Precipitation extremes projections for Poland for the period 2021-2050. Comparison of selected methods

Joanna Wibig, University of Lodz

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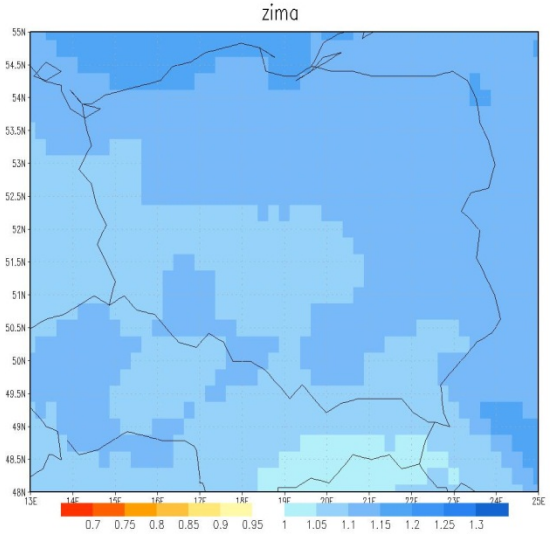
OUTLINE:

- *Motivation*
- *Data & methods*
- *Projections*
  - *Delta change*
  - *Bias correction*
  - *Weather generator*
- *Comparison*
- *Conclusions*

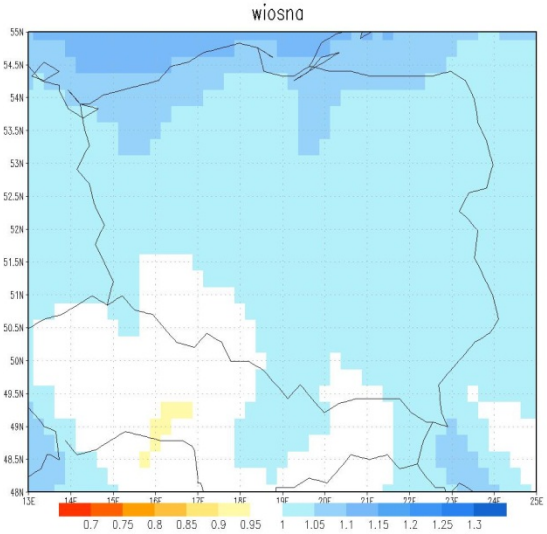
Projected changes in seasonal totals

2021-2050
vs.
1971-2000

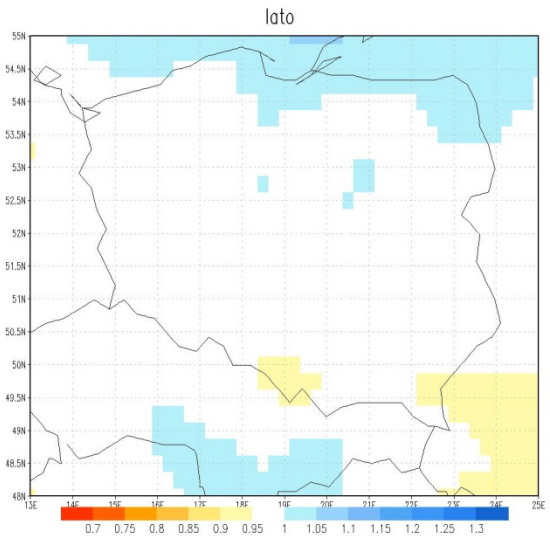
WINTER



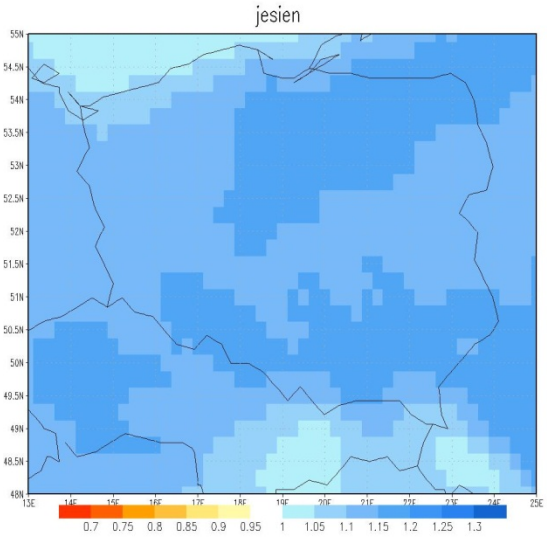
SPRING



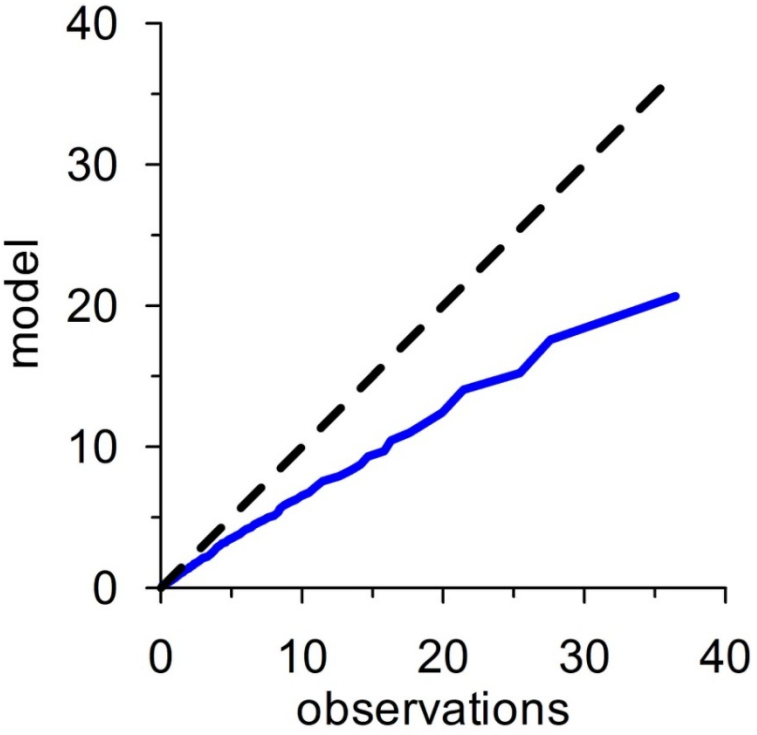
SUMMER

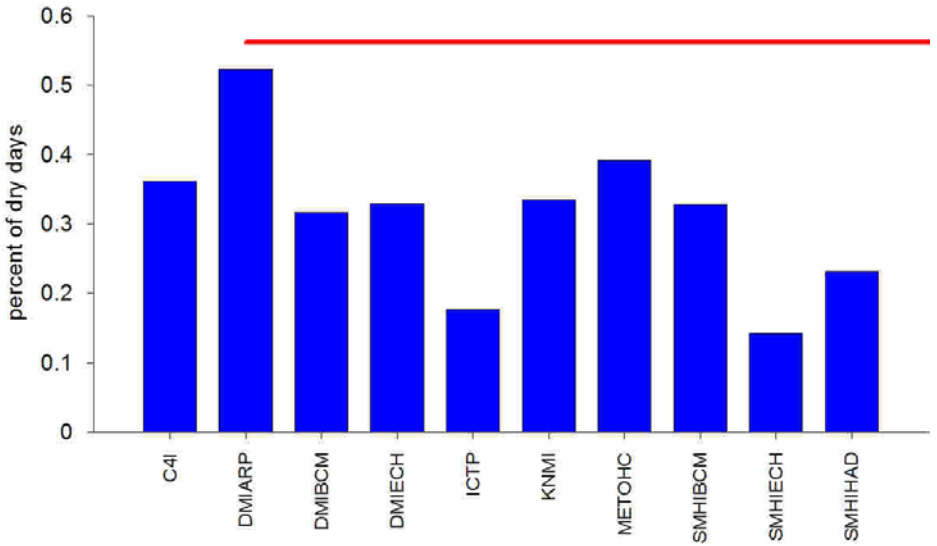


AUTUMN



Comparison of modeled and observed percentiles, example from summer:



