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MAGYARORSZÁG MEGÚJUL
A projekt az Európai Unió támogatásával, az Európai Szociális Alap társfinanszírozásával valósul meg.
NEW SZÉCHENYI PLAN
EURÓPAI LÉPTÉKKEL A TUDÁSÉRT, ELTE

21st century climate assessment for Hungary using different future pathways

I. Pieczka, R. Pongrácz, J. Bartholy
Department of Meteorology, Eötvös Loránd University, Budapest, Hungary

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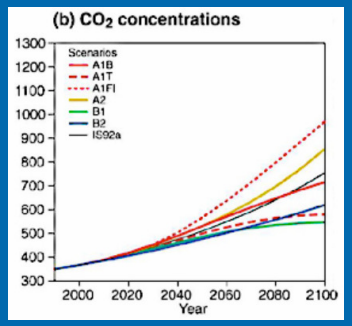
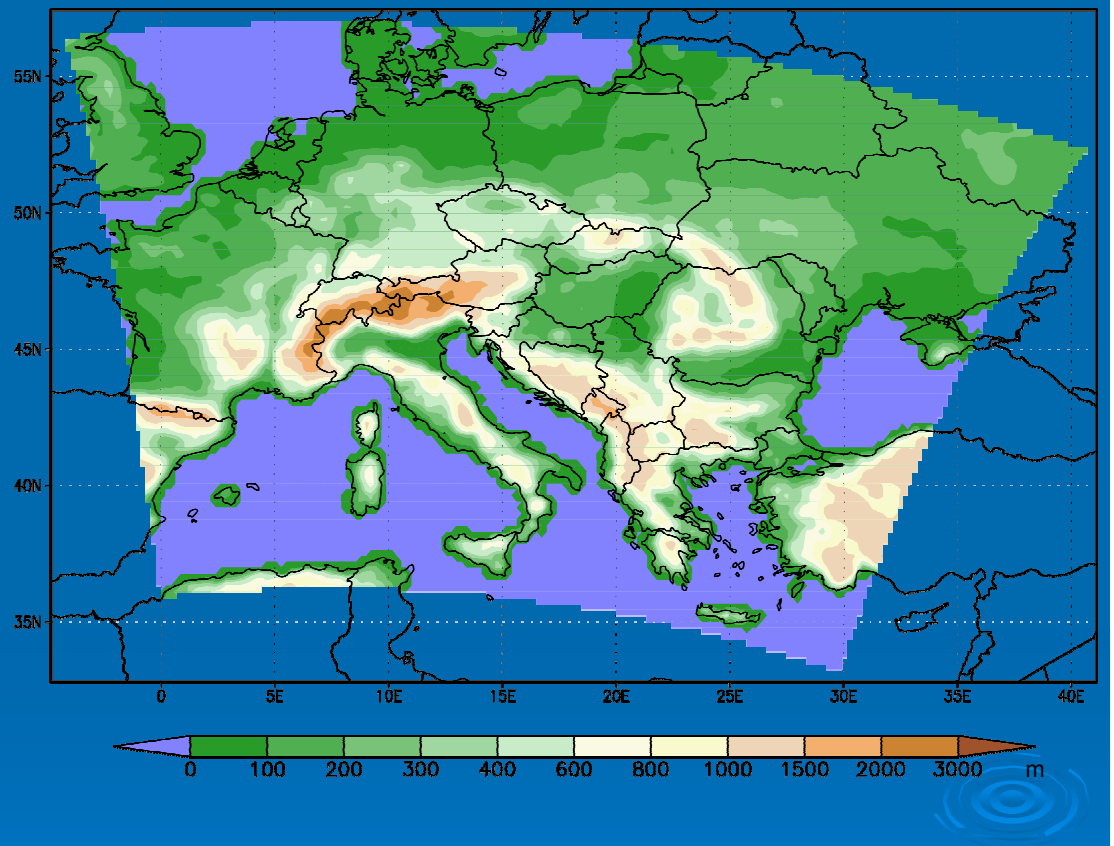
Outline

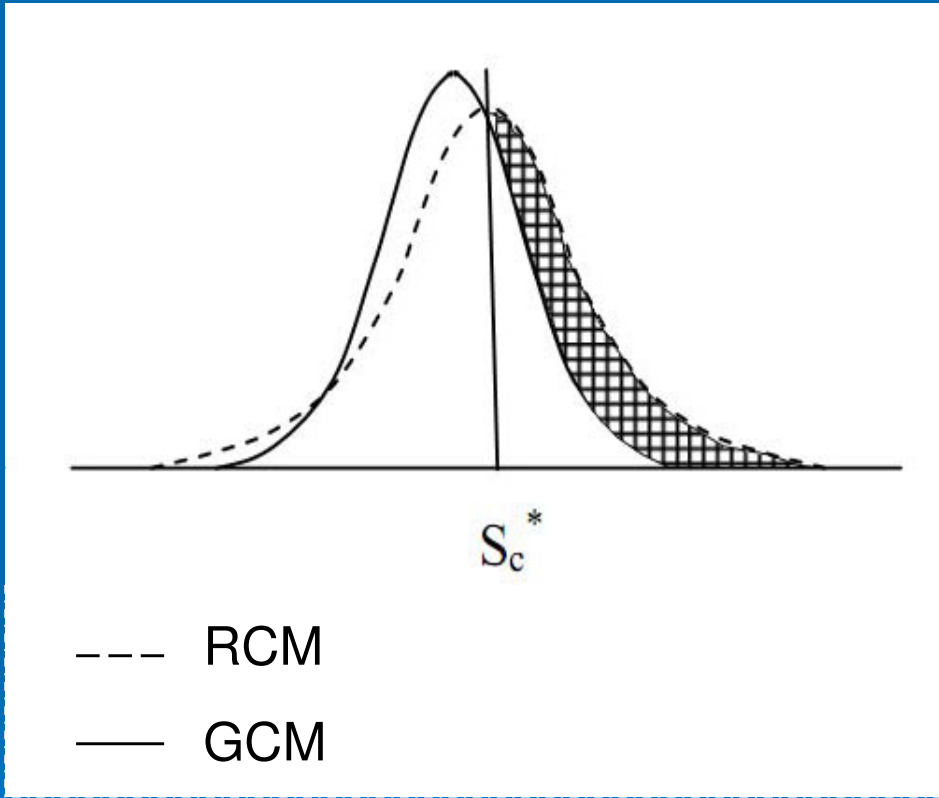
- Applied model: PRECIS
- Horizontal resolution: 0.22°
- Scenarios:
  A2, A1B, B2



