The Abdus Salam
International Centre for Theoretical Physics

United Nations
Educational, Scientific and
Cultural Organization

IAEA

2148-19

Fifth ICTP Workshop on the Theory and Use of Regional Climate Models

31 May - 11 June, 2010

Validation of a high resolution version of the RegCM over the Carpathian basin and analysis of transient climate change simulations.

TORMA Csaba Zsolt and Bartholy J., Pongrácz R., Barcza Z., Coppola E., Giorgi F.

Eotvos Lorand University, Department of Meteorology
Pazmany P. Setany 1/A, H-1117
Budapest
HUNGARY

Validation of a high resolution version of the RegCM over the Carpathian Basin and analysis of transient climate change simulations

Csaba Torma, *Judit Bartholy, Rita Pongrácz, Zoltán Barcza, Erika Coppola, Filippo Giorgi*

Eötvös Loránd University, Budapest

Hungarian Academy of Sciences

Outline

- Testing phase
- Validation
- A1B future simulation (2021-50 and 2071-2100)
- Summary
- Future plans

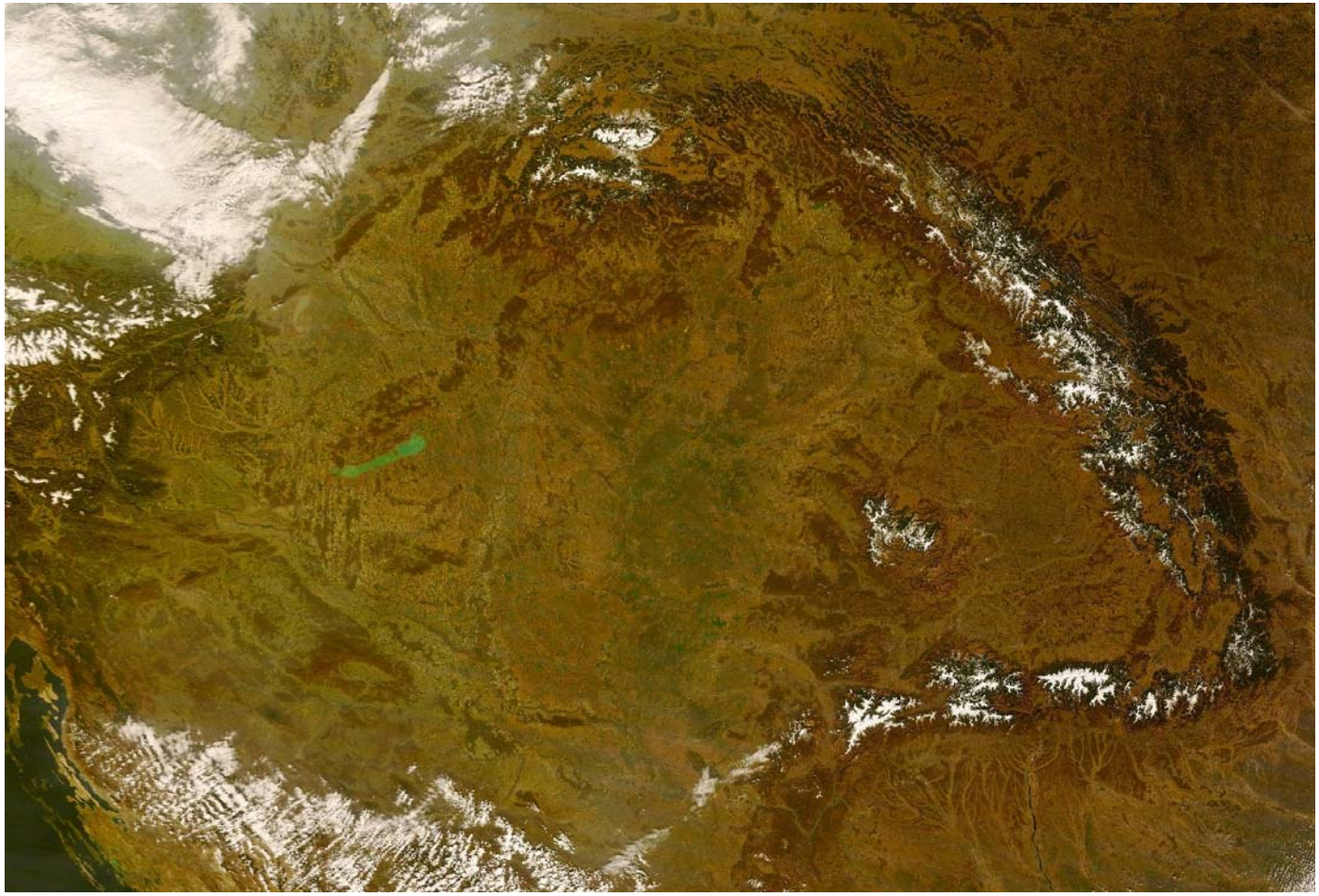
Testing phase

Model settings

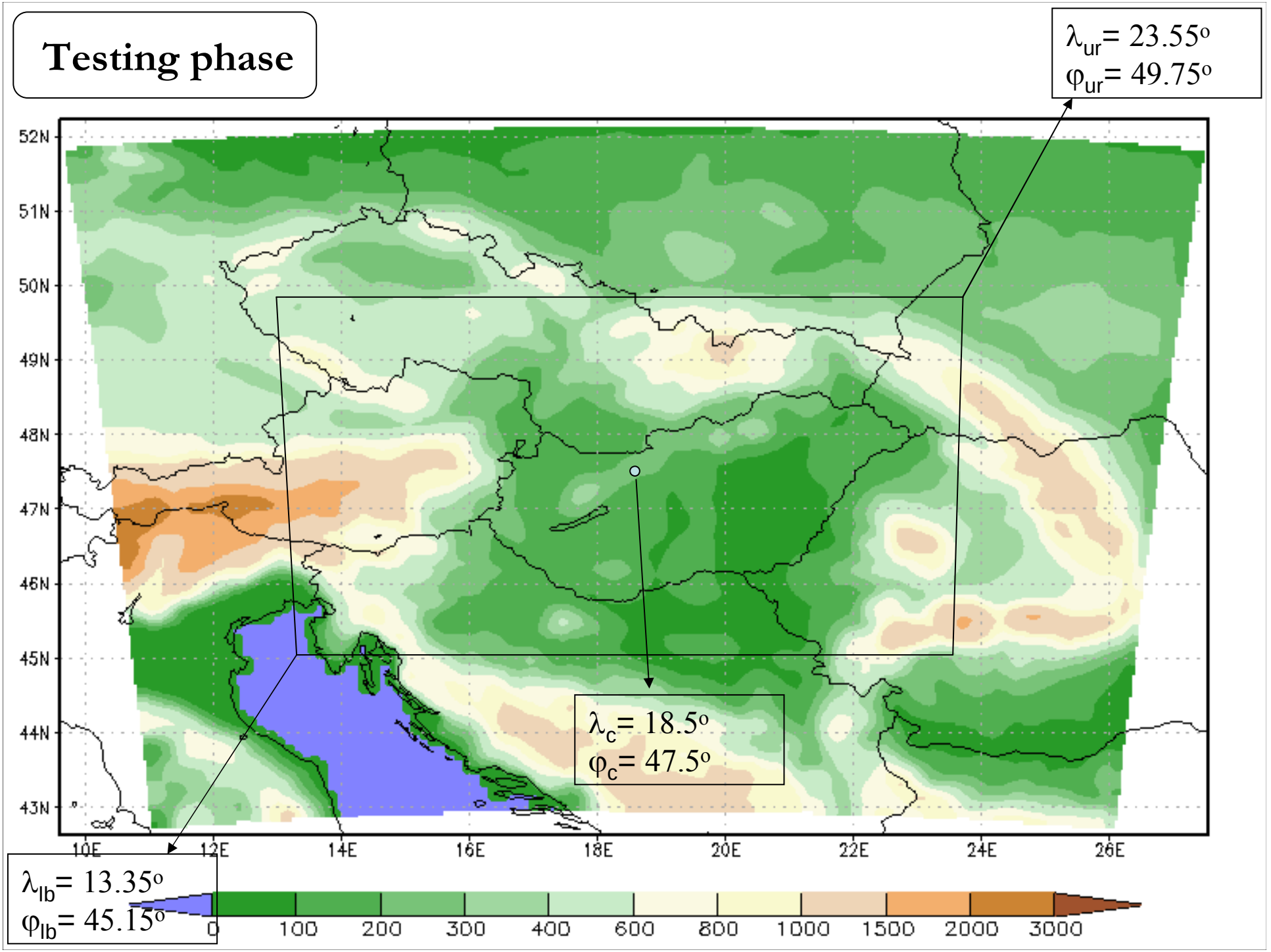
Resolution	**10km, 20km, 25km, 45km, 50km**
Central grid	**47.5N, 18.5 E**
Map projection	**Lambert**
Number of grid points	**200x100, 140x120, 120x100, 100x80, 94x72, 90x70**
ICBC	**NNRP1 és NNRP2 (2.5^{o}), ERA40 (2.5^{o}, 1^{o})**
Convective schemes:	**Grell (FC80), Grell (AS74), Kuo, Emanuel**
Number of vertical levels	**14,18,23**