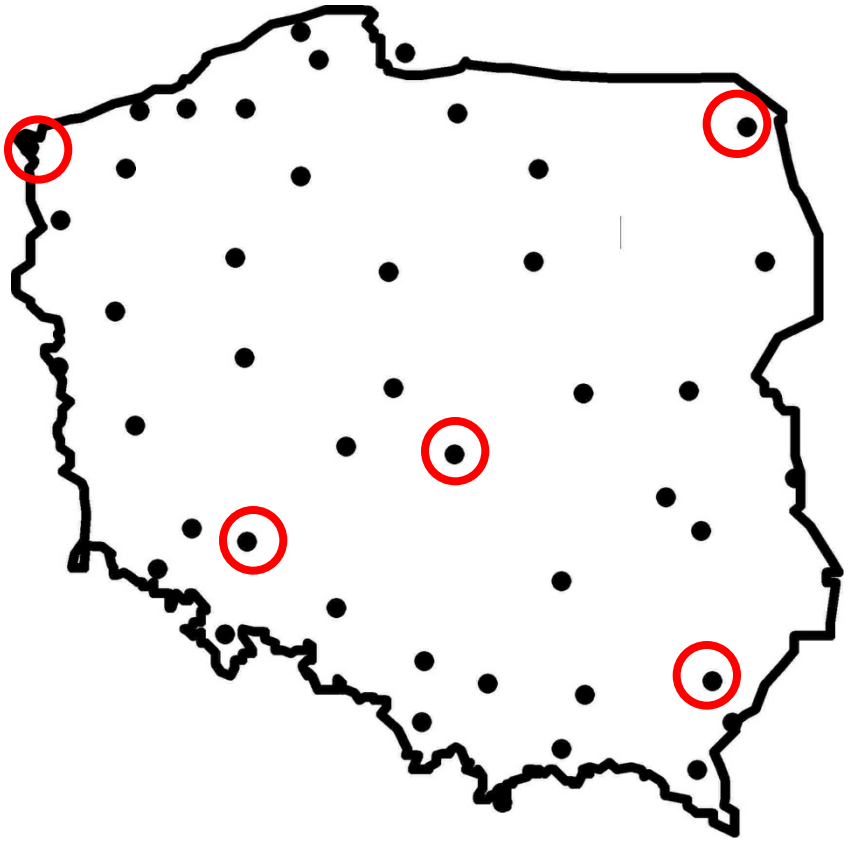


Dry days: comparison of modeled and observed percentages

OBSERVATIONS:

Daily precipitation totals measured at 40 stations in Poland obtained from the Institute of Meteorology and Water Management were used in this study.

Data cover the reference period 1971-2000.

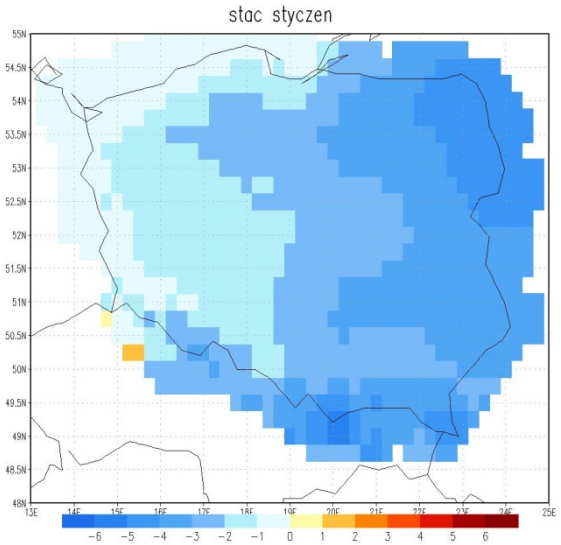


MODEL DATA: ENSEMBLES project,
reference period 1971-2000, scenario period 2021-2050

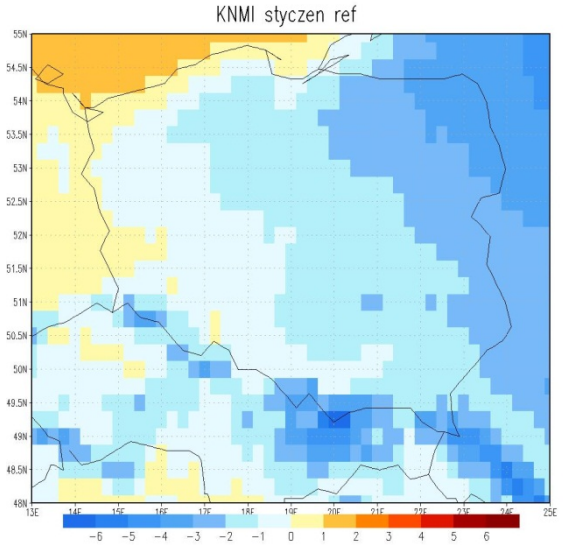
Inst.	GCM	RCM	References
KNMI	ECHAM5-r3	RACMO	van Mejigaard et al. 2008
SMHI	ECHAM5-r3	RCA	Kjellström et al. 2005
SMHI	BCM	RCA	
SMHI	HadCM3Q3	RCA	
DMI	ARPEGE	HIRHAM	Christensen et al 1996
DMI	BCM	DMI-HIRHAM5	
DMI	ECHAM5-r3	DMI-HIRHAM5	
ICTP	ECHAM5-r3	RegCM	Georgi & Mearns, 1999
ETHZ	HadCM3Q0	HadRM3Q0	Collins et al, 2006
C4I	HadCM3Q16	RCA3	Kjellström et al. 2005

