ALADIN-Climate: latest achievements at the Hungarian Meteorological Service
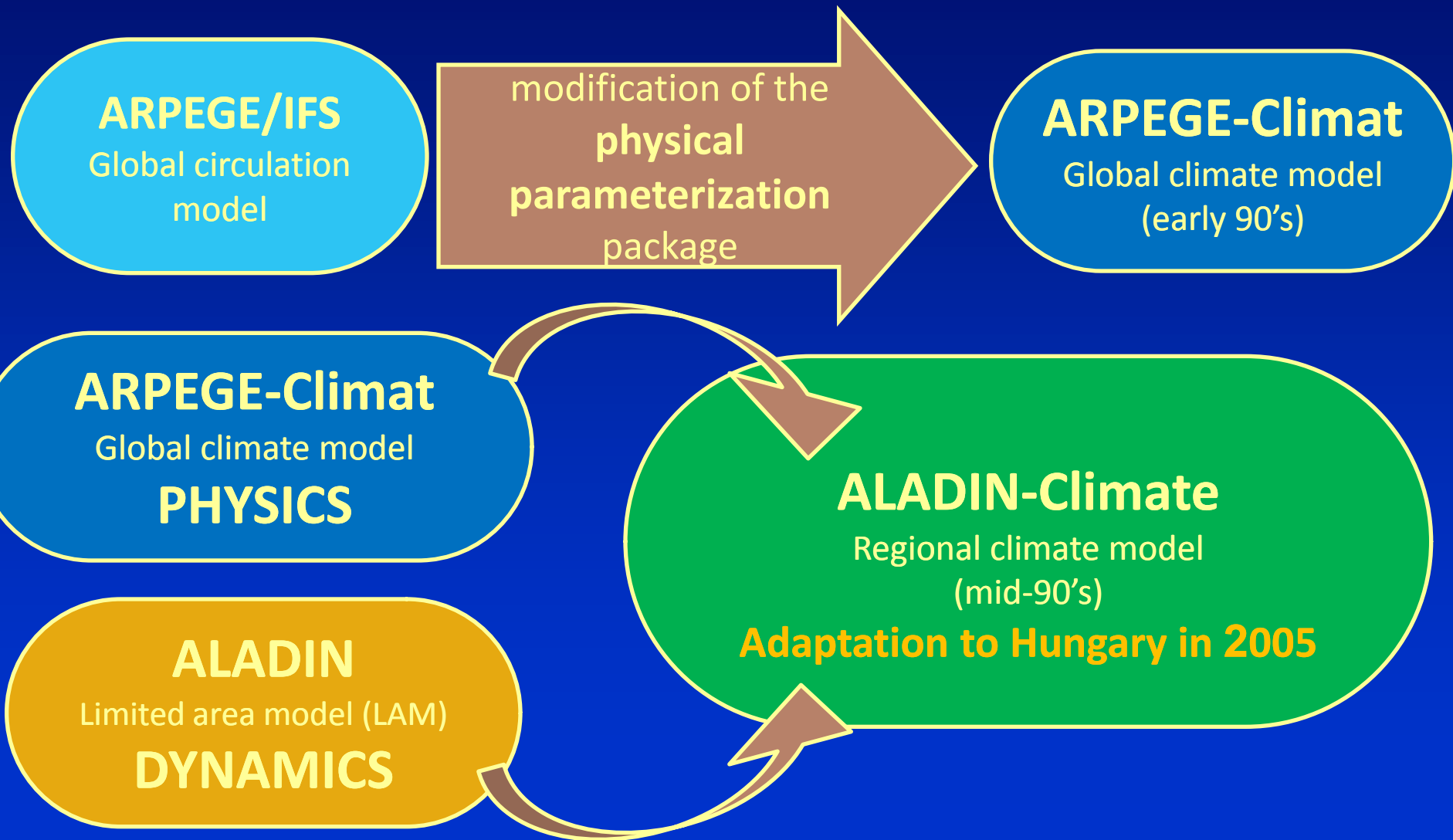
ALADIN / HIRLAM
19th Workshop / All-Staff Meeting Utrecht, 12-15 May 2009
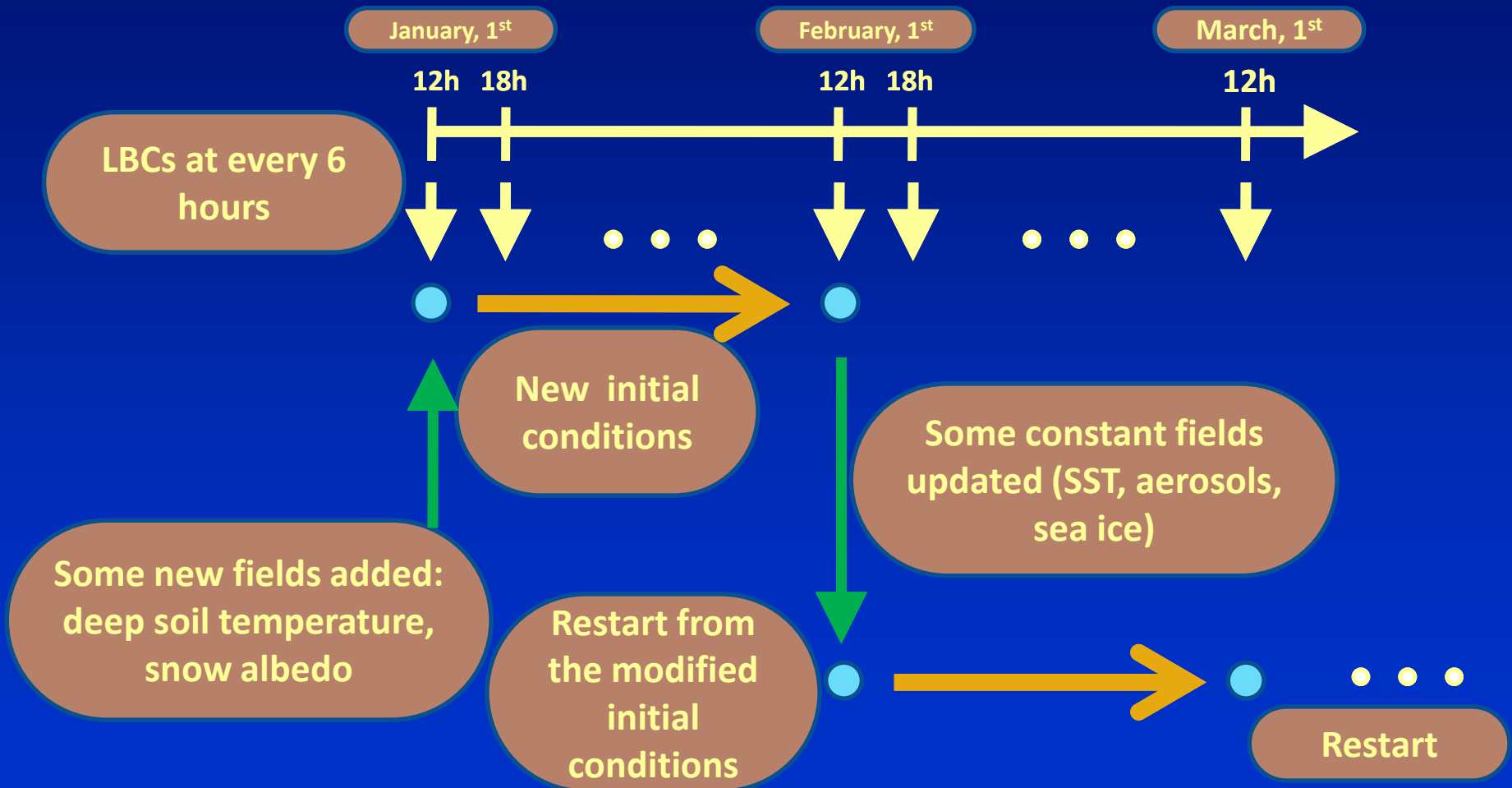
Gabriella Csima (csima.g@met.hu)

