SEGMENT IV: PRESENT EXPERIENCES AND PLANS

NIMH-BAS EXPERIENCES

Vesselin Alexandrov

NIMH
BAS

National Institute of Meteorology and Hydrology of BAS

NIMH has two main tasks:

- **to maintain operational meteorological, hydrological and environmental activities (observations, telecommunication, data processing and archiving, forecasting etc.) as to fulfil the needs of the society in the country and for international exchange.**
- **research in the field of meteorology, hydrology and environment.**

The scientists of NIMH participate in many national, regional and international research projects

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High resolution regional climate change modelling in CECILIA Project - climate change signal in central and Eastern Europe

Sixth Framework Programme: Specific targeted research project

CECILIA

Central and Eastern Europe Climate Change Impact and VulnerabiLIty Assessment

PUBLIC AREA
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- News
- Description
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- Contacts

RESTRICTED
- Deliverables

FOR PARTICIPANTS
- Documents
- Project status

GOOGLE search of CECILIA webpage content:

Project CECILIA (Central and Eastern Europe Climate Change Impact and Vulnerability Assessment) started on June 1st 2006 as a part of the Sixth Framework Programme of the European Union, with sixteen institutions from twelve European countries taking part in its research activities. CECILIA's primary mission is to improve the understanding of local climate change in Central and Eastern Europe and its impacts into forestry, agriculture, hydrology and air quality.

Project summary

The main objective of CECILIA is to deliver a climate change impacts and vulnerability assessment in targeted areas of Central and Eastern Europe. Emphasis is given to applications of regional climate modelling studies at a resolution of 10 km for local impact studies in key sectors of the region. The project contains studies of hydrology, water quality, and water management (focusing at medium-sized river catchments and the Black Sea coast), air quality issues in urban areas (Black Triangle - a polluted region around the common borders of the Czech Republic, Poland and Germany), agriculture (crop yield, pests and diseases, carbon cycle), and forestry (management, carbon cycle). Very high resolution simulations over this region are necessary due to the presence of complex topographical and land use features. Climate change impacts on large urban and industrial areas modulated by topographical and land-use effects which can be resolved at the 10 km scale, are investigated by CECILIA. The high spatial and temporal resolution of dense national observational networks at high temporal resolution and of the CECILIA regional model experiments will uniquely feed into investigations of climate change consequences for weather extremes in the region under study. Comparison with the results based on statistical downscaling techniques will also be provided. Statistical downscaling methods for verification of the regional model results will be developed and applied, and assessments of their use in localization of model output for impact studies will be performed.

CECILIA's research topics are divided into seven individual workpackages, while the overall project organization is provided by the project office, represented by project coordinator and project manager. Details on CECILIA's objectives can be found here, contact information are available here.

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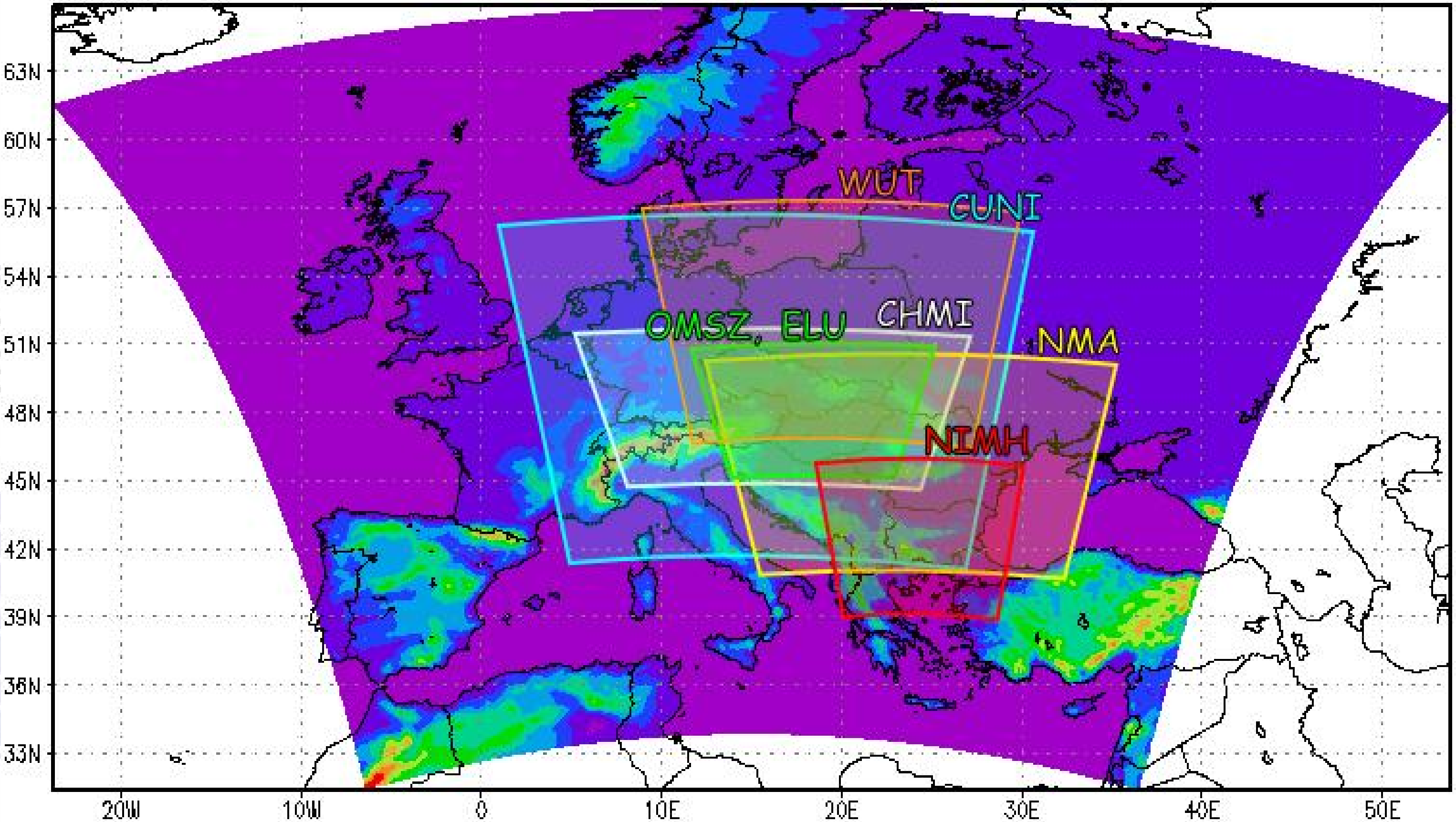
CECILIA Consortium

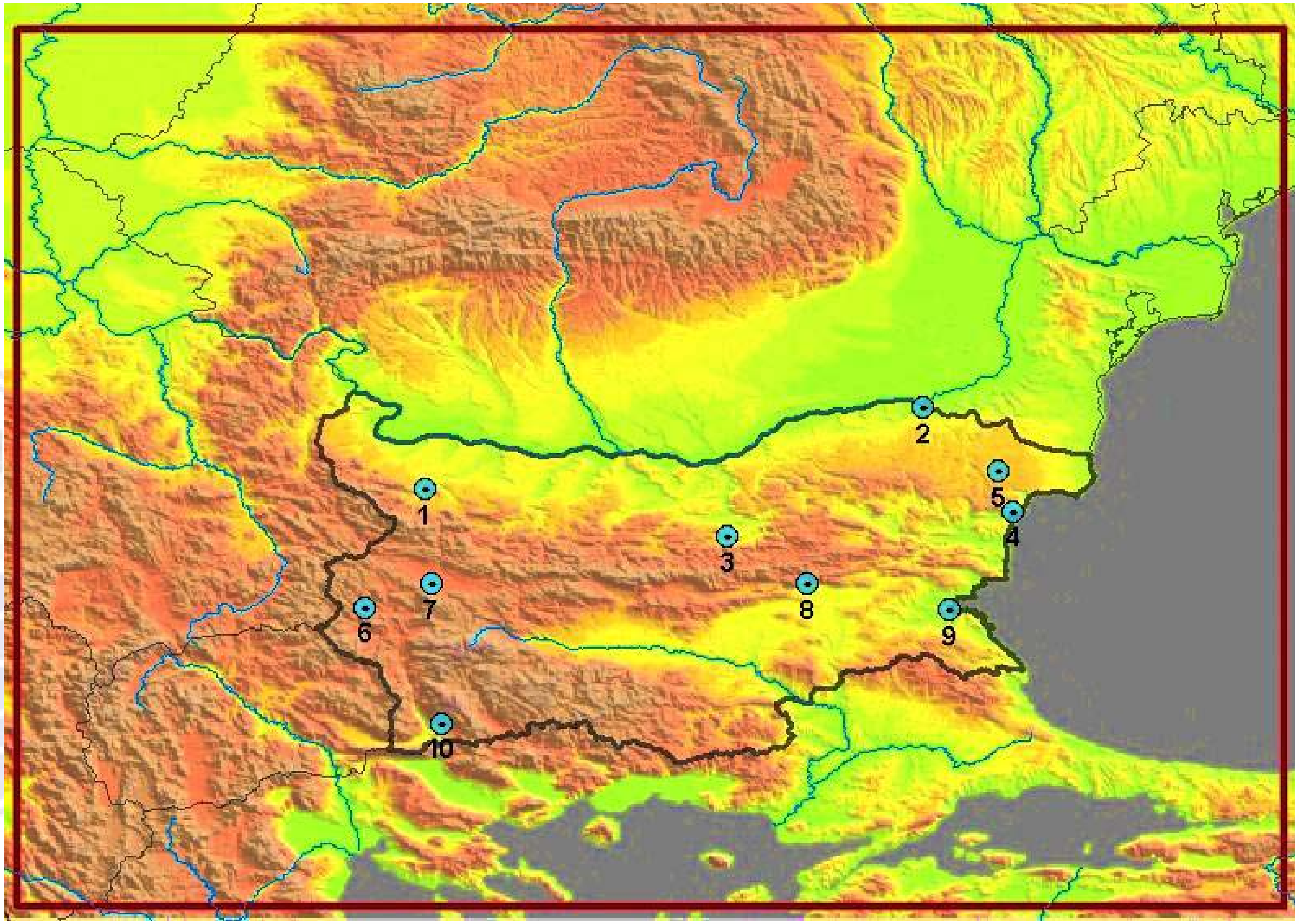
1. CUNI, Czech Republic (coordinator)
2. ICTP, Italy
3. CNRM, France
4. DMI, Denmark
5. AUTH, Greece
6. CHMI, Czech Rep.
7. IAP, Czech Rep.
8. ETH, Switzerland
9. BOKU, Austria
10. NMA, Romania
11. NIMH, Bulgaria
12. NIHWM, Romania
13. OMSZ, Hungary
14. FRI, Slovakia
15. WUT, Poland
16. ELU, Hungary

Simulation domains (10 km resolution)



CECILIA, EC FP6, 2006-2009, http://www.cecilia-eu.org

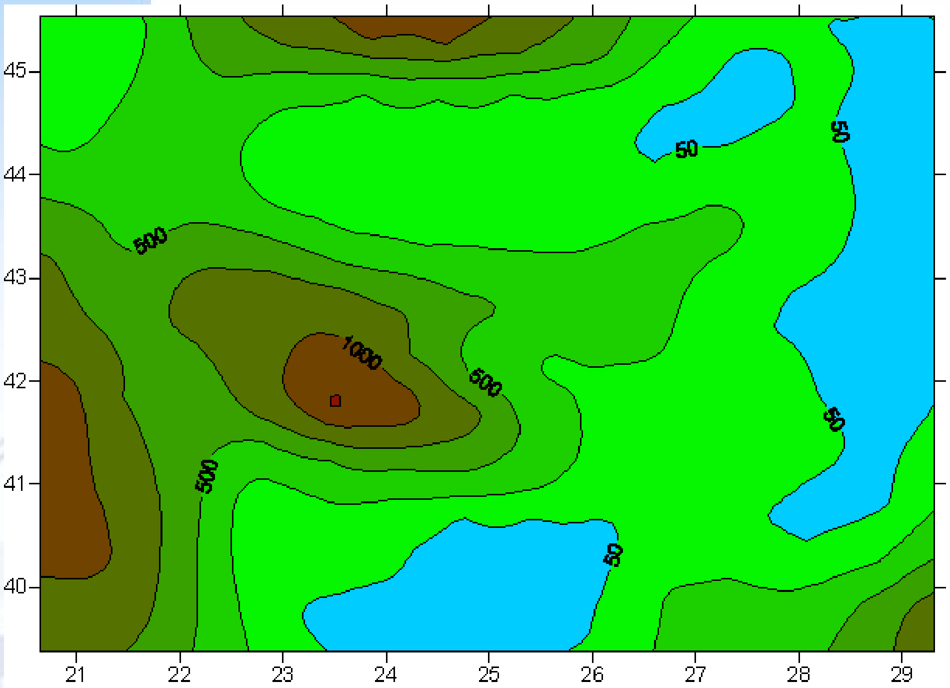
NIMH Domain, ALADIN

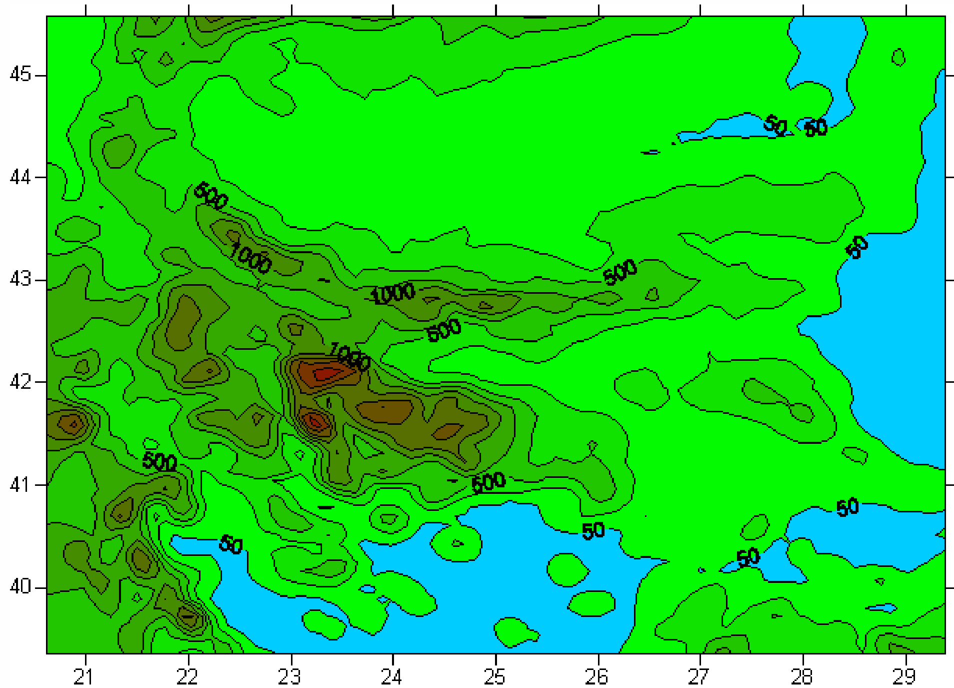


CECILIA project (WP2 objectives)

- producing high resolution (10 km) 30-year time slices over four target areas
- comparing model responses with coarser results from existing simulations to asses the gain of a higher resolution
- archiving daily data from the simulations in a common database
- improving high resolution models for future scenarios

ELEVATION IN BULGARIA: DIFFERENT SPATIAL RESOLUTION

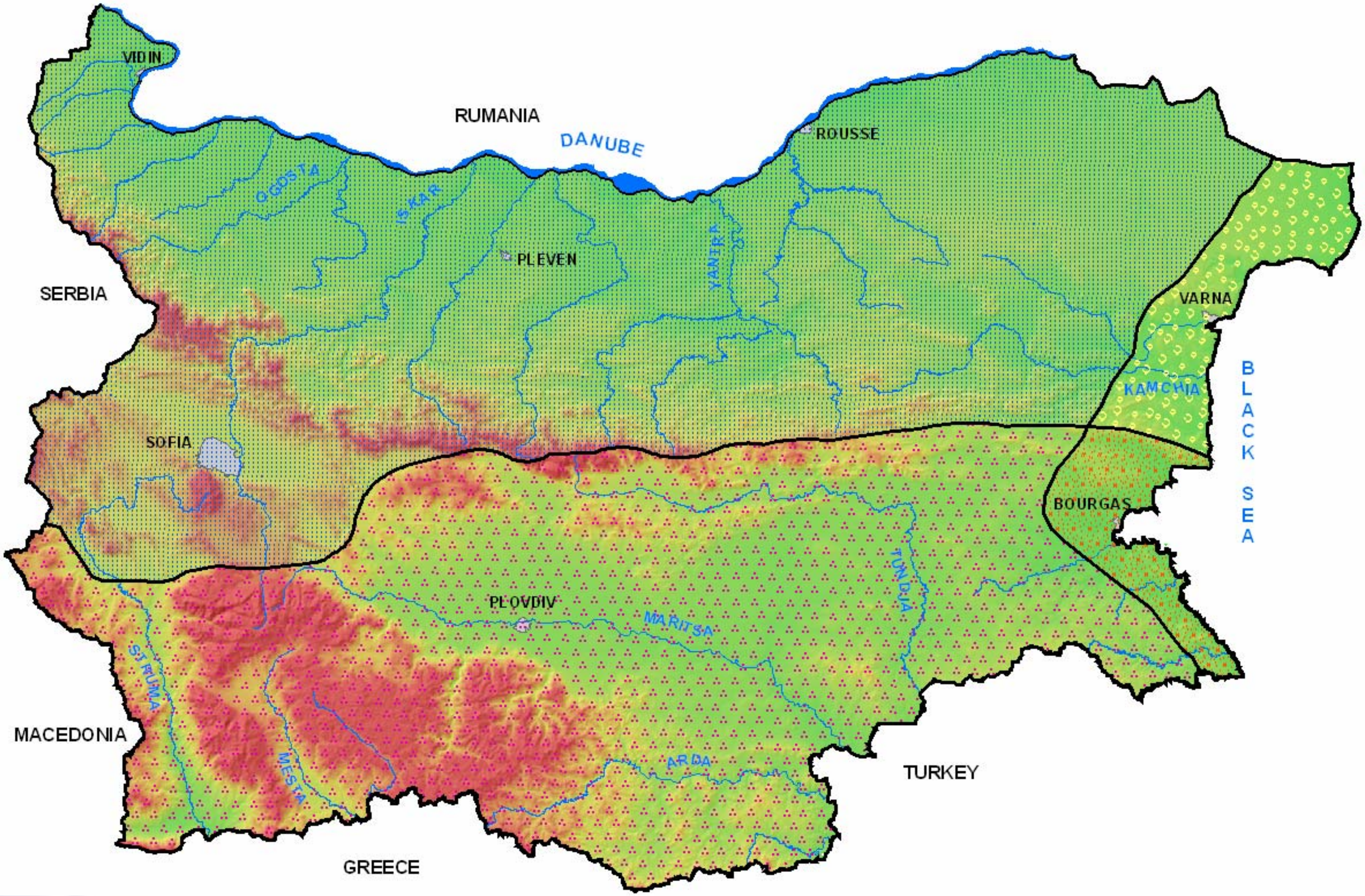




50 км

10 км

- **Why a higher resolution is important for this region?**
- The barrier effect of the Balkan Mountains is felt throughout the country. On the average, northern Bulgaria is more then one degree colder and receives annually about 190 mm precipitation more than southern Bulgaria. Black Sea is too small to be a primary influencing factor of the country's weather;



VIDIN
RUMANIA
DANUBE
ROUSSE
OGOSTA
ISKAR
PLEVEN
YANTRA
SERBIA
VARNA
KAMCHIA
B
L
A
C
K
S
E
A
SOFIA
BOURGAS
TUNDJA
PLOVDIV
MARITSA
STRUMA
MACEDONIA
MESTA
ARDA
TURKEY
GREECE

Fig. 3

Verification

- The problem is that we have not observation network of 10 km. The CRU data are on 50 km and we should downscale them or upscale results on 10 km grid. We selected 56 stations

