

## Supplementary Material

### **Impact of Long-Range Transported African Dust on Cloud Water Chemistry at a Tropical Montane Cloud Forest in Northeastern Puerto Rico - Carlos J. Valle-Díaz et al.**

Tables S1 – S3 show values that corresponds to Figure 2 in main manuscript and tables S4 – S6 show values that corresponds to Figure 3 in main manuscript.

**Table S1:** Minimum, maximum, average concentration, and standard deviation of water-soluble ions ( $\mu\text{N}$ ) and metals ( $\text{mg/L}$ ) in bulk and size-resolved cloud water (N represents the number of samples for each species). **DUST**

		<b>Cations – Dust</b>						
		$\text{Na}^+$	$\text{H}^+$	$\text{NH}_4^+$	$\text{K}^+$	$\text{Mg}^{2+}$	$\text{ss-Ca}^{2+}$	$\text{nss-Ca}^{2+}$
BCW	Min	67.8	0.0562	2.48	1.40	18.1	2.71	0.773
	Max	2147	40.7	75.3	47.9	478	85.9	206
	Average	<b>371</b>	<b>4.65</b>	<b>20.4</b>	<b>10.2</b>	<b>88.8</b>	<b>14.8</b>	<b>42.8</b>
	Stdev	318	8.56	14.4	8.4	71.9	12.7	49.2
	N	51	48	46	51	50	51	51
LCWD	Min	77.6	0.0813	1.58	1.82	16.3	3.11	0.377
	Max	1512	63.1	64.6	36.3	317	60.5	210
	Average	<b>395</b>	<b>11.9</b>	<b>15.9</b>	<b>10.1</b>	<b>93.8</b>	<b>15.8</b>	<b>50.8</b>
	Stdev	283	14.6	13.3	8.0	65.8	11.3	59.6
	N	44	46	42	44	44	44	43
SCWD	Min	51.1	0.0891	0.426	0.862	3.12	2.04	1.18
	Max	1505	87.1	76.6	36.1	315	60.2	175
	Average	<b>242</b>	<b>18.3</b>	<b>23.7</b>	<b>7.92</b>	<b>52.7</b>	<b>9.66</b>	<b>36.6</b>
	Stdev	252	22.7	18.2	7.57	54.5	10.1	41.7
	N	35	46	32	33	35	35	34
		<b>Anions – Dust</b>						
		$\text{Cl}^-$	$\text{NO}_3^-$	$\text{ss-SO}_4^{2-}$	$\text{nss-SO}_4^{2-}$	$\text{HCO}_3^-$	OA	
BCW	Min	78.7	1.27	8.14	0.175	0.126	0.545	
	Max	1796	51.4	258	1.67	91.0	22.8	
	Average	<b>401</b>	<b>8.20</b>	<b>44.5</b>	<b>0.655</b>	<b>16.0</b>	<b>5.05</b>	
	Stdev	284	8.49	38.1	0.702	21.0	4.88	
	N	51	51	51	4	48	46	
LCWD	Min	79.4	1.01	9.32	0.307	0.0812	0.0273	

