Validation of ALADIN-Climate simulations over Central Europe and Hungary

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2. Simulations
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1. Introduction

- **NAGiS**: Information system for adaptation to climate change in Hungary ➡ support for policy makers
- Important basis: climate projections (ALADIN, RegCM)

NAGiS
National Adaptation Geo-information System

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- **RCMGiS** objectives:
  - Perform and improve climate projections
    - Sensitivity study (domain)
    - Validation
    - Evaluation of projections
  - Data provision for impact studies
  - Quantification of uncertainties

RCMGiS

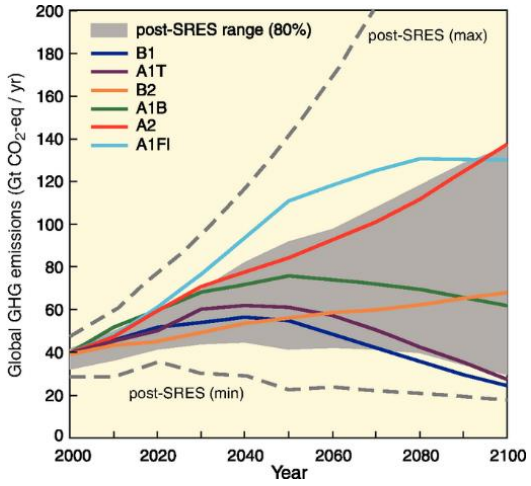
What's new?

- Model version 5.2
- Domain
- LBC
- RCP8.5

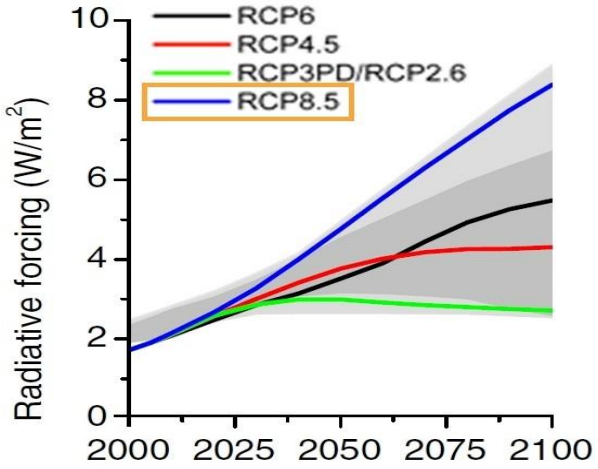
CECILIA project

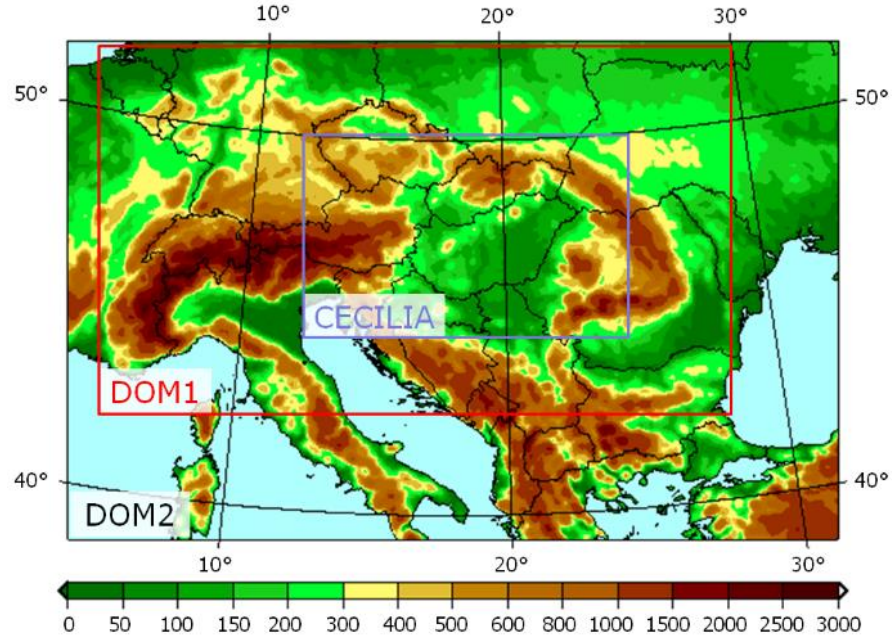
- Domain was too small
- Borders crossed high mountain areas
- Caused numerical noise in results

