



South East European Virtual Climate Change Center

Regional/subregional Long-Range Forecast products relevant to SEECOF

Goran Pejanović,
SEEVCCC / Republic Hydro Meteorological Service of Serbia

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WMO RA VI-Europe RCC functions:

- Climate Data

Lead: KNMI/Netherlands (participate SEEVCCC/RHMS-Serbia)

Every month collecting data from the stations
(400-500 stations; main source for data KNMI-ECA&D, other – climate bulletins, NCDC)

- Climate Monitoring

Lead: DWD/Germany (participate SEEVCCC/RHMS-Serbia)

- mean temperature and precipitation fields,
- temperature anomaly and precipitation percent of normal fields
- all for last month and last three months periods

necessary: direct corporation with countries from the region in exchanging data!

- Long Range Forecast

Lead: Météo-France & ROSHYDROMET (participate SEEVCCC/RHMS-Serbia)

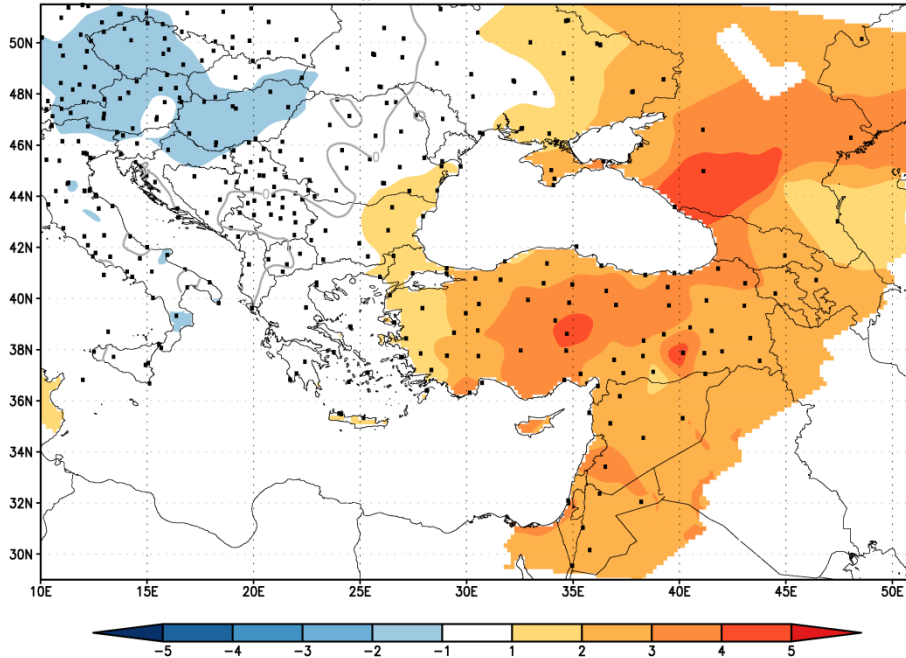
Every month regional long range forecast for 7 months:
dynamical downscaling ECMWF 41 ensemble with RCM-SEEVCCC

Climate Monitoring

- Example of the product : September 2010

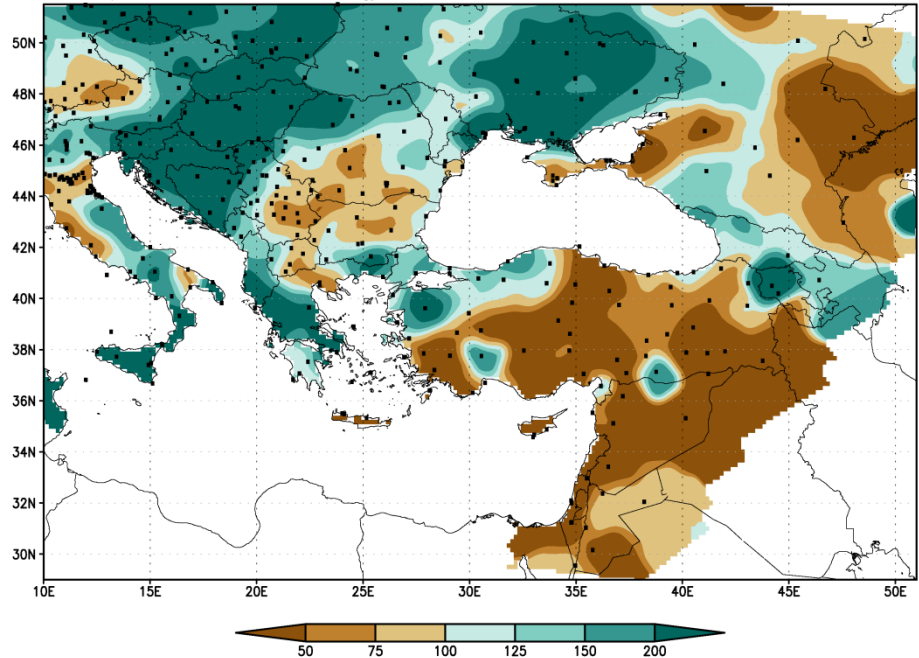
Temperature anomaly

Climate monitoring: Temperature anomaly (°C) for SEP 2010
with respect to 1961–1990 climatology



Precipitation (percent of normal)

Climate monitoring: Precipitation (percent of normal) for SEP 2010
with respect to 1961–1990 climatology



- available maps:

for each month and for 3 months:

- mean 2m temperature, acc. precipitation,
- temperature anomaly, precipitation percent of normal (with respect to 1961-1990)

Long Range Forecast / Seasonal forecast

- ECMWF recommendations

Seasonal forecast strongly depends on the initial state of the climate system whose representation in numerical models has uncertainties. Atmospheric and oceanic numerical models are affected by errors, observations are sparse which limits a seasonal forecast skill. In order to overcome this problem, large number of separate simulations have to be made. This is called ENSEMBLE forecast.