Testing phase

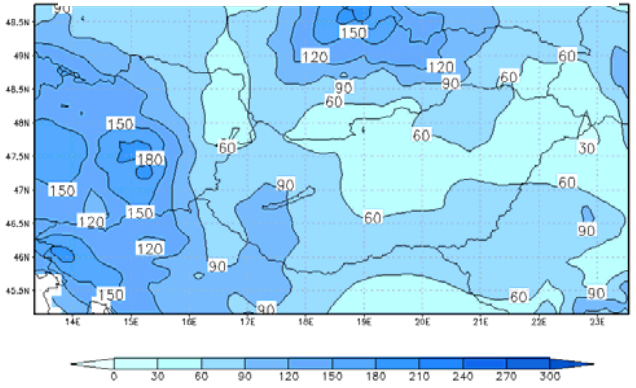
Field of interest



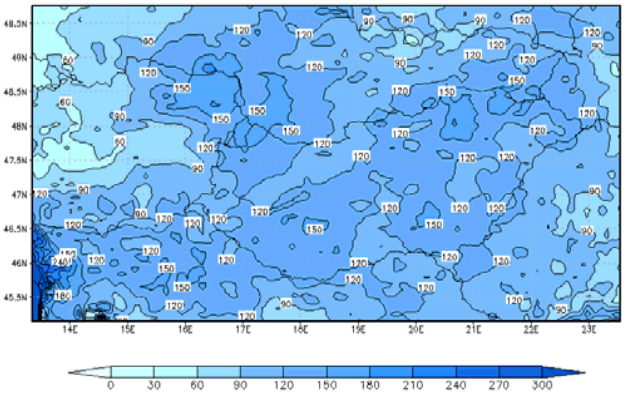
Testing phase



CRUTS1.2

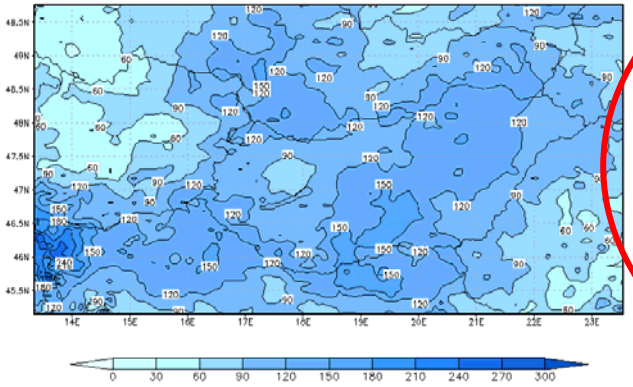


Grell(FC80), 18 Nest

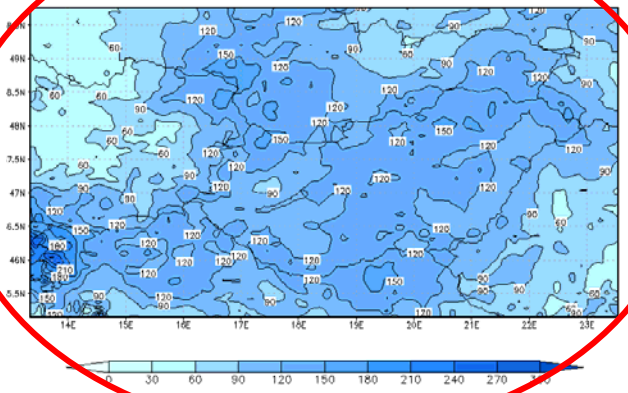


1961 june

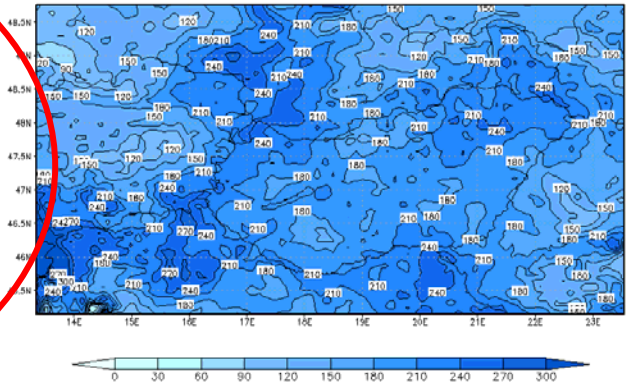
Grell(FC80), 23



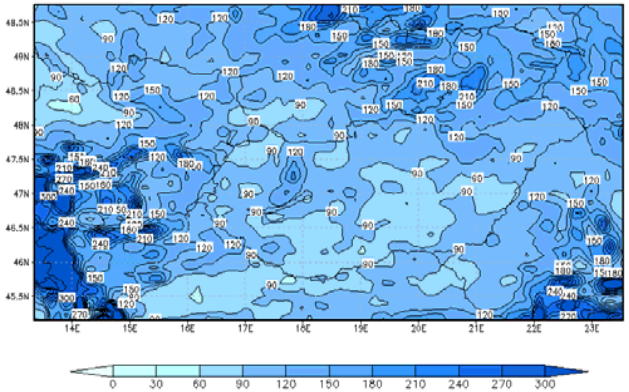
Grell(FC80), 18



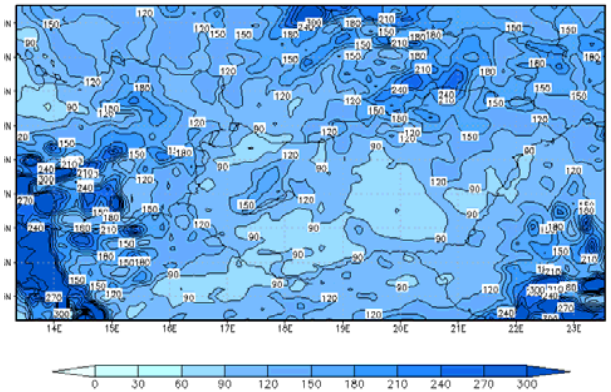
Grell(FC80), 14



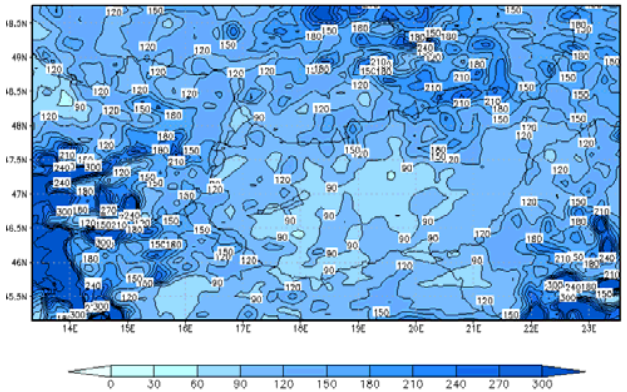
Emanuel, 23



Emanuel, 18



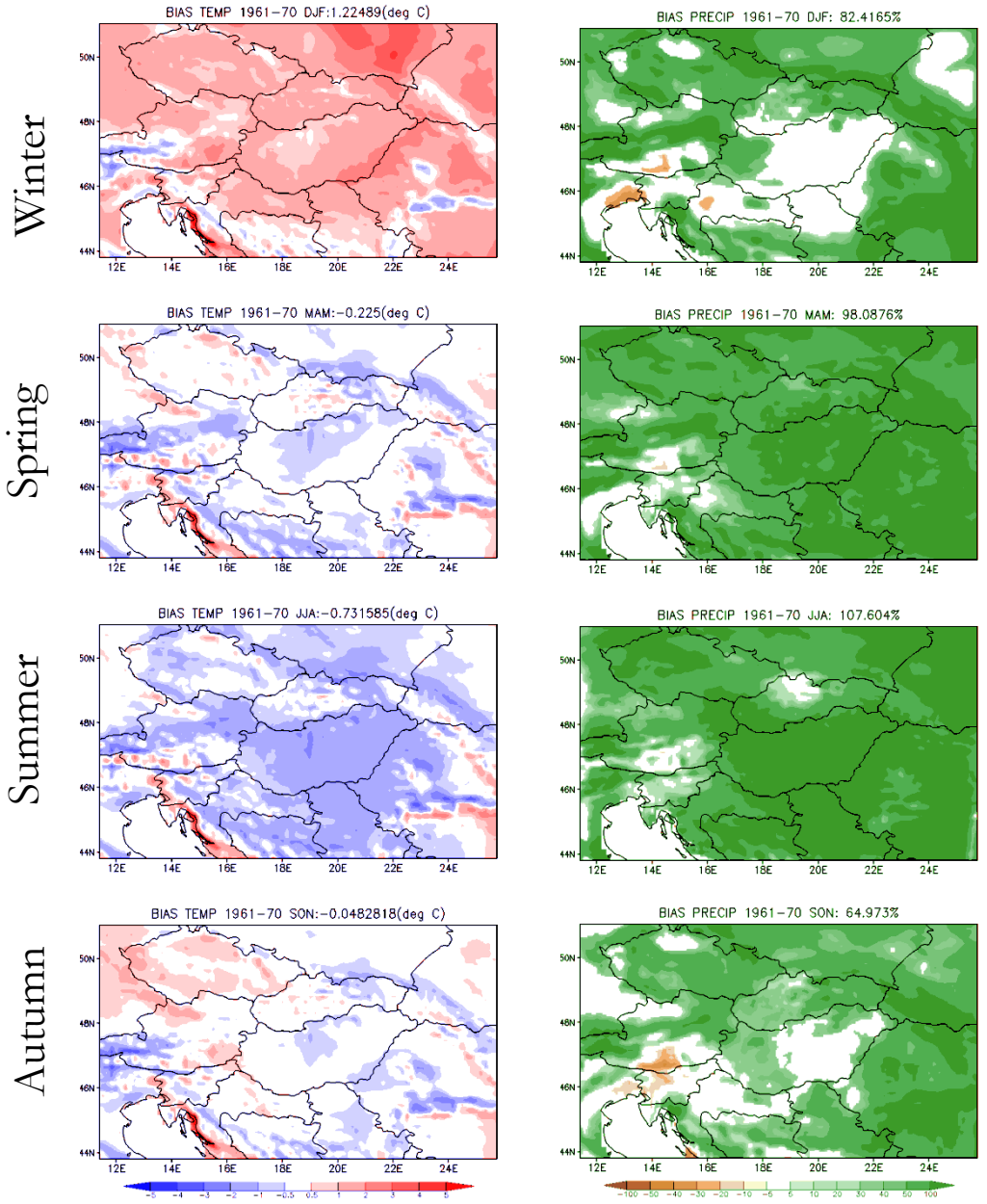
Emanuel, 14



Testing phase

1961-70

Multi-year bias fields

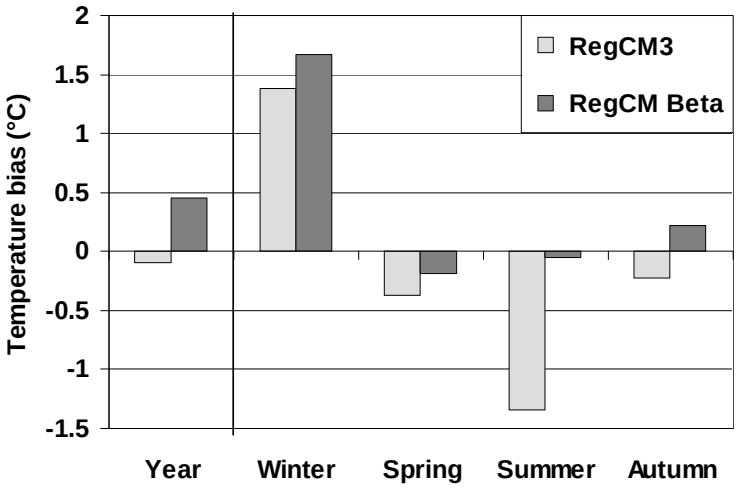


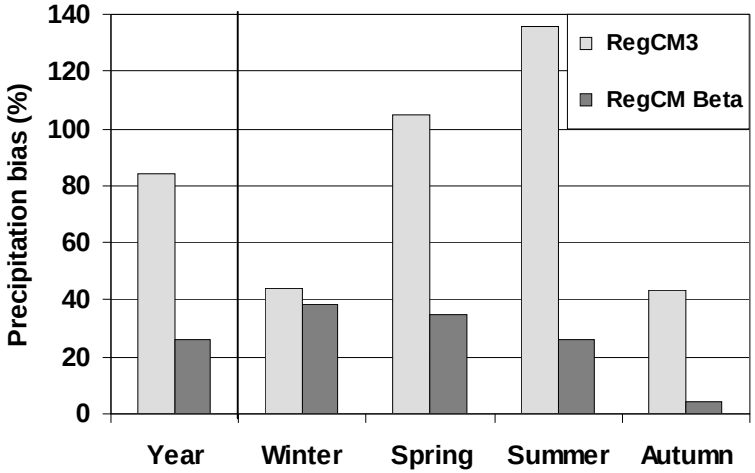
Testing phase

	RegCM3	RegCM Beta
Driving field	ERA40	ERA40
Number of grid points	120 × 100	120 × 100
Number of vertical levels	18	18
Spin up	1 year	1 year
Integration time	1960.01.01-1970.12.31.	1960.01.01-1970.12.31.
Time step	90 s	90 s
Cloud-to-rain autoconversion rate	0.0005	0.00025
Raindrop evaporation rate coefficient	$0.2 \cdot 10^{-4}$ (kg m^{-2} s^{-1})$^{-1/2}$ s^{-1}	$1.0 \cdot 10^{-3}$ (kg m^{-2} s^{-1})$^{-1/2}$ s^{-1}
Raindrop accretion rate	6 m^3 /kg/ s	3 $m^{3/}$ kg/ s