SRES



RCP





2. Simulations

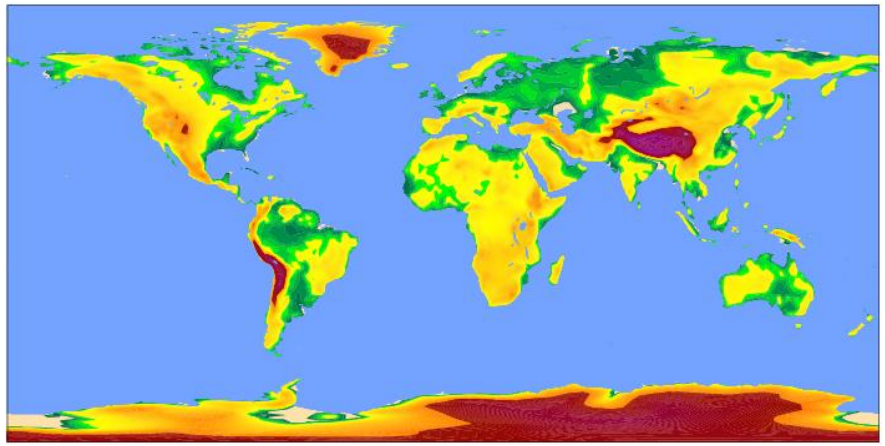
Two simulations with different LBCs

(1.) ERA-Interim reanalysis

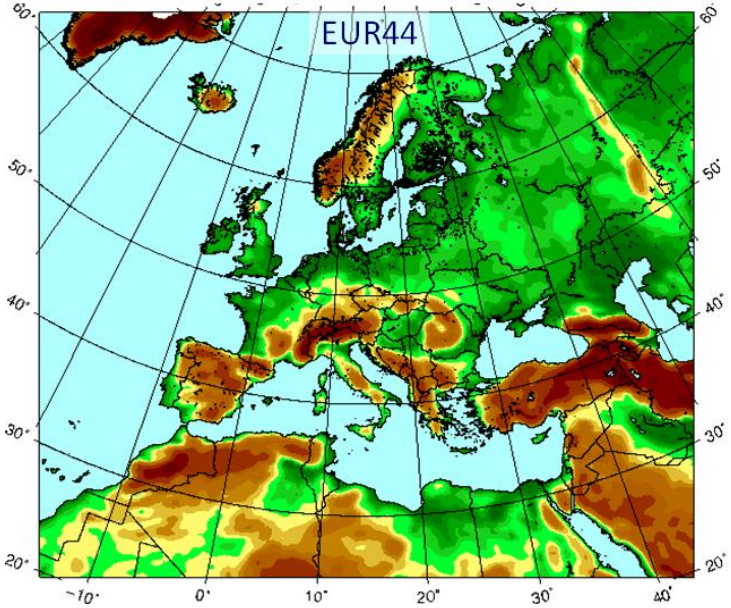
(2.) EUR44 (ALADIN)

- 50 km ALADIN-Climate run
- Output to EURO-CORDEX

ERA-Interim orography



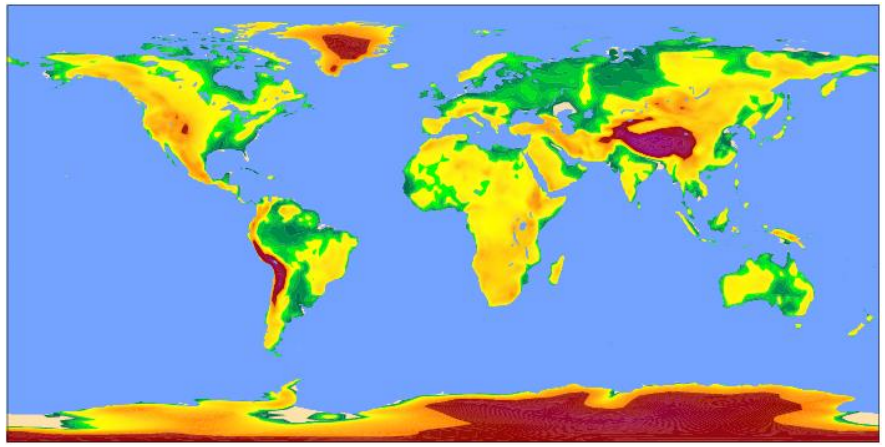
EUR44 orography



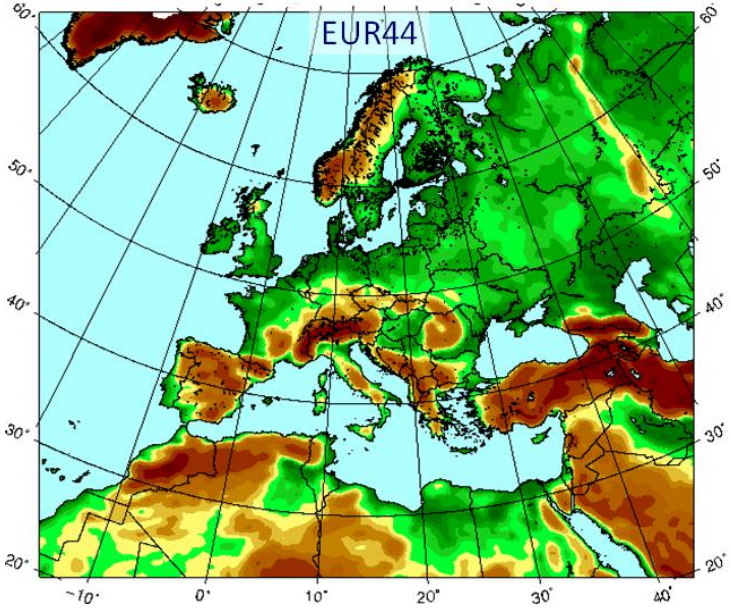
2. Simulations

	ALADIN_ERA-Interim	ALADIN_EUR44
Spatial resolution	10 km	
Vertical levels	31	
Output frequency	6 hours	
Lateral boundary condition	ERA-Interim reanalysis	EUR44 ALADIN-Climate (CNRM-CM5 downscaling)
LBC spatial resolution	approx. 80 km	50 km
Time range	1980 - 2010	1950 - 2100
Scenario	-	RCP 8.5

ERA-Interim orography



EUR44 orography



3. Reference data

1.) E-OBS v10.0

- Daily data
- 0.25° latlon grid
- Covers whole integration domain
- Not homogenized

