

ALADIN-Climate: latest achievements at the Hungarian Meteorological Service

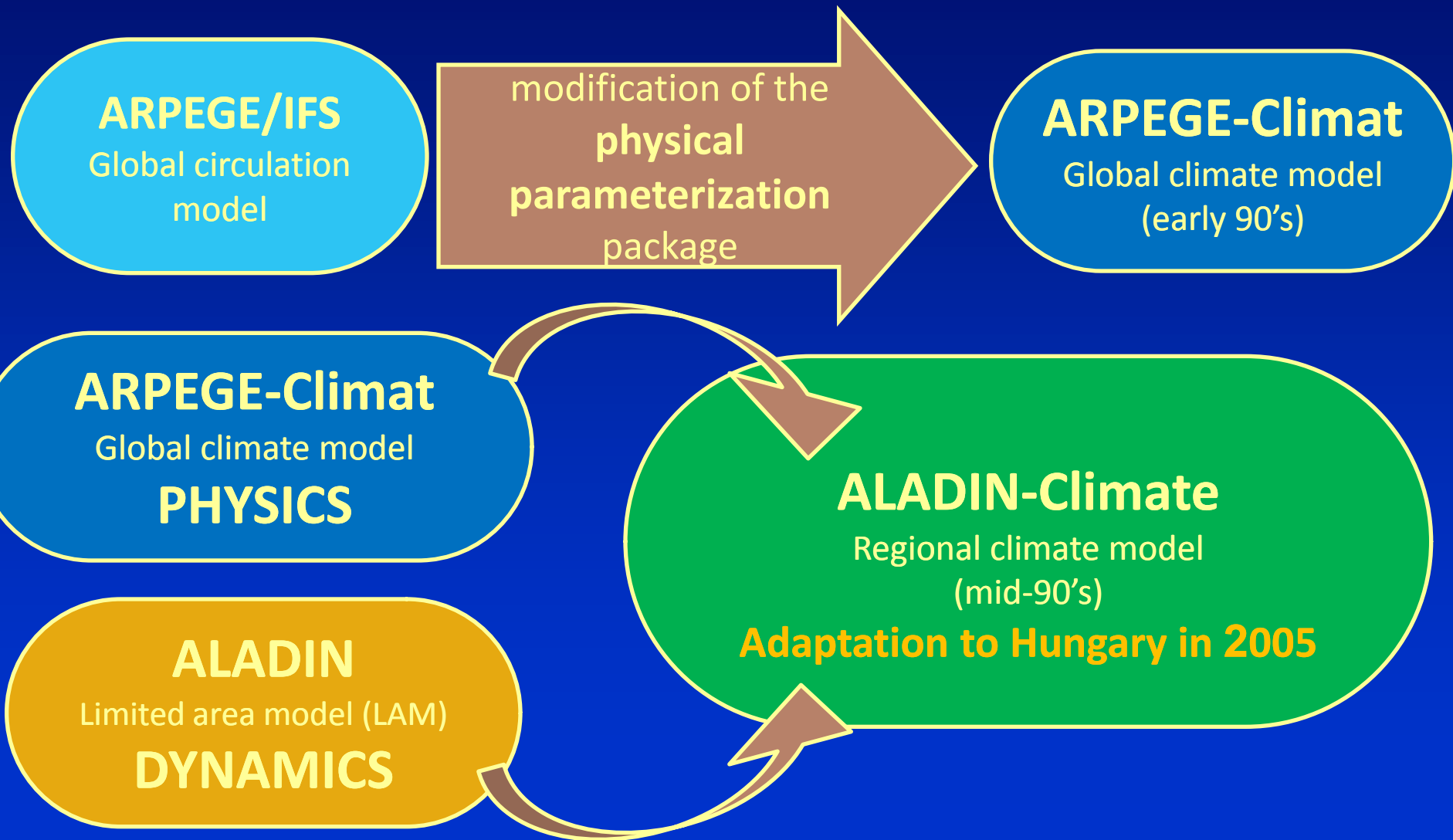
**ALADIN / HIRLAM
19th Workshop / All-Staff Meeting Utrecht,
12-15 May 2009**

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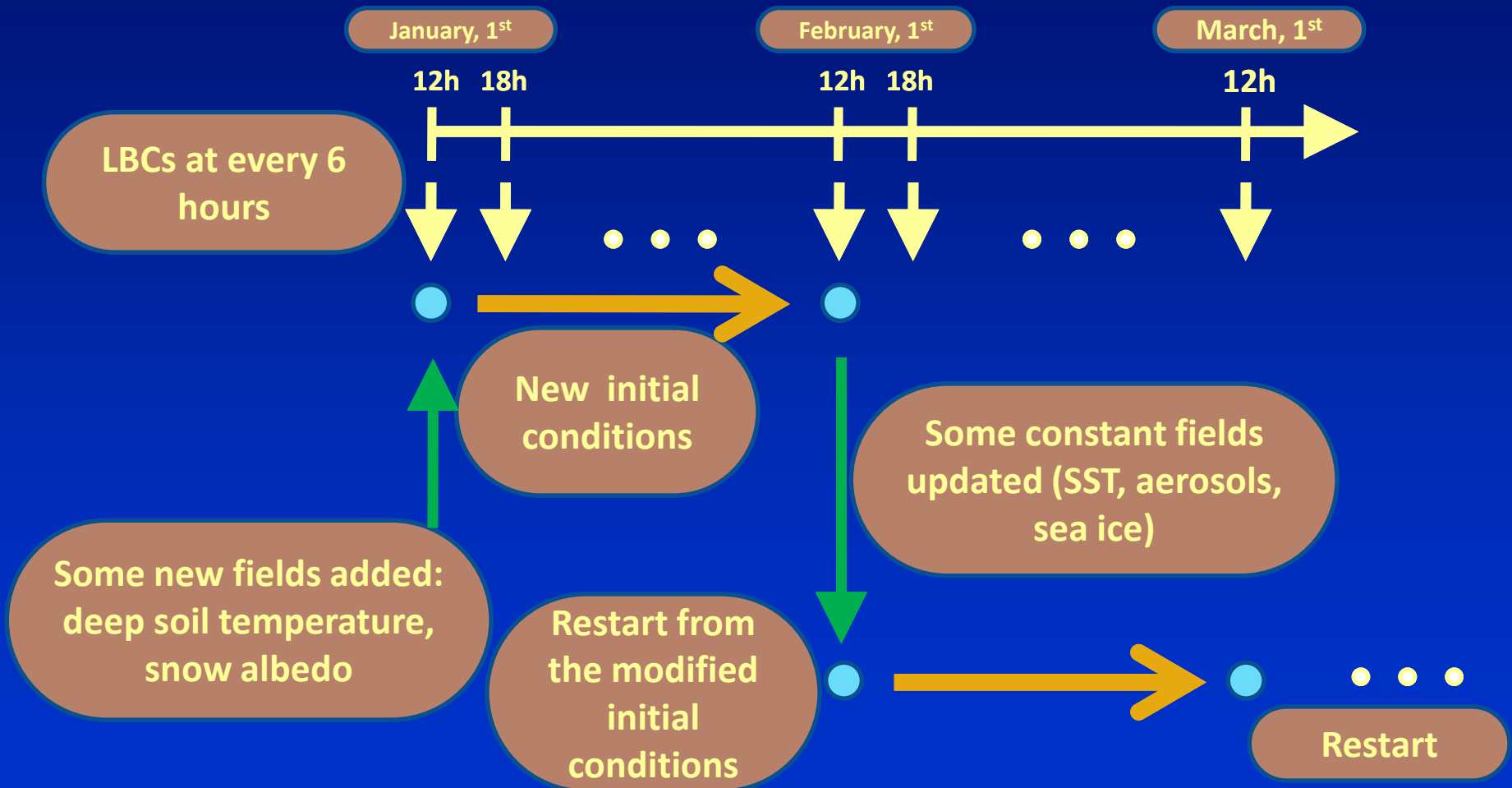
interpreted by

