Supplementary material

Assessment of the morphometric characteristics of the sub-basins of the Grijalva-Villahermosa Hydrological Region in southeastern Mexico

Avaliação das características morfométricas das sub-bacias da Região Hidrológica Grijalva-Villahermosa no sudeste do México

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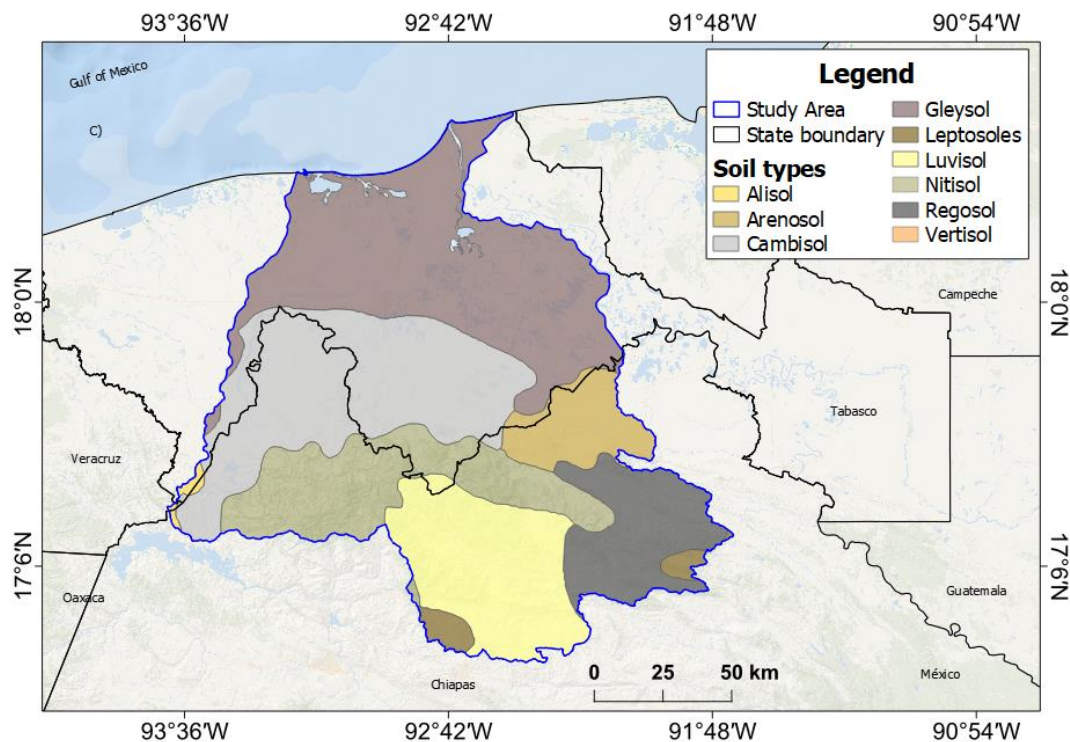
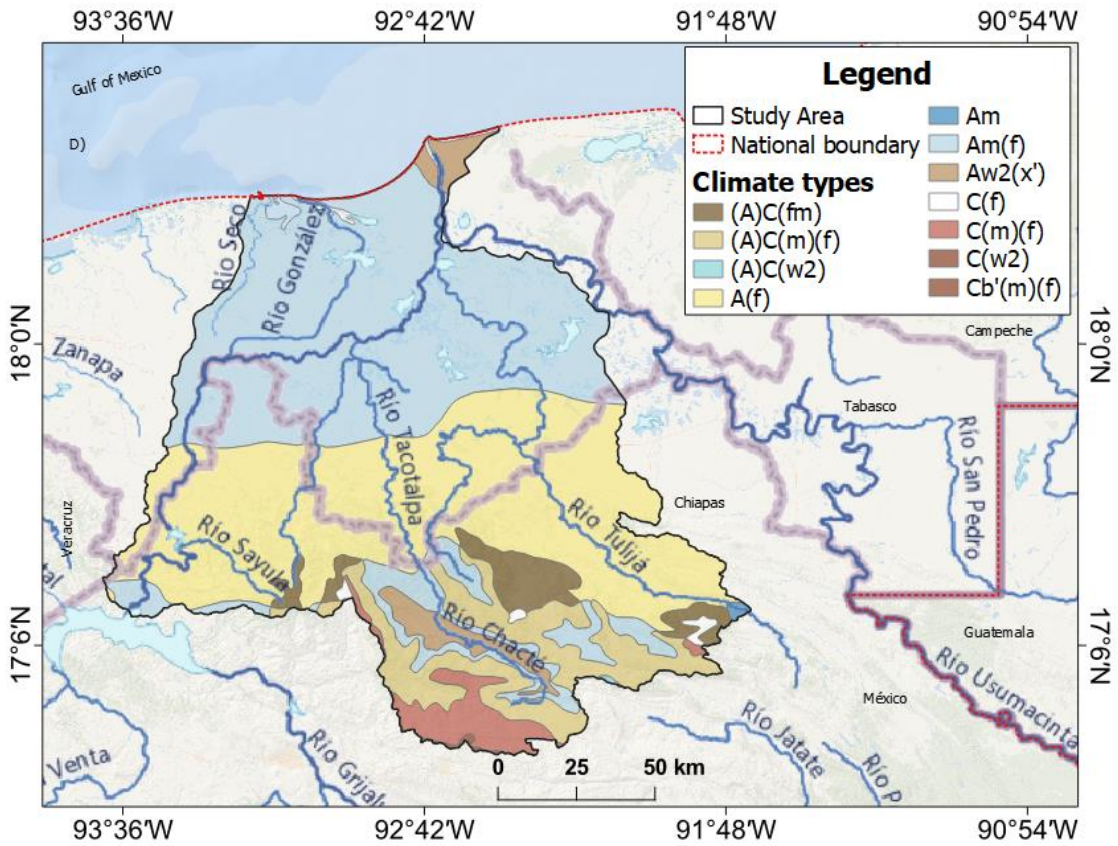**Figure S1**. Edaphic characteristics of RH30D.