interpreted by
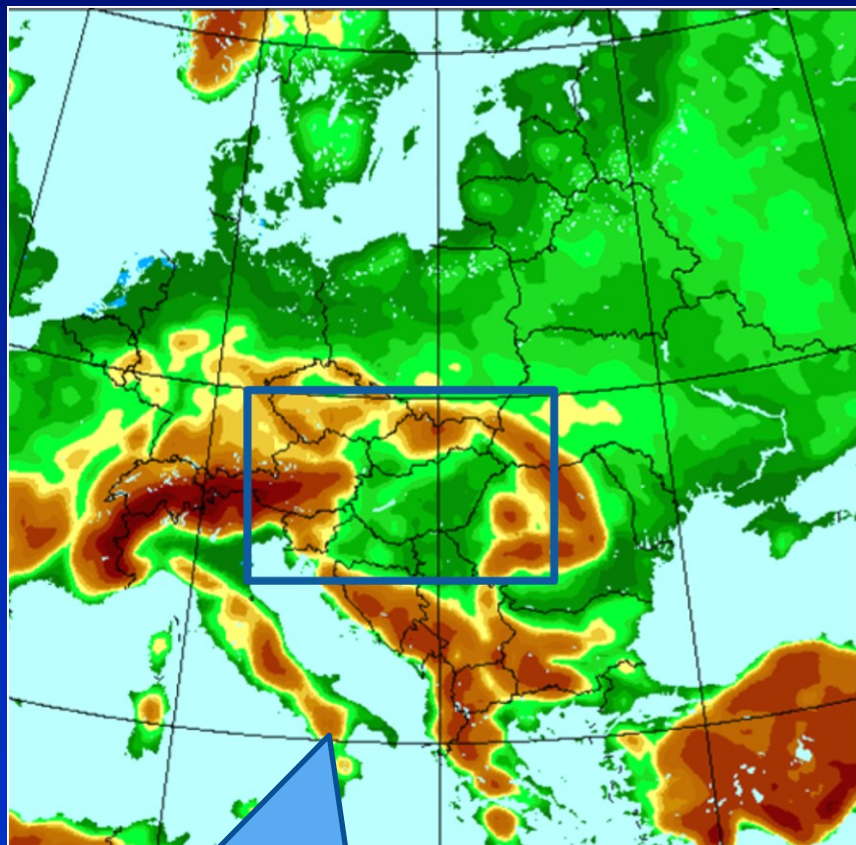**Andras Horanyi (horanyi.a@met.hu)**

The ALADIN-Climate model

ARPEGE/IFS
Global circulation model

modification of the **physical parameterization** package

ARPEGE-Climat
Global climate model
(early 90's)

ARPEGE-Climat
Global climate model
PHYSICS

ALADIN
Limited area model (LAM)
DYNAMICS

ALADIN-Climate
Regional climate model
(mid-90's)
Adaptation to Hungary in 2005

Integration of ALADIN-Climate

January, 1st   February, 1st   March, 1st

12h   18h   12h   18h   12h

LBCs at every 6 hours

New initial conditions

Some constant fields updated (SST, aerosols, sea ice)

Some new fields added: deep soil temperature, snow albedo

Restart from the modified initial conditions

Restart

The ALADIN-Climate model domain and orography

10 km-resolution
(CECILIA)
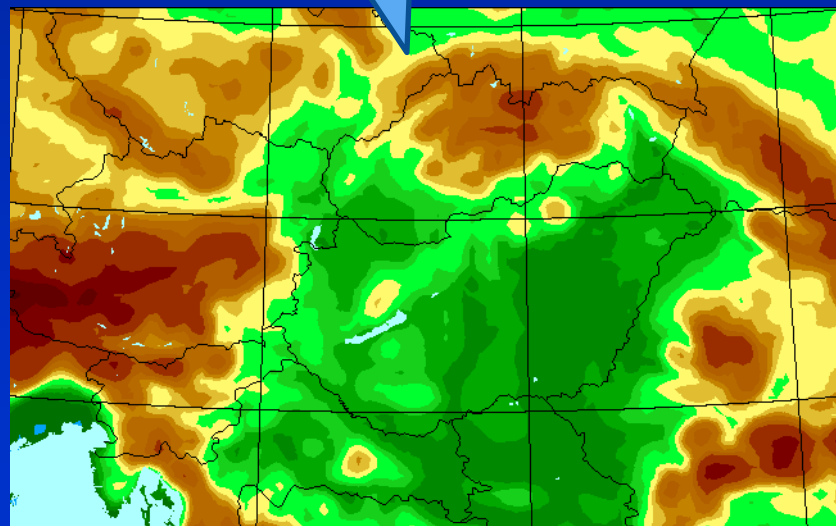
25 km-resolution