Andras Horanyi (horanyi.a@met.hu)

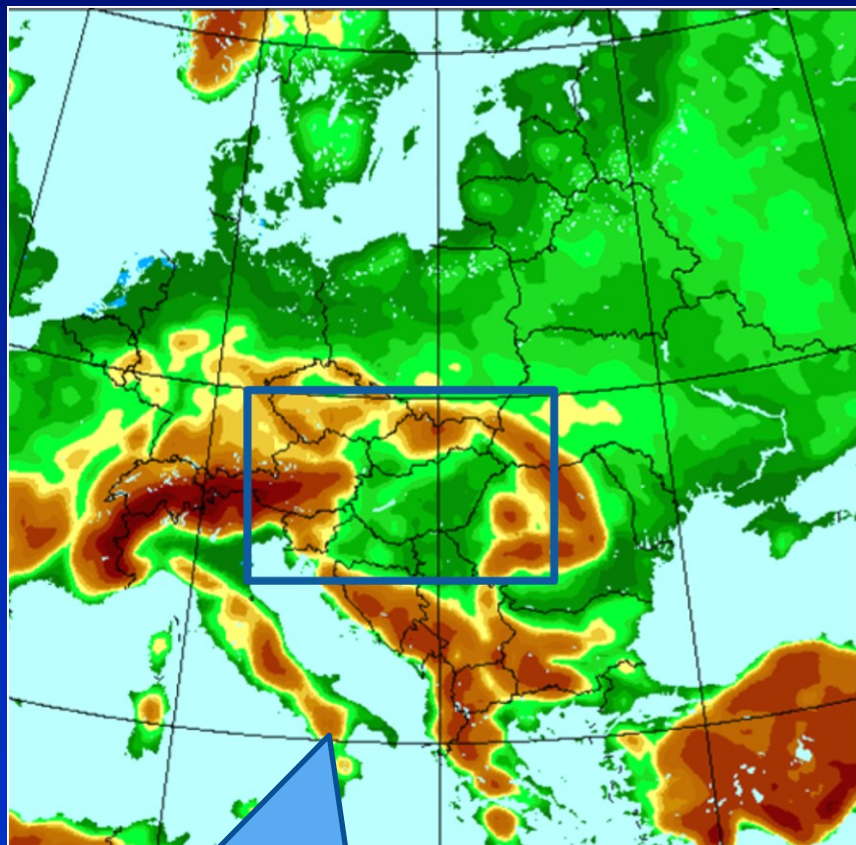
The ALADIN-Climate model



Integration of ALADIN-Climate

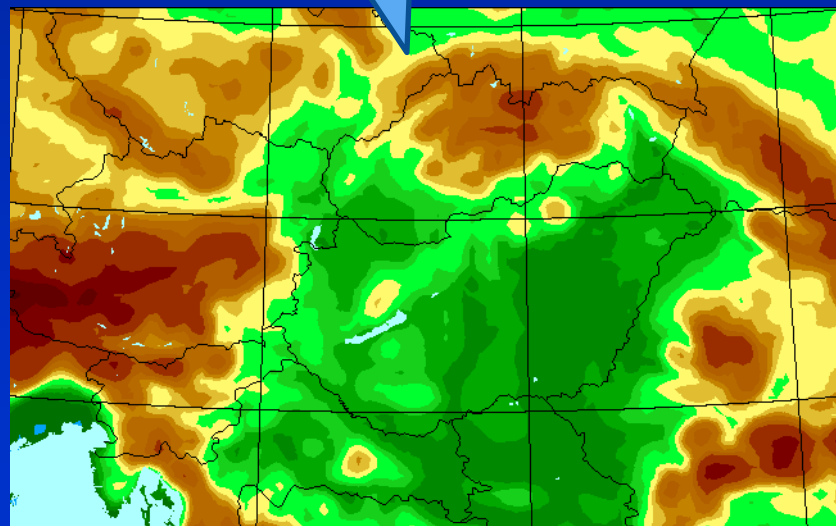


The ALADIN-Climate model domain and orography



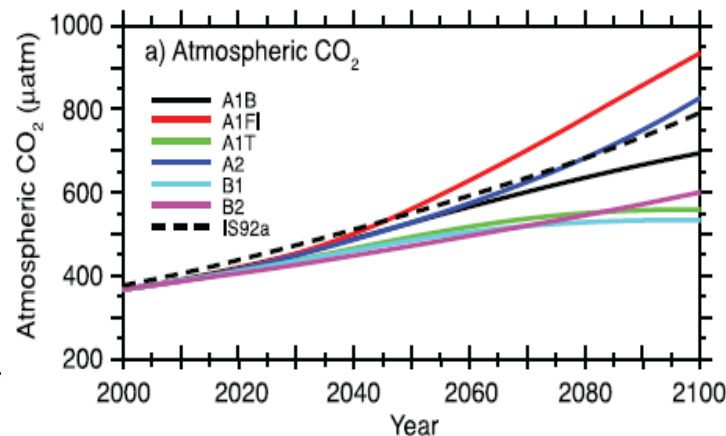
25 km-resolution

10 km-resolution
(CECILIA)



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



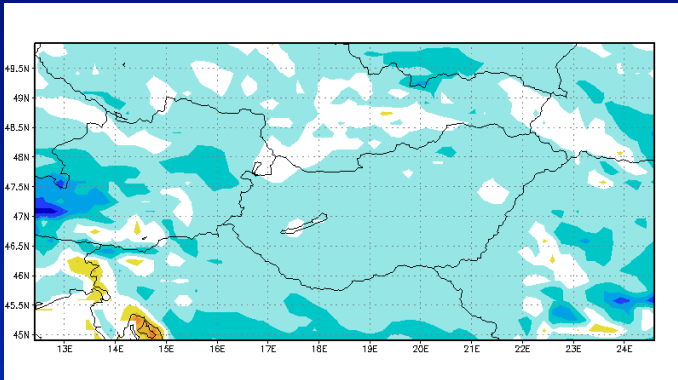
PAST

(1961-1990)

