



Supplement of

HCPD-CA: high-resolution climate projection dataset in central Asia

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Table S1 Land use categories in the HCPD-CA dataset

Land use category	Land use description
1	Evergreen needleleaf forest
2	Evergreen broadleaf forest
3	Deciduous needleleaf forest
4	Deciduous broadleaf forest
5	Mixed forest
6	Closed shrublands
7	Open shrublands
8	Woody savannas
9	Savannas
10	Grasslands
11	Permanent wetland
12	Croplands
13	Urban and build-up
14	Cropland/natural vegetation mosaic
15	Snow and ice
16	Barren or sparsely vegetated
17	Water
18	Wooded tundra
19	Mixed Tundra
20	Barren Tundra
21	Lakes

Table S2 Soil categories in the HCPD-CA dataset

Soil category	Soil description
1	Sand
2	Loamy sand
3	Sandy loam
4	Silt loam
5	Silt
6	Loam
7	Sandy clay loam
8	Silty clay loam
9	Clay loam
10	Sandy clay
11	Silty clay
12	Clay
13	Organic material
14	Water
15	Bedrock
16	Other (land-ice)

Table S3 Statistic metrics [spatial correlation coefficients (SCCs), mean errors (MEs), and root mean square errors (RMSEs)] of the annual mean variables in the RCM simulations over Central Asia and its climate subregions [northern CA (NCA), middle CA (MCA), southern CA (SCA), and the mountainous areas (MT), see their scopes in Fig. 1c]. The ensemble mean (first number) and the minimum and maximum member (in parentheses) are listed. The metrics are calculated based on the gridded observations (CRU TS v4 and ERA5-Land).

Region	CA	NCA	MCA	SCA	MT
<i>T2MEAN (°C)</i>					
SCC	0.98(0.98, 0.98)	0.73(0.71, 0.77)	0.95(0.95, 0.95)	0.94(0.94, 0.95)	0.93(0.93, 0.93)
ME	0.50(0.10, 0.82)	-0.02(-0.39, 0.21)	0.62(0.19, 1.00)	1.21(0.76, 1.57)	-0.73(-0.97, -0.59)
RMSE	1.34(1.16, 1.52)	1.01(0.93, 1.07)	1.06(0.81, 1.29)	1.42(1.08, 1.73)	2.64(2.55, 2.69)
<i>PREC (mm/day)</i>					
SCC	0.85(0.84, 0.86)	0.90(0.89, 0.91)	0.82(0.82, 0.83)	0.88(0.87, 0.88)	0.44(0.41, 0.46)
ME	-0.09(-0.18, 0.02)	-0.05(-0.18, 0.08)	-0.09(-0.16, 0.02)	-0.08(-0.15, -0.01)	-0.22(-0.39, -0.04)
RMSE	0.39(0.37, 0.41)	0.22(0.20, 0.25)	0.23(0.20, 0.26)	0.25(0.22, 0.28)	1.16(1.14, 1.18)
<i>RH2MEAN (%)</i>					
SCC	0.88(0.88, 0.89)	0.87(0.87, 0.88)	0.85(0.84, 0.87)	0.71(0.70, 0.73)	0.37(0.36, 0.37)
ME	-2.19(-3.78, -0.48)	1.73(-0.27, 3.32)	-1.38(-2.93, 0.63)	-5.83(-7.21, -4.37)	-7.13(-8.31, -5.88)
RMSE	5.81(5.16, 6.39)	3.92(3.13, 4.47)	3.99(3.38, 4.59)	7.57(6.30, 8.78)	10.63(9.61, 11.52)
<i>WS10MEAN (m/s)</i>					
SCC	0.60(0.54, 0.64)	0.67(0.65, 0.69)	0.80(0.74, 0.83)	0.56(0.48, 0.60)	0.03(0.03, 0.03)
ME	0.02(-0.02, 0.05)	0.04(-0.03, 0.15)	-0.03(-0.11, 0.04)	-0.14(-0.26, -0.06)	0.77(0.76, 0.78)
RMSE	0.46(0.45, 0.49)	0.33(0.32, 0.35)	0.27(0.25, 0.30)	0.50(0.47, 0.56)	1.11(1.10, 1.12)
<i>SWD (W/m²)</i>					
SCC	0.97(0.97, 0.97)	0.97(0.97, 0.97)	0.89(0.88, 0.90)	0.94(0.93, 0.94)	0.89(0.89, 0.90)
ME	29.65(27.72, 31.43)	28.32(26.52, 30.21)	29.77(27.54, 31.61)	30.09(28.28, 31.93)	31.60(30.58, 32.55)
RMSE	30.11(28.20, 31.86)	28.52(26.73, 30.39)	30.40(28.19, 32.18)	30.28(28.49, 32.10)	32.67(31.61, 33.64)
<i>LWD (W/m²)</i>					
SCC	0.98(0.97, 0.98)	0.92(0.91, 0.94)	0.94(0.93, 0.95)	0.92(0.92, 0.93)	0.90(0.90, 0.90)
ME	-5.38(-8.60, -3.46)	-6.87(-10.35, -4.74)	-4.62(-7.91, -2.65)	-3.42(-6.63, -1.82)	-11.54(-13.65, -9.57)
RMSE	7.73(6.36, 10.04)	7.58(5.75, 10.71)	6.06(4.69, 8.61)	5.40(4.20, 7.72)	17.09(15.68, 18.64)
<i>PSFC (hPa)</i>					
SCC	1.00(1.00, 1.00)	1.00(1.00, 1.00)	1.00(1.00, 1.00)	0.99(0.99, 0.99)	0.99(0.99, 0.99)
ME	-0.39(-0.54, -0.16)	-0.33(-0.65, 0.10)	-0.49(-0.64, -0.23)	-0.02(-0.28, 0.14)	-1.18(-1.41, -0.98)
RMSE	4.59(4.58, 4.60)	3.12(3.10, 3.15)	2.99(2.94, 3.02)	4.00(3.98, 4.01)	11.97(11.95, 12.01)

