REGIONAL SEASONAL FORECASTING WITH DYNAMICAL DOWNSCALING APPROACH

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ABSTRACT

As a part of the operational activates in South East European Virtual Climate Change Center (SEEVCCC, WMO RA VI RCC-Network member) a seasonal prediction system is developed, core of which consist of a coupled atmosphere-ocean regional climate model RCM-SEEVCCC. The RCM-SEEVCCC has been utilized to deliver seasonal forecasts in South East European region on operational basis as of June 2009. The seasonal prediction system is performing a dynamical downscaling of ECMWF System 3 seasonal forecast, from which regional model uses initial and lateral boundary condition. From June 2009 to March 2010, 26 ensemble members were used, and starting April 2010 full 41-ensemble member system of ECMWF is operationally downscaled. The forecast run is for 7 months ahead and is issued ones per month. Horizontal resolution is 0.25 degrees for atmospheric model and 0.2 degrees for the ocean model. Atmosphere is resolved with 32 and ocean with 21 vertical levels. The employment of the regional system to WMO Regional Climate Outlook Forum in SEE will be presented together with the system performance and verification scores. Potential added value to ECMWF global system will be discussed.

INTRODUCTION

SEEVCCC started to issue seasonal forecast for South East Europe region from June 2009. The system is based on dynamical downscaling of ECMWF seasonal forecast, using a regional atmosphere-ocean coupled model (RCM-SEEVCCC). The forecast consists of 41 ensemble members and is issued ones per month between 15th and 20th of a current month. The forecast run is for 7 months. Horizontal resolution is 0.25 degrees for atmospheric model and 0.2 degrees for the ocean model. Atmosphere is resolved with 32 and ocean with 21 vertical levels. The connection between the two components is through a coupler that performs the exchange of atmospheric surface fluxes and SST after every atmospheric physical time step. Exchanged fluxes are calculated using the atmospheric component and are used directly, without any additional parametrization.

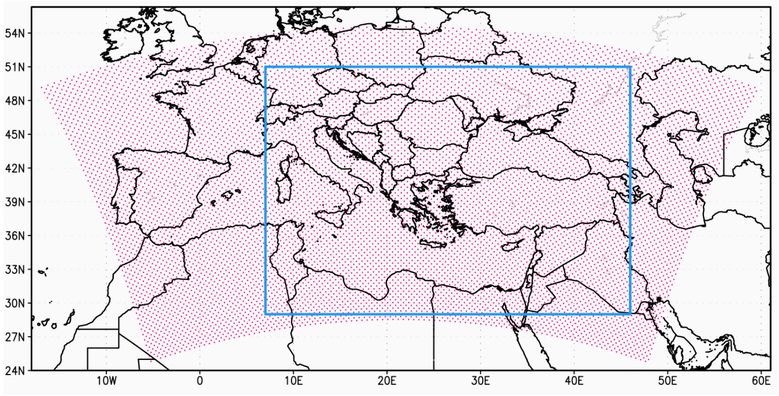


Figure 1. RCM-SEEVCCC model domain (red dots) and area for which web products are prepared (blue rectangle).

MODEL DESCRIPTION

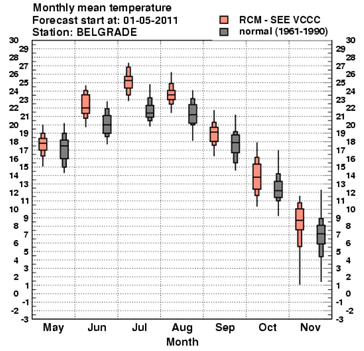
RCM-SEEVCCC is a two-way regional coupled model, with Eta/NCEP limited area model as its atmospheric part and Princeton Ocean Model as its ocean part (Durdjevic V. and Rajkovic B., 2008; Krzic et al., 2011). Exchange of atmospheric fluxes and SST (Sea Surface Temperature) is performed at every atmospheric physics time step (order of minutes). Exchanged fluxes are calculated without any additional parametrization.

The atmospheric component is a limited-area forecast model defined on the E-grid according to the nomenclature of Arakawa and Wininghoff. The physics package consists of NOAH land surface scheme, a Goddard radiation scheme, Mellor-Yamada-Janjic turbulence scheme, Monin-Obukhov PBL scheme with viscous sub-layer and a Betts-Miller-Janjic convection parametrization. POM is a three-dimensional, primitive equation, numerical model. Its horizontal grid uses curvilinear orthogonal coordinates on a C-grid, and its vertical coordinate is a sigma coordinate. It has a free surface, complete thermodynamics, and second order turbulence closure. Advection schemes use the finite volume approach.