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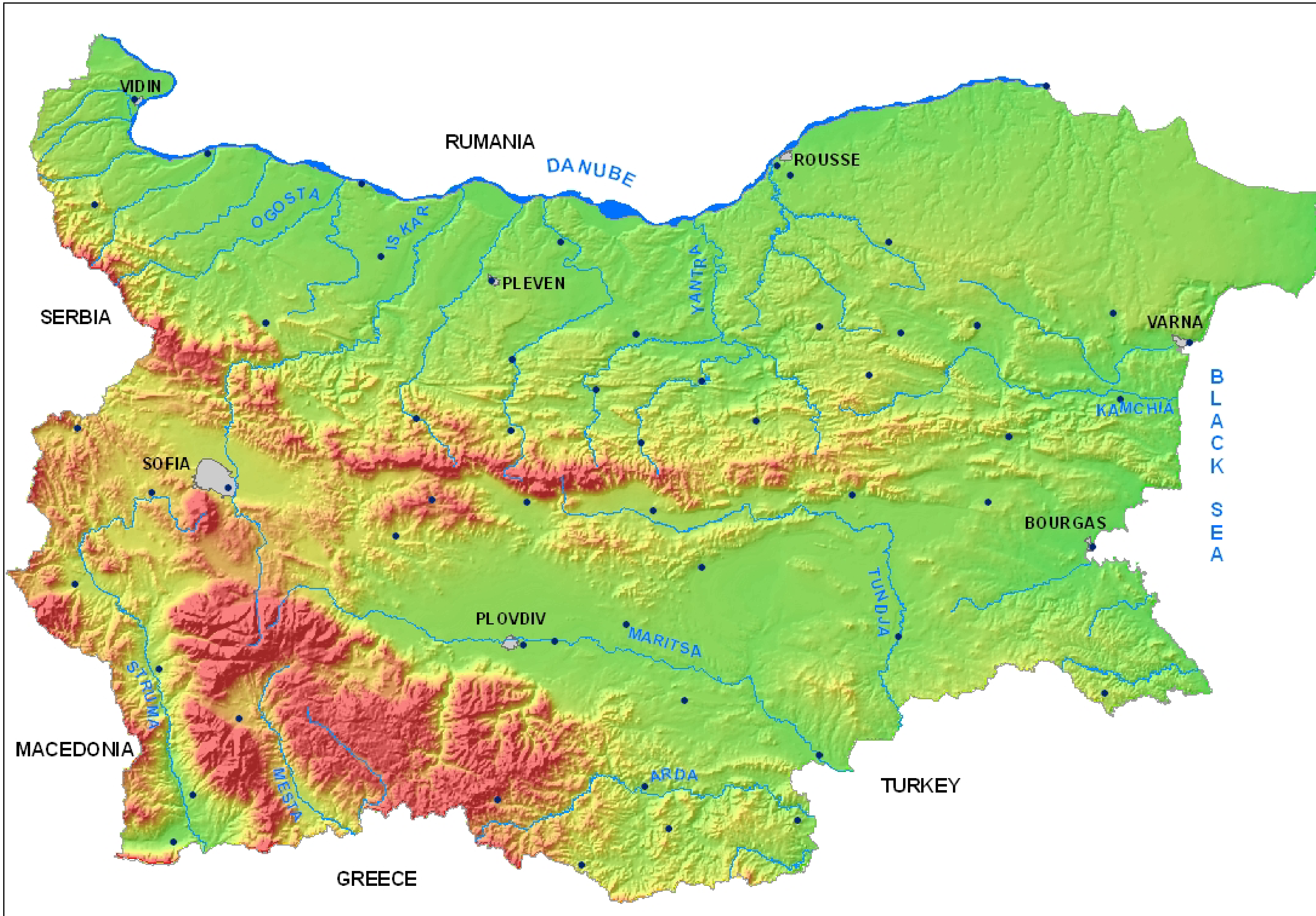
VIDIN
RUMANIA
DANUBE
ROUSSE
OGOSTA
ISKAR
PLEVEN
YANTRA
SERBIA
VARNA
BLACK SEA
KAMCHIA
SOFIA
BOURGAS
TUNDJA
PLOVDIV
MARITSA
STRUMA
MACEDONIA
MESTA
ARDA
TURKEY
GREECE

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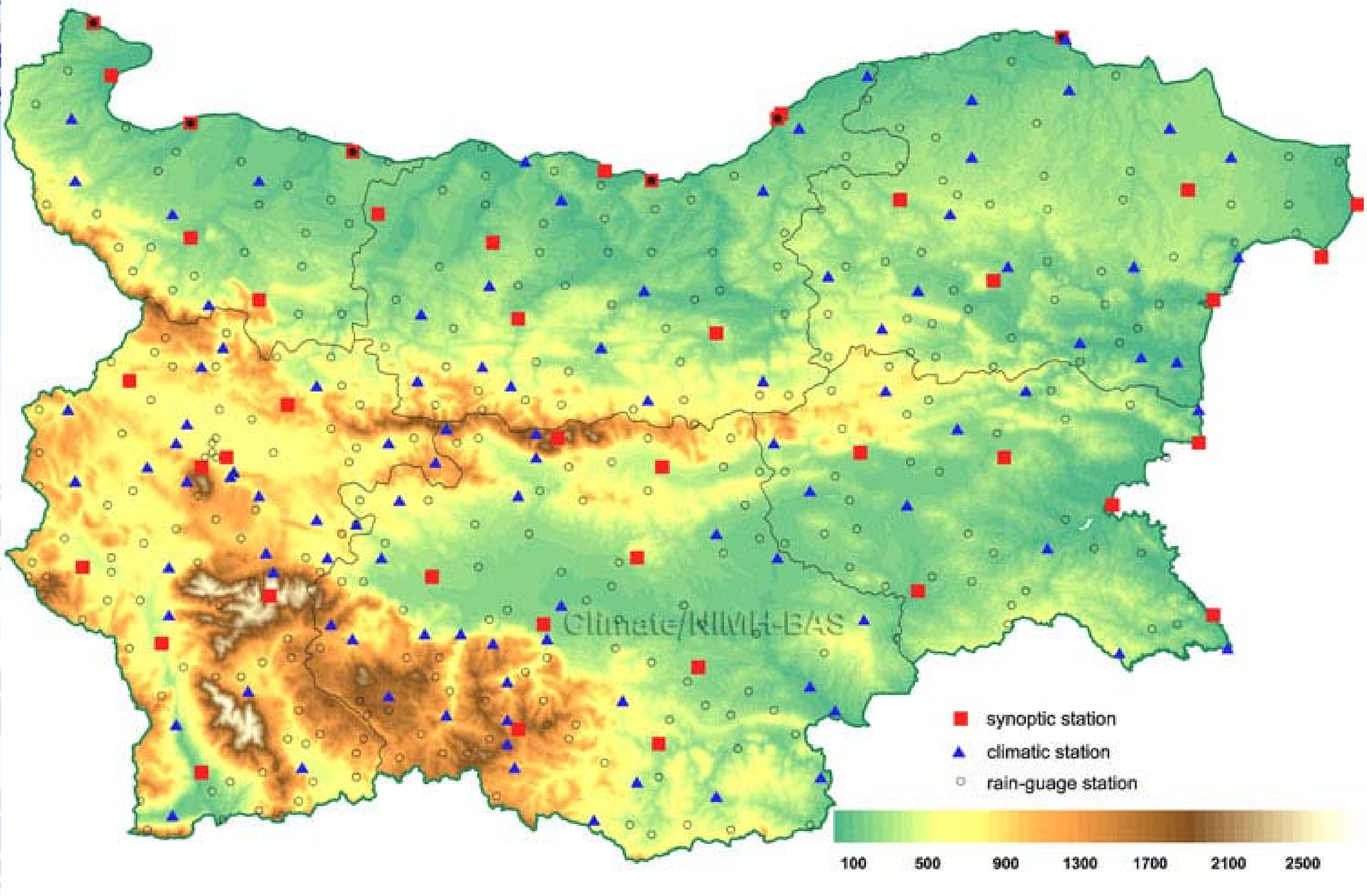

NIMH weather stations in Bulgaria

- For such kind of verification we need **localization** of fields (temperature and precipitation in this case). The idea is to minimize the interpolation error.
- Let the interpolation operator is **A**.
- The problem is to find a transformation **B** of the field **F** (temperature, precipitation), so that:
- **B F - A- (A+ B F) = min**
- In this experiment as an interpolation operator **A** we used bilinear interpolation and below we present results both with **linear** (mentioned by L) localization and described method with a **transformation** (marked by T).

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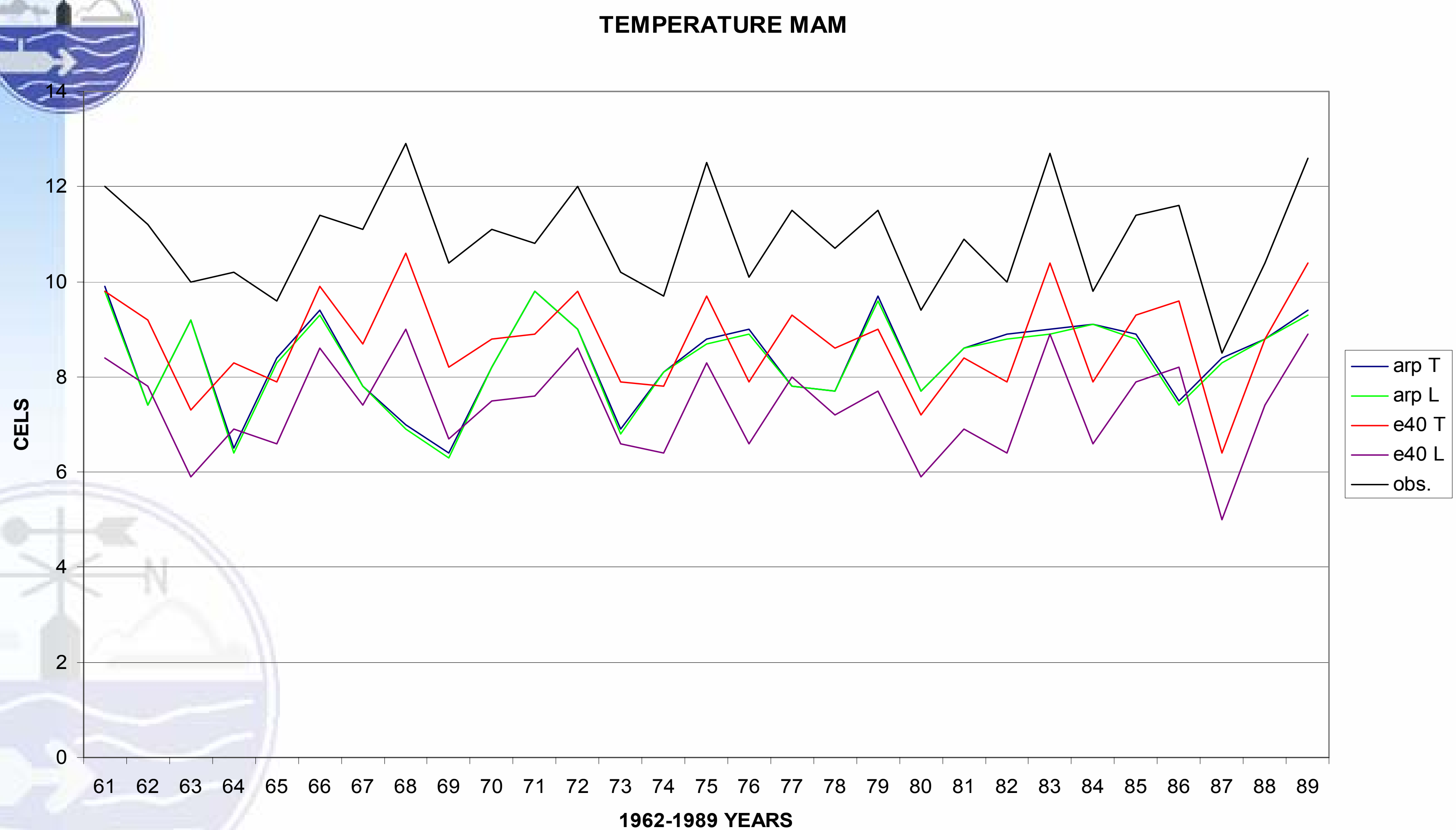
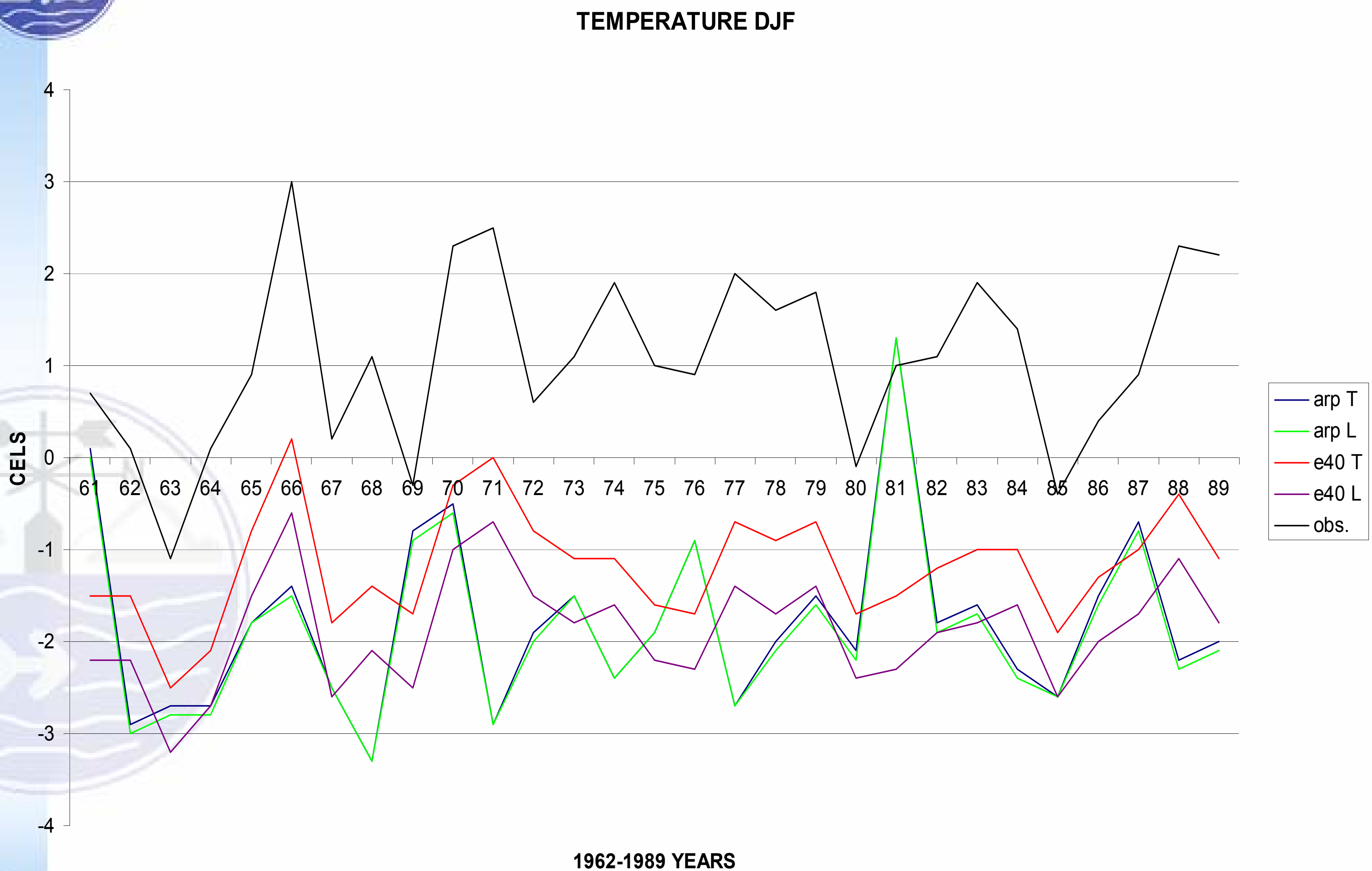


- **Perfect correlation with ERA40 and quite good with ARPEGE couplings.**
- **With ARPEGE couplings there is no sensitivity of the interpolation method unlike ERA40. That means a linear profile of temperature. Both couplings have negative bias**

TEMPERATURE



TEMPERATURE
BIAS

	DJF	MAM	JJA	SON
E4O L	-2.950021	-3.556981	-2.547015	-3.997964
E40 T	-2.105116	-2.184690	-1.163844	-2. 848402
ARP L	-2.925390	-2.670785	-0.6455860	-3.892253
ARP T	-2.917677	-2.630568	-0.5492477	-3.845747

TEMPERATURE
RMS

	DJF	MAM	JJA	SON
E4O L	2.993014	3.630809	2.713115	4.061964
E40 T	2.549860	2.223326	1.197082	2.984402
ARP L	3.224703	2.900206	1.404583	4.179410
ARP T	3.212582	2.854133	1.364826	4.138411