- Added Value Index
- Bias correction
- Simulated climate change

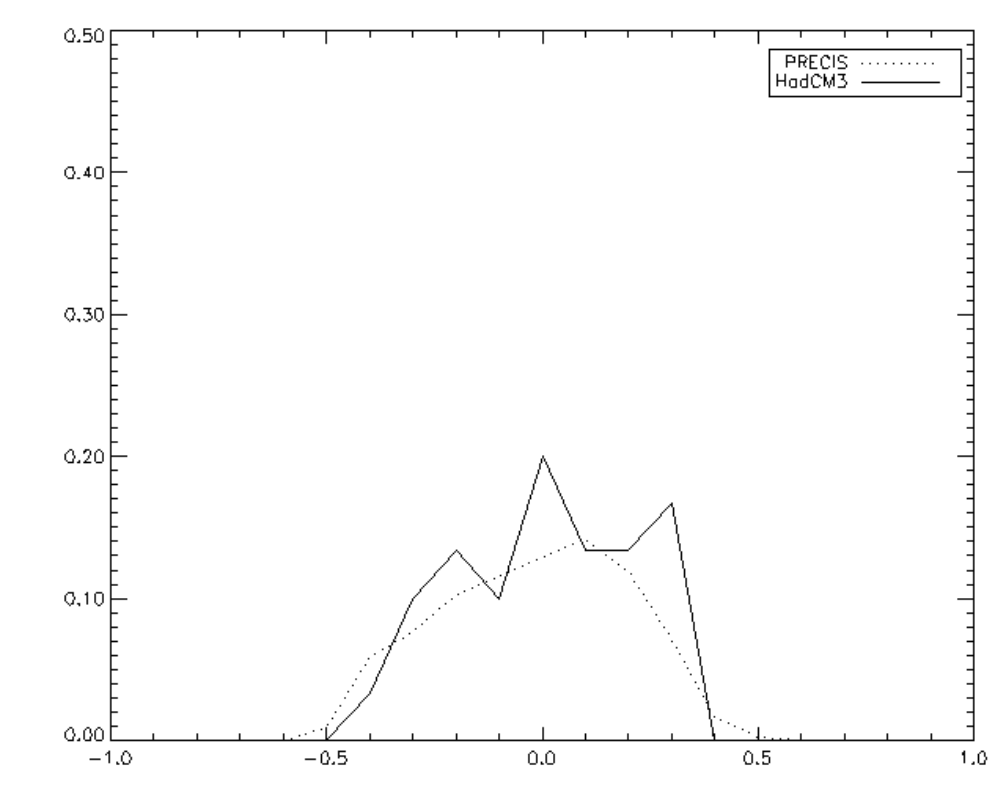


Does PRECIS add value to its driving GCM?



Kanamitsu & DeHaan, 2011

Gaussian distribution



Modified approach

empirical distribution

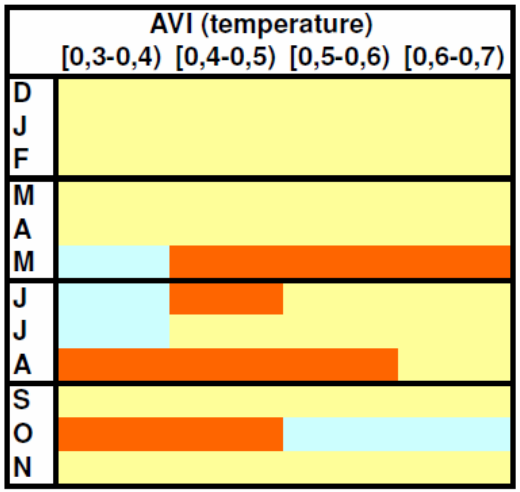
Added Value Index

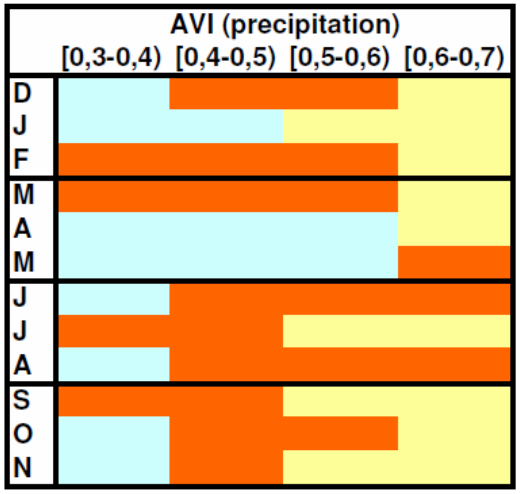
Adapted from Kanamitsu & DeHaan, 2011:

	AVI (temperature)
D	-0.0006145
J	-0.0006356
F	-0.0000004
M	-0.0000248
A	0.0000181
M	0.0448724
J	-0.0119884
J	-0.0232448
A	0.1144206
S	-0.0053201
O	-0.0597612
N	-0.0000683

	AVI (precipitation)
D	-0.0055257
J	-0.0258007
F	-0.0178891
M	0.0235165
A	-0.0252658
M	-0.0974444
J	0.0271230
J	0.0126867
A	0.0085146
S	0.0051816
O	-0.0315878
N	-0.0029081

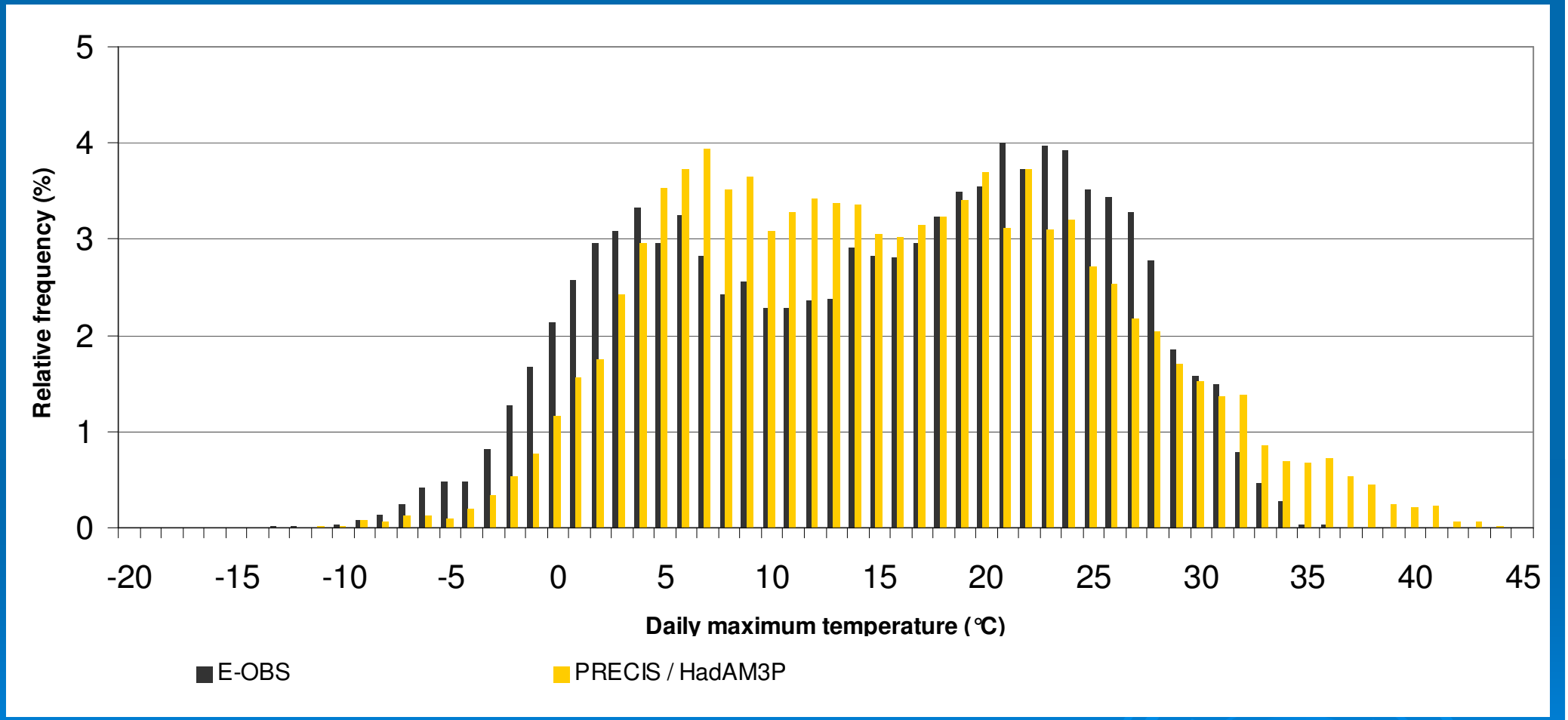
Modified approach:



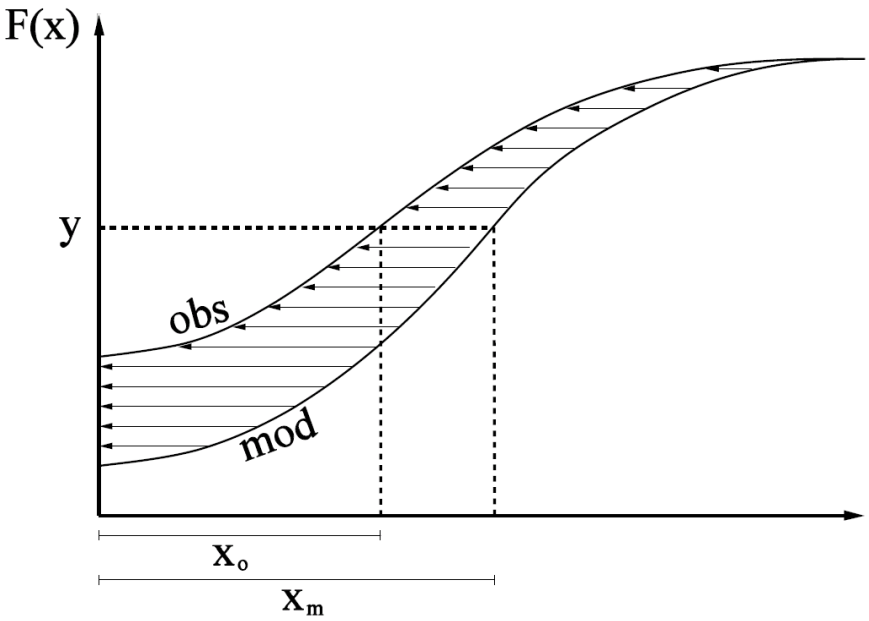


- The two methods produce similar results
- The regional model adds value to the GCM (orange rectangles)
- Precipitation: more detailed physics

Why is bias correction necessary?



