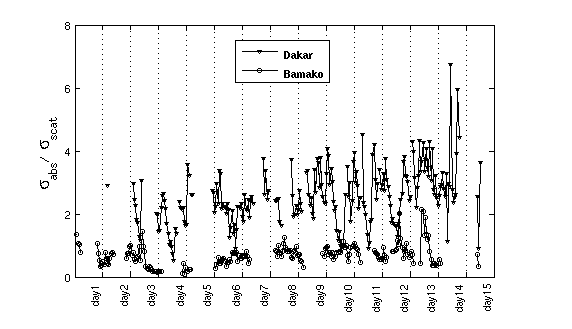
Supplementary Materials:

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**Figure S1.** Daily evolution of σabs / σscat ratio in Bamako and Dakar.

1. Water soluble inorganic compounds

1.1. Blank values and detection limits for water soluble inorganic species

The detection limit (DL) is defined as three times the standard deviation (SD) of the procedure blank. The filter blank values and calculated detection limits for water soluble inorganic species are provided in Table S1. Only Mg2+ blank value is lower than the DL, with a DL value of 1 ppb found in the 24 blanks tested.

**Table S1.** Detection limits and blank values for water soluble species. The analysis was performed on 24 filter blanks and all values are in ppb.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Cl-** | **NO3-** | **SO42-** | **Na+** | **NH4+** | **K+** | **Mg2+** | **Ca2+** |
| Filter blank | 13 | 24 | 4 | 8 | 9 | 2 | 0.3 | 25 |
| DL | 3 | 6 | 3 | 3 | 4 | 1 | 1 | 4 |

1.2. Determination of uncertainties for water soluble inorganic compounds

The overall uncertainty of the measurements in this work arises mainly from (1) sampling uncertainties, including possible gas-particle interactions and particle bounce-off, (2) the relationship between blank values, detection limits, and concentrations measured, and (3) random contamination problems. The uncertainty associated with each element was calculated using Alleman et al. [35] methodology. The following equation was taken into account:

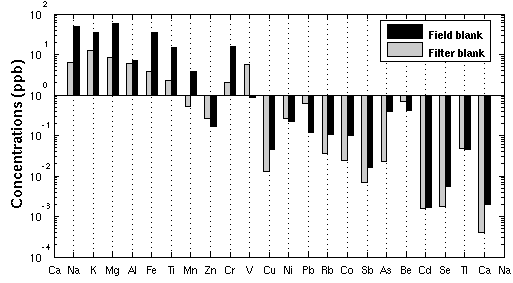
|  |  |
| --- | --- |
|  | (1) |

where C is the concentration of the element in the sample, ur(m) is the relative uncertainty of the mass m, ur(V) is the relative uncertainty of the air volume V, uc is the absolute uncertainty due to the contamination. Using the equation (1), the estimated uncertainties were 4% for SO42−, 18% for NH4+, 44% for NO3−, 14% for Cl−, 25% for Ca2+, and 1% for Mg2+ and K+. NO3− concentrations have a high degree of uncertainty due to evaporation issues [75]. When NO3− is excluded, the average analytical uncertainty is estimated to be around 10%. A few NH4+ data were obtained in Bamako, most likely due to the same volatilization issue as with nitrate. As a result, NH4+ concentrations will not be shown here.

2. Metal elements

2.1. Metal element blank values and detection limits

Metals concentrations were measured in two types of blanks, vessel blanks (VB) and filter blanks (FB). Trace metal concentrations in the vessel blank were used to assess the cleanliness of the microwave digestion and sample treatment processes. The VB was made up of acid solutions similar to those used in sample digestions. Metal concentrations in the FB were measured to establish a baseline from which element concentrations in field samples were subtracted. It was composed of VB and the same amount of filter paper that was used in the field to collect aerosols. Table S2 shows the average concentrations in VB and FB, as well as the detection limits (DL). The background concentrations of all elements are found to be higher in the filter blank than in the vessel blank. The DL for most minor elements is less than 1 µg.l-1, whereas the DL for major elements (Ca, Na, K, Fe, Al, and Mg) ranges between 30 and 221 µg.l-1. Because our samples contain high concentration levels, the high sensitivity of the ICP-MS instrument accounts for the high variability. The high DL values do not pose a problem for atmospheric samples, because the concentrations of these elements are typically much higher. Field blank values (Figure S2) for elements such as Na, K, Mg, Fe, Al, Ti, Zn, Mn, Pb, Be, and Ni are slightly higher than filter blanks, indicating a small field contamination of field blanks for these elements.