ALADIN-Climate integrations

LBC	RESOLUTION	SCENARIO	INTEGRATION PERIODS
ERA40	10 and 25 km	-	1961 - 2000
ARPEGE/OPA	10 km	-	1961 - 1990
ARPEGE/OPA	10 km	A1B	2021 - 2050 2071 - 2100
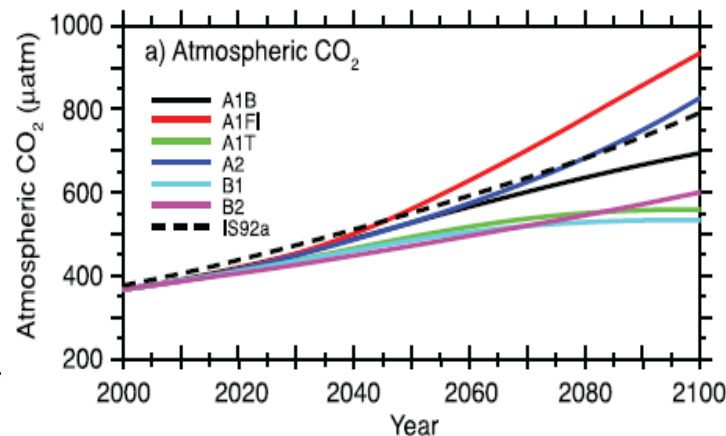
PAST
(1961-1990)

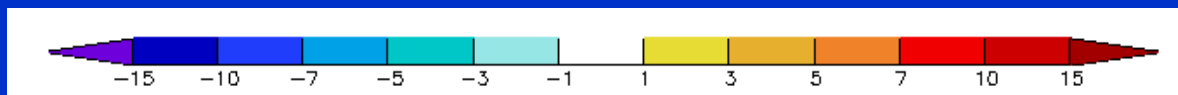# TEMPERATURE (ALADIN – CRU [°C])
Difference of annual mean temperature
1961 - 1990

10 km; LBC: ERA-40
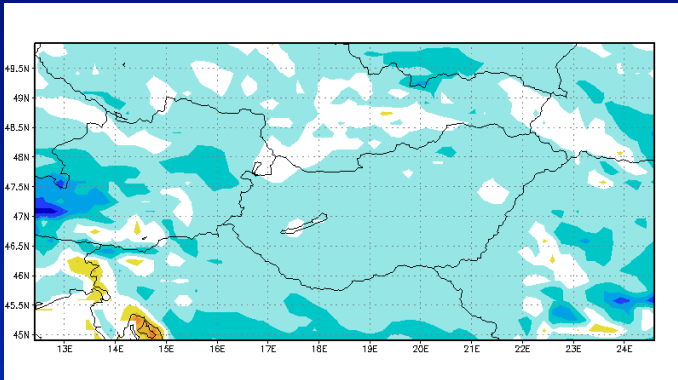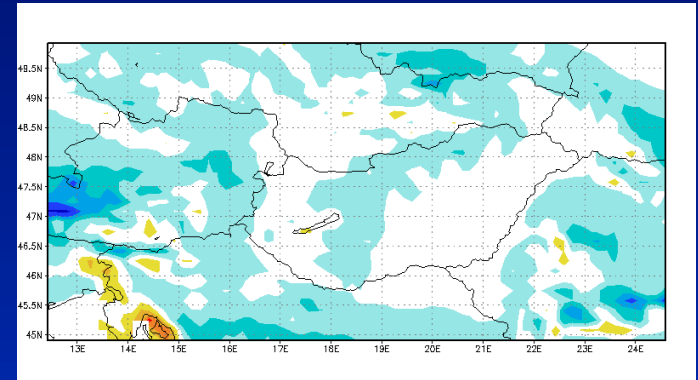
10 km; LBC: ARPEGE
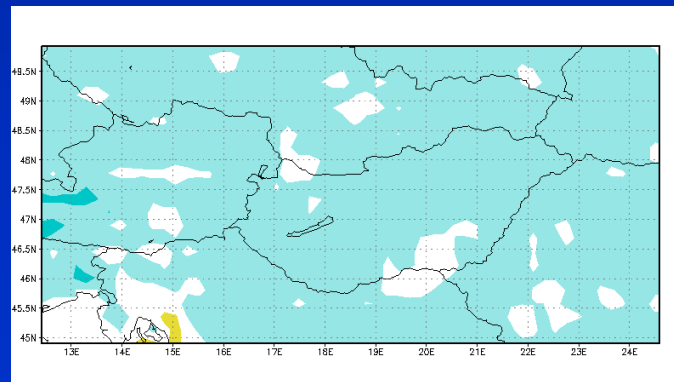
25 km; LBC: ERA-40

PRECIPITATION ((ALADIN – CRU)/CRU [%])
Annual relative difference of precipitation
1961 - 1990

10 km; LBC: ERA-40
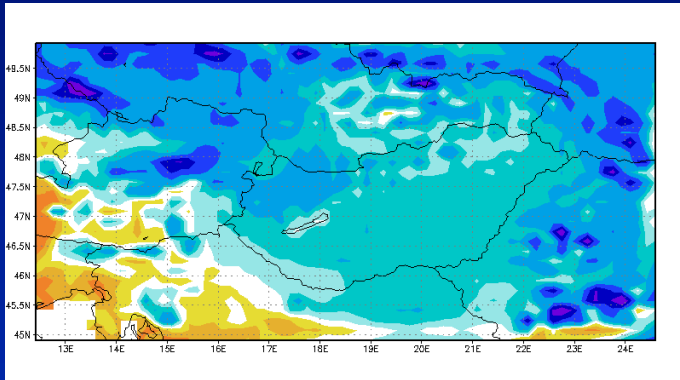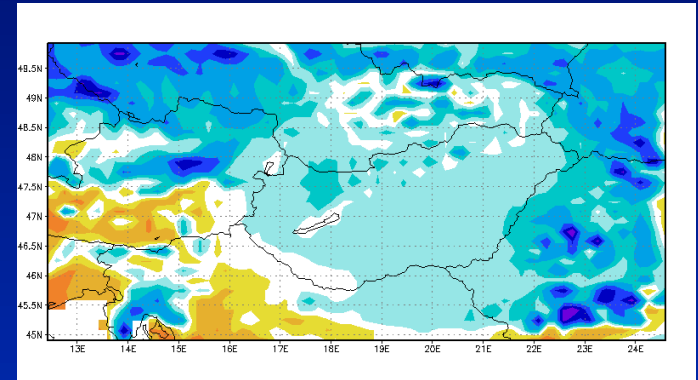
10 km; LBC: ARPEGE