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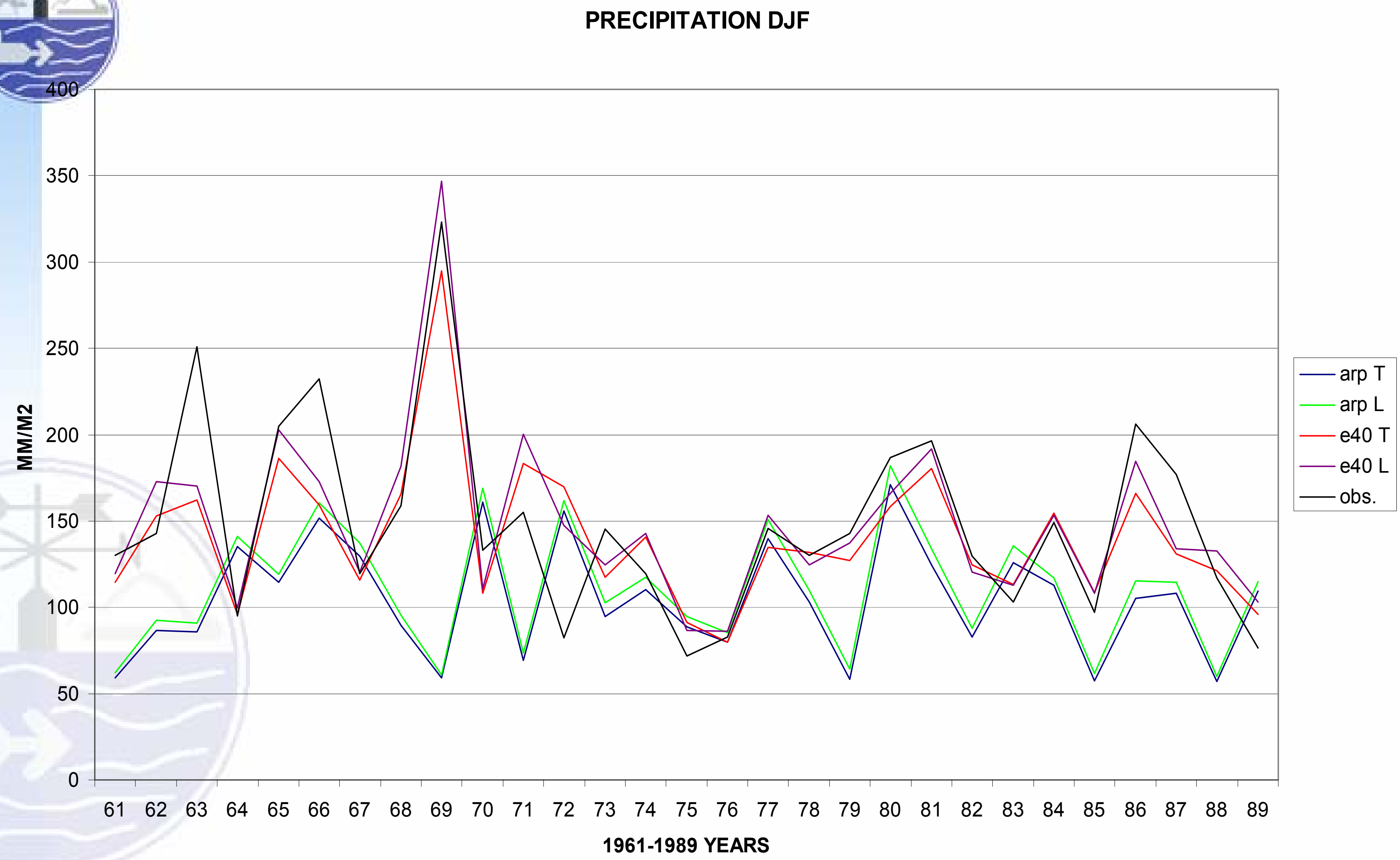
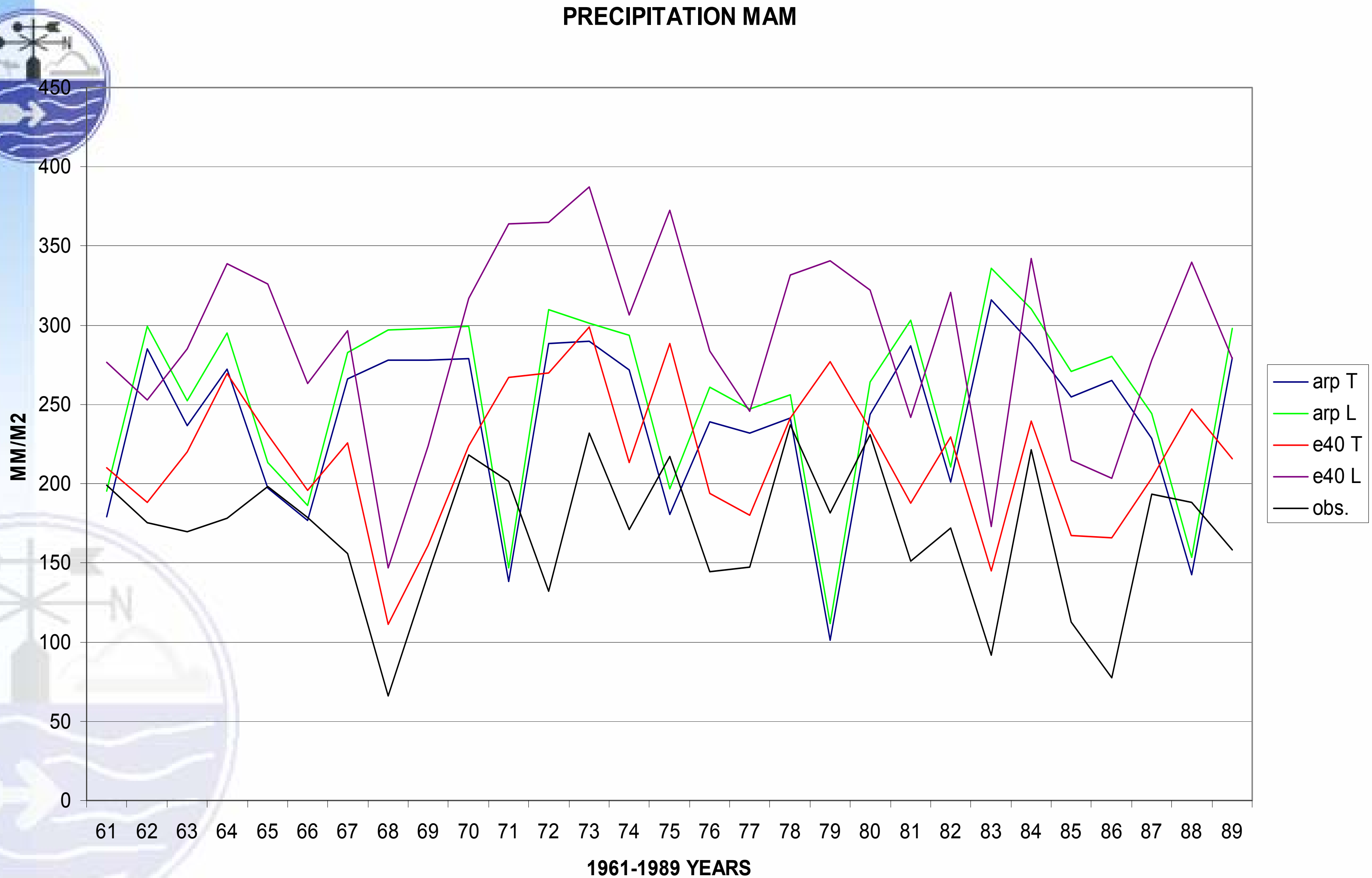


Excellent for ERA40. Longer period for adaptation with ARPEGE couplings. ALADIN is dry. No difference between linear and transformed interpolation for the both couplings.



Good correlation for ERA40, but larger difference between linear and transformed interpolations. With ARPEGE couplings larger period for adaptation is needed. Both are too wet.

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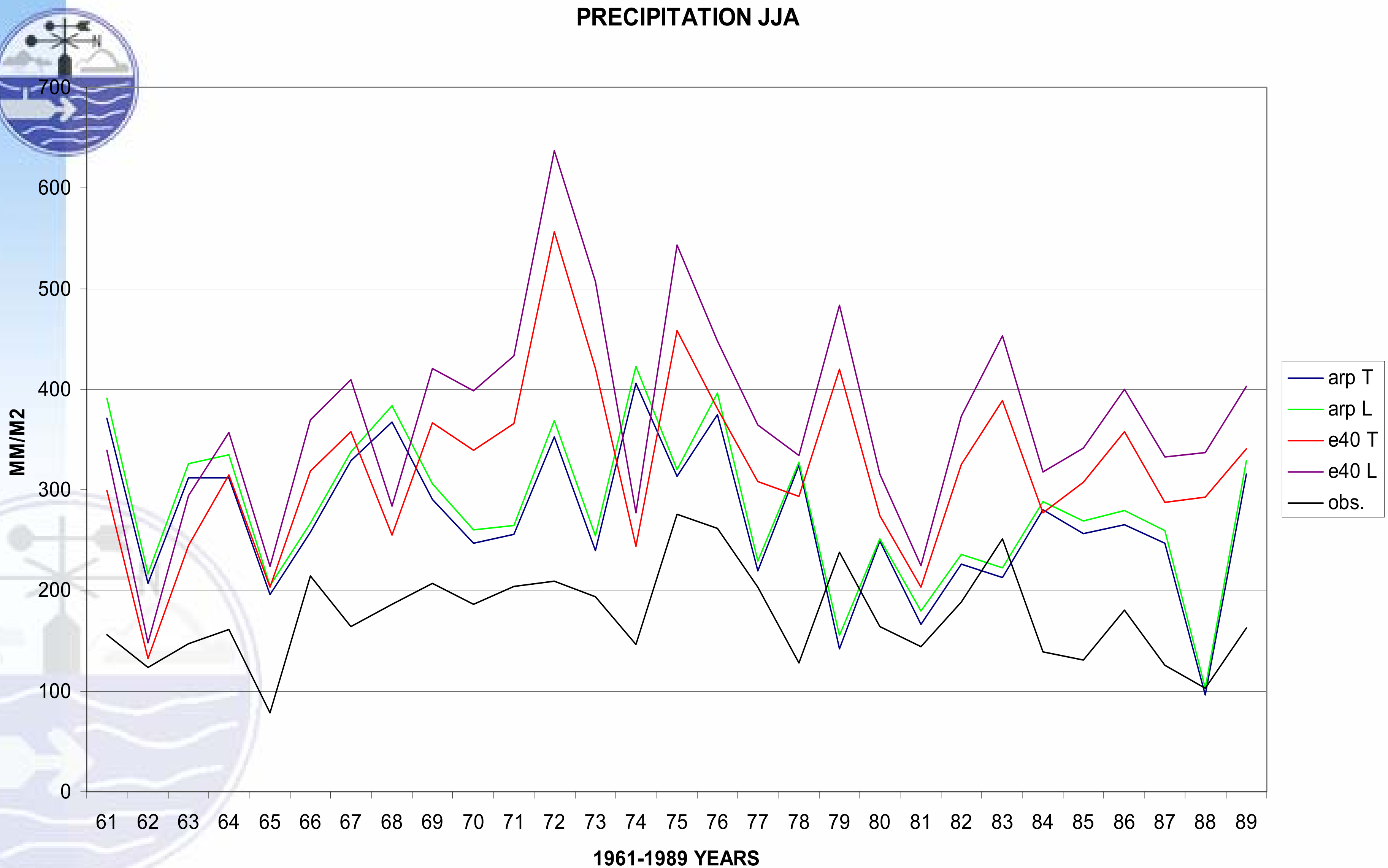
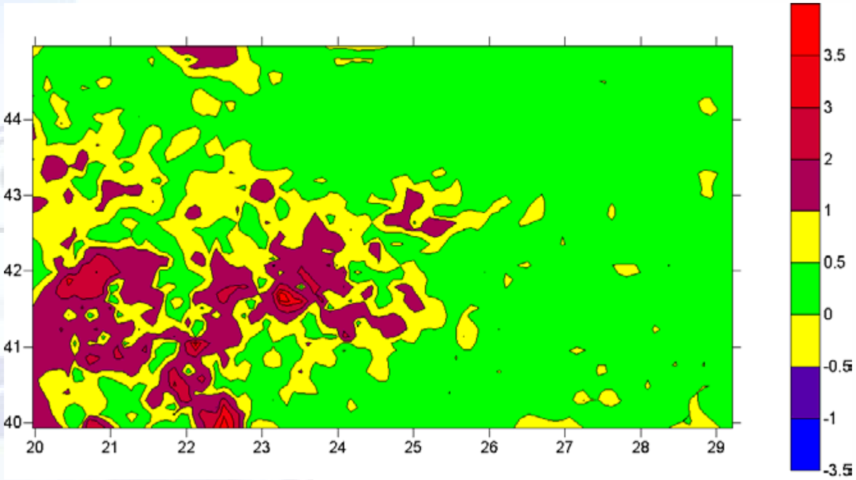


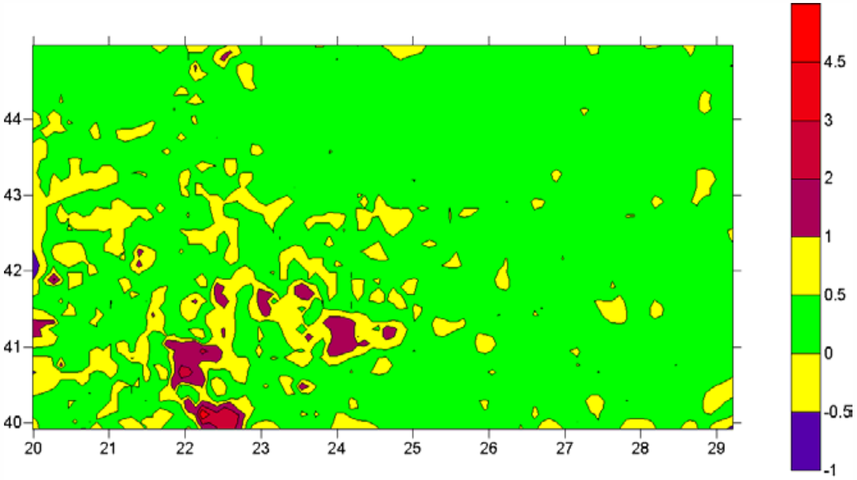
High correlation for the both couplings. With ARPEGE couplings, precipitation like temperature has linear profile with height. Less bias with ARPEGE couplings, but ALADIN is too wet with both of them.

PRECIPITATION
October

direct

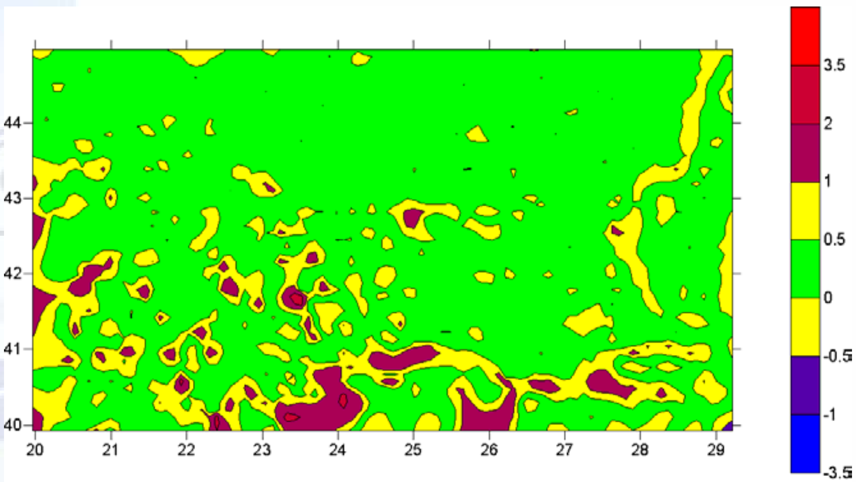
optimized



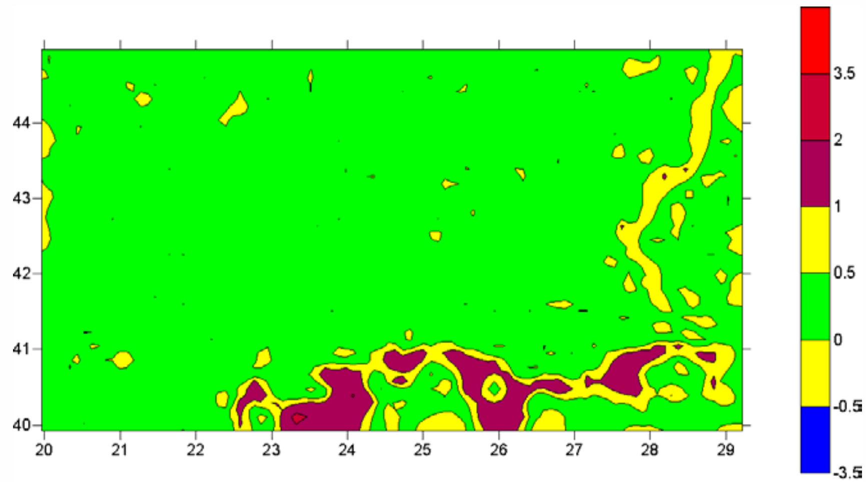


TEMPERATURE
August

direct



optimized



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Notations:

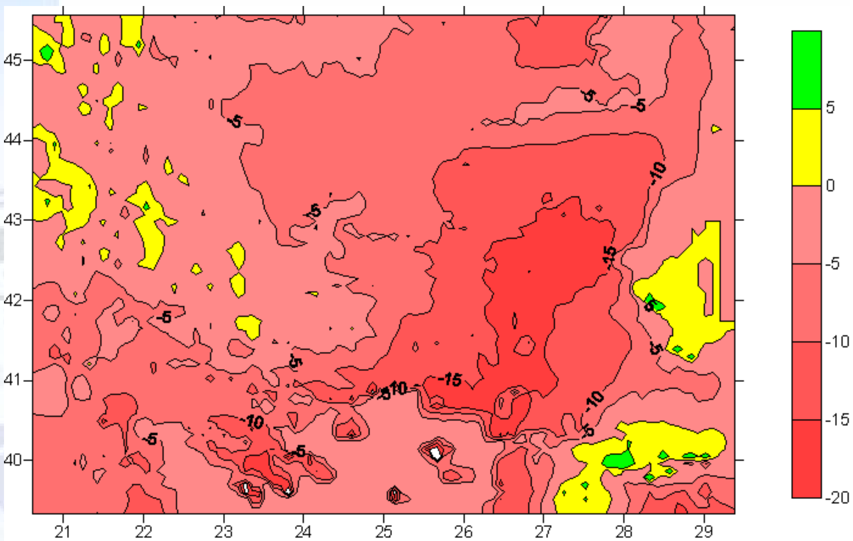
Exp:
-Experiment 2021-2050 (NF) or
-Experiment 2071-2100 (FF).

F_E – field of ERA40 (temperature or precipitation)
F_{EC} – field of statistically corrected ERA40
F_{Exp} - field of one of experiments NF or FF
F_{REF} - reference field 1961-1990

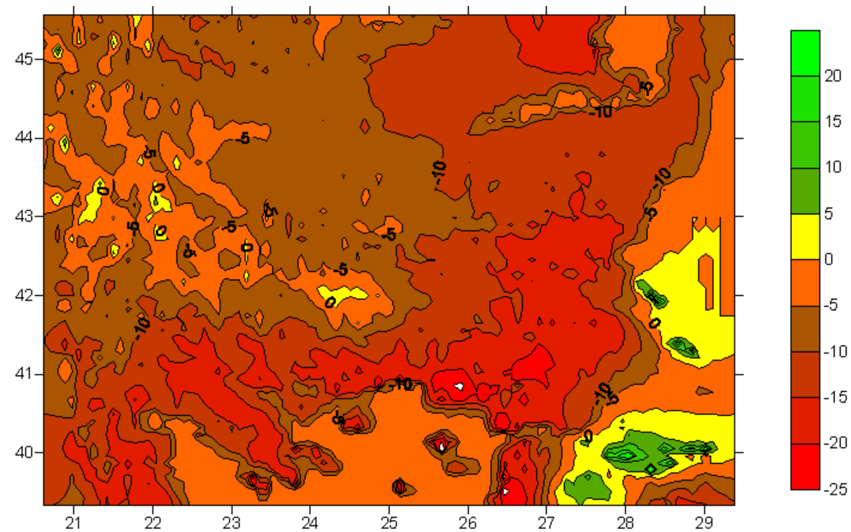
ANNUAL

relative difference of precipitation %

[ALADIN (NF) – ALADIN(REF)]/ ALADIN(REF) %



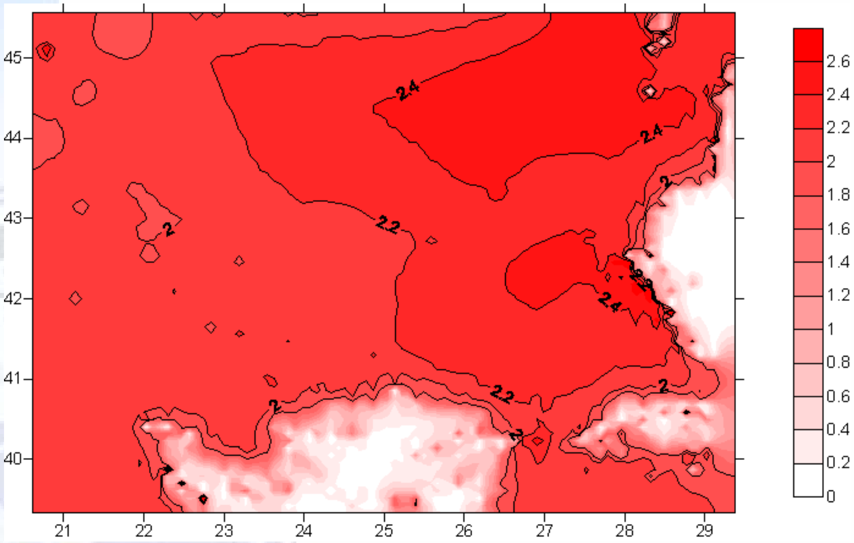
[ALADIN (FF) – ALADIN(REF)]/ ALADIN(REF) %



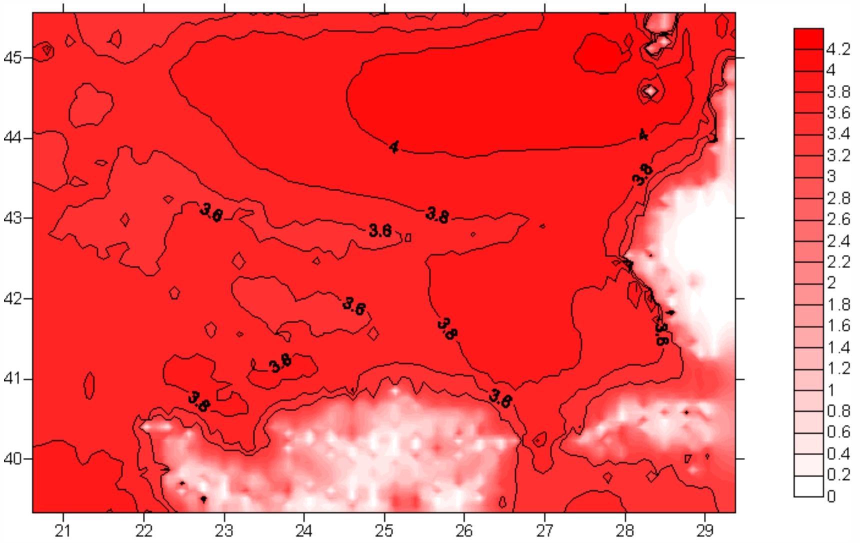
ANNUAL

DIFFERENCE OF MEAN TEMPERATURE

ALADIN (NF)