ECA&D

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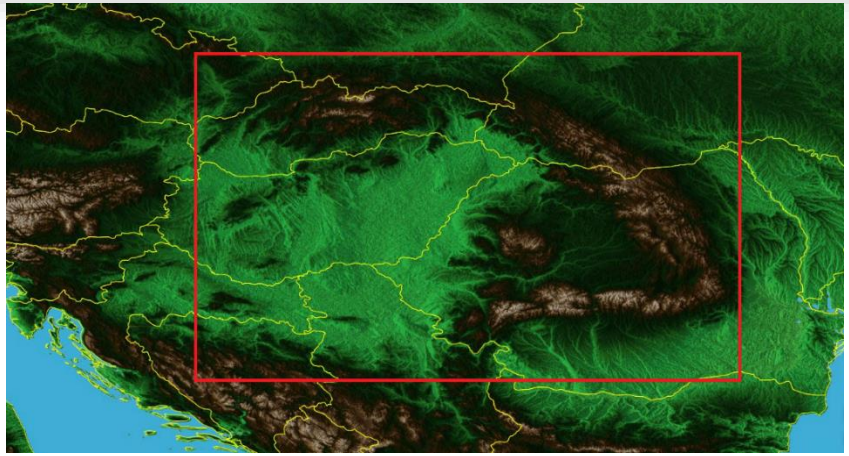
2.) CARPATCLIM

- Developed with international cooperation
- Daily data
- 0.1° latlon grid
- Interpolation: MISH*
- Homogenizations: MASH*
- Used only grid points over Hungary

CARPATCLIM
Climate of the Carpathian Region



*Tamás Szentimrey, 2008

4. Results - Temperature

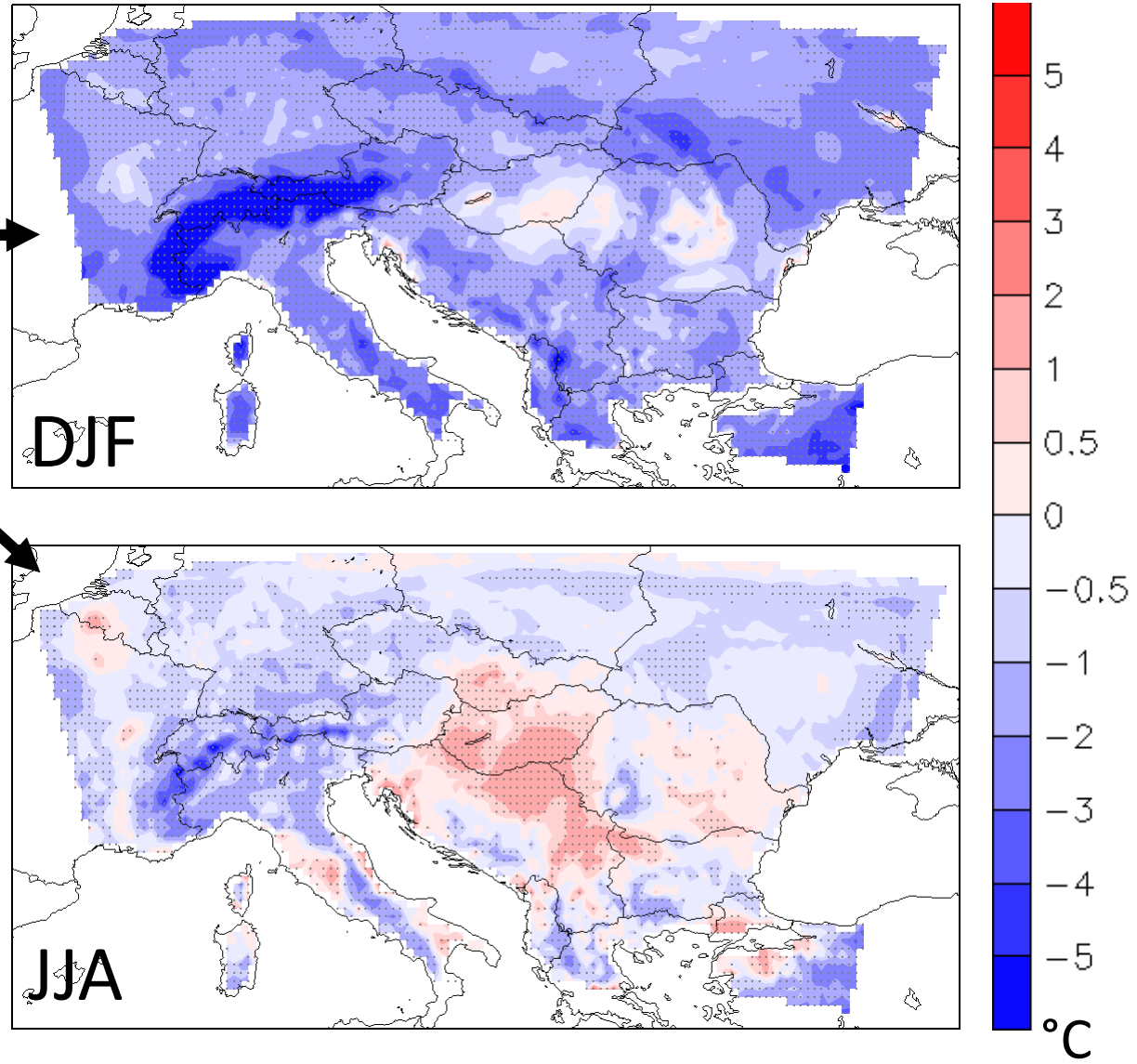
Main features:

- Underestimation: MAM, SON, DJF
- Overestimation: JJA (domain center)

