Operational sub-regional Long-Range Forecasting Unit at RA VI Regional Climate Center – South-East European Virtual Climate Change Center

Vladimir Djurdjevic

1)Institute for Meteorology, Faculty of Physics, University of Belgrade, Serbia
2)Southeast European Virtual Climate Change Center-SEEVCCC, Serbia

November, 2013

Long-Range Forecasting Traning

Introduction

- **Operational dynamical long range forecast in SEEVCCC started in mid 2009 as a one of the first activities in SEEVCCC.**

- **The activity was initiated through RHMSS/SEEVCCC participation in WMO RA VI - Europe RCC network.**

    - **Climate data node**
    - **Climate monitoring node**
    - **Long range forecast node**

      (dynamical downscaling of global LRF is recommended function)

Approach

- **Dynamical downscaling of global long range forecast.**
  - **Dynamical downscaling is widely accepted approach that provides increased temporal and spatial resolution of global model results over area of interest (mainly continental or sub-continental scales),**
  - **It assumes the introduction of regional (limited area) model,**
  - **Time horizon: from short range over medium to long range forecast and climate scenarios.**

RCM-SEEVCCC model

- **RCM-SEEVCCC is a two-way regional coupled model, with Eta/NCEP limited area model as its atmospheric part and Princeton Ocean Model (POM) as its ocean part.**

- **Model has been used and verified for various applications:**
  - **Medium range forecast of atmosphere and sea,**
  - **Reanalysis downscaling,**
  - **Climate change scenarios downscaling.**

RCM-SEEVCCC model

Atmospheric model Eta/NCEP:

- **Grid point model on Arakawa E grid and eta vertical coordinate,**
- **Dynamical core with horizontal differencing that preserves many important properties of differential operators and conserves a variety of basic and derived quantities including, energy and enstrophy,**
- **NOAH land surface scheme,**
- **Radiation adopted from ARPS model,**
- **Bets-Miller-Janjic convection,**
- **Melloer-Yamada-Janjic turbulence and surface layer.**

Ocean model: POM (Princeton Ocean Model)

- **Primitive equation model on C grid and sigma vertical coordinate,**
- **Free surface,**
- **Mellor-Yamada turbulence.**

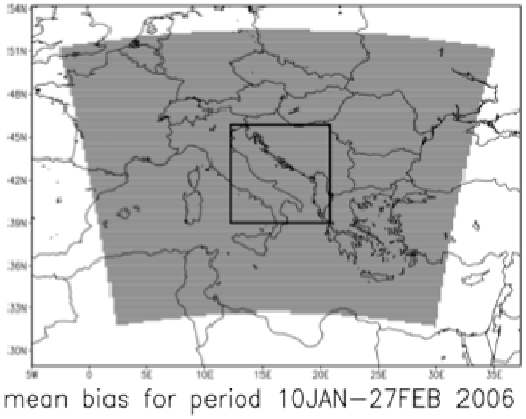
Coupler:

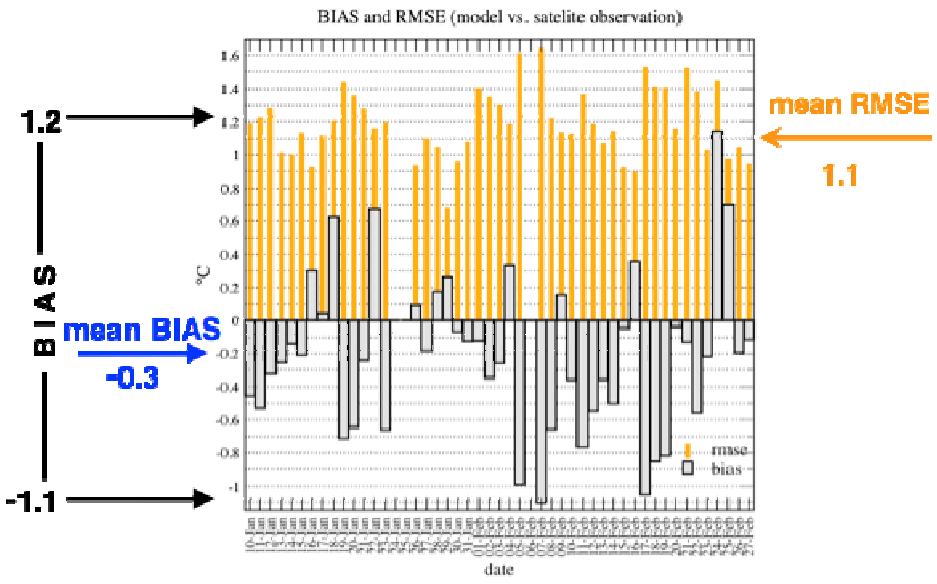
- **Hard coded,**
- **Coupling frequency: after every physical time step in atmospheric model (order of minutes),**
- **Atmosphere to ocean: radiation, turbulent and precipitation fluxes,**
- **Ocean to atmosphere: seas surface temperature.**

