Supplementary Material

Generalized Synchronization between ENSO and hydrological variables in Colombia: A recurrence quantification approach

Table S1. XM river flow gauges, record length 1976–2015

ID	Latitude	Longitude	River	Dam	Central
1	3.53	-76.87	Alto Anchicaya	Alto Anchicaya	Alban
2	4.90	-73.30	Bata	Esmeralda	Chivor
3	2.71	-75.43	Betania	Betania	Betania
4	4.54	-74.26	Bogota	Agr.Bogota	Pagua
5	3.88	-76.56	Calima	Calima	Calima
6	2.94	-76.71	Cauca-Salvajina	Salvajina	Salvajina
7	4.57	-73.70	Chuza	Agr.Bogota	Pagua
8	6.51	-75.45	Grande	Riogrande	La Tasajera
9	6.78	-75.25	Guadalupe	Troneras	Guatron
10	6.29	-74.94	Guatape	Playas	Playas
11	4.73	-73.48	Guavio	Guavio	Guavio
12	5.56	-74.89	Miel I	Amani	Miel I
13	6.32	-75.17	Nare	Peñol	Guatapé
14	6.81	-75.15	Porce II	Porce II	Porce II
15	3.76	-74.89	Prado	Prado	Prado
16	6.21	-74.84	San Carlos	Punchina	San Carlos
17	6.39	-74.99	San Lorenzo	San Lorenzo	Joaguas
18	6.78	-75.32	Tenche	Miraflores	Guatrón

Table S2. IDEAM river flows gauges, record length 1976–2013.

ID	IDEAM code	Name	River	Latitude	Longitude
0	1107701	Bellavista	Atrato	6.57	-76.57
1	1105702	San Padu Antonio	Atrato	6.28	-76.77
2	2306706	Tobia	Negro	5.13	-74.45
3	2308715	Pte Real	Negro	6.15	-75.38
4	2205704	Palmalarga	Saldana	3.68	-75.33
5	2619703	Remolino El	San Juan	5.87	-75.92
6	2119703	Playa La	Sumapaz	4.2	-74.5
7	2903702	Calamar	Magdalena	10.25	-74.91

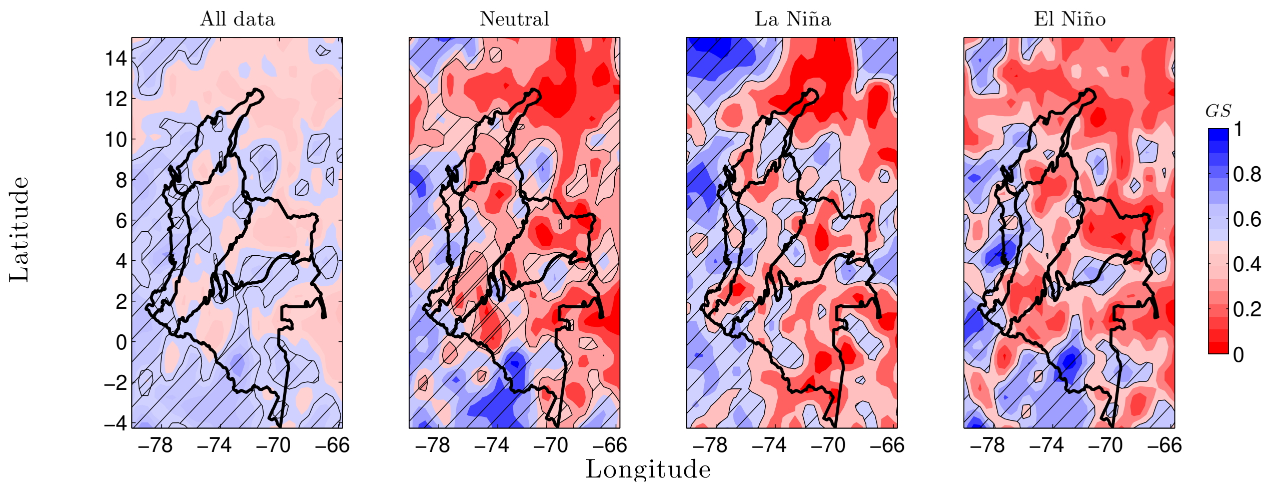

Figure S1. Generalized synchronization between SST gradient in the far-eastern Pacific and rainfall anomalies. Dataset No.1, period 1975-2006. The hatched contours indicates zones where the GS is significant at 5%.

