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Supplemental material: Comparing modelled fire dynamics with charcoal records for the Holocene

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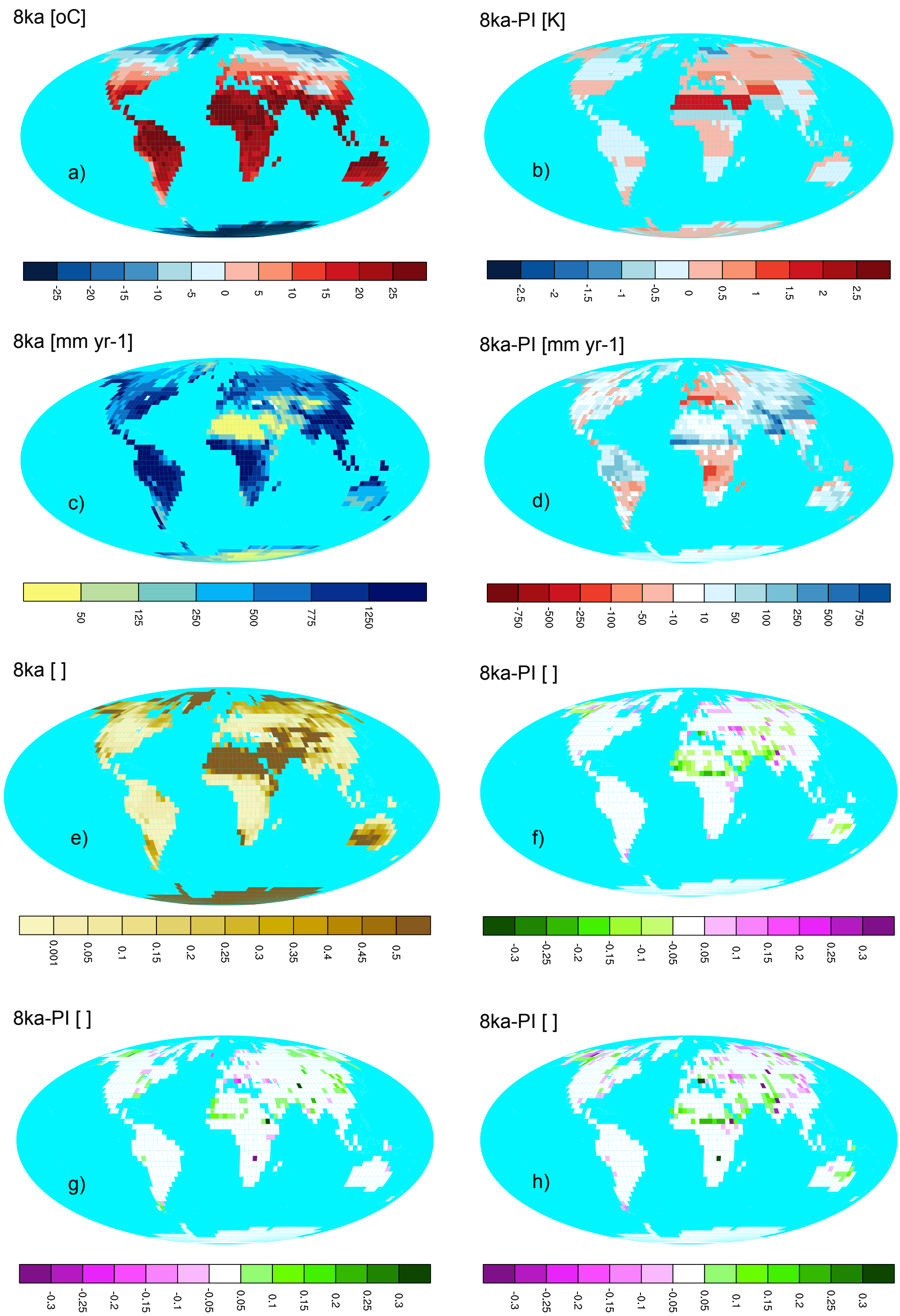

Fig. S1. Maps of climate and vegetation during the Holocene (8 ka=8 000 cal yrs BP) and its differences to pre industrial climate (PI–200 cal yrs BP). Shown are 100 yr averages for temperature [$^{\circ}$C] (a+b), precipitation [$\mathrm{mm\,yr^{-1}}$] (c+d), desert fraction [ ] (e,f), changes in forest [ ] (g) and grass (h) fraction [ ].