Testing phase

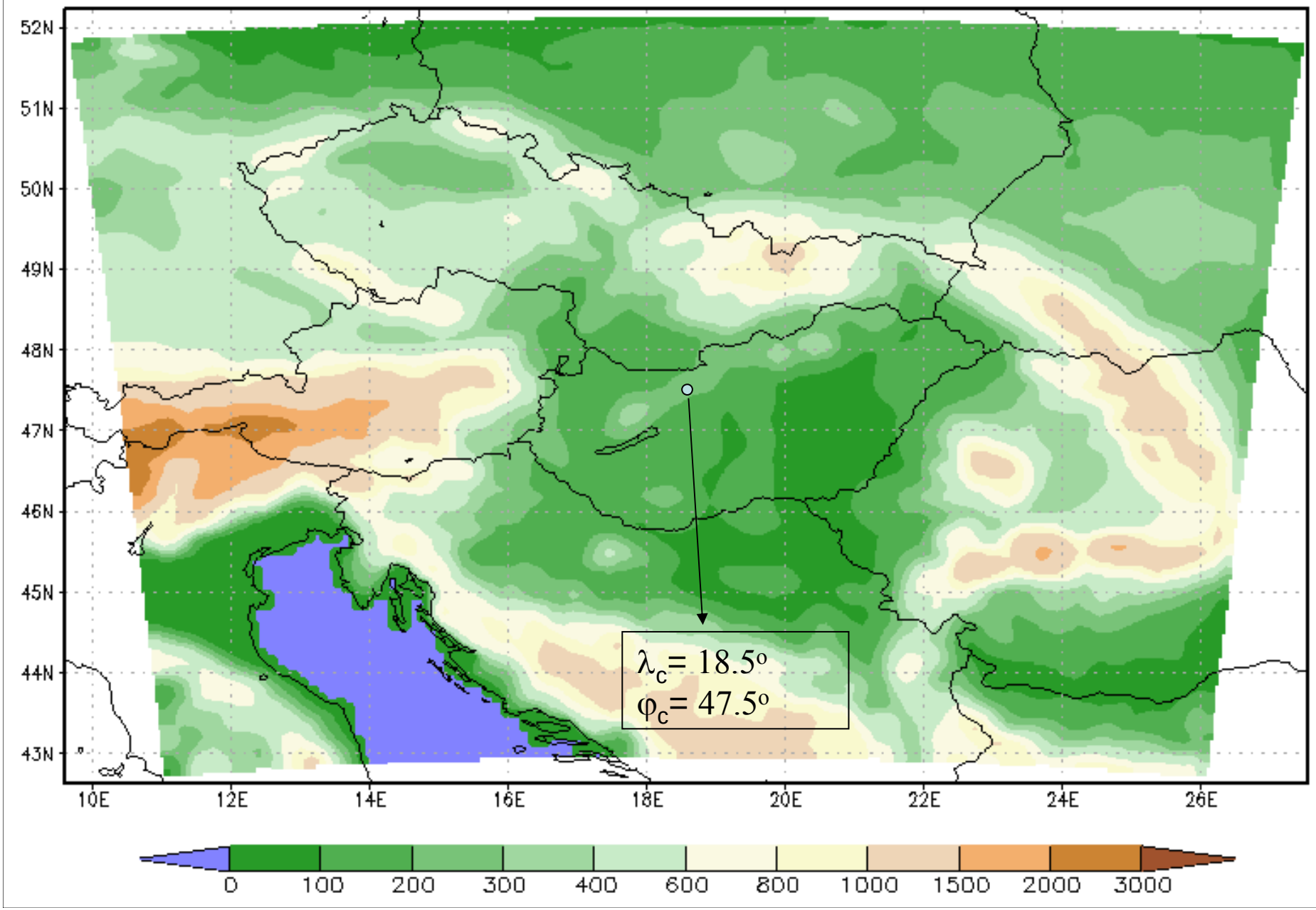
1961-70





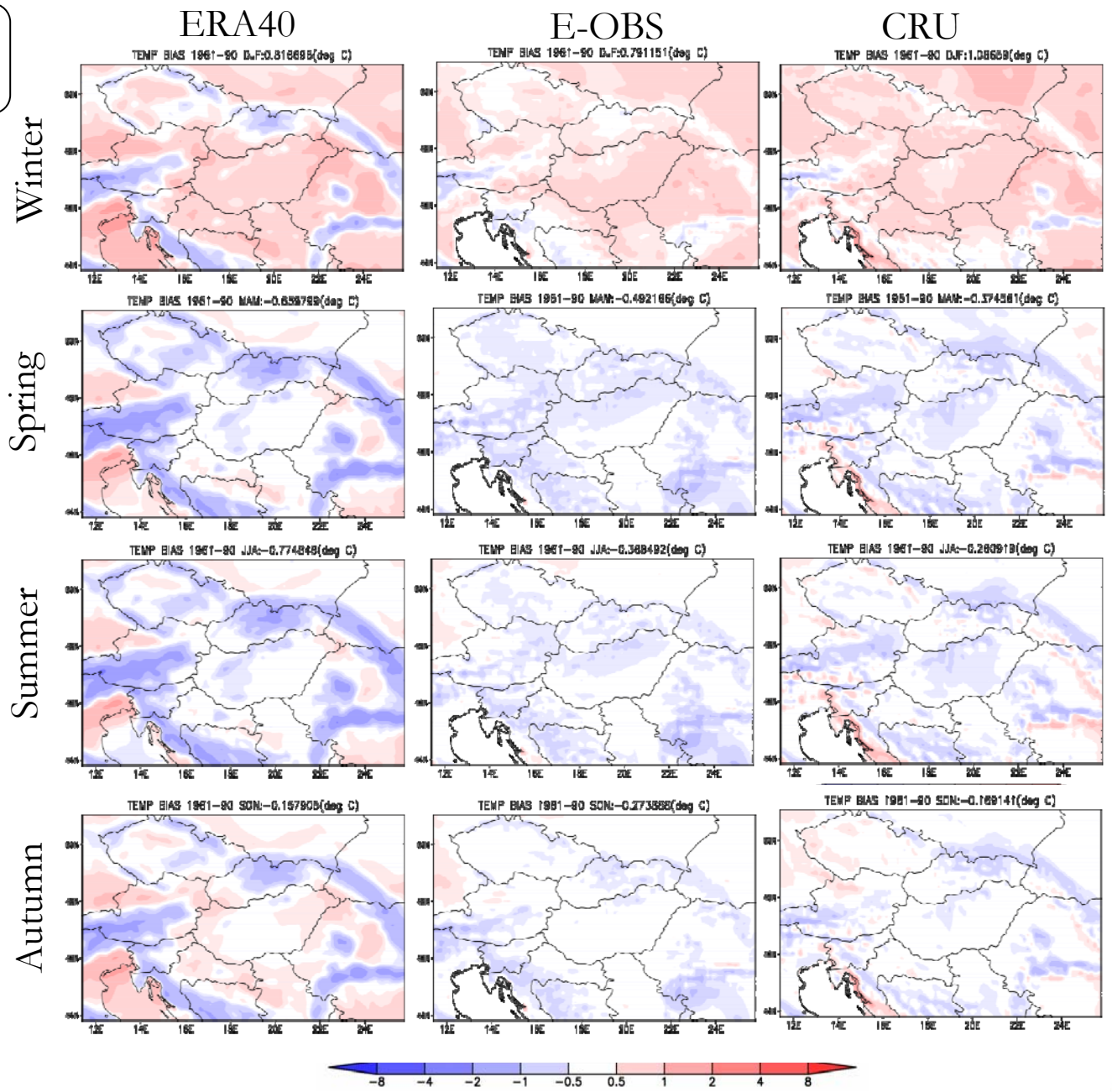
Validation

120x100



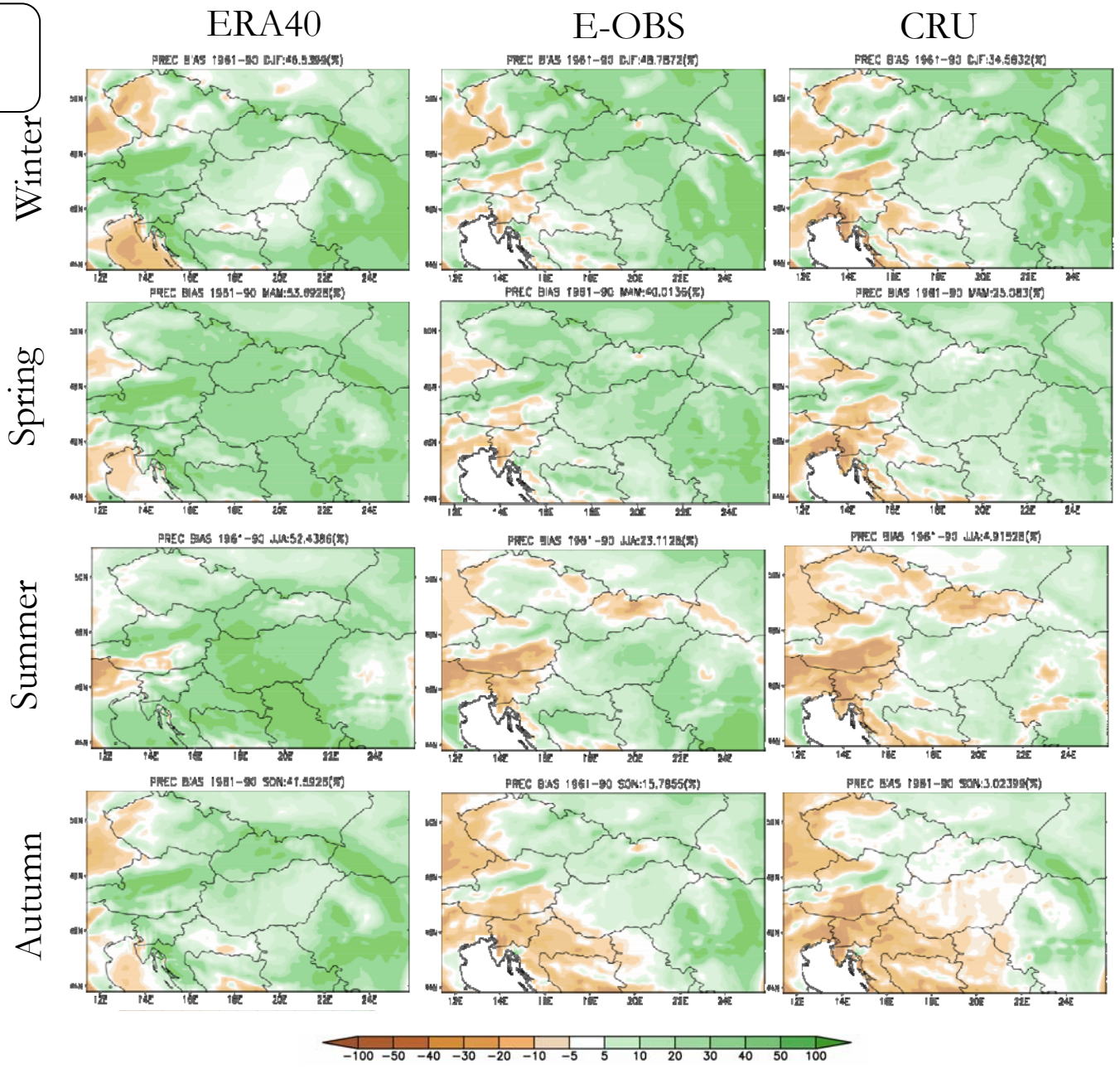
Validation

1961-90



Validation

1961-90



Validation

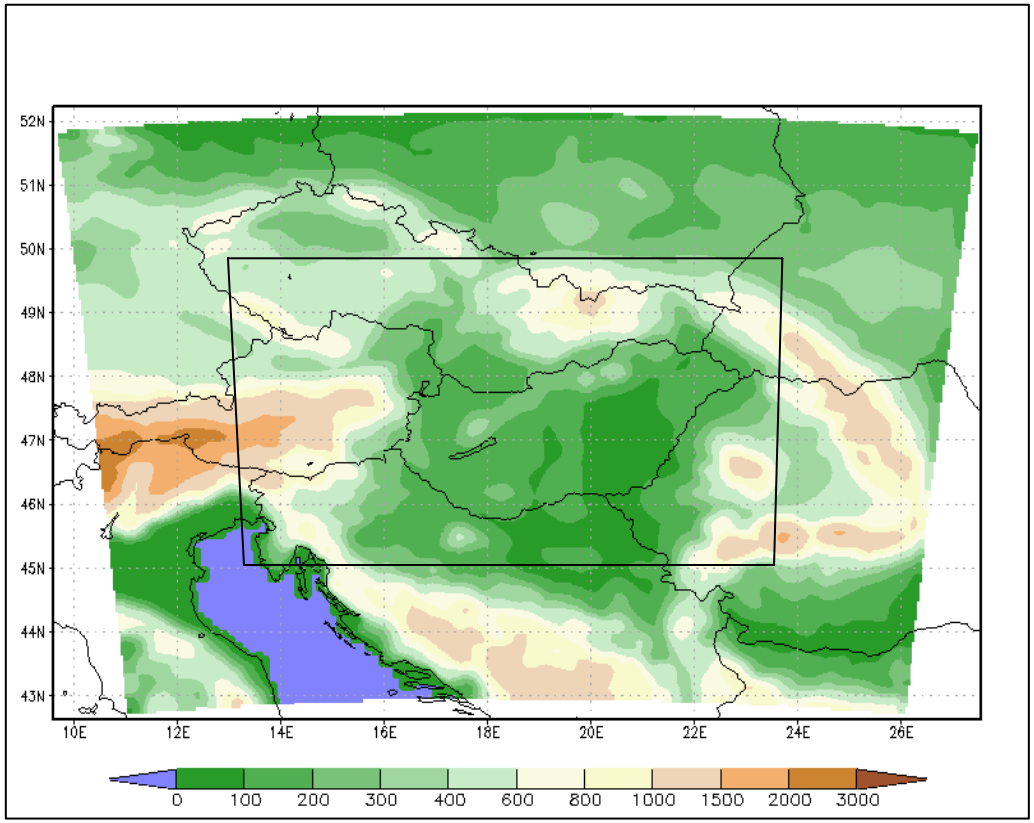
	RegCM (ERA)	RegCM (ERA)	RegCM (ERA)	RegCM (ERA)
	Temperature (C) (1961-90)	Precipitation (%) (1961-90)	Temperature (C) (1961-90)	Precipitation (%) (1961-90)
Winter	+1.1	+34.5	+0.8	+48.8
Spring	-0.4	+25	-0.5	+40
Summer	-0.3	+4.9	-0.4	+23.1
Autumn	-0.2	+3	-0.3	+15.8

