Climatic Feedbacks and Vegetation Changes Driven by Orbital Forcing and Sea Surface Temperature During Interglacials

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1 Supplementary

The supplementary material of this study provides essential additional information for a deeper understanding of the results presented in the main article. It includes detailed reconstructions of the South American biomes, highlighting the main classifications; Additionally, figures illustrating the spatial distribution of the mean seasonal differences in sea level pressure (SLP) between interglacial experiments, compared with sea surface temperature (SST) and precipitation from the control experiment (CTRL), are presented. The differences are shown for the MH-CTRL, MIS5e-CTRL, MIS11c-CTRL and MIS31-CTRL periods, highlighting statistically significant anomalies at the 95% confidence level; Finally, analyses of the Hadley circulation based on the summer (DJFM) and winter (JJAS) composite anomalies are also included, showing the differences between the MH-CTRL, MIS5e-CTRL and MIS11c-CTRL experiments. The figures use maps of meridional mass stream functions, with contour intervals representing fluxes.
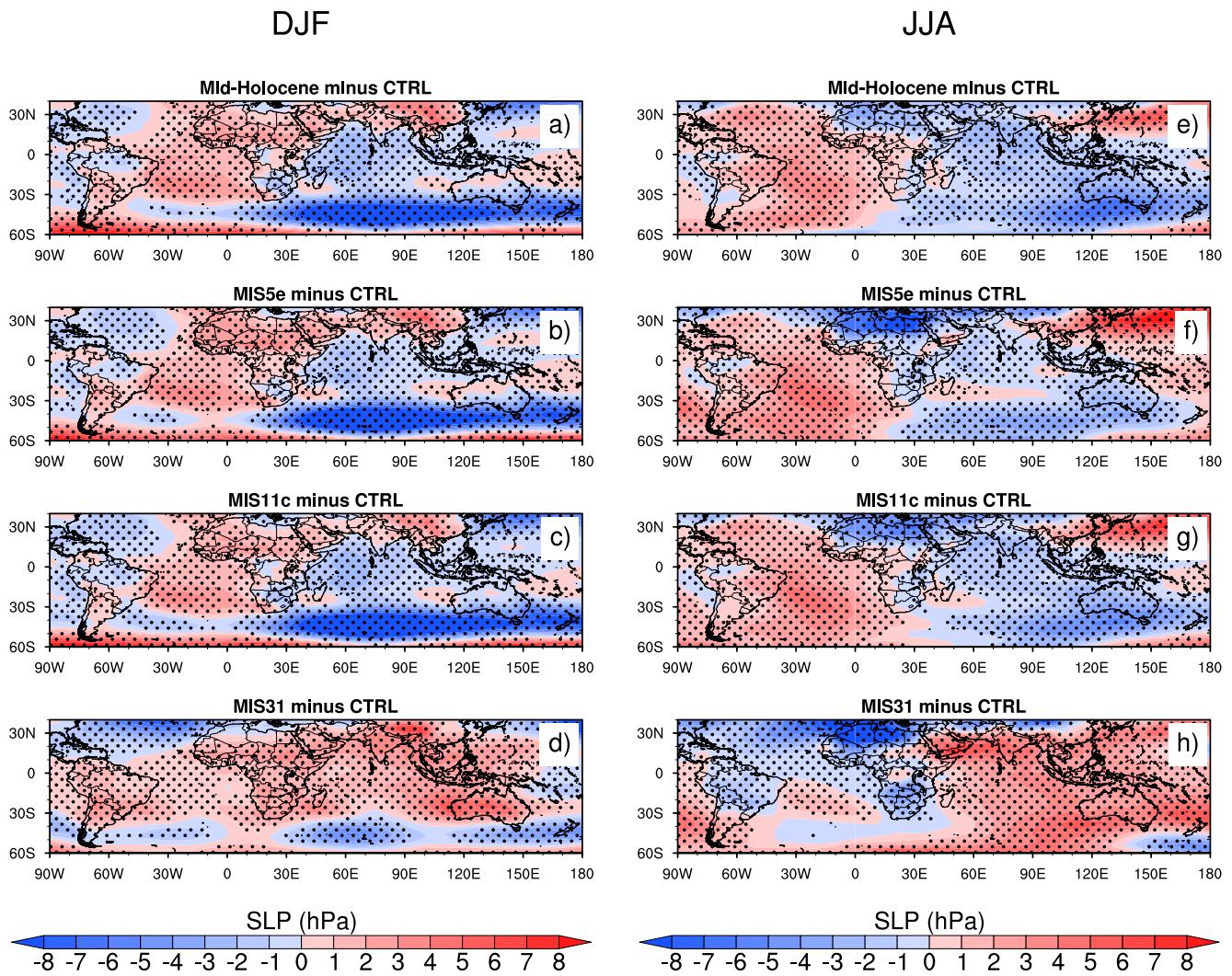
Figure S1. Spatial distribution of season (DJF and JJA) mean surface SLP difference between interglacials experiments compared to SST and precipitation from CTRL; MH minus CTRL (a,e), MIS5e minus CTRL (b,f), MIS11c minus CTRL (c,g) and MIS31 minus CTRL (d,h). Black dots represent correspond to statistically significant anomalies at the 95% confidence interval.
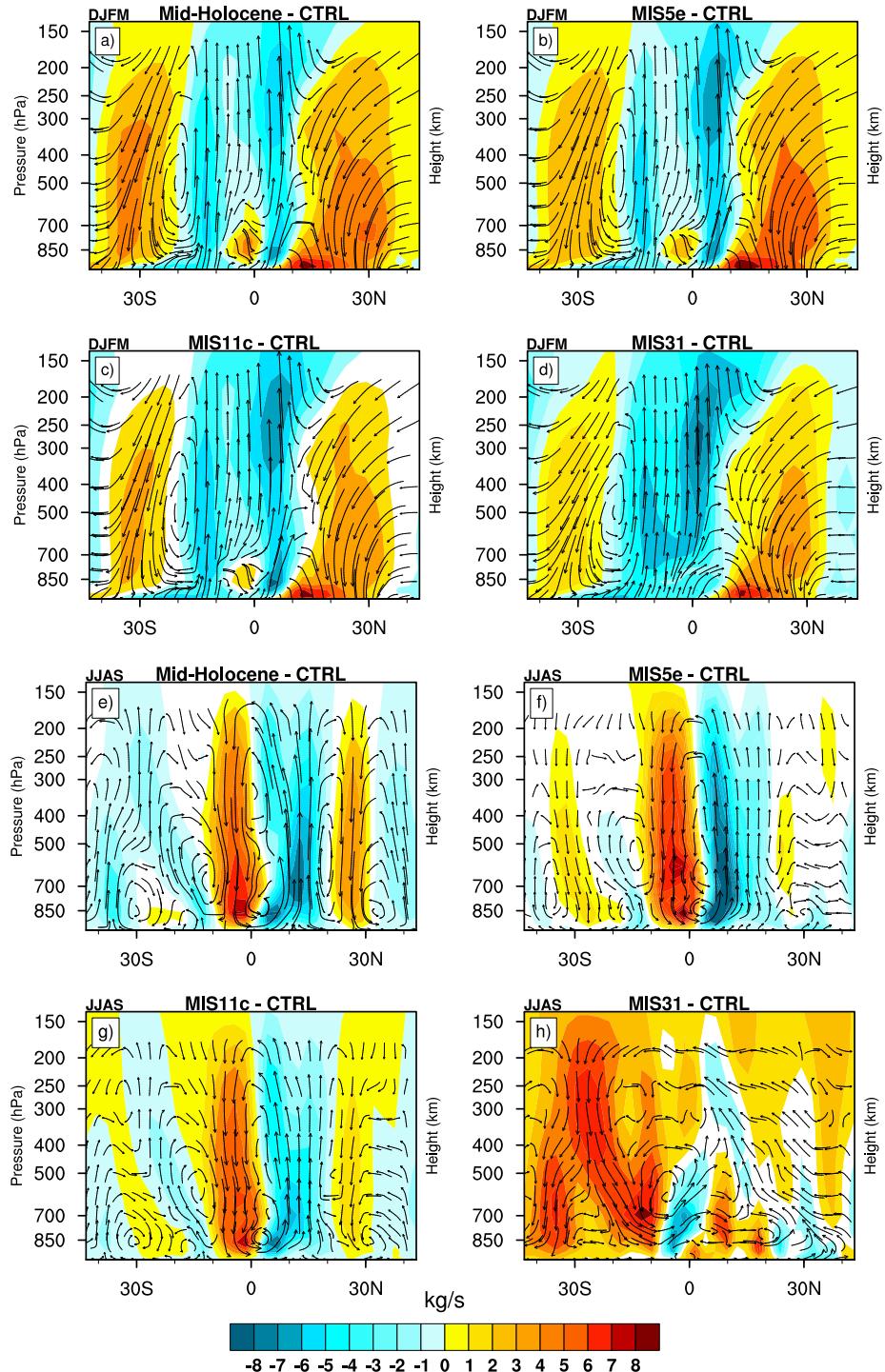
Figure S2. Hadley circulation from the difference between summer (DJFM) composite anomalies MH-CTRL (a), MIS5e-CTRL (b), MIS11c-CTRL (c) and MIS5e-CTRL (d); and winter (JJAS) MH-CTRL (e), MIS5e-CTRL (f), MIS11c-CTRL (g) and MIS5e-CTRL (h). Color bar indicates the value of mass stream function of mean meridional circulation. The contours intervals represents 10^9 kg/s.
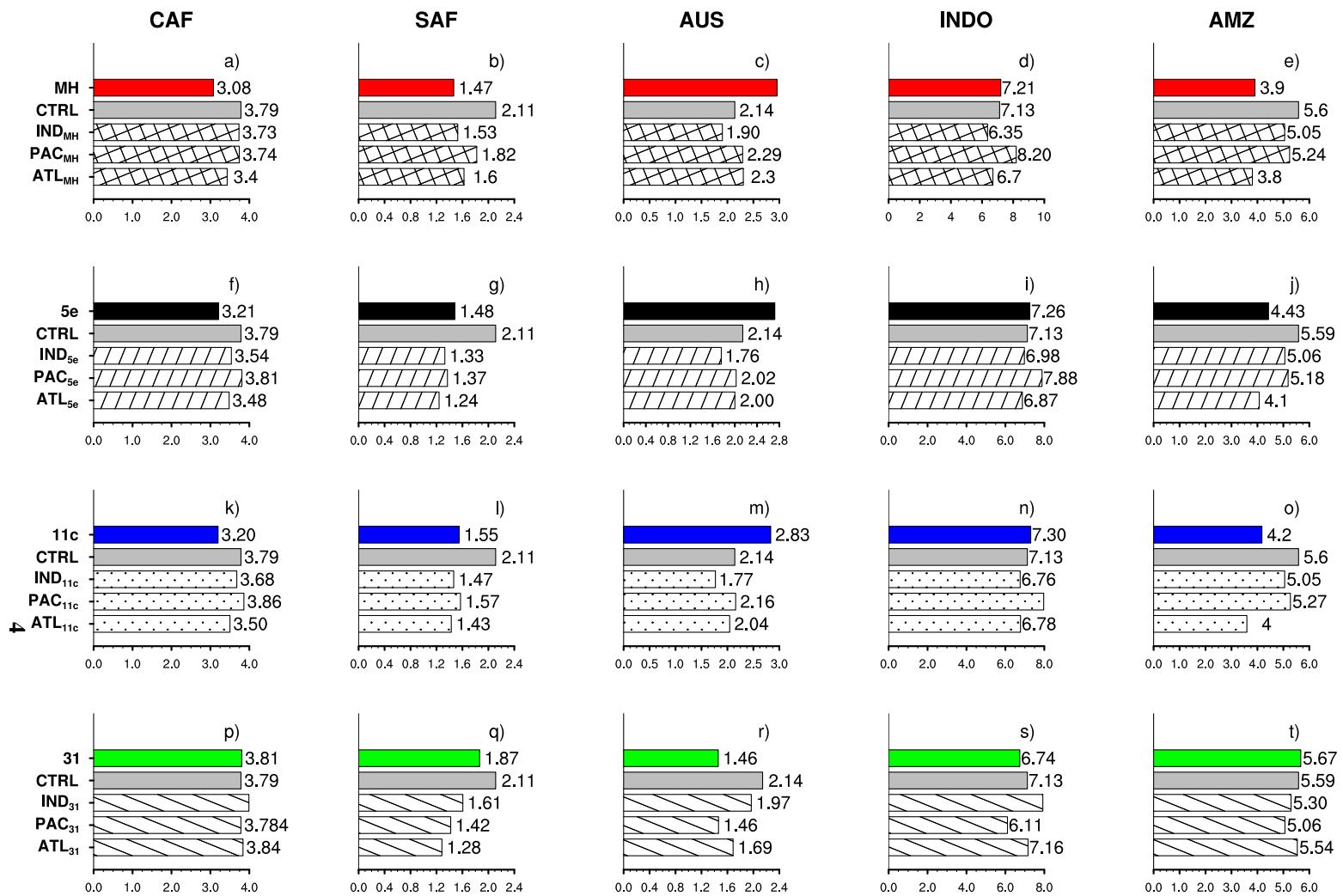
Figure S3. Areal averaged precipitation (mm/day) CAF, SAF, AUS, IND and AMZ, region for the SST sensitivity experiments.
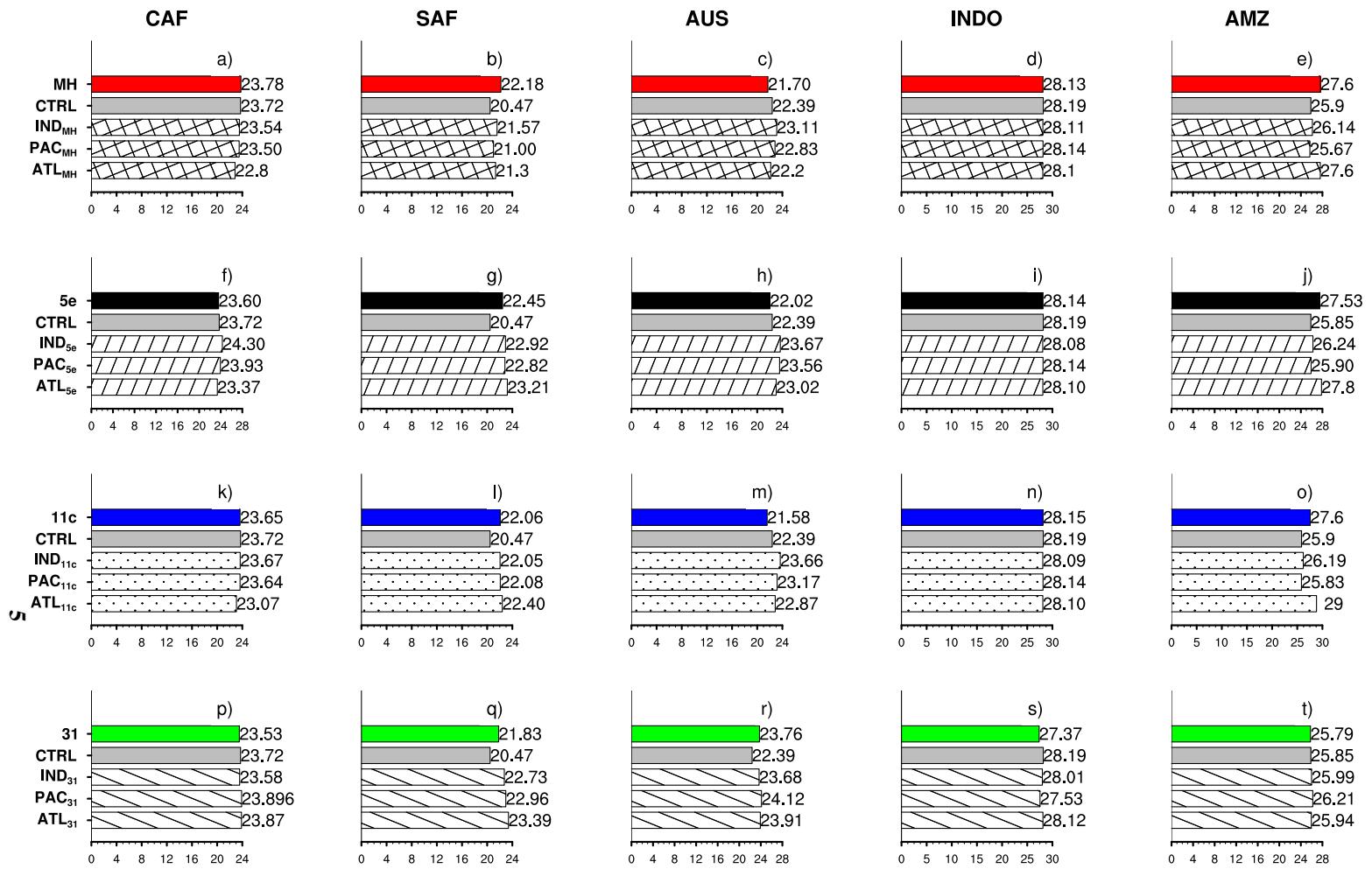
Figure S4. Areal averaged temperature (mm/day) CAF, SAF, AUS, IND and AMZ, region for the SST sensitivity experiments.