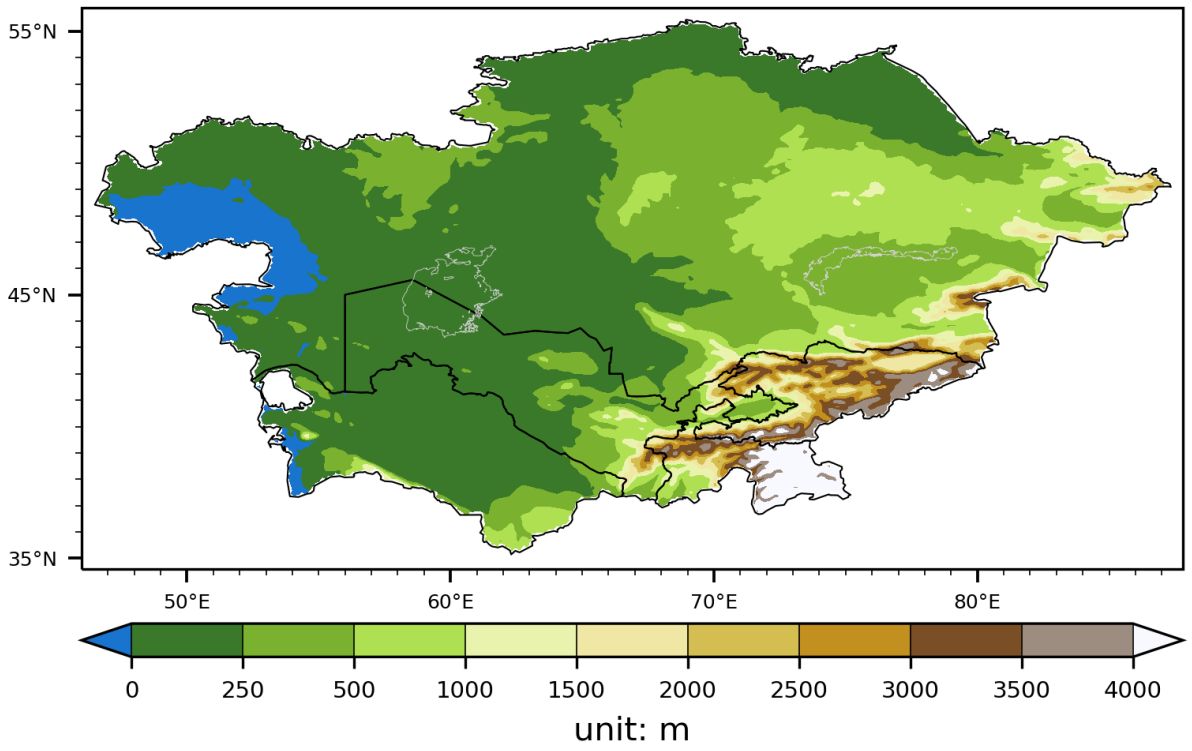


Fig. S1 The terrain height in the WRF model.