Observations

Simulations

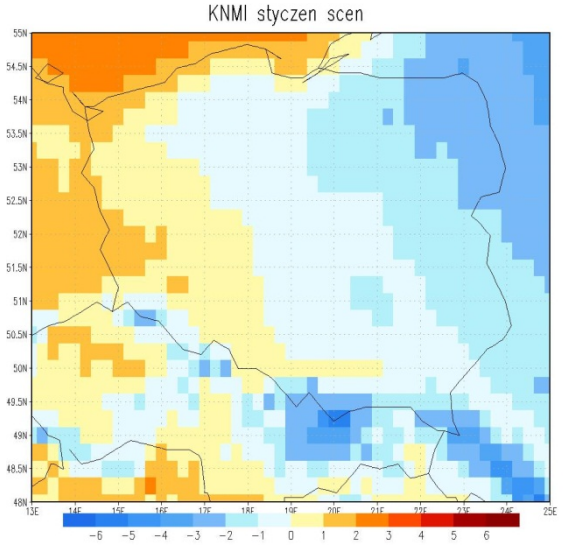


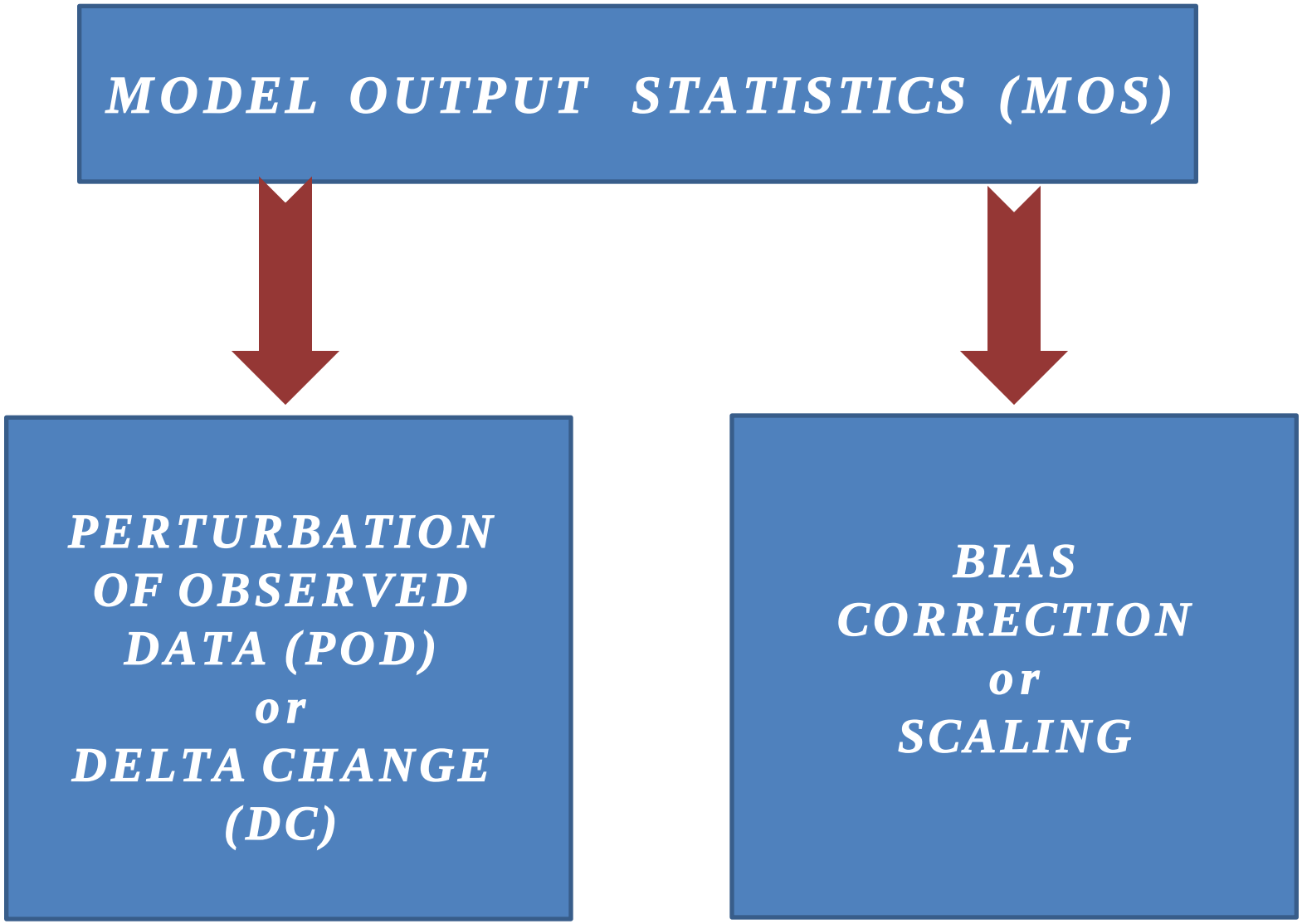
Reference period



?

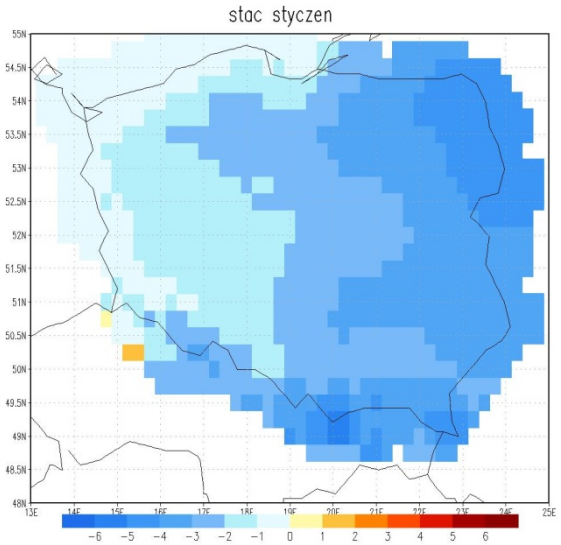
Scenario period



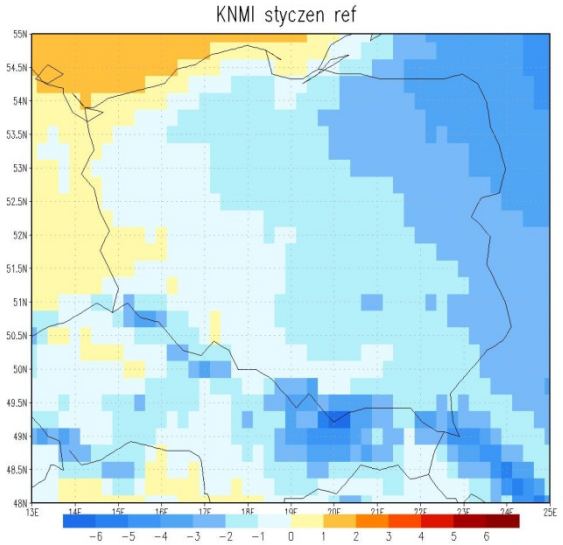

MODEL OUTPUT STATISTICS (MOS)
PERTURBATION OF OBSERVED DATA (POD) or DELTA CHANGE (DC)
BIAS CORRECTION or SCALING

Observations

Simulations



Reference period



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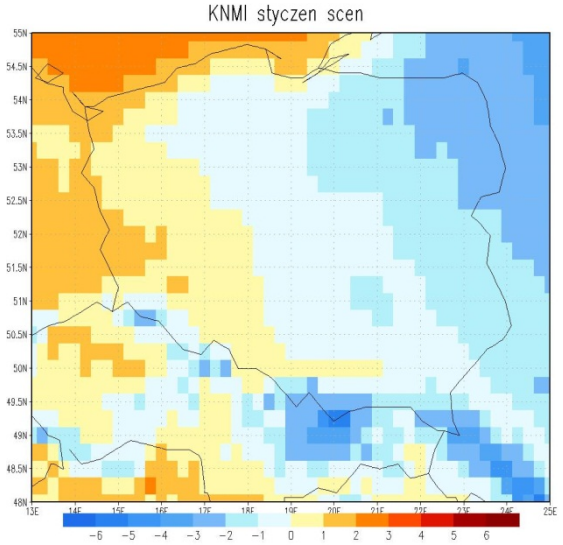
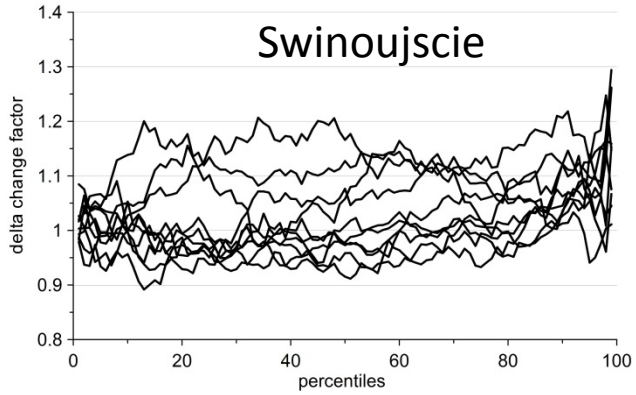
Scenario period