- Probabilistic forecast

- **Seasonal forecast is NOT a weather forecast!**

- Provides statistical summary of the atmosphere and ocean state in forecoming season.

- RCM-SEEVCCC LRF (Long Range Forecast – Seasonal Forecast)

- **regional dynamical downscaling using fully coupled atmosphere-ocean RCM**

- model start: 16th of each month ; forecast duration: 7 months (~215 days)

- model resolution: ~35km atmosphere ; ~20km ocean

- model domain: Euro - Mediterranean region extended toward Caspian Sea

- **41 ensemble members!**

- initial and boundary conditions: ECMWF, resolution:125km

- results prepared for South East European region in form of:

- **mean ensemble maps** (mean 2m temperature, precipitation accumulation, temperature anomaly and precipitation anomaly with respect to CRU data 1961-1990) for month and three months (season)

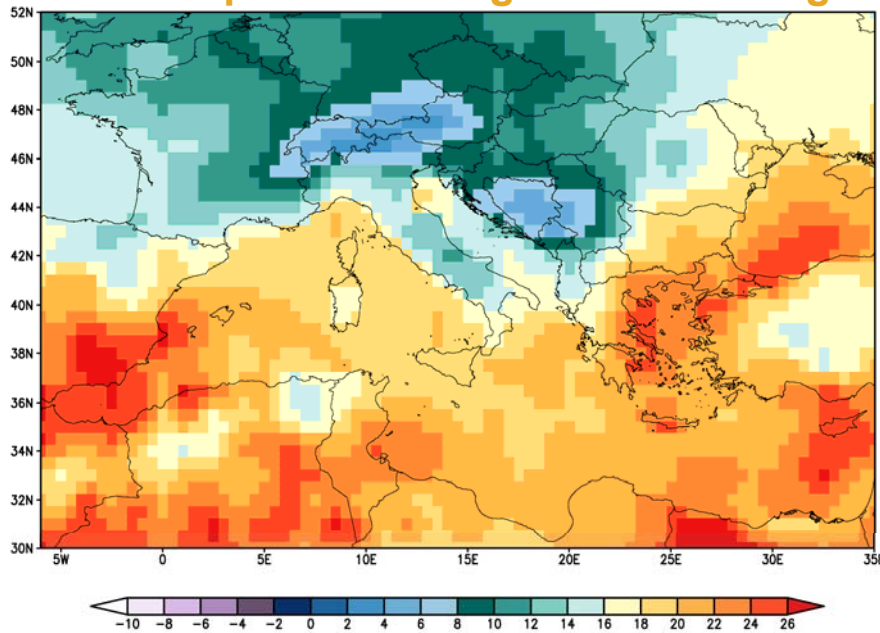
- **diagrams** (probabilistic forecast of mean monthly temperature and monthly precipitation accumulation for specific place)

