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Validation of RegCM simulation of temperature and precipitation over Republic of Moldova and projected changes under A1B scenario

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■ **Abstract**. We validate the ability of the regional climatic model RegCM to simulate seasonal precipitation over the Republic of Moldova. The RegCM simulations were conducted at a horizontal resolution of 10 km in the framework of EU-FP6 project – CECILIA. The domain was centered over Romania at 46ºN, 25ºE and included the Republic of Moldova. The model simulations forced by ERA40 were compared with the observations from CRU TS2.1 dataset and station observations. The validation period is 1960-1997. First, we compare the annual cycle of precipitation based on RegCM simulations with the corresponding values calculated from CRU TS2.1 land observation data set and from observations at 15 representative stations from Republic of Moldova. Then, the maps of mean seasonal precipitation for simulation and CRU data are compared. Both the simulated and CRU data are downscaled at station locations and compared with station data in terms of means and standard deviation of seasonal precipitation totals.

■Data description and methods

➢ We used monthly temperature means and precipitation totals simulated with the Beta version of the regional climatic model ICTP_RegCM3 at a horizontal resolution of 10 km.

➢The RegCM simulations conducted in CECILIA-FP6 Project covered a domain centered over Romania (46ºN, 25ºE) including Republic of Moldova (45.01ºN-49.01ºN; 26.52ºE-30.48ºE) (Boroneat et al., 2011; Halenka 2010).

➢The CRU TS2.10 land observation data set has been used to validate both the RegCM temperature and precipitation simulations. The horizontal resolution of CRU TS2.10 data set is 0.5ºlat x 0.5ºlon.

➢The monthly temperature and precipitation simulations have been also validated against observations recorded at 15 meteorological stations of Moldova's State Hydrometeorological Service .

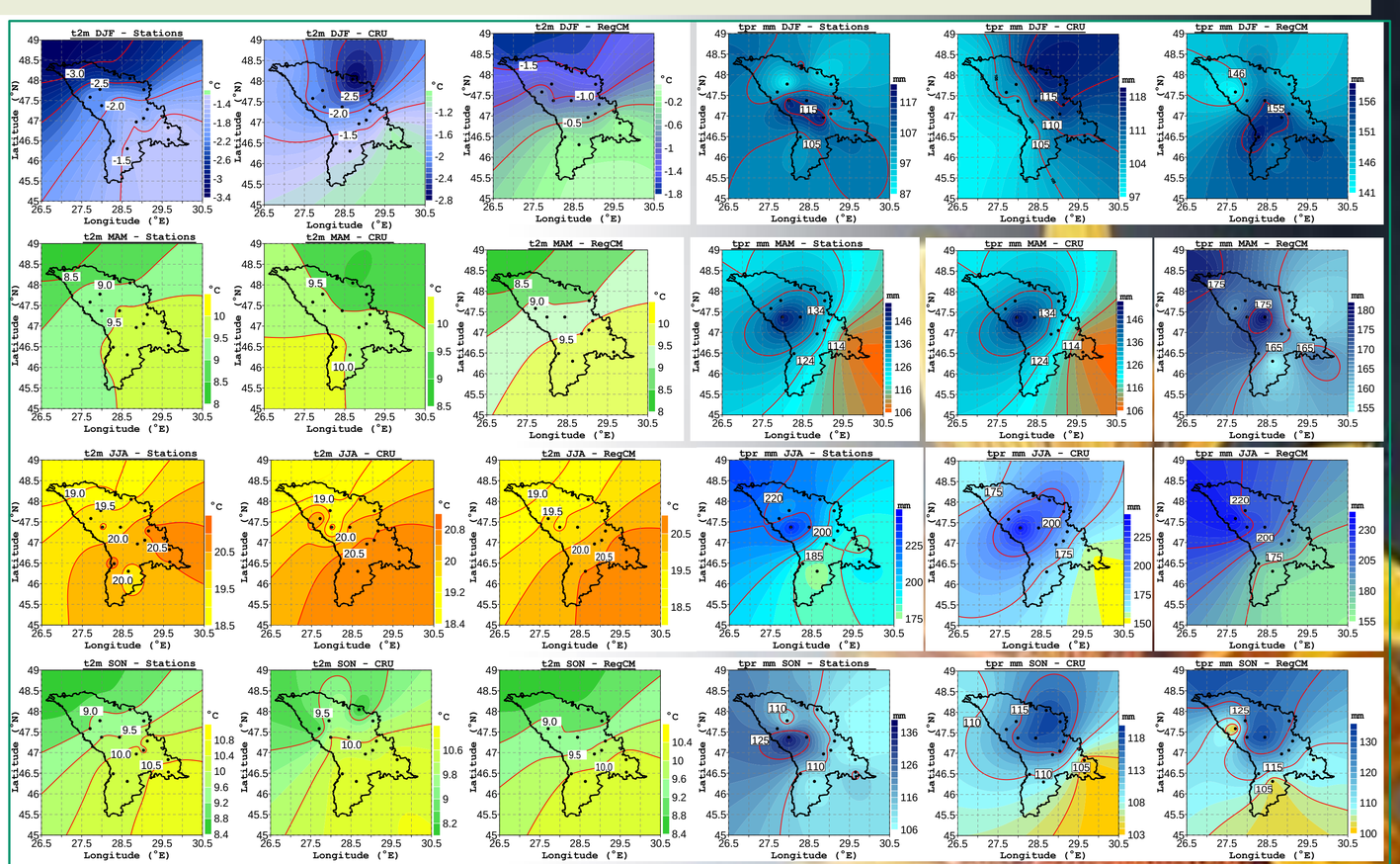
➢We validate the model ability to simulate seasonal temperature and precipitation over the Republic of Moldova domain (Box 1).