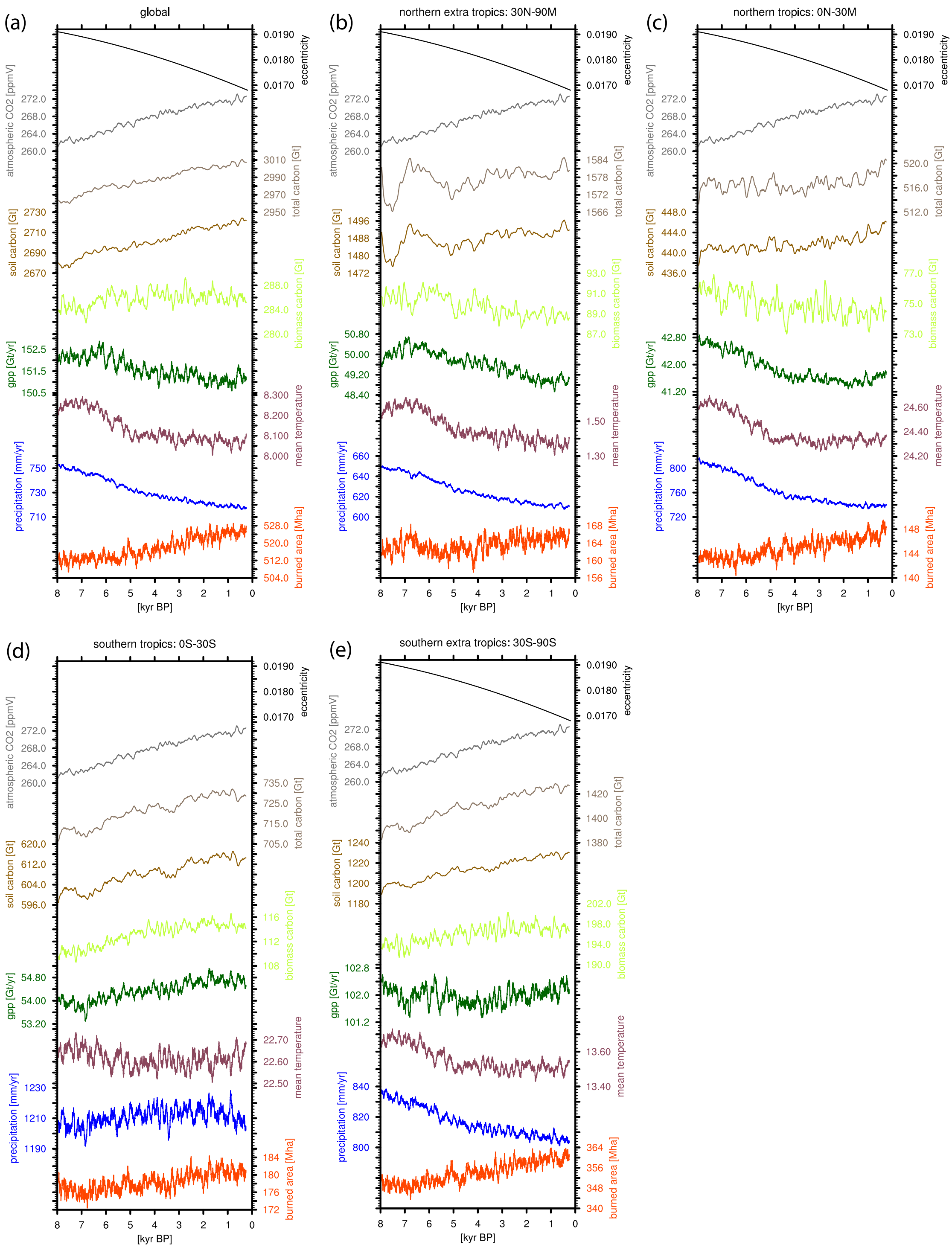

Fig. S2. Time series of hemispheric scale averaged model results over land. Shown are anomalies in burned area $[\mathrm{Mha}]$ (red), precipitation $[\mathrm{mm\,yr^{-1}}]$ (blue), yearly mean temperature $[^\circ\mathrm{C}]$ (dark red), GPP $[\mathrm{Gt\,yr^{-1}}]$ (dark green), biomass carbon $[\mathrm{Gt}]$ (light green), soil carbon $[\mathrm{Gt}]$ (brown), total carbon $[\mathrm{Gt}]$ (dark brown), atmospheric $\mathrm{CO_2}$ concentration $[\mathrm{ppm}]$ (gray), and eccentricity (black) for the global land area (a), northern and southern extra tropics (b+e), as well as northern and southern tropics (c+d).