Benefit Of Using Regional Climate Models

- DYNAMICAL DOWNSCALING FOR SEASONAL FORECAST

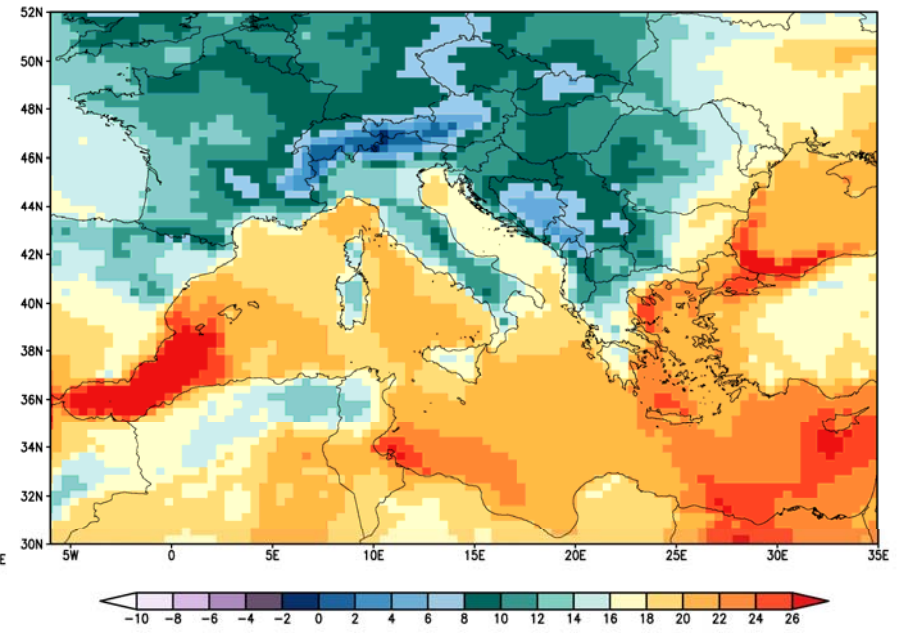
2m temperature ECMWF

interpolated on higher res.: 0.5deg



resolution: 125km

2m temperature RCM-SEEVCCC

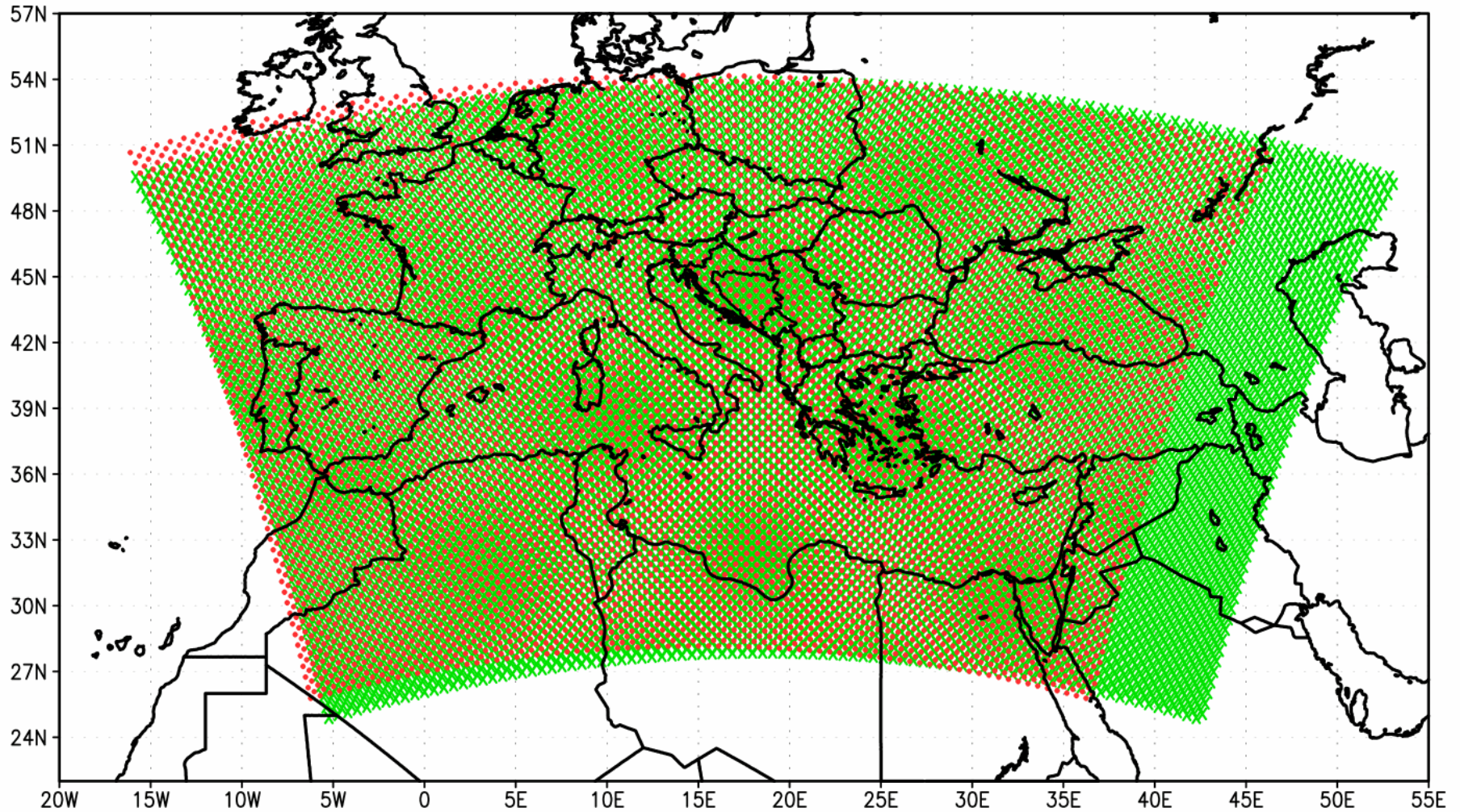


resolution: 35km atmosphere
20km ocean

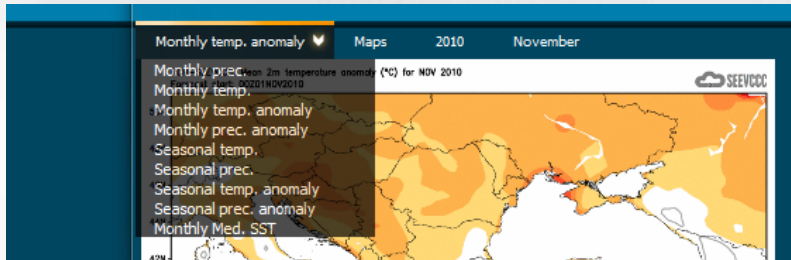
More detailed temperature field using regional model!

RCM-SEEVCCC LRF: domain

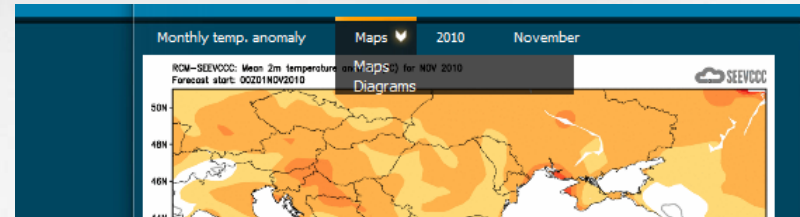
- from June 2010 domain is expanded to the east (green)



