Analysis of precipitation-related climate indices projected for Central/Eastern Europe using bias-corrected ENSEMBLES simulations

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ABSTRACT

In order to build regional adaptation and mitigation strategies, global climate model (GCM) simulation results must be downscaled for local analysis, which can better serve agriculture-related end-users' needs. This is especially important in case of precipitation due to the large temporal and spatial variability. Furthermore, both the high potential risks of drought events on agricultural production, and the possible flood events sometimes resulting in inland water covered areas for longer or shorter periods, also highlight the importance of this issue.

On the base of evaluating raw RCM precipitation outputs of ENSEMBLES model experiments for 1951-2000 and comparing to the E-OBS datasets containing gridded daily precipitation values (Haylock et al., 2008), simulated values usually significantly overestimate the observations in the Carpathian Basin, except in summer when mostly underestimations were found (Pongracz et al., 2011). These biases of the raw RCM outputs are corrected using the monthly empirical distribution functions by fitting to the observed distribution (Formayer & Haas, 2009). Then, the calculated bias correcting factors are applied to the outputs of RCM experiments for the future 2000-2100 period taking into account the SRES A1B emission scenario (Nakicenovic & Swart, 2000), according to which CO_2 concentration by 2100 is estimated to exceed 700 ppm (more than twice of the preindustrial level). Finally, time series of precipitation-related climate indices (Karl et al., 1999) are calculated from the corrected precipitation data sets for each grid point. Projected seasonal changes by 2071-2100 are determined relative to the 1961-1990 reference period and presented in this poster.

Index		Definition	Unit
CDD	Consecutive dry days	max(k)[R_{ij} < 1 mm)], k length	day
RR1	Number of precipitation days exceeding 1 mm	$R_{ij} \geq 1$ mm	day
RR10	Number of heavy precipitation days	$R_{ij} \geq 10$ mm	day
RX1	Highest 1-day precipitation amount	max (R_{ij})	mm
SDII	Simple daily intensity index	$R_{ij} \geq$RR1	mm/day

ENSEMBLES outputs (http://ensembles-eu.metoffice.com) for 1951-2100 using SRES A1B scenario

Horizontal resolution of all RCM experiments: 25 km (van der Linden & Mitchell, 2009) The table lists the RCM experiments used in this analysis focusing on the Carpathian basin (i.e., Hungary and its vicinity), the responsible institutes, and the driving GCMs

Institute	Driving global model	Regional model
HC (Hadley Centre, United Kingdom Met Office)	HadCM3Q0	HadRM3Q0
ETHZ (Swiss Federal Institute of Technology Zurich)	HadCM3Q0	CLM
C4I (Community Climate Change Consortium)	HadCM3Q16	RCA3
SMHI (Swedish Meteorological and Hydrological Institute)	HadCM3Q3	RCA
	ECHAM4-r1	RCA
ICTP (International Centre of Theoretical Physics)	ECHAM5-r3	RegCM
KNMI (Royal Netherlands Meteorological institute)	ECHAM5-r3	RACMO
MPI (Max-Planck-Institut for Meteorologie)	ECHAM-r3	REMO
DMI (Danish Meteorological Institute)	ARPEGE	HIRHAM5
	ECHAM5-r3	HIRHAM5
CNRM (Centre National de la Recherche Scientifique)	ARPEGE_RM.1	ALADIN

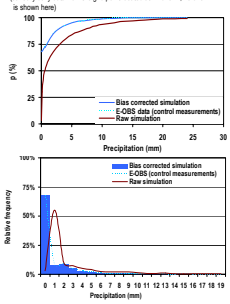
Estimated CO_2-level according to the applied A1B scenario by 2050: 532 ppm, by 2100: 717 ppm based on Nakicenovic & Swart (2000)

Driving GCMs: ECHAM (MPI-M, DE) - Roeckner et al. (2006)
HadCM3Q (UKMO, UK) - Gordon et al. (2000); Rowell (2005)
ARPEGE (CNRM, FR) - Déqué et al. (1998)

List of the precipitation-related climate indices used in this analysis

Bias correction of raw simulation data: 1951-2000

(January daily data from the grid point located at 47.625°N, 19.625°E is shown here)



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SUMMARY OF THE RESULTS --- PROJECTED SEASONAL CHANGES (%) BY 2071-2100 RELATIVE TO 1961-1990 REFERENCE PERIOD

Composite maps (on the left) are determined from the average of 3 groups of RCM experiments driven by the same GCM. Spatial mean changes (on the right) for each experiment take into account the grid points located within the boundary of the subregion, and significant changes (at 0.05 level) are indicated by filled symbols and summarized at the bottom.