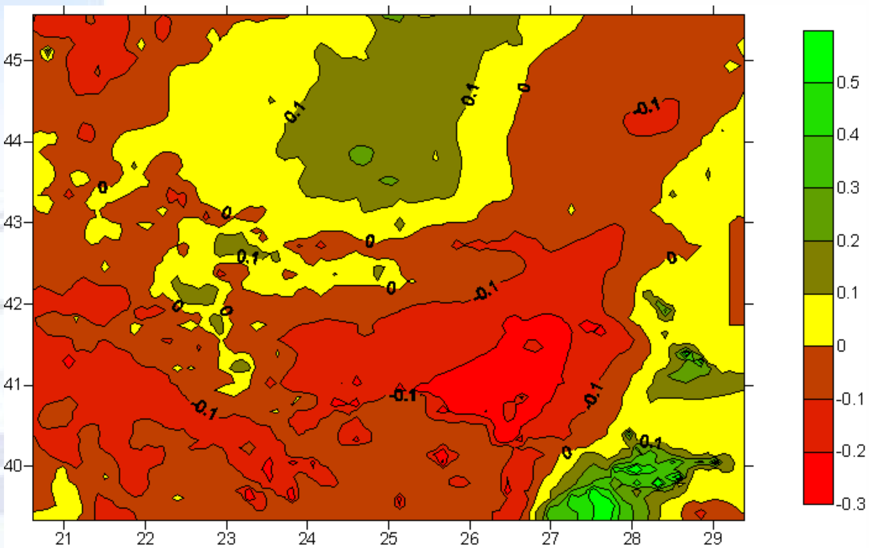
ALADIN (FF)

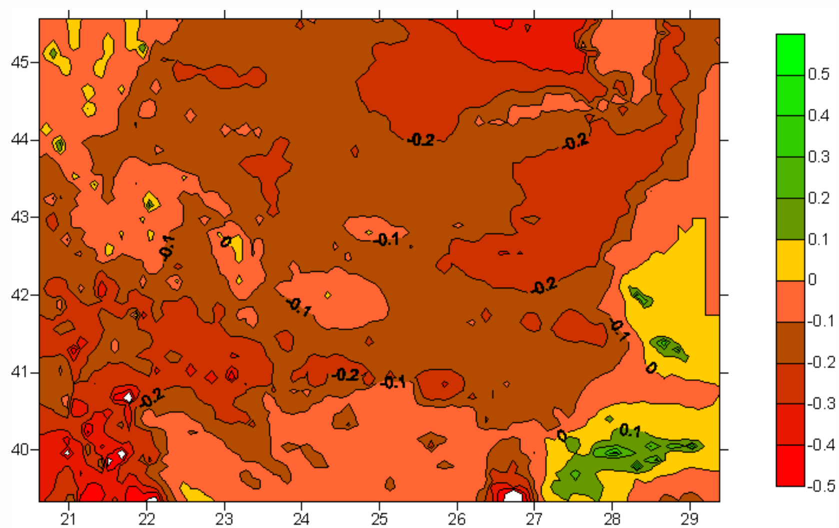


DJF FF

relative difference of precipitation %

NON MODIFIED	MODIFIED



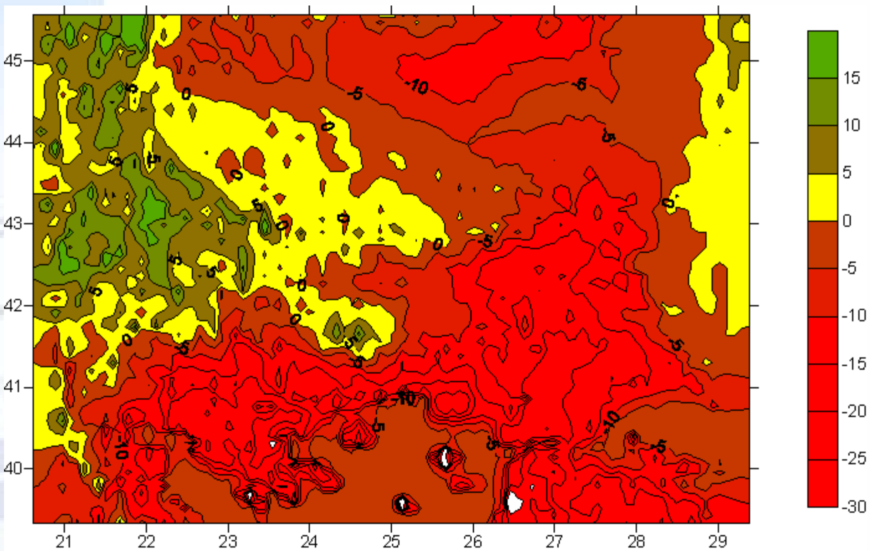


NIMH BAS

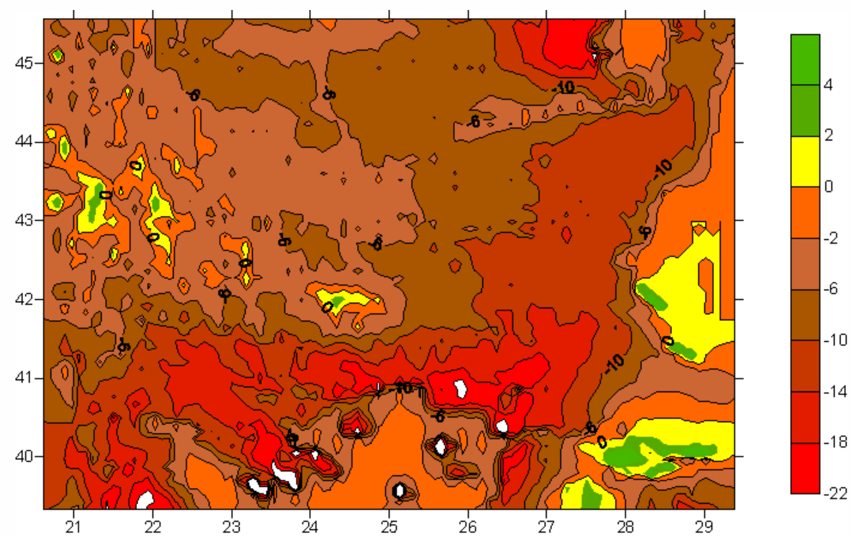
MAM FF

relative difference of precipitation %

NON MODIFIED



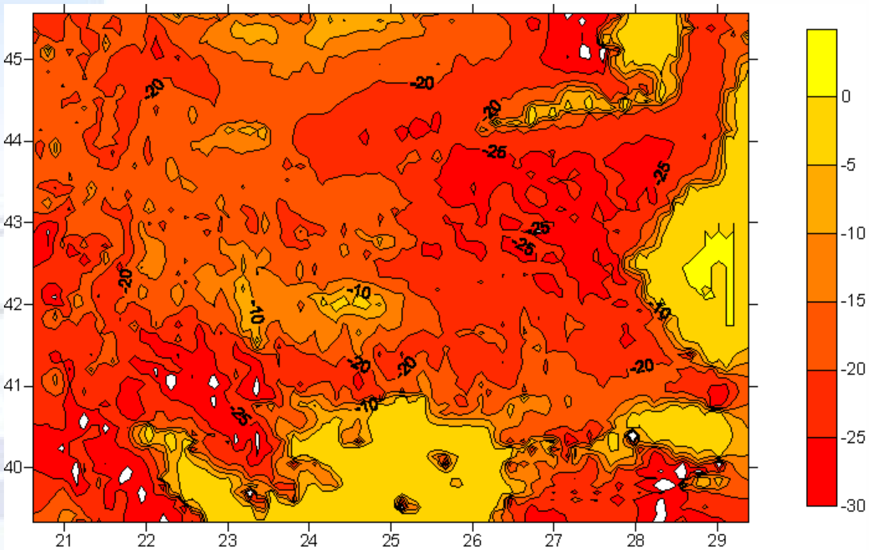
MODIFIED



JJA FF

relative difference of precipitation %

NON MODIFIED



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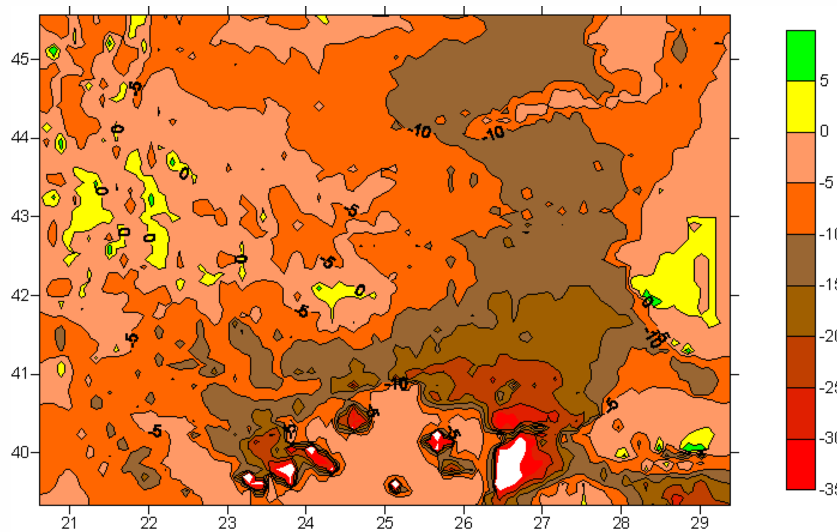
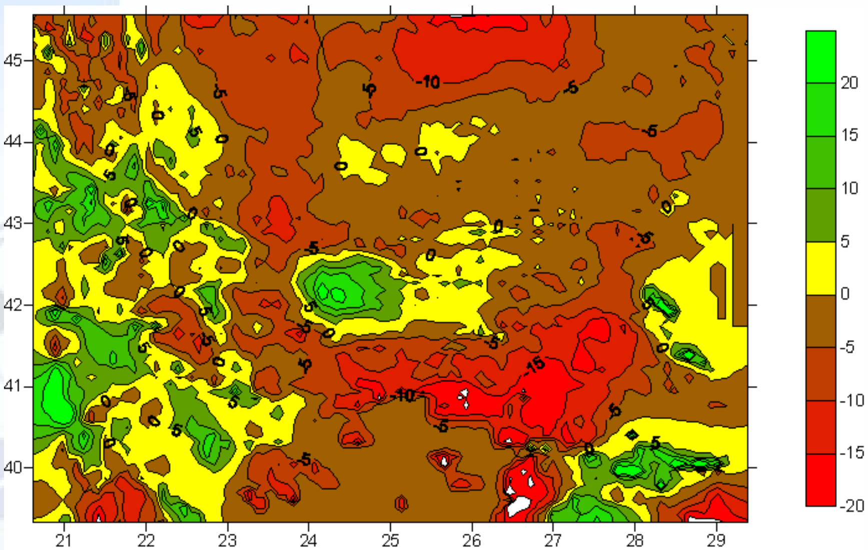


NIMH
BAS

SON

relative difference of precipitation %

NON MODIFIED



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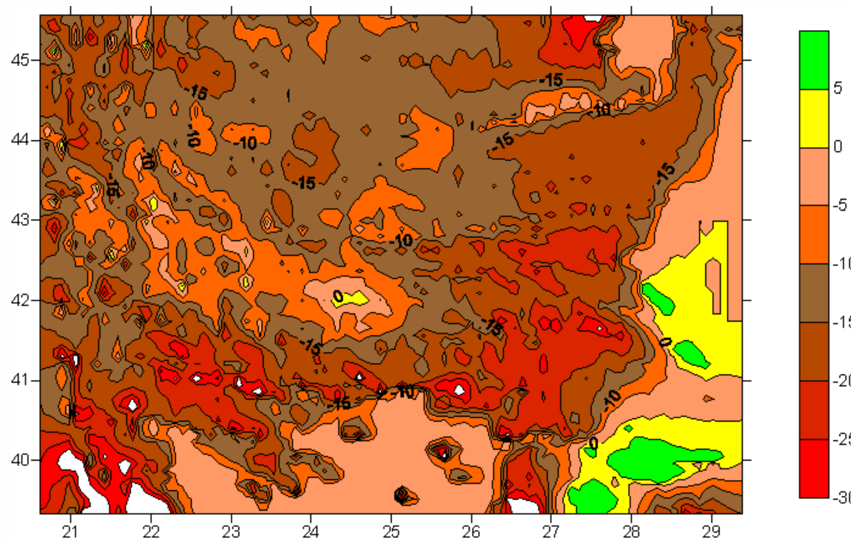
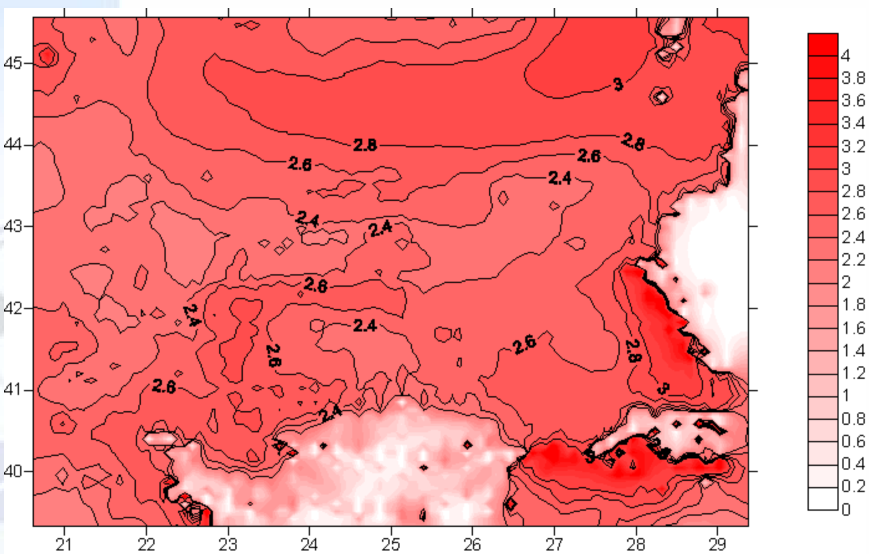


NIMH
BAS

DJF FF

DIFFERENCE OF MEAN SEASONAL TEMPERATURE

NON MODIFIED



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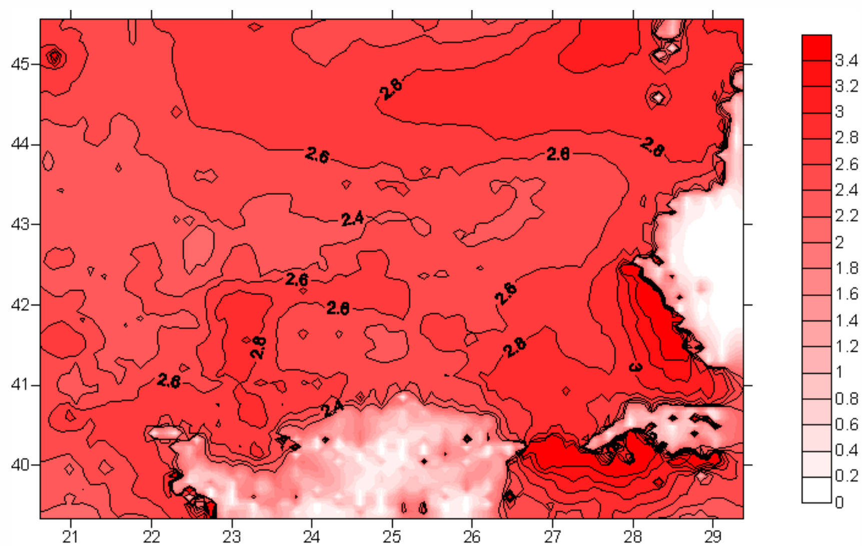
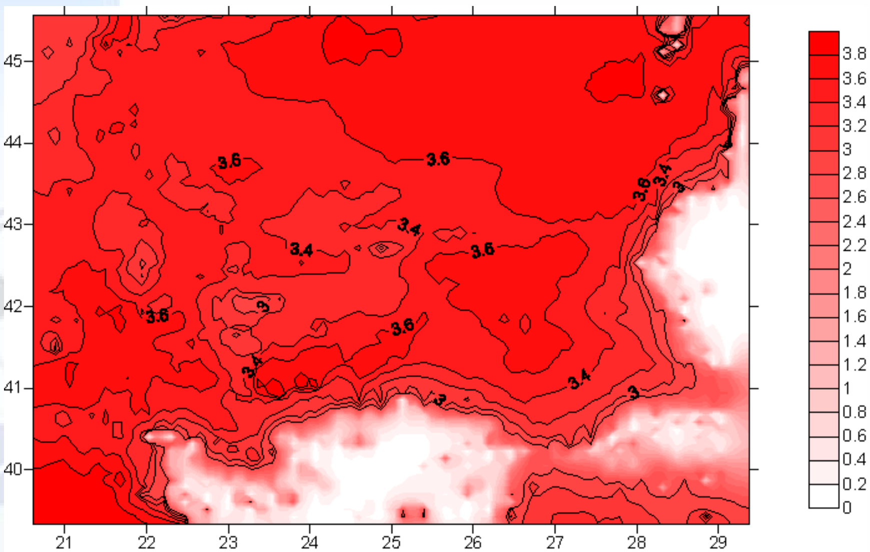


MAM FF

DIFFERENCE OF MEAN SEASONAL TEMPERATURE

NON MODIFIED



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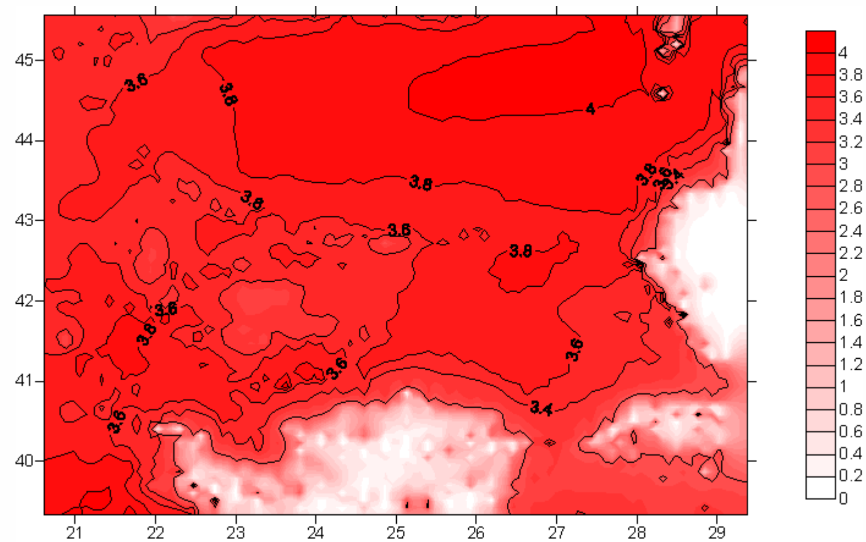

NIMH
BAS

JJA FF

DIFFERENCE OF MEAN SEASONAL TEMPERATURE

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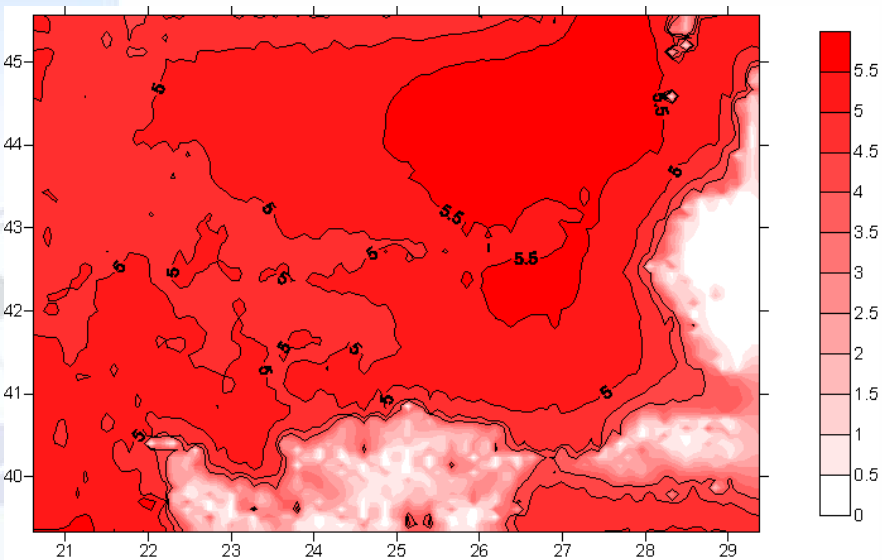