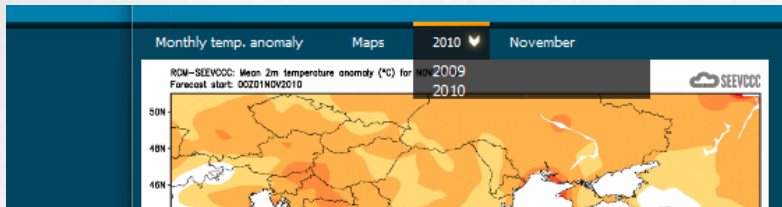
Choose parameter



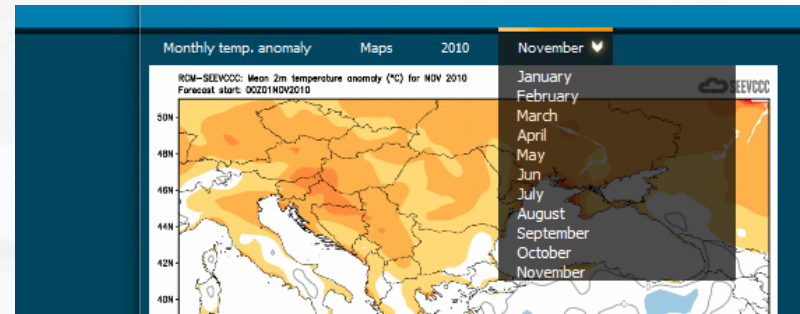
Choose map or diagram



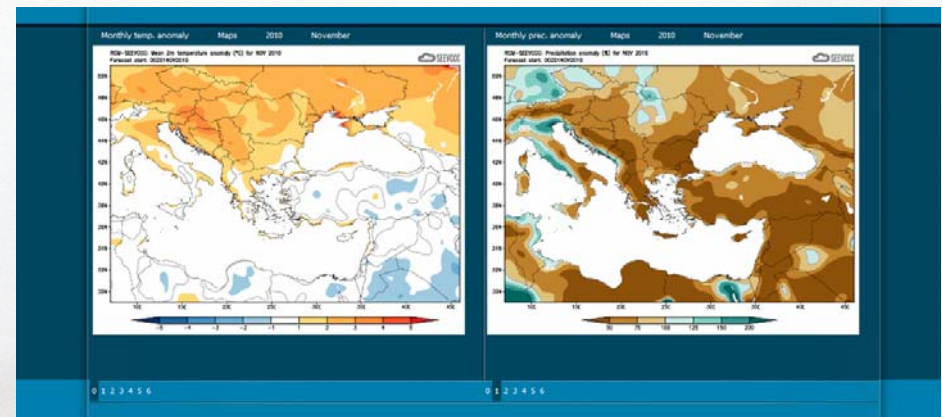
Choose year



Choose lead month

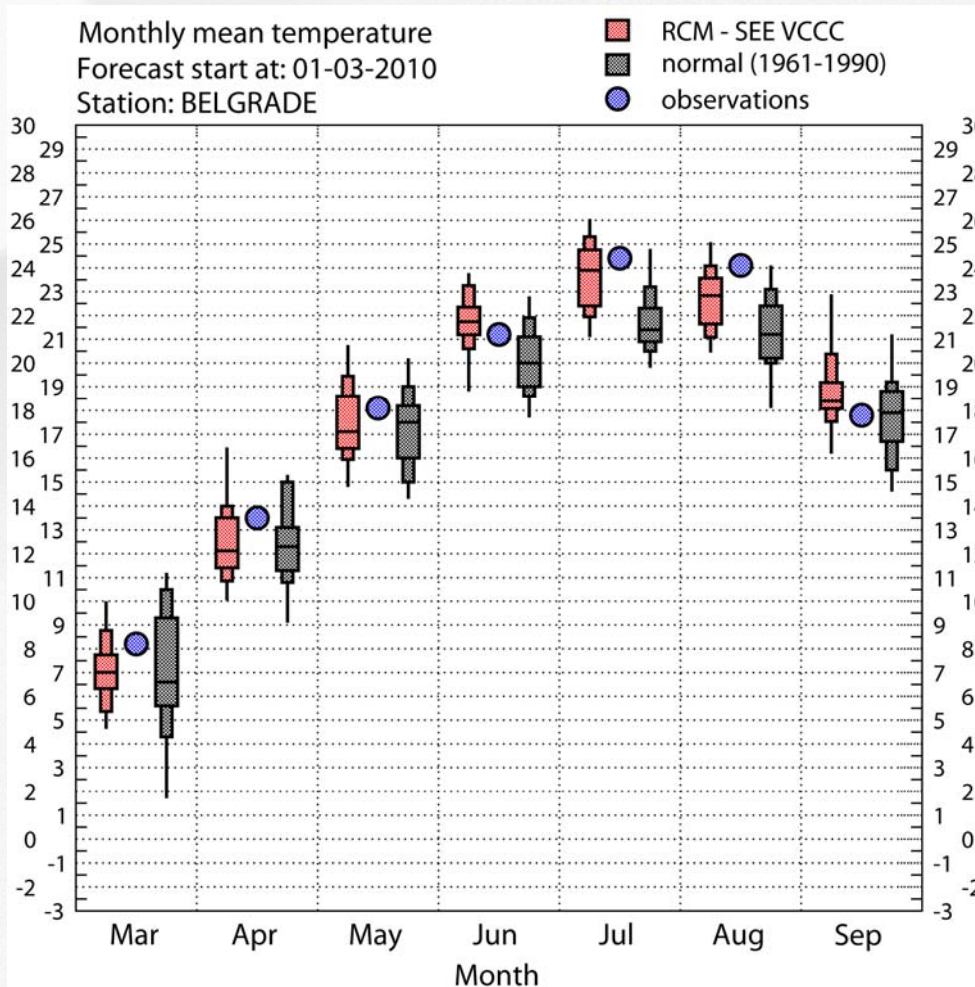


Option for results comparison of different parameters or selected forecast

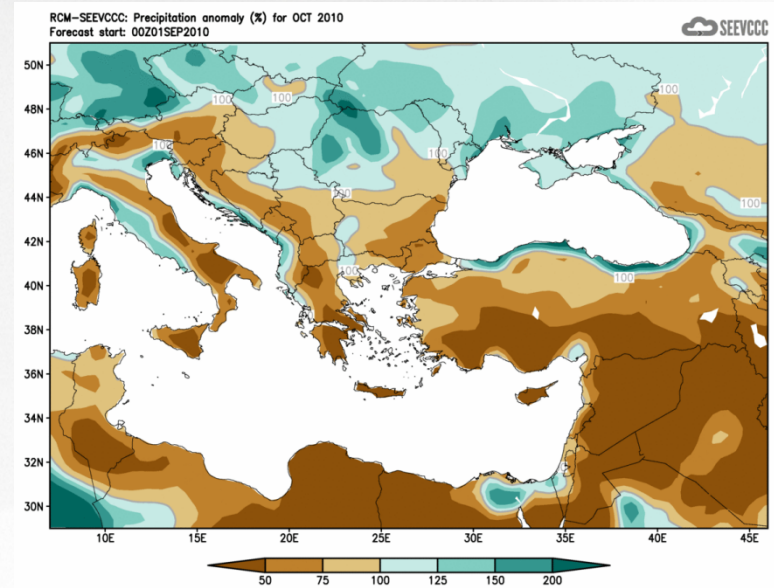


- Example for LRF products

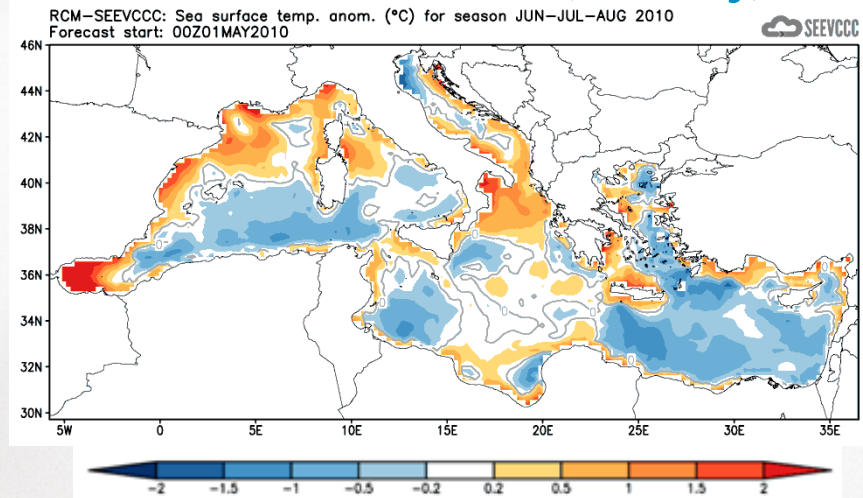
Probabilistic Long Range Forecast



Maps of ensemble mean



Additional: SST (anomaly)



Correction of Model results for special application

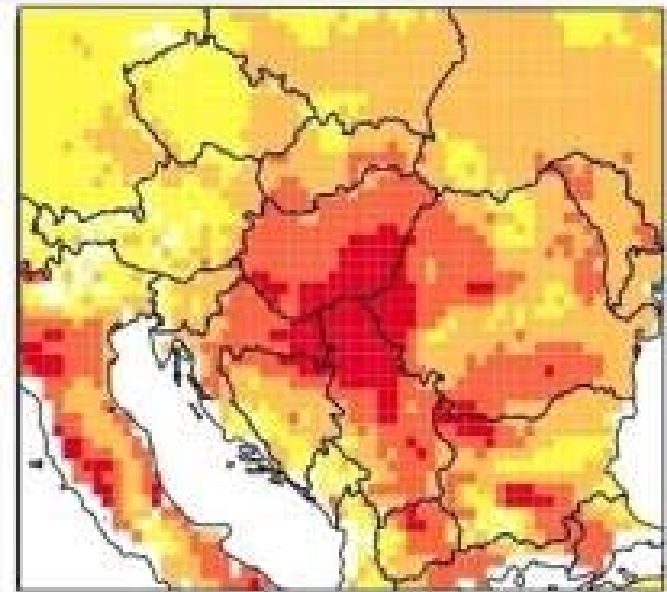
- **Summer drying problem**

- It is well known that models have BIAS, which is noticed and most studied in climate projections. Seasonal forecast is also affected with the same problem.

- Citation from EU FP6 project **CLAVIER** (CLimate ChAnge and Variability: Impact on Central and Eastern EuRope) – WP1:

“The most severe systematic error relevant for the CLAVIER domain is known as the **Summer Drying Problem (SDP)**, and is characterized by the too dry and too warm simulation of climate over Central and Eastern Europe during (late) summer [Hagemann et al., 2004, Jacob et al., 2008]. It is typical for many regional and also some global climate models.”

