



Supplement of

High number concentrations of transparent exopolymer particles in ambient aerosol particles and cloud water – a case study at the tropical Atlantic Ocean

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36 Table S1: Sampling period of ambient aerosol particles (TSP) and meteorological parameters and inorganic ions sampled from PM₁₀ during the
 37 sampling interval.

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Sample ID	Start sampling (UTC)	Stop sampling (UTC)	V [m ⁻³]	wind speed [m s ⁻¹]	wind dir. [deg]	Temp [degC]	RH [%]	Magnesium [µg m ⁻³]	Calcium [µg m ⁻³]	ss Ca [µg m ⁻³]	non-ss Ca [µg m ⁻³]	Dust [µg m ⁻³]
TEP (Air)-2	19.09.2017 17:05	20.09.2017 16:05	11.8	2.4	159.3	27.4	86.6	0.35	1.12	0.15	0.97	38.2
TEP (Air)-3	20.09.2017 16:38	21.09.2017 14:20	11.3	4.6	79.3	27.4	87.3	no data	no data	no data	no data	30.0
TEP (Air)-4	21.09.2017 14:41	22.09.2017 15:30	12.7	8.4	32.5	27.0	82.3	0.35	0.44	0.16	0.27	14.5
TEP (Air)-5	22.09.2017 15:50	24.09.2017 14:55	24.1	6.8	52.9	26.4	75.1	0.25	0.21	0.12	0.09	4.1
TEP (Air)-6	24.09.2017 15:20	25.09.2017 16:27	12.9	4.2	58.4	26.1	75.3	0.23	0.67	0.11	0.56	2.2
TEP (Air)-7	25.09.2017 16:58	26.09.2017 15:13	11.3	3.6	40.8	26.5	82.2	0.31	no data	no data	no data	11.6
TEP (Air)-8	26.09.2017 15:36	27.09.2017 10:08	9.7	3.9	42.5	26.8	84.1	0.21	0.90	0.05	0.84	37.6
TEP (Air)-9	27.09.2017 10:42	28.09.2017 12:25	13.2	4.6	44.1	27.1	84.2	0.24	0.80	0.07	0.73	20.6
TEP (Air)-10	28.09.2017 12:48	29.09.2017 15:50	13.6	6.2	31.8	27.2	85.5	0.47	0.99	0.19	0.80	27.3
TEP (Air)-11	29.09.2017 16:20	30.09.2017 10:30	9.1	6.9	34.8	27.0	85.0	0.58	0.84	0.25	0.59	27.3
TEP (Air)-12	30.09.2017 11:00	01.10.2017 10:45	12.1	8.2	38.0	26.7	81.9	0.48	0.60	0.20	0.39	42.7
TEP (Air)-14	01.10.2017 11:03	02.10.2017 10:55	12.2	8.5	40.3	26.2	78.9	0.32	0.47	0.14	0.33	29.1

TEP (Air)-15	02.10.2017 11:19	03.10.2017 12:44	13.0	6.1	46.2	26.2	78.9	0.25	0.54	0.12	0.42	14.8
TEP (Air)-16	03.10.2017 13:10	04.10.2017 13:09	12.1	5.7	37.8	26.2	77.7	0.21	0.60	0.10	0.50	13.2
TEP (Air)-17	04.10.2017 14:34	05.10.2017 13:45	11.5	5.2	49.3	26.4	79.7	0.19	0.53	0.12	0.41	17.2
TEP (Air)-18	05.10.2017 14:13	06.10.2017 10:32	10.2	4.9	40.0	26.5	84.2	0.47	0.56	0.18	0.38	17.0
TEP (Air)-19	06.10.2017 11:00	07.10.2017 16:09	14.5	7.0	19.0	26.5	85.9	0.54	0.66	0.21	0.45	16.8
TEP (Air)-20	07.10.2017 16:31	08.10.2017 11:38	9.5	6.8	21.1	26.4	86.1	0.51	0.56	0.20	0.36	16.8
TEP (Air)-21	08.10.2017 12:00	09.10.2017 09:47	10.9	6.6	39.0	26.4	84.2	no data	no data	no data	no data	27.6
TEP (Air)-22	09.10.2017 10:13	10.10.2017 11:05	12.4	7.3	41.3	26.3	78.6	0.25	0.44	0.13	0.31	27.6