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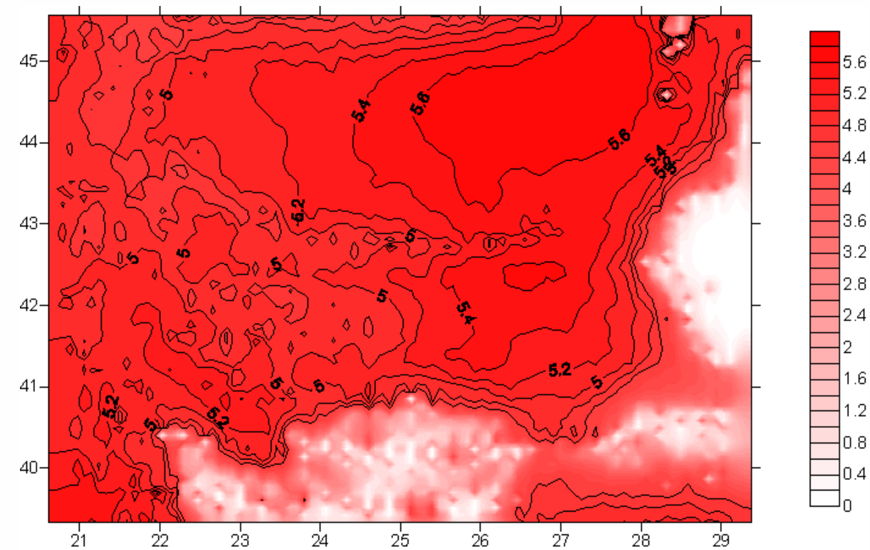

NIMH
BAS

SON FF

DIFFERENCE OF MEAN SEASONAL TEMPERATURE

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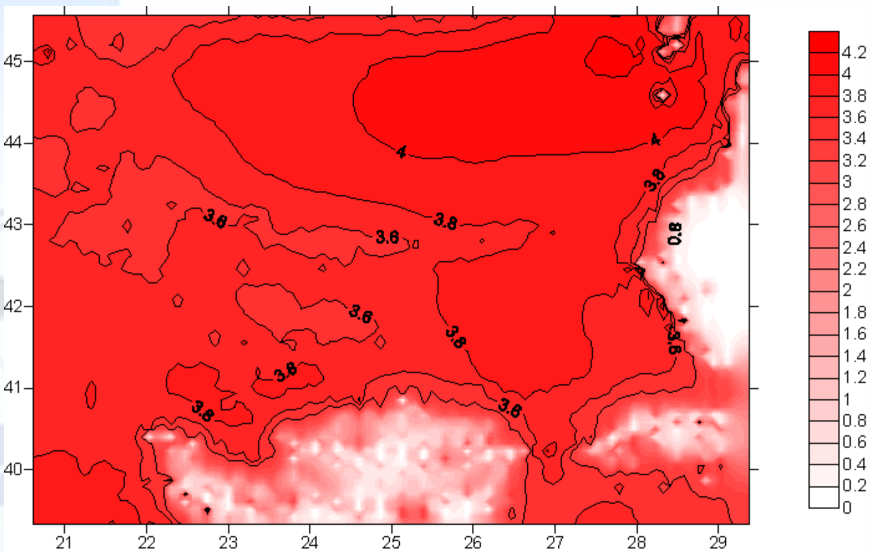

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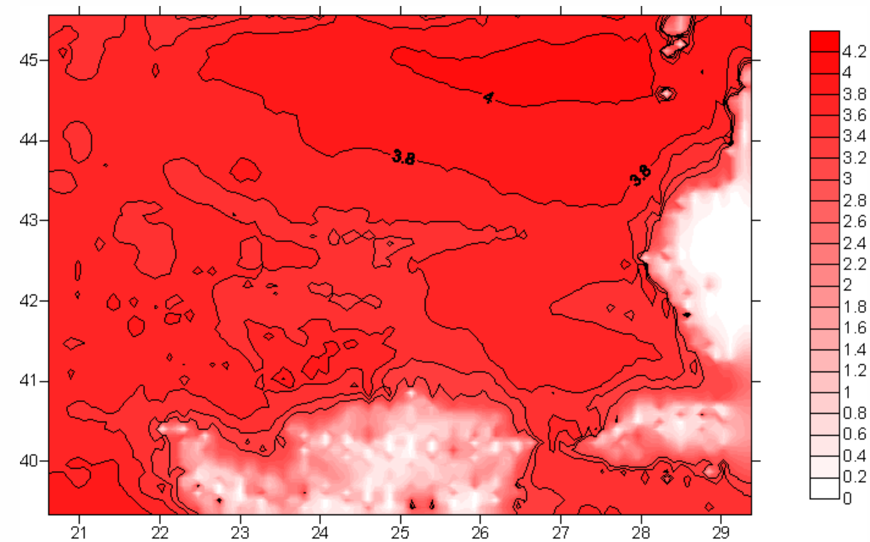

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2021-2050

TEMP

PRECIP

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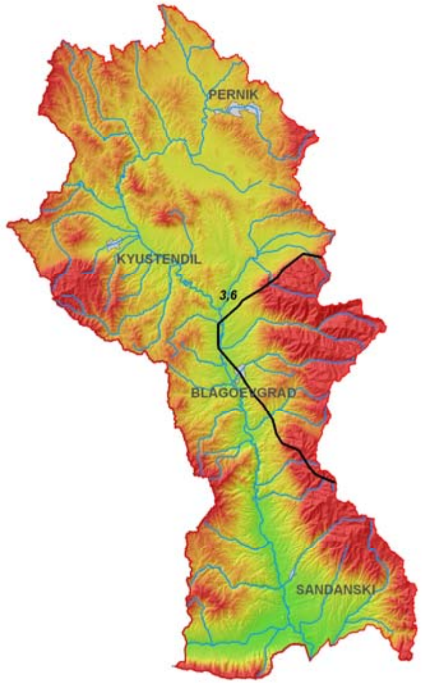
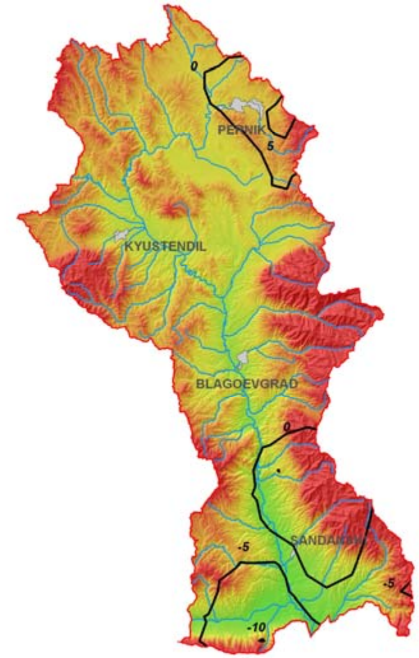
Струма
годишна промяна 2021-2050



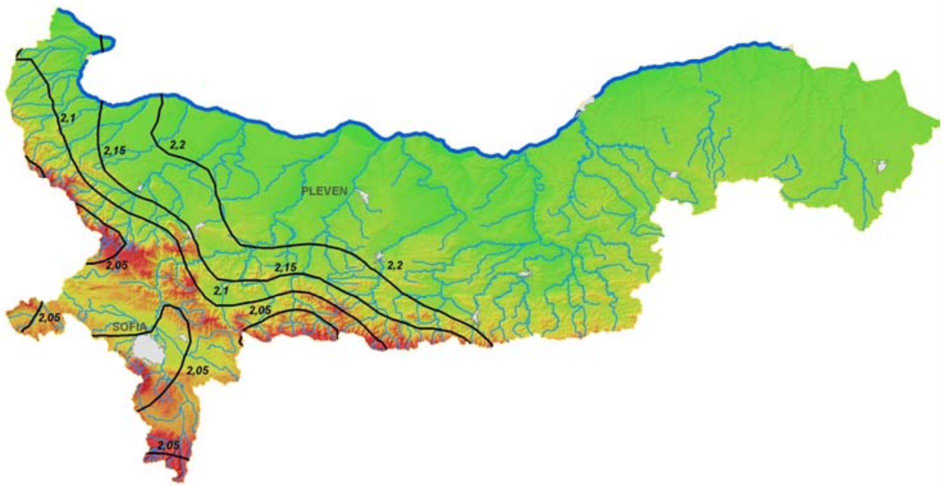
TEMP

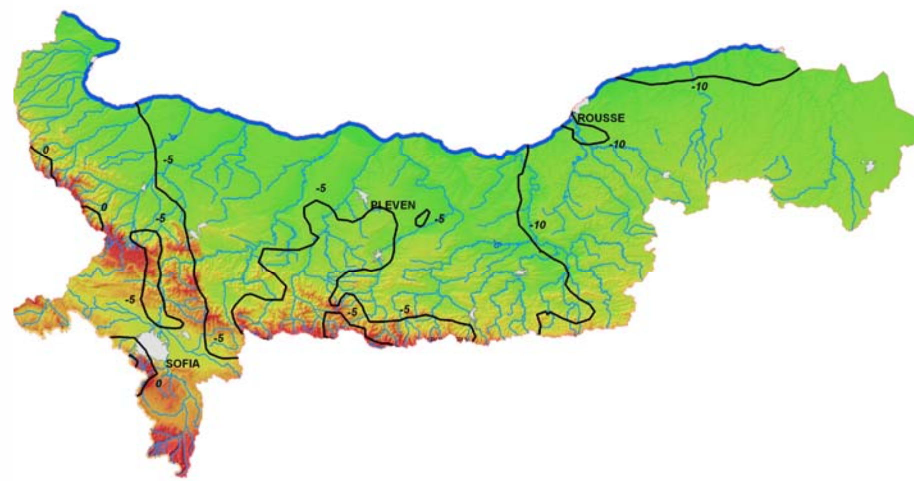


PRECIP

NIMH
BAS

Дунав
годишна промяна 2021-2050

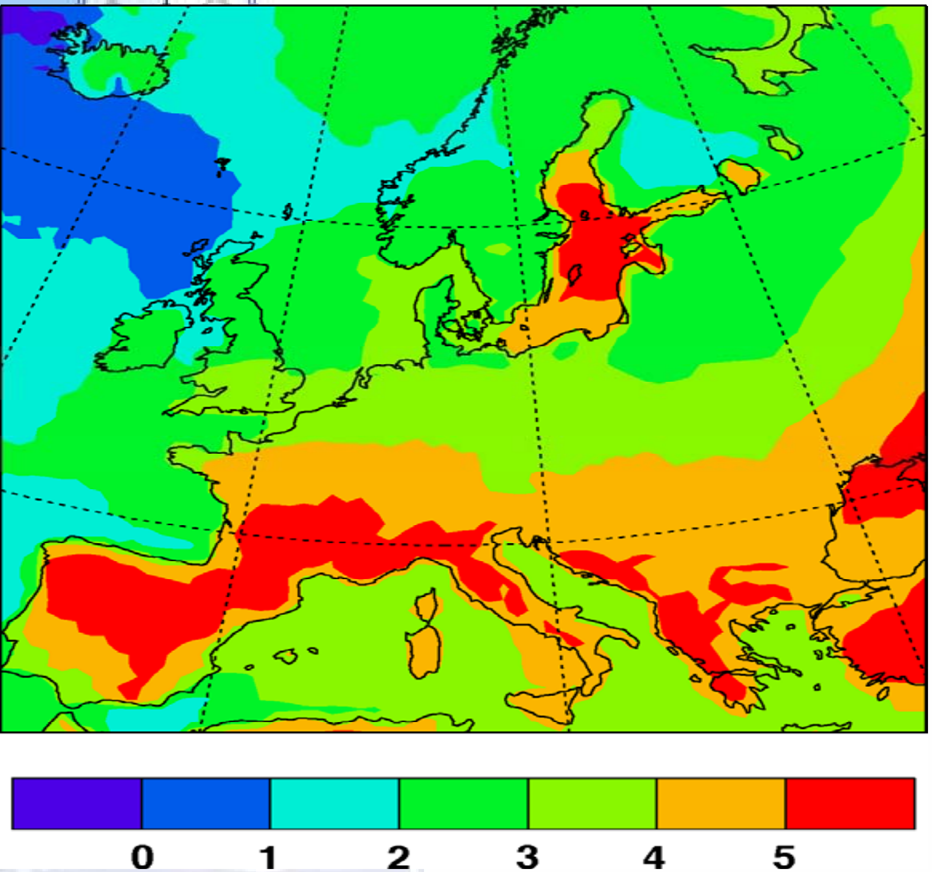


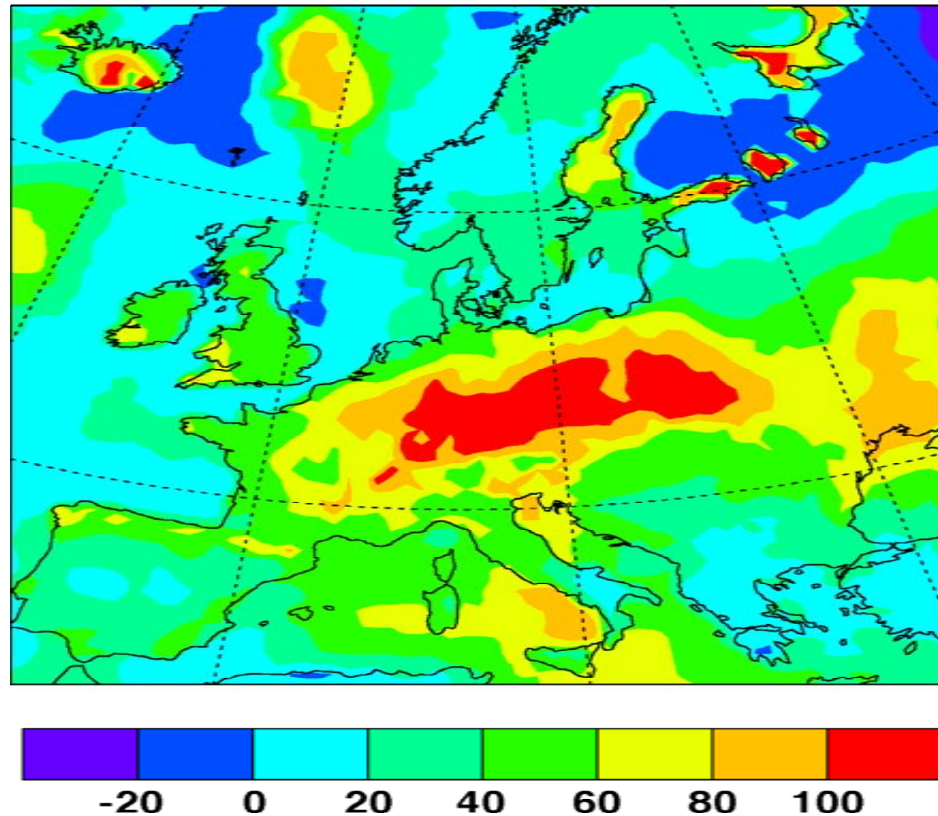


TEMP

PRECIP

Extreme events



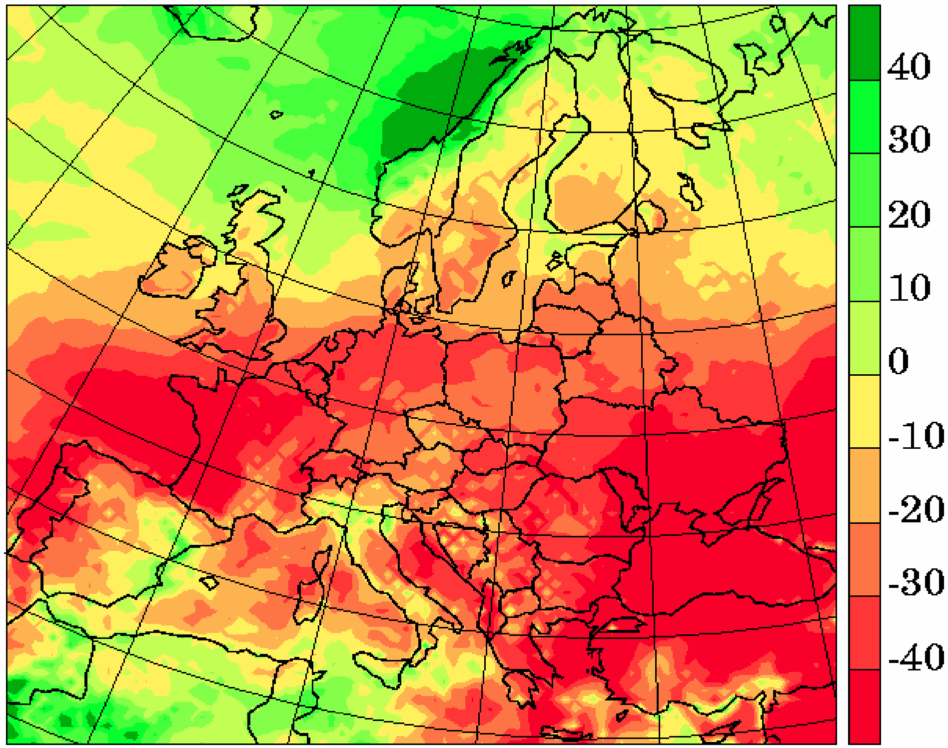


Models project large increases in climate variability and extremes in Central and Eastern Europe

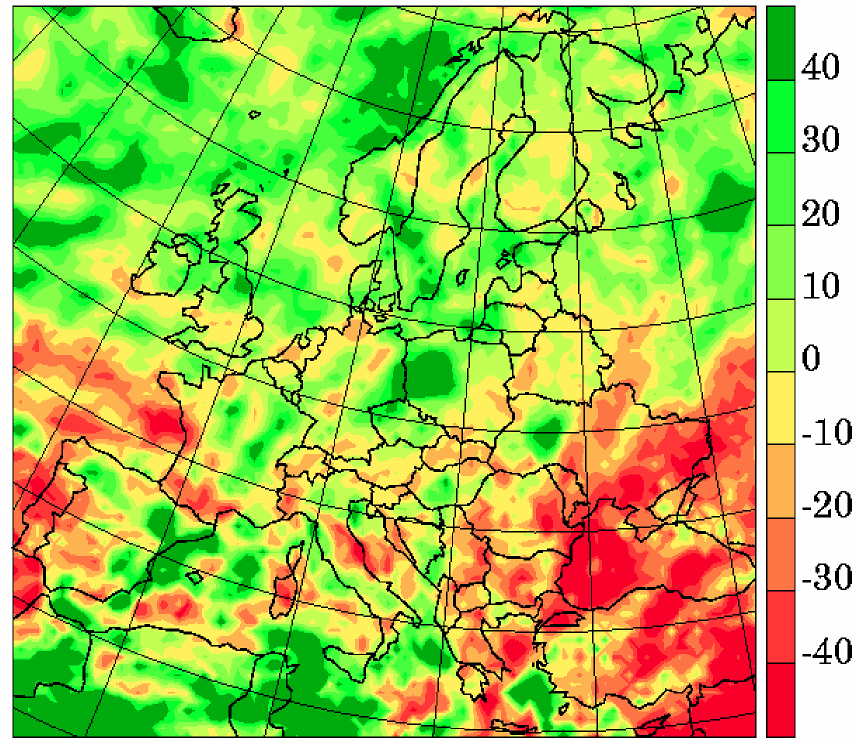
(source: Schär et al. 2004)

(JAS)