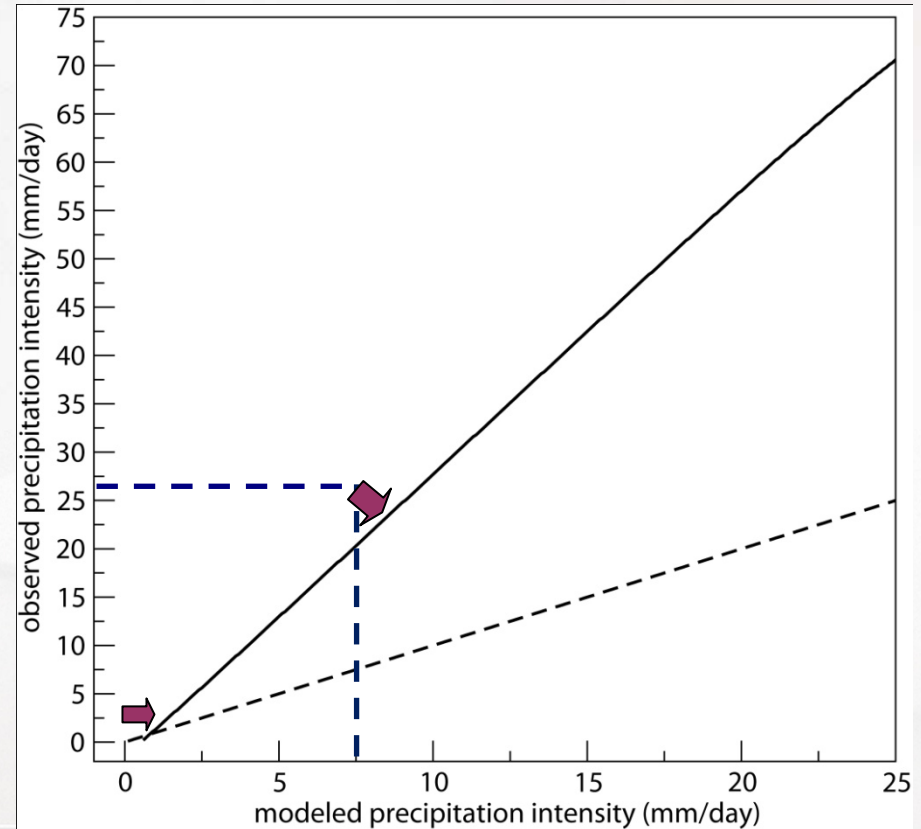
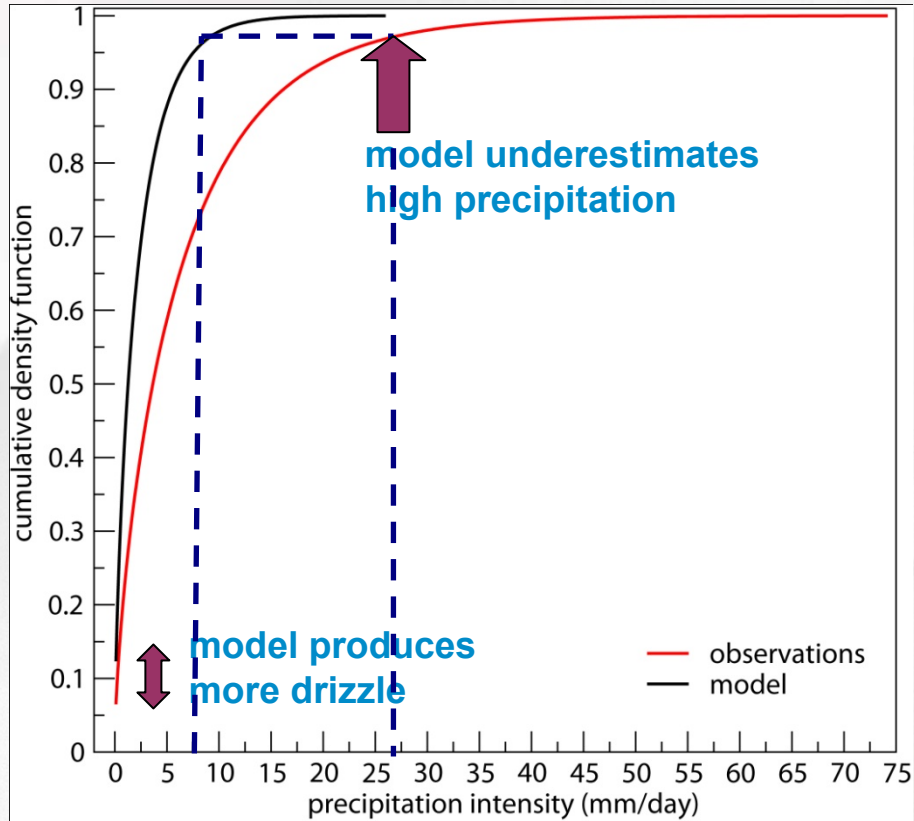
Image from CLAVIER-WP1: Climate



2mTemp. diff. between simulation and observations (summer 1981-2000)

- **Best solution:** presenting results as a difference from **model climatology**; for ensemble seasonal forecast large CPU time needed for model climatology runs!
 - for now, model climatology do not exist and that is the reason for introducing **statistical BIAS correction method**

● STATISTICAL BIAS CORRECTION – HOW TO ...

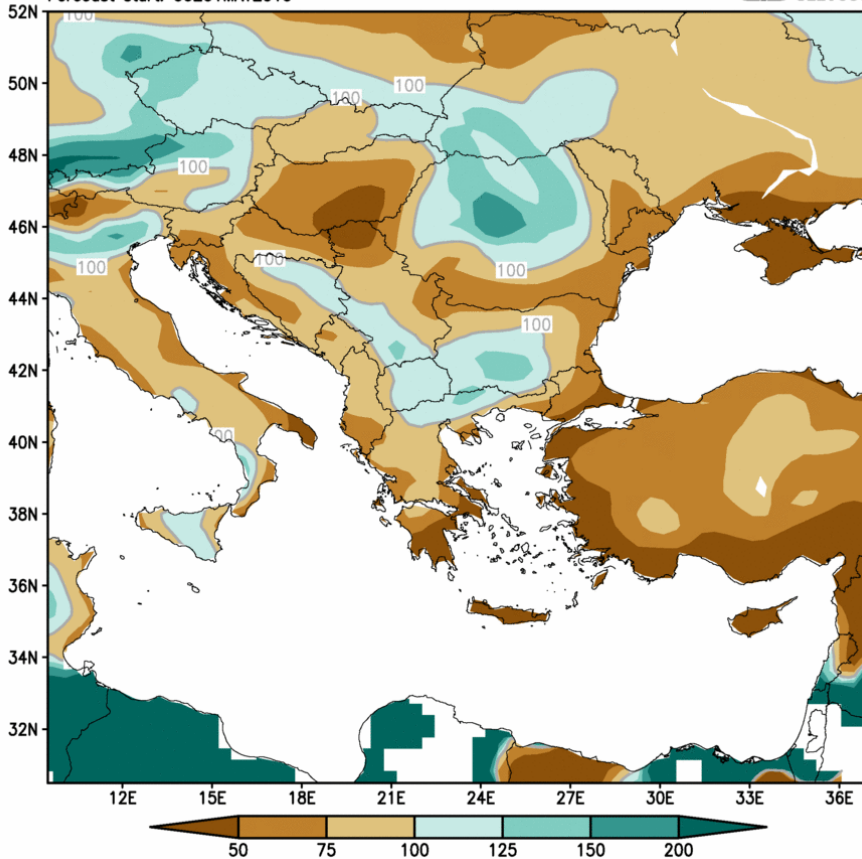


model overestimates number of dry days!

