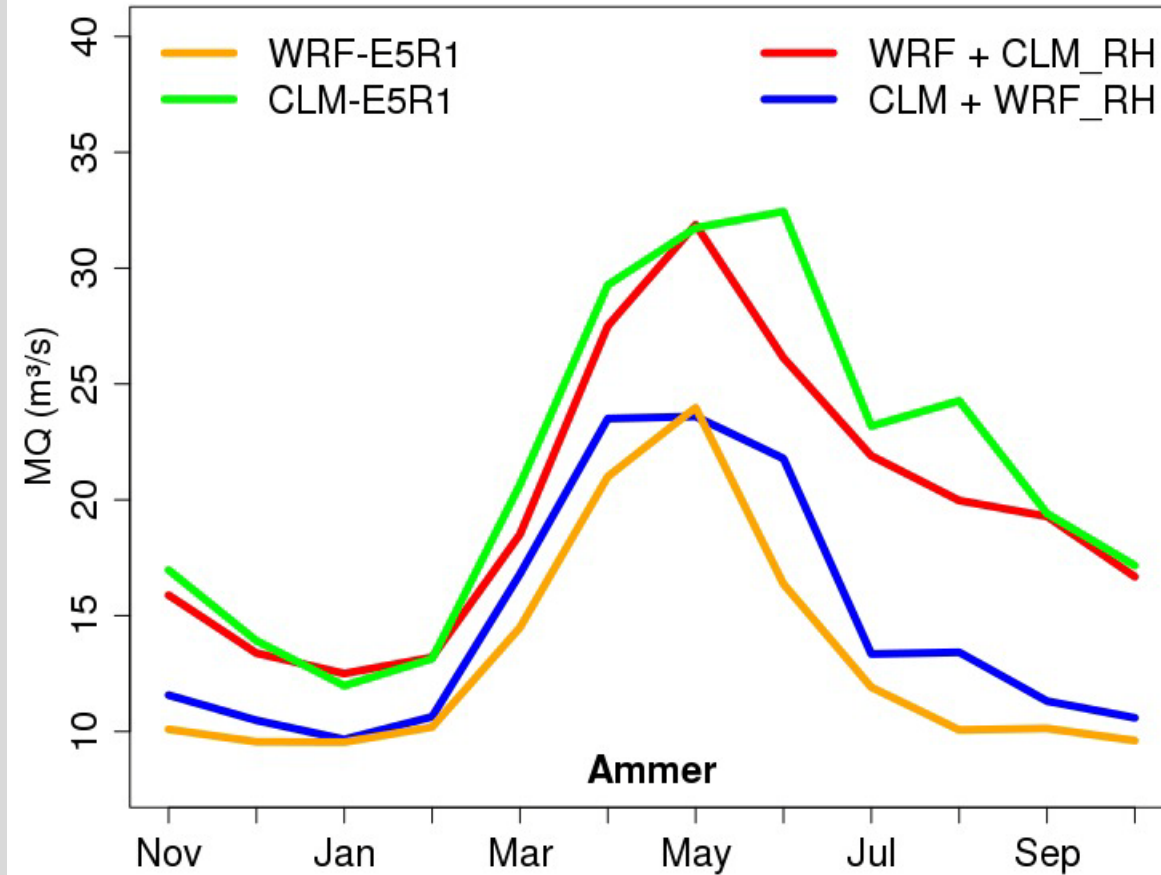| (%)	Ammer		Mulde		Ruhr		Ø	
	WH	SH	WH	SH	WH	SH	WH	SH
GCM	17	14	31	14	30	9	27	12
Realisation	24	24	29	10	28	15	28	14
RCM	40	55	26	69	14	67	25	66
HM	19	8	14	6	28	10	20	8

WaSiM:
Impact of bias correction on MQ (Mulde)

Observed
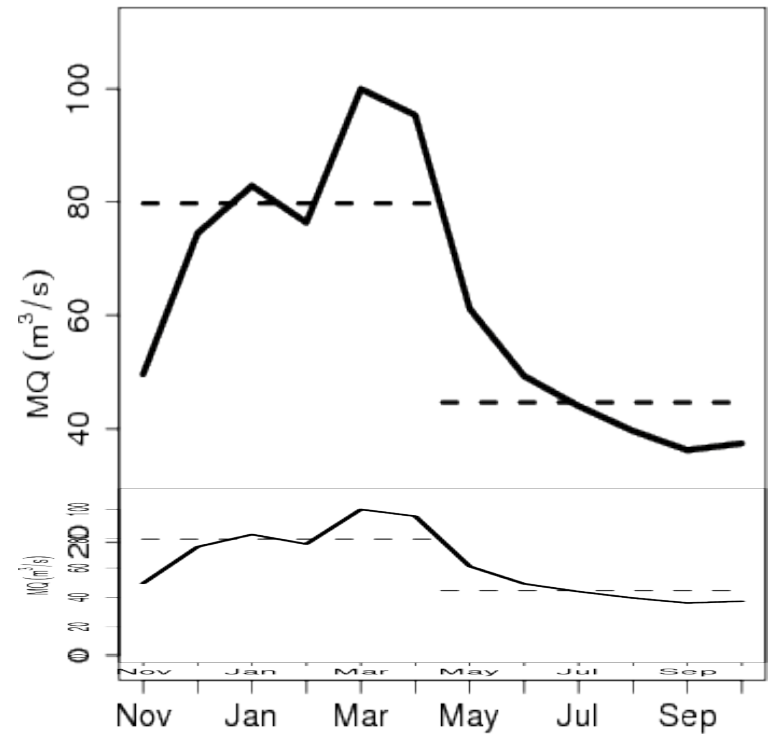
WaSiM Ammer:
Sensitivity test for RH

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