25 km; LBC: ERA-40
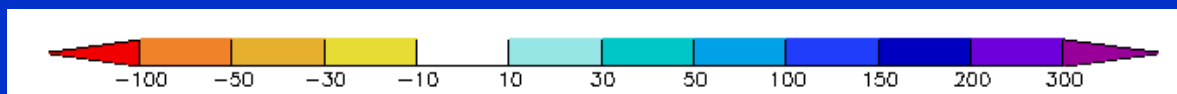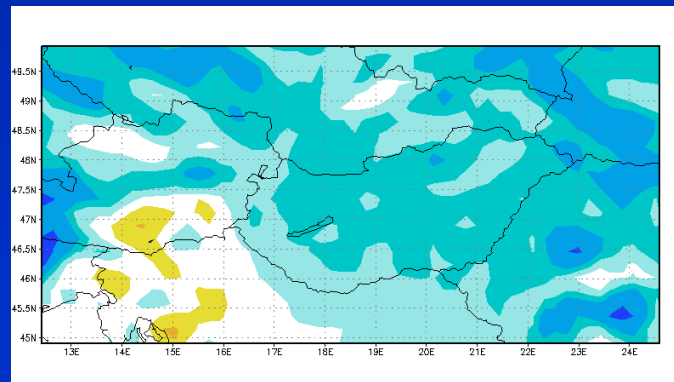
Summary of the results for the past

- **Temperature:**

  - The model is **too cold**

    - "LBC: ARPEGE " closest to the observations

- **Precipitation:**

  - The model is **too wet**

- **Issues:**

  – Perfect boundaries are not better

  – Higher resolution is not better

  – Spurious noise along the boundaries for the 10km version (**too small domain**!)

FUTURE
(2021-2050
2071-2100)

Difference of annual mean temperature [ºC]
reference period: 1961-1990

2021-2050

+3.5 ºC

+2 ºC

2071-2100

Difference of seasonal mean temperature [ºC]
reference period: 1961-1990
2021-2050