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51 Table S2: TEP concentrations as well as inorganic ion concentrations and calculated enrichment factors of the ambient aerosol particles (TSP)
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Sample ID	Atmosphere							Ocean			EF
	TEP [# m ⁻³]	TEP [μm ³ m ⁻³]	TEP _{5-10μm} [# m ⁻³]	TEP _{5-10μm} [μm ³ m ⁻³]	Na ⁺ [mg m ⁻³]	Na ⁺ - PM ₁ [mg m ⁻³] ¹⁾	TEP/Na _{aer.} [μm ³ mg ⁻¹]	TEP _{5-10μm} [μm ³ L ⁻¹] ²⁾	Na ⁺ [mg L ⁻¹] ³⁾	TEP/Na _{ocean} [μm ⁻³ mg ⁻¹]	EF _{aer. ambient} ⁴⁾
TEP (Air)-2	1.5E+04	9.8E+06	1.2E+04	2.0E+06	0.0040	0.0039	5.14E+08	4.57E+08	1.0E+04	4.57E+04	1.12E+04
TEP (Air)-3	1.5E+04	1.7E+07	9.9E+03	2.2E+06	no data	no data	no data	4.57E+08	1.0E+04	4.57E+04	no data
TEP (Air)-4	6.0E+03	7.0E+06	4.2E+03	9.1E+05	0.0042	0.0041	2.22E+08	4.57E+08	1.0E+04	4.57E+04	4.85E+03
TEP (Air)-5	4.3E+03	3.2E+06	1.6E+03	5.7E+05	0.0031	0.0030	1.92E+08	4.57E+08	1.0E+04	4.57E+04	4.19E+03
TEP (Air)-6	5.0E+03	2.8E+06	3.5E+03	3.1E+05	0.0028	0.0027	1.13E+08	4.57E+08	1.0E+04	4.57E+04	2.46E+03
TEP (Air)-7	1.7E+04	1.8E+07	1.3E+04	2.2E+06	0.0033	0.0032	6.80E+08	4.57E+08	1.0E+04	4.57E+04	1.49E+04
TEP (Air)-8	< LOD	-	-	-	0.0014	0.0013	0.00E+00	4.57E+08	1.0E+04	4.57E+04	no data
TEP (Air)-9	6.9E+02	1.2E+06	4.3E+02	8.3E+04	0.0018	0.0017	4.94E+07	4.57E+08	1.0E+04	4.57E+04	1.08E+03
TEP (Air)-10	2.1E+04	1.9E+07	2.0E+04	2.9E+06	0.0050	0.0049	5.85E+08	4.57E+08	1.0E+04	4.57E+04	1.28E+04
TEP (Air)-11	2.7E+04	3.7E+07	1.8E+04	3.9E+06	0.0065	0.0064	6.09E+08	4.57E+08	1.0E+04	4.57E+04	1.33E+04
TEP (Air)-12	9.7E+03	6.4E+06	7.7E+03	1.3E+06	0.0053	0.0052	2.40E+08	4.57E+08	1.0E+04	4.57E+04	5.24E+03
TEP (Air)-14	8.9E+03	3.8E+06	7.3E+03	1.3E+06	0.0037	0.0036	3.58E+08	4.57E+08	1.0E+04	4.57E+04	7.82E+03
TEP (Air)-15	4.8E+03	3.3E+06	3.9E+03	5.9E+05	0.0033	0.0032	1.88E+08	4.57E+08	1.0E+04	4.57E+04	4.11E+03
TEP (Air)-16	9.6E+03	7.4E+06	7.6E+03	1.4E+06	0.0026	0.0025	5.52E+08	4.57E+08	1.0E+04	4.57E+04	1.21E+04
TEP (Air)-17	8.4E+03	6.9E+06	6.7E+03	1.2E+06	0.0030	0.0029	4.14E+08	4.57E+08	1.0E+04	4.57E+04	9.04E+03
TEP (Air)-18	1.6E+04	1.3E+07	1.2E+04	2.2E+06	0.0047	0.0046	4.89E+08	4.57E+08	1.0E+04	4.57E+04	1.07E+04
TEP (Air)-19	1.3E+04	8.8E+06	1.0E+04	1.8E+06	0.0055	0.0054	3.29E+08	4.57E+08	1.0E+04	4.57E+04	7.19E+03
TEP (Air)-20	2.6E+04	2.4E+07	2.4E+04	4.7E+06	0.0052	0.0051	9.13E+08	4.57E+08	1.0E+04	4.57E+04	2.00E+04
TEP (Air)-21	1.1E+04	8.4E+06	8.1E+03	1.4E+06	no data	no data	no data	4.57E+08	1.0E+04	4.57E+04	
TEP (Air)-22	3.9E+03	2.7E+06	3.1E+03	5.2E+05	0.0033	0.0032	1.62E+08	4.57E+08	1.0E+04	4.57E+04	3.53E+03
average	1E+04	1E+07	9E+03	2E+06	0.004	0.004	4E+08	5E+08	1E+04	5E+04	8.5E+03

