



Supplement of

Evaluation of regional climate models ALARO-0 and REMO2015 at 0.22° resolution over the CORDEX Central Asia domain

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ALARO-0 **REMO** rotated pole 0.22° projection resolution Lambert conical projection 0.22° 2nd order finite differences on staggered spectral on collocated grid horizontal spatial discretisation C-grid vertical coordinate 46 hybrid levels 27 hybrid levels levels temporal semi-implicit semi-Lagrangian leap-frog with semi-implicit correction and discretisation Asselin filter, semi-Lagrangian advection time step 450 s 120 s 3MT scheme convective scheme Tiedtke with modifications after Nordeng and Pfeifer (Pfeifer, 2006) radiation scheme The Action de Recherche Petite Echelle Grande Morcrette et al. (1986) and Giorgetta and Echell (ARPEGE) Calcul Radiatif Wild (1995) avec Nebulosité (ACRANEB) scheme for radiation turbulence vertical A pseudoprognostic turbulent kinetic energy Louis-type with a higher order closure diffusion (pTKE) scheme (i.e., a Louis-type scheme for scheme for the transfer coefficients of stability dependencies, but with memory, momentum, heat, moisture and cloud water advection, and autodiffusion of the overall within and above the planetary boundary intensity of turbulence) layer. Eddy diffusion coefficients are calculated as functions of the turbulent kinetic energy. cloud microphysics statistical sedimentation scheme for The cloud microphysical scheme by А scheme precipitation within a prognostic-type scheme for Lohmann and Roeckner (1996). microphysics. land surface scheme The Interaction Sol-Biosphère-Atmosphère Based on the surface runoff scheme (ISBA) scheme (Hagemann, 2002), inland glaciers (Kotlarski, 2007), vegetation and phenology (Rechid, 2009) **RMIB-UGent** HZG-GERICS (https://remo-rcm.de/) institute

Table S1: Overview of the model specifications for the ALARO-0 and REMO RCM experiments used for this study.



5 Figure S1: Difference between absolute value of bias and observational spread for the variable mean temperature (°C) of RCMs REMO and ALARO-0.



Figure S2: Difference between absolute value of bias and observational spread for the variable minimum temperature (°C) of RCMs REMO and ALARO-0.



Figure S3: Difference between absolute value of bias and observational spread for the variable maximum temperature (°C) of RCMs REMO and ALARO-0.



15 Figure S4: Absolute difference between the average seasonal and annual CRU precipitation (mm month⁻¹) and the precipitation simulated by REMO and ALARO-0 over the 1980-2017 period.

20 Table S2: Climatological mean CRU precipitation (mm month⁻¹) for the 1980-2017 period over the CAS-CORDEX domain and subdomains, and absolute biases (mm month⁻¹) and MAE (mm month⁻¹) against CRU for the RCMs (REMO and ALARO-0), and the other reference datasets (ERA-Interim, MW and GPCC).