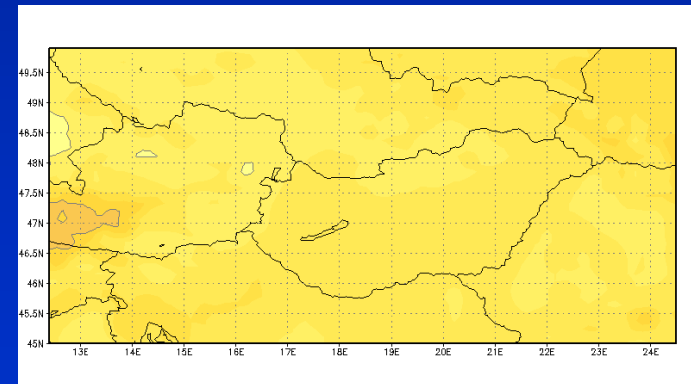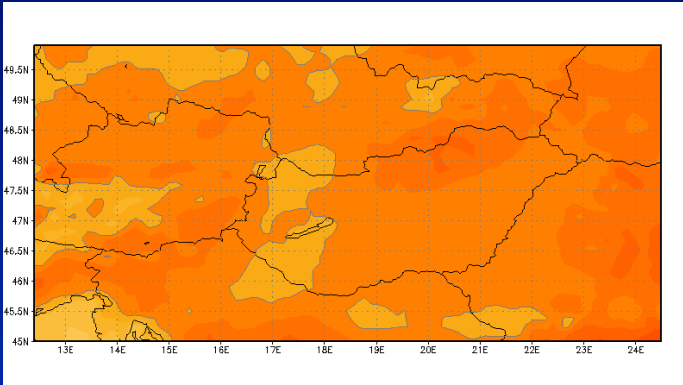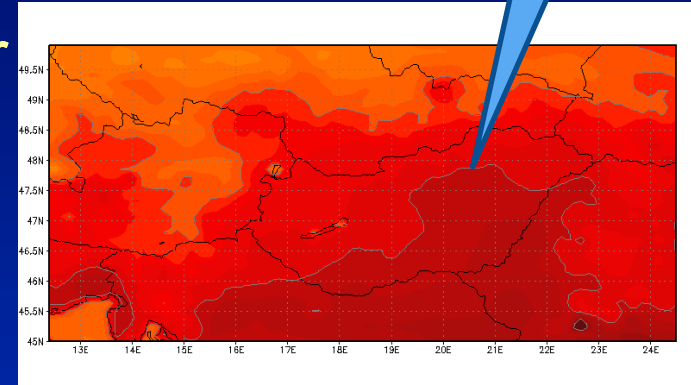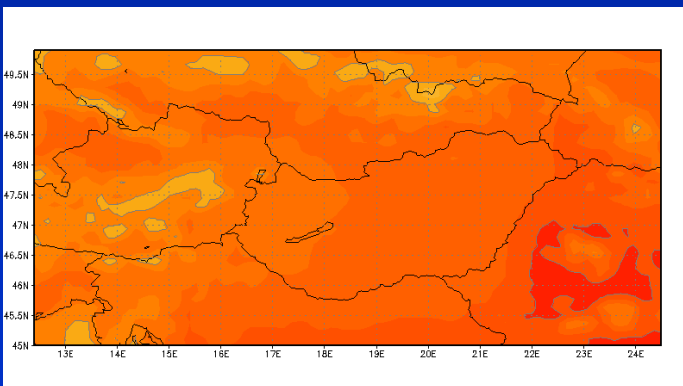# Difference of seasonal mean temperature [ºC]
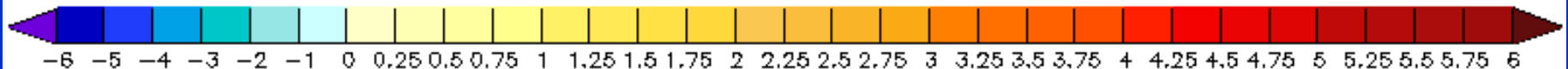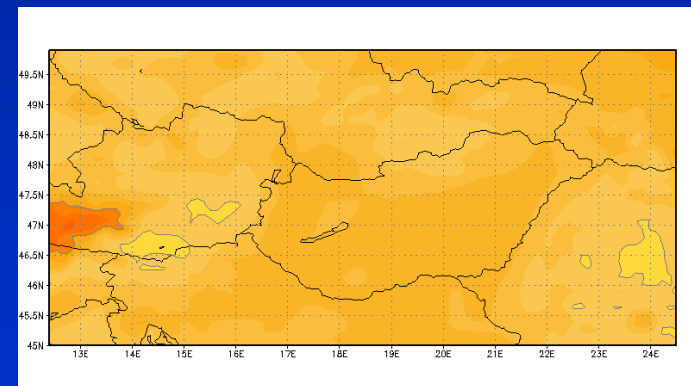reference period: 1961-1990
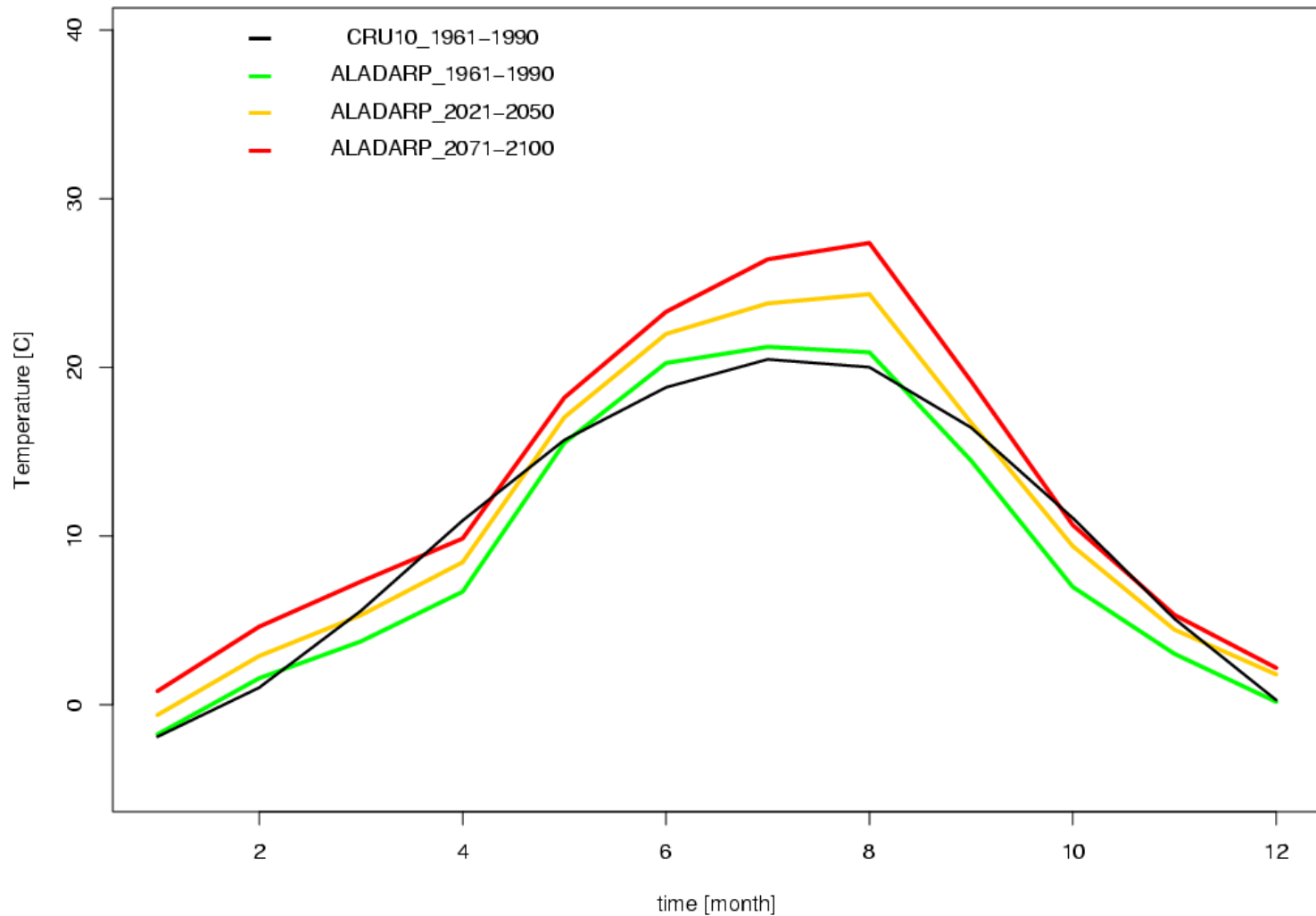## 2071-2100

Spring

Summer

+5 ºC

Autumn

Winter

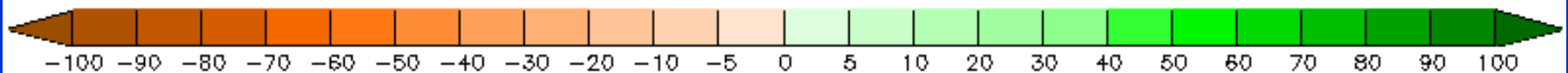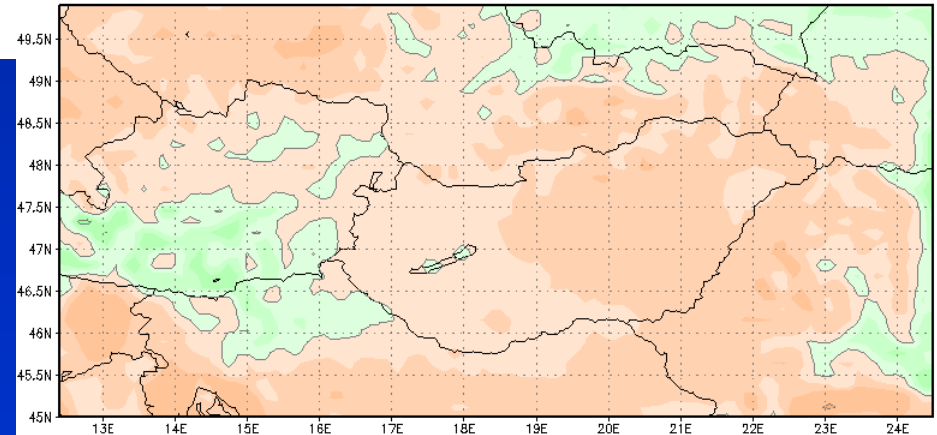# Climatological annual cycle of temperature over Hungary (1961-1990; 2021-2050; 2071-2100)