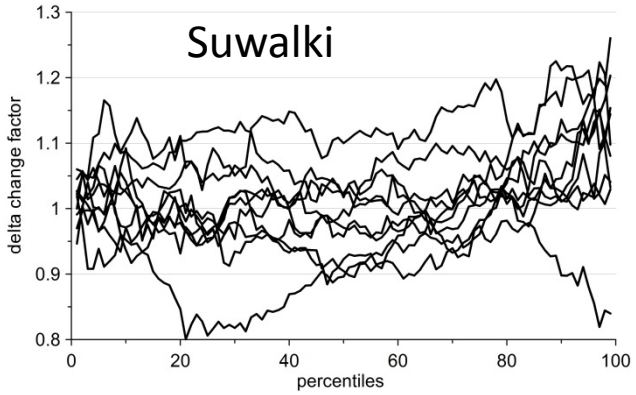


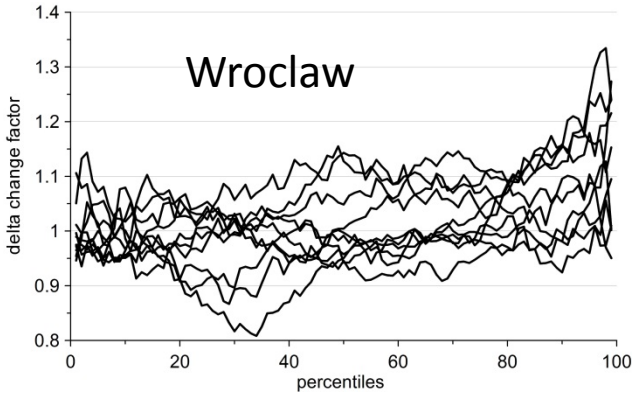
Weather generator

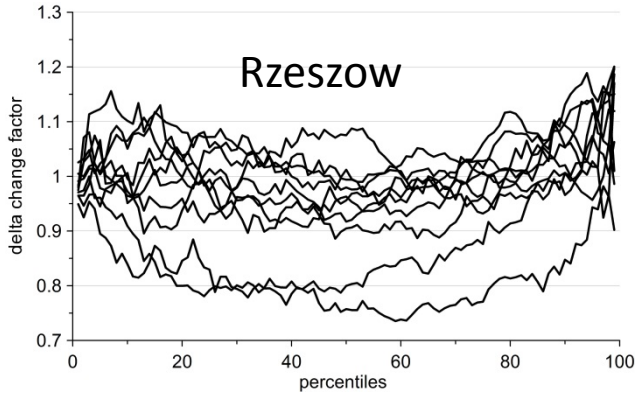
- ***the first order Markov chain was used to decide whether the day is dry or wet***
- ***the gamma distribution was applied to predict the daily totals (Wilks and Wilby, 1999).***