Applied bias correction method: monthly-based quantile matching



Formayer and Haas, 2010

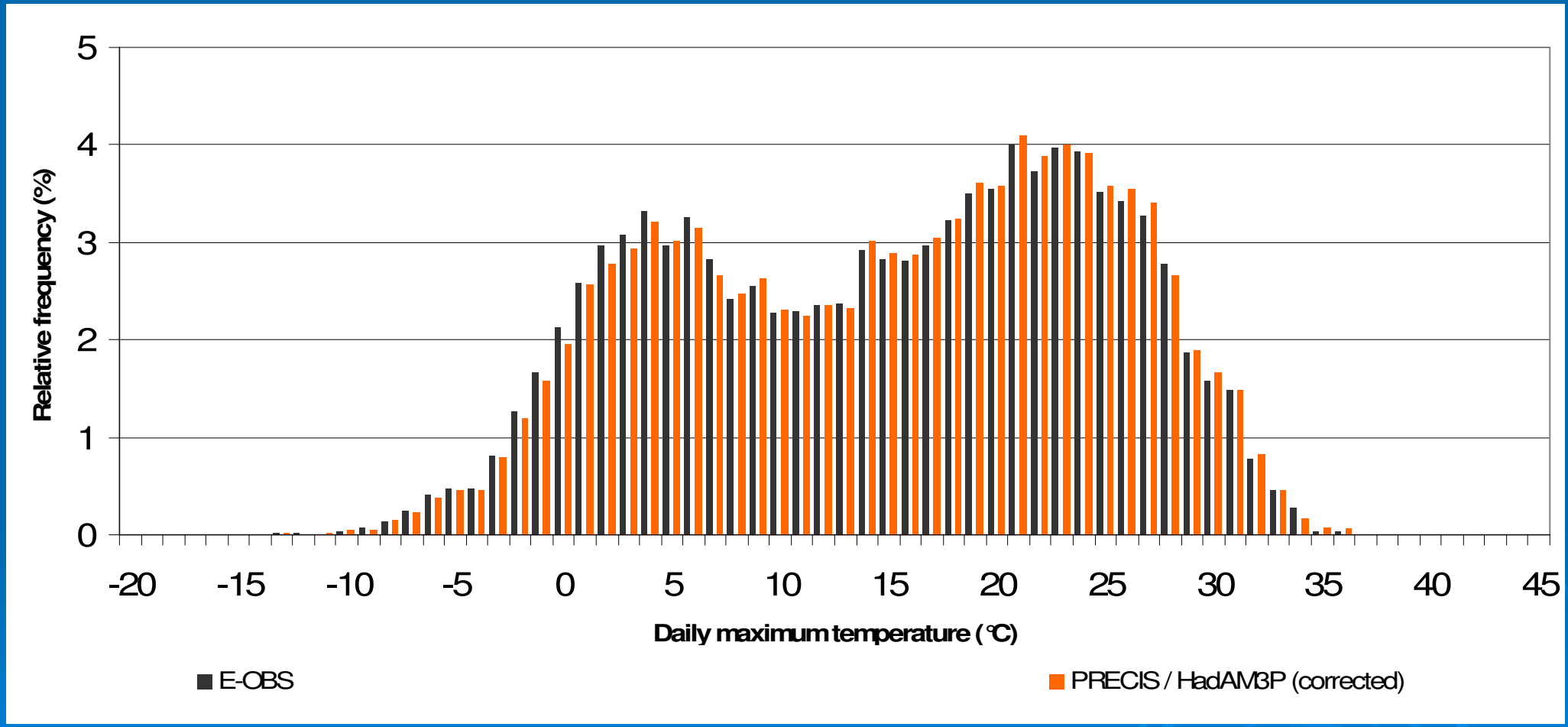
Additive factor (for temperature):

$$f_a(y) = F_o^{-1}(y) - F_m^{-1}(y) = x_o - x_m$$

Multiplicative factor (for precipitation):