CRU

E-OBS

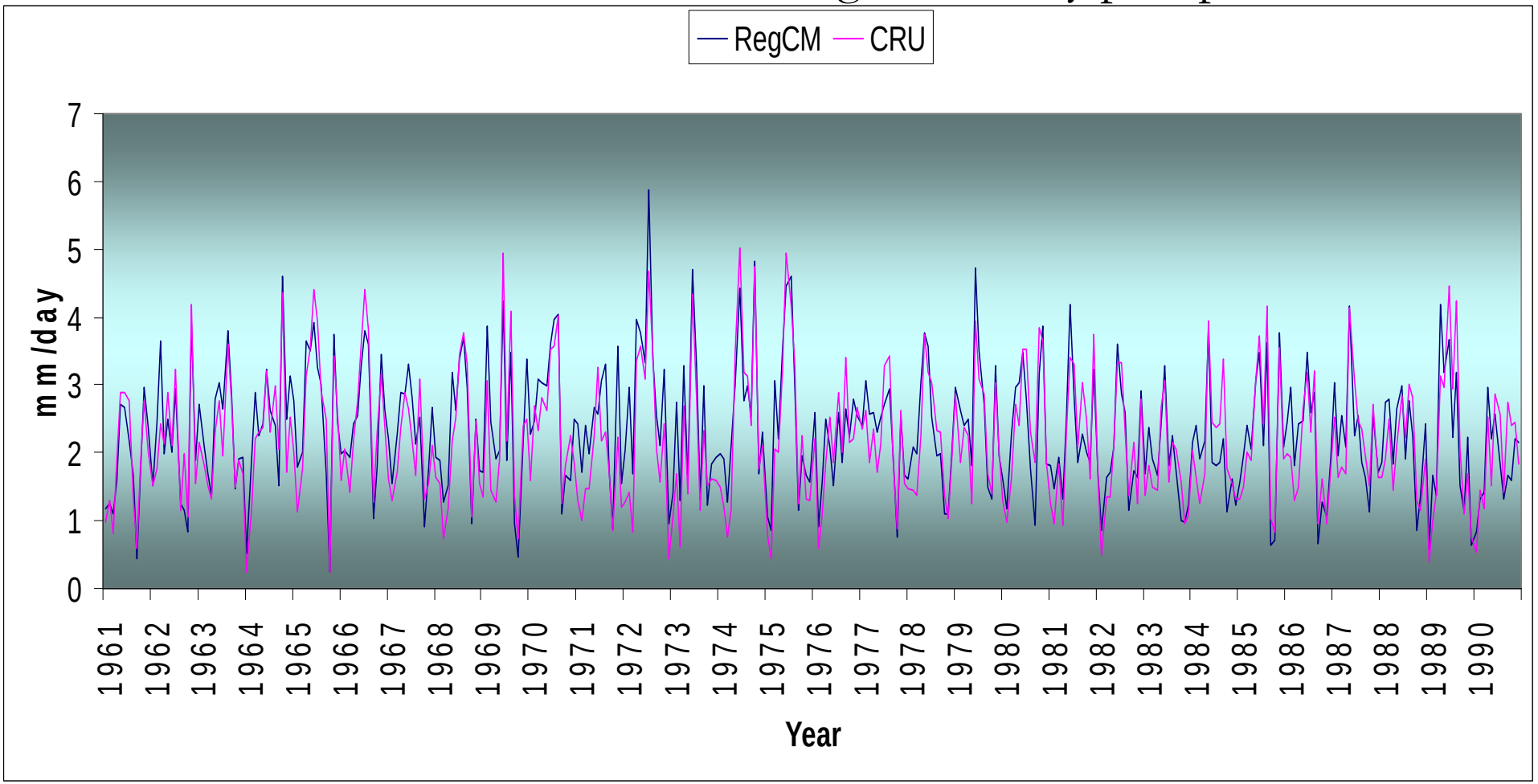
Validation

- Lon: 13.35 – 23.55
- Lat: 45.15 – 49.75



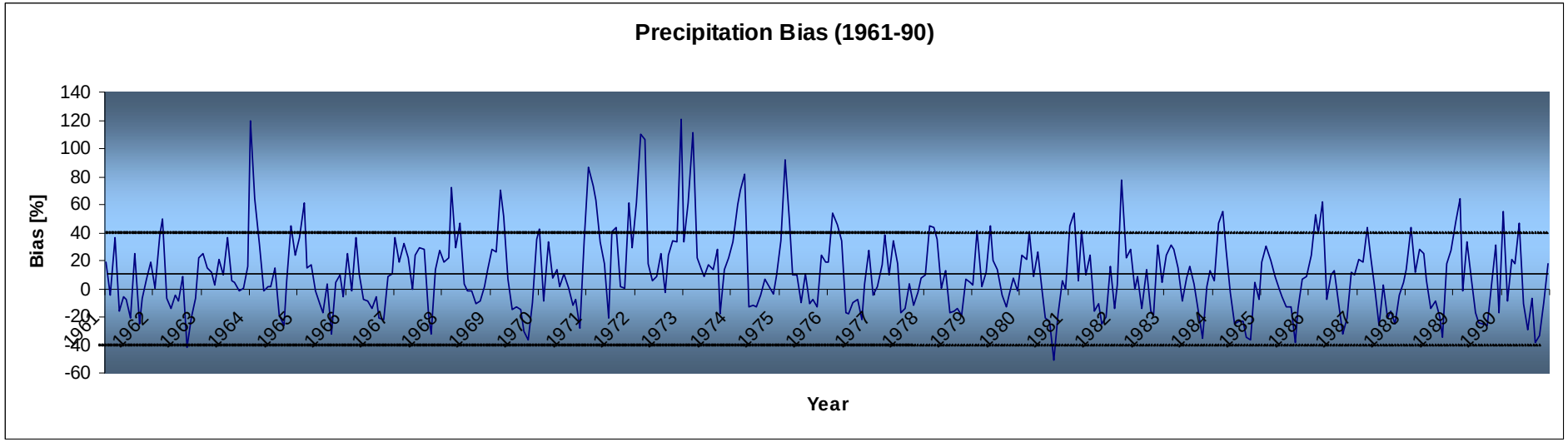
Validation

Time series of area-averaged monthly precipitation



Validation

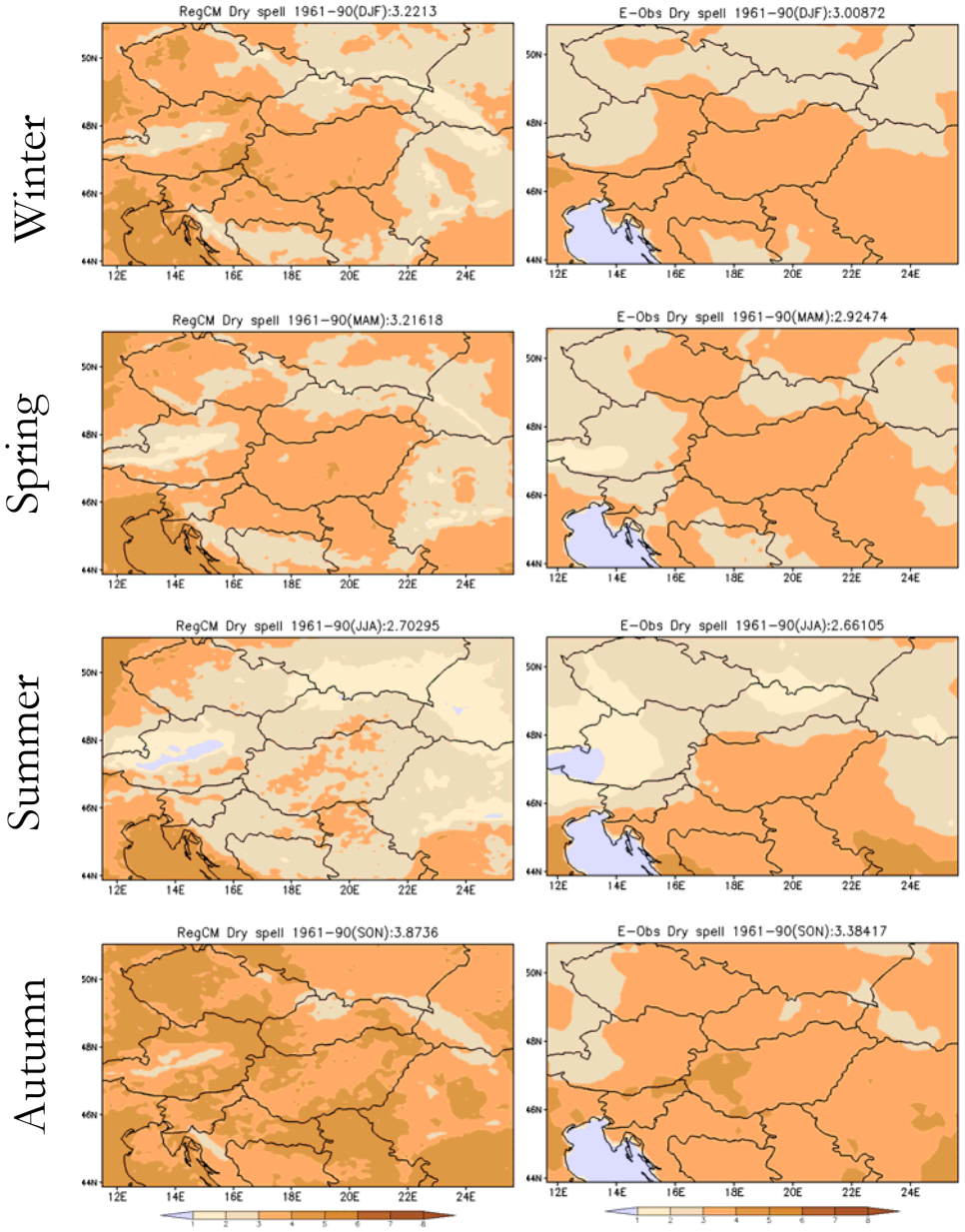
Time series of area-averaged monthly precipitation



Validation

Dry spell

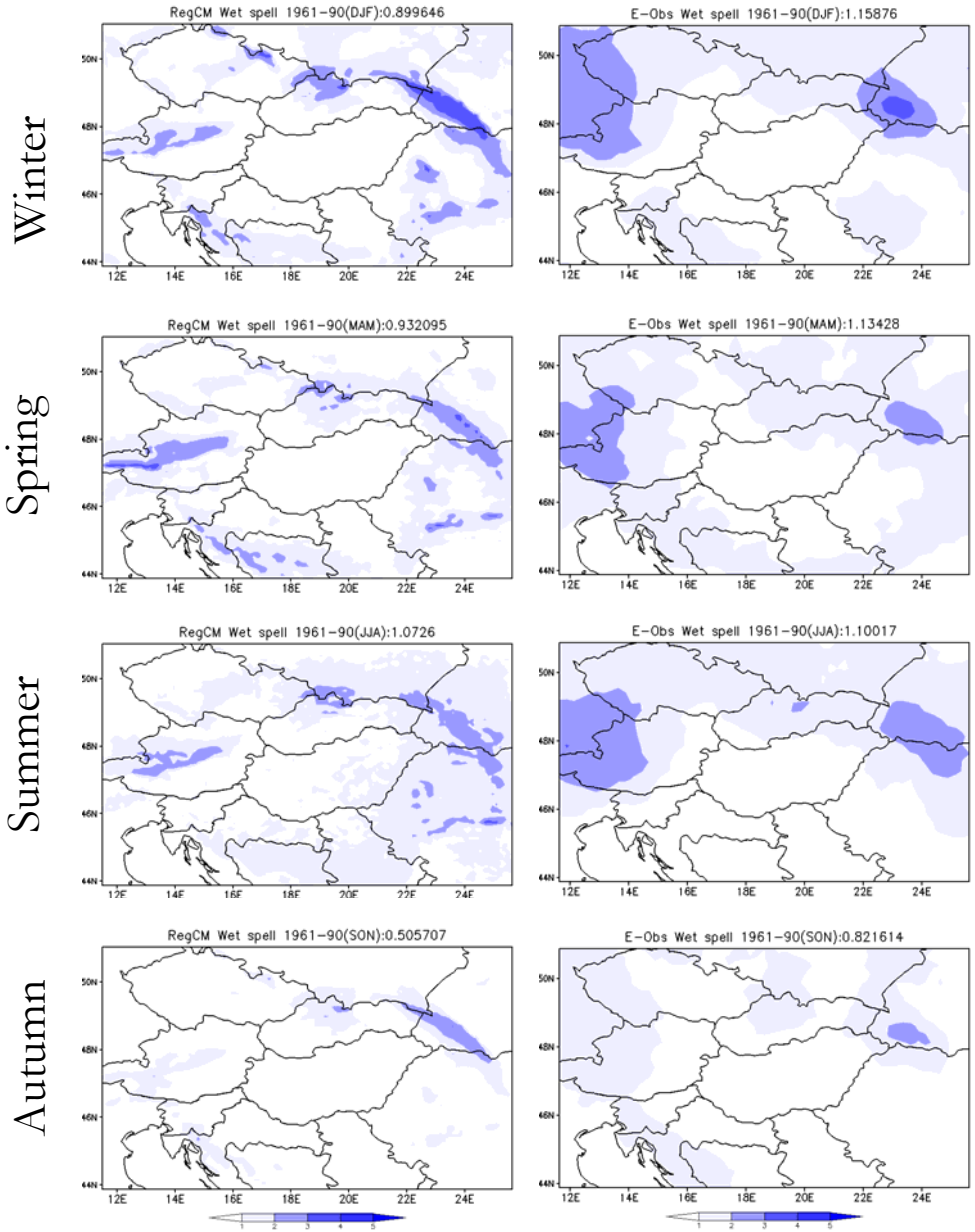
(5 consecutive days < 1mm/day)