Delta change factor in a function of percentiles

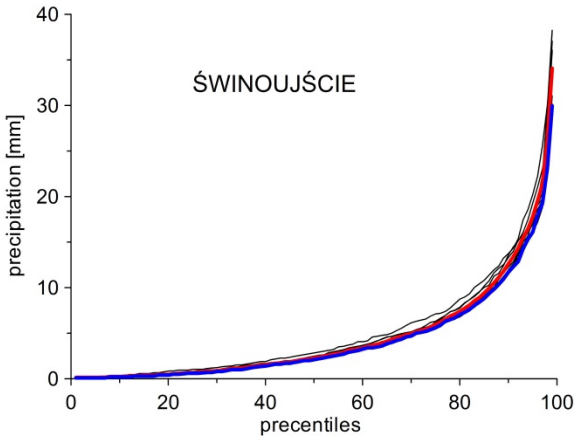


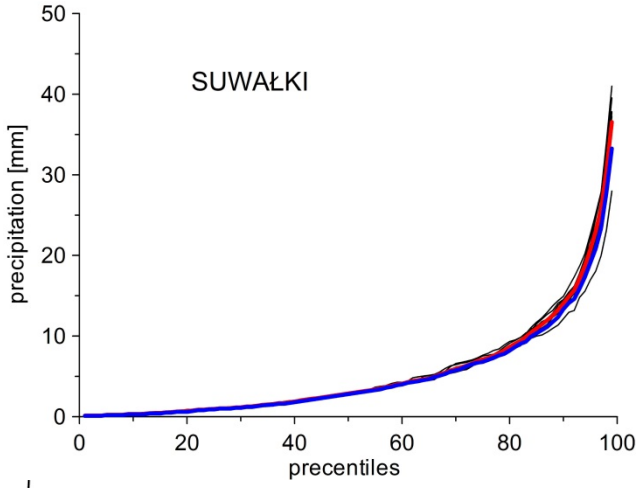


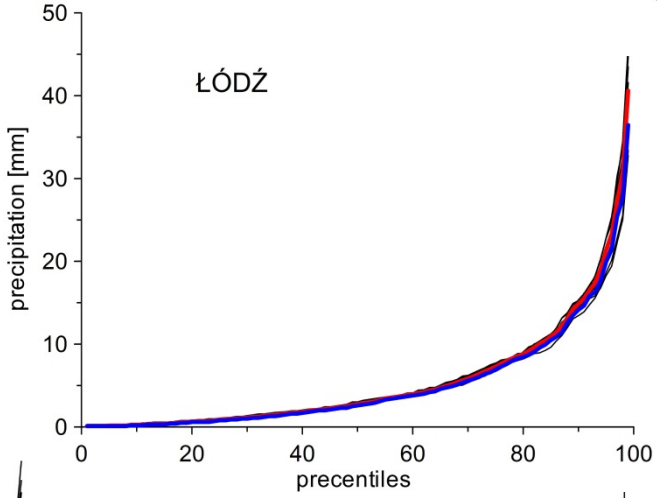


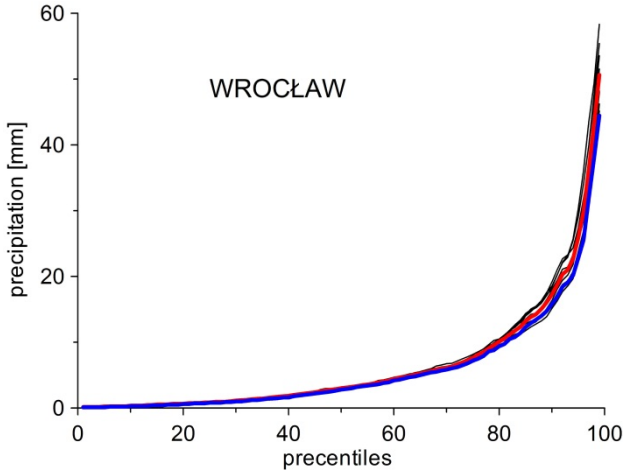


DELTA CHANGE

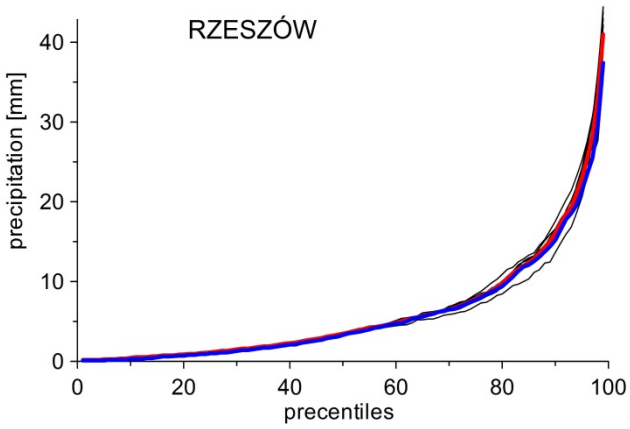






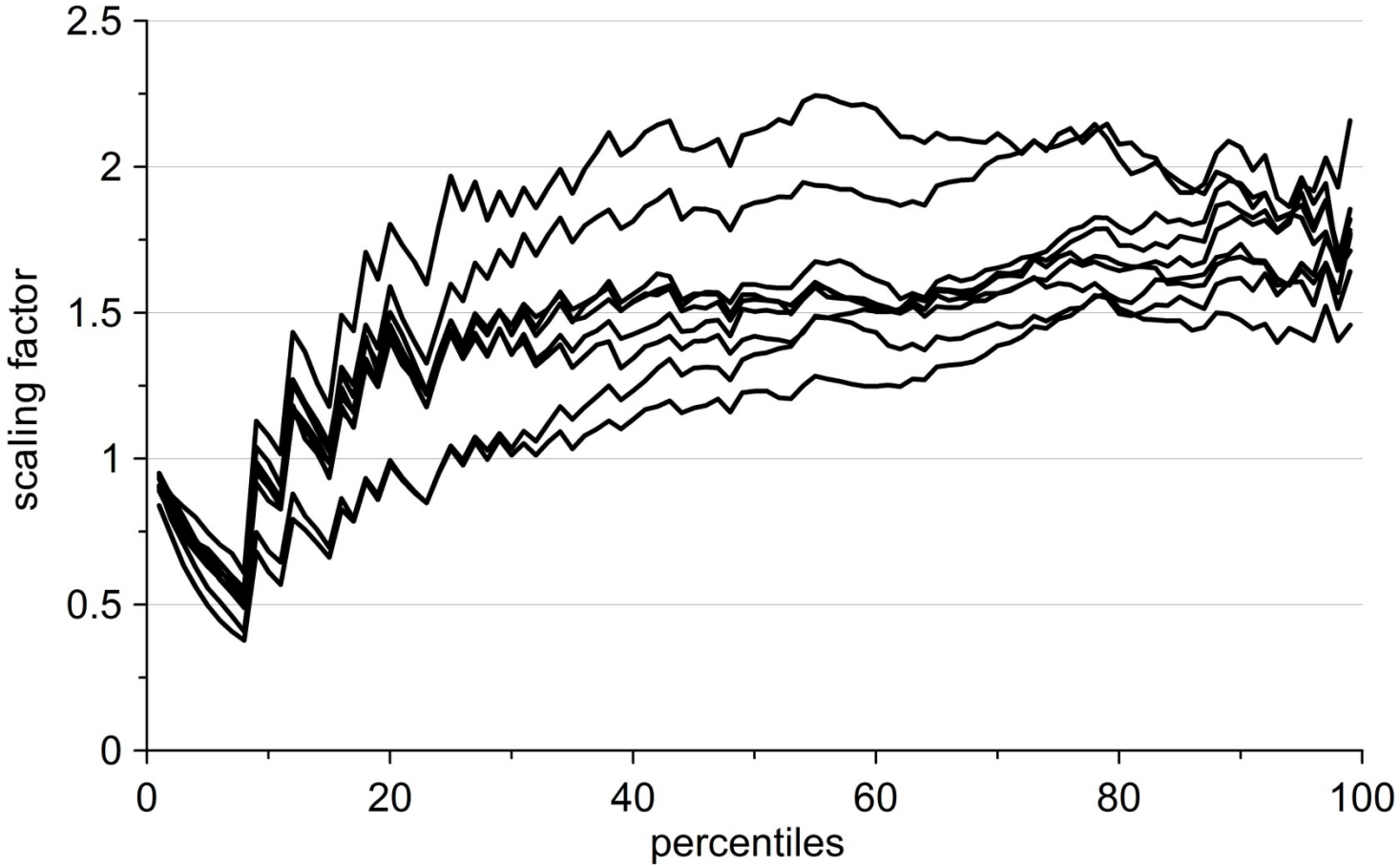


Individual models
2021-2050
Ensemble mean
2021-2050
Observations
1971-2000

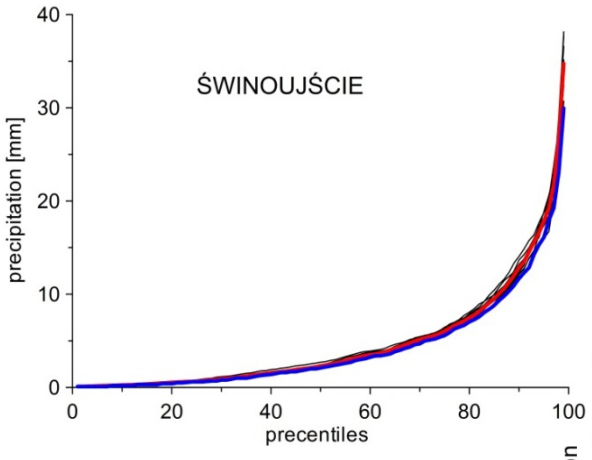


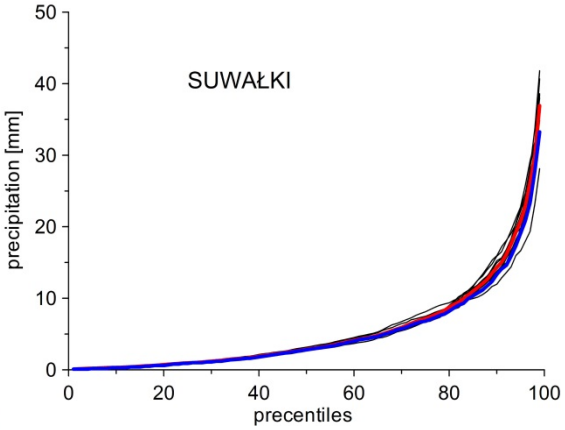
BIAS CORRECTION

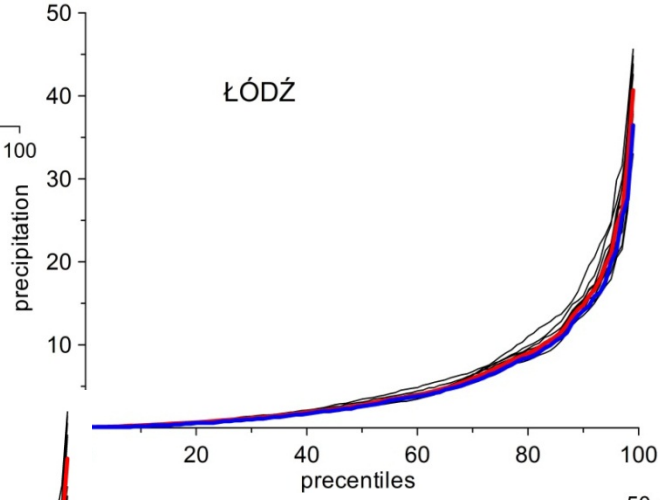
Scaling factor for different percentiles