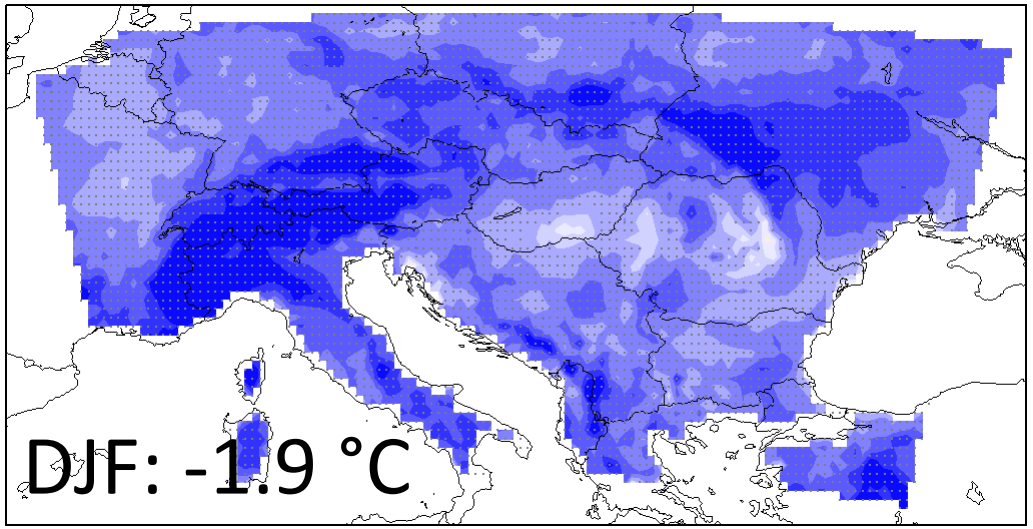
- Annual average bias over Hungary: -0.6 °C

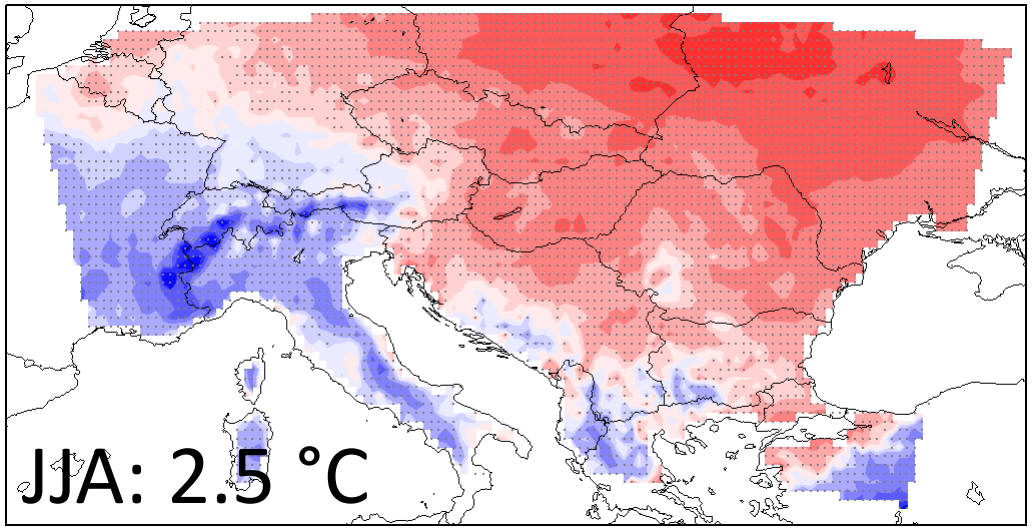
- EUR44 driven run is the less precise
- No major difference between references (below 0.1 °C)

AL_ERAI – E-OBS (1981-2000)