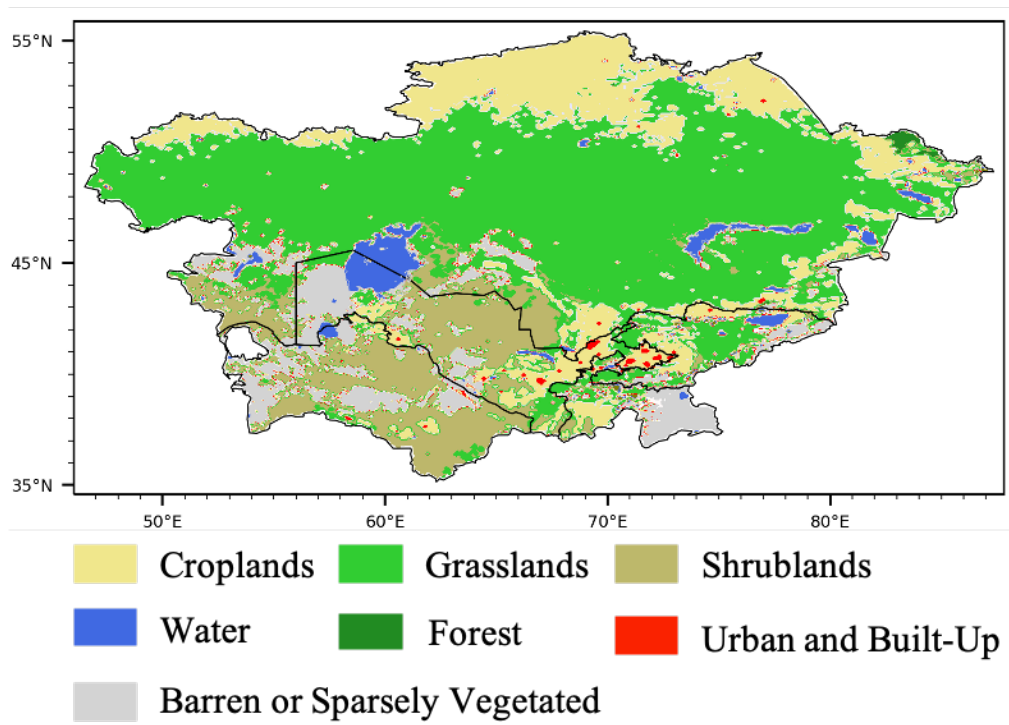


Fig. S2 The main land use categories in the WRF model.