LRF - Precipitation for June 2010

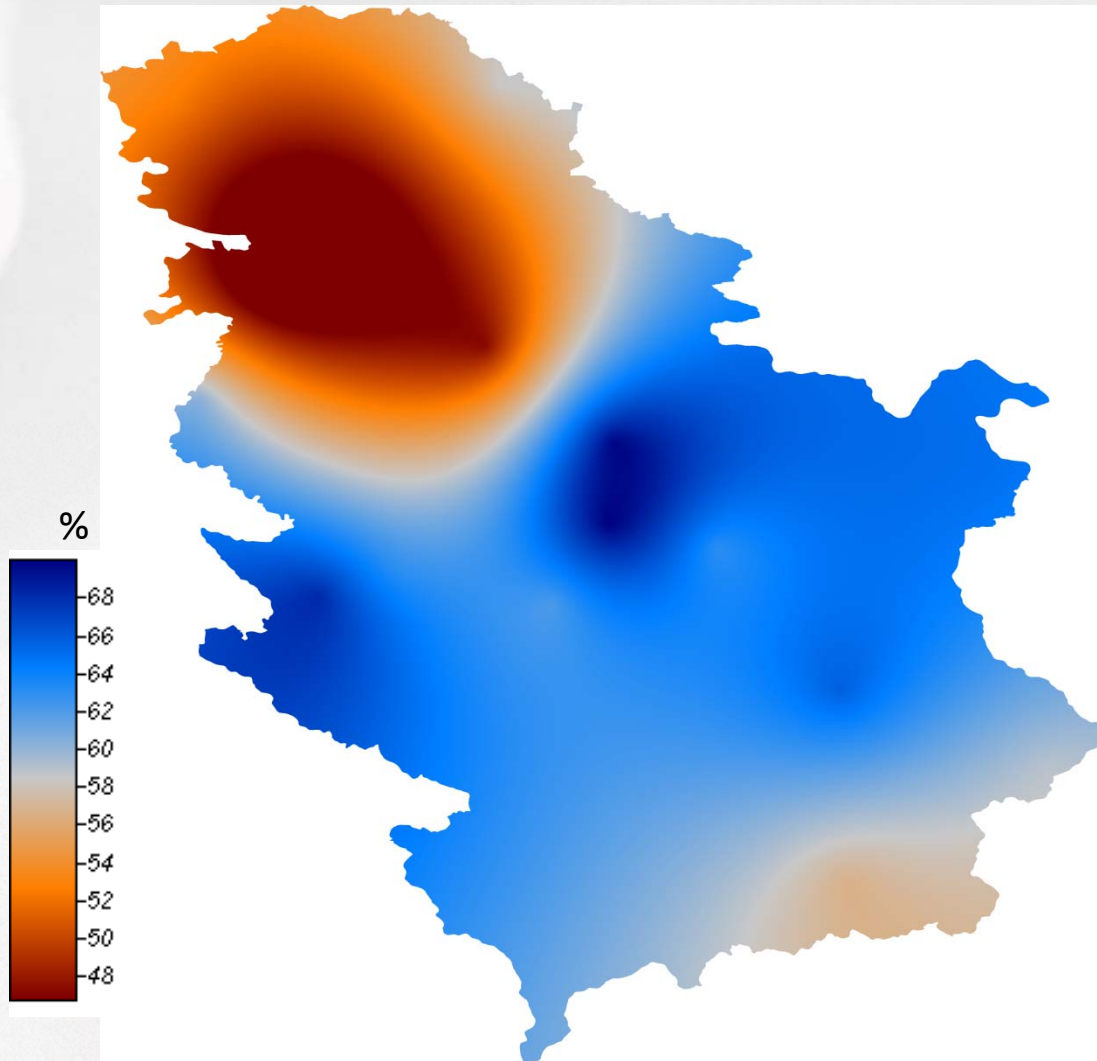
Mean ensemble precipitation anomaly

RCM-SEEVCCC: Precipitation anomaly (%) for JUN 2010
Forecast start: 00Z01MAY2010



- 01-04 June: Heavy rainfall over the northern Balkan peninsula due to a quasi-stationary upper-tropospheric low
- 16-17 June: Severe thunderstorm with hail e.g. in Slovenia, Hungary, Bulgaria
- In June: Heavy rain caused severe flooding in Romania, Moldova, Bosnia and Herzegovina and Serbia