	Max	1326	45.6	182	8.228	63.0	22.1	
	Average	<b>428</b>	<b>7.21</b>	<b>47.4</b>	<b>4.27</b>	<b>9.90</b>	<b>6.63</b>	
	Stdev	272	7.48	34.0	5.60	15.5	5.56	
	N	44	44	44	2	46	43	
SCWD	Min	55.3	0.140	6.13	0.392	0.0588	0.102	
	Max	1320	24.9	181	26.1	57.4	41.0	
	Average	<b>260</b>	<b>7.03</b>	<b>29.0</b>	<b>9.60</b>	<b>6.30</b>	<b>8.56</b>	
	Stdev	236	6.41	30.2	8.06	13.6	8.32	
	N	33	33	35	15	42	34	
Metals – Dust								
		Al	Ca	Fe	K	Mg	Na	S
BCW	Min	0.0320	0.181	0.00200	0.0200	0.0940	0.00900	0.0170
	Max	2.57	4.81	1.85	1.46	3.74	23.6	4.72
	Average	<b>0.781</b>	<b>1.46</b>	<b>0.459</b>	<b>0.528</b>	<b>1.17</b>	<b>7.94</b>	<b>1.72</b>
	Stdev	0.748	1.31	0.524	0.357	0.83	4.92	1.03
	N	40	37	42	42	48	48	38
LCWD	Min	0.00400	0.157	0.00200	0.0450	0.267	2.01	0.460
	Max	2.59	6.00	1.89	1.49	3.96	23.8	4.18
	Average	<b>0.771</b>	<b>1.60</b>	<b>0.488</b>	<b>0.497</b>	<b>1.32</b>	<b>8.62</b>	<b>1.72</b>
	Stdev	0.726	1.64	0.541	0.372	0.97	5.46	0.96
	N	35	34	33	38	43	43	39
SCWD	Min	0.119	0.198	0.00600	0.0470	0.156	1.26	0.345
	Max	5.53	5.23	3.29	2.04	3.63	19.9	5.69
	Average	<b>1.19</b>	<b>1.63</b>	<b>0.676</b>	<b>0.689</b>	<b>0.975</b>	<b>5.61</b>	<b>2.07</b>
	Stdev	1.15	1.29	0.742	0.635	0.762	3.99	1.14
	N	23	23	23	23	27	27	27

**Table S2:** Minimum, maximum, average concentration, and standard deviation of water-soluble ions ( $\mu\text{N}$ ) and metals ( $\text{mg/L}$ ) in bulk and size-resolved cloud water (N represents the number of samples for each species). **MARINE**

Cations – Marine								
		$\text{Na}^+$	$\text{H}^+$	$\text{NH}_4^+$	$\text{K}^+$	$\text{Mg}^{2+}$	$\text{ss-Ca}^{2+}$	$\text{nss-Ca}^{2+}$
BCW	Min	36.1	0.269	1.21	0.761	5.94	1.44	0.0972
	Max	415	51.3	20.7	21.3	92.1	16.6	1.63
	Average	<b>218</b>	<b>7.42</b>	<b>5.94</b>	<b>5.12</b>	<b>46.1</b>	<b>8.72</b>	<b>0.905</b>
	Stdev	115	12.5	5.58	5.02	28.0	4.60	0.730
	N	15	15	14	15	15	15	5
LCWD	Min	76.5	5.62	0.609	1.56	17.0	3.06	0.597

	Max	512	28.8	31.4	10.1	115	20.5	0.818
	Average	<b>225</b>	<b>15.4</b>	<b>6.70</b>	<b>4.33</b>	<b>50.0</b>	<b>9.01</b>	<b>0.707</b>
	Stdev	136	7.5	9.58	2.63	31.5	5.44	0.156
	N	11	11	10	11	11	11	2
SCWD	Min	6.64	7.24	1.43	0.312	6.52	0.266	0.365
	Max	216	39.8	25.4	4.87	43.4	8.64	9.12
	Average	<b>91.2</b>	<b>19.4</b>	<b>5.84</b>	<b>2.49</b>	<b>19.9</b>	<b>3.65</b>	<b>3.59</b>
	Stdev	66.0	10.9	7.72	1.57	13.0	2.64	3.60
	N	9	11	9	8	7	9	5

