Supplementary Materials: Trends of Hydroclimatic Intensity in Colombia

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We analyzed precipitation data both from rain gauges and the Climate Hazards Group InfraRed Precipitation with Station database (CHIRPS) [1]. The gauges are in 1706 sites in the whole territory of Colombia from the Colombian Meteorological Service (IDEAM) rain gauge network. Data comprise daily time series of rainfall amounts. We also used.

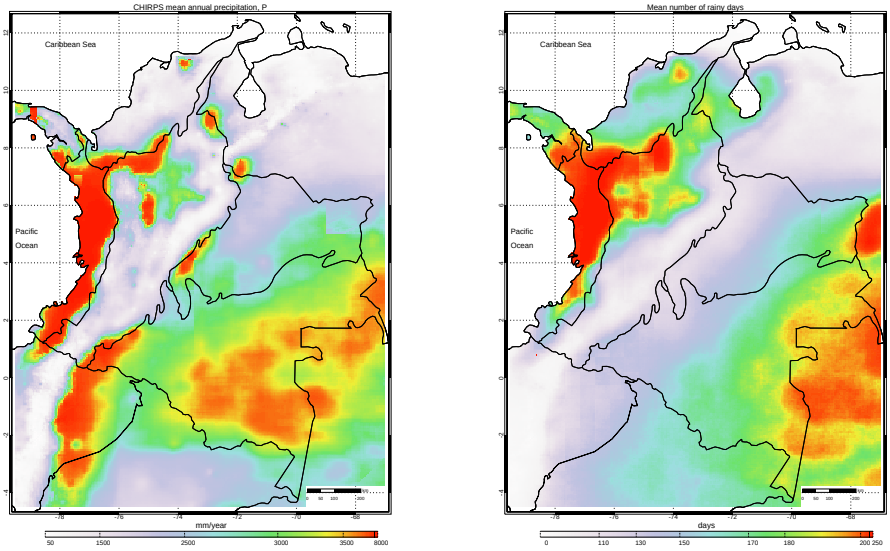

Figure S1. Mean annual precipitation over the period 1981-2018 from the CHIRPS database (left). Mean annual number of rainy days over the same period (right).

Table S1 presents the confusion matrix that illustrates the need to consider the autocorrelation of the series in estimating trends for the variables of this study.

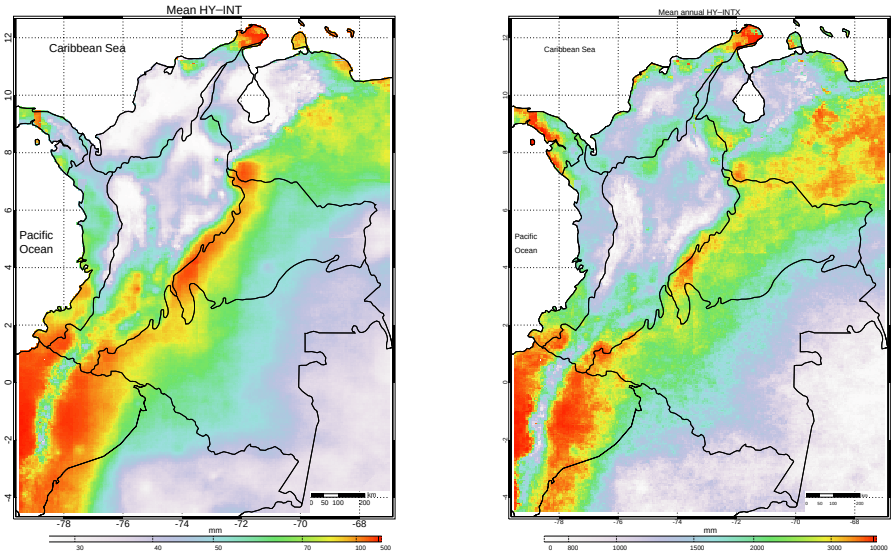

Figure S2. Average HY-INT over the period 1981-2018 from the CHIRPS database (left). Average HY-INTX over the same period (right).

Table S2 shows a sensitivity analysis of the results obtained using the different filters of the rain gauge data.

