Supplementary Material

| domain	lower left [°]		upper right [°]		p.g.r*	res.**	number of cells		parent start	
	lat.	lon.	lat.	lon.			w.e.[†]	s.n.[‡]	i	j
D01	-32.2	-89.4	-0.5	-43.2	1	38.0	118	86	1	1
D02	-26.3	-78.7	-7.2	-53.9	4	9.5	253	205	28	18
D03	-20.5	-70.9	-13.9	-62.0	3	3.2	274	214	80	65
D04	-17.2	-69.0	-15.6	-67.3	3	1.0	154	151	61	110

Table S1. Description of the domains used for the WRF simulation. * parent grid ratio, ** resolution (km), [†] west east, [‡] south north


Figure S1. Describes the properties of the main 6 pathways (similar to Fig. 12). The main pathway's digits refer to the clockwise direction of the centre of mass of the air masses. The colours are unique for each PW and the same scheme is used on Fig. 12 and Fig. 5a and b. The SRR [%] columns describe the average contribution of each cluster. We also show the distance from CHC, height above ground and height above sea level of each cluster's centre of mass. Furthermore, $\frac{SRR_{<1.5km}}{SRR_{total}}[\%]$ shows the ratio between the SRR below $1.5\,km$ and the SRR summed over the full vertical column (SRR_{total}).
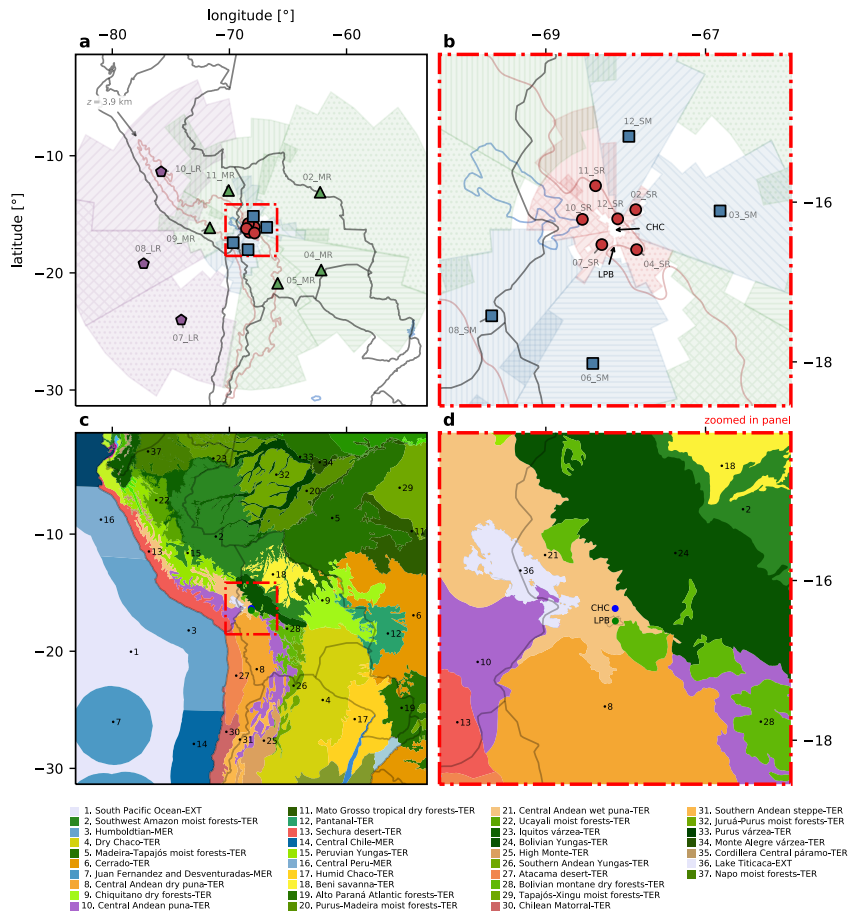
Figure S2. Panels a) and b) show the horizontal location of the 18 clusters. The colour is related to their distance range from CHC and the hatch distinguishes each cluster independently. For easier visualization, we only show 80% of the grid cells where the SRR is highest. We also show the centroid markers for each of the clusters. Each cluster centroid is marked with a disk (short range), square (short-medium range), triangle (medium range), or pentagon (long range) locator. The brown line corresponds to a height of $3.9\,\mathrm{km}$ a.s.l. and encircles the Altiplano plateau. Panel b) corresponds to the region inside the red rectangle in panel a). Panels c) and d) show the eco-regions as described in Section 4 and are shown for comparing the area of the pathways to the under-laying biome.
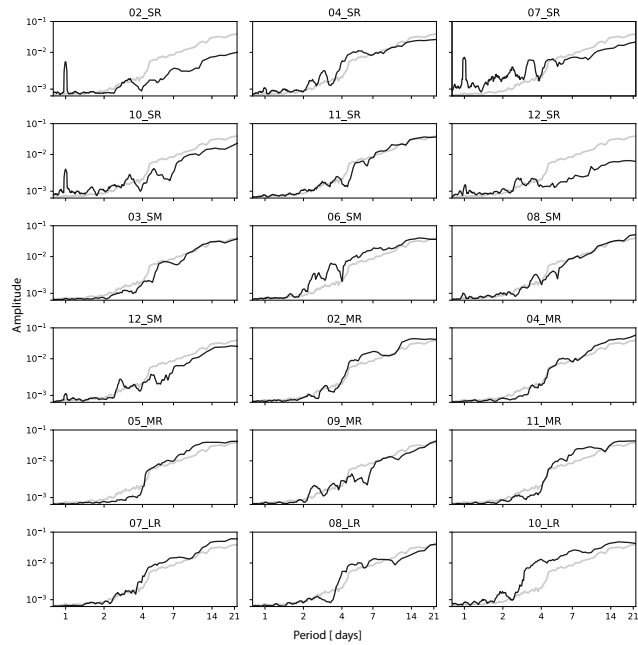
Figure S3. Power spectra of the clusters' timeseries obtained via the Fourier transform. In light gray is the median of all the spectra (shown for reference). Clusters 02_SR, 07_SR, 03_SR and 12_SR show a local peak at a daily frequency and therefore are analysed in detail in Figs. S4 to S7
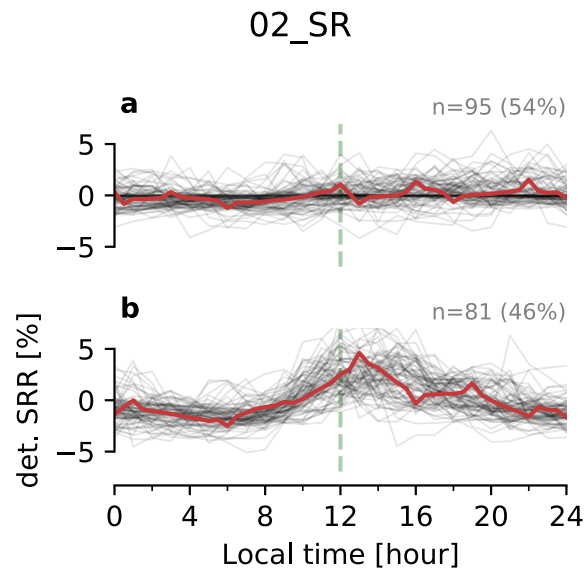
02_SR