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¹⁾Sodium mass concentrations for PM₁ show an average concentration of 0.0001 mg m⁻³ (Triesch et al. 2021) and are therefore below 3% of PM₁₀ and are subtracted from PM₁₀ sodium concentration.

²⁾TEP volume concentration were calculated from the number concentrations in a size range between 5 and 10 μm (Tab. S5) assuming spherical particles.

³⁾Average sodium concentration in seawater.

⁴⁾ Error discussion of the $EF_{atm.}$: Even though the same TEP size ranges (diameters between 5 and 10 μm) were compared for oceanic and atmospheric measurements, the size distribution of TEP in the respective compartments might be affected by the different temperature, pressure, ion strength and pH in seawater and in the atmosphere. Such effects cannot be accounted for in the present study.

Applying sodium concentrations for the $EF_{aer.}$ and EF_{cloud} calculations also represents a source of error. TEP can form networks with inorganic cations and that might affect sodium concentrations in the seawater and in the atmosphere. However, it was reported that the TEP formation was essentially determined by the calcium concentration, while monovalent cations, such as sodium, seem not to be significantly involved in TEP formation (Meng and Liu, 2016). Hence, this error should be negligible.

54 Table S3: TEP concentrations and sodium concentrations as well as enrichment factor for the tank-generated aerosol particles (TSP).

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Sample ID	Atmosphere								Ocean			EF
	Start sampling (UTC)	Stop sampling (UTC)	V [m ⁻³]	TEP [# m ⁻³]	TEP _{5-10µm} [µm ³ m ⁻³] ¹⁾	Na ⁺ [µg m ⁻³] ²⁾	Na ⁺ [mg m ⁻³]	TEP/Na _{aer.} [µm ⁻³ mg ⁻¹]	TEP _{5-10µm} [µm ³ L ⁻¹] ³⁾	Na ⁺ [mg L ⁻¹] ⁴⁾	TEP/Na _{ocean} [µm ³ mg ⁻¹]	EF _{aer. tank}
Tank 1	03.10.2017 11:05	04.10.2017 11:04	9.7	2.4E+03	4.4E+05	97.20	0.097	4.51E+06	4.57E+08	1.0E+04	5.E+04	98.6
Tank 2	04.10.2017 11:14	05.10.2017 11:17	8.8	1.2E+03	2.1E+05	62.70	0.063	3.38E+06	4.57E+08	1.0E+04	5.E+04	73.8
Tank 3	05.10.2017 11:27	06.10.2017 12:03	9.8	5.5E+02	9.9E+04	90.05	0.090	1.10E+06	4.57E+08	1.0E+04	5.E+04	24.2
Tank 7	07.10.2017 12:00	08.10.2017 09:05	9.4	3.9E+02	7.2E+04	51.93	0.052	1.38E+06	4.57E+08	1.0E+04	5.E+04	30.1
Tank 9	08.10.2017 09:15	09.10.2017 07:00	9.5	4.2E+02	7.7E+04	78.05	0.078	9.80E+05	4.57E+08	1.0E+04	5.E+04	21.4
<i>average</i>				<i>9.9E+02</i>	<i>1.8E+05</i>	<i>75.99</i>	<i>0.076</i>	<i>2.3E+06</i>	<i>4.6E+08</i>	<i>1.0E+04</i>	<i>4.6E+04</i>	<i>49.6</i>

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¹⁾ For the tank-generated aerosol particles, solely the total number concentrations were available. TEP volume concentration were calculated from the number concentrations in a size range between 5 and 10 µm assuming spherical particles after the equation from Fig. S1: ($y = 181.66x$) assuming a similar size distribution of the tank-generated TEP to the ambient TEP.