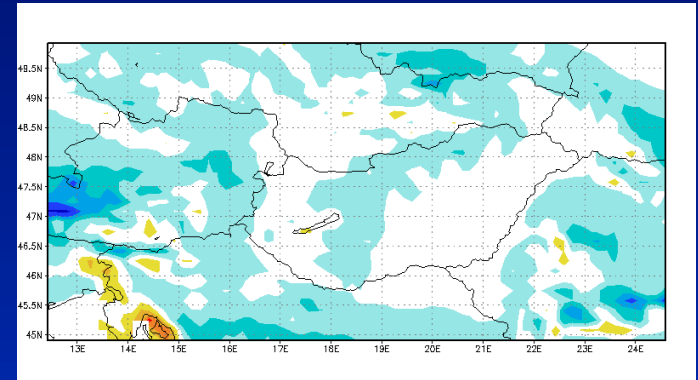
TEMPERATURE (ALADIN – CRU [°C])

Difference of annual mean temperature 1961 - 1990

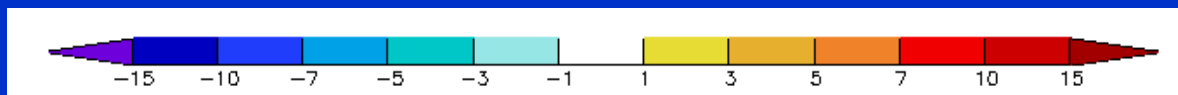
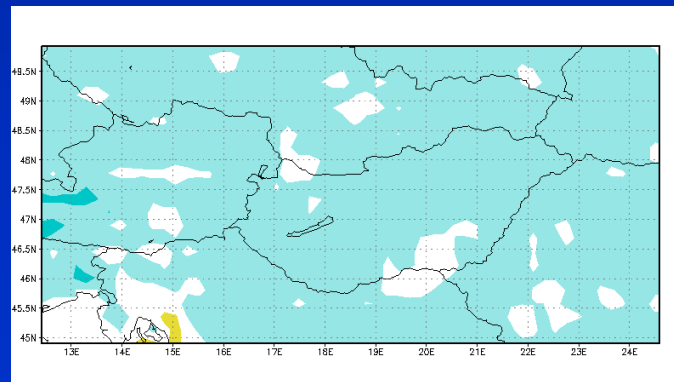
10 km; LBC: ERA-40



10 km; LBC: ARPEGE



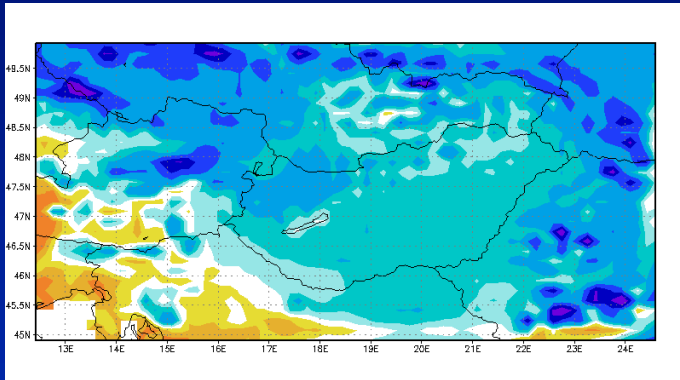
25 km; LBC: ERA-40



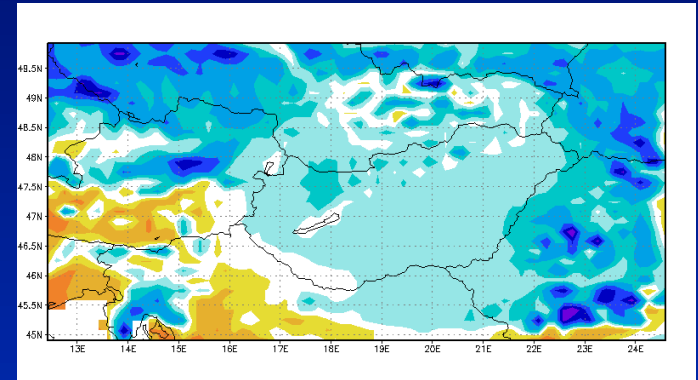
PRECIPITATION ((ALADIN – CRU)/CRU [%])

Annual relative difference of precipitation 1961 - 1990

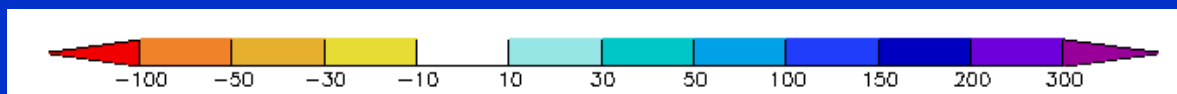
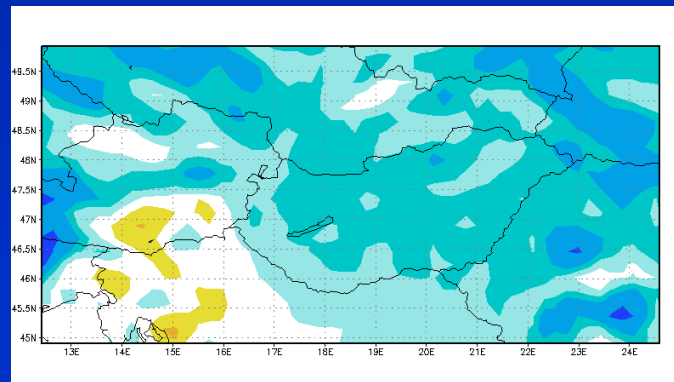
10 km; LBC: ERA-40



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 [°C]