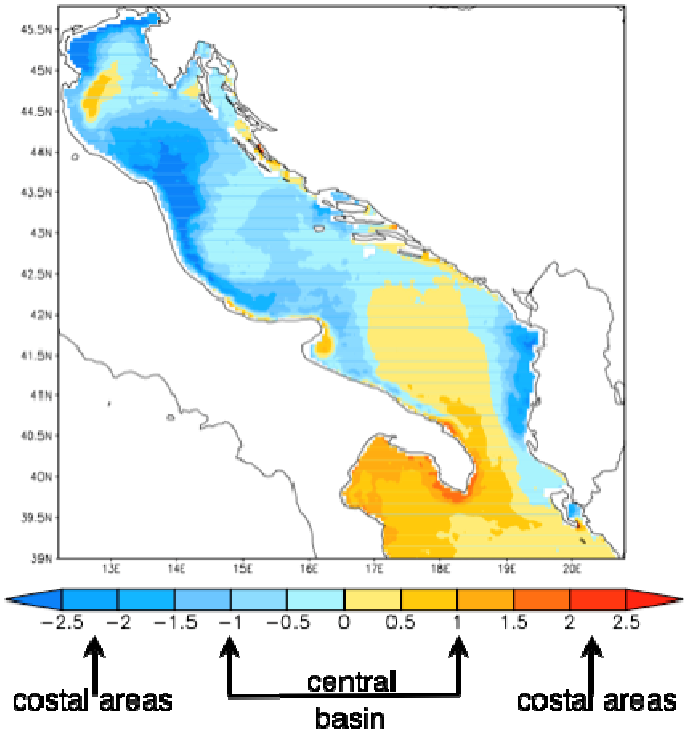
RCM-SEEVCC: Some application and verification exsamples

Medium range forecast

- Downscaling of ECMWF and NCEP 7 day forecasts
- Adriatic sea
- Verification of SST forecast against satellite observations