Figure S2. Climate and river characteristics of RH30D.
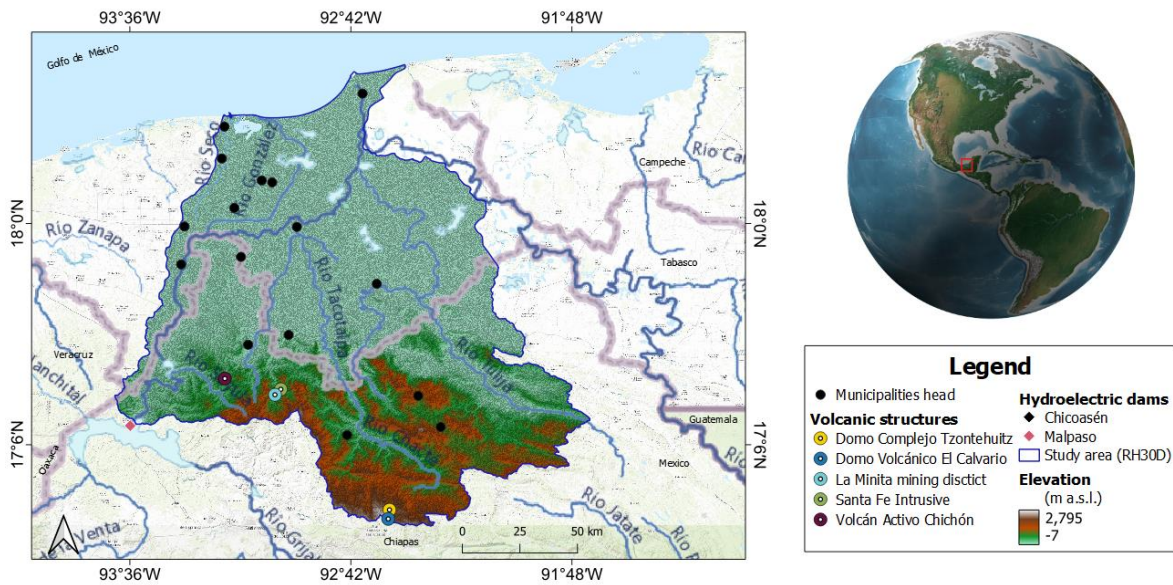

Figure S3. Rivers and socio-environmental references in RH30D.