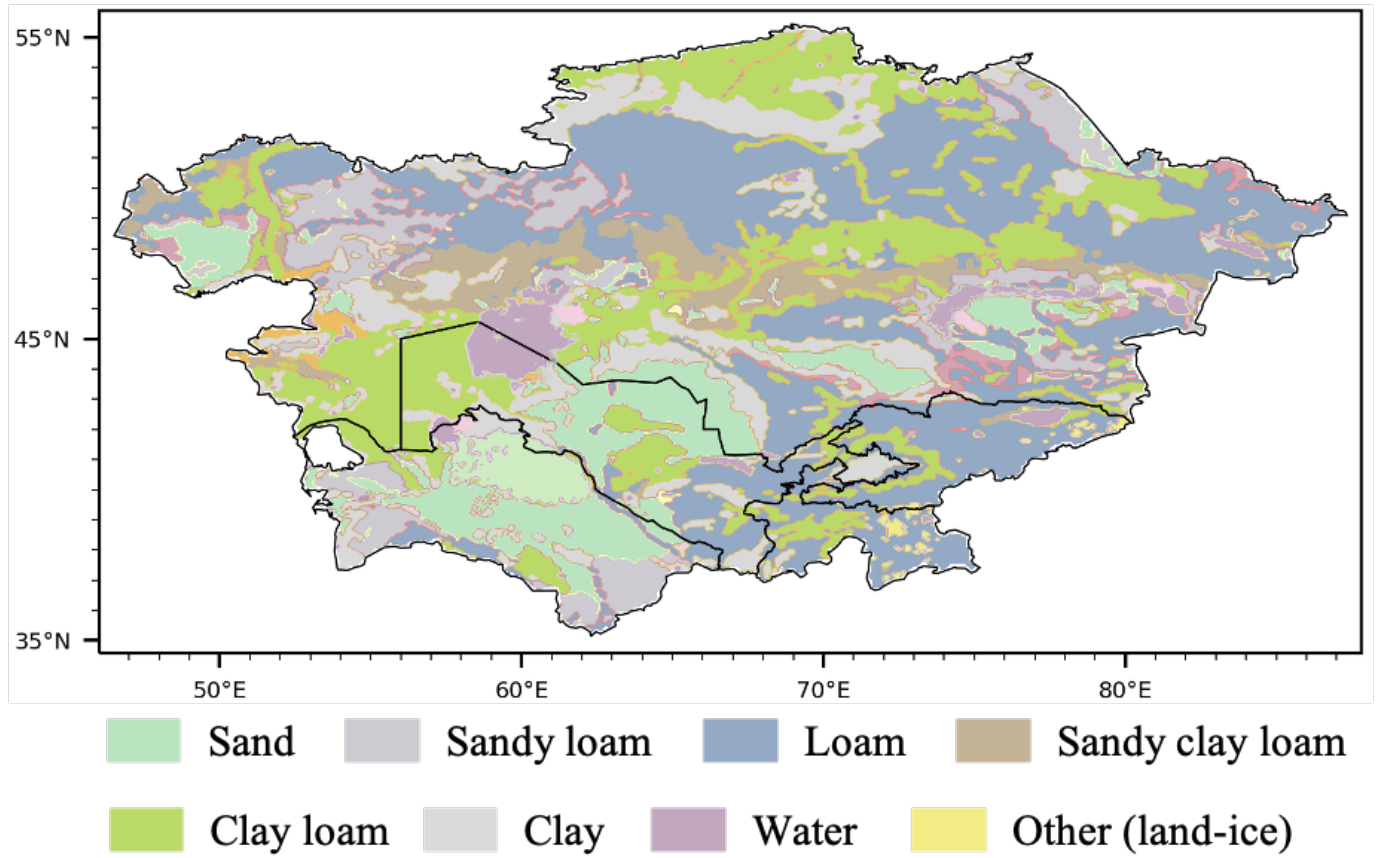


Fig. S3 The main soil categories in the WRF model.