Figure S4. Detrended daily SRR timeseries of cluster 02_SR divided into a) no diurnal influence and b) diurnal influence by applying a dynamic time warping classification with 2 groups. In grey, we show the timeseries for each single modelled day and red line is the group median evolution.
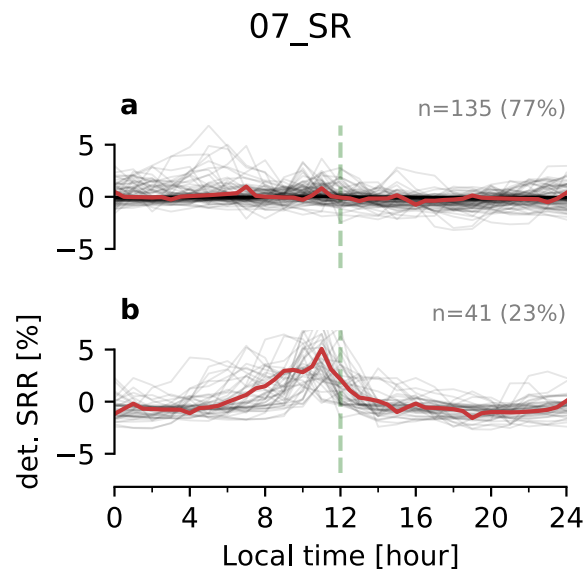
07_SR