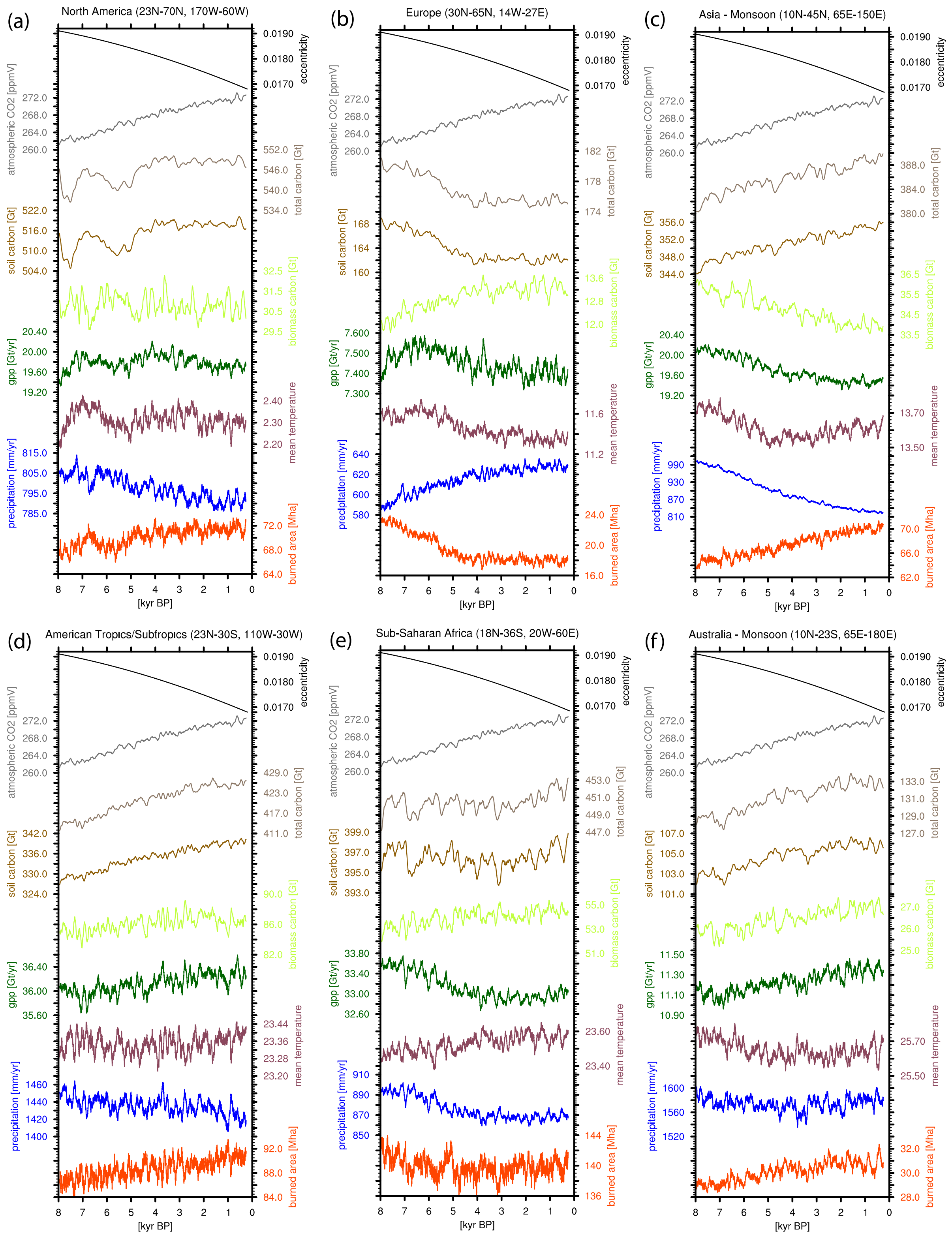

Fig. S3. Same as Fig. S2, but for the regional domains North America (a), Europe (b), Asia Monsoon (c), American Tropics (d), Sub-Saharan Africa (e), and Australia (f) given in Fig. **??**.

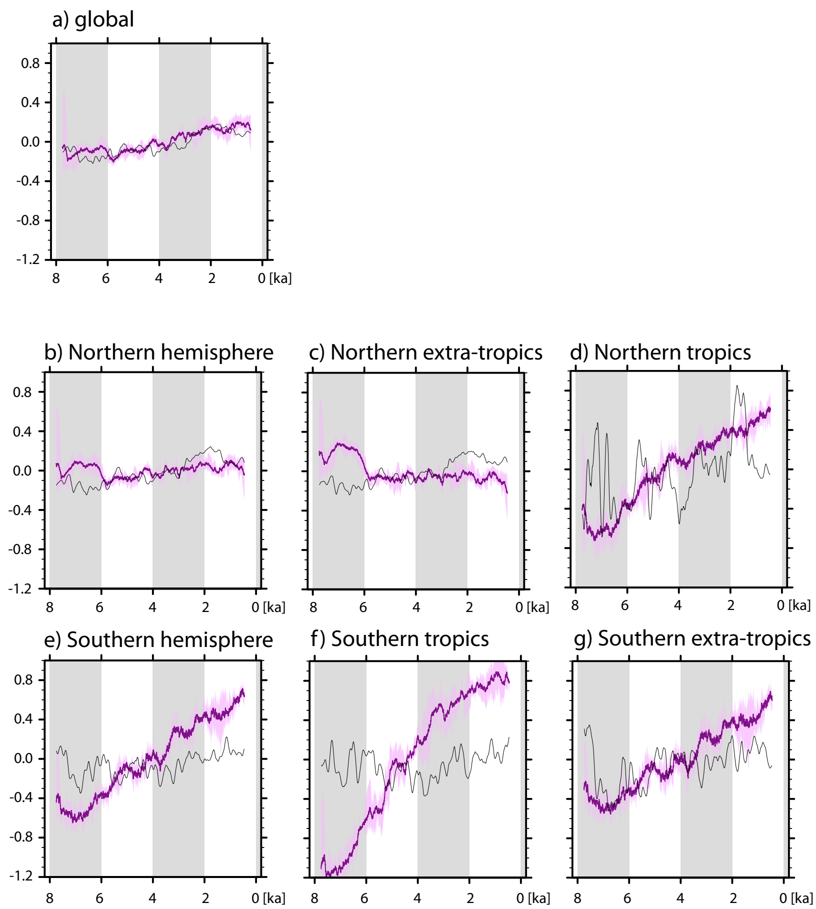

Fig. S4. Time series of global (a) and hemispheric scale (b-g) Z-score transformed and averaged burned area. Shown is the spread out of four ensemble members (pink) and the mean (red) plus the Z-scores out of charcoal reconstructions in black (median only).