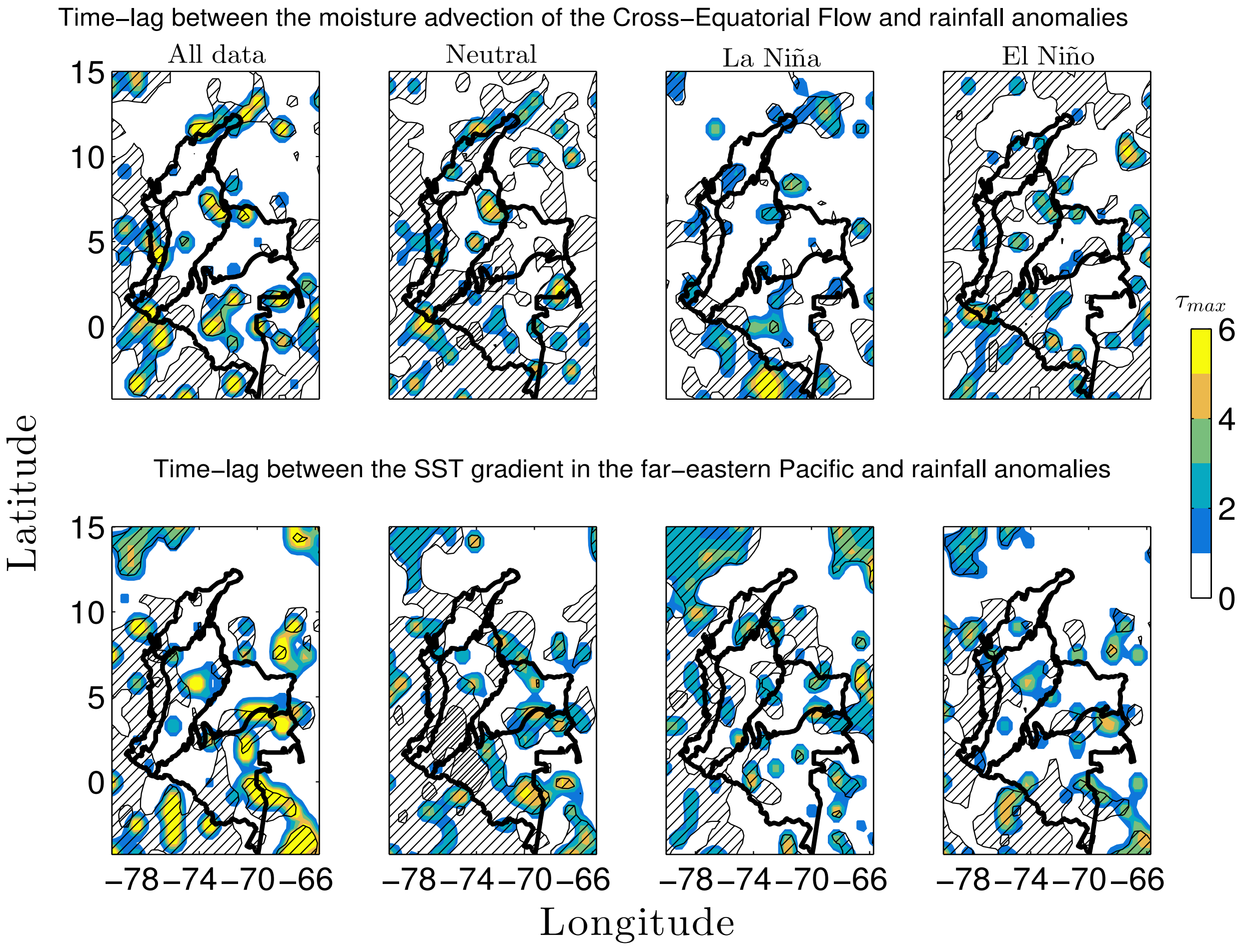

Figure S2. Time-lag in months between (top row) the moisture advection by the Cross-Equatorial Flow and rainfall anomalies and, (bottom row) SST gradient in the far-eastern Pacific and rainfall