Validation

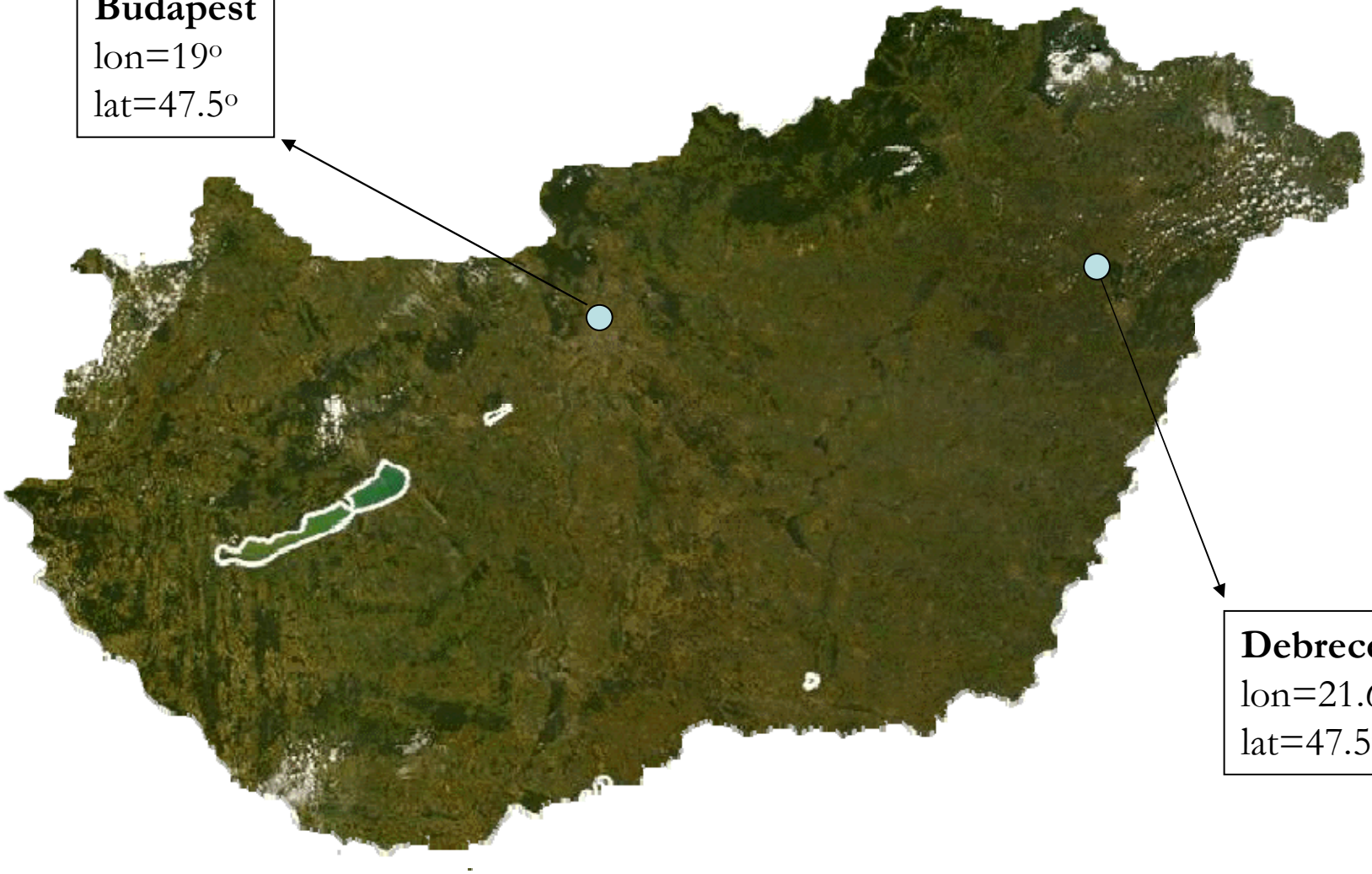
Wet spell

(5 consecutive days > 1mm/day)



Validation

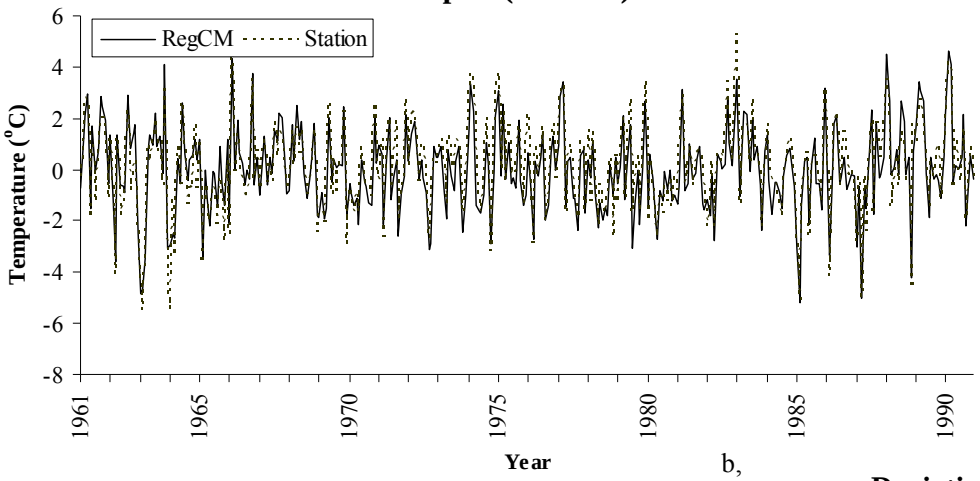
Station data comparisons (Budapest, Debrecen)

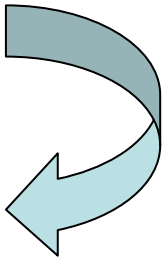


Validation

a,

Deviations from the mean annual cycle of temperature, Budapest (1961-90)



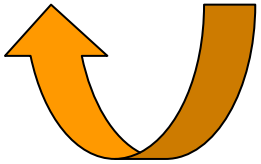


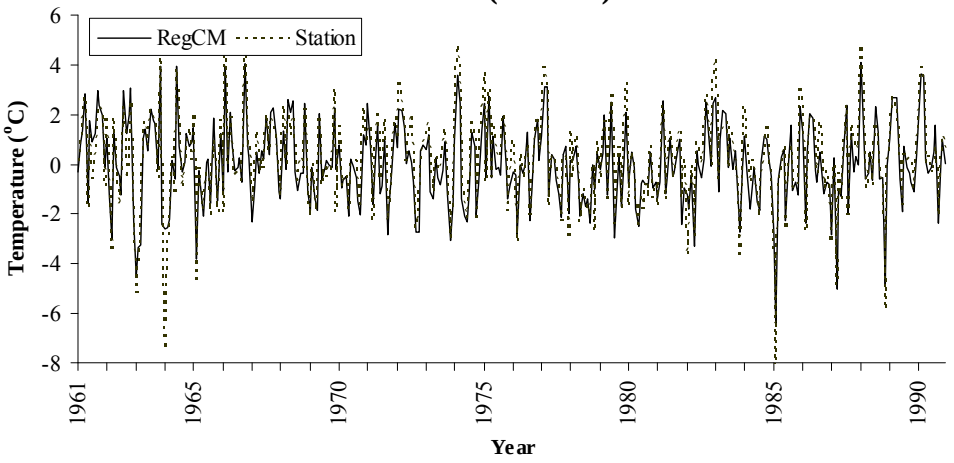
~ -1 °C

b,

Deviations from the mean annual cycle of temperature, Debrecen (1961-90)

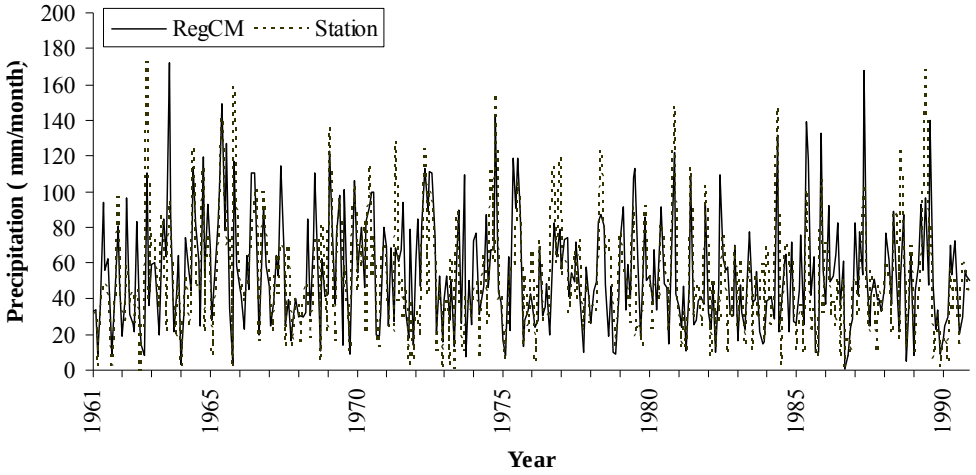
~ 0,5 °C



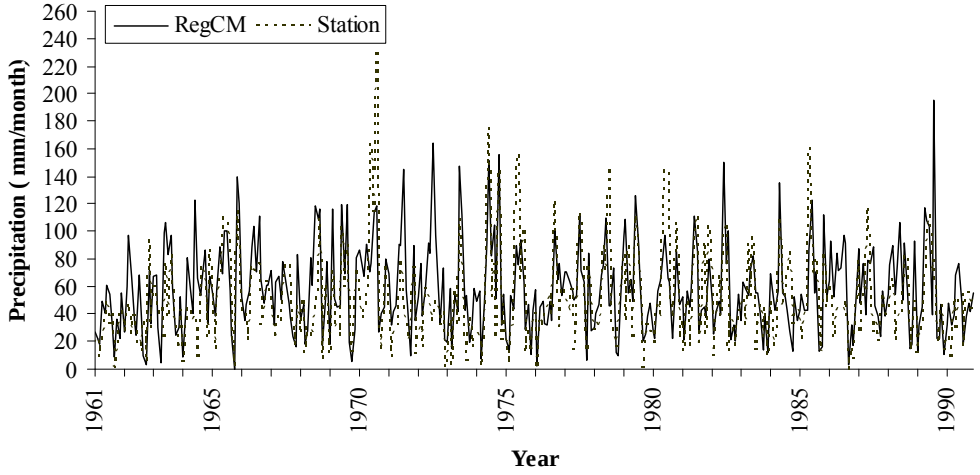


Validation

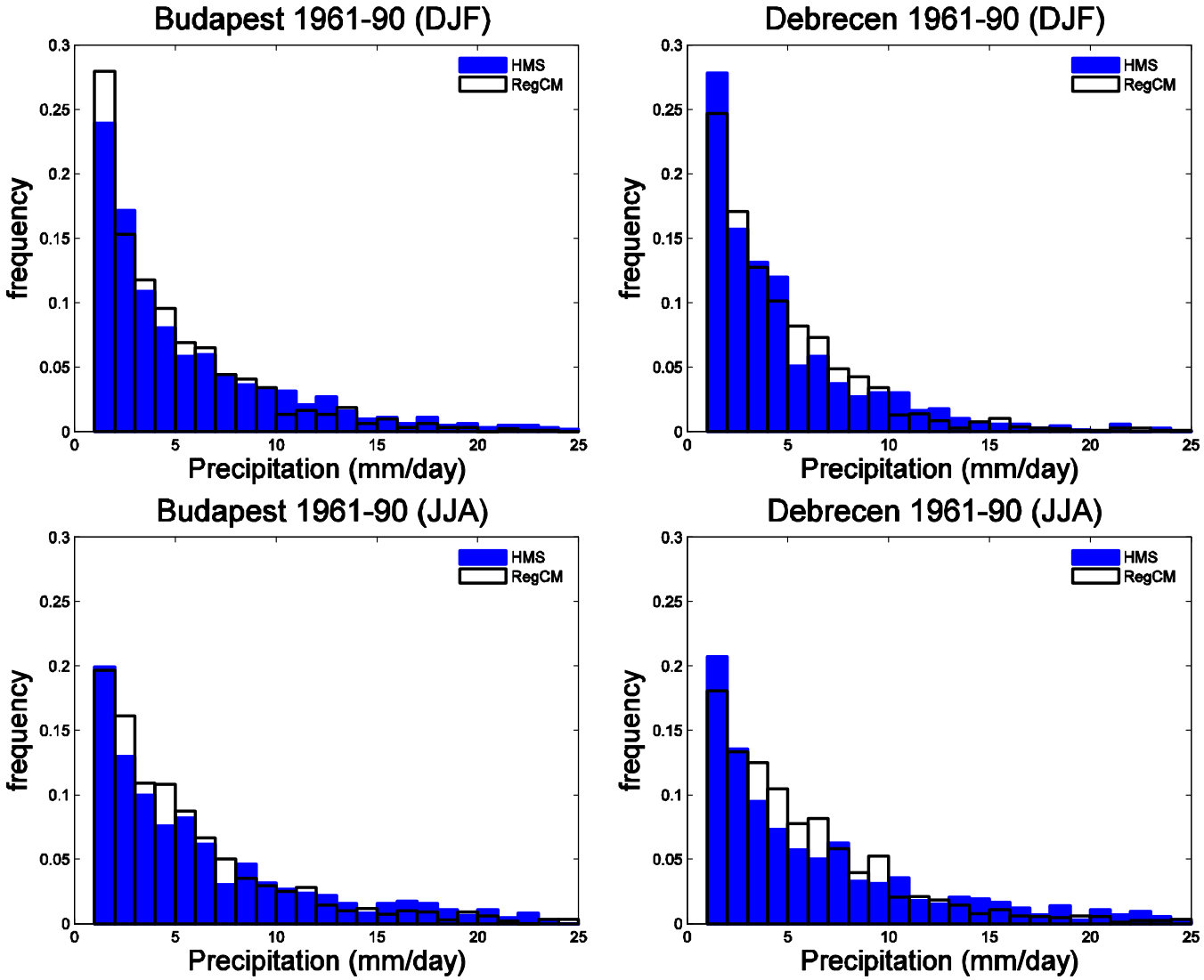
Precipitation, Budapest (1961-90)