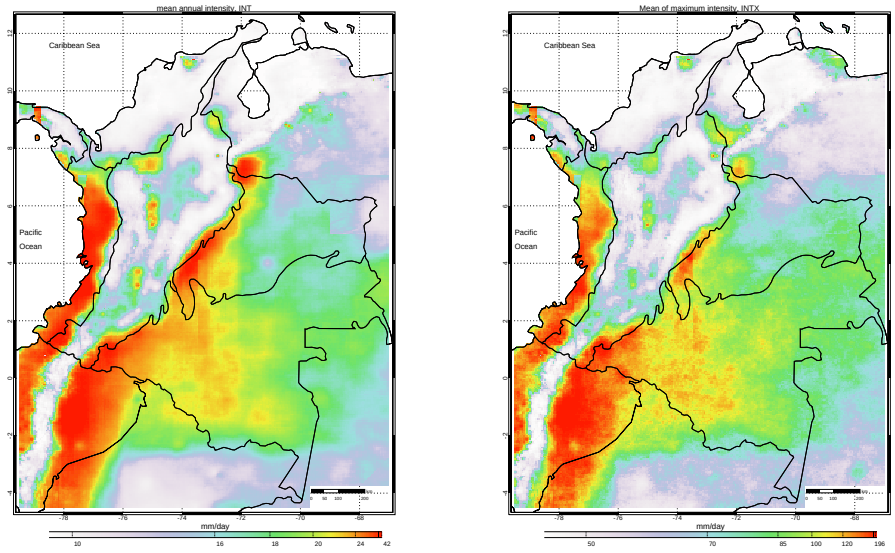

Figure S3. Mean average intensity over the period 1981-2018 from the CHIRPS database (left). Mean maximum intensity over the same period (right).

Table S3 presents a regional summary of the trends of the main variables studied.

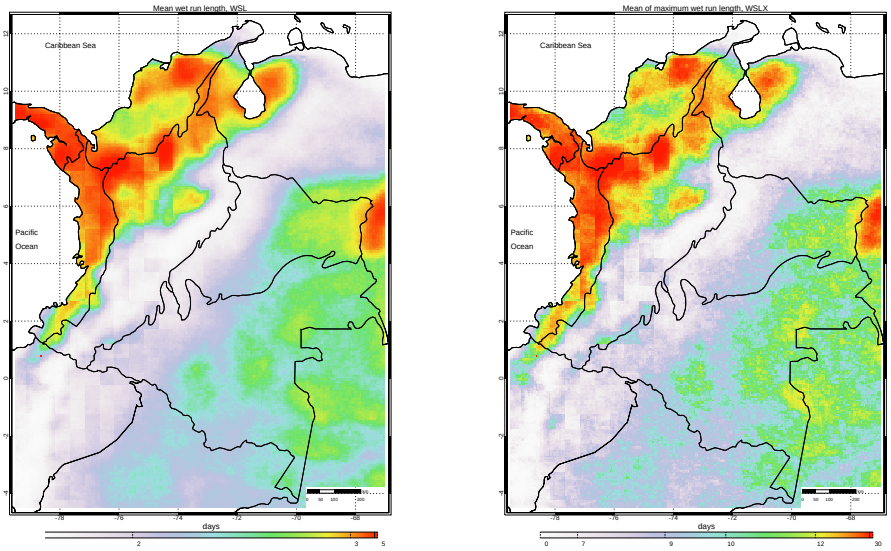

Figure S4. Mean wet run length over the period 1981-2018 from the CHIRPS database (left). Mean maximum wet run length over the same period (right).

Figure S1 presents a map of the mean annual precipitation over Colombia. Similar maps for the averages of the other variables considered in this study are in Figures S2 to S6. Figure S7 shows the histograms of the spatial distribution of the mean annual precipitation and the mean annual number of rainy days.

Table S1. Confusion matrices for the evaluation method of the significance of the trends for each of the indicated variables without taking into account autocorrelation. For the illustration, the Mann-Kendall test with autocorrelation is considered the true one. The Table shows the results for the fourth sensitivity rain gauge dataset, but notice the similarity among all datasets. True trend means that both methods give significant trends. A false trend is when ignoring autocorrelation gives a significant trend but it is non-significant if it is considered. A false no trend is when the roles are inverted. A true no trend is when both methods indicate non-significant trend.