anomalies. Dataset No.1, period 1975-2006. The hatched contours indicates zones where the GS is significant at 5%.

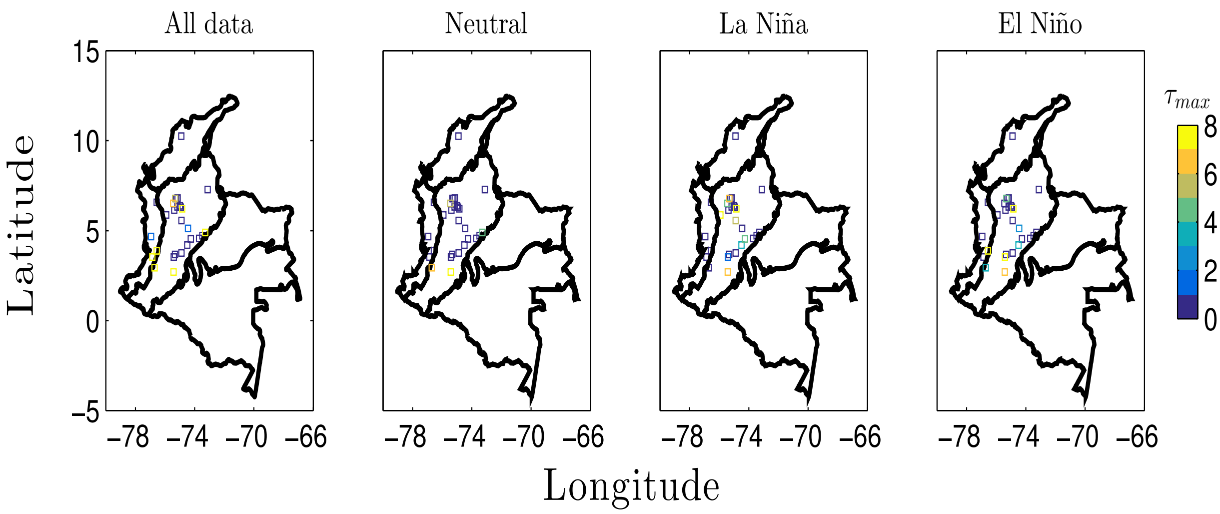

Figure S3. Time-lag in months between MEI and streamflows anomalies, period 1976-2013.