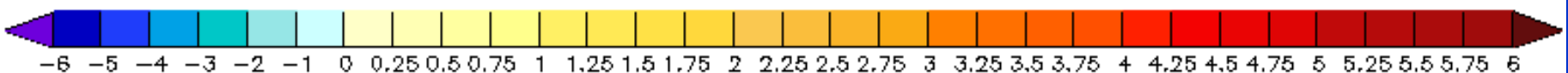
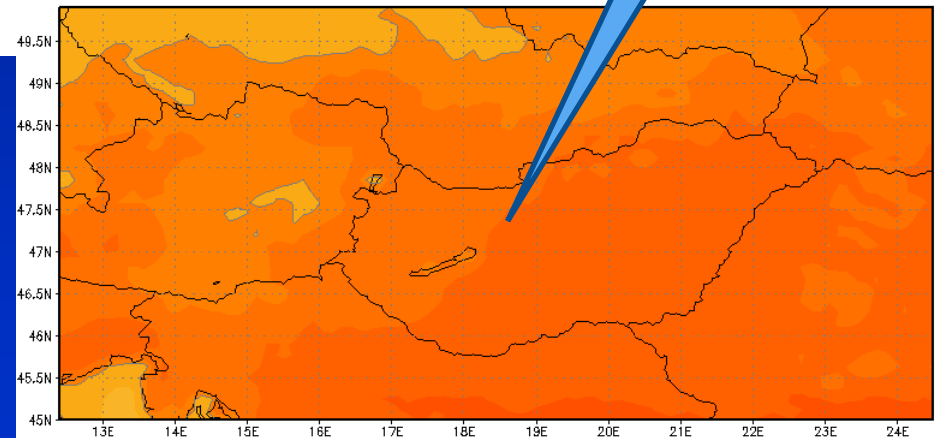
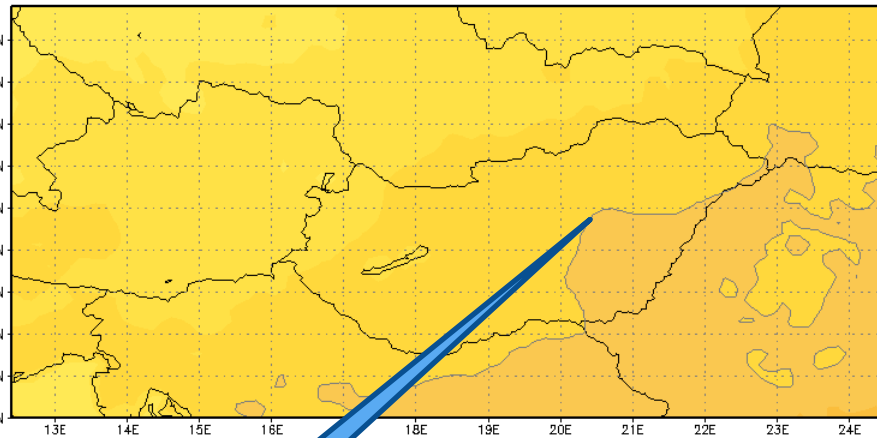
reference period: 1961-1990

2021-2050

+3.5 °C

+2 °C

2071-2100



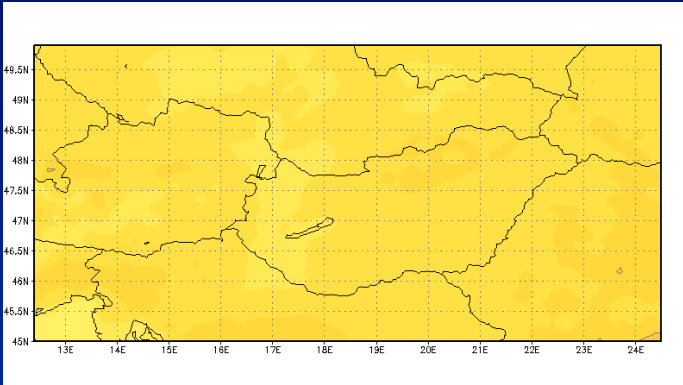
Difference of seasonal mean temperature [°C]

reference period: 1961-1990

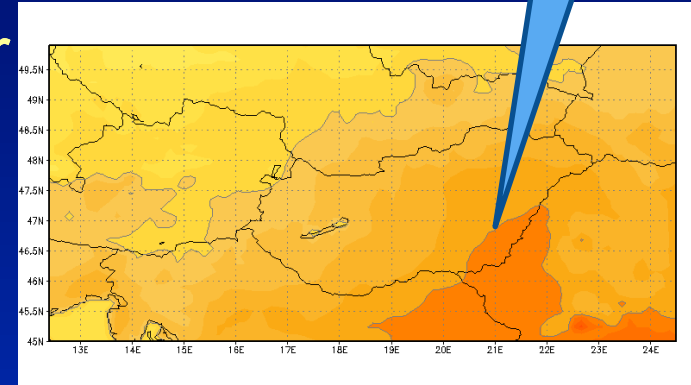
2021-2050

+3 °C

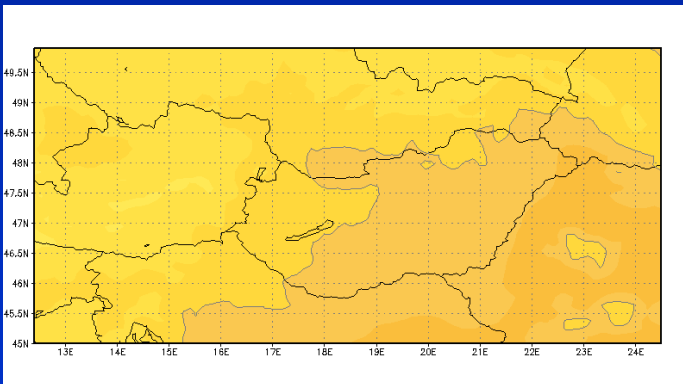
Spring



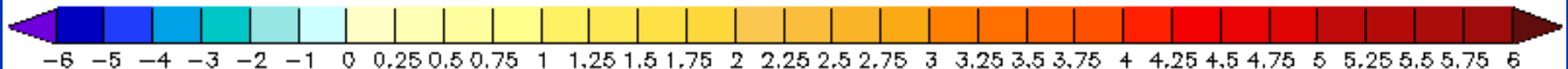
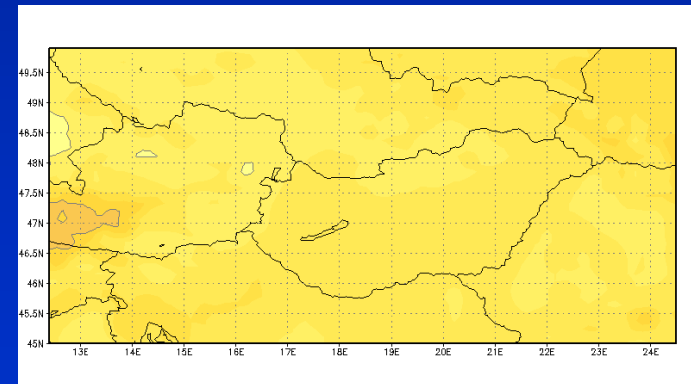
Summer