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**Anions – Marine**

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		Cl <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>	ss-SO <sub>4</sub> <sup>2-</sup>	nss-SO <sub>4</sub> <sup>2-</sup>	HCO <sub>3</sub> <sup>-</sup>	OA
BCW	Min	38.1	0.787	4.33	-	0.0998	0.324
	Max	468	13.2	49.8	-	19.0	5.209
	Average	<b>238</b>	<b>4.39</b>	<b>26.2</b>	-	<b>2.80</b>	<b>2.17</b>
	Stdev	136	3.67	13.8	-	4.70	1.68
	N	15	15	15	0	15	11
LCWD	Min	84.7	0.784	9.18	1.03	0.178	0.221
	Max	585	10.3	61.5	-	0.910	4.62
	Average	<b>259</b>	<b>3.84</b>	<b>25.1</b>	-	<b>0.437</b>	<b>2.30</b>
	Stdev	161	2.72	15.8	-	0.262	1.43
	N	11	11	10	1	11	9
SCWD	Min	19.8	0.719	0.797	0.777	0.129	0.0776
	Max	252	8.02	25.9	4.18	0.707	13.0
	Average	<b>113</b>	<b>3.24</b>	<b>10.9</b>	<b>2.24</b>	<b>0.360</b>	<b>5.13</b>
	Stdev	74	2.51	7.9	1.55	0.211	4.63
	N	8	8	9	4	11	8

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**Metals – Marine**

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		Al	Ca	Fe	K	Mg	Na	S
BCW	Min	0.0200	0.0780	0.00200	0.0320	0.181	0.202	0.0550
	Max	0.488	0.388	0.0720	1.28	1.28	12.0	2.28
	Average	<b>0.287</b>	<b>0.215</b>	<b>0.0180</b>	<b>0.356</b>	<b>0.660</b>	<b>4.83</b>	<b>0.836</b>
	Stdev	0.177	0.117	0.0240	0.397	0.348	3.23	0.719
	N	7	6	8	13	12	16	9
LCWD	Min	0.00100	0.100	-	0.0700	0.235	2.14	0.565
	Max	0.255	0.359	-	0.503	1.60	14.3	2.06
	Average	<b>0.122</b>	<b>0.236</b>	-	<b>0.217</b>	<b>0.659</b>	<b>5.46</b>	<b>0.949</b>
	Stdev	0.122	0.094	-	0.142	0.420	3.64	0.629

	N	6	7	0	11	11	11	5
SCWD	Min	0.0180	0.0710	0.00900	0.0220	0.116	0.553	0.333
	Max	0.511	0.193	0.0140	0.242	0.589	5.06	0.828
	Average	<b>0.310</b>	<b>0.126</b>	<b>0.0120</b>	<b>0.122</b>	<b>0.337</b>	<b>2.70</b>	<b>0.556</b>
	Stdev	0.211	0.051	0.0040	0.083	0.173	1.59	0.208
	N	6	4	2	7	8	9	5

**Table S3:** Minimum, maximum, average concentration, and standard deviation of water-soluble ions ( $\mu\text{N}$ ) and metals ( $\text{mg/L}$ ) in bulk and size-resolved cloud water (N represents the number of samples for each species). **DUST + ANTHROPOGENIC**