LRF – probability SPI forecast

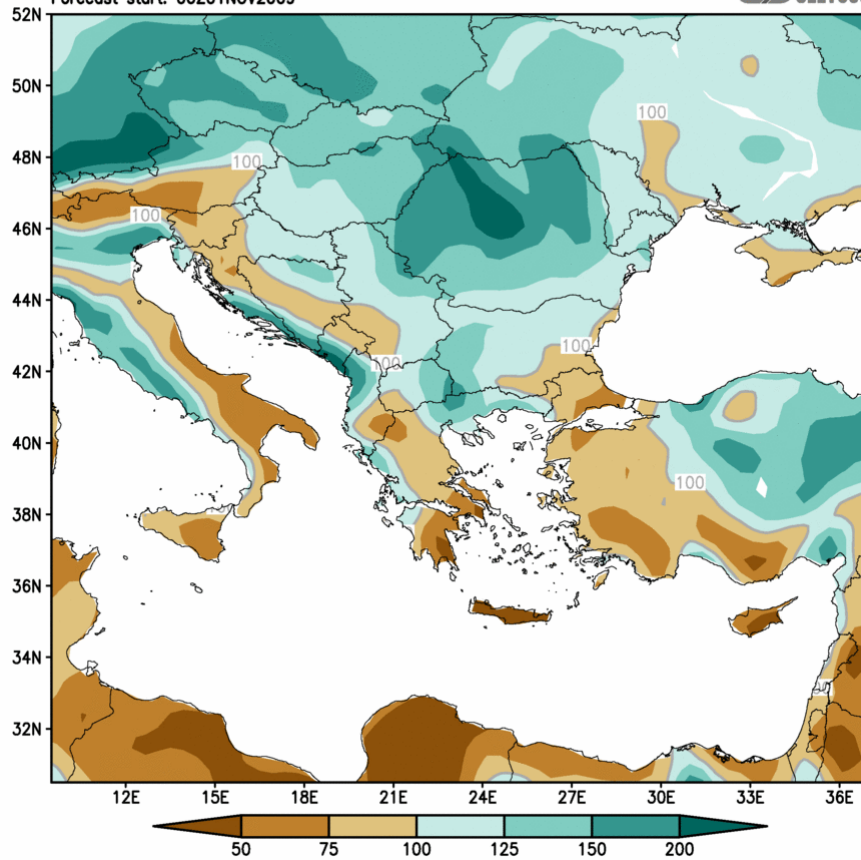


- Forecast issued April 1st 2010.
- Ensemble probability of SPI2 > 1.282 (considerably increased moisture) for **May 2010**
- Favorable conditions for flood in case of possible incoming precipitations

LRF - Precipitation for March 2010

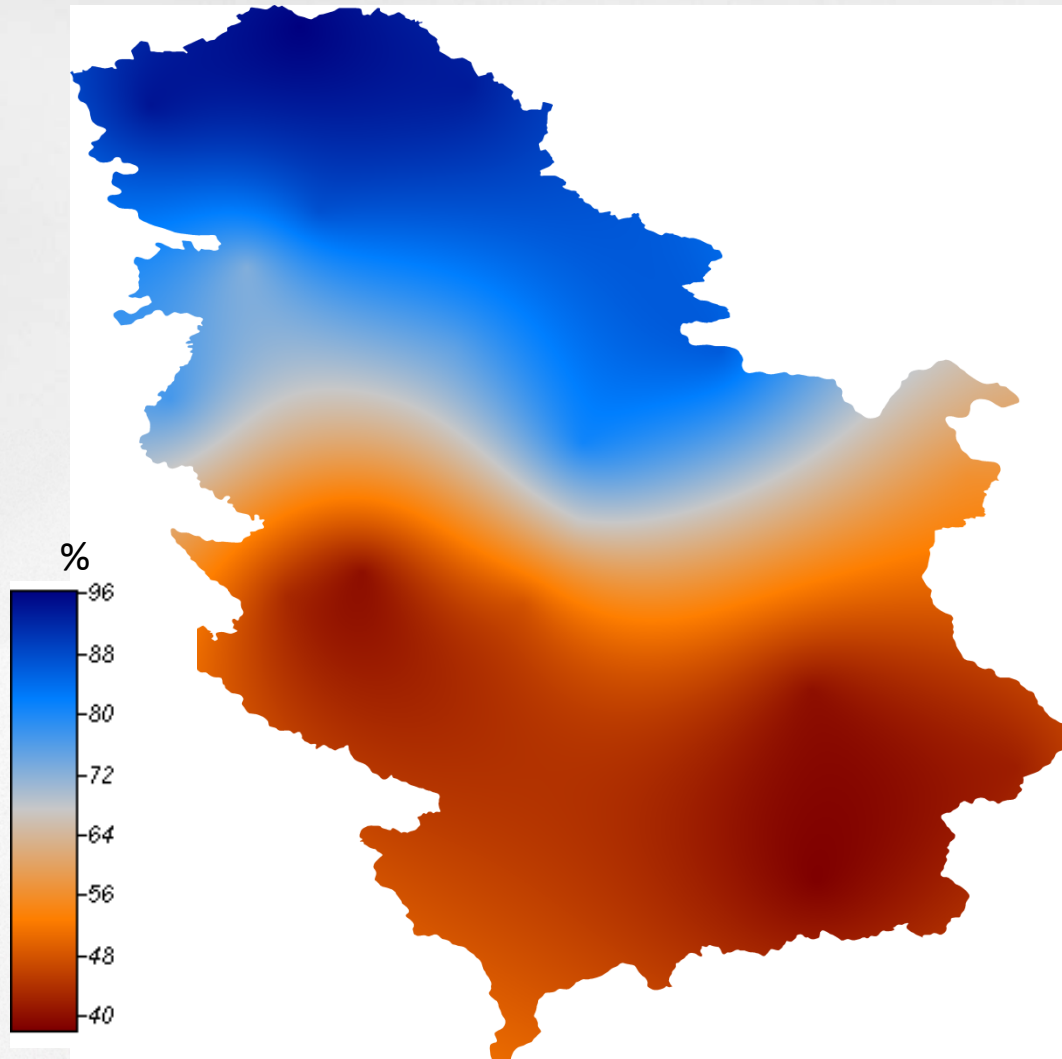
Mean ensemble precipitation anomaly

RCM-SEEVCCC: Precipitation anomaly (%) for MAR 2010
Forecast start: 00Z01NOV2009



- In March: Heavy rain caused severe flooding in Serbia

LRF – probability SPI forecast



- Forecast issued January 1st 2010.
- Ensemble probability of SPI2 > 1.282 (considerably increased moisture) for **February 2010**
- SPI2 well correlated to floods and drought

Further R&D: Earth Modeling System

- **NCEP/NMMB – Nonhydrostatic Multiscale Model on B grid**

- Numerical Weather Prediction Model (NWPM)
Works on global, regional (res. ~10km) and local scales (res.~100m)
Valuable tool to perform simulations on any desirable resolution
- quasi-operational in SEEVCCC on global and regional scales

- **Atmospheric particles**

- Implementation of dust, seasalt, minerals and other atmospheric particles: transport and their interactions with atmosphere and ocean (influence on cloud formation, radiation, ocean flora and fauna,...)
- for now dust component (DREAM) is prepared for implementation in NMMB

- **Hydrology**

- Dynamical hydrology model is developed - HYPROM
simulation of hydrology cycle
- HYPROM ready to be included into atmospheric driver NMMB

- **Ocean**

- First action is to couple NMMB with ocean model
necessary because of large influence of sea on climate in the region