²⁾ Sodium was measured on TSP, however it was shown that particles greater than 10 µm radius are quickly removed in the atmosphere (Madry et al., 2011) and in sea spray model systems (Hoffman and Duce, 1976). Hence the sodium data on TSP is expected to be comparable to PM₁₀ and therefore to the TEP volume concentrations between 5 and 10 µm.

³⁾ TEP volume concentration were calculated from the number concentrations in a size range between 5 and 10 µm (Tab. S5) assuming spherical particles.

⁴⁾ Average sodium concentration in seawater.

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Table S4: TEP concentrations and sodium concentrations as well as enrichment factor for the cloud water samples.

Sample ID	Atmosphere									Ocean			EF
	Start sampling (UTC)	Stop sampling (UTC)	V [mL]	TEP [# L ⁻¹]	TEP [# m ⁻³] ¹⁾	TEP _{5-10µm} [µm ³ m ⁻³]	Na ⁺ [mg L ⁻¹]	Na ⁺ [µg m ⁻³] ¹⁾	TEP/Na _{aer.} [µm ⁻³ mg ⁻¹]	TEP _{5-10µm} [µm ³ L ⁻¹] ³⁾	Na ⁺ [mg L ⁻¹] ⁴⁾	TEP/Na _{ocean} [µm ⁻³ mg ⁻¹]	EF _{cloud}
WW2	20.09.2017 16:38	21.09.2017 14:20	200	4.0E+06	1.6E+03	7.2E+08 ²⁾	11.89	4.6	6.10E+07	4.57E+08	1.0E+04	45737	1.3E+03
WW5	28.09.2017 12:48	29.09.2017 15:50	150	9.1E+06	3.5E+03	1.6E+09 ²⁾	22.09	8.6	7.47E+07	4.57E+08	1.0E+04	45737	1.6E+03 ⁴⁾
WW5 meas ³⁾	28.09.2017 12:48	29.09.2017 15:50	150	9.1E+06	3.5E+03	1.2E+03 ³⁾	22.09	8.6	5.51E+07	4.57E+08	1.0E+04	45737	1.2E+03 ⁴⁾
WW8	03.10.2017 13:10	04.10.2017 13:09	200	8.2E+06	3.2E+03	1.5E+09 ²⁾	32.30	12.6	4.63E+07	4.57E+08	1.0E+04	45737	1.0E+03
average				7E+06	3E+03	1E+09	22	9	6E+07	5E+08	1E+04	45737	1E+03

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¹⁾ based on a cloud liquid water content of 0.39 g m⁻³

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²⁾ TEP volume concentration were calculated from the number concentrations in a size range between 5 and 10 µm assuming spherical particles after the equation from Fig. S1: (y = 181.66x) assuming a similar size distribution of the cloud water TEP to the ambient TEP

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³⁾ TEP volume concentrations were calculated from measured TEP number size distributions (shown in Fig. 4e).

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⁴⁾ EF_{cloud} derived from measured TEP volume concentration agreed well with EF_{cloud} from the calculated TEP volume concentration.