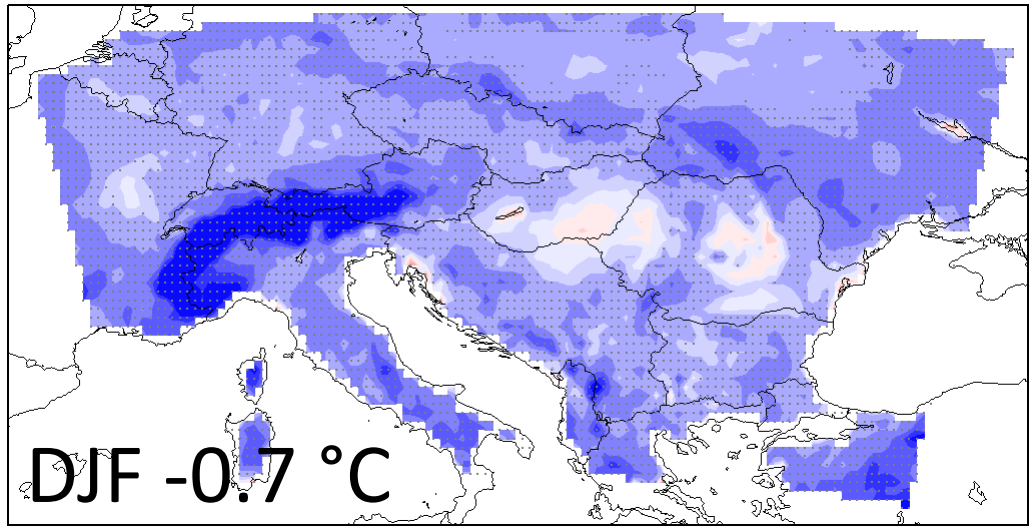


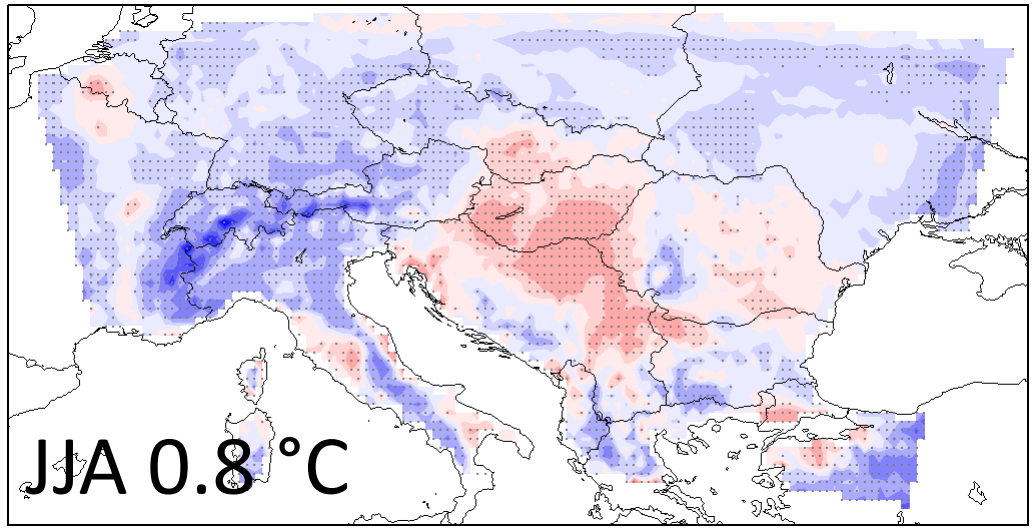
AL_EUR44 – E-OBS

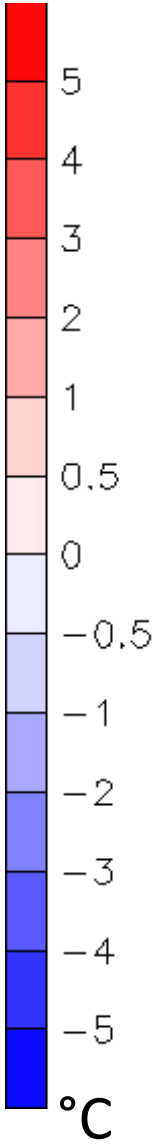


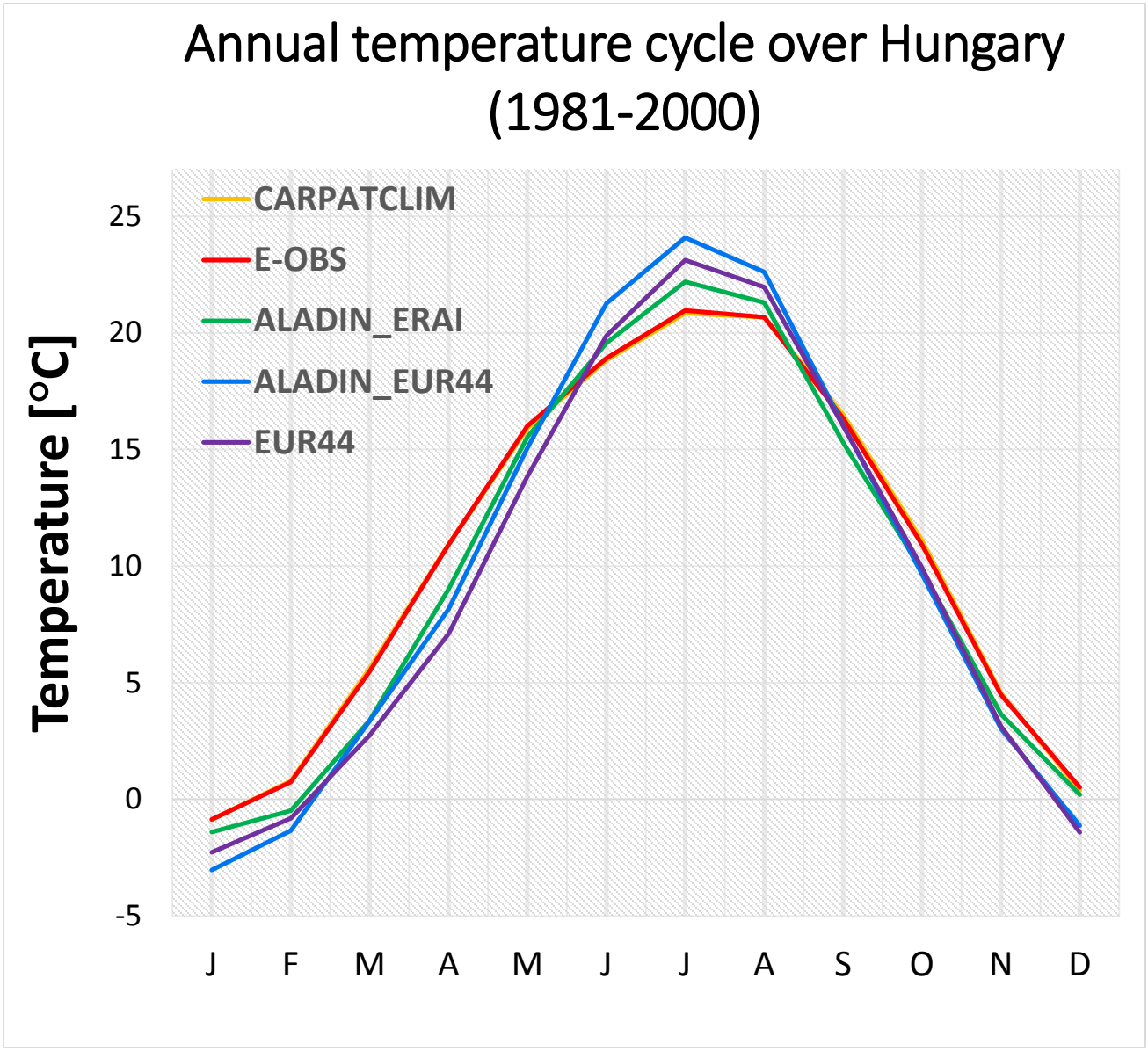


AL_ERAI – E-OBS









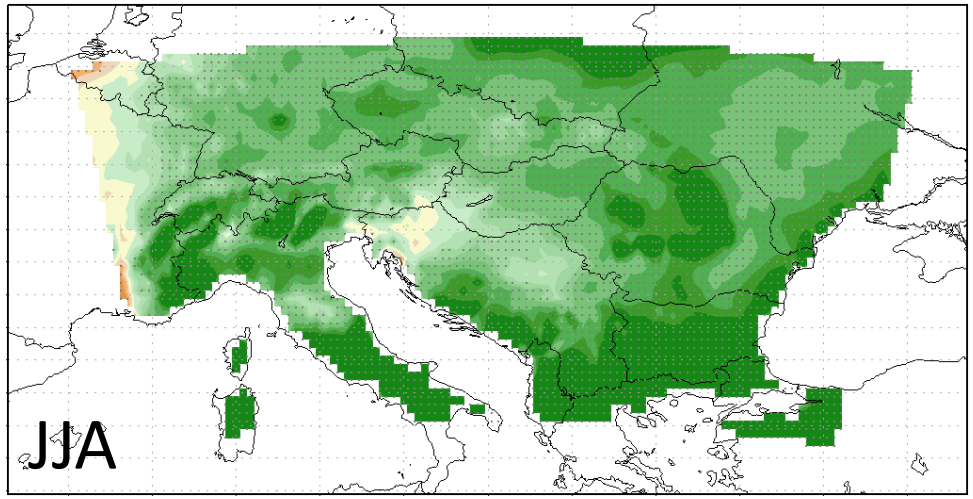
- Annual temperature cycle is reproduced by both simulations
- Maximum too high, minimum too low
- JJA, DJF: LBC is better
- MAM: downscaled is better