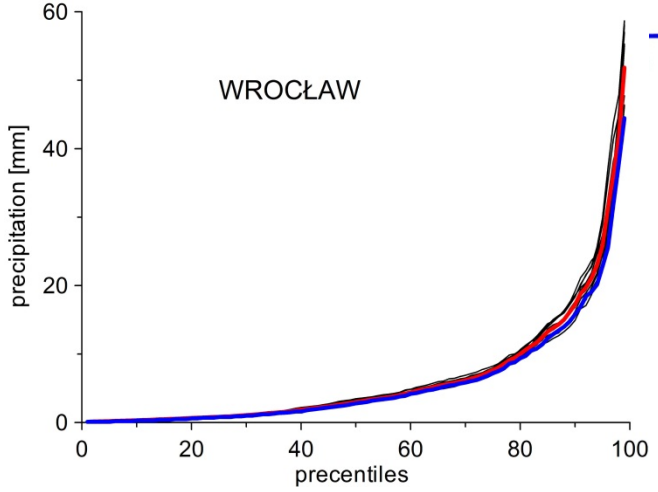


BIAS CORRECTION





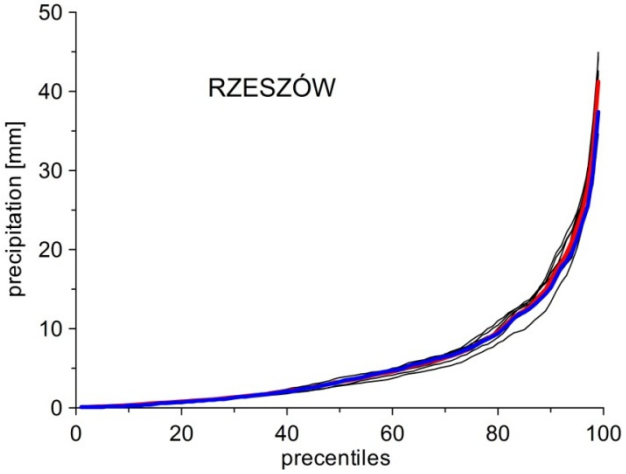




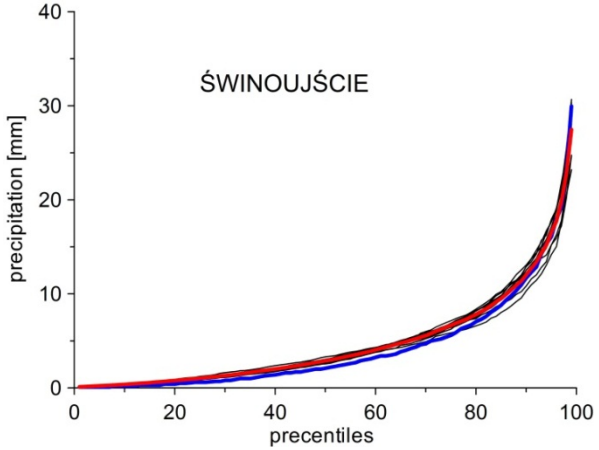
Individual models 2021-2050

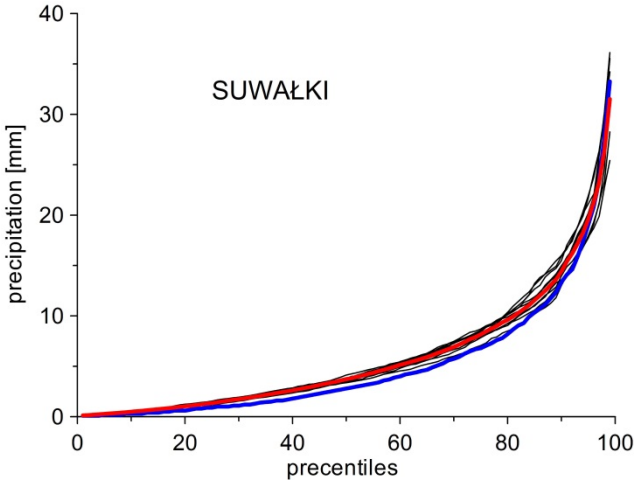
Ensemble mean 2021-2050

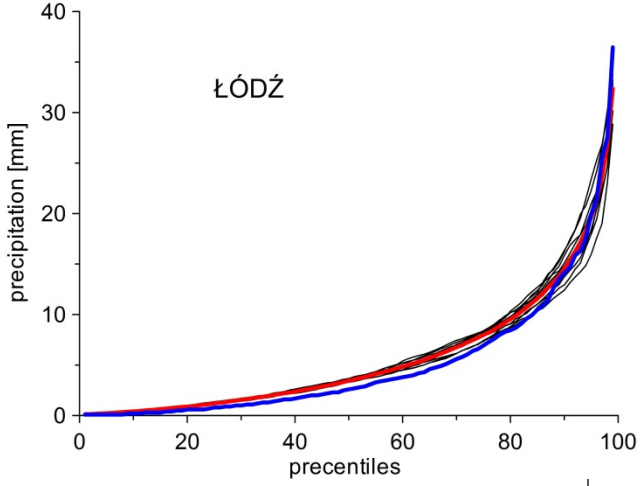
Observations 1971-2000

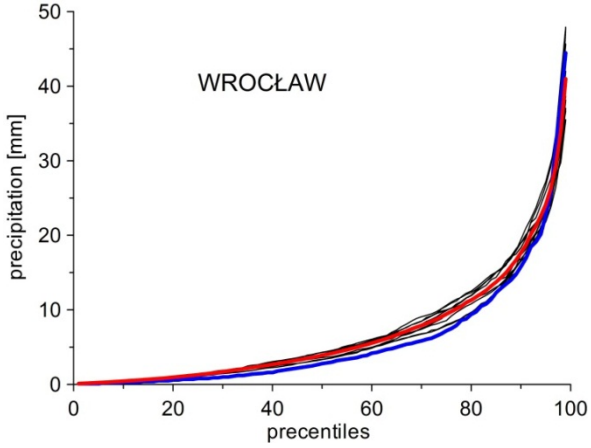


WEATHER GENERATOR





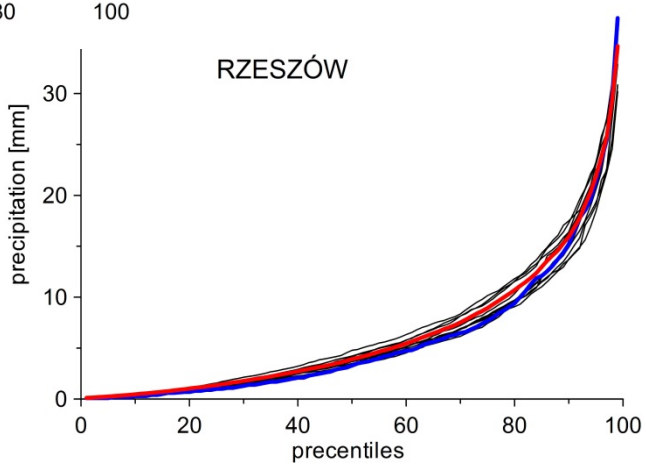




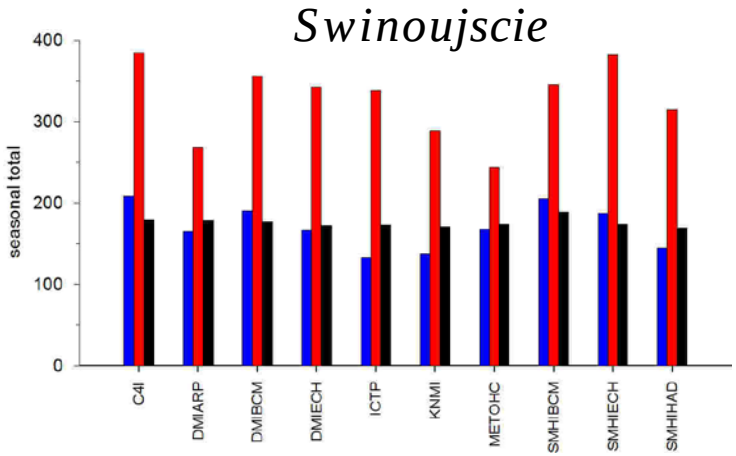
Individual models 2021-2050