			EEU					WSB					ESB		
	DJF	MAM	JJA	SON	Annual	DJF	MAM	JJA	SON	Annual	DJF	MAM	JJA	SON	Annual
CRU	34.91	34.16	55.26	45.62	42.51	22.74	27.99	51.53	35.94	34.60	11.13	22.10	72.28	29.62	33.90
REMO - CRU	4.18	6.83	4.02	4.31	4.84	3.73	7.10	6.72	4.96	5.64	3.33	14.01	5.73	6.35	7.38
MAE REMO CRU	5.62	7.86	8.64	5.61	5.62	6.23	9.83	10.73	7.69	7.31	5.18	15.00	11.37	9.09	8.88
ALARO - CRU	7.45	3.95	5.50	8.33	6.29	4.55	0.90	-2.21	6.05	2.30	3.91	-0.26	-13.52	6.08	-0.99
MAE ALARO CRU	8.04	5.72	10.58	8.73	7.18	5.93	4.66	8.11	7.59	4.85	5.24	5.14	18.38	8.65	5.96
ERA-Interim - CRU	4.49	6.53	5.75	3.98	5.19	3.99	7.46	8.35	5.50	6.34	3.26	12.61	8.19	9.07	8.30
MAE ERA-Interim CRU	5.18	6.59	6.62	4.46	5.33	4.80	8.47	9.41	6.10	6.97	4.08	12.88	11.21	9.71	8.84
MW - CRU	-3.69	-2.33	-3.69	-2.89	-3.14	-1.75	-1.47	-4.13	-2.00	-2.34	-0.42	-3.42	-9.59	-2.72	-4.05
MAE MW CRU	4.49	3.07	4.44	4.49	4.49	3.48	3.69	6.10	3.48	3.48	2.09	4.42	11.04	2.09	2.09
GPCC - CRU	-8.21	-5.23	-4.05	-5.19	-5.65	-2.70	-3.19	-1.81	-2.81	-2.63	-0.81	-4.59	-6.57	-3.72	-3.94
MAE GPCC CRU	8.82	5.68	5.85	8.82	8.82	4.88	5.02	4.70	4.88	4.88	2.38	5.15	8.24	2.38	2.38
			WCA					TIB				CA	\S-CORDE	X	
	DJF	MAM	WCA JJA	SON	Annual	DJF	MAM	TIB JJA	SON	Annual	DJF	C# MAM	AS-CORDE JJA	EX SON	Annual
CRU	DJF 33.18	MAM 37.52	WCA JJA 16.74	SON 18.45	Annual 26.46	DJF 8.12	MAM 17.73	TIB JJA 48.56	SON 15.02	Annual 22.45	DJF 22.60	CA MAM 32.34	AS-CORDE JJA 64.75	EX SON 35.50	Annual 38.88
CRU REMO - CRU	DJF 33.18 5.77	MAM 37.52 -3.59	WCA JJA 16.74 -3.20	SON 18.45 3.24	Annual 26.46 0.53	DJF 8.12 21.07	MAM 17.73 34.40	TIB JJA 48.56 15.23	SON 15.02 28.07	Annual 22.45 24.70	DJF 22.60 6.55	C# MAM 32.34 12.45	AS-CORDE JJA 64.75 2.47	EX SON 35.50 6.98	Annual 38.88 7.12
CRU REMO - CRU MAE REMO CRU	DJF 33.18 5.77 17.57	MAM 37.52 -3.59 16.96	WCA JJA 16.74 -3.20 7.87	SON 18.45 3.24 8.51	Annual 26.46 0.53 11.32	DJF 8.12 21.07 24.04	MAM 17.73 34.40 39.38	TIB JJA 48.56 15.23 32.92	SON 15.02 28.07 30.72	Annual 22.45 24.70 30.47	DJF 22.60 6.55 10.85	Cr MAM 32.34 12.45 18.88	AS-CORDE JJA 64.75 2.47 18.13	EX SON 35.50 6.98 12.80	Annual 38.88 7.12 13.56
CRU REMO - CRU MAE REMO CRU ALARO - CRU	DJF 33.18 5.77 17.57 -0.71	MAM 37.52 -3.59 16.96 -1.75	WCA JJA 16.74 -3.20 7.87 -3.00	SON 18.45 3.24 8.51 1.61	Annual 26.46 0.53 11.32 -0.96	DJF 8.12 21.07 24.04 2.15	MAM 17.73 34.40 39.38 6.37	TIB JJA 48.56 15.23 32.92 6.85	SON 15.02 28.07 30.72 5.64	Annual 22.45 24.70 30.47 5.26	DJF 22.60 6.55 10.85 5.04	Cz MAM 32.34 12.45 18.88 6.14	AS-CORDE JJA 64.75 2.47 18.13 0.74	EX SON 35.50 6.98 12.80 7.82	Annual 38.88 7.12 13.56 4.93
CRU REMO - CRU MAE REMO CRU ALARO - CRU MAE ALARO CRU	DJF 33.18 5.77 17.57 -0.71 11.24	MAM 37.52 -3.59 16.96 -1.75 11.63	WCA JJA 16.74 -3.20 7.87 -3.00 11.06	SON 18.45 3.24 8.51 1.61 8.09	Annual 26.46 0.53 11.32 -0.96 9.13	DJF 8.12 21.07 24.04 2.15 7.83	MAM 17.73 34.40 39.38 6.37 16.36	TIB JJA 48.56 15.23 32.92 6.85 32.96	SON 15.02 28.07 30.72 5.64 12.83	Annual 22.45 24.70 30.47 5.26 16.29	DJF 22.60 6.55 10.85 5.04 8.31	Cz MAM 32.34 12.45 18.88 6.14 12.75	AS-CORDE JJA 64.75 2.47 18.13 0.74 19.82	EX SON 35.50 6.98 12.80 7.82 11.69	Annual 38.88 7.12 13.56 4.93 11.41
CRU REMO - CRU MAE REMO CRU ALARO - CRU MAE ALARO CRU ERA-Interim - CRU	DJF 33.18 5.77 17.57 -0.71 11.24 6.90	MAM 37.52 -3.59 16.96 -1.75 11.63 10.79	WCA JJA 16.74 -3.20 7.87 -3.00 11.06 12.85	SON 18.45 3.24 8.51 1.61 8.09 7.02	Annual 26.46 0.53 11.32 -0.96 9.13 9.41	DJF 8.12 21.07 24.04 2.15 7.83 4.76	MAM 17.73 34.40 39.38 6.37 16.36 20.81	TIB JJA 48.56 15.23 32.92 6.85 32.96 30.60	SON 15.02 28.07 30.72 5.64 12.83 10.98	Annual 22.45 24.70 30.47 5.26 16.29 16.86	DJF 22.60 6.55 10.85 5.04 8.31 4.88	Cz MAM 32.34 12.45 18.88 6.14 12.75 12.37	AS-CORDE JJA 64.75 2.47 18.13 0.74 19.82 12.50	EX SON 35.50 6.98 12.80 7.82 11.69 7.61	Annual 38.88 7.12 13.56 4.93 11.41 9.37