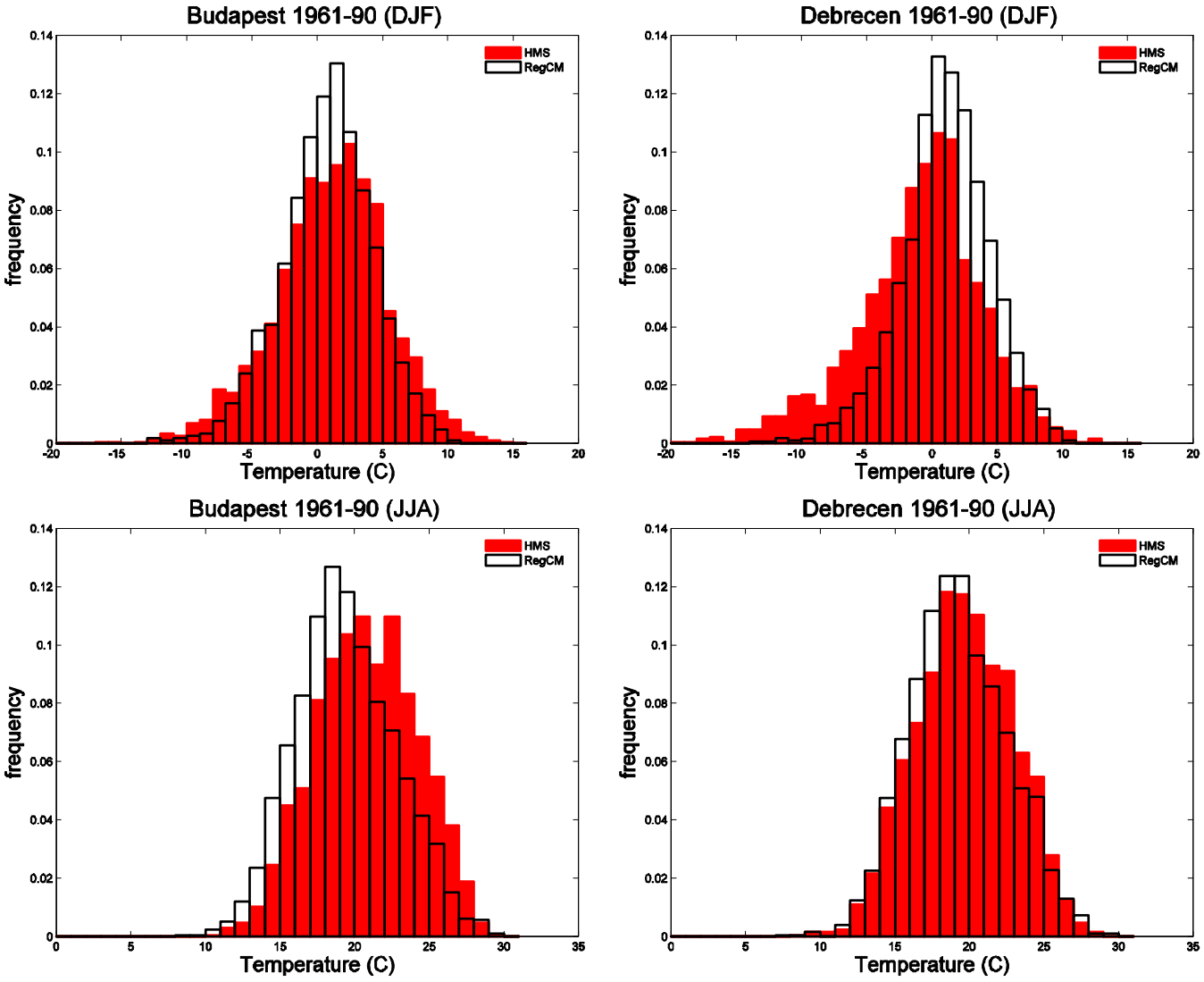
Precipitation, Debrecen (1961-90)



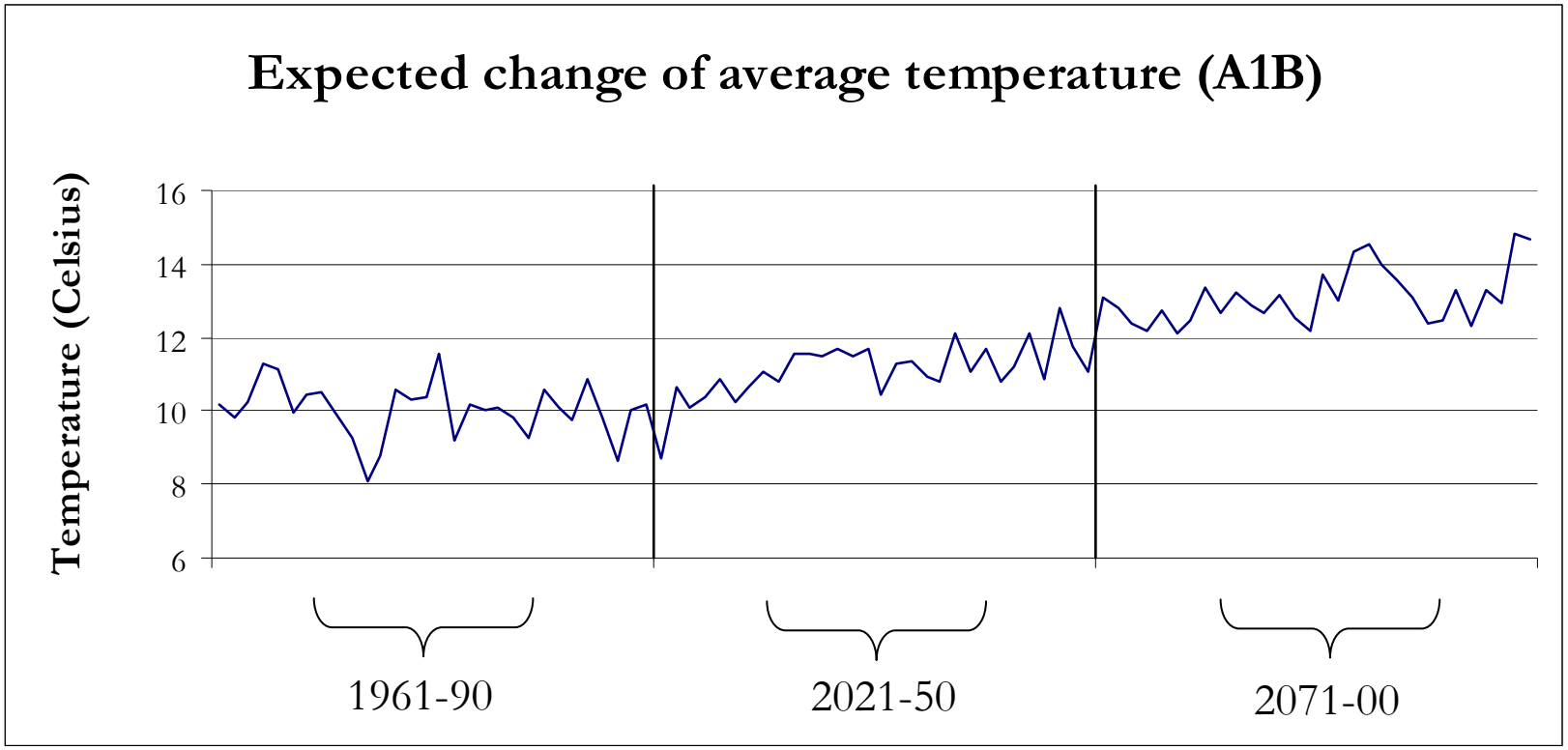
Validation


Budapest 1961-90 (DJF)
Debrecen 1961-90 (DJF)
Budapest 1961-90 (JJA)
Debrecen 1961-90 (JJA)
HMS
RegCM
frequency
Precipitation (mm/day)
0
0.05
0.1
0.15
0.2
0.25
0.3
5
10
15
20
25

