Supporting Information for "The location of large-scale soil moisture anomalies affects moisture transport and precipitation over southeastern South America"

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Introduction

The supplementary material contains four additional figures and five tables used in the main manuscript.

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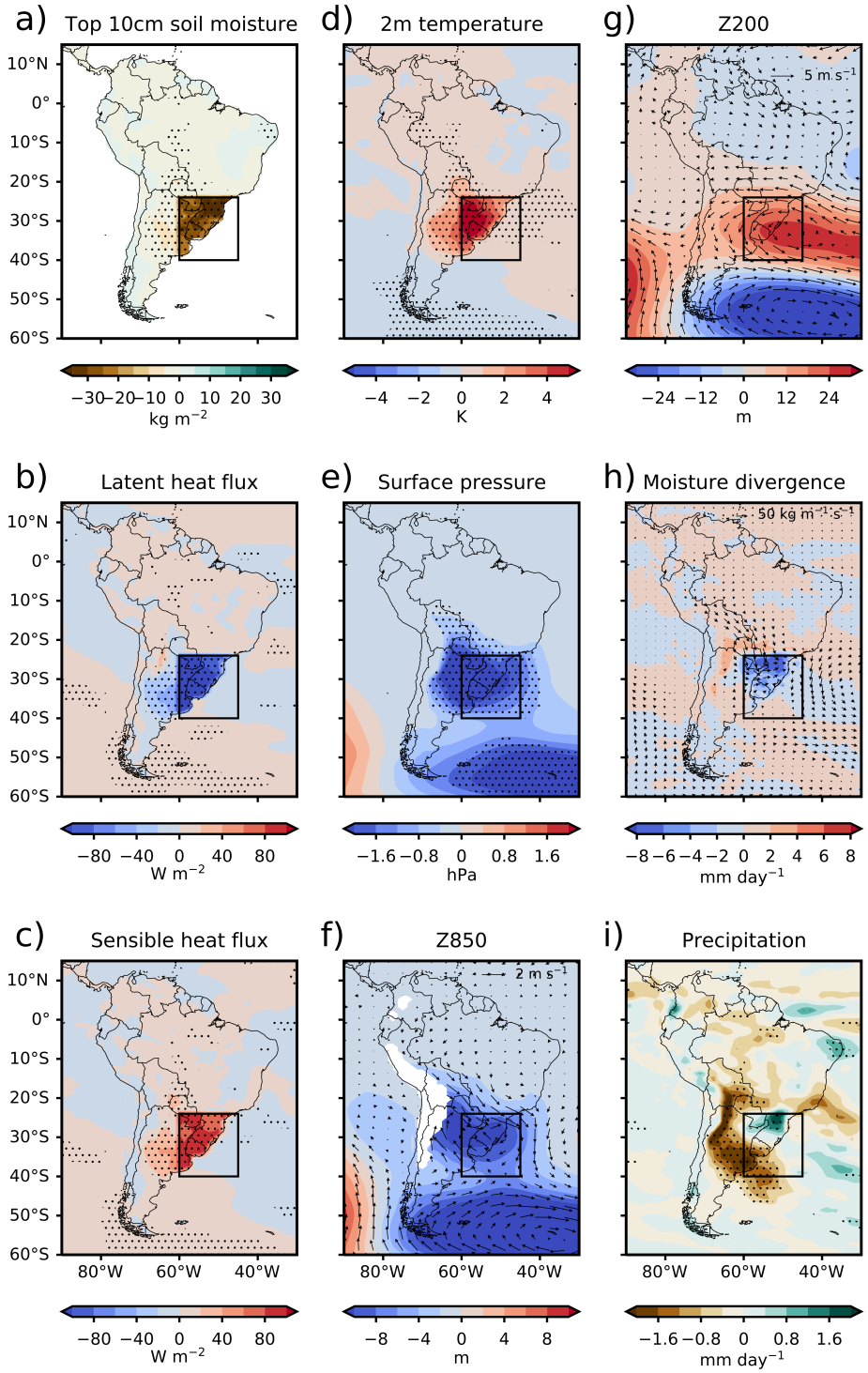

Figure S1. As in Fig. 1, but for the dry eastern SESA simulations.