Autumn



Winter



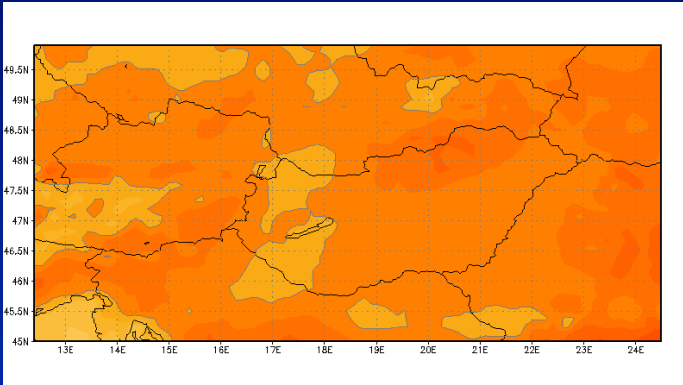
Difference of seasonal mean temperature [°C]

reference period: 1961-1990

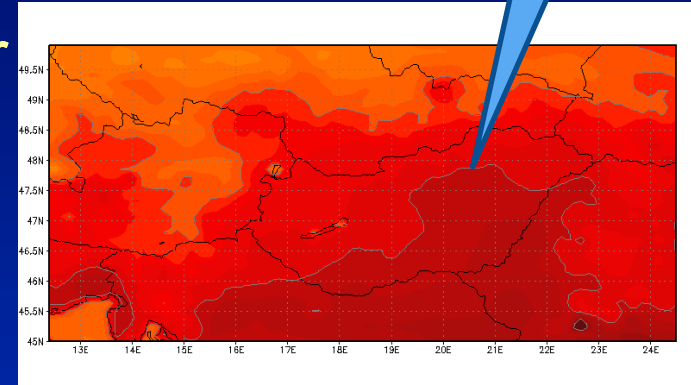
2071-2100

+5 °C

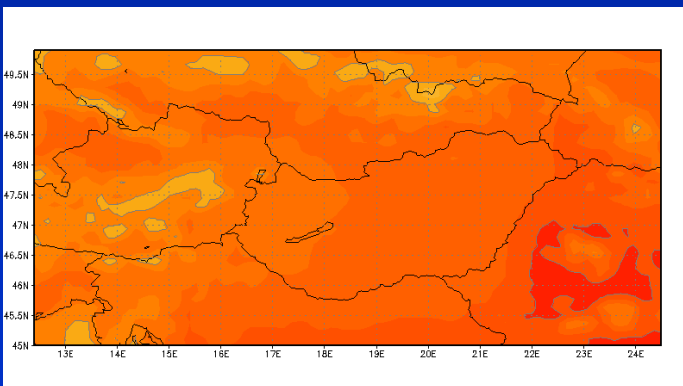
Spring



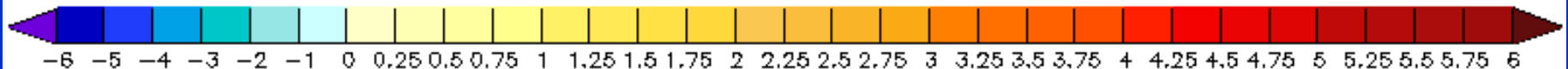
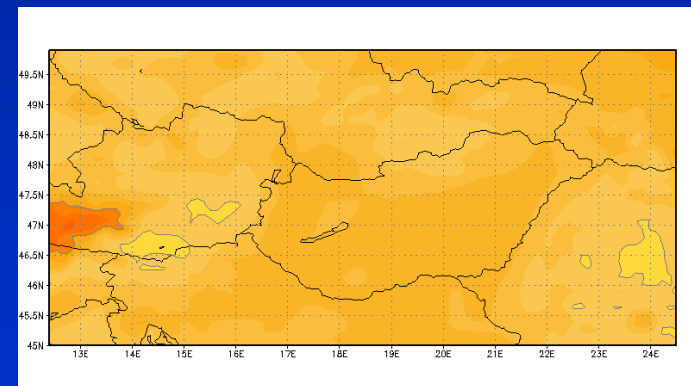
Summer