Variable	true trend	false trend	false no trend	true no trend
	Number of gauges (Percentage of the total number of gauges)			
P	45 (3%)	293 (18%)	180 (11%)	1111 (68%)
INT	116 (7%)	400 (25%)	245 (15%)	868 (53%)
DSL	62 (4%)	316 (19%)	184 (11%)	1067 (66%)
HY-INT	108 (7%)	393 (24%)	212 (13%)	916 (56%)

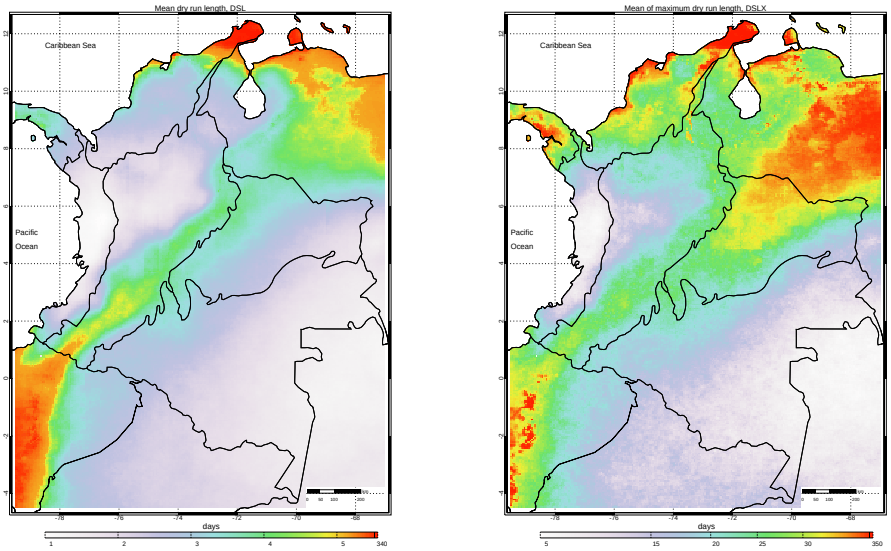

Figure S5. Mean dry run length over the period 1981-2018 from the CHIRPS database (left). Mean maximum dry run length over the same period (right).

Figure S8 shows examples of trend analysis for two stations. Figure S9 presents the trend slope of the histograms of the total annual precipitation, the number of wet days in the year, and the number of wet spells. Figures S10 and S11 present maps of the trend slope for the number of wet days, the number of wet runs, the average length of wet runs, and the maximum length of wet runs.

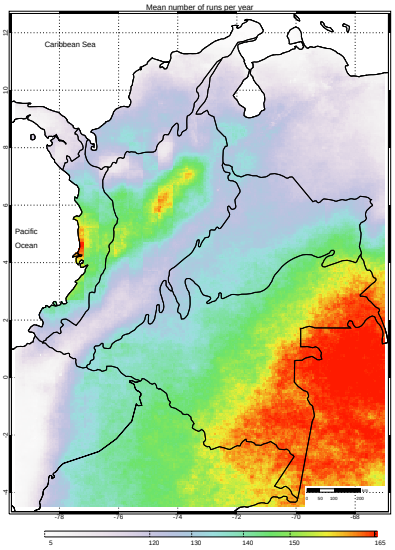

Figure S6. Mean number of runs over the period 1981-2018 from the CHIRPS database

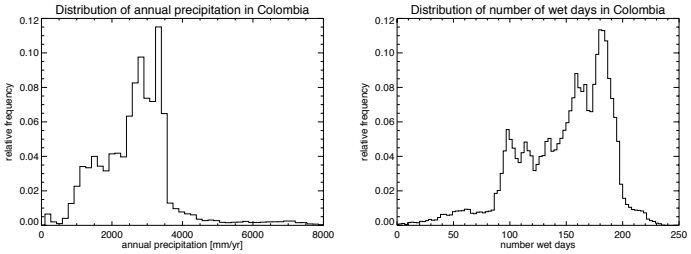

Figure S7. Histograms of mean annual precipitation over the period 1981-2018 from the CHIRPS database (left) and mean annual number of rainy days over the same period (right).