➢The bias correction has been calculated as a difference (ratio) between the temperature (precipitation) mean of the RegCM control run forced by the ECHAM5 GCM and the RegCM forced by the ERA40 for the reference period 1961-1990. The corrections have then been applied to each value of grid point time series (Boxs 2-3).

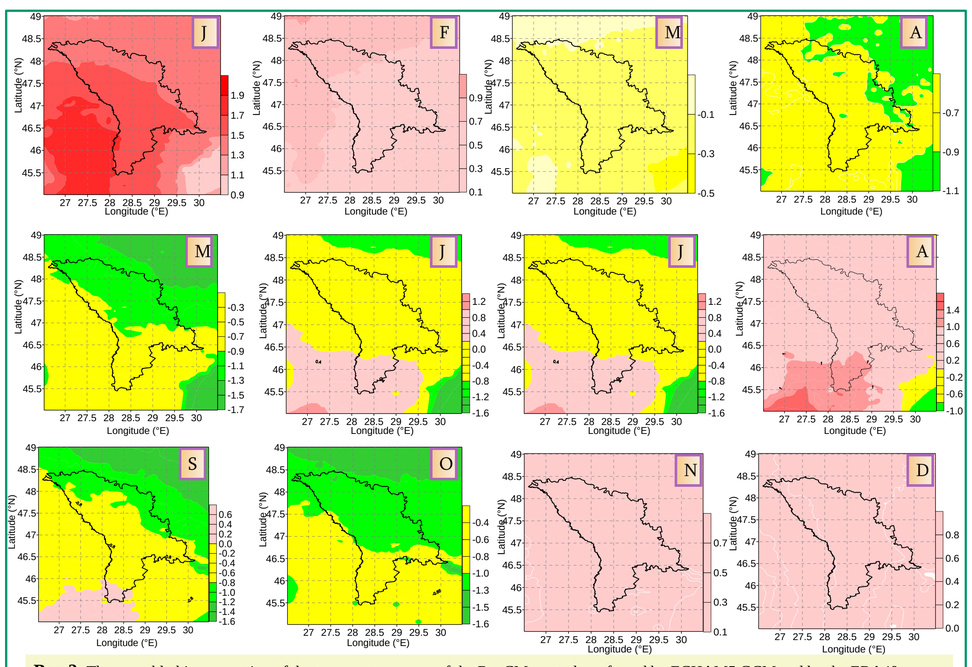
➢The RegCM simulations (control and scenario runs) forced with the ECHAM GCM have been corrected against the systematic errors induced by the GCM.

➢Projected changes in seasonal mean air temperatures (Box 4) and precipitation (Box 5) for the control run (1961-1990) and for the periods 2021-2050 and 2071-2100.

➢The simulations were driven by ERA40 double nested from 25 km RegCM run for the period 1960-1997 and by the ECHAM driven RegCM run at 25 km for the time slices 1961-1990 (control run) and 2021 -2050 and 2071-2100 (A1B scenario runs) (Boxs 6-7).