$$f_m(y) = \frac{F_o^{-1}(y)}{F_m^{-1}(y)} = \frac{x_o}{x_m}$$

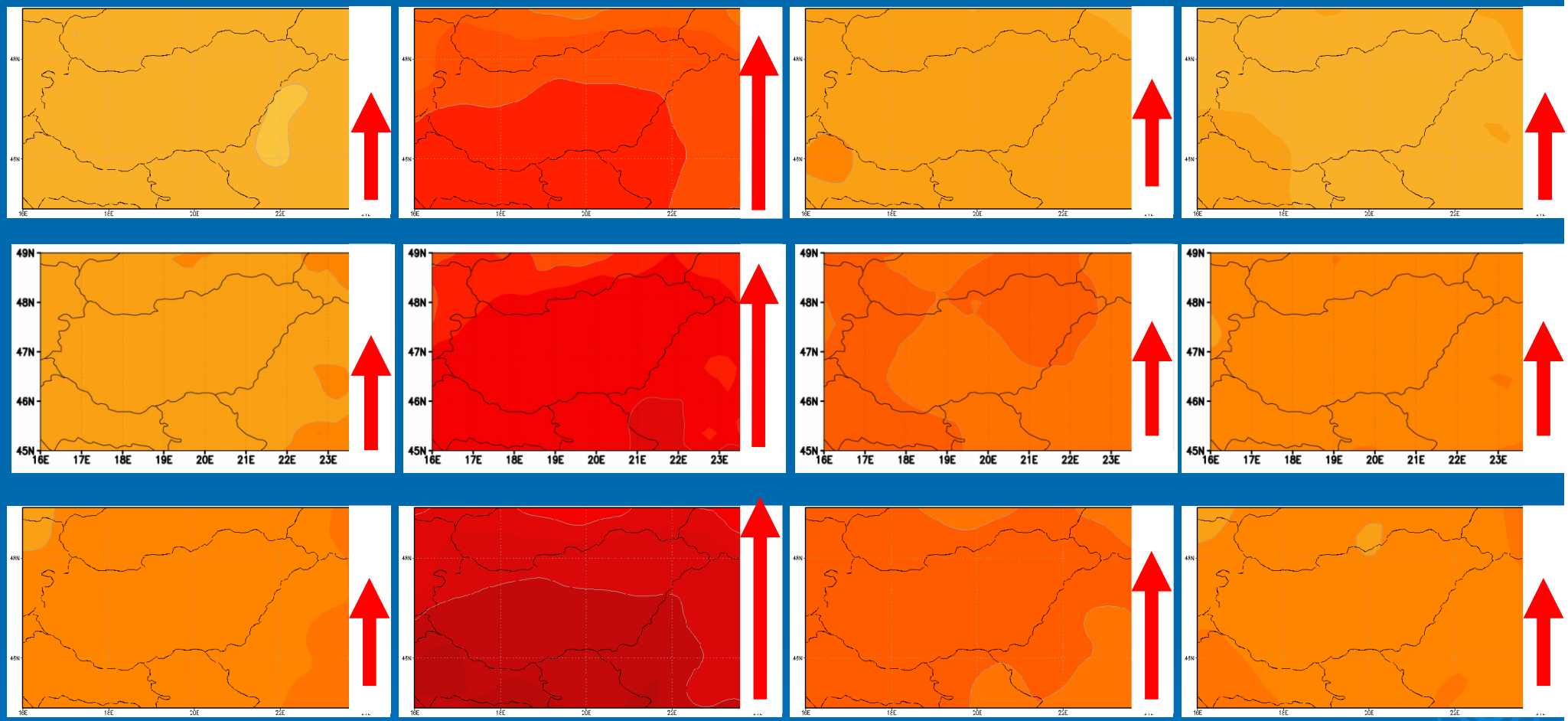
Application of correction to daily temperature data

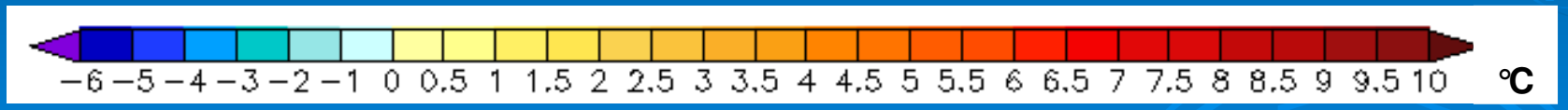


Results: 21st century climate assessment for Hungary

Simulated seasonal temperature change by 2071–2100 (reference period: 1961–1990)