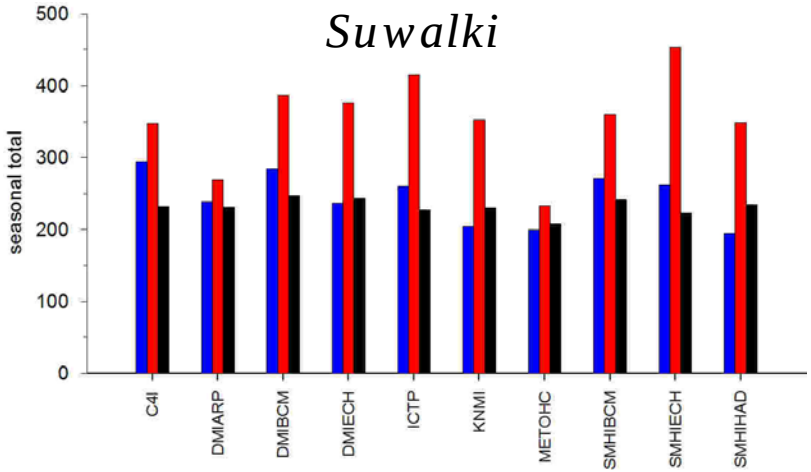
Ensemble mean 2021-2050

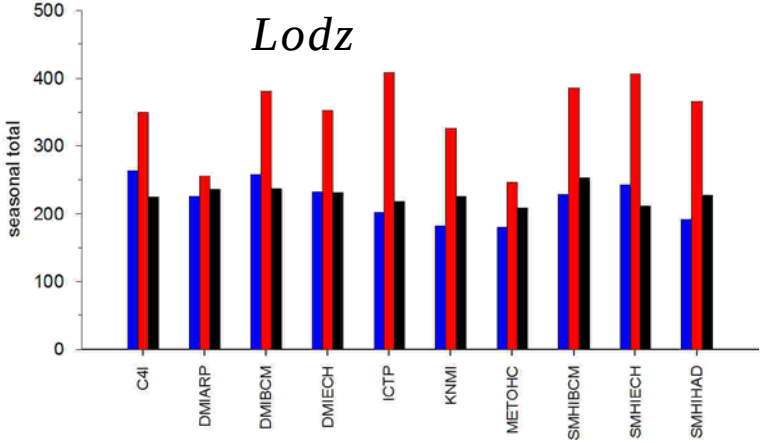
Observations 1971-2000



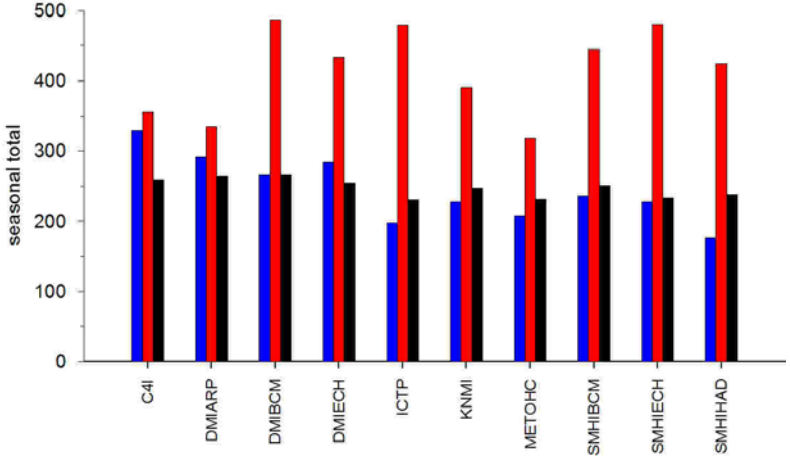
Projections of seasonal totals

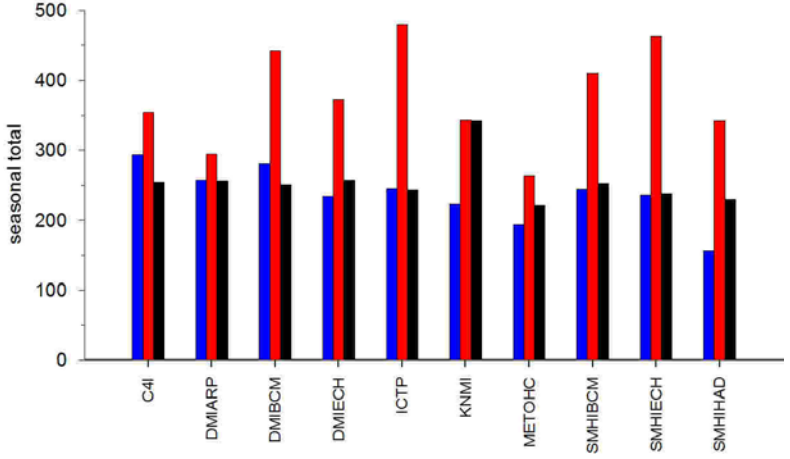




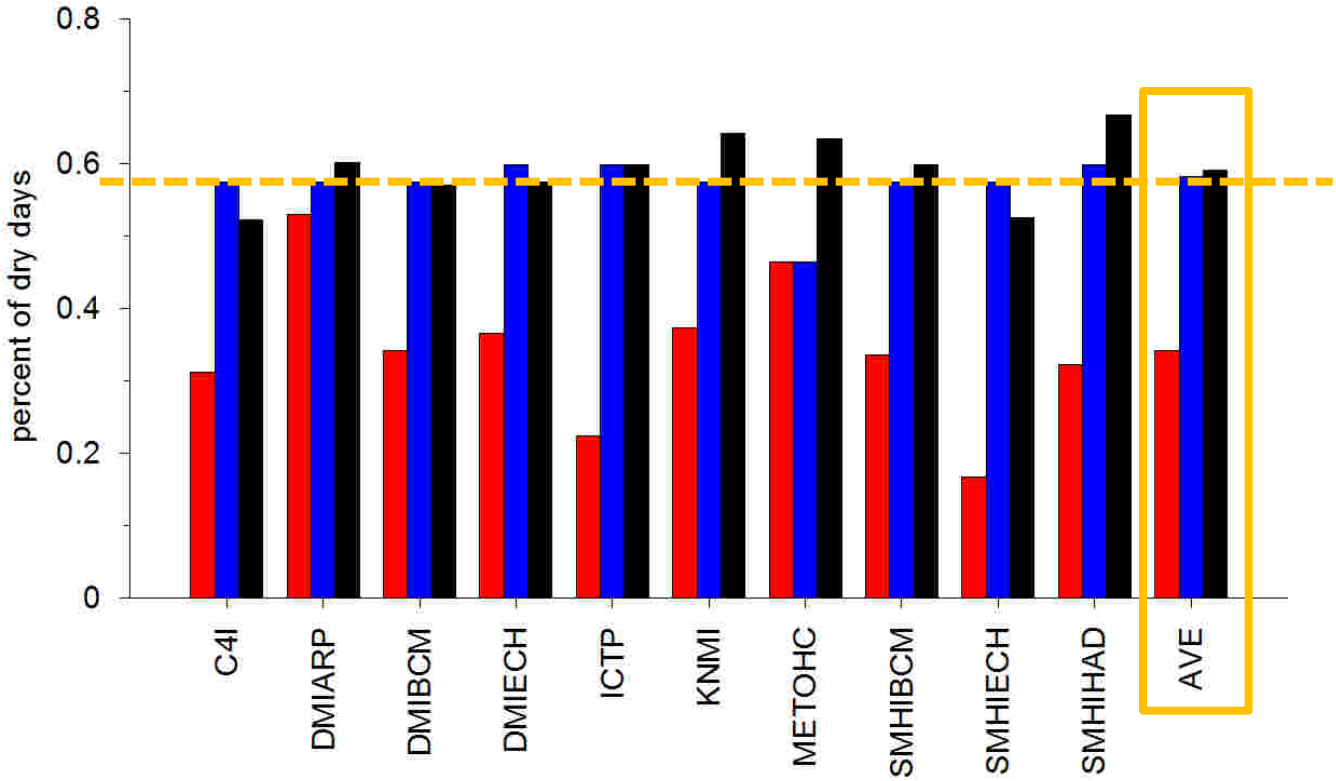


DC
BIAS
WG





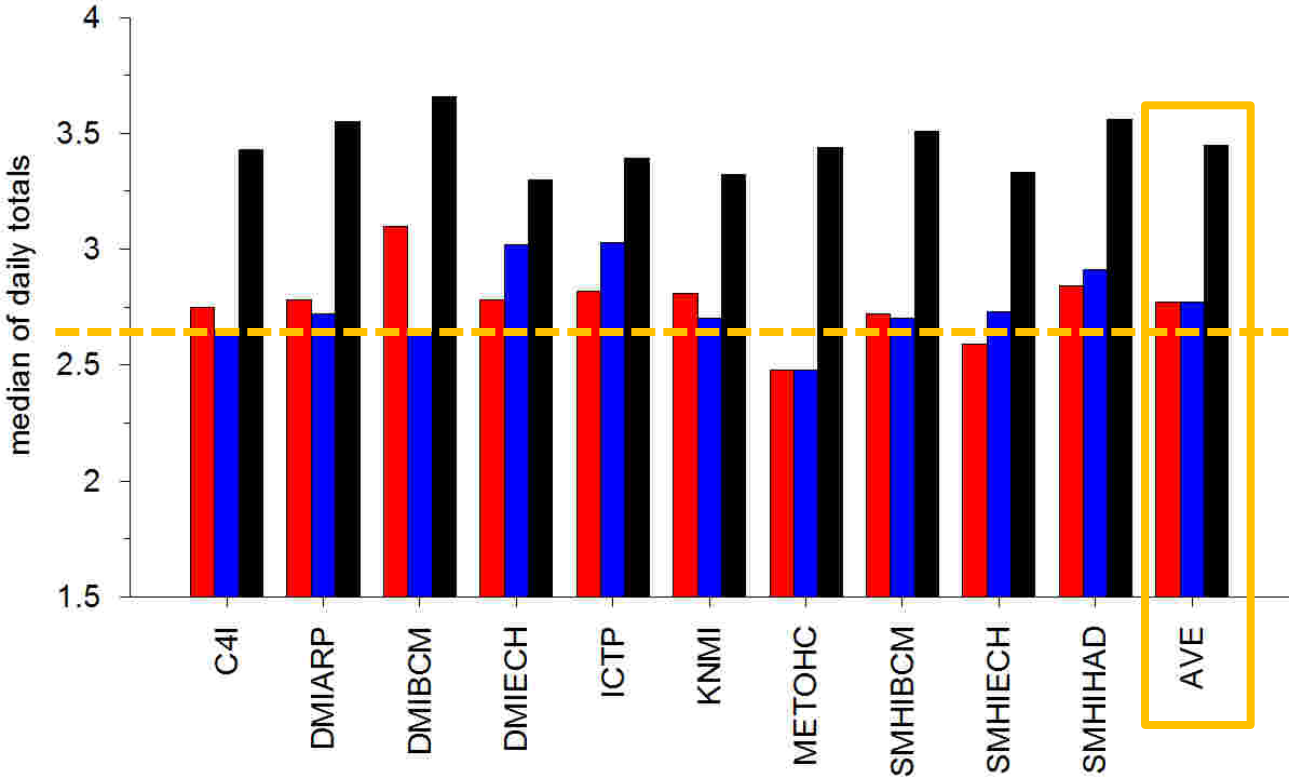
PROJECTION of DRY DAY PERCENTAGEs



BIAS, DC, WG scenarios for 2021-2050

observations in ref. period

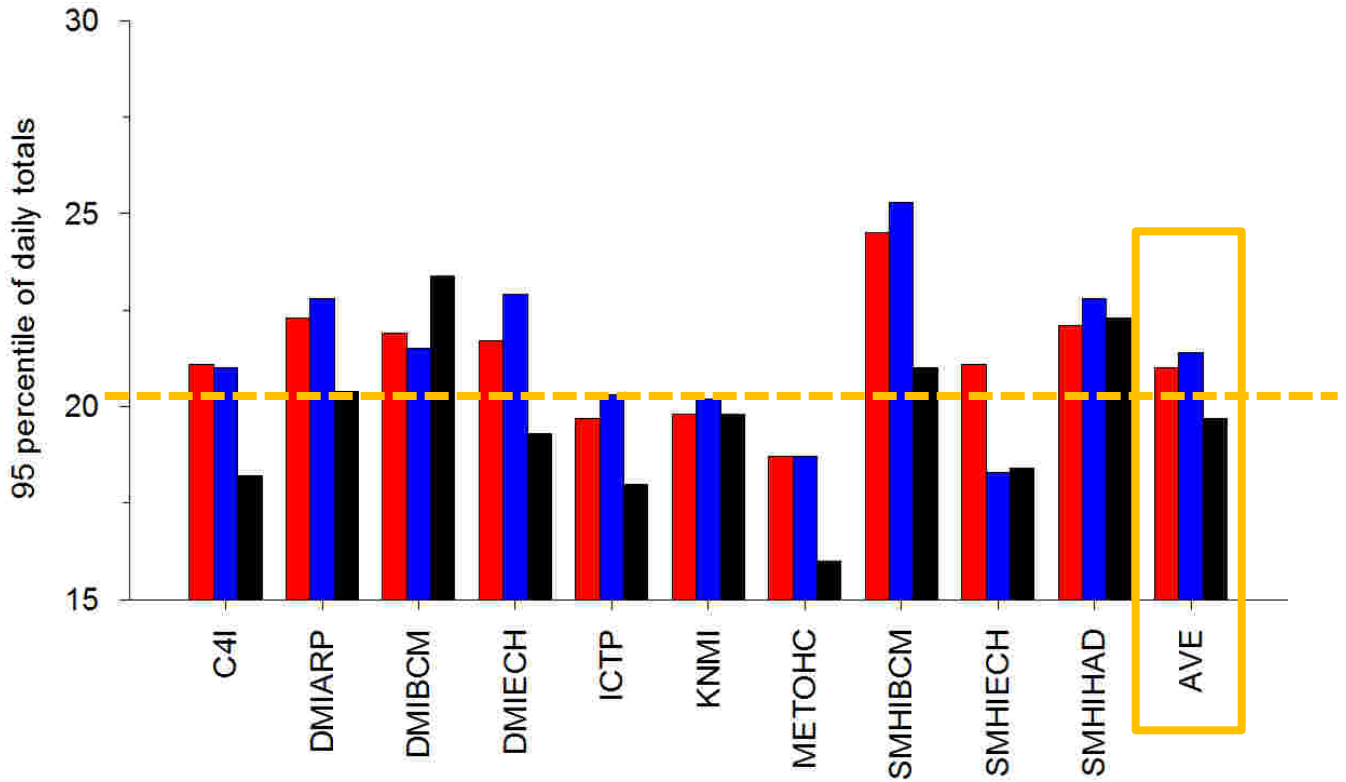
PROJECTION of MEDIAN of DAILY TOTALS



BIAS, DC, WG scenarios for 2021-2050

observations in ref. period

PROJECTION of 95 PERCENTILE of DAILY TOTALS



BIAS, DC, WG scenarios for 2021-2050

observations in ref. period

CONCLUSIONS

- **Bias correction**
  - **too small number of dry days,**
  - **too high monthly totals**
- **Delta change**
  - **almost no change in dry day number**
- **Weather generator with gamma distribution**
  - **too high values in mean percentiles,**
  - **too low values in high percentiles**