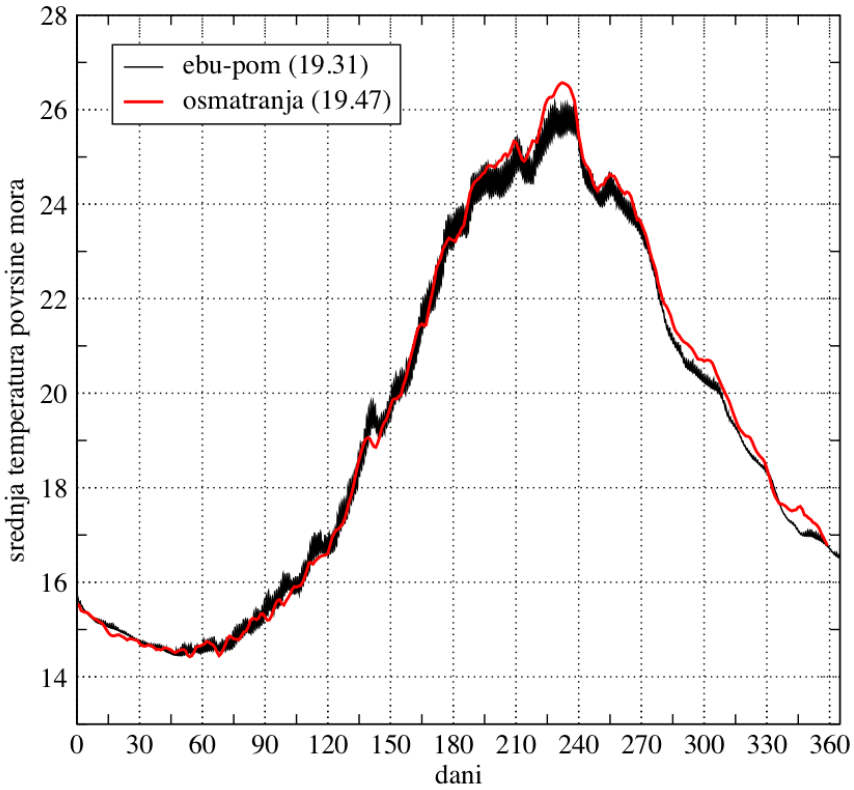




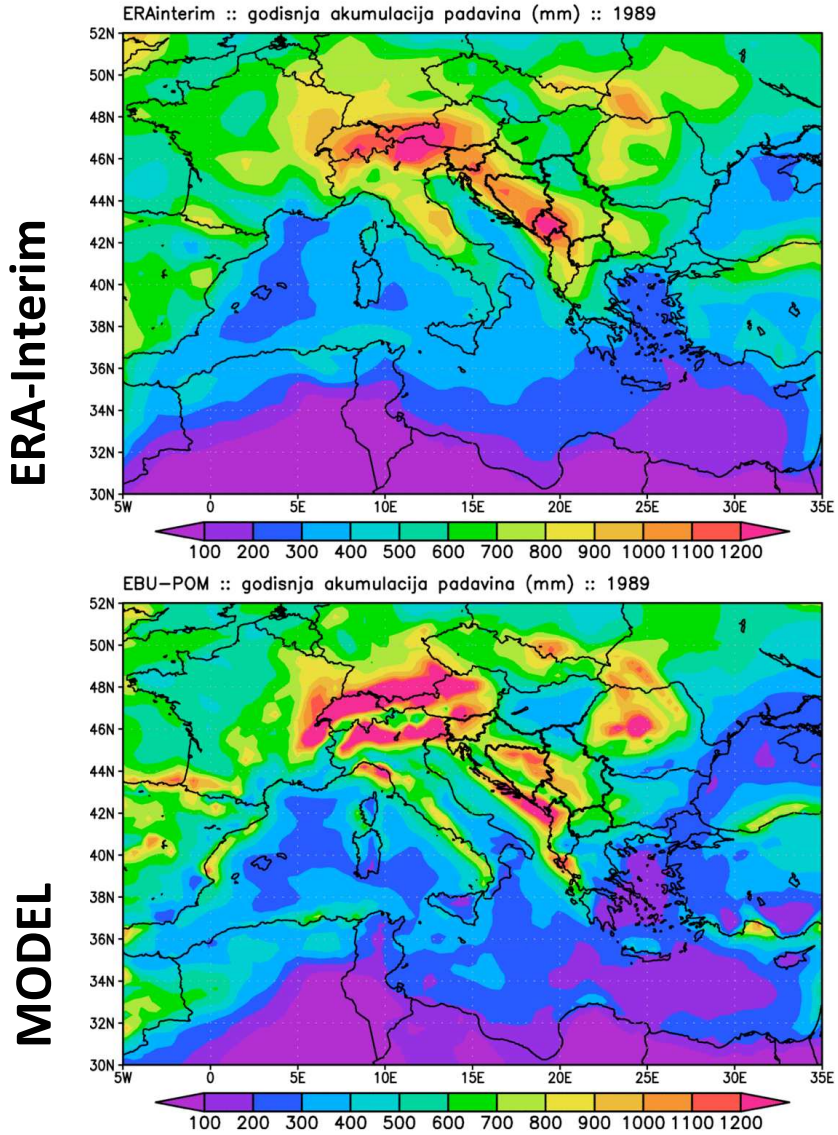
RCM-SEEVCC: Some application and verification exsamples

ERA – Interim downscaling

Mean Mediterranean sea surface temperature one year cycle; black – model; red - observations