Table S1. General parameters of the sub-basins of RH30D.

Sub-basins	Code (RH30)	A (km²)	P (km)	Lc (km)	Oc	Ntc	Ltc (km)	R (msnm)
Grijalva R.	Da	1,923.85	464.88	109.51	5	3,203	2,546.37	91
Viejo Mezcalapa R.	Db	565.69	165	44.06	5	982	731.75	82
RMezcalapa R.	Dc	1,280.93	352.77	82.03	6	2,213	1,677.69	4
Tzimbac R.	Dd	252.3	127.65	45.91	4	427	300.96	2,220
Zayula R.	De	419.59	119.36	38.88	5	734	498.5	2,338
Platanar R.	Df	399.61	129.92	36.64	5	653	541.02	1,105
Paredón R.	Dg	381.67	117.98	32.66	5	630	516.49	609
Pichucalco R.	Dh	1,313.18	260.71	77.9	6	1,131	1,806.52	2,139
de la Sierra R.	Di	1,072.72	267.25	82.23	5	1,863	1,358.38	2,458
Tacotalpa R.	Dj	514.18	171.96	42.89	5	791	651.88	1,002
Almendros R.	Dk	1,042.03	174.61	50.79	6	1,754	1,337.46	2,416
Plátanos R.	Dl	610.8	139.07	36.51	6	1,114	809.23	2,511
Chacté R.	Dm	1,489.55	218.45	54.21	5	1,289	1,387.93	2,511
Puxcatán R.	Dn	673.85	184.86	49.85	5	1,182	868.19	2,142
Macuspana R.	Do	1,178.36	228.64	44.1	6	2,029	1,673.97	2,087
Shumulá R.	Dp	1,006.30	192.22	55.25	6	1,841	1,318.14	1,970
Yashijá R.	Dq	565.54	155.44	41.77	5	1,038	747.05	1,862
Tulijá R.	Dr	1,698.44	337.95	90.41	6	2,799	2,407.62	1,491
Bascá R.	Ds	438.82	124.92	38.4	5	8,36	626.83	864
Chilapa R.	Tr	2,171.32	253.8	65.55	6	3,701	3,113.32	287
Chilapilla R.	Du	685.1	152.08	36.66	5	1,194	939.64	79
Tabasquillo R.	Dv	251.05	81.91	30	4	386	317.99	15
Carrizal R.	Dw	1,165.69	266.95	54.92	5	1,977	1,585.84	42
Samaria R.	Dx	548.58	127.68	44.82	6	937	720.09	30
Cunduacán R.	Dy	507.84	192.94	72	4	820	596.8	61
Cuxcuchapa R.	Dz	633.27	158.14	53.74	5	1,008	786.62	40

Note. A= Area; P= Perimeter; Lc= Length of main channel; Oc= Order of streams; Ntc= Total number of streams; Ltc=Total length of streams; and R= unevenness.

Table S2. Values of morphometric parameters (MP) of the sub-basins.