Annual relative difference of precipitation [%]
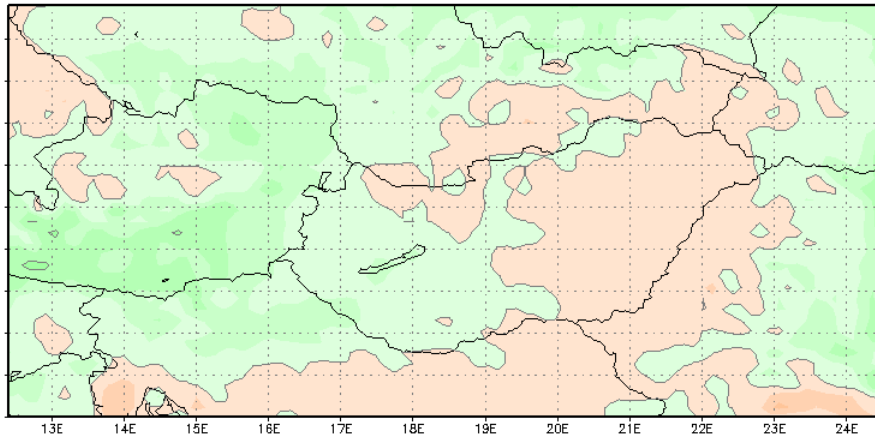## Reference period: 1961-1990
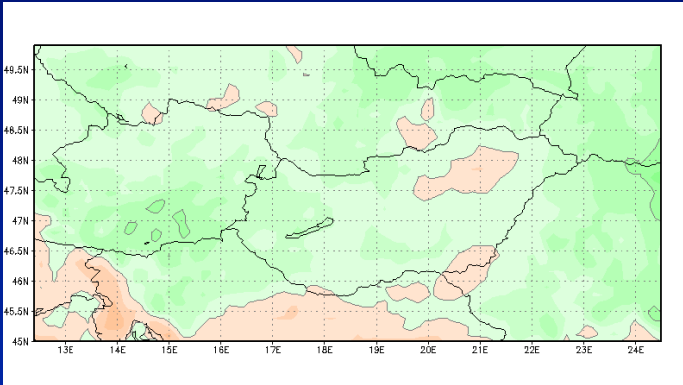
2021-2050

2071-2100

Seasonal relative difference of precipitation [%]