4. Results - Precipitation

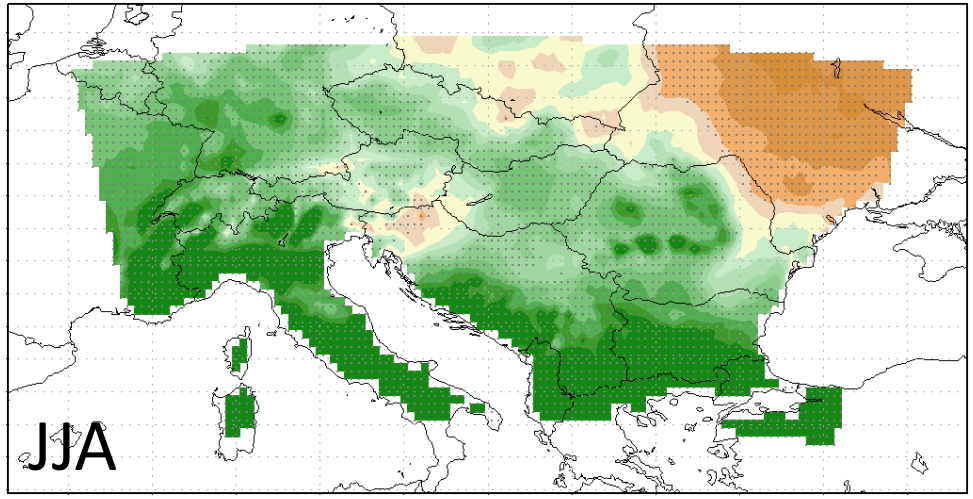
Main features:

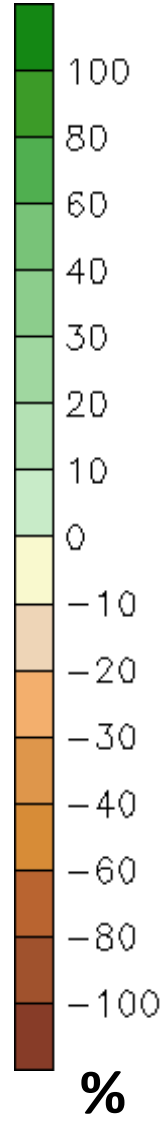
- MAM, JJA overestimation
- SON, DJF mixed picture
- JJA bias over Hungary: 30-40 %
- Simulations differ
- (RCM driven performs better)
- References differ significantly
  - JJA bias with CARPATCLIM 10-30 %

AL_ERAI – E-OBS (1981-2000)



AL_EUR44 – E-OBS (1981-2000)