ΔP

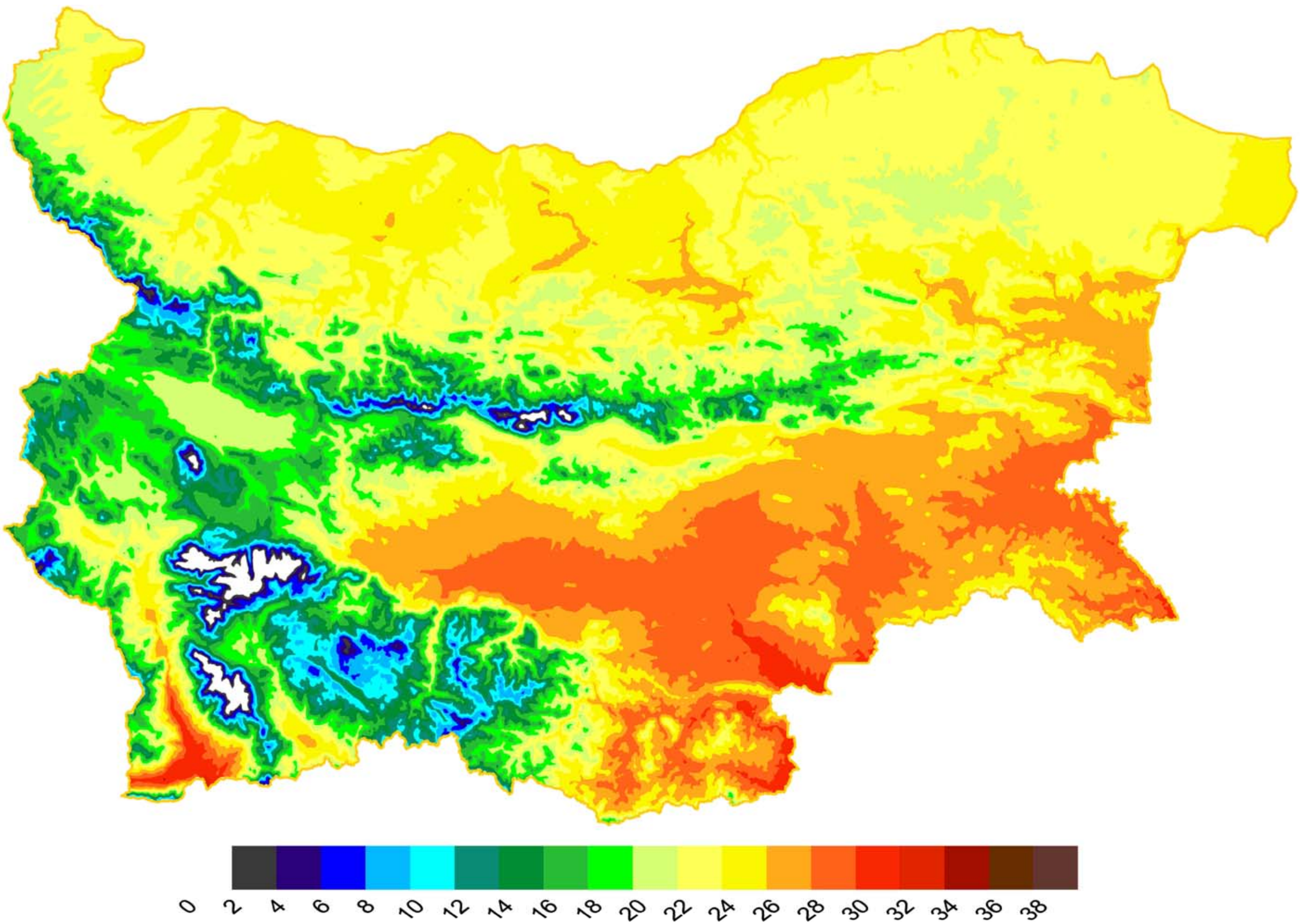


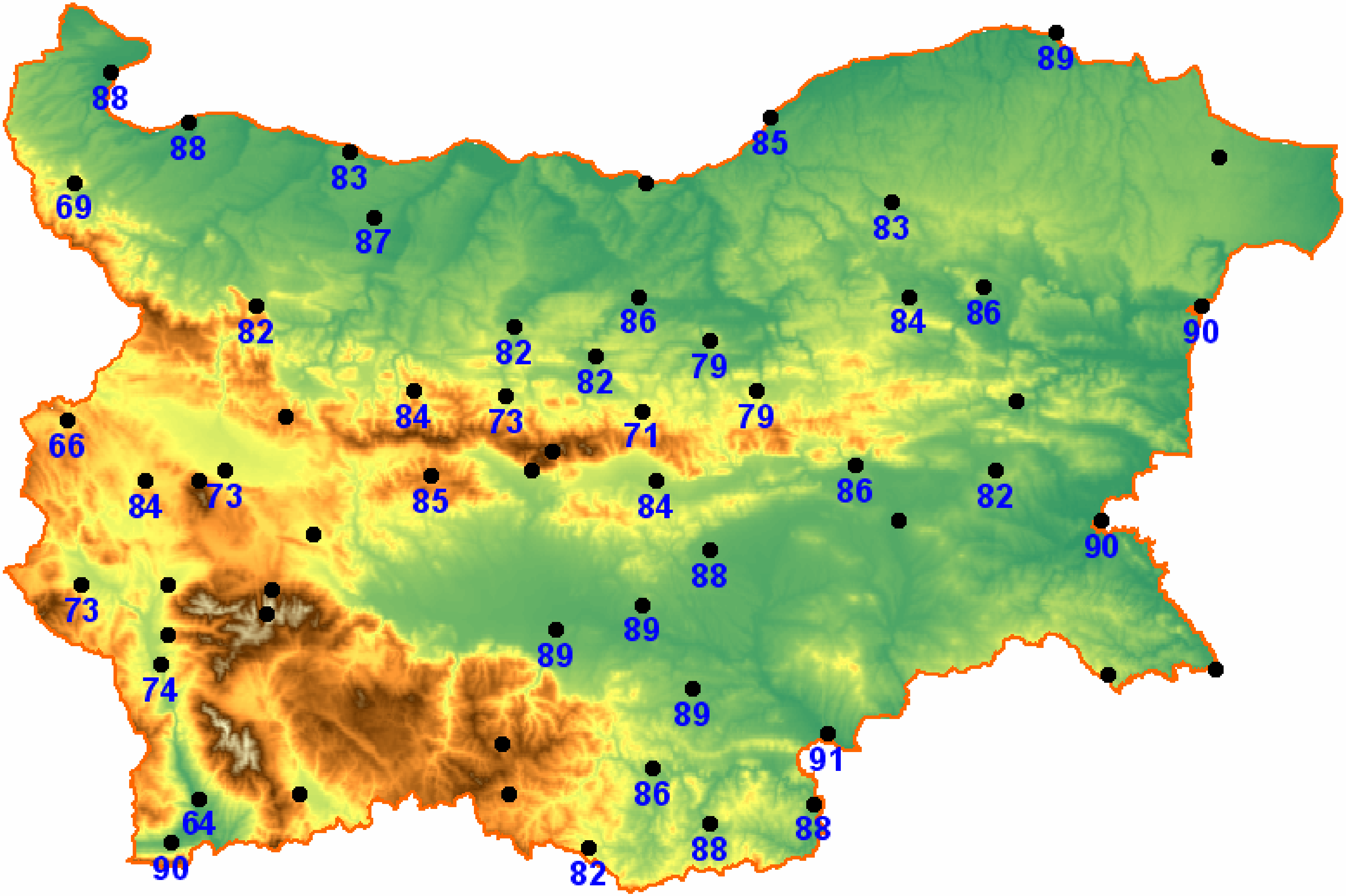
$\Delta 99\%$ (n=5d)



Models project large increases in climate variability and extremes in Central and Eastern Europe

Summer days (Tmax>25oC), 1961-1990





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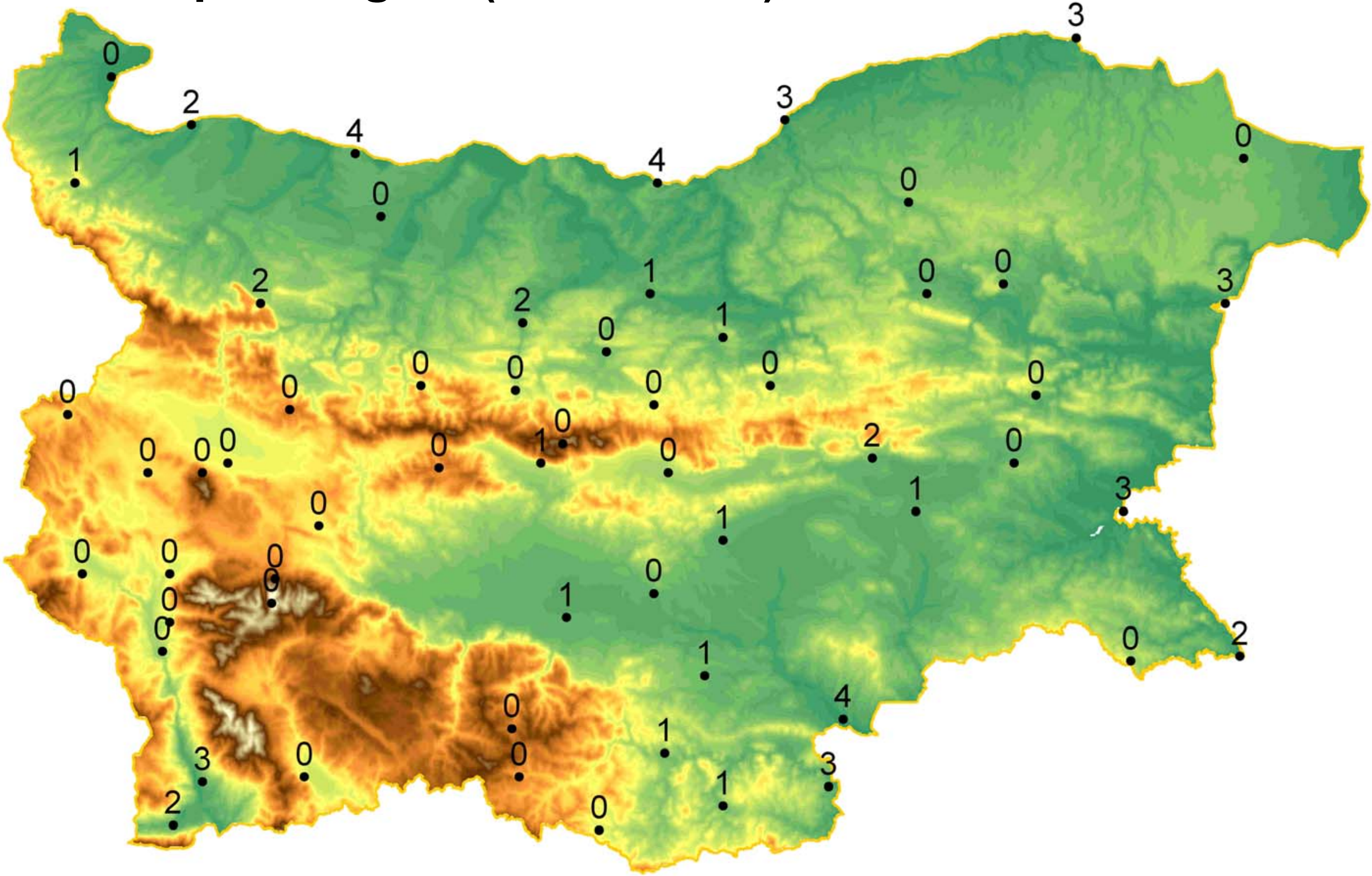
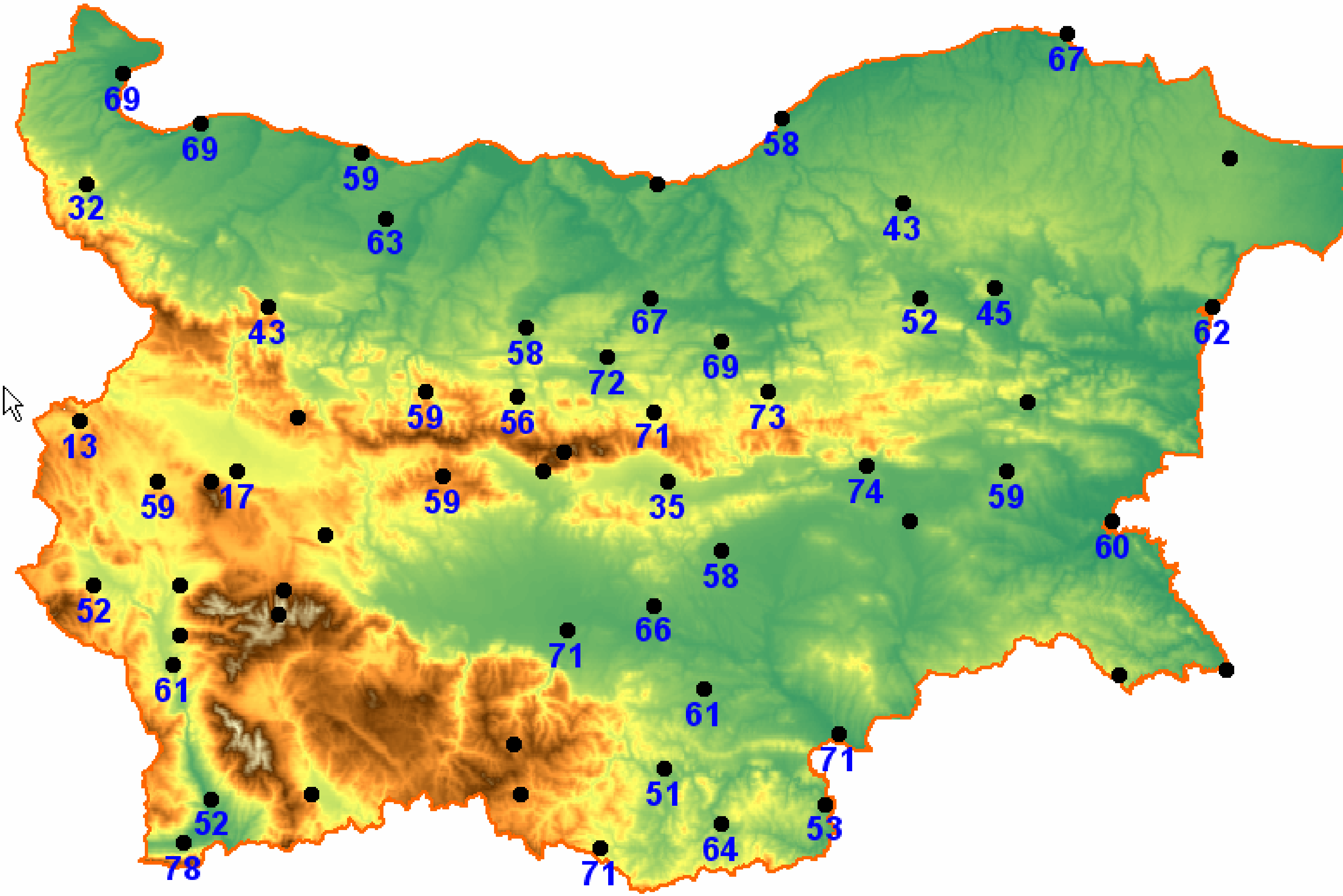
Summer days (Tmax>25oC) , 2021-2050