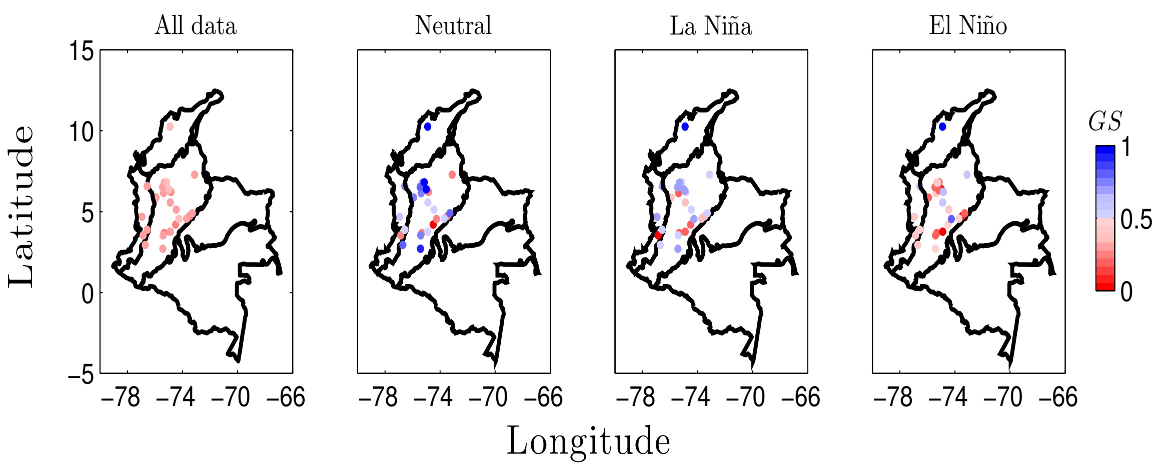

Figure S4. Generalized Synchronization Index between the Eastern Pacific (EP) index and river flow anomalies from the IDEAM and XM datasets, period 1976-2013.

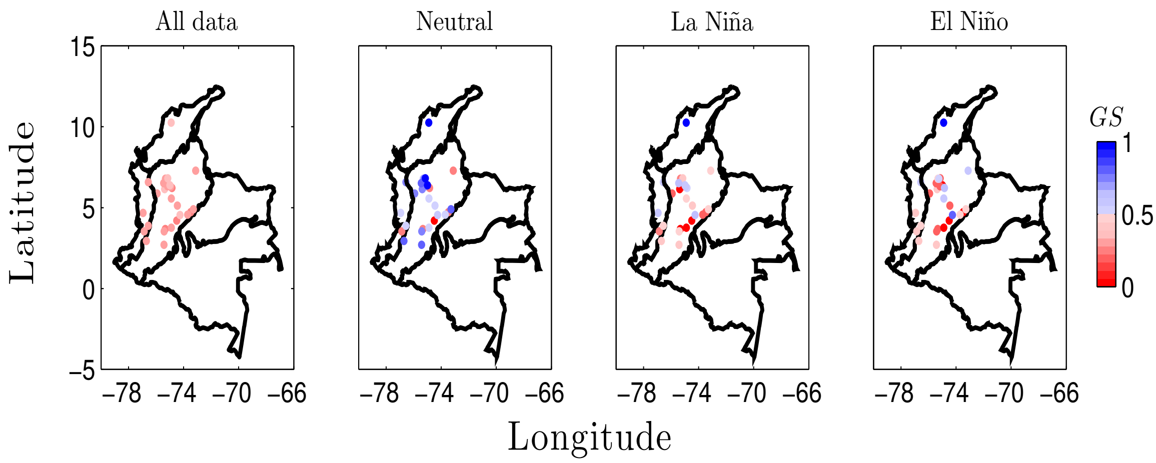

Figure S5. Generalized Synchronization Index between the Central Pacific (CP) index and river flow anomalies from the IDEAM and XM datasets, period 1976-2013.