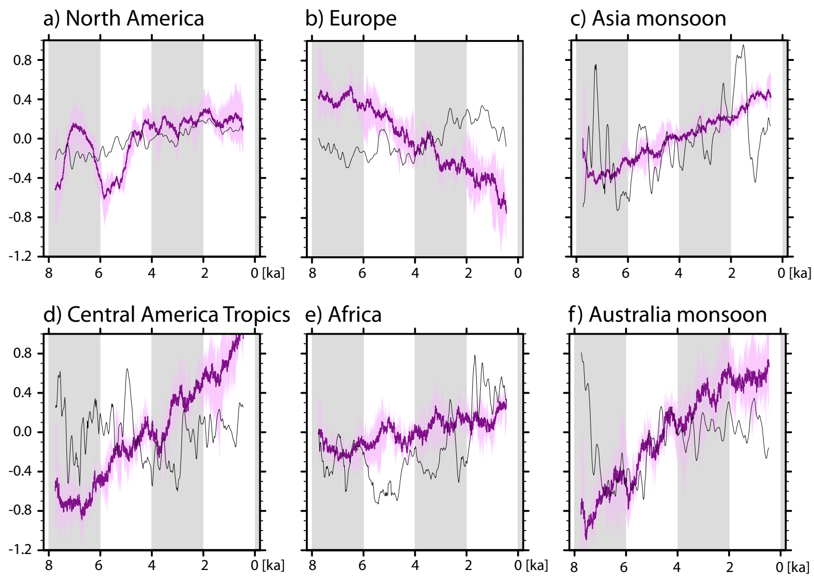

Fig. S5. Same as Fig. S4, but for regional domains given in Fig. **??**.

Table S1. Summary of all Spearman correlation coefficients (ρ) and their significance level (p) for each region and time frame. Shown are the values for correlations based on Z-scores from reconstructed charcoal influxes (Z), untransformed and Z-score transformed model output of burned area (F,F^Z) or carbon emissions (C,C^Z). Correlation coefficients that are negative or insignificant on a 5% significance level are in light gray. All correlations higher than 0.4 are bold and printed in blue ($\rho = 0.4\ldots0.7$), purple ($\rho = 0.7\ldots0.8$), or red ($\rho > 0.8$).