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80 Table S5: Size-resolved TEP concentrations from ocean surface water (sampling depth: 10 m, average over three stations) from Engel et al., (2020). Numbers in
 81 **bold** represent values between 5 and 10 μm , corresponding to the TEP diameter on the aerosol particles and in the cloud water.
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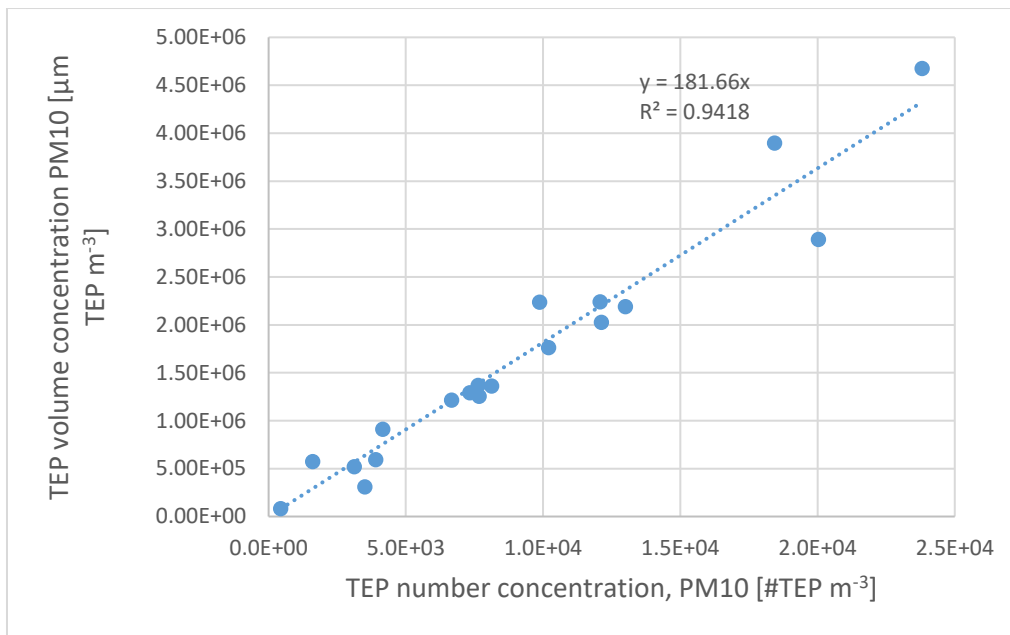
particle diameter [μm]

max	min	average	TEP[# mL ⁻¹]	RSD [%] ¹⁾	TEP [$\mu\text{m}^3 \text{mL}^{-1}$] ²⁾	TEP [# L ⁻¹]	TEP [$\mu\text{m}^3 \text{L}^{-1}$]
1.3	1.1	1.2	9.04E+03	36	5.48E+03	9.04E+06	5.48E+06
1.8	1.3	1.5	2.42E+03	52	4.19E+03	2.42E+06	4.19E+06
2.5	1.8	2.1	2.08E+03	57	1.01E+04	2.08E+06	1.01E+07
3.5	2.5	3.0	1.86E+03	39	2.58E+04	1.86E+06	2.58E+07
5.0	3.5	4.2	1.53E+03	34	5.99E+04	1.53E+06	5.99E+07
7.1	5.0	6.0	1.11E+03	33	1.22E+05	1.11E+06	1.22E+08
10	7.1	8.4	8.83E+02	37	2.75E+05	8.83E+05	2.75E+08
14	10	12	5.48E+02	36	4.82E+05	5.48E+05	4.82E+08
20	14	17	3.38E+02	62	8.43E+05	3.38E+05	8.43E+08
28	20	24	1.92E+02	67	1.35E+06	1.92E+05	1.35E+09
40	28	34	6.10E+01	75	1.22E+06	6.10E+04	1.22E+09
57	40	48	3.40E+01	81	1.92E+06	3.40E+04	1.92E+09
80	57	67	8.53E+00	118	1.36E+06	8.53E+03	1.36E+09
113	80	95	3.34E+00	155	1.50E+06	3.34E+03	1.50E+09
160	113	135	3.40E+00	155	4.33E+06	3.40E+03	4.33E+09
						(sum: 2.01E+07)	
10	5	6.3	3.53E+03		4.57E+05	3.53E+06	4.57E+08

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84 ¹⁾ Relative standard deviation of three measurement stations, each probed in duplicate (n=6)

85 ²⁾ TEP volume concentration was calculated from the number concentration assuming spherical particles.



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88 Figure S1: Correlation between TEP number concentration and TEP volume concentration achieved
 89 from the ambient aerosol samples (TEP diameter: 5-10 μm). The function was applied for the tank-
 90 generated aerosol particles and for the cloud water samples to calculate the volume concentration
 91 from the measured number concentration. A similar size distribution of the TP in the size range
 92 between 5 and 10 μm was shown for the cloud water and assumed for the tank -generated aerosol
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