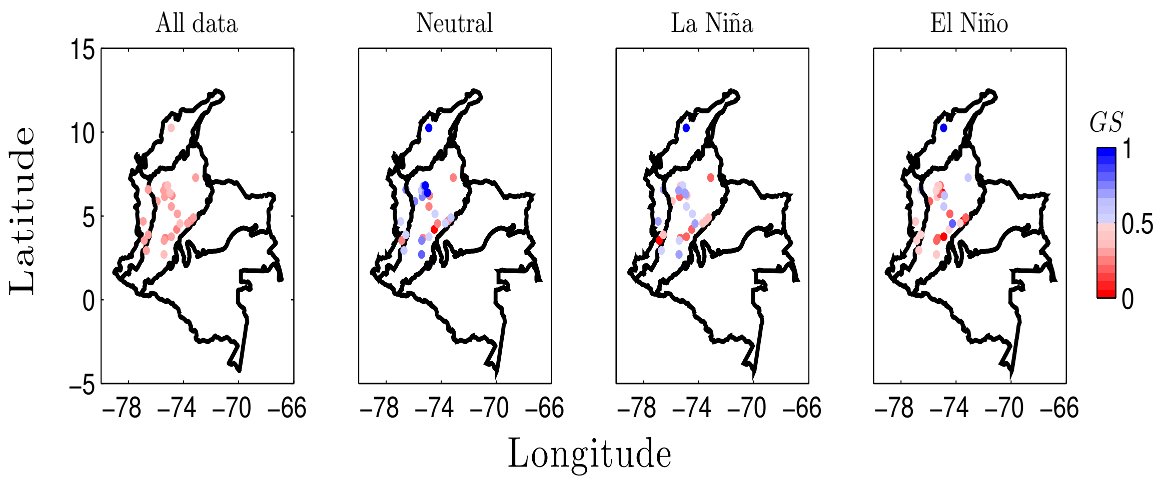

Figure S6. Generalized Synchronization Index between the Mixed-type index and river flow anomalies from the IDEAM and XM datasets, period 1976-2013.

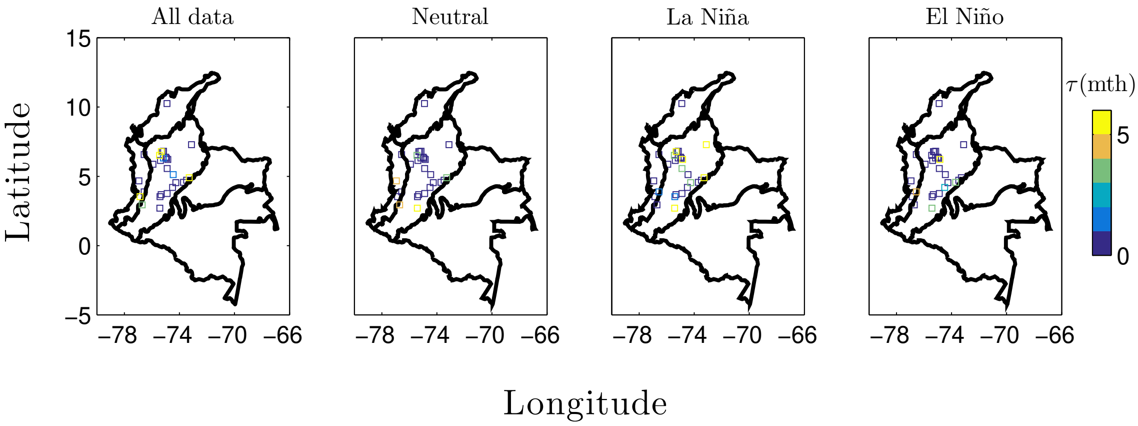

Figure S7. Timelags between the Eastern Pacific (EP) index and streamflow anomalies from the IDEAM and XM datasets, period 1976-2013.

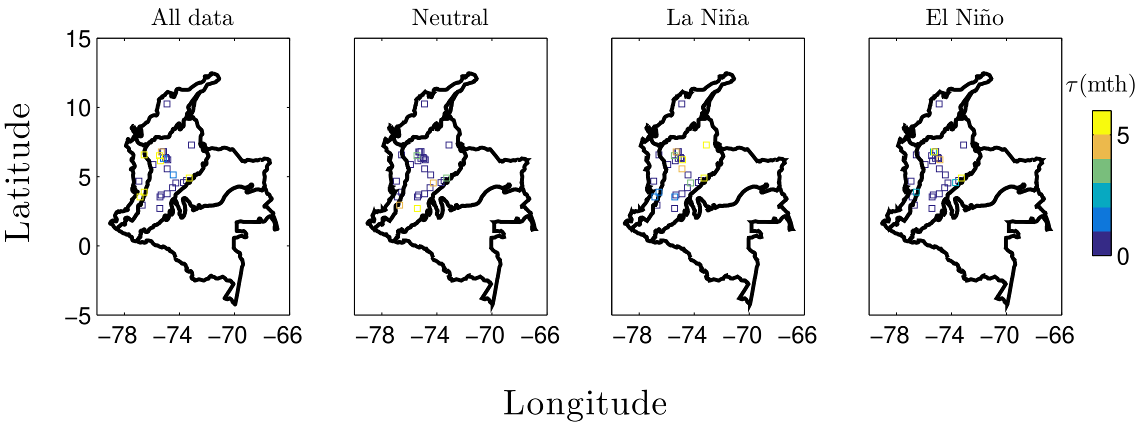

Figure S8. Timelags between the Central Pacific (CP) index and streamflow anomalies from the IDEAM and XM datasets, period 1976-2013.