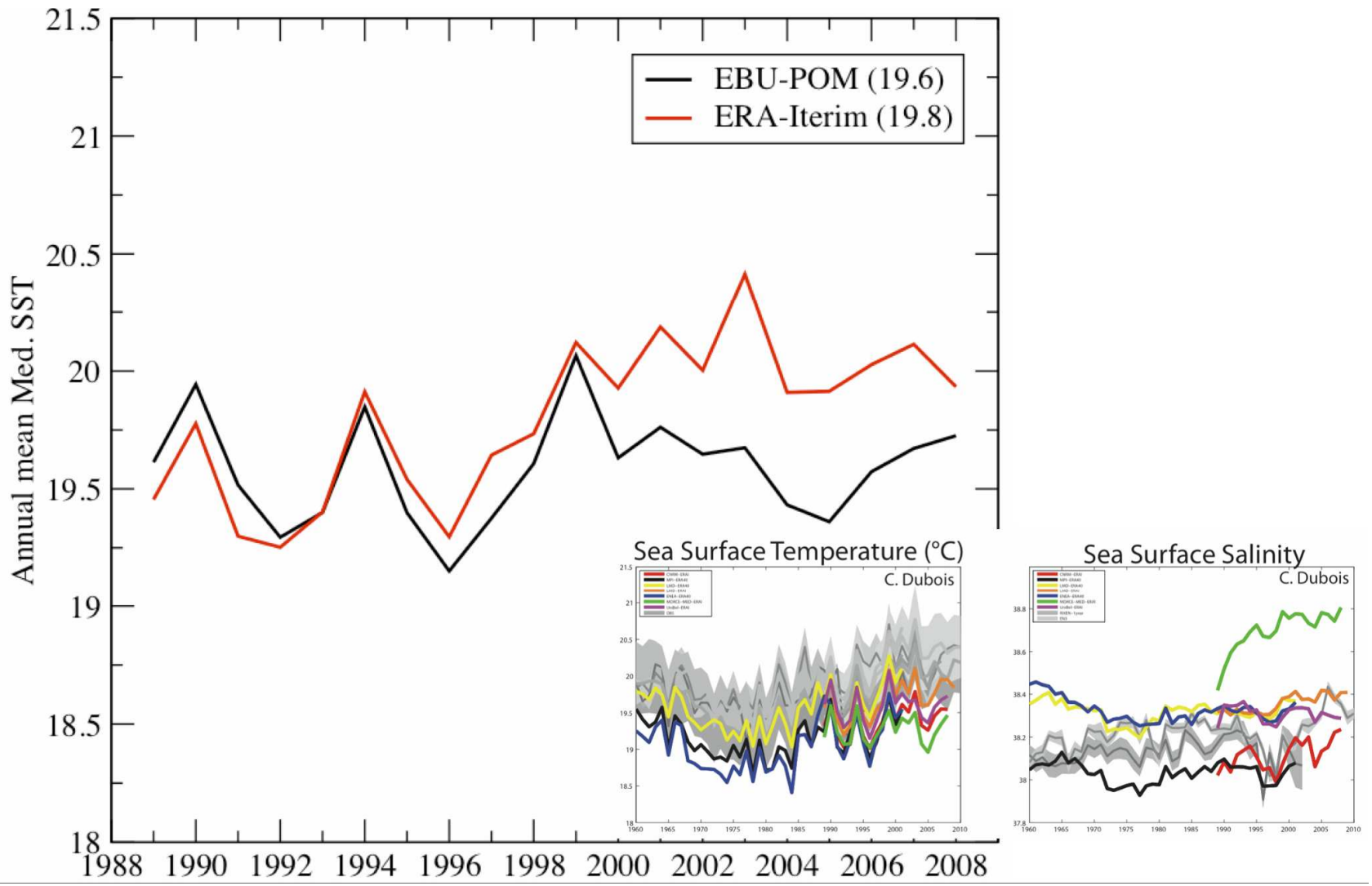


Annual precipitation

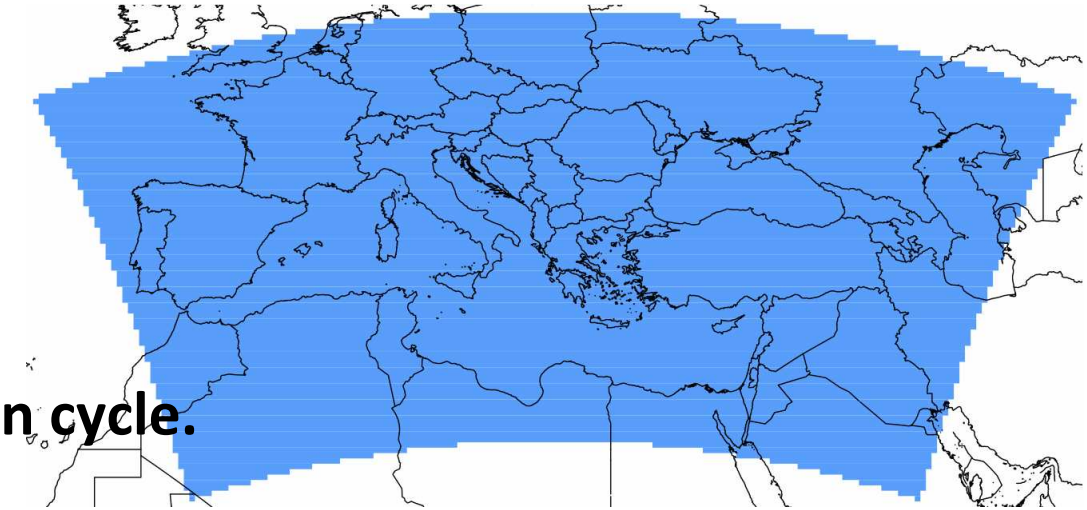


RCM-SEEVCC: Some application and verification exsamples

ERA – Interim downscaling



RCM-SEEVCC set-up for LRF downscaling



Atmospheric model:

- Horizontal resolution 0.25°,
- 42 vertical levels,
- Top at 50mb,
- Long term annual vegetation cycle.

Ocean model:

- Domain cover Mediterranean sea,
- Horizontal resolution 0.2°,
- 21 vertical levels.

Coupler:

- Every 360 seconds.