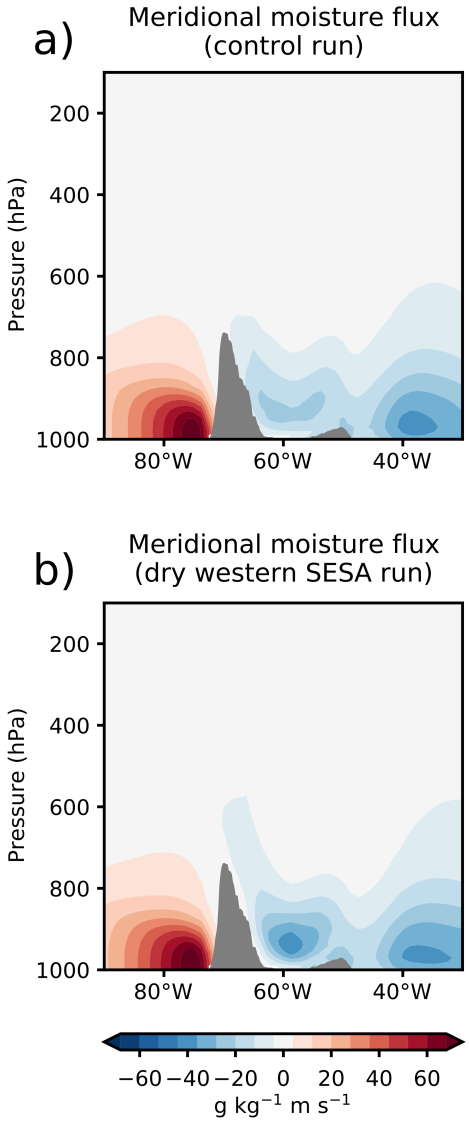

Figure S2. Vertical cross sections of the ensemble average meridional moisture flux averaged between 24°S and 40°S in (A) control simulations and (B) dry western SESA simulations. Gray shading indicates the topography.

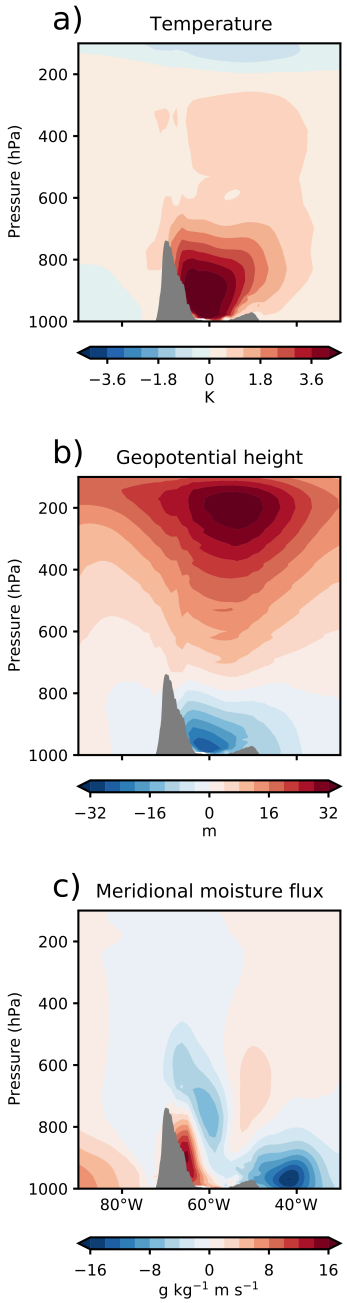

Figure S3. Vertical cross sections of (A) temperature, (B) geopotential height, and (C) meridional moisture flux are anomalies between the ensemble average of the dry SESA simulations and the control simulations in December. Gray shading indicates the topography. Values in vertical cross section are averaged between 24°S and 40°S.