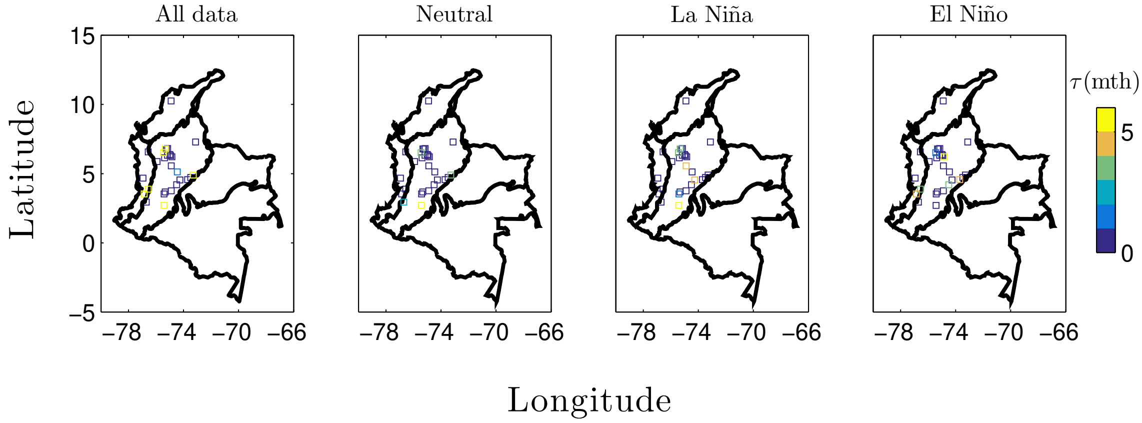

Figure S9. Timelags between the Mixed-Type El Niño index and streamflow anomalies from the IDEAM and XM datasets, period 1976-2013.