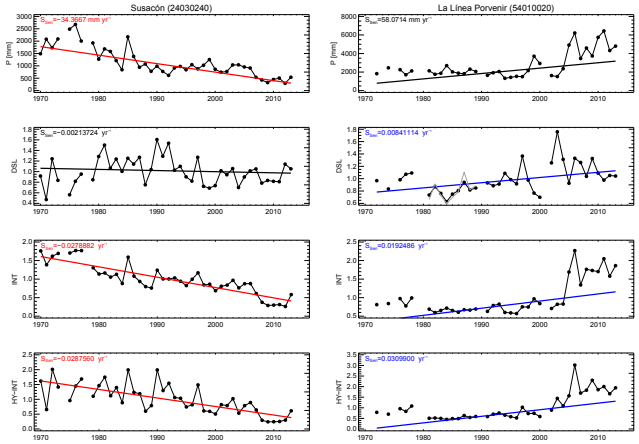

Figure S8. Two examples of trend analysis for (top to bottom) P, DSL, INT, and HY-INT for two representative stations, left panel: Susacón in Boyacá, at 2550 m.a.s.l., right panel: La Línea El Porvenir in Risaralda, at 1955 m.a.s.l.

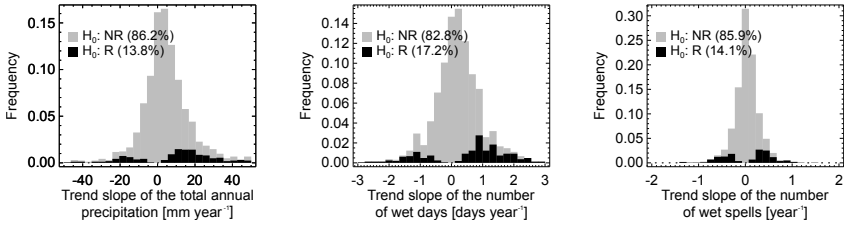

Figure S9. Same as Figure **??** for the trend slope of the total annual precipitation (left), the number of wet days in the year (center) and the number of wet spells in the year (right).

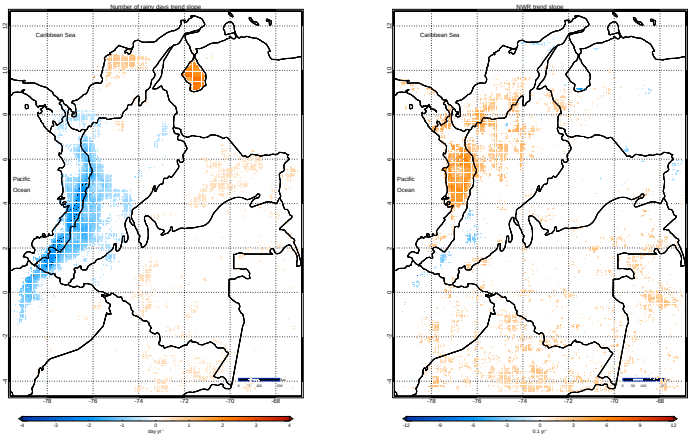

Figure S10. Maps of the trend slope for the number of wet days (left) and the number of wet runs (right) for the CHIRPS dataset. Non-significant trends are not plotted.

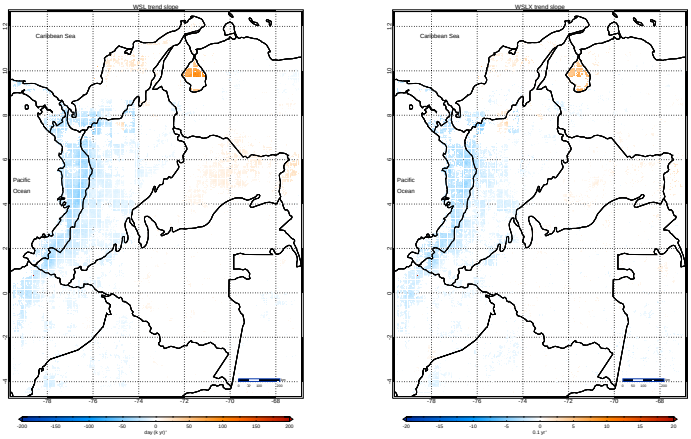

Figure S11. Maps of the trend slope for the average length of wet runs (left) and the maximum length of wet runs (right) for the CHIRPS dataset. Non-significant trends are not plotted.

Table S2. Comparison of sensitivity alternatives for data filtering. Percentage of stations with a significant trend for each of the four sensitivity datasets (%S1 to %S4) and percentage of those with positive trends (%P1 to %P4). Variable symbols are the same as in Table **??**.