		<b>Cations – Dust + Anthropogenic</b>						
		$\text{Na}^+$	$\text{H}^+$	$\text{NH}_4^+$	$\text{K}^+$	$\text{Mg}^{2+}$	$\text{ss-Ca}^{2+}$	$\text{nss-Ca}^{2+}$
BCW	Min	103	1.12	4.47	2.68	25.6	4.11	2.67
	Max	740	107	69.2	20.8	190	29.6	134
	Average	<b>241</b>	<b>42.5</b>	<b>31.6</b>	<b>7.55</b>	<b>62.8</b>	<b>9.65</b>	<b>44.4</b>
	Stdev	173	37.9	17.3	4.47	43.8	6.90	36.4
	N	15	14	13	15	15	15	15
LCWD	Min	52.5	1.32	0.397	0.937	14.1	2.10	0.650
	Max	792	151	60.4	19.0	187	31.7	139
	Average	<b>259</b>	<b>59.2</b>	<b>24.1</b>	<b>6.36</b>	<b>59.7</b>	<b>10.4</b>	<b>36.2</b>
	Stdev	182	44.7	16.7	4.42	44.0	7.28	41.0
	N	14	16	12	14	14	14	14
SCWD	Min	54.5	4.90	8.04	1.83	6.82	2.18	4.20
	Max	256	245	90.6	11.2	98.1	10.2	70.6
	Average	<b>121</b>	<b>98.7</b>	<b>44.6</b>	<b>5.15</b>	<b>31.7</b>	<b>4.84</b>	<b>28.1</b>
	Stdev	65.8	80.0	25.4	2.53	25.4	2.63	25.0
	N	11	14	11	11	11	11	11
		<b>Anions – Dust + Anthropogenic</b>						
		$\text{Cl}^-$	$\text{NO}_3^-$	$\text{ss-SO}_4^{2-}$	$\text{nss-SO}_4^{2-}$	$\text{HCO}_3^-$	OA	
BCW	Min	143	2.80	12.3	0.723	0.0480	0.301	
	Max	779	27.0	88.8	37.5	4.56	23.6	
	Average	<b>278</b>	<b>10.7</b>	<b>29.0</b>	<b>14.9</b>	<b>0.807</b>	<b>8.37</b>	
	Stdev	180	6.3	20.7	12.5	1.35	7.21	
	N	15	15	15	15	14	15	
LCWD	Min	127	2.41	6.29	0.179	0.0338	3.04	
	Max	774	25.8	95.0	33.7	3.88	27.8	
	Average	<b>301</b>	<b>10.3</b>	<b>31.1</b>	<b>15.9</b>	<b>0.39</b>	<b>11.5</b>	

	Stdev	167	7.2	21.8	13.1	0.95	7.5	
	N	14	14	14	12	16	12	
SCWD	Min	62.0	1.88	6.54	11.1	0.0209	1.23	
	Max	296	14.1	30.7	99.0	1.05	23.5	
	Average	<b>153</b>	<b>7.40</b>	<b>14.5</b>	<b>45.6</b>	<b>0.144</b>	<b>10.3</b>	
	Stdev	71	3.95	7.9	29.1	0.274	7.9	
	N	11	11	11	11	13	11	
<b>Metals – Dust + Anthropogenic</b>								
		Al	Ca	Fe	K	Mg	Na	S
BCW	Min	0.00500	0.248	0.0230	0.108	0.329	2.34	0.939
	Max	1.95	3.96	1.19	0.678	3.14	17.9	6.43
	Average	<b>0.765</b>	<b>1.29</b>	<b>0.407</b>	<b>0.366</b>	<b>0.983</b>	<b>6.07</b>	<b>2.90</b>
	Stdev	0.629	1.08	0.386	0.203	0.763	4.29	1.62
	N	11	11	12	11	13	13	11
LCWD	Min	0.0180	0.259	0.0120	0.0940	0.190	2.64	1.08
	Max	2.23	3.97	1.17	0.822	3.29	18.8	5.77
	Average	<b>0.943</b>	<b>1.37</b>	<b>0.445</b>	<b>0.377</b>	<b>0.997</b>	<b>6.64</b>	<b>2.63</b>
	Stdev	0.770	1.09	0.468	0.243	0.824	4.35	1.32
	N	10	11	12	11	14	14	13
SCWD	Min	0.0450	0.298	0.0360	0.0920	0.333	1.71	1.27
	Max	2.31	3.50	1.23	0.620	2.27	11.4	8.39
	Average	<b>0.841</b>	<b>1.10</b>	<b>0.418</b>	<b>0.293</b>	<b>0.710</b>	<b>3.94</b>	<b>4.16</b>
	Stdev	0.817	1.00	0.413	0.185	0.595	2.98	2.57
	N	9	9	10	8	10	10	10