Area	correlation coefficient	8ka-PI ρ	8ka-PI p	8ka-4ka ρ	8ka-4ka p	4ka-PI ρ	4ka-PI p
Global	ρ(Z,F)	0.18	<0.01	0.22	<0.01	0.04	0.63
Global	ρ(Z,F^Z)	**0.73**	<0.01	**0.49**	<0.01	-0.02	0.79
Global	ρ(Z,C^Z)	**0.77**	<0.01	**0.48**	<0.01	0.20	0.01
Global	ρ(F^Z,C^Z)	**0.98**	<0.01	**0.99**	<0.01	**0.91**	<0.01
Northern extra tropics	ρ(Z,F)	0.05	0.32	0.06	0.46	-0.04	0.63
Northern extra tropics	ρ(Z,F^Z)	-0.16	0.32	-0.11	0.15	-0.45	<0.01
Northern extra tropics	ρ(Z,C^Z)	-0.32	<0.01	-0.36	<0.01	-0.47	<0.01
Northern extra tropics	ρ(F^Z,C^Z)	**0.95**	<0.01	**0.90**	<0.01	**0.96**	<0.01
Northern tropics	ρ(Z,F)	0.13	0.01	0.12	0.11	0.11	0.14
Northern tropics	ρ(Z,F^Z)	**0.42**	0.01	0.15	0.04	0.19	0.01
Northern tropics	ρ(Z,C^Z)	**0.42**	<0.01	0.21	<0.01	0.13	0.09
Northern tropics	ρ(F^Z,C^Z)	**0.99**	<0.01	**0.96**	<0.01	**0.98**	<0.01
Southern tropics	ρ(Z,F)	0.12	0.02	0.14	0.06	0.15	0.04
Southern tropics	ρ(Z,F^Z)	**0.45**	0.02	0.37	<0.01	0.20	0.01
Southern tropics	ρ(Z,C^Z)	**0.48**	<0.01	0.38	<0.01	0.29	<0.01
Southern tropics	ρ(F^Z,C^Z)	**0.99**	<0.01	**0.97**	<0.01	**0.97**	<0.01
Southern extra tropics	ρ(Z,F)	0.02	0.76	-0.02	0.82	<0.01	0.97
Southern extra tropics	ρ(Z,F^Z)	0.24	0.76	**0.66**	<0.01	-0.26	<0.01
Southern extra tropics	ρ (Z,C^Z)	0.22	<0.01	**0.63**	<0.01	-0.32	<0.01
Southern extra tropics	ρ(F^Z,C^Z)	**0.99**	<0.01	**0.96**	<0.01	**0.98**	<0.01
North America	ρ(Z,F)	0.14	0.01	0.08	0.28	-0.01	0.93
North America	ρ(Z,F^Z)	**0.66**	0.01	-0.11	0.14	0.22	<0.01
North America	ρ(Z,C^Z)	**0.62**	<0.01	-0.38	<0.01	0.29	<0.01
North America	ρ(F^Z,C^Z)	**0.98**	<0.01	**0.90**	<0.01	0.99	<0.01
Europe	ρ(Z,F)	-0.24	<0.01	-0.02	0.74	-0.11	0.13
Europe	ρ(Z,F^Z)	-0.69	<0.01	-0.40	<0.01	-0.09	0.20
Europe	ρ(Z,C^Z)	-0.69	<0.01	-0.40	<0.01	-0.10	0.17
Europe	ρ(F^Z,C^Z)	**1.00**	<0.01	**0.99**	<0.01	**0.99**	<0.01
Central America Tropics	ρ(Z,F)	0.14	0.01	0.11	0.12	0.18	0.02
Central America Tropics	ρ(Z,F^Z)	-0.09	0.01	**0.51**	<0.01	-0.20	0.01
Central America Tropics	ρ(Z,C^Z)	-0.04	0.47	**0.67**	<0.01	-0.14	0.07
Central America Tropics	ρ(F^Z,C^Z)	**0.99**	<0.01	**0.95**	<0.01	**0.98**	<0.01
Africa	ρ(Z,F)	0.03	0.59	0.14	0.05	-0.08	0.30
Africa	ρ(Z,F^Z)	0.32	0.59	0.23	<0.01	-0.24	<0.01
Africa	ρ(Z,C^Z)	**0.46**	<0.01	**0.61**	<0.01	-0.46	<0.01
Africa	ρ(F^Z,C^Z)	**0.86**	<0.01	**0.84**	<0.01	**0.69**	<0.01
Australian Monsoon	ρ(Z,F)	0.02	0.66	-0.07	0.33	-0.02	0.76
Australian Monsoon	ρ(Z,F^Z)	0.39	0.66	0.03	0.66	0.08	0.30
Australian Monsoon	ρ(Z,C^Z)	**0.42**	<0.01	0.16	0.03	0.11	0.15
Australian Monsoon	ρ(F^Z,C^Z)	**0.98**	<0.01	**0.95**	<0.01	**0.94**	<0.01
Asia monsoon	ρ(Z,F)	0.18	<0.01	0.09	0.23	0.08	0.31
Asia monsoon	ρ(Z,F^Z)	**0.48**	<0.01	0.09	0.22	0.23	<0.01
Asia monsoon	ρ(Z,C^Z)	**0.45**	<0.01	-0.07	0.35	0.21	0.01
Asia monsoon	ρ(F^Z,C^Z)	**0.99**	<0.01	**0.95**	<0.01	**0.97**	<0.01