Sub-basins	Code (RH30)	Ff	Er	Cr	Cc	K	Rh	Dd	Rn	Br	Tr	Fs	Lg
Grijalva R.	Da	0.16	0.45	0.11	2.97	4.9	0.83	1.32	120.45	2.12	6.89	1.66	0.38
Viejo Mezcalapa R.	Db	0.29	0.61	0.26	1.94	2.69	1.86	1.29	106.07	1.49	5.95	1.74	0.39
RMezcalapa R.	Dc	0.19	0.49	0.13	2.76	4.13	0.05	1.31	5.24	1.81	6.27	1.73	0.38
Tzimbac R.	Dd	0.12	0.39	0.19	2.25	6.56	48.36	1.19	2,648.11	1.35	3.35	1.69	0.42
Zayula R.	De	0.28	0.59	0.37	1.63	2.83	60.14	1.19	2,777.66	1.34	6.15	1.75	0.42
Platanar R.	Df	0.3	0.62	0.3	1.82	2.64	30.16	1.35	1,496.01	2.34	5.03	1.63	0.37
Paredón R.	Dg	0.36	0.67	0.34	1.69	2.2	18.64	1.35	824.11	3.03	5.34	1.65	0.37
Pichucalco R.	Dh	0.22	0.52	0.24	2.01	3.63	27.46	1.38	2,942.57	1.62	4.34	1.77	0.36
de la Sierra R.	Di	0.16	0.45	0.19	2.28	4.95	29.89	1.27	3,112.56	1.47	6.97	1.74	0.39
Tacotalpa R.	Dj	0.28	0.6	0.22	2.12	2.81	23.36	1.27	1,270.34	2.48	4.6	1.54	0.39
Almendros R.	Dk	0.4	0.72	0.43	1.51	1.94	47.57	1.28	3,100.96	1.43	10.05	1.68	0.39
Plátanos R.	Dl	0.46	0.76	0.4	1.58	1.71	68.77	1.32	3,326.75	1.69	8.01	1.82	0.38
Chacté R.	Dm	0.51	0.8	0.39	1.58	1.55	46.32	0.93	2,339.69	1.4	5.9	0.87	0.54
Puxcatán R.	Dn	0.27	0.59	0.25	1.99	2.9	42.97	1.29	2,759.79	1.35	6.39	1.75	0.39
Macuspana R.	Do	0.61	0.88	0.28	1.86	1.3	47.33	1.42	2,964.78	1.74	8.87	1.72	0.35
Shumulá R.	Dp	0.33	0.65	0.34	1.7	2.38	35.66	1.31	2,580.49	1.55	9.58	1.83	0.38
Yashijá R.	Dq	0.32	0.64	0.29	1.83	2.42	44.58	1.32	2,459.63	1.35	6.68	1.84	0.38
Tulijá R.	Dr	0.21	0.51	0.19	2.3	3.78	16.49	1.42	2,113.56	1.49	8.28	1.65	0.35
Bascá R.	Ds	0.3	0.62	0.35	1.67	2.64	22.5	1.43	1,234.19	1.48	6.69	1.91	0.35
Chilapa R.	Tr	0.51	0.8	0.42	1.53	1.55	4.38	1.43	411.51	1.68	14.58	1.7	0.35
Chilapilla R.	Du	0.51	0.81	0.37	1.63	1.54	2.15	1.37	108.35	1.61	7.85	1.74	0.36
Tabasquillo R.	Dv	0.28	0.6	0.47	1.45	2.82	0.5	1.27	19	1.93	4.71	1.54	0.39
Carrizal R.	Dw	0.39	0.7	0.21	2.19	2.03	0.76	1.36	57.14	1.72	7.41	1.7	0.37
Samaria R.	Dx	0.27	0.59	0.42	1.53	2.88	0.67	1.31	39.38	1.68	7.34	1.74	0.38
Cunduacán R.	Dy	0.1	0.35	0.17	2.4	8.02	0.85	1.18	71.69	2.17	4.25	1.61	0.43
Cuxcuchapa R.	Dz	0.22	0.53	0.32	1.76	3.58	0.74	1.24	49.69	1.84	6.37	1.59	0.4

Note. Form Factor (Ff), Elongation Ratio (Er), Circularity Ratio (Cr), Compactness Coefficient (Cc), Lemniscate Ratio (K), Relief Ratio (Rh), Drainage Density (Dd), Ruggedness Number (Rn), Bifurcation Ratio (Br), Drainage Texture (Tr), Stream Frequency (Fs), and Length of Overland Flow (Lg).