Figure S5. Similar to Fig. S4 but for cluster 07_SR.
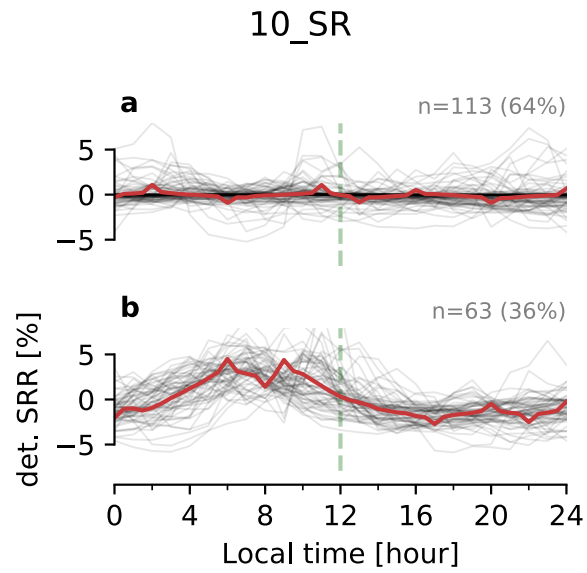
10_SR

Figure S6. Similar to Fig. S4 but for cluster 10_SR.
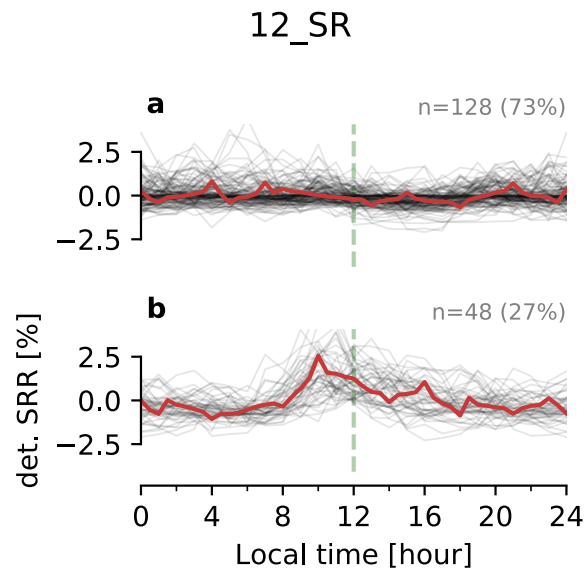
12_SR

Figure S7. Similar to Fig. S4 but for cluster 12_SR.

Ecoregion	02_MR	02_SR	03_SM	04_MR	04_SR	05_MR	06_SM	07_LR	07_SR	08_LR	08_SM	09_MR	10_LR	10_SR	11_MR	11_SR	12_SM	12_SR
1.South Pacific Ocean-EXT								34		78		12						
2.Southwest Amazon moist forests-TER	5		45	1								24				59	53	
3.Humboldtian-MER							1	19		19	34	32	16					
4.Dry Chaco-TER			42		19													
5.Madeira-Tapajós moist forests-TER	30															2		
6.Cerrado-TER	21			10														
7.Juan Fernandez and Desventuradas-MER								25		3								
8.Central Andean dry puna-TER					3	25	63		11		16							
9.Chiquitano dry forests-TER	10		2	7														
10.Central Andean puna-TER						19					17	22	2	10				
11.Mato Grosso tropical dry forests-TER	12																	
12.Pantanal-TER	6			7														
13.Sechura desert-TER											20	29	8					
14.Central Chile-MER								16										
15.Peruvian Yungas-TER											8	9			8			
16.Central Peru-MER													11					
17.Humid Chaco-TER				14														
18.Beni savanna-TER	6		6												2		10	
19.Alto Paraná Atlantic forests-TER				12														
20.Purus-Madeira moist forests-TER	4														7			
21.Central Andean wet puna-TER		16				23	2		89		2	7	4	56	7	35		100
22.Ucayali moist forests-TER													7					
23.Iquitos várzea-TER													6		4			
24.Bolivian Yungas-TER		84	45	2	5										3	44	37	
25.High Monte-TER						11												
26.Southern Andean Yungas-TER				1		8												
27.Atacama desert-TER						3	34	2			11							
28.Bolivian montane dry forests-TER			1	3	69	5								2		21		
31.Southern Andean steppe-TER						7												
36.Lake Titicaca-EXT													1	33				

Table S2. Table showing the ecoregions and the land cover percentage that they occupy in each of the 18-clusters. For a description of the ecoregions see Section 4