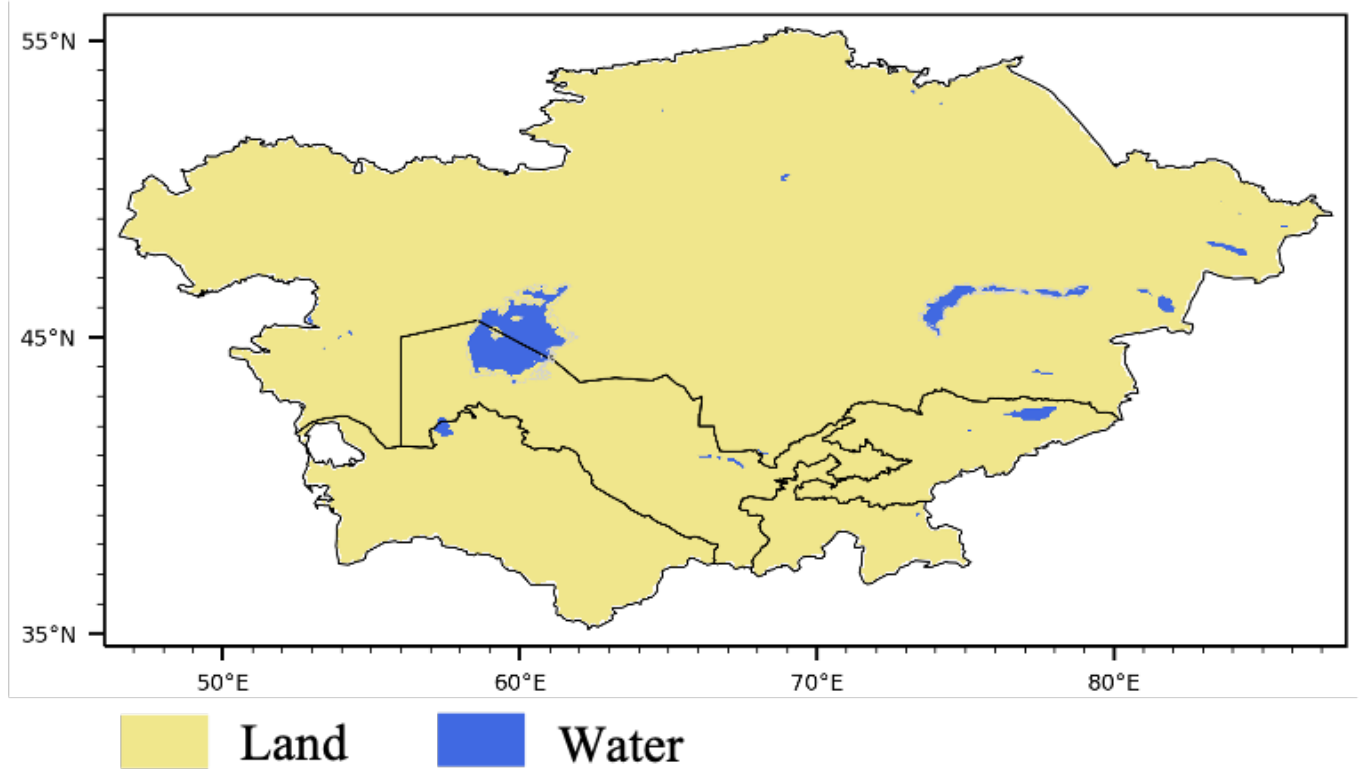


Fig. S4 The land mask in the WRF model.