Table S3. Percentage of Cumulative Variance and eigenvalues of the PMs in the sub-basins of the Principal Component Analysis

Component	Variance (%)	Cumulative Variance (%)	Eigenvalues
1	40.90	41.10	4.91
2	21.02	61.92	2.52
3	17.19	79.11	2.06

Table S4. Contribution of the PM to the principal components.

Parameters	Dim.1	Dim.2	Dim.3
Ff	17.06	0.01	2.24
Er	17.80	0.01	2.31
Cr	10.96	4.25	6.34
Cc	9.75	4.78	6.97
K	17.88	0.03	2.14
Rh	4.45	12.55	14.27
Dd	3.87	26.31	3.61
Rn	3.51	9.38	20.23
Br	0.46	10.13	13.01
Tr	9.03	3.42	1.23
Fs	1.50	2.24	24.63
Lg	3.73	26.88	3.01

Table S5. Significant correlations of morphometric parameters with the first three axes of the PCA.

PM	Component 1		Component 2		Component 3	
	Correlation	p.value	Correlation	p.value	Correlation	p.value
Dd	0.436	0.026	0.8147	0.000		
Tr	0.6657	0.000				
Ff	0.9151	0.000				
Fs					0.7128	0.000
K	-0.9368	0.000				
Cc	-0.6918	0.000				
Lg	-0.4277	0.029	-0.8234	0.000		
Br			0.5056	0.008	-0.518	0.007
Cr	0.7334	0.000				
Er	0.9347	0.000				
Rh	0.4671	0.016	-0.5626	0.003	0.5426	0.004
Rn	0.4153	0.035	-0.4865	0.012	0.646	0.000

Table S6. Mean, standard deviation (SD) and coefficient of variation (CV) of morphometric parameters by sub-basin groups obtained with the medoids.

PM	Group	Mean	DS	CV	PM	Group	Mean	DS	CV
Ff	**1**	-1.113	0.369	-33.2	**Dd**	**1**	-0.001	1.056	-73,208.5
	2	-0.177	0.848	-480.3		**2**	-0.509	1.010	-198.3
	3	-0.254	0.406	-160.2		**3**	-0.012	0.747	-6,076.6
	4	1.080	0.839	77.7		**4**	0.520	0.676	130.1
Er	**1**	-1.227	0.536	-43.6	**Rn**	**1**	-0.773	1.017	-131.5
	2	-0.149	0.887	-596.6		**2**	0.452	0.481	106.3
	3	-0.174	0.426	-245.1		**3**	-0.169	0.753	-445.5
	4	1.041	0.701	67.3		**4**	0.155	1.151	741.6
Cr	**1**	-1.446	0.366	-25.3	**Br**	**1**	0.592	0.761	128.5
	2	-0.020	0.752	-3,732.2		**2**	-0.974	0.542	-55.7
	3	0.208	0.892	428.2		**3**	1.106	0.773	69.9
	4	0.674	0.846	125.5		**4**	0.087	0.407	468.6
Cc	**1**	1.371	0.538	39.3	**Tr**	**1**	-0.159	1.061	-668.0
	2	-0.031	0.609	-1,979.3		**2**	-0.182	0.882	-484.8
	3	-0.323	0.978	-302.6		**3**	-1.081	0.489	-45.3
	4	-0.643	0.746	-115.9		**4**	1.115	0.679	60.9
Cc	**1**	1.353	0.676	50.0	**Fs**	**1**	-0.366	0.539	-147.0
	2	0.186	0.969	521.7		**2**	0.543	1.281	235.9
	3	0.192	0.443	230.3		**3**	-0.615	0.807	-131.2
	4	-1.062	0.718	-67.6		**4**	0.353	0.560	158.8
Rh	**1**	-0.812	0.939	-115.6	**Lg**	**1**	0.000	1.073	305,936.3
	2	0.523	0.422	80.7		**2**	0.506	0.989	195.4
	3	-0.021	0.599	-2,873.1		**3**	-0.088	0.704	-796.8
	4	0.204	1.033	506.7		**4**	-0.535	0.640	-119.5