Variable	%S1	%S2	%S3	%S4	%P1	%P2	%P3	%P4
N Gauges	355	1345	1320	1629				
P	12	13	14	14	80	81	82	73
INT	21	20	19	22	49	56	59	57
DSL	18	16	15	15	17	18	20	31
HY-INT	22	18	18	20	29	33	34	40
N Wet Days	18	17	17	17	74	81	80	71
WSL	20	19	17	18	83	75	74	64
N Wet Runs	17	15	14	14	66	64	62	58
INTX	11	9	10	9	68	62	64	57
DSLX	11	9	10	9	34	27	26	20
HY-INTX	10	9	10	9	43	34	37	26
WSLX	17	14	14	14	77	74	71	64

Table S3. Regional summary of the trends of all the variables studied, for the base rain gauges and the CHIRPS datasets. Column symbols as in Table **??**. The number of stations and pixels for each region are: Amazon, 12 and 14006; Andes, 622 and 9741; Caribbean, 207 and 3901; Orinoco, 30 and 6729; and Pacific, 38 and 2635 respectively.

Region	% SIG	% INC	% SIG	% INC
	Gauges		CHIRPS	
	Total Annual Precipitation			
Amazon	0	-NaN	10	80
Andes	13	73	6	84
Caribbean	14	90	5	97
Orinoco	17	80	8	50
Pacific	24	100	28	77
Total	13	79	10	76
	HY-INT			
Amazon	25	0	12	0
Andes	20	30	31	79
Caribbean	21	36	38	4
Orinoco	17	60	22	0
Pacific	37	43	31	100
Total	21	33	23	39
	INTX, Maximum Intensity			
Amazon	17	0	4	43
Andes	11	62	20	53
Caribbean	8	63	22	5
Orinoco	7	100	12	12
Pacific	8	67	17	100
Total	10	62	13	41
	HY-INTX			
Amazon	8	0	5	17
Andes	11	39	13	71
Caribbean	6	58	12	26
Orinoco	7	100	6	3
Pacific	24	0	15	100
Total	10	38	9	48

Continuation of Table S3

Region	% SIG Gauges	% INC Gauges	% SIG CHIRPS	% INC CHIRPS
		INT		
Amazon	17	0	12	8
Andes	20	52	34	89
Caribbean	25	60	20	38
Orinoco	20	67	37	1
Pacific	24	67	43	100
Total	21	55	25	48
		DSL		
Amazon	8	0	7	6
Andes	16	23	15	81
Caribbean	17	14	12	1
Orinoco	17	20	2	0
Pacific	37	14	22	99
Total	17	20	10	51
		N Wet Days		
Amazon	8	100	6	86
Andes	19	85	32	2
Caribbean	15	77	19	70
Orinoco	20	33	15	100
Pacific	32	58	59	0
Total	18	80	20	32
		N Wet Runs		
Amazon	17	50	7	100
Andes	13	55	18	87
Caribbean	17	86	19	91
Orinoco	23	71	2	90
Pacific	26	80	51	100
Total	15	66	14	94
		WSL		
Amazon	8	0	4	38
Andes	18	82	46	2
Caribbean	20	66	23	42
Orinoco	30	44	19	100
Pacific	29	46	78	0
Total	19	74	25	21

Continuation of Table S3

Region	% SIG Gauges	% INC Gauges	% SIG CHIRPS	% INC CHIRPS
		WSLX		
Amazon	0	-NaN	5	36
Andes	14	81	34	4
Caribbean	15	61	13	55
Orinoco	10	67	8	90
Pacific	24	44	69	0
Total	15	74	18	16
		DSLX		
Amazon	8	0	6	15
Andes	10	31	5	82
Caribbean	8	53	3	77
Orinoco	0	-NaN	4	13
Pacific	29	0	12	100
Total	10	31	5	47

References

1. Funk, C.; Peterson, P.; Landsfeld, M.; Pedreros, D.; Verdin, J.; Shukla, S.; Husak, G.; Rowland, J.; Harrison, L.; Hoell, A.; et al. The climate hazards infrared precipitation with stations—A new environmental record for monitoring extremes. *Sci. Data* **2015**, *2*, doi:10.1038/sdata.2015.66.