A2 scenario A1B scenario B2 scenario

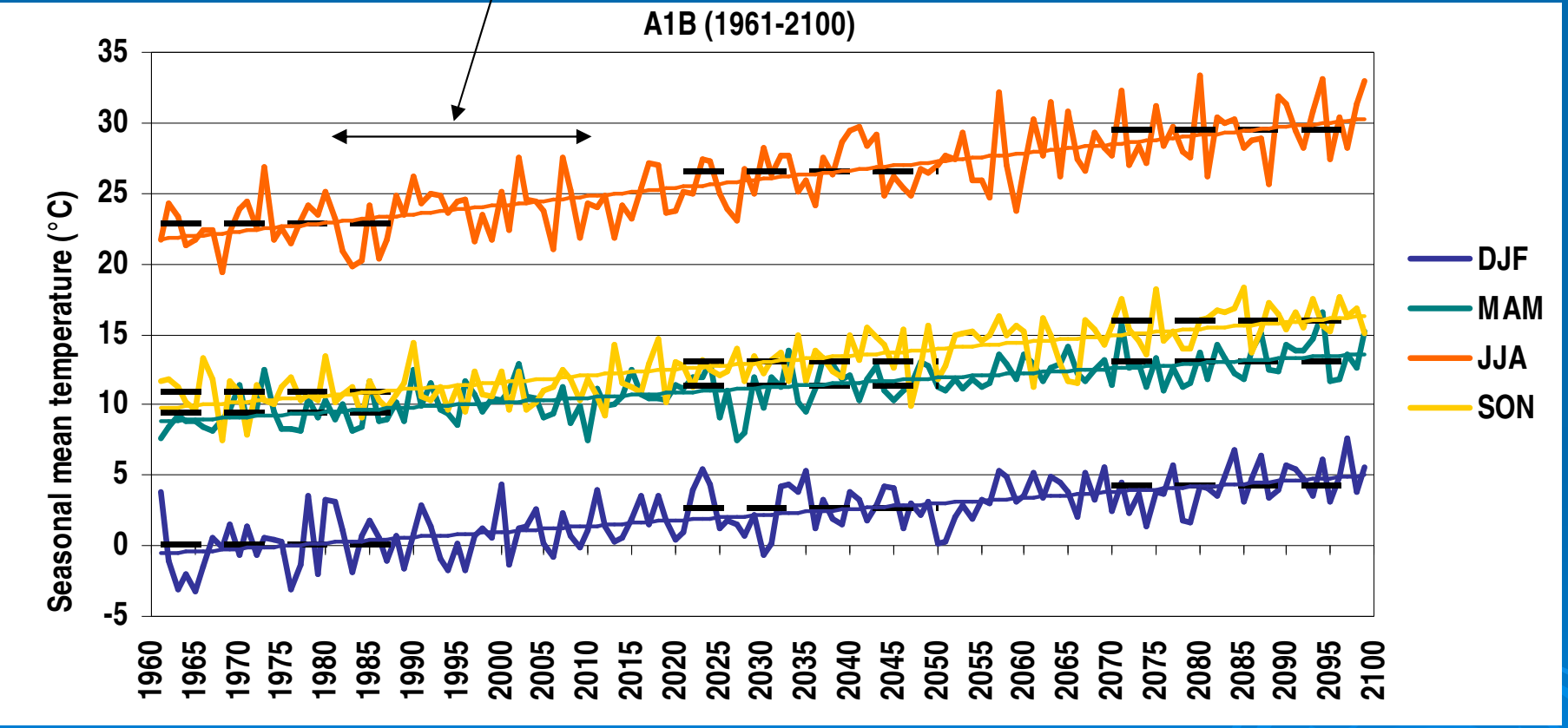




Projected change: increasing temperature (especially in summer)

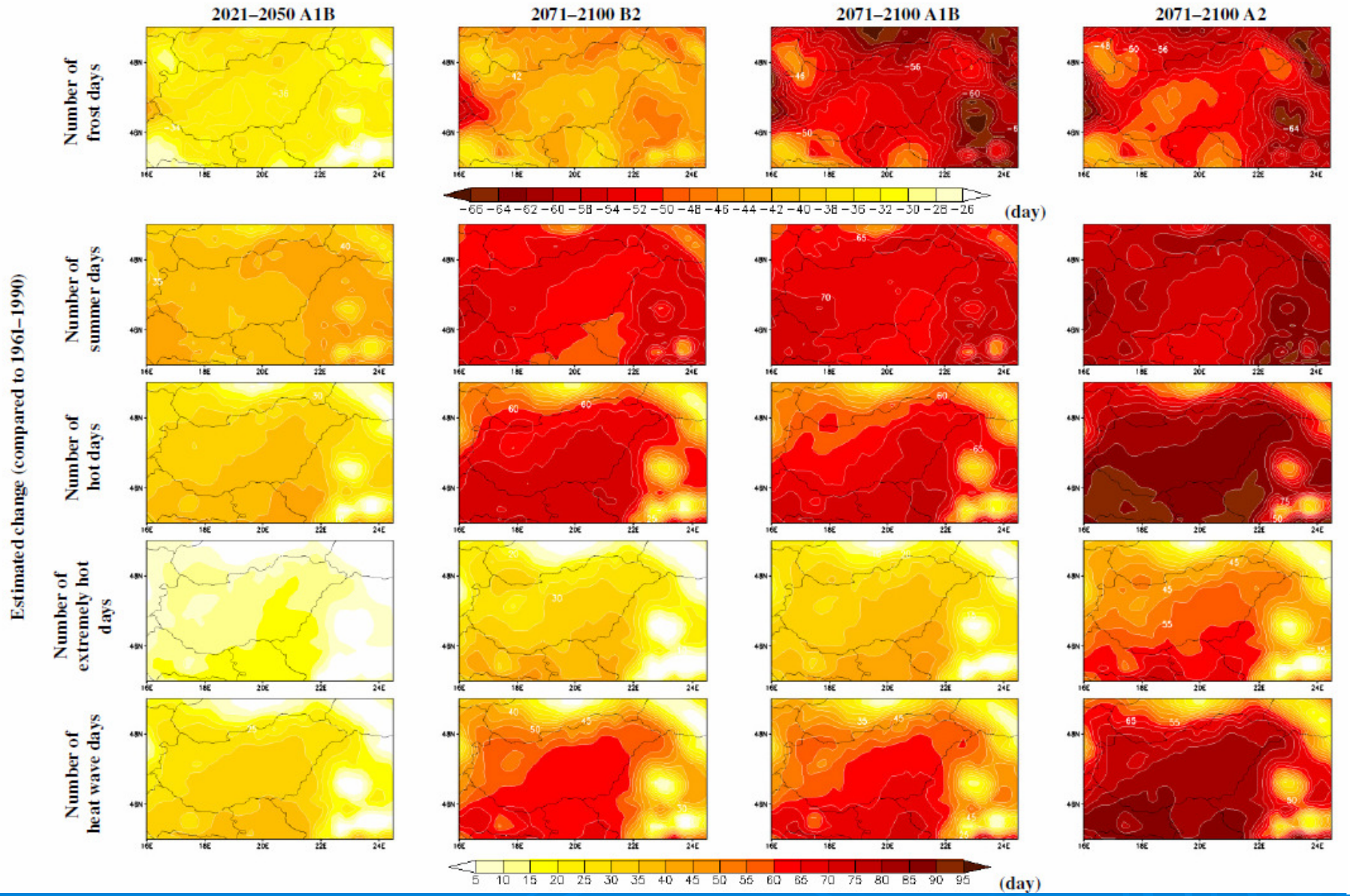
Year-to-year variation of seasonal mean simulated temperature