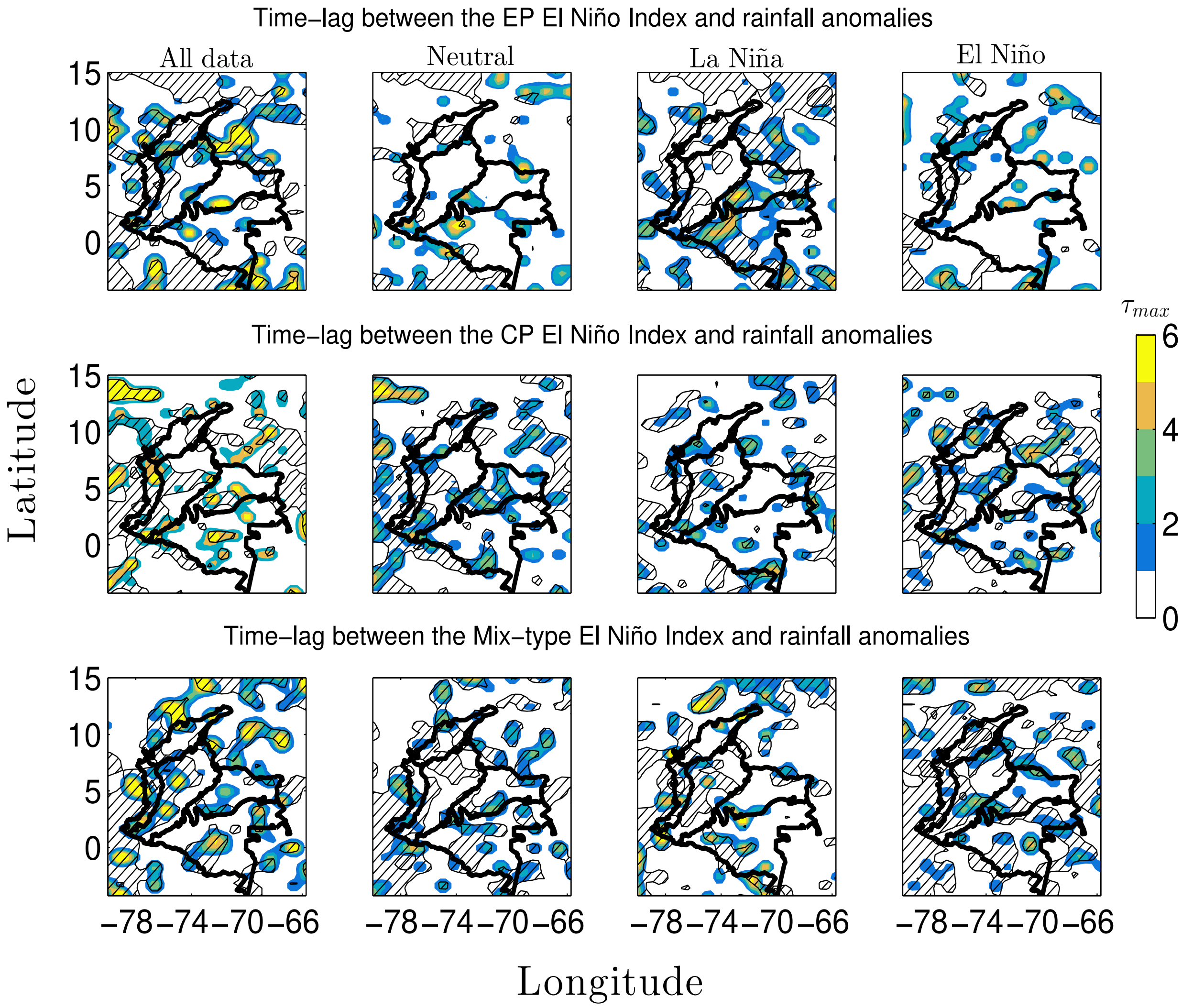

Figure S10. Time-lag in months between (top row) Eastern Pacific (EP) type of El Niño index and rainfall anomalies, (middle row) Central Pacific (CP) type of El Niño index and rainfall anomalies, and (bottom row) Mixed-type of El Niño index and rainfall anomalies. Dataset No.1, period 1975-2006. The hatched contours indicates zones where the GS is significant at 5%.