RCM-SEEVCC set-up for LRF downscaling

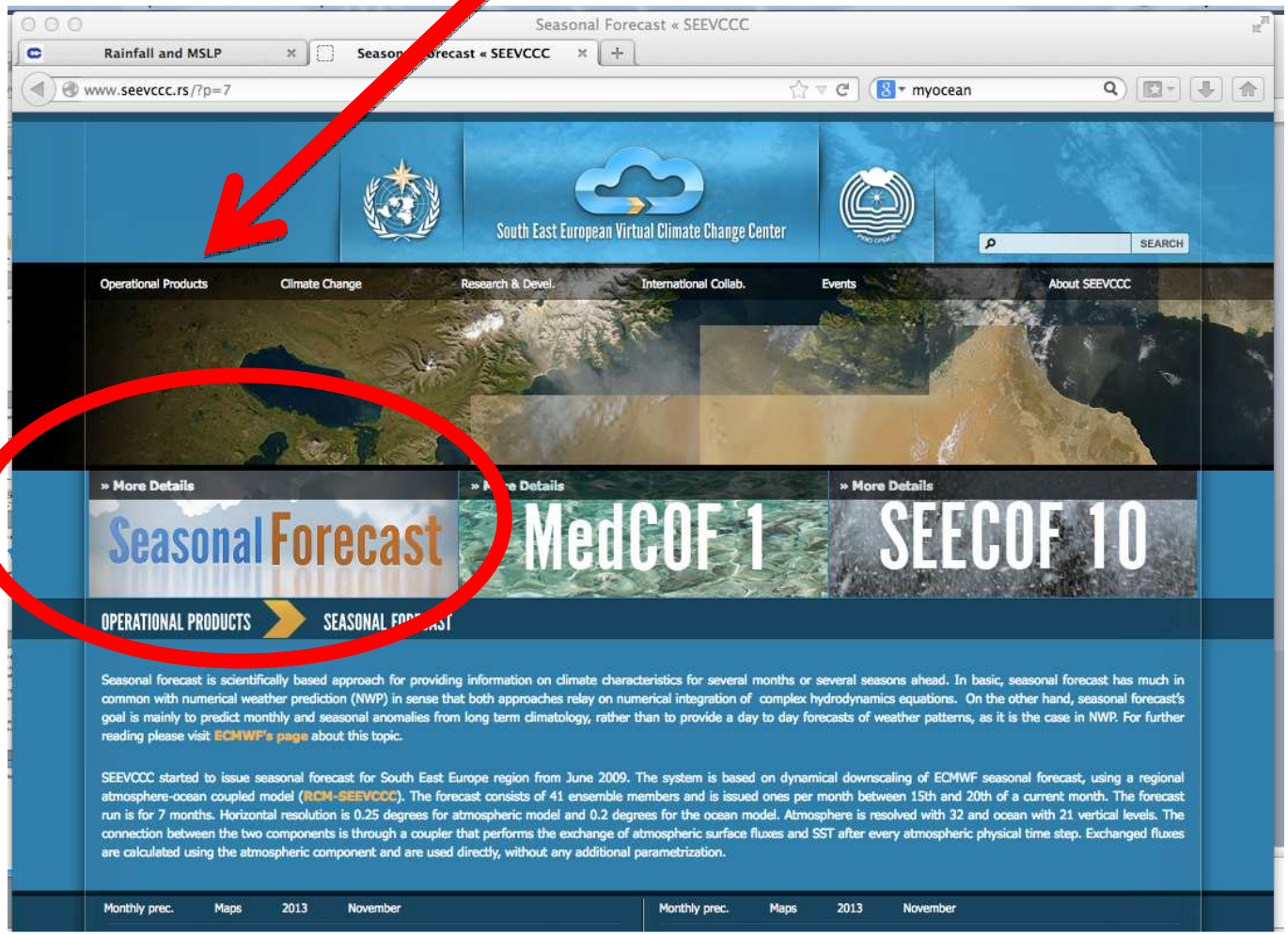
- Initial & boundary conditions: ECMWF SYSTEM-4,
- Model start: 10th of each month,
- 51 ensemble members,
- Forecast duration: 7 months (~215 days),
- Ocean initial condition long term Mediterranean climatology,
    - My-Ocean project?

- Single code run on separate CPU, 51 runs in parallel,
- About 1.5 day from download start to graphical products.

Graphical products are available on SEEVCCC web site

www.seevccc.rs

Operational Products tab



Graphical products are available on SEEVCCC web site

Ensemble mean

- **Monthly temperature,**
- **Monthly precipitation,**
- **Monthly temperature anomaly,**
- **Monthly precipitation anomaly,**
- **Seasonal temperature,**
- **Seasonal precipitation,**
- **Seasonal temperature anomaly,**
- **Seasonal precipitation anomaly,**
- **Mediterranean monthly mean SST.**