Reference period: 1961-1990

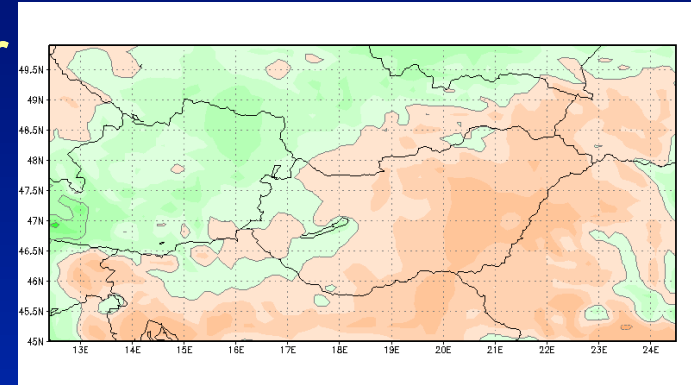## 2021-2050

Seasonal relative difference of precipitation [%]
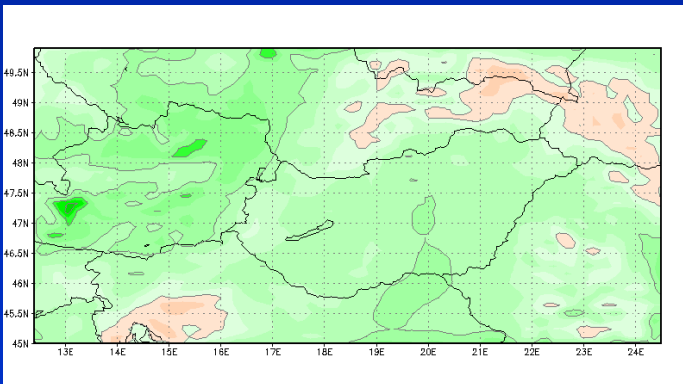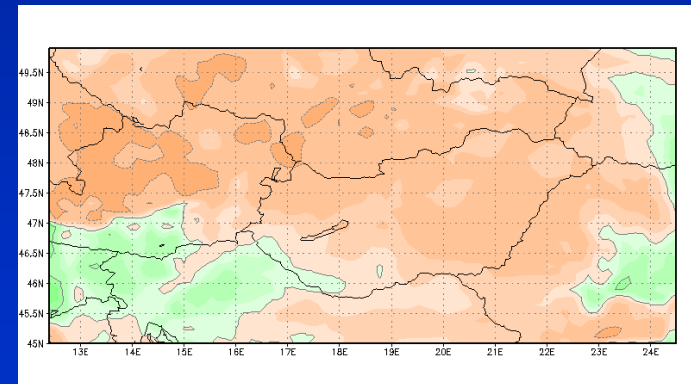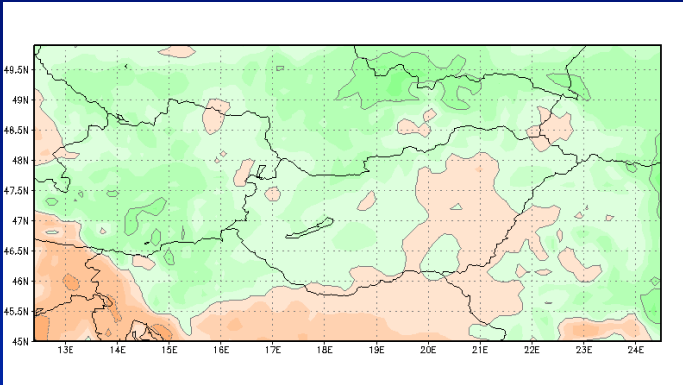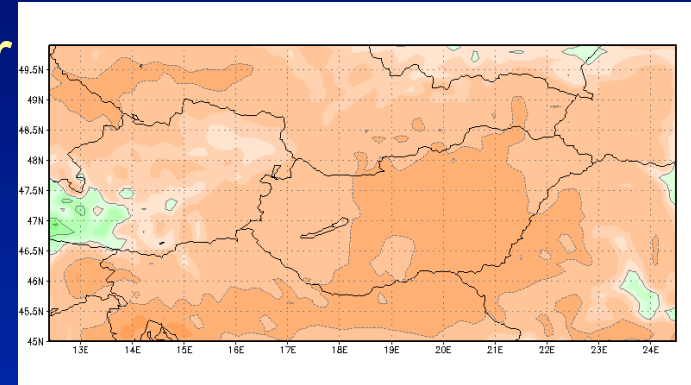
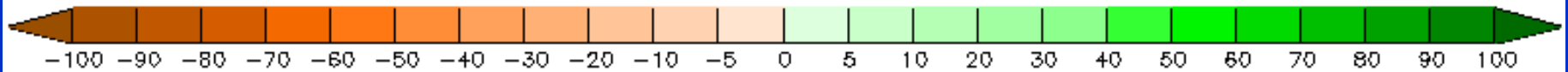Reference period: 1961-1990
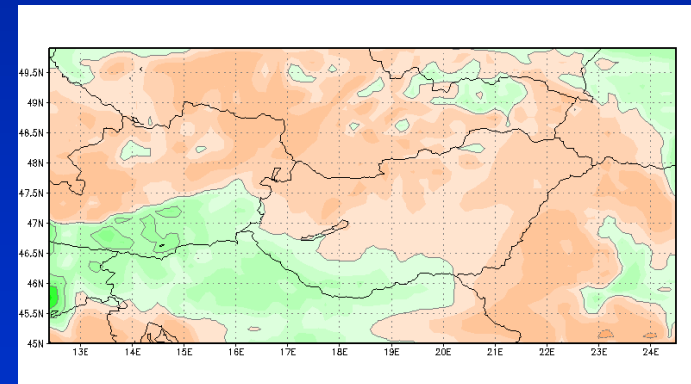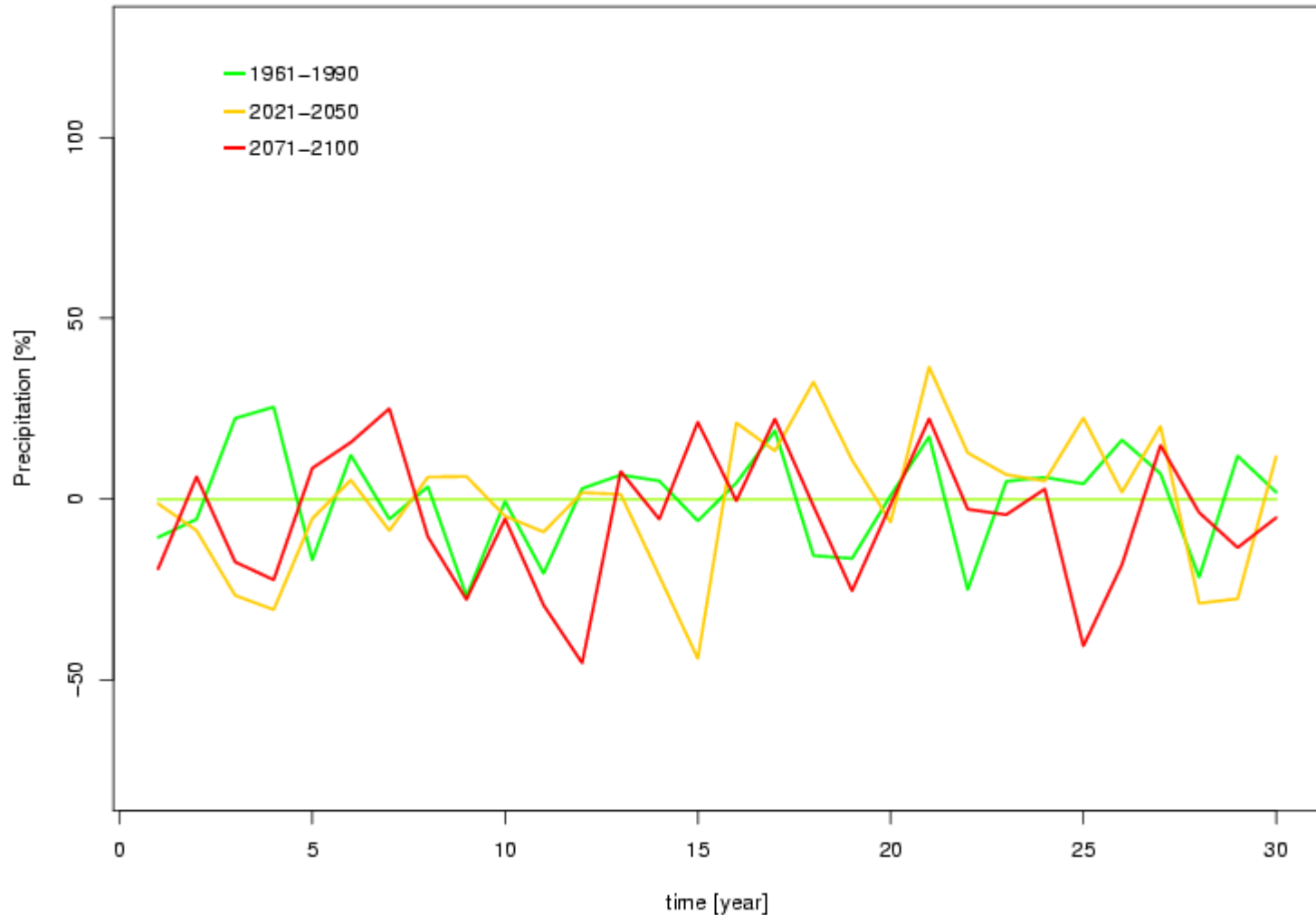
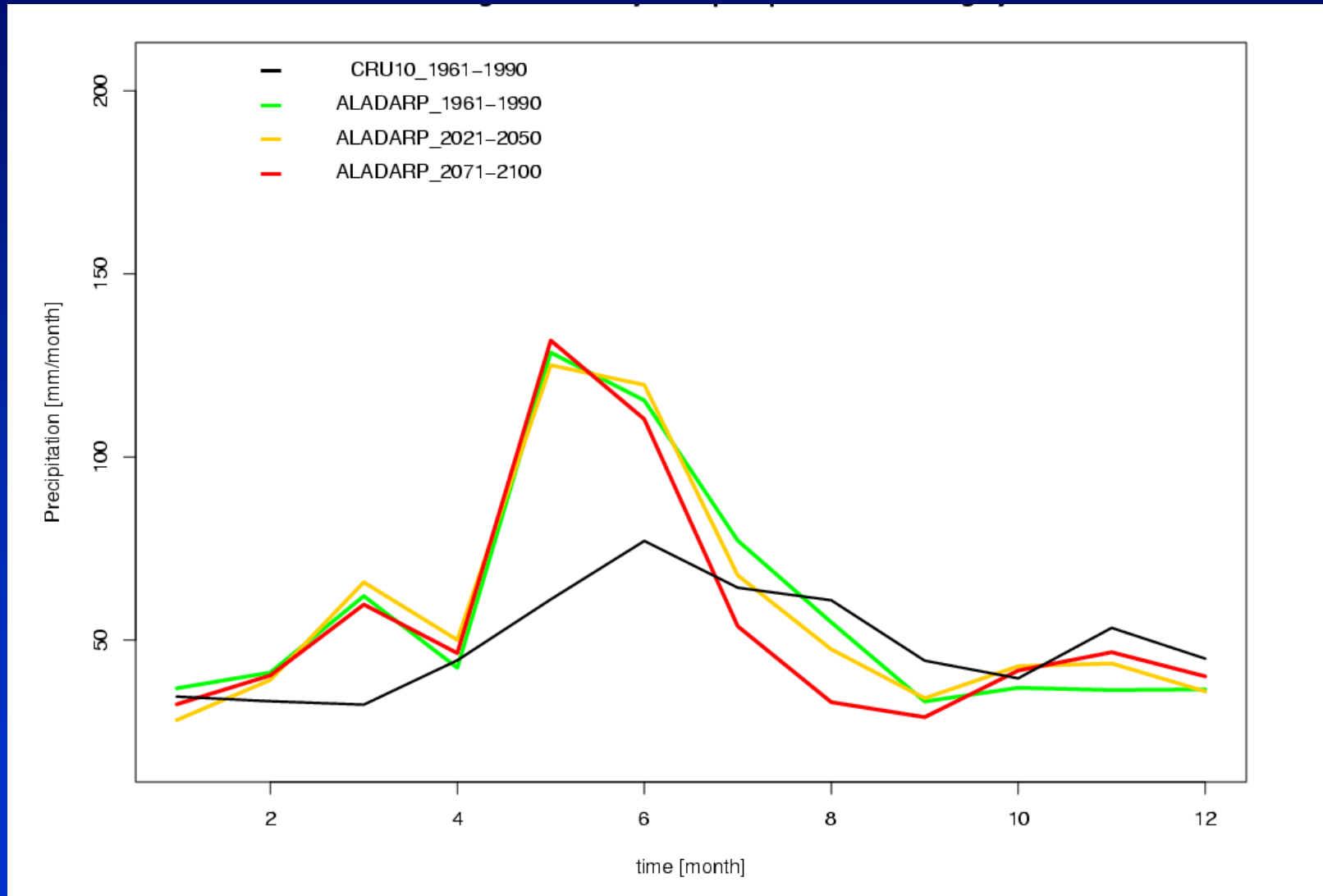## 2071-2100