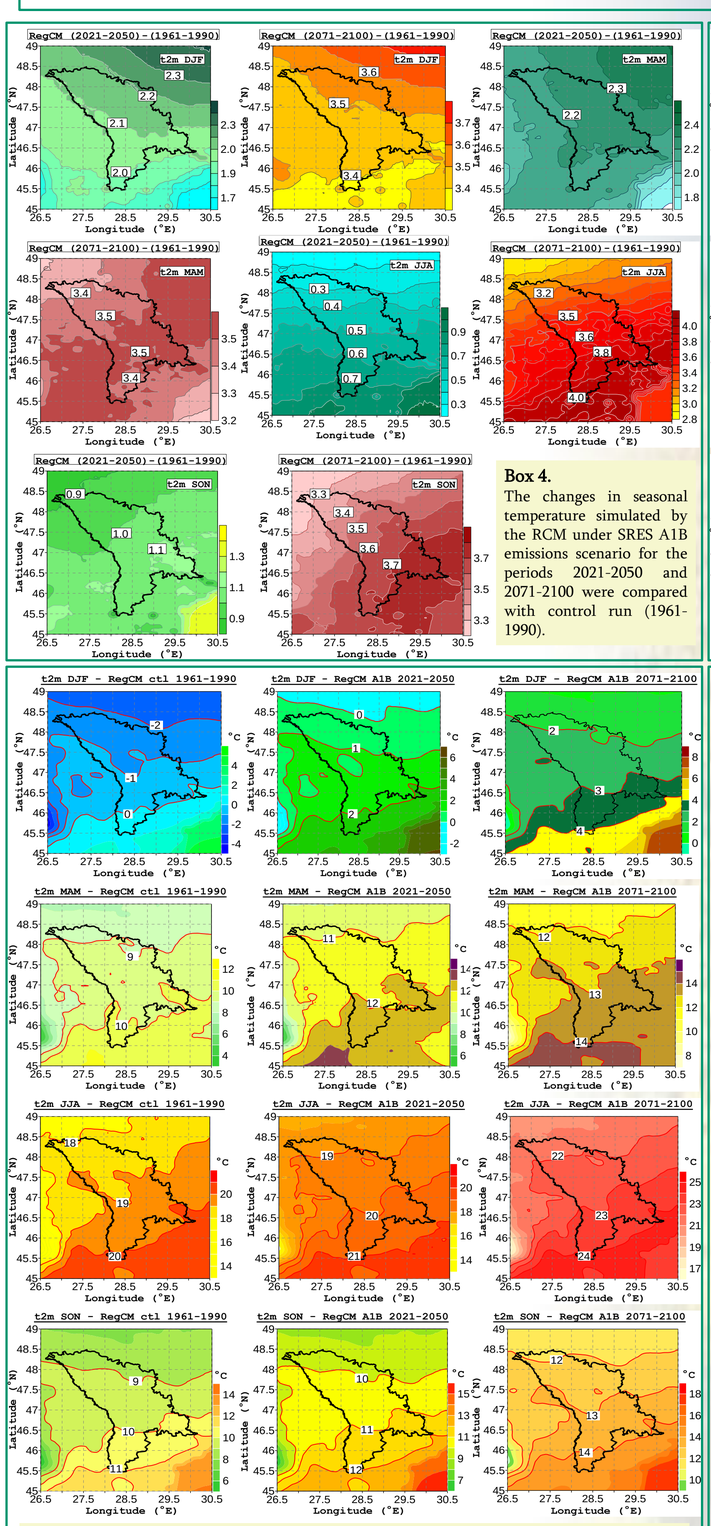


Box 1. The maps of mean seasonal air temperature and precipitation for simulation (RegCM3) and CRU TS2.1 data (0.5ºlat x 0.5ºlon) and station observations. The validation period is 1960-1997.

