Influence of various parameters INM RAS climate model on the extreme precipitation simulation

Maria Tarasevich¹, Evgeny Volodin²

¹Moscow Institute of Physics and Technology

²Marchuk Institute of Numerical Mathematics of the Russian Academy of Sciences

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Introduction

- Extreme weather simulation is one way to compare climate models.¹
- INMCM4 and INMCM5 differ in the parametrization of cloudiness and condensation.
- The models comparison shows that precipitation related parameters need to be tuned.
- Precipitation impacting factors: falling precipitation evaporation in the upper atmosphere, vertical mixing of horizontal velocity components, air resistance acting on falling precipitation particles.

¹*Karl, T., and D. Easterling* (1999), Climate extremes: Selected review and future research directions, Clim. Chang., 42, 309–325.

Vertical mixing of horizontal velocities

Name, units	Label	INMCM4	INMCM5	$A_0 = 7.5$
Max 1 day precipitation, mm	RX1day	19.5	23.1	21.2
Max 5 day precipitation, mm	RX5day	32.1	48.1	44.4
Simple daily intensity, mm	SDII	1.66	1.53	1.53
Number of wet days	R1mm	42.1	38.1	37.9
Heavy precipitation days	R10mm	25.6	21.3	19.8
Very heavy precipitation days	R20mm	8.08	5.93	6.17
Very wet days precipitation, mm	R95p	141	167	167
Extremely wet days precipitation, mm	R99p	72.5	90.8	86.9
Total wet-day precipitation, mm	PRCPTOT	462	416	407

RMSE for precipitation-related indices between the specified models and the ERA Interim reanalysis

Air resistance

- Air-water mix is considered instead of precipitation particles falling through the air.
- The atmosphere dynamic equations include additional density: $\rho = \rho_{\rm air} + \rho_{\rm prec}.$
- Here the additional density is obtained as $\rho_{\text{prec}} = \frac{F_{\text{prec}}}{W_{\text{prec}}}$.
- *w*_{prec} is chosen empirically.
- Taking air resistance into account gives more significant improvement than adjusting vertical mixing parameters.