Spring

Summer

Autumn
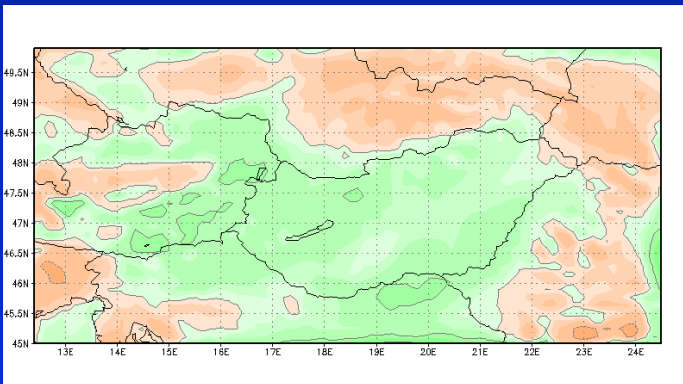
Winter

Temporal evolution of the annual precipitation relative difference [%] – reference period: 1961-1990 (1961-1990; 2021-2050; 2071-2100)

Climatological annual cycle of precipitation over Hungary
(1961-1990; 2021-2050; 2071-2100)

Summary of the results for the future

- **Temperature:**

  - Significant warming trend

  - Strongest temperature increase in summer

- **Precipitation:**

  - Basically no change of annual precipitation amount, BUT changes in its annual distribution (significant only for the summer drying for the end of the century)

Some points for discussion

- How to quantify the model errors for the past (perfect LBCs vs. LBCs from the global models)?

- How the deficiencies of the model for the past can be used for objectively „correcting" the simulations for the future?

- Can perfectly tuned models for the past provide „perfect" climate scenarios?

- Large sensitivity to the resolution and domain size (problems with too small domains and too high resolution)

Conclusions, further work

- The regional climate models are available for the „prediction" of climate change (strong pressure on their application)

- Sensitivity experiments for finding the optimal domain size for the Carpathian Basin

- Further improvements of the model (physics)?

- Correction of the results based on past experiences

Thank you for your attention!