CRU REMO - CRU MAE REMO CRU ALARO - CRU MAE ALARO CRU ERA-Interim - CRU MAE ERA-Interim CRU	DJF 33.18 5.77 17.57 -0.71 11.24 6.90 10.46	MAM 37.52 -3.59 16.96 -1.75 11.63 10.79 14.20	WCA JJA 16.74 -3.20 7.87 -3.00 11.06 12.85 15.02	SON 18.45 3.24 8.51 1.61 8.09 7.02 8.85	Annual 26.46 0.53 11.32 -0.96 9.13 9.41 11.13	DJF 8.12 21.07 24.04 2.15 7.83 4.76 7.88	MAM 17.73 34.40 39.38 6.37 16.36 20.81 23.20	TIB JJA 48.56 15.23 32.92 6.85 32.96 30.60 39.94	SON 15.02 28.07 30.72 5.64 12.83 10.98 13.36	Annual 22.45 24.70 30.47 5.26 16.29 16.86 19.98	DJF 22.60 6.55 10.85 5.04 8.31 4.88 6.85	Cz MAM 32.34 12.45 18.88 6.14 12.75 12.37 14.00	AS-CORDE JJA 64.75 2.47 18.13 0.74 19.82 12.50 17.27	EX SON 35.50 6.98 12.80 7.82 11.69 7.61 9.50	Annual 38.88 7.12 13.56 4.93 11.41 9.37 11.08
CRU REMO - CRU MAE REMO CRU ALARO - CRU MAE ALARO CRU ERA-Interim - CRU MAE ERA-Interim CRU MW - CRU	DJF 33.18 5.77 17.57 -0.71 11.24 6.90 10.46 -1.22	MAM 37.52 -3.59 16.96 -1.75 11.63 10.79 14.20 -2.98	WCA JJA 16.74 -3.20 7.87 -3.00 11.06 12.85 15.02 -0.33	SON 18.45 3.24 8.51 1.61 8.09 7.02 8.85 1.20	Annual 26.46 0.53 11.32 -0.96 9.13 9.41 11.13 -0.83	DJF 8.12 21.07 24.04 2.15 7.83 4.76 7.88 1.11	MAM 17.73 34.40 39.38 6.37 16.36 20.81 23.20 0.53	TIB JJA 48.56 15.23 32.92 6.85 32.96 30.60 39.94 4.14	SON 15.02 28.07 30.72 5.64 12.83 10.98 13.36 3.07	Annual 22.45 24.70 30.47 5.26 16.29 16.86 19.98 2.21	DJF 22.60 6.55 10.85 5.04 8.31 4.88 6.85 -1.28	Cz MAM 32.34 12.45 18.88 6.14 12.75 12.37 14.00 -1.25	AS-CORDE JJA 64.75 2.47 18.13 0.74 19.82 12.50 17.27 -1.75	EX SON 35.50 6.98 12.80 7.82 11.69 7.61 9.50 -0.84	Annual 38.88 7.12 13.56 4.93 11.41 9.37 11.08 -1.28
CRU REMO - CRU MAE REMO CRU ALARO - CRU MAE ALARO CRU ERA-Interim - CRU MAE ERA-Interim CRU MW - CRU MAE MW CRU	DJF 33.18 5.77 17.57 -0.71 11.24 6.90 10.46 -1.22 9.75	MAM 37.52 -3.59 16.96 -1.75 11.63 10.79 14.20 -2.98 9.57	WCA JJA 16.74 -3.20 7.87 -3.00 11.06 12.85 15.02 -0.33 5.00	SON 18.45 3.24 8.51 1.61 8.09 7.02 8.85 1.20 9.75	Annual 26.46 0.53 11.32 -0.96 9.13 9.41 11.13 -0.83 9.75	DJF 8.12 21.07 24.04 2.15 7.83 4.76 7.88 1.11 6.13	MAM 17.73 34.40 39.38 6.37 16.36 20.81 23.20 0.53 9.50	TIB JJA 48.56 15.23 32.92 6.85 32.96 30.60 39.94 4.14 20.30	SON 15.02 28.07 30.72 5.64 12.83 10.98 13.36 3.07 6.13	Annual 22.45 24.70 30.47 5.26 16.29 16.86 19.98 2.21 6.13	DJF 22.60 6.55 10.85 5.04 8.31 4.88 6.85 -1.28 4.56	Cz MAM 32.34 12.45 18.88 6.14 12.75 12.37 14.00 -1.25 6.08	AS-CORDE JJA 64.75 2.47 18.13 0.74 19.82 12.50 17.27 -1.75 11.10	EX SON 35.50 6.98 12.80 7.82 11.69 7.61 9.50 -0.84 4.56	Annual 38.88 7.12 13.56 4.93 11.41 9.37 11.08 -1.28 4.56
CRU REMO - CRU MAE REMO CRU ALARO - CRU MAE ALARO CRU ERA-Interim - CRU MAE ERA-Interim CRU MW - CRU MAE MW CRU	DJF 33.18 5.77 17.57 -0.71 11.24 6.90 10.46 -1.22 9.75 0.08	MAM 37.52 -3.59 16.96 -1.75 11.63 10.79 14.20 -2.98 9.57 -2.50	WCA JJA 16.74 -3.20 7.87 -3.00 11.06 12.85 15.02 -0.33 5.00 -1.21	SON 18.45 3.24 8.51 1.61 8.09 7.02 8.85 1.20 9.75 -0.38	Annual 26.46 0.53 11.32 -0.96 9.13 9.41 11.13 -0.83 9.75 -1.01	DJF 8.12 21.07 24.04 2.15 7.83 4.76 7.88 1.11 6.13 -0.74	MAM 17.73 34.40 39.38 6.37 16.36 20.81 23.20 0.53 9.50 -3.08	TIB JJA 48.56 15.23 32.92 6.85 32.96 30.60 39.94 4.14 20.30 -2.11	SON 15.02 28.07 30.72 5.64 12.83 10.98 13.36 3.07 6.13 -0.30	Annual 22.45 24.70 30.47 5.26 16.29 16.86 19.98 2.21 6.13 -1.57	DJF 22.60 6.55 10.85 5.04 8.31 4.88 6.85 -1.28 4.56 -1.65	Cz MAM 32.34 12.45 18.88 6.14 12.75 12.37 14.00 -1.25 6.08 -2.65	AS-CORDE JJA 64.75 2.47 18.13 0.74 19.82 12.50 17.27 -1.75 11.10 -0.92	EX SON 35.50 6.98 12.80 7.82 11.69 7.61 9.50 -0.84 4.56 -1.89	Annual 38.88 7.12 13.56 4.93 11.41 9.37 11.08 -1.28 4.56 -1.77