Graphical products are available on SEEVCCC web site

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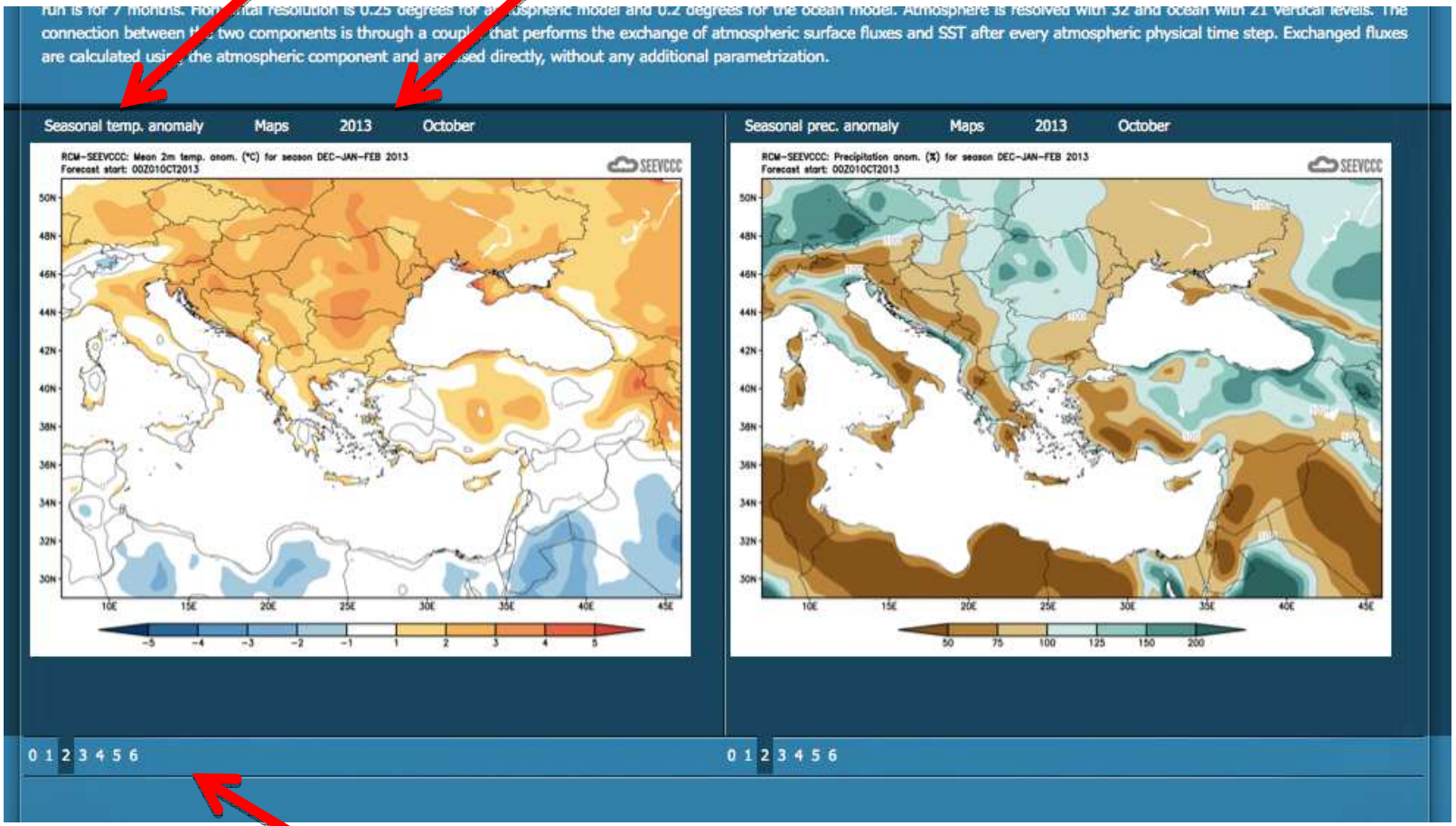
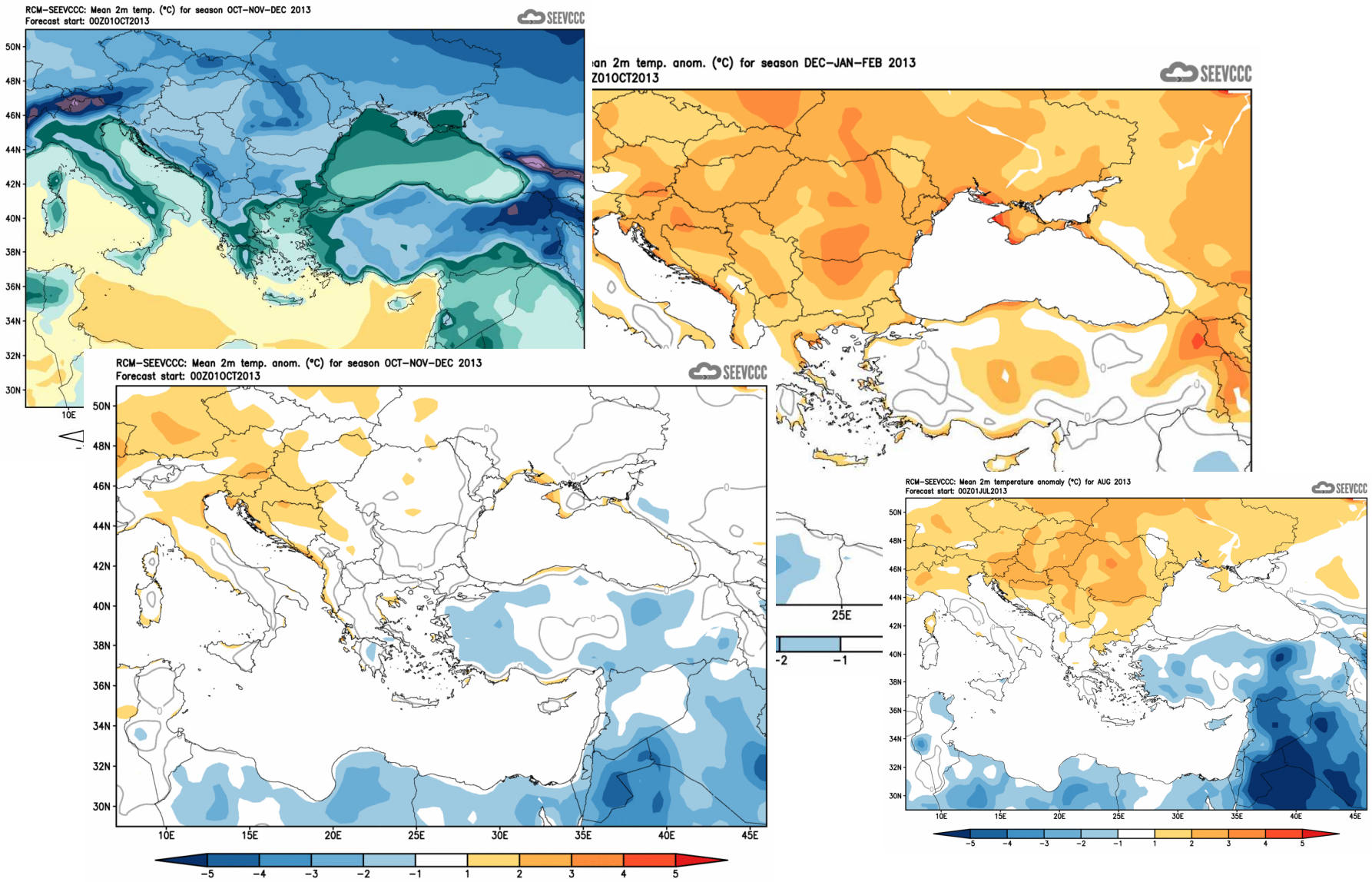
Variable **Forecast initial month and year**