Tropical nights (Tmin>20oC), 1961-1990

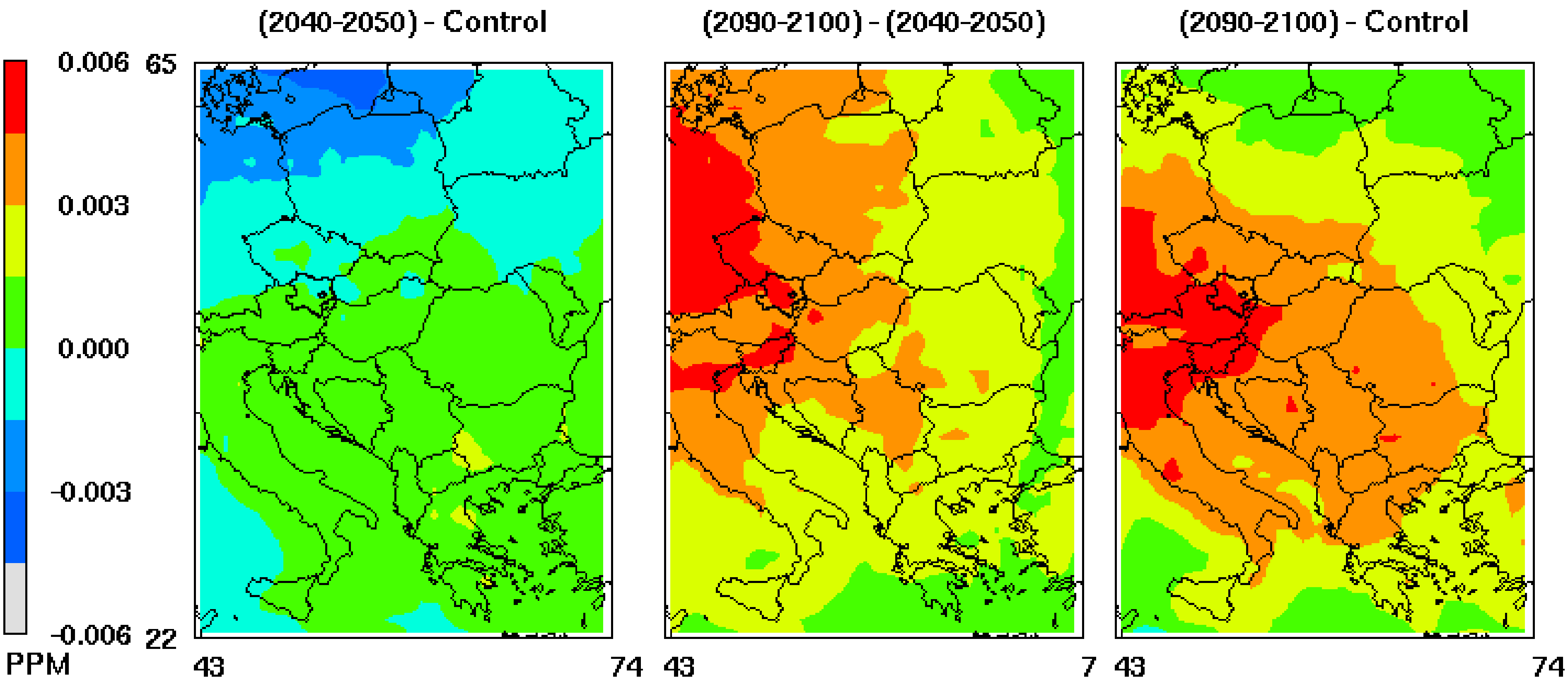


Some results were not interpolated…

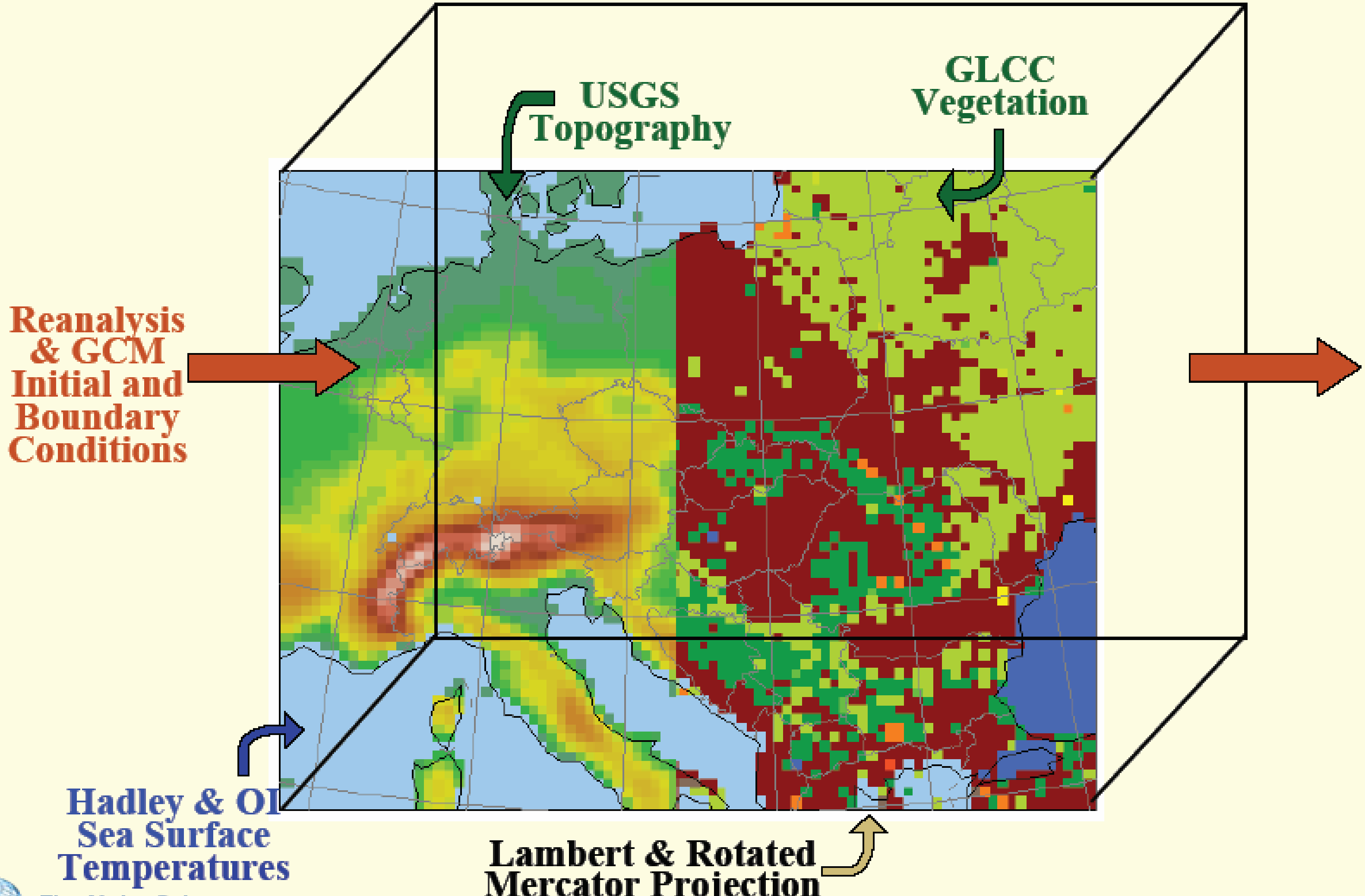
Tropical nights (Tmin>20oC), 2021-2050



Difference of ozone



Summary of the RegCM3 Input/Output



The Abdus Salam International Centre for Theoretical Physics

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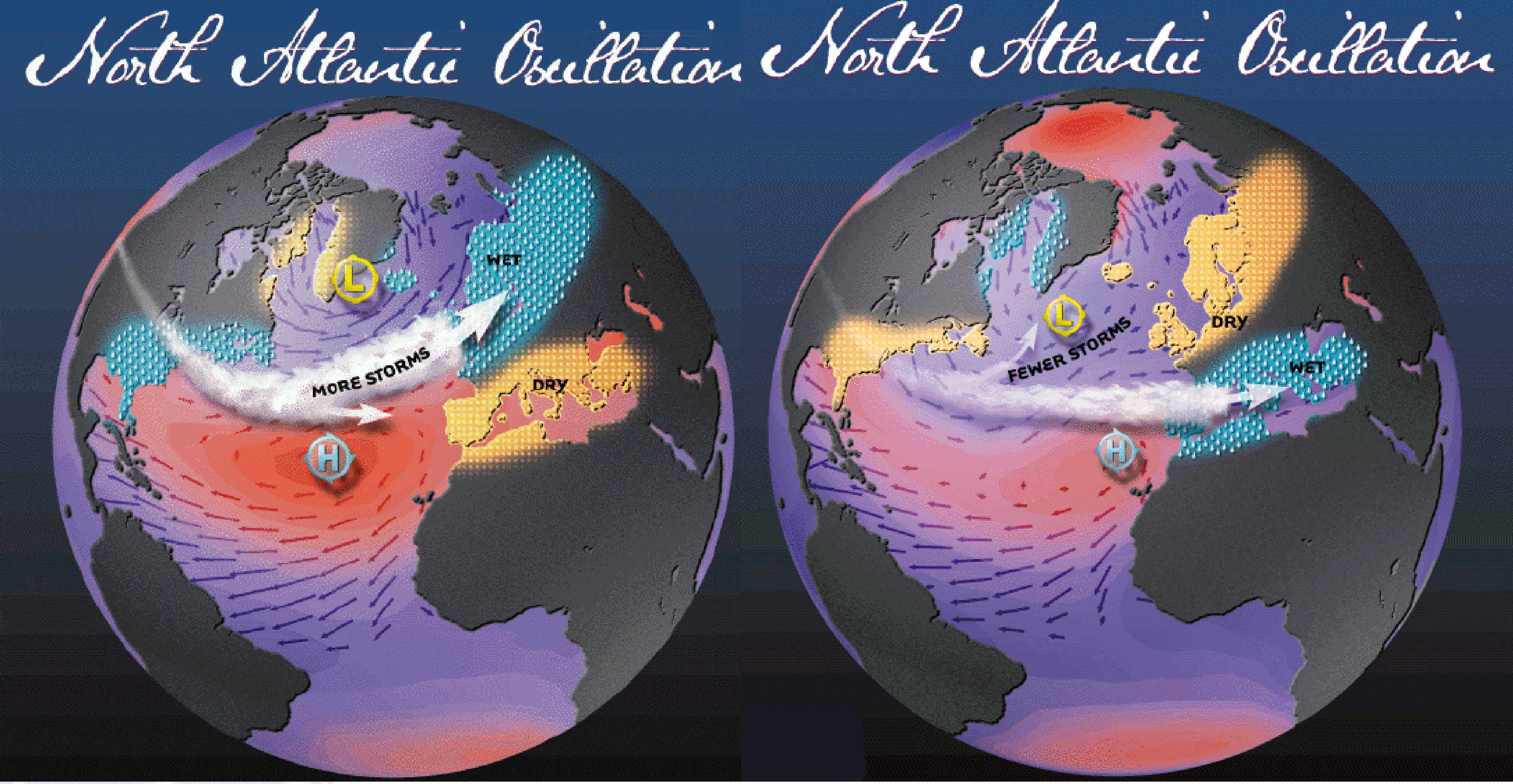
RegCM3 regional climate model ***(source: Pal, 2005)***

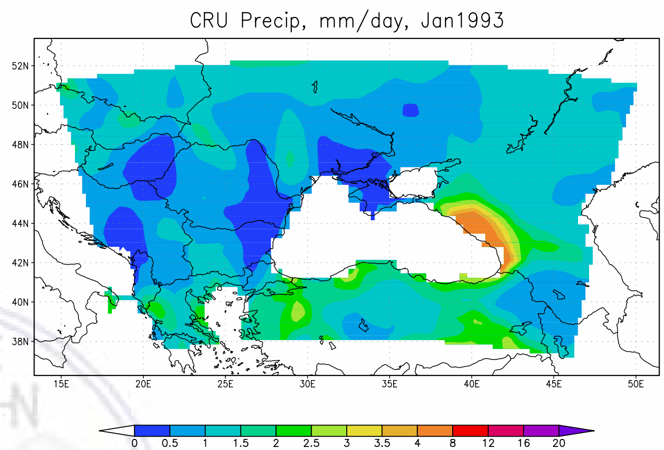


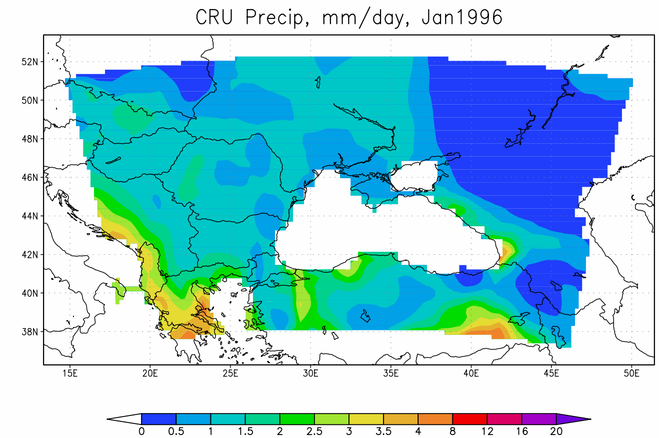
Positive (left) and negative (right) NAO phases and related impacts on weather in Europe

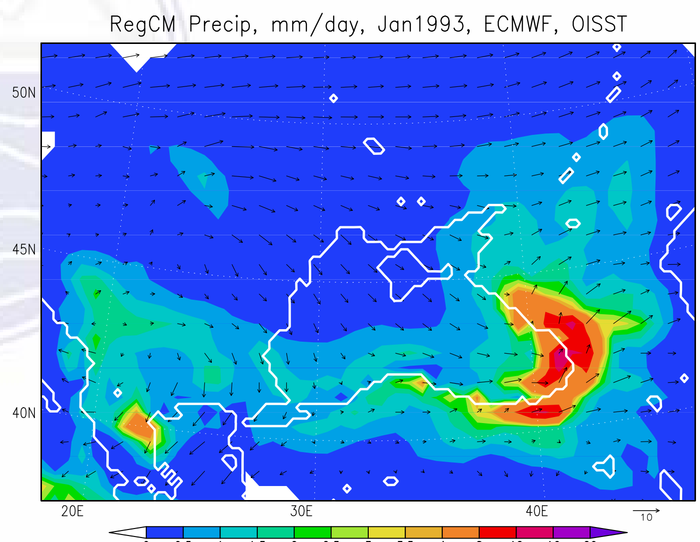
Comparison between RegCM (ECMWF+OISST) and CRU driven by different large scale circulation conditions

Jan 1993 NAO+

Jan 1996 NAO-







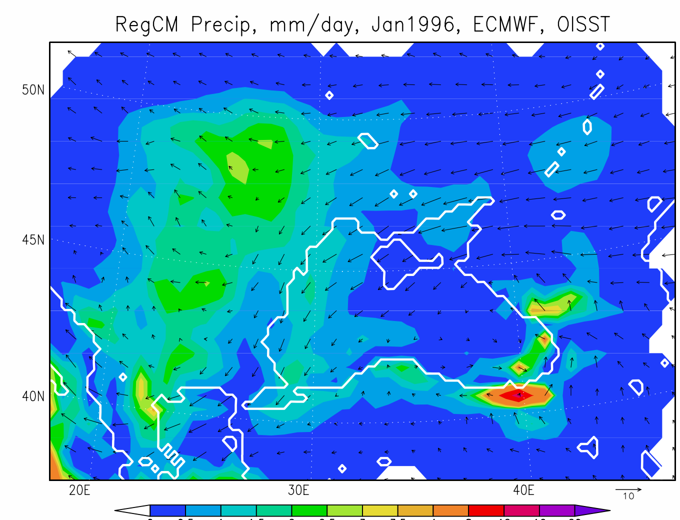


Figure 6.8 Annual-mean air temperature at 2m (upper, °C) and precipitation rate (lower, mm/day) in function of time from 1951 to 2050. The spatial average was performed for the CLAVIER region (Hungary, Romania and Bulgaria).

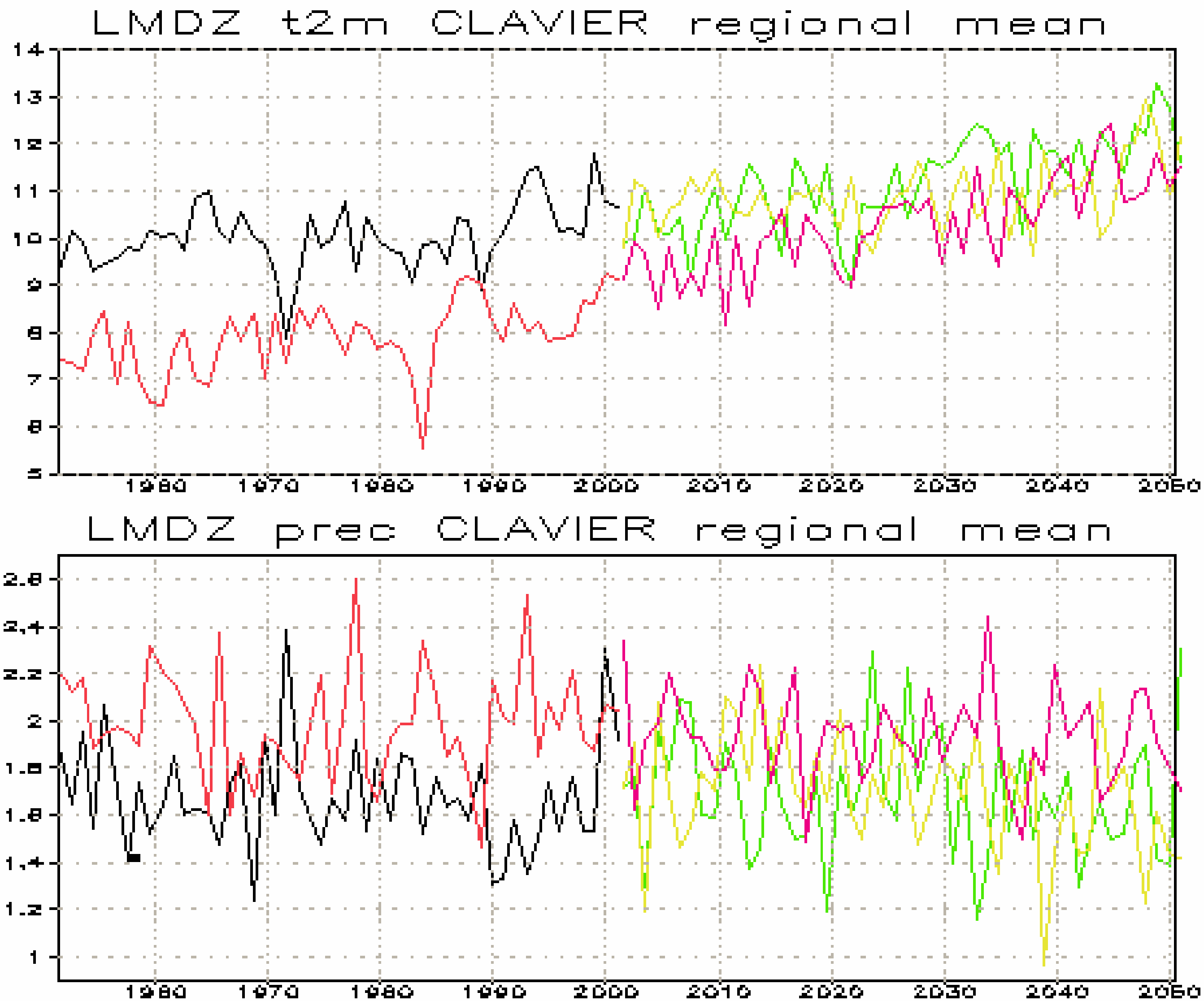
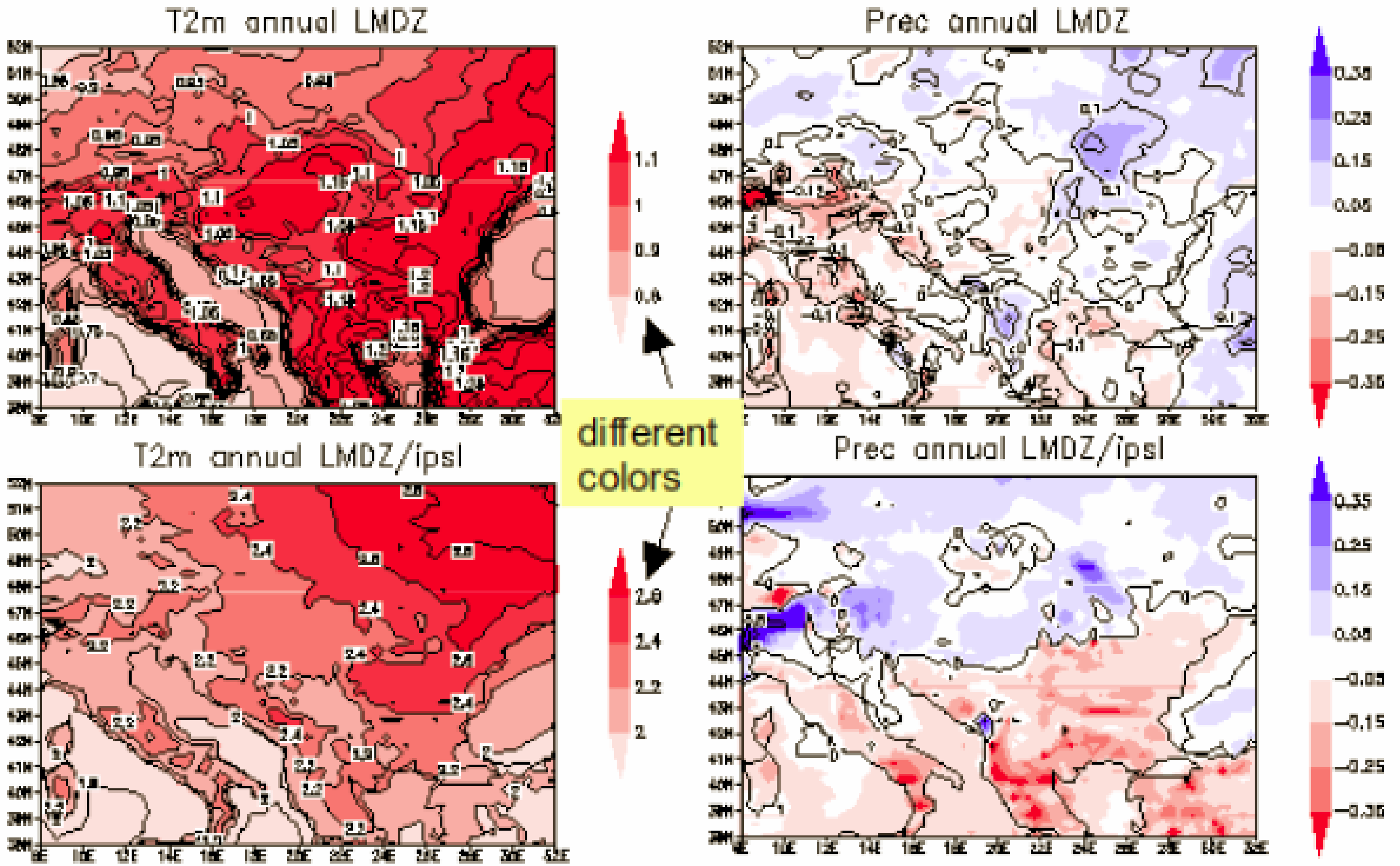


Figure 6.9 Changes of surface air temperature (left, °C) and precipitation rate (right, mm/day) as predicted by LMDZ-regional (2001/2050 - 1951/2000). The upper panels are from LMDZ-regional forced by the MPI global climate model



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PLANS

- The EnviroGRIDS @ Black Sea Catchment project
-
- EnviroGRIDS aims at building the capacity of scientist to assemble such a system in the Black Sea Catchment, the capacity of decision-makers to use it, and the capacity of the general public to understand the important environmental, social and economic issues at stake.
- EnviroGRIDS will particularly target the needs of the Black Sea Commission (BSC) and the International Commission for the Protection of the Danube River (ICPDR) in order to help bridging the gap between science and policy.

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The EnviroGRIDS @ Black Sea Catchment project

- **NIMH Role in the project:**

- based on ERA40 reanalysis (1961-2000) and provide meteorological GRID data with 10 km resolution for Danube catchments area and East part of Black sea.
- For the same area and resolution climatic runs will be performed based on A1B scenario.
- The climate simulations will be based on ALDIN and REMO regional climatic models and will cover the period 2020-2050 years.

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models and/or their related outputs

Regional climate models **(Greece):**

- **PRECIS**

Kotroni et al. Climatic projections in the eastern Mediterranean using the regional climatic model PRECIS. 8th Conference on Meteorology - Climatology – Atmospheric Physics, Athens, May 24-26, 2006.

In order to investigate climate change and impacts in Greece as well as in the Eastern Mediterranean area, the regional climate model PRECIS, has been implemented in the National Observatory of Athens (NOA). For the application of the PRECIS model at NOA a horizontal analysis of 25 km was selected, which is the finest resolution used so far in the area as well as the complex land-sea distribution.

WMO DEFINITIONS OF METEOROLOGICAL FORECASTING RANGES

6. ***Long-range forecasting (Seasonal to Interannual Prediction (SIP)):*** **from 30 days up to 2 years**
   - **6.1. *Monthly outlook***
   - **6.2. *Three month outlook:* Description of averaged weather parameters expressed as a departure from climate values for that 90 day period**
   - **6.3. *Seasonal outlook***

In some countries, SIP are considered to be climate products

7. ***Climate forecasting:*** **beyond 2 years**
   - **7.1. *Climate variability prediction***
   - **7.2. *Climate prediction:* expected future climate including the effects of natural and human influences**

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CLIPS Questionnaire *(Gocheva & Hechler, 2004)*

Is ***Seasonal to Interannual Prediction (SIP):*** **currently successful in specified regions and sectors?**

***Albania*:**

do not use SIP and have not any precise opinion about SIP

***Azerbaijan*:**

about successfulness of SIP it is difficult to say something

Latvia:

it is difficult to point out any geographic region where SIP works better

Bulgaria; Estonia, Slovenia, Cyprus:

SIP seems successful for specific regions and sectors

Croatia, Poland, Romania:

successful in ENSO-related regions with some week predictability in mid-latitudes (NAO)

Armenia, Moldova, Kazakhstan:

SIP is successful in wide geographical regions

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CLIPS Questionnaire *(Gocheva & Hechler, 2004)*

Does your NMHSs provide official SIP?