~ 2 ℃, confirmed by observations



Statistically significant trend in each season

Temperature indices



1961-90 E-OBS/HU:

Number of frost days
(T_{min} < 0 °C)
93 days

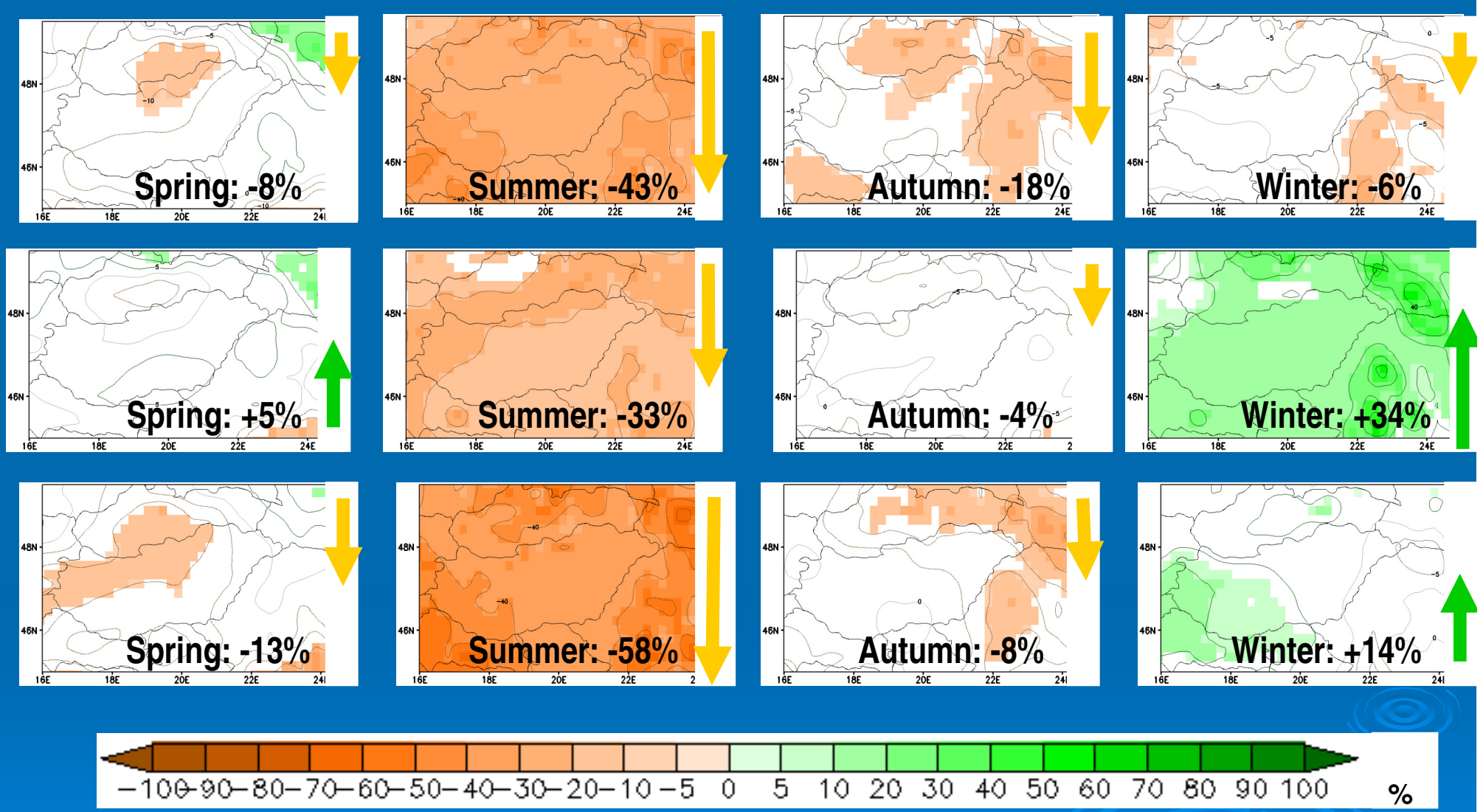
Number of summer days
(T_{max} > 25 °C)
67 days