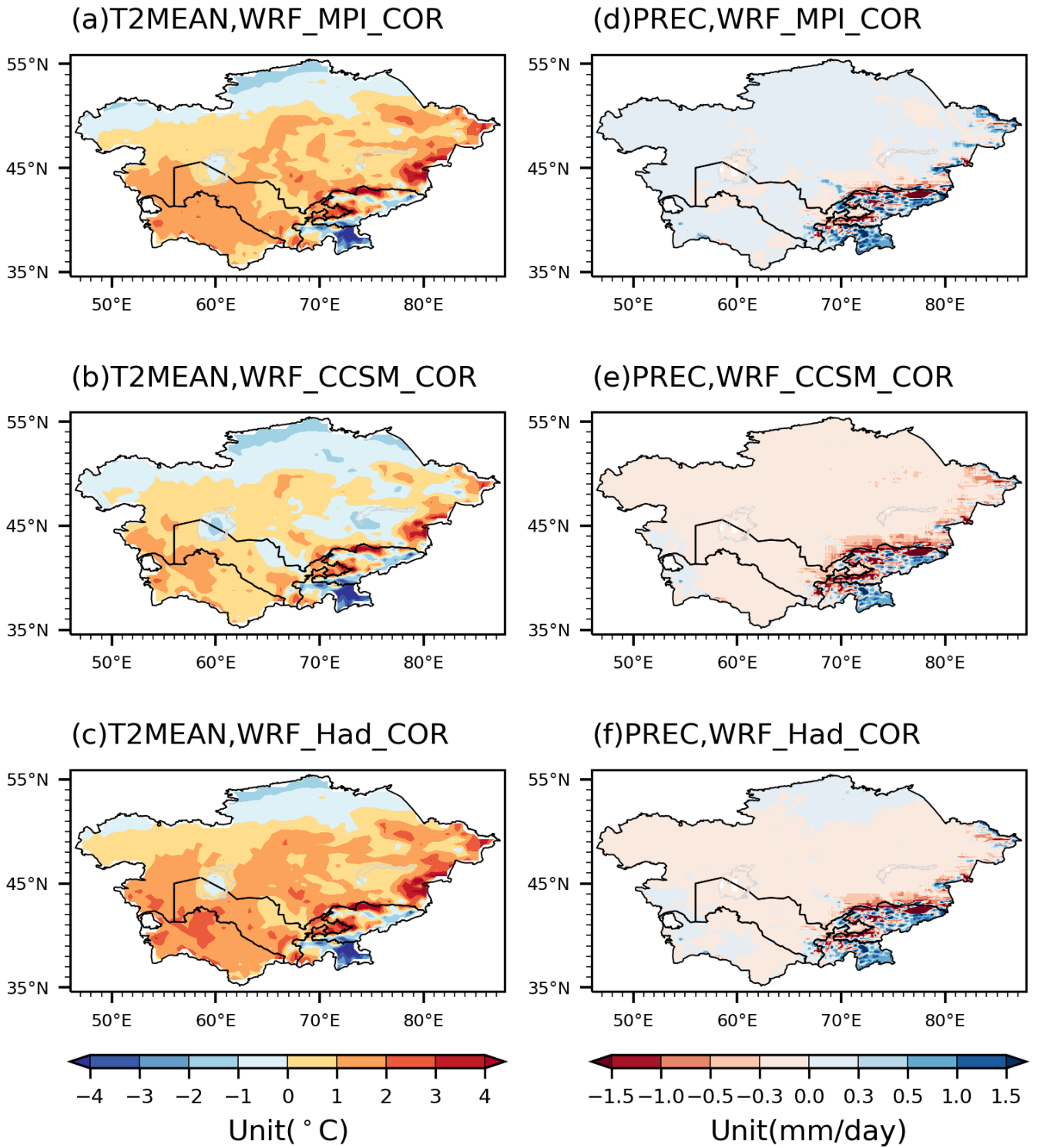


Fig. S5 The biases of the simulated annual mean T2MEAN and PREC in Central Asia during the reference period (1986-2005) relative to the observations.