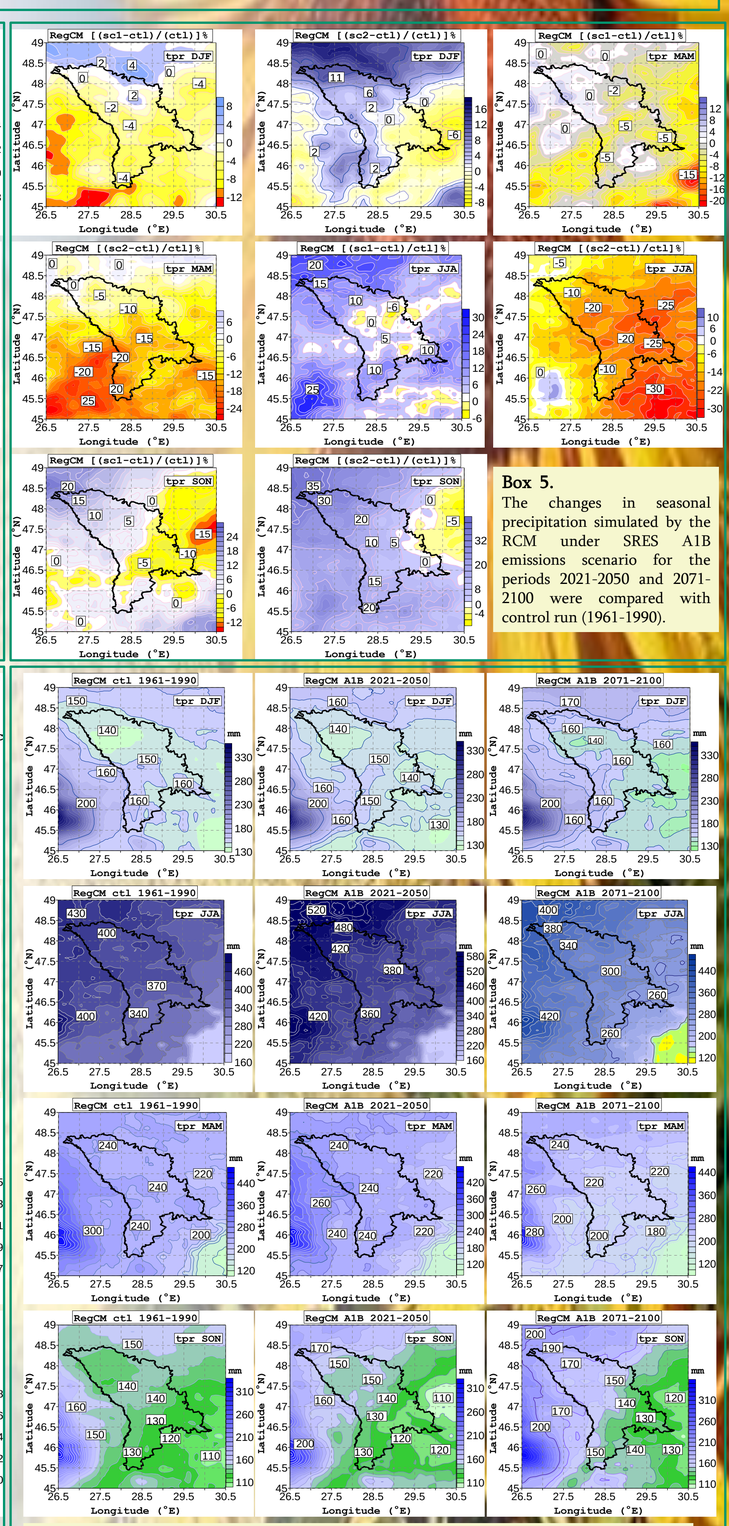


Box 2. The monthly bias correction of the temperature mean of the RegCM control run forced by ECHAM5 GCM and by the ERA40 run for the reference period 1961-1990

Box 3. The monthly bias correction of the precipitation totals of the RegCM control run forced by the ECHAM5 GCM and by the ERA40 run for the reference period 1961-1990



Box 4. The changes in seasonal temperature simulated by the RCM under SRES A1B emissions scenario for the periods 2021-2050 and 2071-2100 were compared with control run (1961-1990).



Box 5. The changes in seasonal precipitation simulated by the RCM under SRES A1B emissions scenario for the periods 2021-2050 and 2071-2100 were compared with control run (1961-1990).

Box 6.
Maps of the seasonal temperature means simulations by RegCM3 at a horizontal resolution of 10 km for the control simulation of the present climate (1961-1990) and a scenario simulation of future climate (under SRES A1B scenario for 2021-2050 and 2071-2100 periods)

Box 7.
Maps of the seasonal precipitation totals simulations by RegCM3 at a horizontal resolution of 10 km for the control simulation of the present climate (1961-1990) and a scenario simulation of future climate (under SRES A1B scenario for 2021-2050 and 2071-2100 periods)

■Conclusions

➢The results show that the model does quite well in representing the annual cycle of temperature but precipitation totals are systematically overestimated compared both to stations and CRU data. This feature is transferred to SPI which is based only on precipitation. Consequently, the model underestimates the severity of droughts.

➢The temperatures projected by the A1B scenario runs will increase compared to the control run. The temperatures are projected to increase by the end of the 21st century compared to the mid 21st century and to the reference period 1961-1990.

➢ The precipitation totals are projected to slightly decrease in autumn, winter and spring and increase in summer during the period 2021-2050. Significant decrease of precipitation is projected for summer during the period 2071-2100.

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