Figure S5: Difference between absolute bias and observational spread for the variable precipitation of RCMs REMO and ALARO-0.



30 Figure S6: Absolute difference between the average seasonal and annual ERA-Interim precipitation (mm month⁻¹) and the precipitation simulated by REMO and ALARO-0 over the 1980-2017 period.

Table S3: Overview of the identifiers on the ESGF data platform (data node: esgf1.dkrz.de) of the used ALARO-0 and REMO RCM35climate data.

Data	Identifier	PID
ALARO-0		,
precipitation	cordex.output.CAS-22.RMIB-UGent.ECMWF-	7
	ERAINT.evaluation.r1i1p1.ALARO-0.v1.mon.pr	
temperature	cordex.output.CAS-22.RMIB-UGent.ECMWF-	/
	ERAINT.evaluation.r1i1p1.ALARO-0.v1.mon.tas	
minimum	cordex.output.CAS-22.RMIB-UGent.ECMWF-	7
temperature	ERAINT.evaluation.r1i1p1.ALARO-0.v1.mon.tasmin	
maximum	cordex.output.CAS-22.RMIB-UGent.ECMWF-	/
temperature	ERAINT.evaluation.r1i1p1.ALARO-0.v1.mon.tasmax	
REMO		
precipitation	cordex.output.CAS-22.GERICS.ECMWF-	hdl:21.14103/2ecffe86-b5e4-359c-8c34-
	ERAINT.evaluation.r1i1p1.REMO2015.v1.day.pr	e7152de17a43
temperature	cordex.output.CAS-22.GERICS.ECMWF-	hdl:21.14103/bf8468cf-b15c-3a20-ae42-
	ERAINT.evaluation.r1i1p1.REMO2015.v1.day.tas	4c42b14e749c
minimum	cordex.output.CAS-22.GERICS.ECMWF-	hdl:21.14103/74aa90a5-c99b-35f9-888e-
temperature	ERAINT.evaluation.r1i1p1.REMO2015.v1.day.tasmin	acc0115dfc4d
maximum	cordex.output.CAS-22.GERICS.ECMWF-	hdl:21.14103/a72e5ea1-533d-3685-b04d-
temperature	ERAINT.evaluation.r1i1p1.REMO2015.v1.sem.tasmax	5e4ab162e065

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