Slide bar for lead months

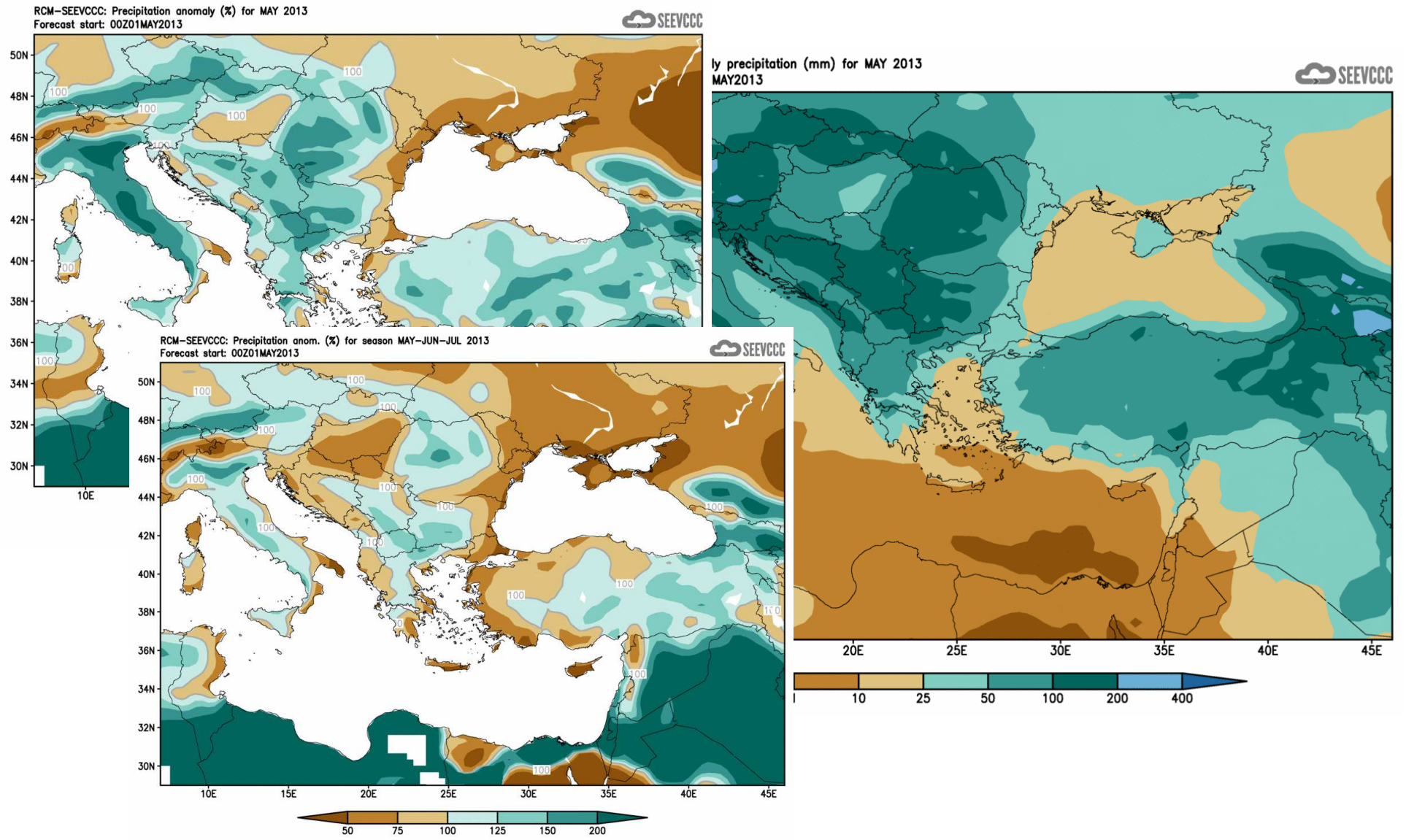
Graphical products

Monthly and seasonal temperature and anomalies



Graphical products

Monthly and seasonal precipitation and anomalies



Products available via WMO WIS

http://wis-geo.hidmet.gov.rs:8080/geonetwork/srv/en/main.home

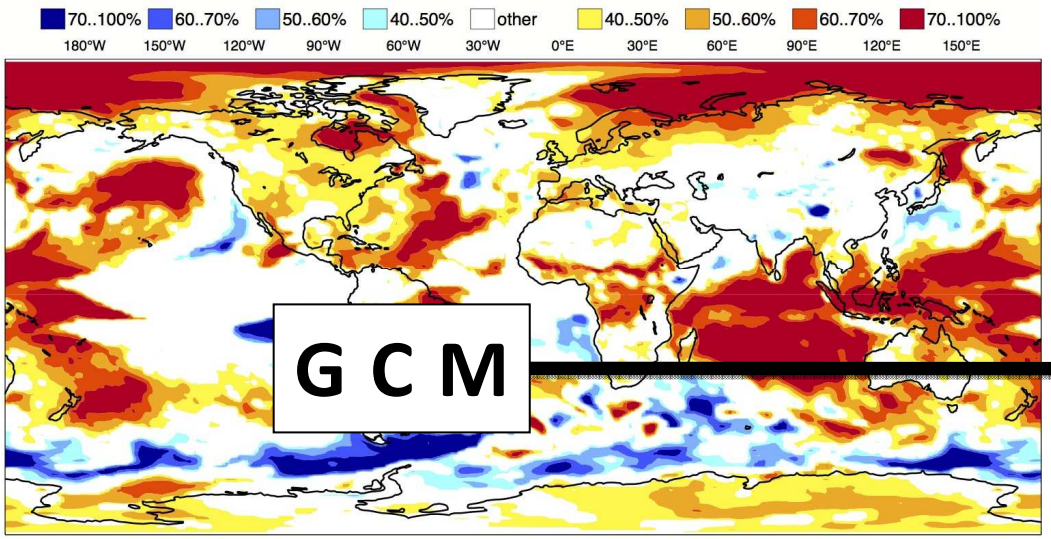
Products available via WMO WIS

FTP access to long range forecast forecast

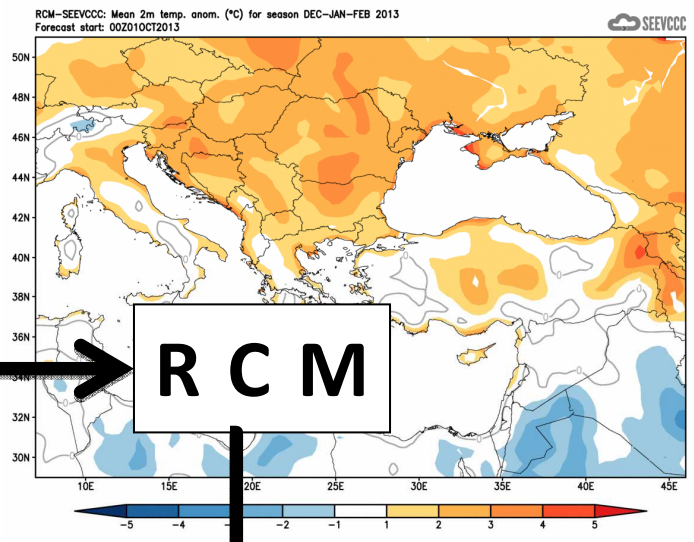
wis-geo.hidmet.gov.rs

- **Monthly mean temperature and accumulated precipitation**