**Figure S2.** Comparison between average concentration of field blanks and filter blanks.

**Table S2.** Detection limits, vessel blank (VB) and filter blank (FB) in a matrix of 10 ml HNO3 and 0.5 ml HF.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Metals** | **Vessel blank (VB)**  **(µg.l-1)** | **Field blank (FB)**  **(µg.l-1)** | **DLVB (µg.l-1)** | **DLFB (µg.l-1)** |
| Ag | 0.07 | 0.02 | 0.20 | 0.10 |
| Al | 0.84 | 34 | 1.07 | 60 |
| As | 0.09 | 0.41 | 0.65 | 0.61 |
| Ba | 0.05 | 0.70 | 0.17 | 1.89 |
| Ca | 3 | 49 | 5 | 221 |
| Cd | 0.0005 | 0.006 | 0.0006 | 0.015 |
| Ce | 0.001 | 0.03 | 0.004 | 0.13 |
| Co | 0.001 | 0.02 | 0.001 | 0.07 |
| Cr | 0.03 | 0.9 | 0.20 | 3.2 |
| Cs | 0.0002 | 0.001 | 0.0002 | 0.002 |
| Cu | 0.038 | 0.2 | 0.036 | 0.7 |
| Eu | 0.001 | 0.002 | 0.003 | 0.008 |
| Fe | 0.7 | 15 | 4.2 | 86 |
| Hf | 0.0009 | 0.007 | 0.003 | 0.017 |
| K | 3 | 57 | 6 | 102 |
| La | 0.0009 | 0.01 | 0.0022 | 0.06 |
| Mg | 0.3 | 7 | 0.8 | 34 |
| Mn | 0.03 | 0.2 | 0.06 | 0.7 |
| Mo | 0.004 | 0.07 | 0.011 | 0.24 |
| Na | 3 | 34 | 6 | 132 |
| Ni | 0.04 | 0.12 | 0.05 | 0.19 |
| Pb | 0.006 | 0.11 | 0.018 | 0.38 |
| Rb | 0.01 | 0.10 | 0.01 | 0.16 |
| Sb | 0.002 | 0.39 | 0.004 | 3.03 |
| Se | 0.07 | 0.05 | 0.48 | 0.03 |
| Sm | 0.0002 | 0.003 | 0.0003 | 0.012 |
| Sn | 0.03 | 11 | 0.08 | 20 |
| Sr | 0.02 | 0.2 | 0.07 | 1.2 |
| Th | 0.0002 | 0.002 | 0.0006 | 0.006 |
| Ti | 0.07 | 4 | 0.29 | 10 |
| U | 0.001 | 0.006 | 0.005 | 0.025 |
| V | 0.01 | 0.05 | 0.03 | 0.17 |
| W | 0.002 | 0.03 | 0.005 | 0.09 |
| Zn | 0.5 | 15 | 4 | 120 |
| Zr | 0.01 | 0.2 | 0.05 | 0.5 |
| Be | 0.001 | 0.002 | 0.001 | 0.002 |
| Tl | 0.0001 | 0.002 | 0.0001 | 0.008 |

For analytical quality assurance, nine replicate NIST standard reference materials (SMRs-1648 Urban Particulate Matter) were measured. These materials were directly used without any treatment, except for acids added to match their matrix against samples analyzed in the same sequence. Table S3 shows the reported recovery values for certified and non-certified elements. The digestion method provides good recoveries (84-105%, with standard deviation SD range 2.7-6.5%) for SMRs referenced elements, except for Cr and Rb with have recoveries of 60 and 69%, respectively. Several authors reported comparable low Cr recovery percentages [76,77]. This could be due to the amount of HF used during mineralization, with more HF increasing recovery.

**Table S3.** Certified/non certified and resulting concentration for elements in SRM 1648.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Concentration (µg.g-1)** | **SD (%)** | **Certified SRM 1648 (µg.g-1)** | **Recovery (%)** |
| Na | 4416 ± 1277 | 3.5 | 4250 ± 20 | 104 |
| Mg | 6732 ± 1723 | 3.9 | (8000) | 84 |
| Al | 30025 ± 7885 | 3.8 | 34200 ± 1100 | 88 |
| K | 10051 ± 2594 | 3.9 | 10500 ± 100 | 96 |
| Cr | 243 ± 73 | 3.3 | 403 ± 12 | 60 |
| Mn | 729 ± 188 | 3.9 | 786 ± 17 | 93 |
| Fe | 33207 ± 8425 | 3.9 | 39100 ± 1000 | 85 |
| Co | 16 ± 4 | 3.9 | (18) | 88 |
| Ni | 81 ± 24 | 3.4 | 82 ± 3 | 99 |
| Cu | 543 ± 135 | 4.0 | 609 ± 27 | 89 |
| Zn | 4489 ± 1222 | 3.7 | 4760 ± 140 | 94 |
| As | 115 ± 31 | 3.7 | 115 ± 10 | 100 |
| Se | 27 ± 10 | 2.7 | 27 ± 1 | 99 |
| Be | 3.2 ± 0.7 | 3.4 | - | - |
| Cd | 68 ± 19 | 3.6 | 75 ± 7 | 91 |
| Sb | 37 ± 9 | 4.1 | (45) | 83 |
| Cs | 3.2 ± 0.9 | 3.6 | (3) | 105 |
| Ba | 668 ± 167 | 4.0 | (737) | 91 |
| Ce | 46 ± 12 | 3.9 | (55) | 83 |
| Ca | 37781 ± 7883 | 3.9 | 58400 ± 1900 | - |
| Rb | 50 ± 13 | 3.2 | (52) | 69 |
| Pb | 6413 ± 1014 | 6.3 | 6550 ± 80 | 98 |
| Th | 7.3 ± 1.1 | 6.4 | (7.4) | 98 |
| U | 5.4 ± 0.8 | 6.5 | 5.5 ± 0.1 | 97 |
| V | 119 ± 30 | 3.9 | 127 ± 7 | 94 |
| Ti | 3332 ± 784 | 4.2 | (4000) | 83 |