WEB PRODUCTS

On **WWW.SEEVCCC.RS** different products can be found:

- Monthly mean temperature
- Monthly accumulated precipitation
- Monthly temperature anomaly
- Monthly precipitation anomaly
- Seasonal mean temperature
- Seasonal accumulated precipitation
- Seasonal temperature anomaly
- Seasonal precipitation anomaly
- Monthly mean Mediterranean SST
- Diagrams for SEE capital cities



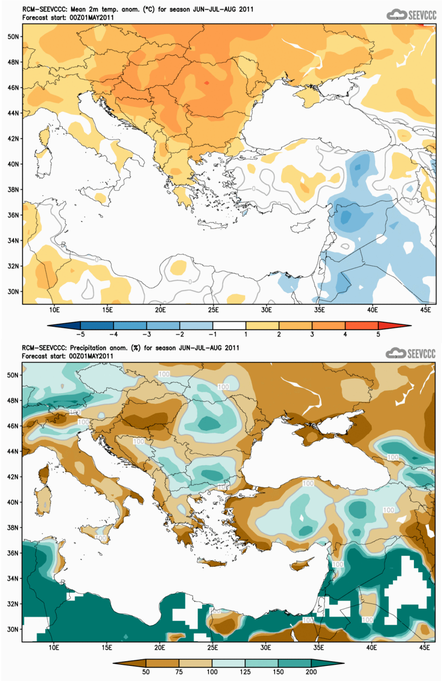


Figure 2. Examples of different products from **WWW.SEEVCCC.RS**.

PRELIMINARY VERIFICATION

SEEVCCC start to implement and develop different tools for seasonal forecast verification. All verification is done on anomalies against 1961-1900 climatology and the main challenge is development of model climatology. Some of preliminary forecast verification is displayed below. From November 2011 SEEVCCC will switch whole system from ECMWF SYSTEM3 to SYSTEM4 input files.

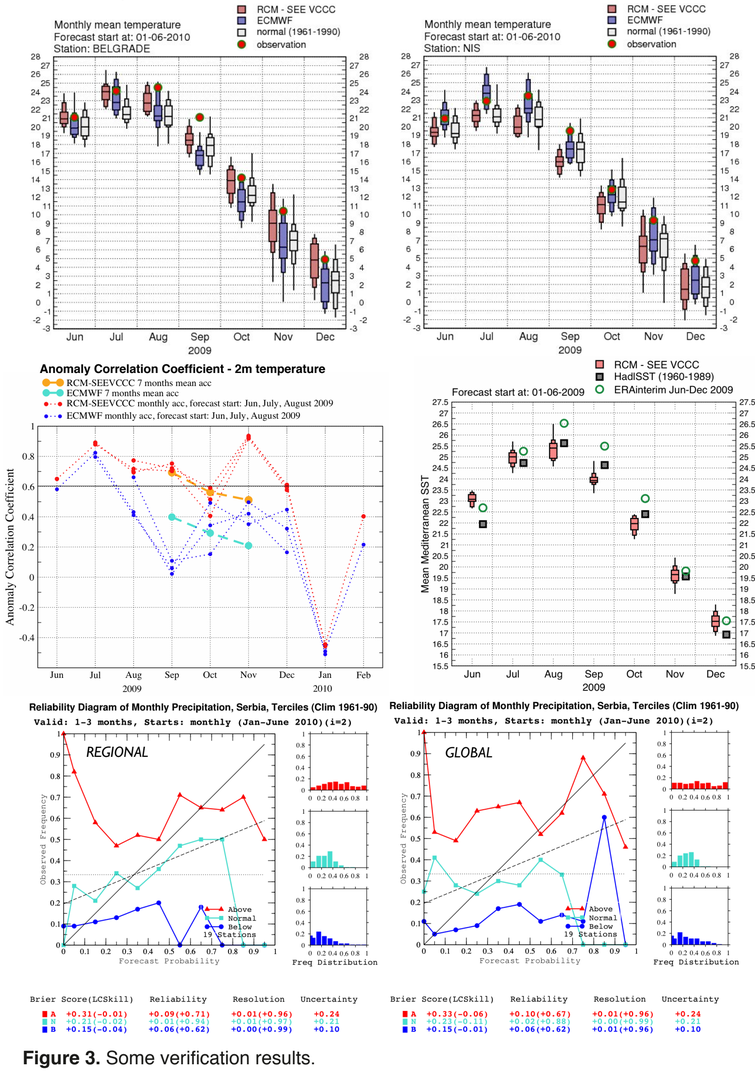


Figure 3. Some verification results.

REFERENCES:
Djurdjevic V. and Rajkovic, B. (2008). Verification of a coupled atmosphere-ocean model using satellite observations over the Adriatic Sea. Annales Geophysicae, 26(7): 1935-1954.
Krzic A, Tosic I, Djurdjević V, Veljović K, Rajković B (2011) Changes in climate indices for Serbia according to the SRES-A1B and SRES-A2 scenarios. Clim Res 49:73-86