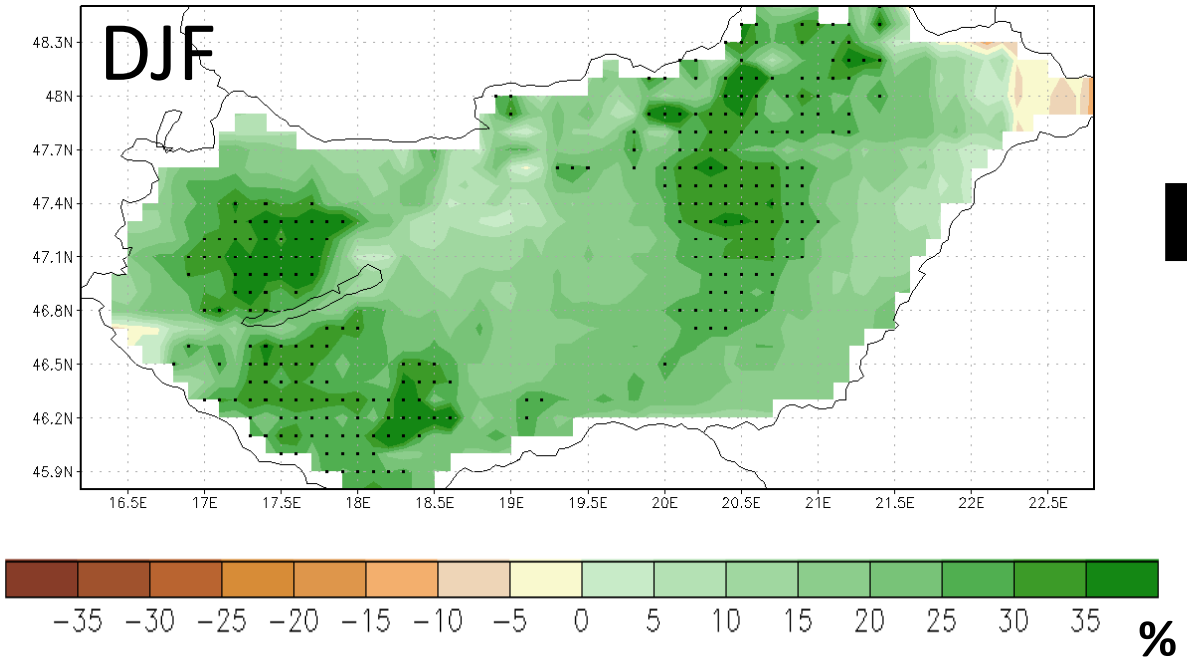




CARPATCLIM vs E-OBS

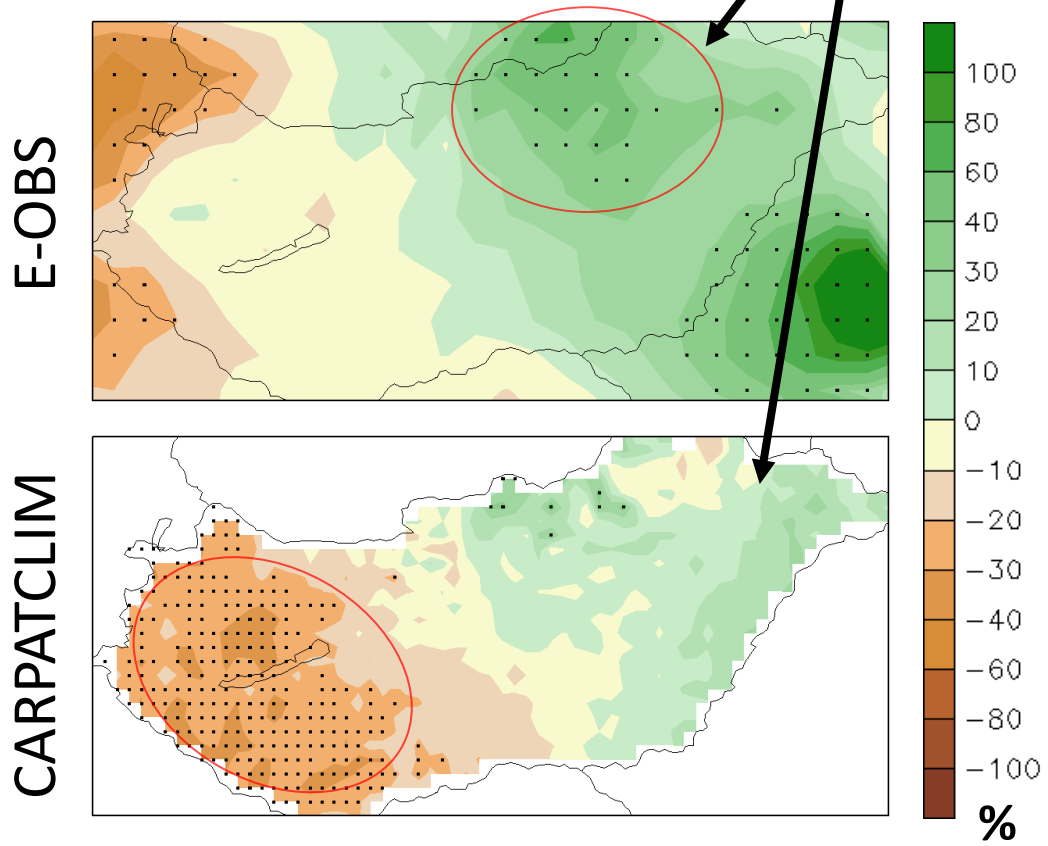
Differences in observations

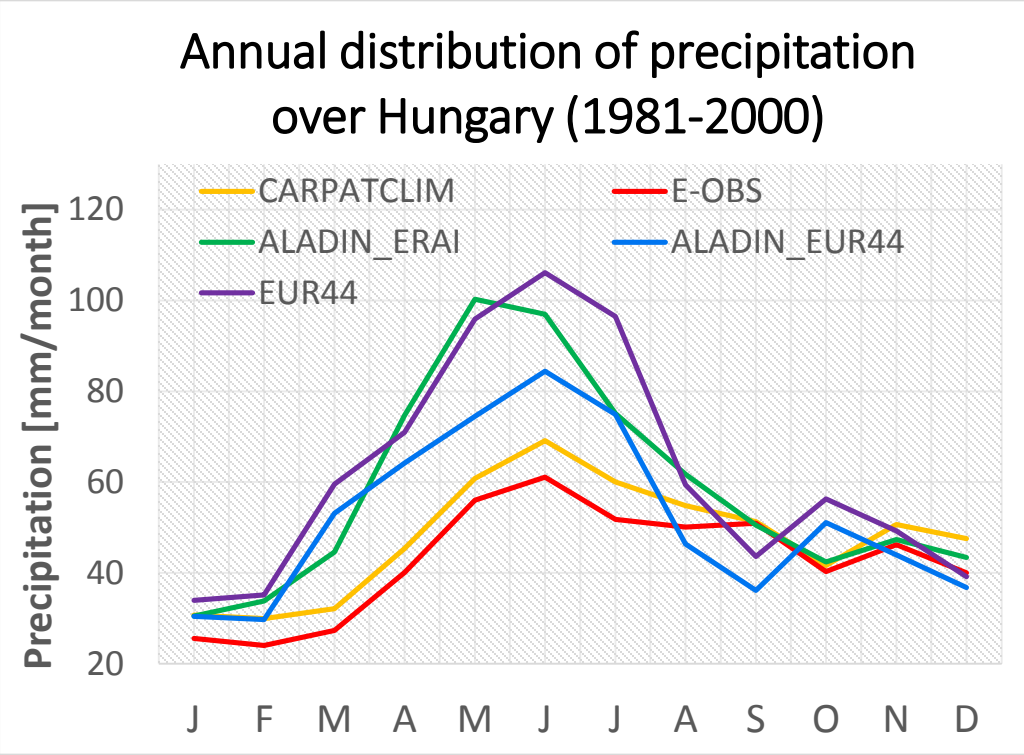
Difference of observations [%]		
CARPATCLIM - E-OBS	JJA	DJF
	10.9	**16.4**

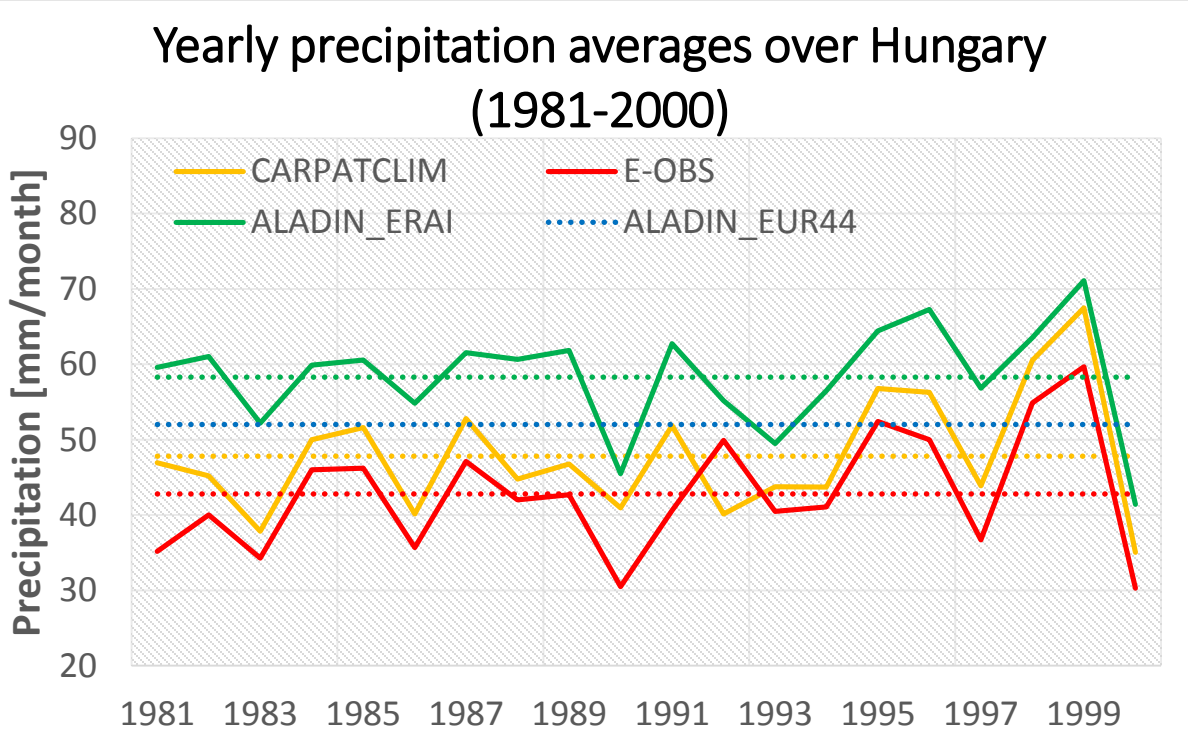


Differences in validation results

AL_EUR44 bias over Hungary [%]		
Reference	JJA	DJF
E-OBS	26.0	**9.1**
CARPATCLIM	11.8	**-9.1**







- Strong MAM, JJA overestimation
- Reanalysis driven simulation: higher positive bias, maximum is earlier
- Dynamical downscaling EUR44 improved its results

- Difference in measurements (11 % annually)
- AL_ERAI follows annual changes with a positive shift
- Difference between AL_EUR44 and CARPATCLIM is less than the difference of the two references

5. Summary

- **Performed detailed validation**
  - New domain improved model performance
    - Temperature and precipitation results improved in 3 seasons
    - (comparison not evident, different period, different reference, different lbc)
- **Compared observation datasets**
  - Significant difference in precipitation data
- Next step: evaluate projections for 2021-2050, 2071-2100

Thank you for your attention!

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