Table S1. Correlation coefficients of mean time series between the Niño3.4 index and the precipitations over areas of the tropical regional. Bold values indicate statistical significance at the 95% level.

	MH	MIS5e	MIS11c	MIS31
Austral Summer (DJFM)				
Index			$Niño_{34}$	
Precipitation Domain				
CAF	**-0.39**	-0.24	0.34	0.12
SAF	-0.24	-0.12	-0.11	0.13
AUS	**-0.35**	-0.1	0.17	**-0.47**
INDO	-0.23	-0.14	0.29	-0.25
AMZ	-0.19	-0.13	-0.1	0.17

Table S2: Biome reconstructed for South America. Code biome: TRFO (Tropical rainforest); TSFO (Tropical seasonal forest); TDFO (Tropical dry forest); WTRF (Warm temperate rainforest); WEFO (Warm temperate evergreen broadleaf forest); CTRF (Cool temperate rainforest); WAMF (Warm temperate mixed forest); COMI (Cool mixed forest); CGSS (Cool grasslands); STEP (Steppe); DESE (Desert); CGSH (Cool grass shrublands).

Site	Lat	Lon	Biome 6k
Lake Åsa3	-62.62	-61.13	STEP
Harberton	-54.88	-67.16	CTRF
Puerto del Hambre	-53.59	-70.92	STEP
La Misión	-53.5	-67.83	CTRF
Punta Arenas	-53.15	-70.97	CTRF
Meseta Latorre 1	-51.52	-72.05	CGSH
Meseta Latorre 2	-51.44	-72.03	TDFO
Torres del Paine	-50.98	-72.66	COMI
Dichan	-49.66	-73.88	CTRF
Puerto Eden	-49.13	-74.41	CTRF
Laguna Six Minutes	-46.43	-74.33	CTRF
Laguna Stibnite	-46.43	-74.43	CGSH
Laguna Stibnite	-46.43	-74.38	CTRF
Laguna Lincoln	-45.34	-74.07	CTRF
Laguna Lofel	-44.85	-74.43	CTRF
Estero Huitanque	-43.61	-73.82	COMI
Mayol	-42.64	-73.75	CTRF
Puchilco	-42.63	-73.62	CTRF
Mallin Book	-41.33	-71.58	CTRF
Puerto Octay PM13	-40.93	-72.90	CTRF
Primavera	-40.66	-71.18	TDFO
Caunahue	-40.00	-72.00	CTRF
Salina Anzotegui	-39.06	-63.77	STEP
Cueva Haichol	-38.58	-70.66	STEP
Cerro La China	-37.84	-58.64	TDFO
Empalme Querandı´es	-37.00	-60.65	TDFO
Veranada Pelan	-36.88	-70.38	TDFO
Vaca Lauquen	-36.83	-71.08	CGSH
Veranada Vulkanpickel	-36.68	-70.41	TDFO

Site	Lat	Lon	Biome 6k
Salina 2	-32.25	-69.33	STEP
Serra do Rio Rastro	-28.55	-49.55	CGSH
Morro da Igreja	-28.18	-49.86	WTRF
Serra da Boa Vista	-27.70	-49.15	CTRF
Rano Raraku Bore 3	-27.16	-109.28	TDFO
Rano Aroui	-27.08	-109.40	CGSH
Serra Campos Gerais	-24.66	-50.21	TDFO
Aguilar	-23.83	-65.75	STEP
Rio da Curuá	-23.83	-48.83	TRFO
Tumbre 2	-23.31	-67.78	STEP
Aguas Calientas	-23.08	-67.42	CGSH
Lagoa da Caço	-22.97	-43.43	TDFO
Morro de Itapeva	-22.78	-45.63	TDFO
Salitre	-19.00	-46.78	TDFO
Lago do Pires	-17.95	-42.21	TSFO
Wasa Mayu	-17.54	-65.91	CGSH
Crominia	-17.28	-49.45	TSFO
Mt. Blanco	-17.02	-67.35	CGSS
Lake Huinãmimarca	-16.50	-69.00	CGSH
Cerro Calvario	-16.50	-68.50	CGSH
Rio Kaluyo	-16.43	-68.13	STEP
Chacaltaya 1	-16.36	-68.13	CGSH
Cumre Unduavi	-16.33	-68.03	CGSS
Aguads Emendadas	-15.56	-47.58	TSFO
Amarete	-15.23	-68.98	CGSH
Cotapampa	-15.21	-69.11	CGSH
Katantica	-14.8	-69.18	CGSH
Laguna Chaplin	-14.50	-61.05	TDFO
Laguna Bella Vista	-13.58	-61.56	TSFO
Laguna Jeronimo	-11.78	-75.21	CGSH
Laguna Pomacocha	-11.75	-75.50	CGSH
Laguna Tuctua	-11.66	-75.00	WTRF