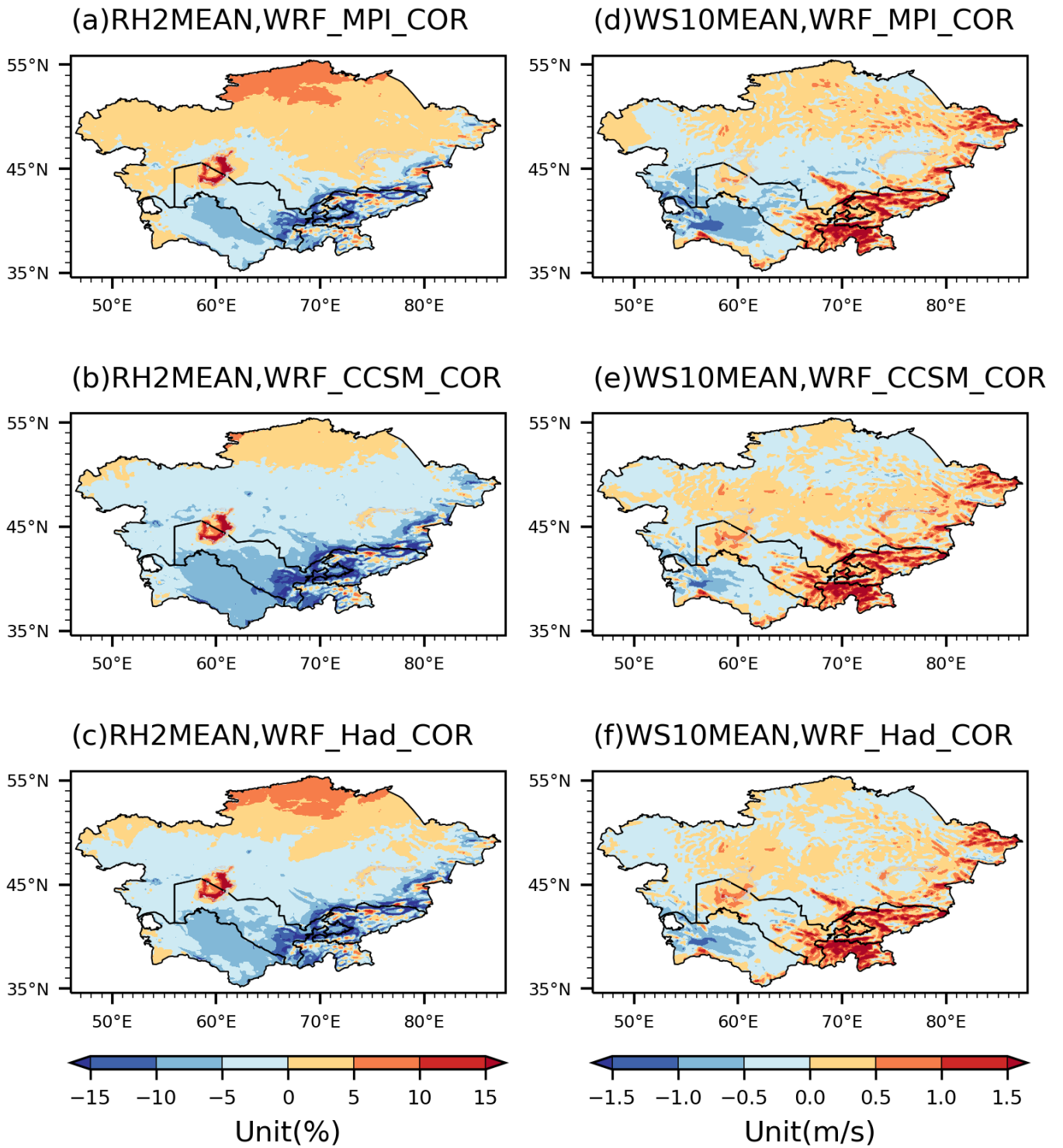


Fig. S6 Same as **Fig. S5**, but for the annual mean RH2MEAN and WS10MEAN.