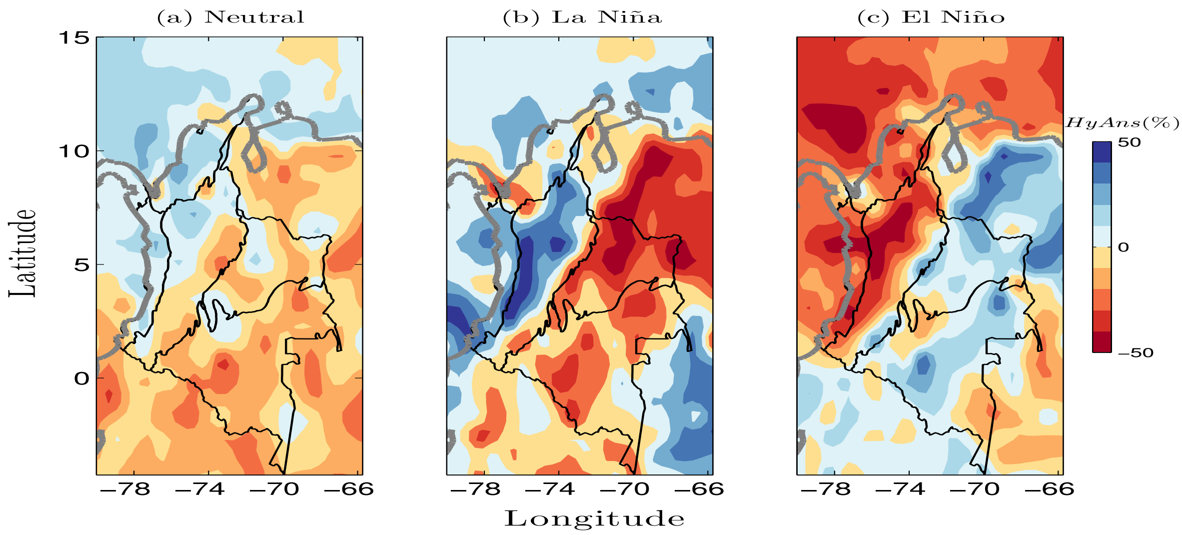

Figure S11. Composite average rainfall anomalies in Colombia during ENSO. Rainfall anomalies were calculated using F-Filtering of the annual cycle by moving averages, which is previously mentioned as the HyAns–FAC method. (gray line) northern South American coast line. (black line) Borders of the Colombia's natural regions.

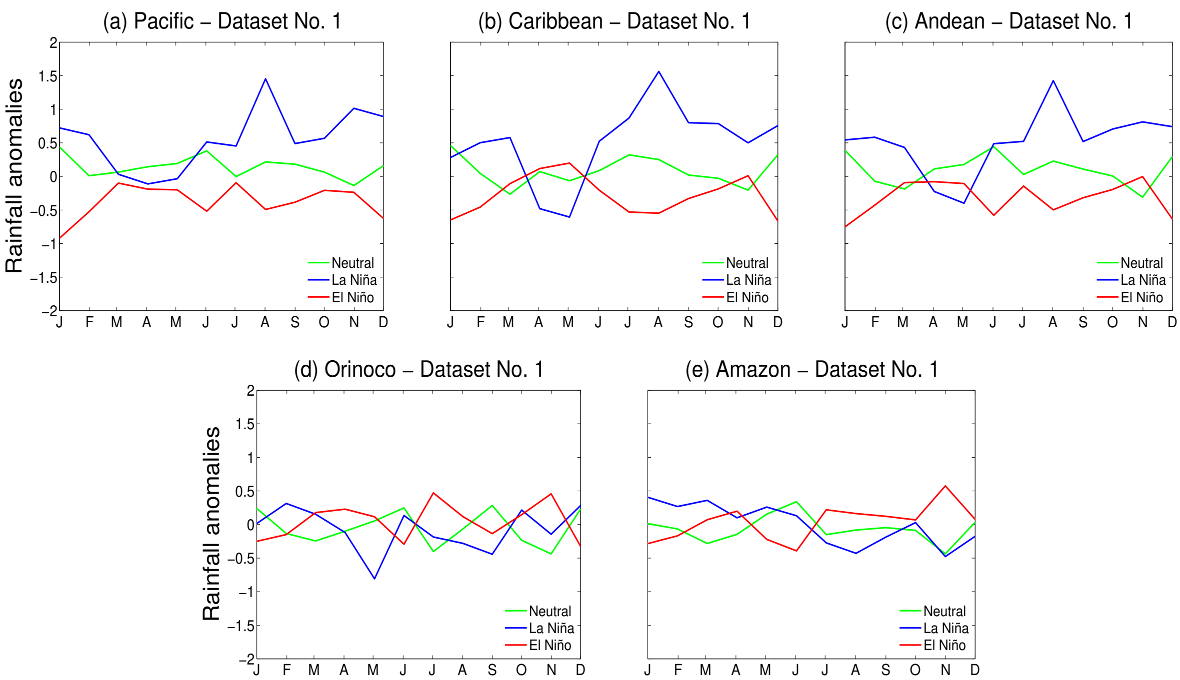

Figure S12. Annual cycle of rainfall anomalies averaged over the five natural regions (Pacific, Caribbean, Andean, Orinoco, and Andes) of Colombia during the phases of ENSO (La Niña, El Niño and Neutral) for Dataset No. 1, period 1975-2006.