Albania, Croatia, Cyprus, Estonia, Greece, Lithuania, Slovenia:

No

***Bulgaria, Latvia, Serbia & Montenegro, Slovakia*:**

monthly

Belarus, Armenia, Azerbaijan, Poland:

monthly and seasonal

Romania:

one-month forecasts,

prognostic estimates for the next 2 months, following the forecasting month; "seasonal supplement", containing the anomaly notification in the geophysical environment in past season and meteorological outlook for the next season;

annual forecasting estimates bulletin elaborated at the beginning of each season and containing estimates of the temperature and precipitation anomalies for the next four seasons

Russia:

operational 1-3 month SIP regional and global predictions

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CLIPS Questionnaire *(Gocheva & Hechler, 2004)*

Does your NMHS use SIP products from global producers?

Croatia, Cyprus, Estonia:

No

Armenia, Azerbaijan, Belarus, Latvia etc.:

ROSHYDROMET

Slovakia, Greece:

ECMWF products

Bulgaria:

ECMWF, IRI, UK Met Office, Météo-France for monthly weather forecast involving local weather and climate archive data downscaling

Lithuania:

IRI, World Resource Institute and Swedish Regional Climate Modelling Programme

Poland:

ECMWF, IRI, DWD

Romania:

ECMWF, Met Office, IRI and Japan Meteorological Agency, etc.

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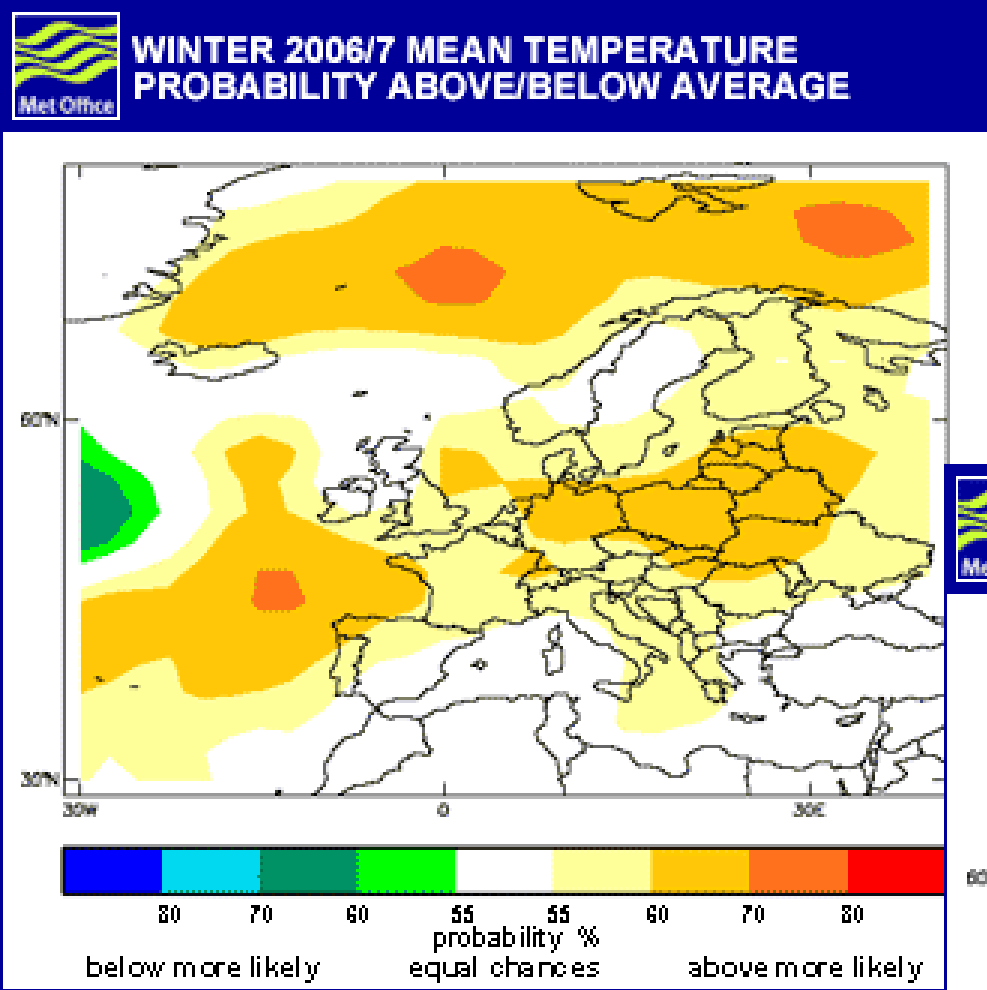
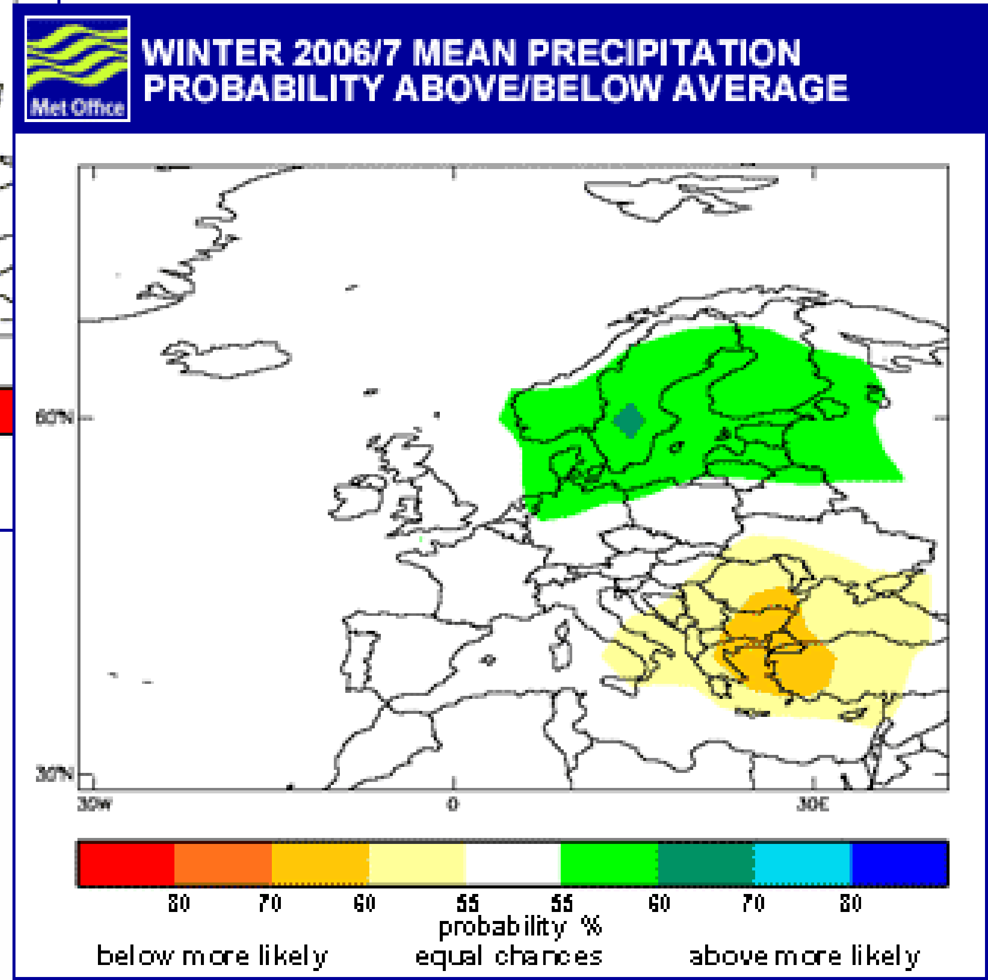

Met Office
WINTER 2006/7 MEAN TEMPERATURE
PROBABILITY ABOVE/BELOW AVERAGE
60°N
30°N
30W
0
30E
80
70
60
55
55
60
70
80
probability %
below more likely
equal chances
above more likely


Met Office
WINTER 2006/7 MEAN PRECIPITATION
PROBABILITY ABOVE/BELOW AVERAGE
60°N
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70
60
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55
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80
probability %
below more likely
equal chances
above more likely

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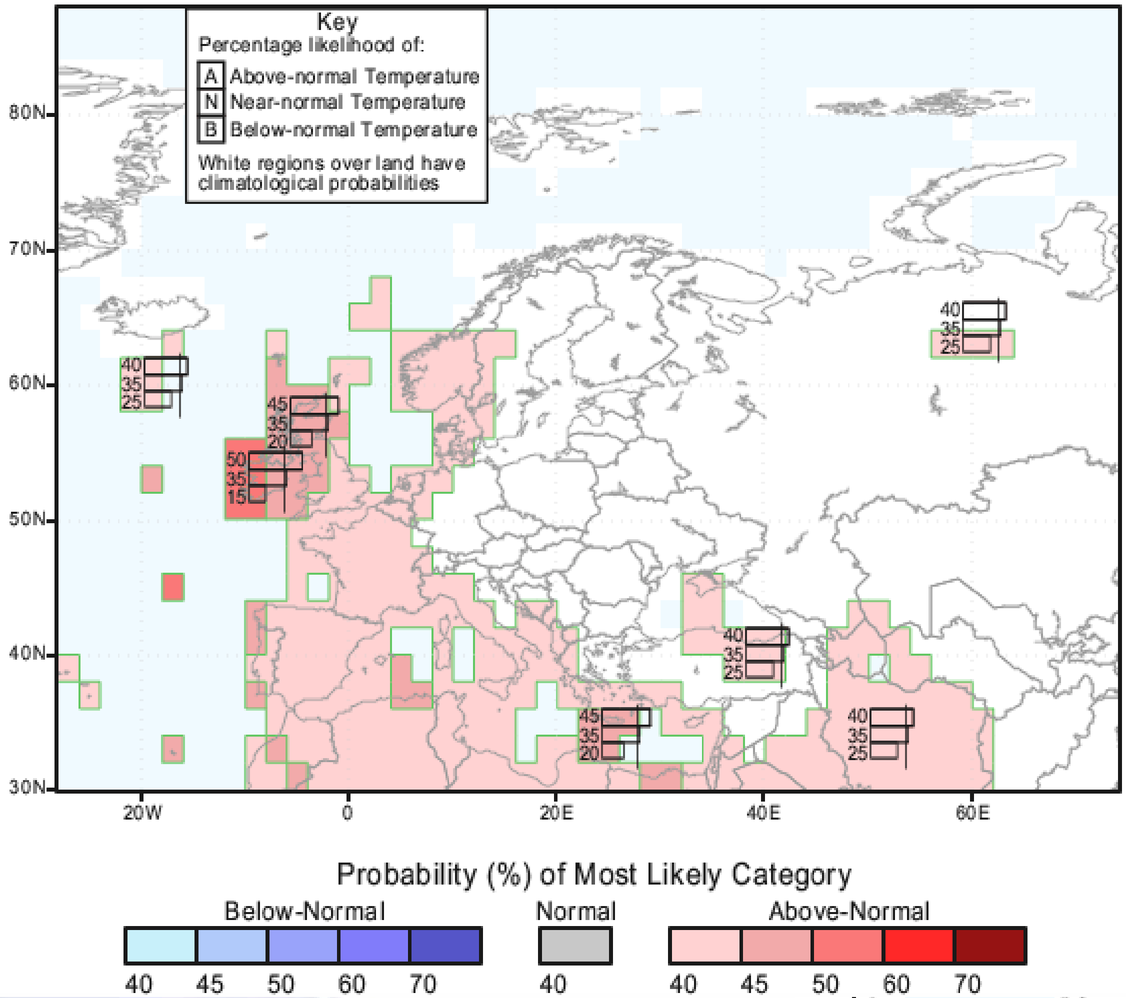
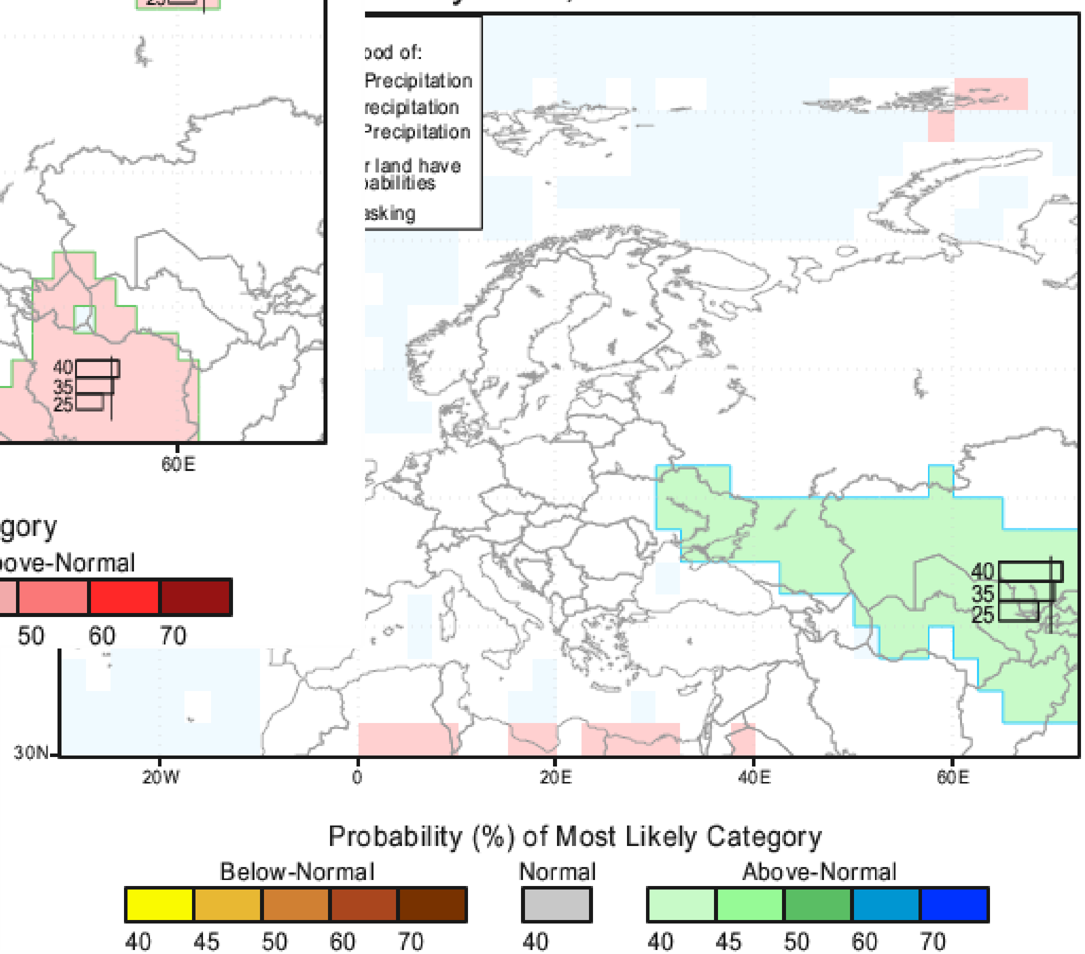
IRI Multi-Model Probability Forecast for Temperature for March-April-May 2007, Issued November 2006



l Probability Forecast for Precipitation il-May 2007, Issued November 2006



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CRITICAL POINTS

- Climate prediction is global, but agricultural applications are considerably local
- The science of climate prediction is relatively new, but farmer's traditions persist for a long time – sometimes it is difficult to change the farmer's behaviour

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CLIPS Questionnaire *(Gocheva & Hechler, 2004)*

Do you apply SIP in the management of agricultural production, water resources, etc.?

Albania, Cyprus, Greece, Lithuania, Slovenia:

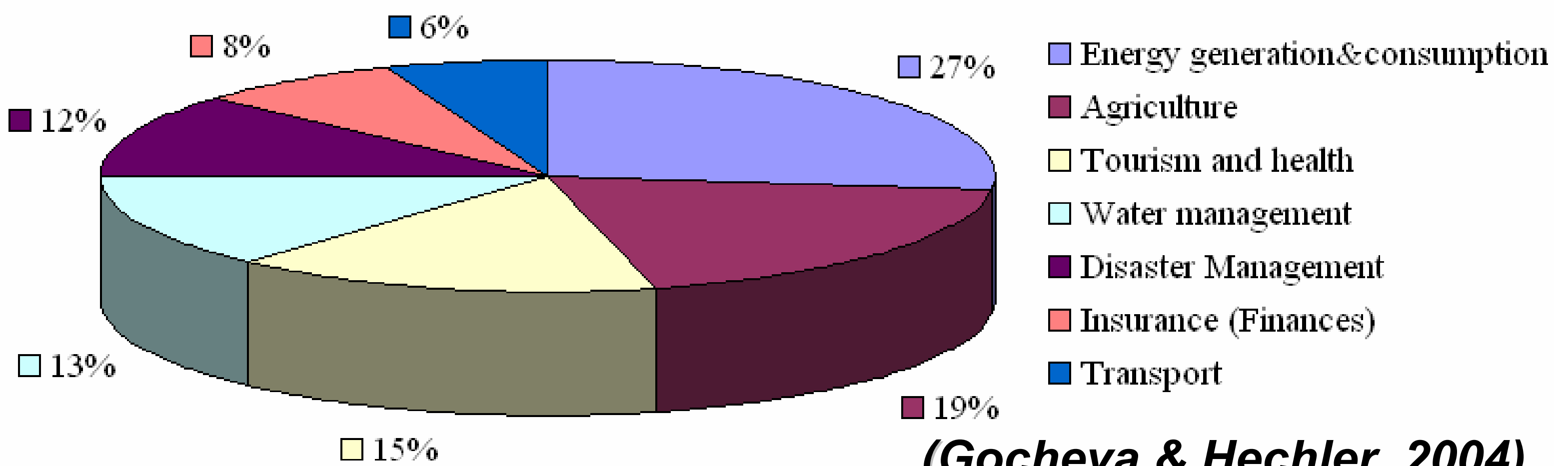
No

Russia, Croatia, Serbia & Montenegro, Slovakia:

partial application in some sectors, occasionally, etc.

Armenia, Belarus, Bulgaria, Kazakhstan, Latvia, Poland, Romania:

relatively broad SIP application in various sectors of the economy:



(Gocheva & Hechler, 2004)

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European Climate Change Monitoring and Prediction System

Title:	European Climate Change Monitoring and Prediction System
Acronym:	EUROCLIM
Start date	09-Sep-01
End date	31-Aug-04
Project website:	http://euroclim.nr.no/
Contact Person:	Rune SOLBERG

Abstract:

Develop and validate an advanced system for climate monitoring and prediction for the support of a sustainable development and protection of the environment in Europe. The system will focus on global warming and the consequences thereof. The European cryosphere (the Euro-Arctic region and high-mountain areas with seasonal snow, including Greenland) will be the focus of the main indicator system. Snow and ice variables are extracted and processed by advanced sensor technology and algorithms and applied in regional climate models and statistical models in order to predict changes and run scenario analyses. Project partners with national operational responsibilities have committed themselves with assistance from the industrial partners in the consortium to make EuroClim an operational long-term monitoring system if the prototype system is a technical and cost-effective success.

Objectives:

The main goal of the project is to develop an advanced climate monitoring and prediction system for Europe. This is achieved through seven sub-goals:

1) Determination of climate-change user needs

2) Development of architecture and technology for generic, scalable and distributed processing and storage of geographical data

3) Development of methodology for precise retrieval of cryospheric variables, based on integrated analysis and storage of multi-sensor, multi-resolution and multi-temporal data

4) Improvement of the accuracy of algorithms for retrieval of cryospheric variables from earth-observation data

5) Improvement of climate models in order to predict future climate accurately

notes

- Advances have been done in the last years in developing understanding of climate prediction

- Need to further refine and promote the adoption of current climate prediction tools

- Improved climate prediction techniques are growing faster and finding more applications

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notes

- Close contacts between climate forecasters, and USERS are needed
- Bringing science to society – feedbacks from the end user are essential identifying the opportunities for varios applications