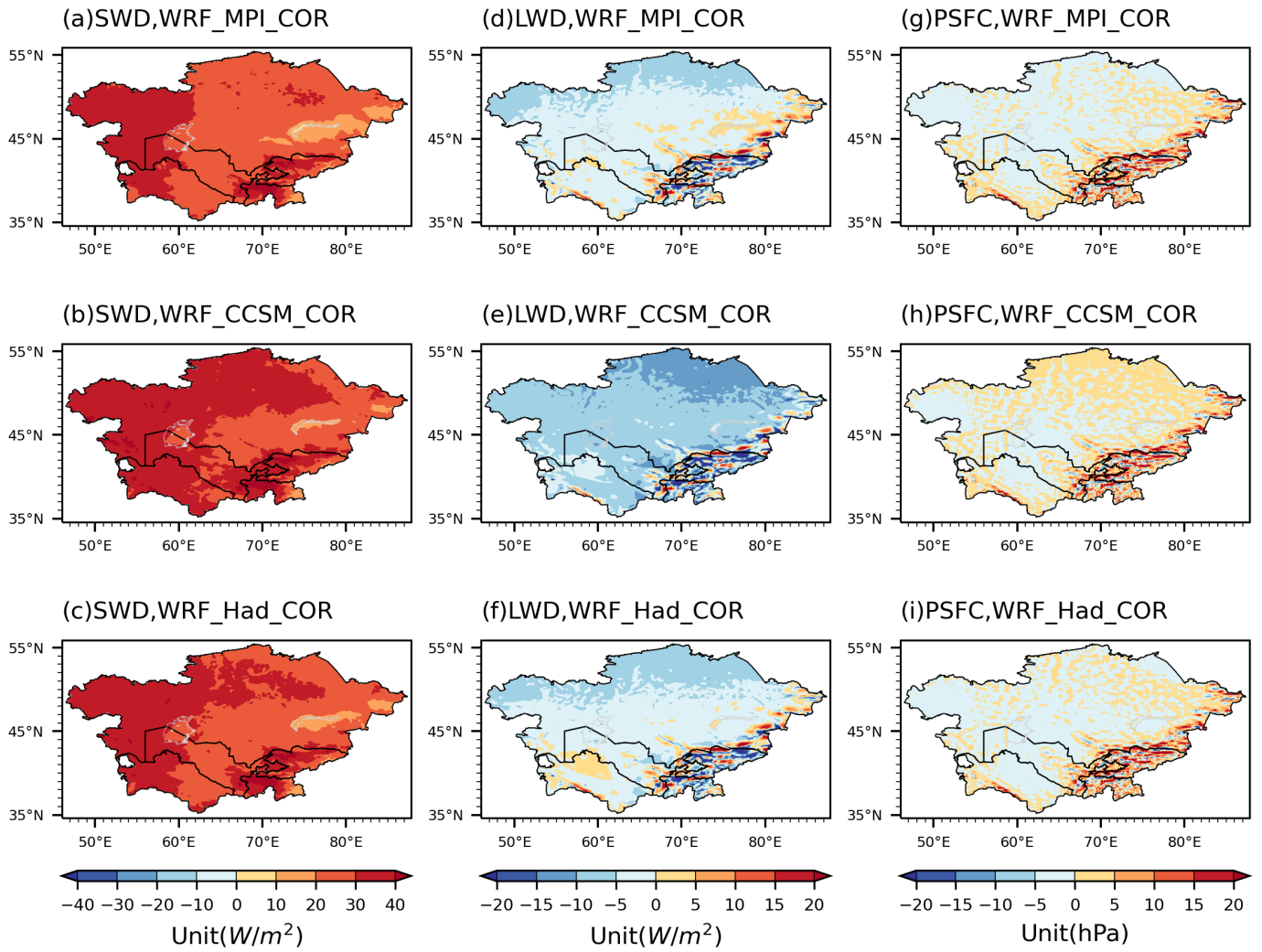


Fig. S7 Same as **Fig. S5**, but for the annual mean SWD, LWD, and PSFC.

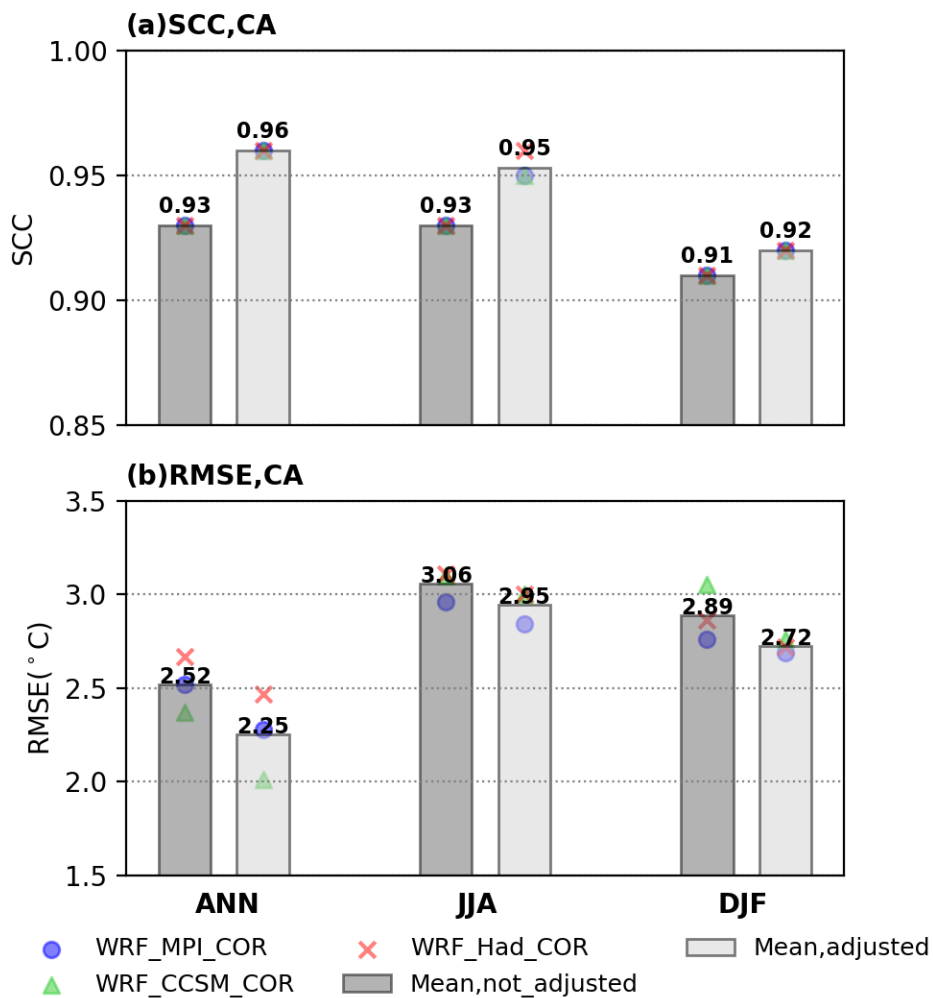


Fig. S8 Spatial correlation coefficients (SCCs) and root mean square errors (RMSEs) of the simulated annual (ANN), summer (JJA: June-July-August), and winter (DJF: December-January-February) mean T2MEAN over CA before and after adjusting based on the elevation differences between the observations and the model grids. The metrics are calculated based on 58 stations' data across CA.