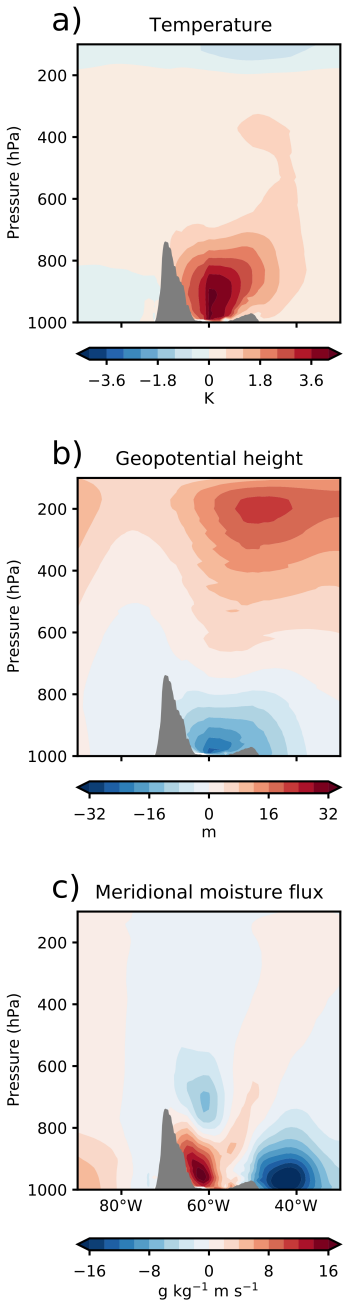

Figure S4. As in Fig. S3, but for dry eastern SESA simulations.

Table S1. Driest months based on root zone (top 1 m) soil moisture in ERA5 reanalysis. All variables in Fig. 3 (except soil moisture) are associated with the month following each driest month.

Driest month order	Year-month	Western SESA SMroot (kg m^{-2})
1	2009-10	176
2	2013-10	191
3	2009-11	191
4	1995-10	195
5	2005-10	196

Table S2. The ensemble average of soil moisture, energy budget terms, and other atmospheric variables averaged over land areas within SESA in the dry SESA simulations and control simulations, as well as their differences and percentage changes. Values in bold font indicate statistically significant differences (p-value less than or equal to 0.05).

Variables	Units	Dry SESA run	Control run	Difference (Dry−Control)	Percentage
Soil water in top 10 cm	kg m^{-2}	0.00	26.33	**−26.33**	−100.00
Surface latent heat flux	W m^{-2}	12.67	121.01	**−108.34**	−89.53
Surface sensible heat flux	W m^{-2}	126.72	43.00	**83.72**	194.70
2m temperature	K	299.57	295.00	**4.57**	1.55
Surface pressure	hPa	968.35	971.27	**−2.92**	−0.30
Geopotential height at 850 hPa	m	1476.25	1486.06	**−9.81**	−0.66
Geopotential height at 200 hPa	m	12212.15	12181.58	**30.57**	0.25
Vertically integrated moisture convergence over SESA	mm day^{-1}	5.24	2.05	**3.19**	155.61
Precipitation over SESA	mm day^{-1}	4.04	4.76	**−0.72**	−15.13
Downward solar radiation at surface	W m^{-2}	276.83	261.42	**15.41**	5.89
Upward solar radiation at surface	W m^{-2}	46.17	35.53	**10.64**	29.95
Net solar radiation at surface	W m^{-2}	230.66	225.89	4.77	2.11
Upward longwave radiation at surface	W m^{-2}	474.47	434.02	**40.45**	9.32
Downward longwave radiation at surface	W m^{-2}	385.42	376.77	**8.65**	2.30
Net longwave radiation at surface	W m^{-2}	89.05	57.25	**31.80**	55.55
Net radiation at surface	W m^{-2}	141.61	168.63	**−27.02**	−16.02

Table S3. As in Table S2, but for dry western SESA simulations. Note that the precipitation and vertically integrated moisture convergence are averaged over land areas within the entire SESA to compare the impact on regional climate.

Variables	Units	Dry western SESA run	Control run	Difference (Dry−Control)	Percentage
Soil water in top 10 cm	kg m^{-2}	0.00	23.81	**−23.81**	−100.00
Surface latent heat flux	W m^{-2}	10.39	111.88	**−101.49**	−90.71
Surface sensible heat flux	W m^{-2}	137.94	55.50	**82.44**	148.54
2m temperature	K	298.81	295.36	**3.45**	1.17
Surface pressure	hPa	962.34	964.57	**−2.23**	−0.23
Geopotential height at 850 hPa	m	1472.13	1481.42	**−9.29**	−0.63
Geopotential height at 200 hPa	m	12176.85	12155.25	**21.60**	0.18
Vertically integrated moisture convergence over SESA	mm day^{-1}	4.06	2.05	**2.01**	98.05
Precipitation over SESA	mm day^{-1}	4.85	4.76	0.09	1.89
Downward solar radiation at surface	W m^{-2}	292.46	277.69	**14.77**	5.32
Upward solar radiation at surface	W m^{-2}	46.07	37.34	**8.73**	23.38
Net solar radiation at surface	W m^{-2}	246.39	240.36	**6.03**	2.51
Upward longwave radiation at surface	W m^{-2}	473.56	438.74	**34.82**	7.94
Downward longwave radiation at surface	W m^{-2}	377.92	371.11	**6.81**	1.84
Net longwave radiation at surface	W m^{-2}	95.64	67.63	**28.01**	41.42
Net radiation at surface	W m^{-2}	150.75	172.73	**−21.98**	−12.73