- **All 51 ensemble member**
- **Re-gridded to regular lat-lon grid, 0.25^{o}**

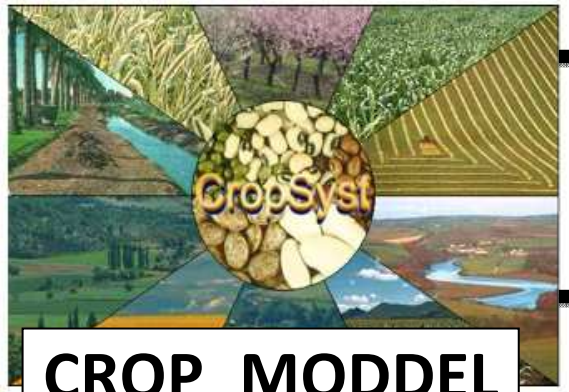
From GCM to end users



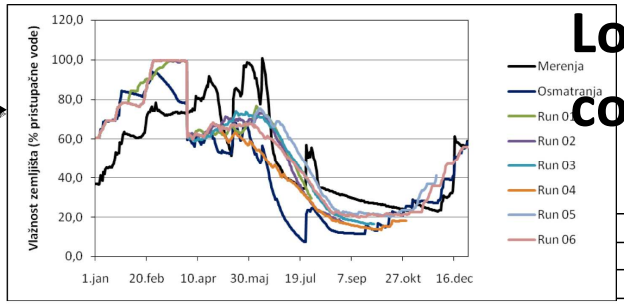
G C M



R C M



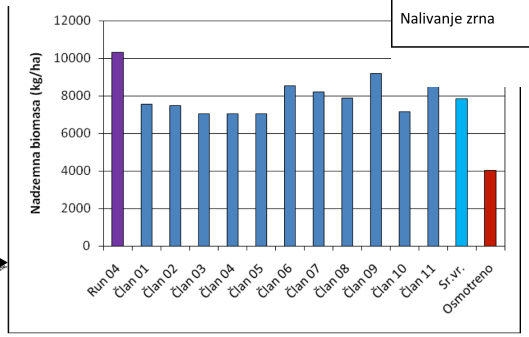
CROP MODDEL



Local soil condition

			15.04.	15.04.	15.04.
			106	106	106
			30.04.	04.05.	28.04.
			121	125	119
Početak cvetanja	07.07.	03.07.	01.07.	02.07.	28.06.
	189	185	183	184	180
Nalivanje zrna	25.07.	23.07.	21.07.	22.07.	18.07.
	207	205	203	204	200

Phenology



Production

Thank you