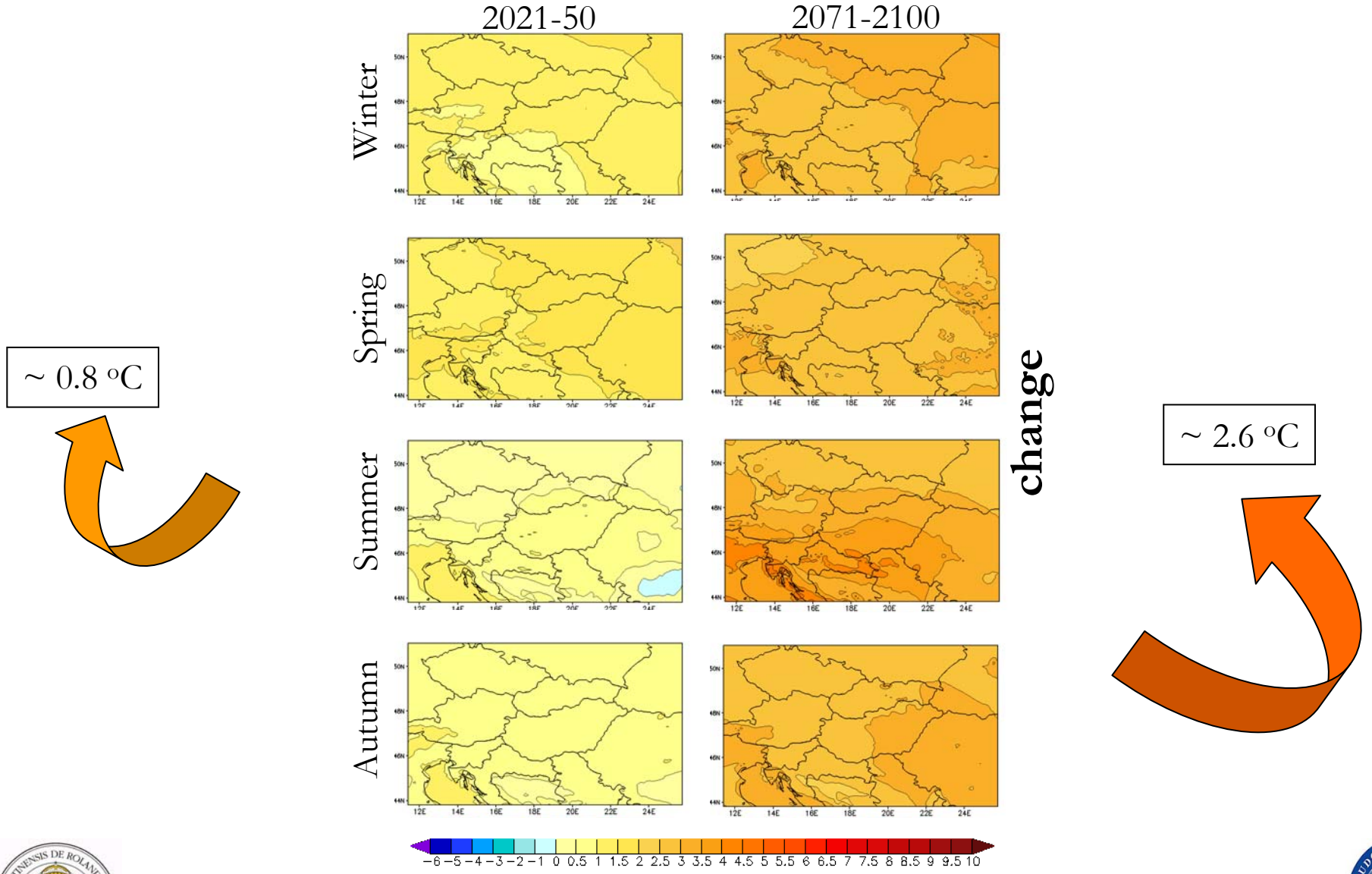
Validation


Budapest 1961-90 (DJF)
Debrecen 1961-90 (DJF)
Budapest 1961-90 (JJA)
Debrecen 1961-90 (JJA)
HMS
RegCM
frequency
Temperature (C)

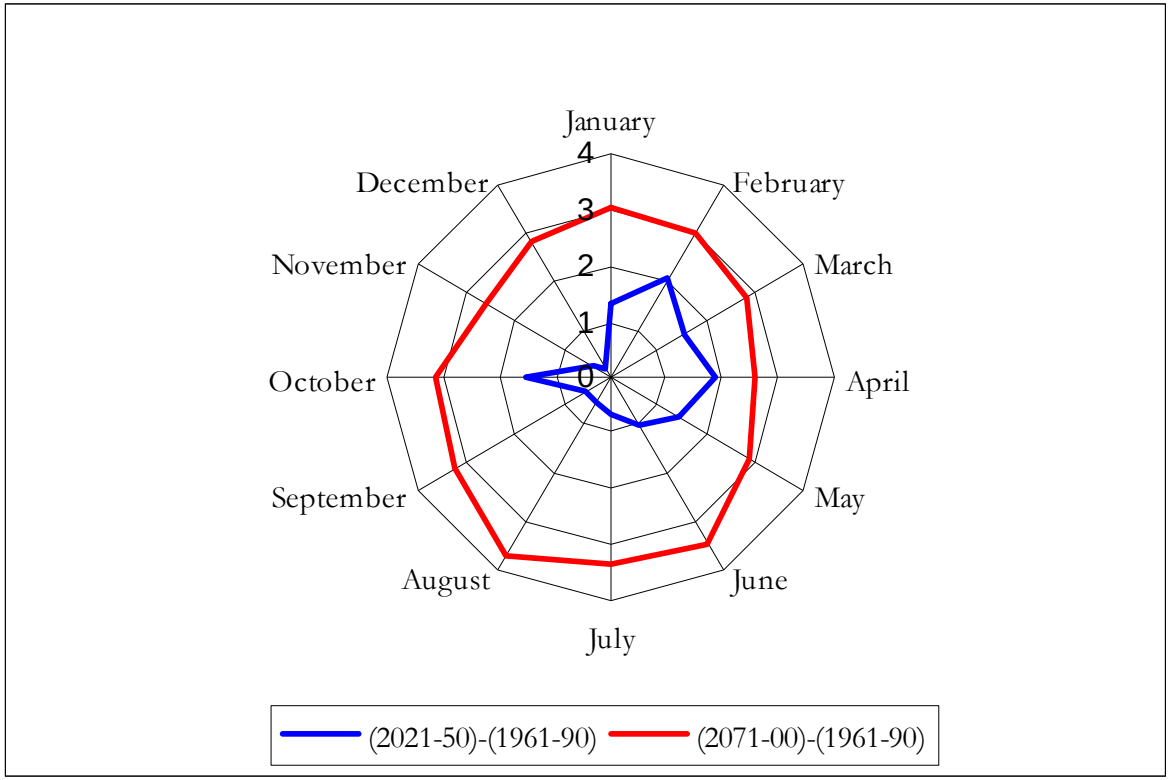
A1B future simulation (2021-50 and 2071-2100)



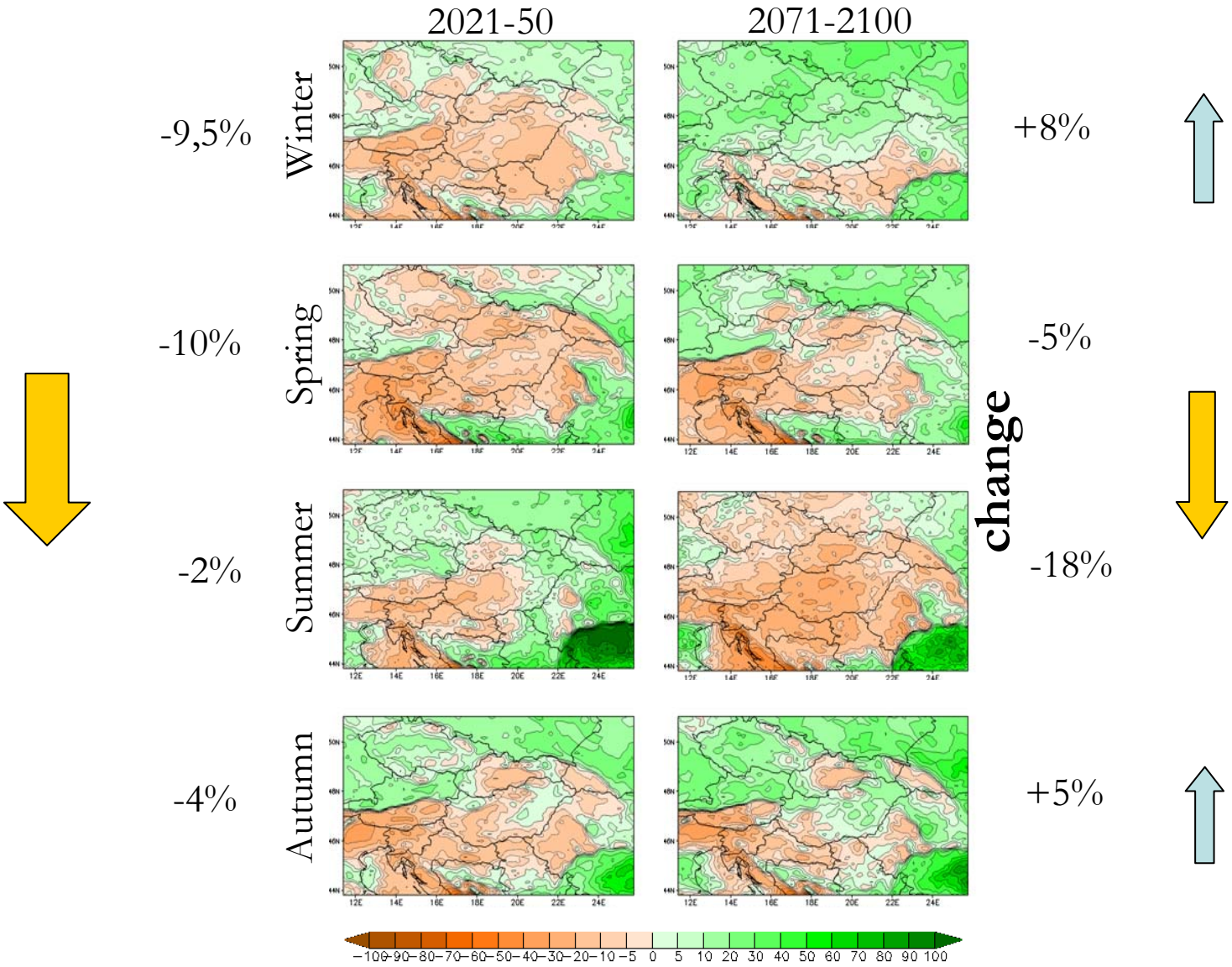
A1B future simulation (2021-50 and 2071-2100)



A1B future simulation (2021-50 and 2071-2100)



A1B future simulation (2021-50 and 2071-2100)



Summary

- Wide range of test runs (domain, schemes, vertical levels…)
- RegCM Beta reproduces well the observed surface air temperature, from climatology to interannual and decadal scales (except winter)
- RegCM Beta tends to overestimate precipitation
- The modell is able to reproduce the interannual variability of precipitation and dry/wet spells as well
- On local scale, RegCM Beta shows good agreement with station data
- Warmer and drier summers, and warmer but wetter winters can be expected in far future (Hungary)

Future plans

-„Mini ensembeles” cooperating with the Hungarian Meteorological Service
(4 regional models: Aladin, REMO, PRECIS, RegCM)

Thank you for your attention!

Grazie per la attenzione!

Köszönöm a figyelmet!