Number of hot days
(T_{max} > 30 °C)
14 days

Number of extremely hot days
(T_{max} > 35 °C)
0.3 days

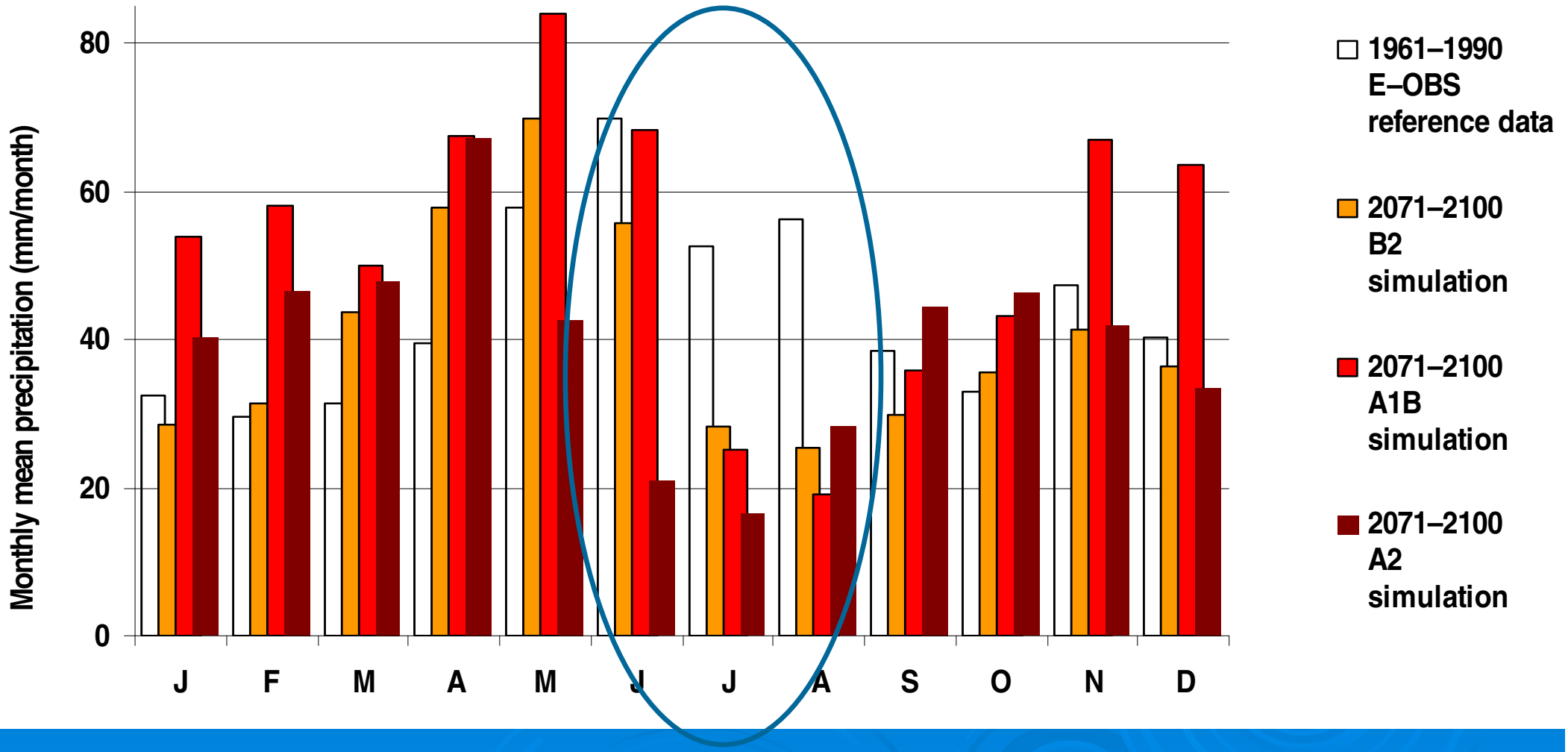
Number of heatwave days
(T_{mean} > 25 °C)
4 days

Simulated seasonal precipitation change by 2071–2100 (reference period: 1961–1990)



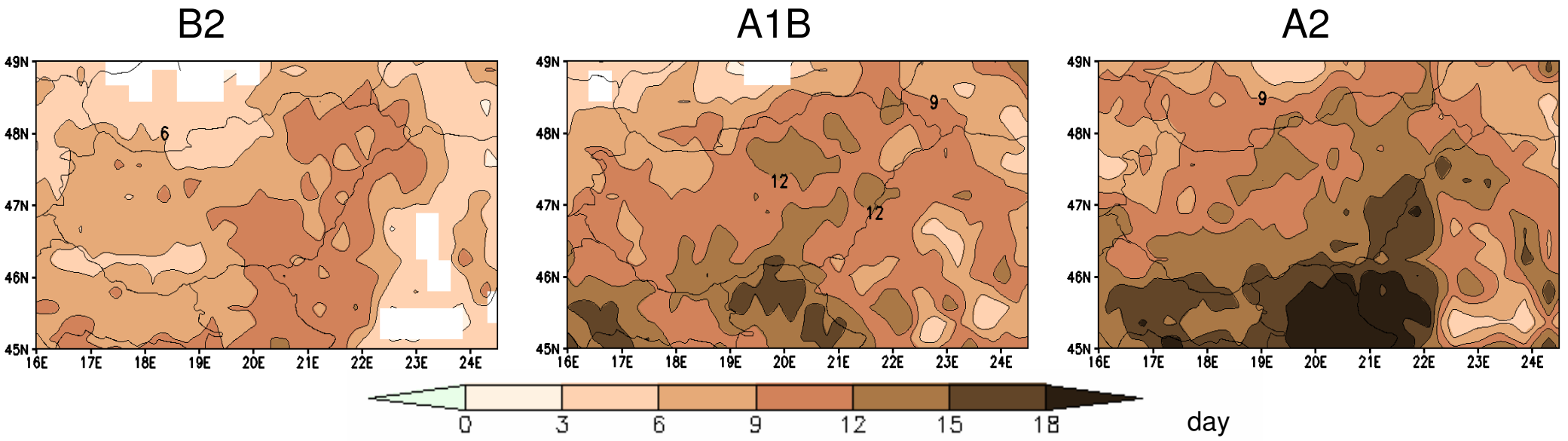
Projected change: summer decrease, winter increase

Annual distribution of monthly mean precipitation (mm/month)



Consecutive dry days

Projected change by 2071–2100 (summer)
(reference period: 1961–1990)



1961–1990, E-OBS/HU: 28 days

Significant increase in the maximum length of consecutive dry days in summer is projected

Conclusions

- The regional model improves the results of the global model
- Bias correction: important role when analyzing threshold-based climate indices
- The climate of Hungary is very likely to become significantly warmer, and in summer substantially drier

Thank you for your attention!

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