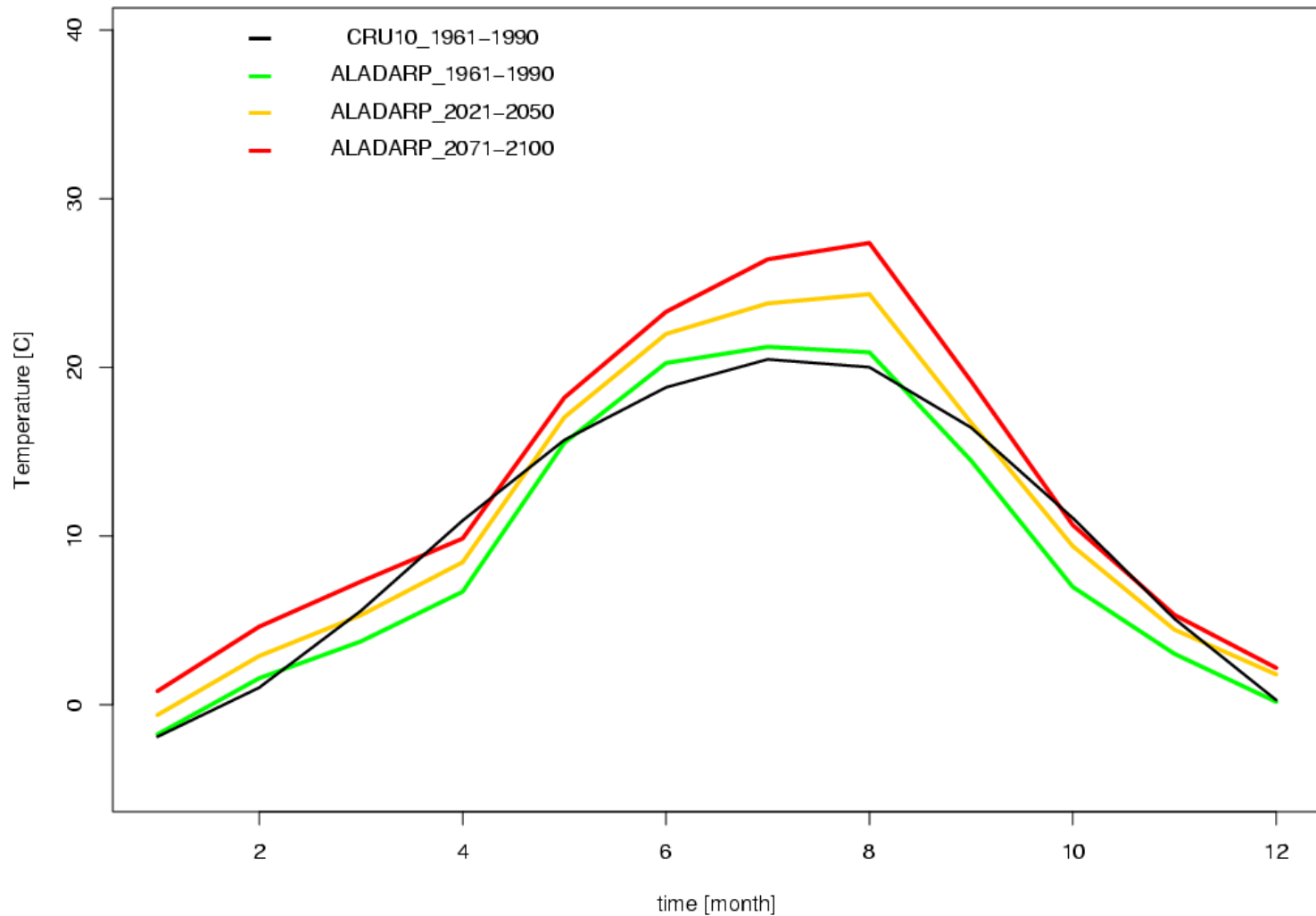
Autumn



Winter



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

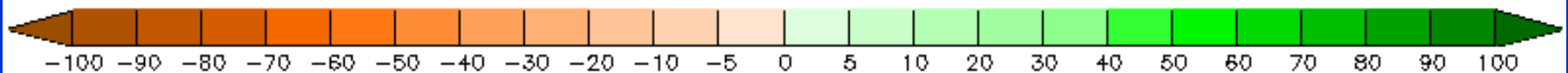
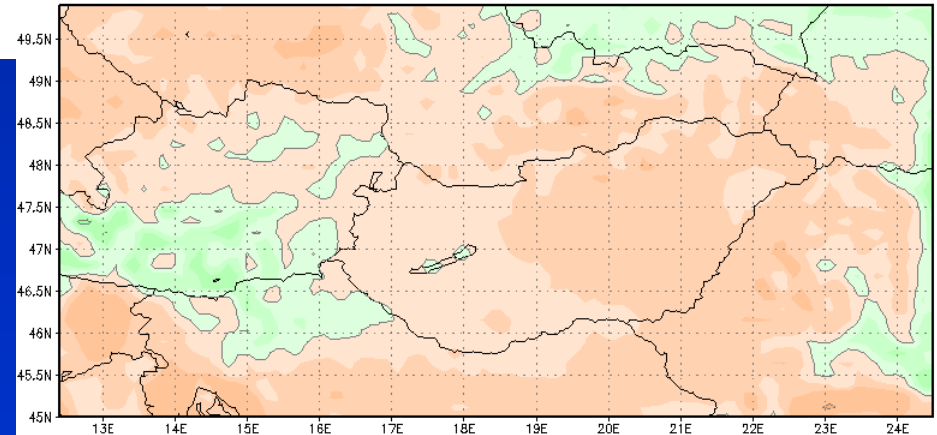
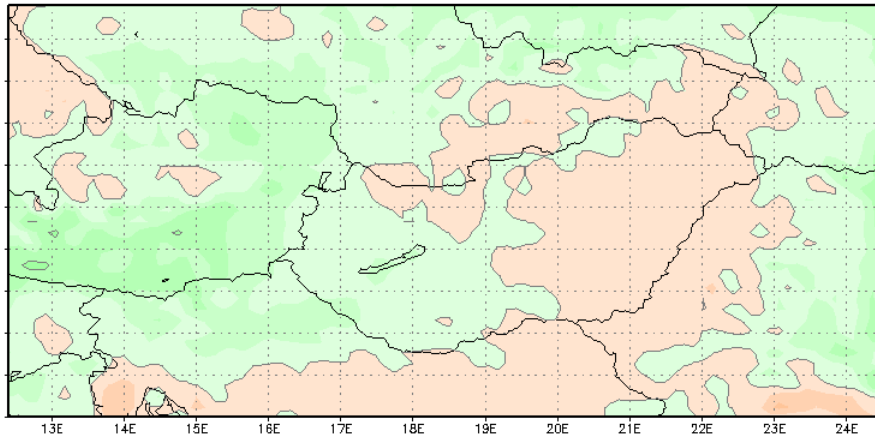


Annual relative difference of precipitation [%]

Reference period: 1961-1990

2021-2050

2071-2100

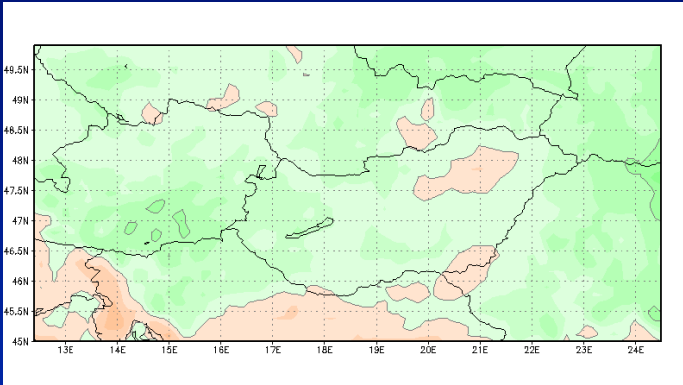


Seasonal relative difference of precipitation [%]

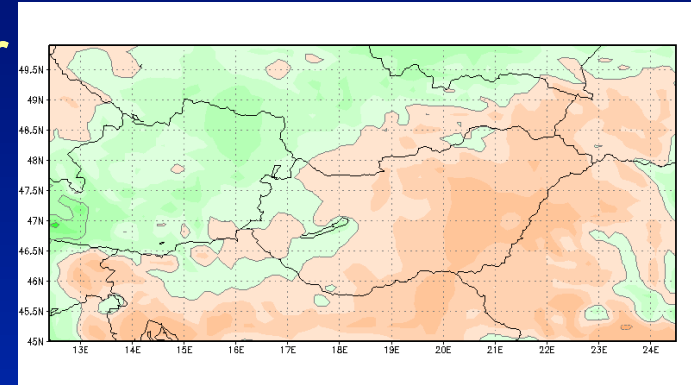
Reference period: 1961-1990

2021-2050

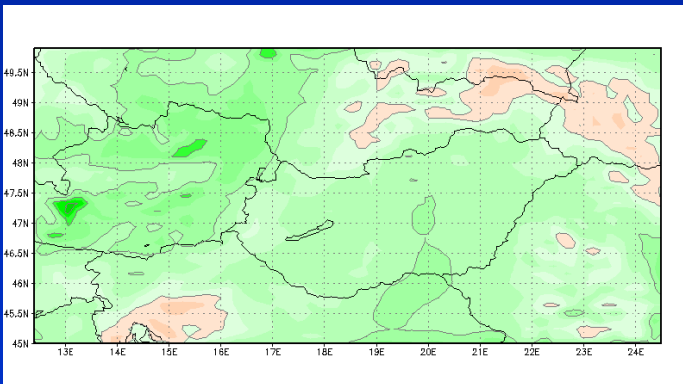
Spring



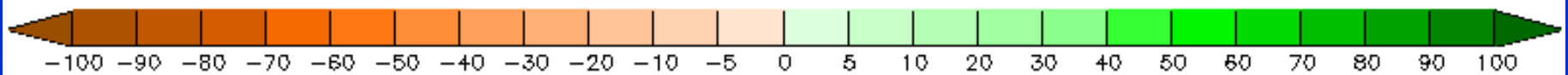
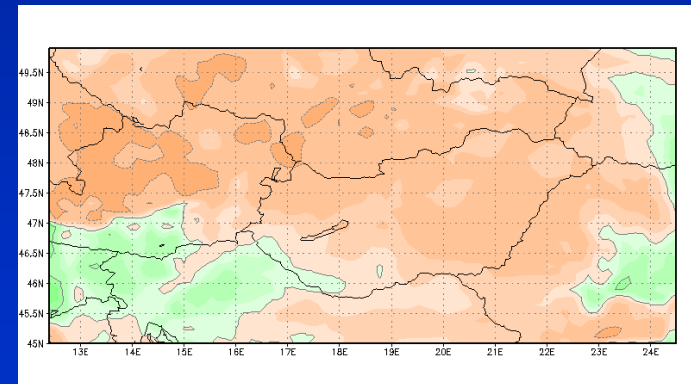
Summer