Site	Lat	Lon	Biome 6k
Laguna Milloc	-11.56	-76.35	CGSH
Laguna Junin2	-11.00	-76.18	COMI
Laguna Huatacocha	-10.76	-76.55	CGSH
Rio São Francisco	-10.46	-43.00	TSFO
Saquinho	-10.44	-43.23	WEFO
Katira	-9.00	-63.00	TDFO
Carajas	-5.00	-48.00	TSFO
Ciudad Universitaria X	-4.75	-74.18	WAMF
Lake Surucucho	-3.75	-78.95	WTRF
Ayauch	-2.09	-78.13	TSFO
Lago Crispim	-0.8	-48.00	TSFO
Lagoa da Curuça2	-0.76	-47.85	TRFO
Mariñame-II	-0.66	-72.03	WTRF
Monica-1	-0.60	-72.50	TRFO
Cayambe	-0.03	-78.03	CGSH
La Pata	0.25	-66.66	WTRF
Lagoa das Patas	0.26	-66.68	TSFO
Piusbi	1.66	-77.89	TRFO
Pitalito	1.75	-76.50	TSFO
Piagua	2.30	-76.50	WEFO
Pantano de Genagra	2.50	-76.50	WEFO
Rio Timbio	2.50	-76.50	WEFO
Loma Linda	3.22	-73.35	TDFO
Lago Agua Sucia	3.46	-73.54	STEP
El Gobernador	3.95	-75.00	WTRF
La Guitarra	4.00	-74.28	CTRF
La Primavera	4.00	-74.13	COMI
Carimagua	04.04	-74.14	CGSS
La Rabona	04.05	-74.25	CTRF
El Piñal	04.09	-70.40	TDFO
Alsacia	04.09	-74.11	COMI
Andabobos	04.09	-74.15	CGSH

Site	Lat	Lon	Biome 6k
De la América	4.33	-74.00	CTRF
Laguna Angel	4.45	-70.54	TDFO
Libano	4.50	-75.50	COMI
de Pedro Palo III	4.50	-74.41	WTRF
Paramo Palacio	4.76	-73.88	CGSH
Greja	4.86	-73.70	CGSH
Sardinas	4.95	-69.45	TDFO
Herrera	5.00	-73.91	COMI
Agua Blanca	5.0	-74.45	CTRF
El Abra II	05.02	-73.96	CTRF
Paramo de Peña Negra	05.09	-74.09	COMI
ODP site 932	5.18	-47.03	WTRF
Comprida	5.18	-47.63	TRFO
Geral	5.18	-47.53	TRFO
Paramo de Laguna Verde	5.25	-74.00	CGSH
Fúquene II	5.50	-73.87	CTRF
Cienaga del Visitador	6.13	-72.83	CGSH
Valle de Lagunillas	6.50	-72.34	CTRF
La Chonta	8.00	-82.00	COMI
La Yeguada,	8.43	-80.78	TSFO
Valle Laguna Victoria	8.80	-70.79	CGSH
Paramo de Miranda	8.91	-70.85	CGSH
Panama	9.00	-80.87	TSFO
Paramo Piedras Blancas	9.16	-70.83	CGSH
Lago de las Morrenas	9.50	-83.49	CTRF
Lake Valencia	10.32	-67.75	TDFO
Lago Quexil	16.92	-89.88	WEFO
Lake Peten-Itza	17.25	-90.00	WEFO
Quila	19.30	-99.20	WAMF
Lake Texcoco	19.44	-99.12	WAMF
Chalco Lake	19.50	-99.00	WAMF
Lake Pátzcuaro	19.58	-101.58	WAMF

Table S2 – continued from previous page

Site	Lat	Lon	Biome 6k
San Jose Chulchaca	20.86	-90.13	WEFO
Lake Coba	20.86	-87.55	WEFO