**Table S4:** Minimum, maximum, average, and standard deviation of pH, conductivity ( $\mu\text{S}/\text{cm}$ ), and charge balance (anions/cations) in bulk and size-resolved cloud water (N represents the number of samples for each species). **DUST**

		pH	Conductivity	Anions (Total)	Cations (Total)	Ratio (A/C)
BCW	Min	4.39	17.9	90.6	106	0.612
	Max	7.25	181	1989	3250	0.935
	Average	<b>5.98</b>	<b>64.1</b>	<b>456</b>	<b>580</b>	<b>0.819</b>
	Stdev	0.80	36.0	319	491	0.064
	N	48	50	51	51	51
LCWD	Min	4.20	21.8	95.7	126	0.643
	Max	7.09	263	1487	2313	0.985
	Average	<b>5.52</b>	<b>76.3</b>	<b>479</b>	<b>609</b>	<b>0.817</b>

	Stdev	0.92	49.8	306	451	0.069
	N	46	48	44	44	44
	Min	4.06	13.0	70.8	78.3	0.609
	Max	7.05	148	1479	2300	0.918
SCWD	Average	<b>5.25</b>	<b>53.0</b>	<b>313</b>	<b>409</b>	<b>0.797</b>
	Stdev	0.86	27.3	268	408	0.0721
	N	45	46	32	32	32

**Table S5:** Minimum, maximum, average, and standard deviation of pH, conductivity ( $\mu\text{S}/\text{cm}$ ), and charge balance (anions/cations) in bulk and size-resolved cloud water (N represents the number of samples for each species). **MARINE**

		pH	Conductivity	Anions (Total)	Cations (Total)	Ratio (A/C)
	Min	4.29	8.15	44.8	52.5	0.643
	Max	6.57	90.5	509	602	1.08
BCW	Average	<b>5.43</b>	<b>40.0</b>	<b>257</b>	<b>304</b>	<b>0.853</b>
	Stdev	0.52	20.9	143	163	0.127
	N	15	15	15	15	15
	Min	4.54	22.0	98.2	125	0.787
	Max	5.25	101	628	699	0.921
LCWD	Average	<b>4.87</b>	<b>44.7</b>	<b>276</b>	<b>311</b>	<b>0.875</b>
	Stdev	0.24	24.0	168	183	0.043
	N	11	11	11	11	11
	Min	4.40	8.83	26.4	35.7	0.739
	Max	5.14	60.4	295	335	0.879
SCWD	Average	<b>4.78</b>	<b>31.7</b>	<b>132</b>	<b>155</b>	<b>0.837</b>
	Stdev	0.26	16.1	85	95	0.048
	N	11	11	8	8	8

**Table S6:** Minimum, maximum, average, and standard deviation of pH, conductivity ( $\mu\text{S}/\text{cm}$ ), and charge balance (anions/cations) in bulk and size-resolved cloud water (N represents the number of samples for each species). **DUST + ANTHROPOGENIC**

		pH	Conductivity	Anions (Total)	Cations (Total)	Ratio (A/C)
	Min	3.97	29.2	165	183	0.644
	Max	5.95	165	952	1293	0.898
BCW	Average	<b>4.69</b>	<b>69.4</b>	<b>341</b>	<b>451</b>	<b>0.759</b>
	Stdev	0.67	35.2	214	283	0.079
	N	14	15	15	15	15

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	Min	3.82	32.9	148	176	0.578
	Max	5.88	165	913	1263	1.08
LCWD	Average	<b>4.42</b>	<b>76.8</b>	<b>372</b>	<b>481</b>	<b>0.784</b>
	Stdev	0.53	33.4	197	268	0.116
	N	16	16	13	13	13
	Min	3.61	26.8	86.7	115	0.536
	Max	5.31	163	427	618	0.756
SCWD	Average	<b>4.19</b>	<b>83.2</b>	<b>231</b>	<b>346</b>	<b>0.669</b>
	Stdev	0.47	49.3	108	154	0.072
	N	14	14	11	11	11

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