Autumn



Winter

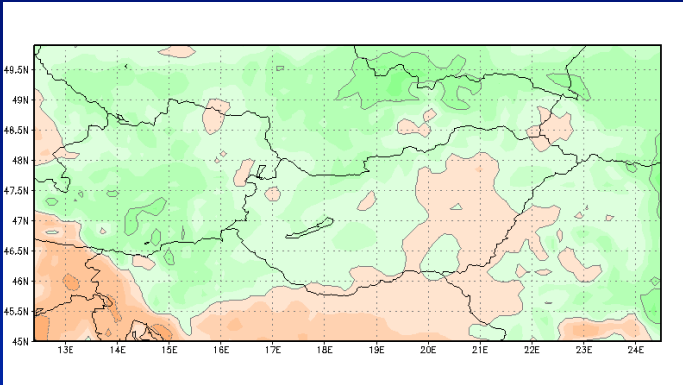


Seasonal relative difference of precipitation [%]

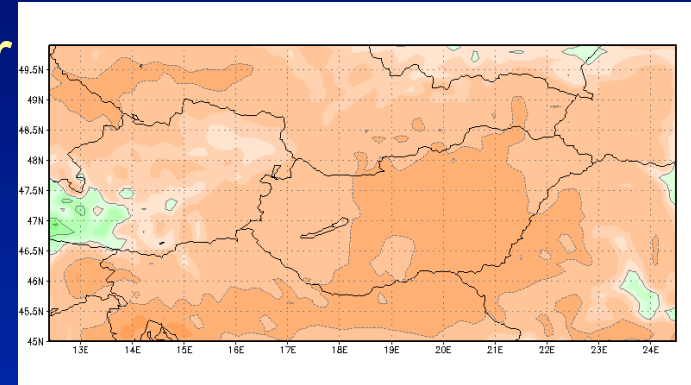
Reference period: 1961-1990

2071-2100

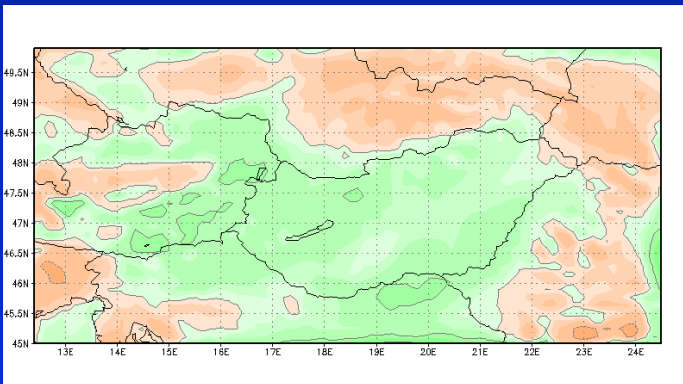
Spring



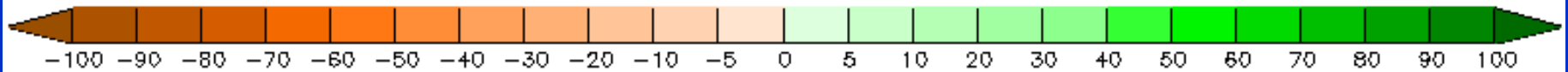
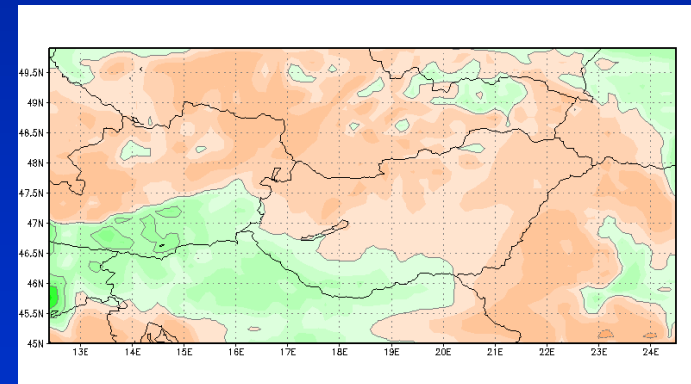
Summer