Table S4. As in Table S2, but for dry eastern SESA simulations. Note that the precipitation and vertically integrated moisture convergence are averaged over land areas within the entire SESA to compare the impact on regional climate.

Variables	Units	Dry eastern SESA run	Control run	Difference (Dry−Control)	Percentage
Soil water in top 10 cm	kg m^{-2}	0.00	28.02	**−28.02**	−100.00
Surface latent heat flux	W m^{-2}	17.15	130.40	**−113.25**	−86.85
Surface sensible heat flux	W m^{-2}	116.42	31.75	**84.67**	266.68
2m temperature	K	299.29	294.81	**4.48**	1.52
Surface pressure	hPa	979.56	982.46	**−2.90**	−0.30
Geopotential height at 850 hPa	m	1480.45	1490.07	**−9.62**	−0.65
Geopotential height at 200 hPa	m	12221.76	12203.99	**17.77**	0.15
Vertically integrated moisture convergence over SESA	mm day^{-1}	3.83	2.05	**1.78**	86.83
Precipitation over SESA	mm day^{-1}	4.12	4.76	**−0.64**	−13.45
Downward solar radiation at surface	W m^{-2}	258.54	248.10	**10.44**	4.21
Upward solar radiation at surface	W m^{-2}	46.30	34.20	**12.10**	35.38
Net solar radiation at surface	W m^{-2}	212.24	213.89	−1.65	−0.77
Upward longwave radiation at surface	W m^{-2}	469.29	430.37	**38.92**	9.04
Downward longwave radiation at surface	W m^{-2}	392.53	382.58	**9.95**	2.60
Net longwave radiation at surface	W m^{-2}	76.75	47.78	**28.97**	60.63
Net radiation at surface	W m^{-2}	135.49	166.11	**−30.62**	−18.43

Table S5. The average of soil moisture, energy budget terms, and other atmospheric variables averaged over land areas within western SESA in the ERA5 reanalysis extremely dry western SESA cases and climatology, as well as their differences and percentage changes. Note that the precipitation and vertically integrated moisture convergence are averaged over land areas within the entire SESA to compare the impact on regional climate.

Variables	Units	Dry	Climatology	Difference (Dry−Climatology)	Percentage
Soil water in top 1 m	kg m^{-2}	193.28	227.50	−34.22	−15.04
Surface latent heat flux	W m^{-2}	88.55	93.81	−5.26	−5.61
Surface sensible heat flux	W m^{-2}	65.08	61.34	3.74	6.10
2m temperature	K	295.50	294.87	0.63	0.21
Surface pressure	hPa	962.28	963.41	−1.13	−0.12
Geopotential height at 850 hPa	m	1477.57	1485.34	−7.77	−0.52
Geopotential height at 200 hPa	m	12181.65	12165.42	16.23	0.13
Vertically integrated moisture convergence over SESA	mm day^{-1}	1.32	0.51	0.81	158.82
Precipitation over SESA	mm day^{-1}	4.57	4.13	0.44	10.65
Downward solar radiation at surface	W m^{-2}	283.02	286.44	−3.42	−1.19
Upward solar radiation at surface	W m^{-2}	42.28	42.95	−0.67	−1.56
Net solar radiation at surface	W m^{-2}	240.74	243.49	−2.75	−1.13
Upward longwave radiation at surface	W m^{-2}	440.07	435.40	4.67	1.07
Downward longwave radiation at surface	W m^{-2}	359.73	354.54	5.19	1.46
Net longwave radiation at surface	W m^{-2}	80.34	80.87	−0.53	−0.66
Net radiation at surface	W m^{-2}	160.40	162.62	−2.22	−1.37