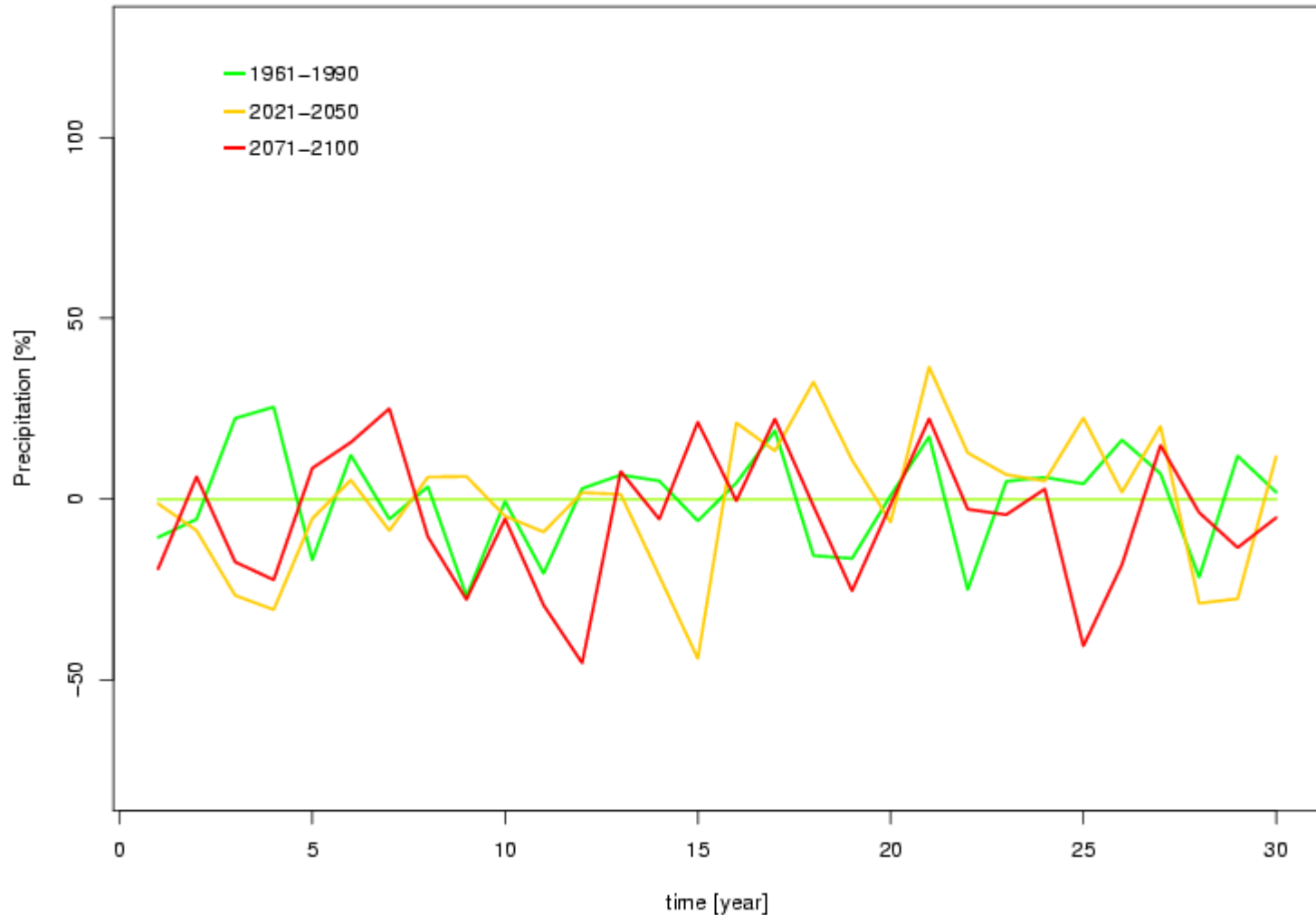
Autumn



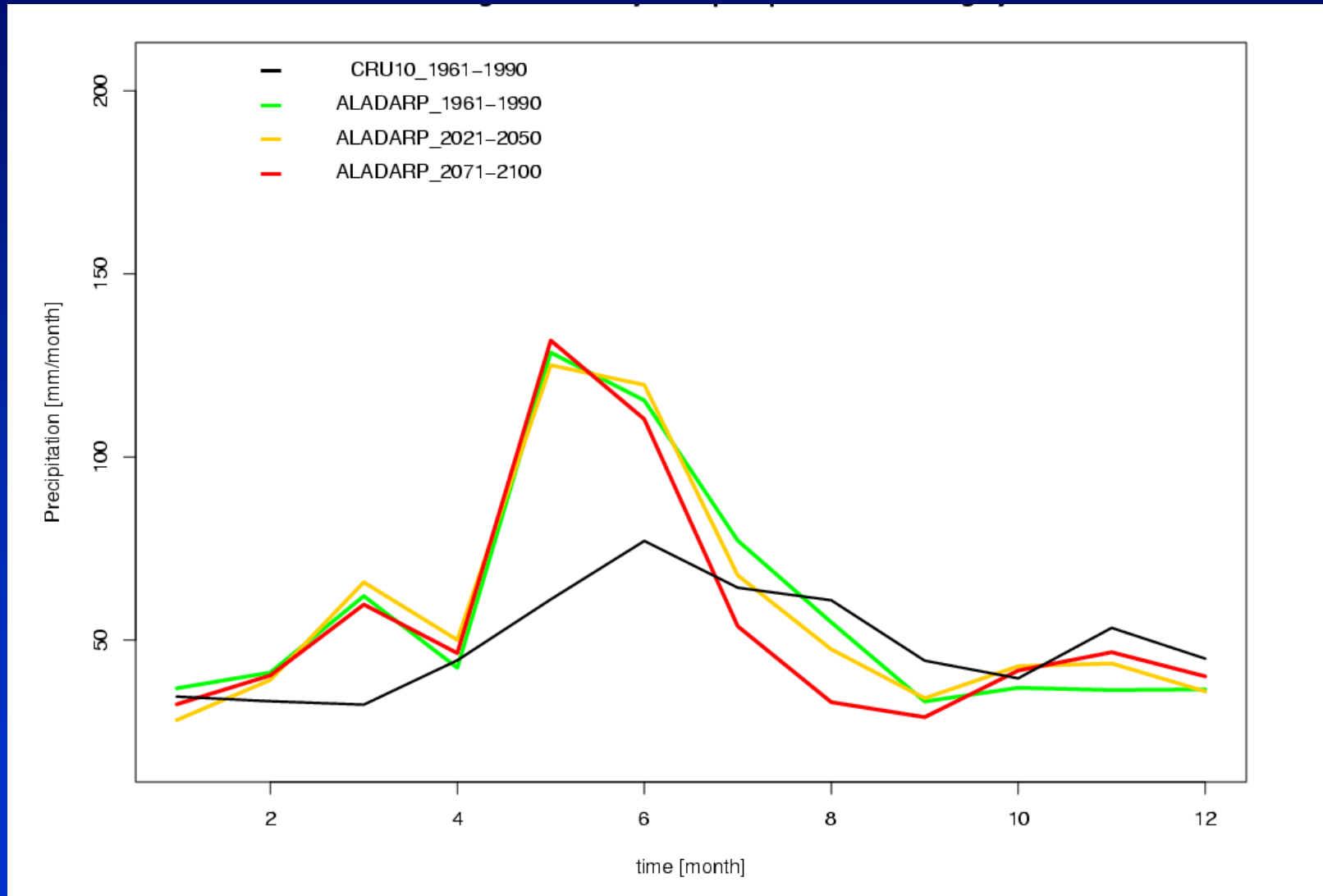
Winter



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!

IDŐJÁRÁS

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OF THE HUNGARIAN METEOROLOGICAL SERVICE

Special Issue: Workshop on Regional Climate Modeling

Guest Editors: Tamas Halenka and Daniela Jacob
Local Organizer: András Horányi

CONTENTS

Preface	I
Editorial	III
<i>Daniela Jacob, Lela Kotova, Philip Lorenz, Christopher Morley and Susanne Pfister: Regional climate modeling activities in relation to the CLAVIER project</i>	141
<i>Gabriella Cserna and András Horányi: Validation of the ALADIN-CM3-mat regional climate model in the Hungarian Meteorological Service</i>	155
<i>Michel Déqué and Samuel Somot: Analysis of heavy precipitation for France using high-resolution ALADIN RCM simulations</i>	179
<i>Petr Štáhlák, Petr Štěpánek and Aleš Furdík: Validation of ALADIN-ClimatouZ for present climate (1961-1999) over the Czech Republic</i>	191
<i>Gabriella Szécsi and András Horányi: Transient simulation of the REMO regional climate model and its evaluation over Hungary</i>	203
<i>Csaba Torma, Judit Barthelemy, Rita Pongrácz, Zoltán Barcza, Erika Coppola and Péter Gyöngy: Adaptation of the RegCM3 climate model for the Carpathian Basin</i>	233
<i>Judit Barthelemy, Rita Pongrácz, Gyöngy Gyöbbi and Péter Szabó: Analysis of expected climate change in the Carpathian Basin using the PRUDENCE results</i>	249
<i>Gabriella Szécsi: Regional change of climate extremes over Hungary based on different regional climate models of the PRUDENCE project</i>	265
<i>Bernad C. Krüger, E. Kesztyös, I. Trogulák, F. Zsolt, D. Melis, E. Coppola, S. Rauscher, P. Hecser and T. Halász: Regional photochemical model calculations for Europe concerning ozone levels in a changing climate</i>	285
Book review	301

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