1 SD, the relative standard deviation between replicates (n = 9). Values in parenthesis are non-certified and are given for information.

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2.2. Comparison between non-soluble (ICP-MS) and soluble (IC) components

To ensure the quality of our data and to assess the ratio of soluble to non-soluble components, the concentrations of calcium, potassium, sodium, and magnesium in PM2.5, PM10, and TSP measured by ICP-MS (Inductively Coupled Plasma-Mass Spectrometry) and IC (Ion Chromatography) were compared. The total elemental concentrations (Ca, K, Na and Mg) are measured by ICP-MS, whereas the water-soluble fraction (Ca2+, K+, Na2+, and Mg2+) is measured by IC.

Linear regressions for elements such as calcium and sodium show slopes ranging from 0.9 to 1.3 in Dakar and from 1.9 to 2.1 in Bamako (Figure S3), indicating that the majority of inorganic Ca and Na are soluble in Dakar (difference of 10-30%). Calcium and sodium concentrations in Bamako measured by IC are two times lower than those measured by ICP-MS. According to the findings, inorganic aerosols are less soluble in Bamako than in Dakar. This could be attributed to the strong influence of natural sources in Bamako, such as resuspended dust and Saharan Desert dust.

Total potassium (K) concentrations are approximately 3 to 4 times that of soluble potassium (K+) concentrations in both sites, and this value reached 10 during the dust episode in Bamako. This is significant because soluble potassium (K+) is a key indicator for wood burning [78]. The increasing K/K+ ratio during the dust event suggests that a fraction of the non-soluble potassium came from crustal dust. The same results are obtained for Mg/Mg2+ ratios (about 3-4). Mg2+ is a tracer for marine aerosols. The rising Mg/Mg2+ ratio (from 3 to 16) during the dust event implies that a fraction of the non-soluble magnesium is also derived from crustal material [62].

Scatter chart

Description automatically generated with low confidence

**Figure S3.** Comparison of calcium, sodium, potassium and magnesium elements measured by ICP-MS and IC, excluded the dust episode.

3. Carbonaceous elements

**Table S4.** Summary of the Thermal Optical Reflectance (TOR) and THERMAL (THE) protocols.

|  |  |  |
| --- | --- | --- |
| **Protocol** | **TOR** | **Thermal** |
| Combustion environment for OC | He | O2 |
| Combustion environment for BC | 98%He, 2%O2 | O2 |
| Temperature plateau for OC (°C) | 550 | 340 |
| Residence time for OC (s) | 580 | 7200 |
| Temperature plateau for BC (°C) | 800 | 1100 |
| Residence time for BC (s) | 580 | 600 |
| Optical/charring correction | Reflectance | 10% of OC; BC decomposition of 0.22% per min during OC analysis |
| Convert and detector | Methanator FID/CH4 | Coulometric titration/CO2 |

**Table S5.** Comparison of no decarbonatation (noDC) and decarbonatation (DC) procedures on OC, BC and TC (OC + BC) measurements at Bamako.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Comparison** | | **Filter** | **Mean ratio** | Correlation | Mean values (µg.cm-2) | | | |
| **noDC** | **DC** | **n** | **DC/noDC** | r2 | noDC | DC | noDC - DC | Difference (%) |
| PM2.5 | |  |  |  |  |  |  |  |
| OC1 | OC1 | 11 | 0.03 ± 0.05 | -0.86 | 8.46 | 0.23 | 8.23 | -97 |
| OC2 | OC2 | 11 | 0.11 ± 0.20 | 0.02 | 50.11 | 4.63 | 45.48 | -91 |
| OC3 | OC3 | 11 | 0.40 ± 0.15 | 0.66 | 49.40 | 19.40 | 29.99 | -61 |
| OC4 | OC4 | 11 | 0.72 ± 0.12 | 0.47 | 12.19 | 8.77 | 3.42 | -28 |
| BC1 | BC1 | 11 | 1.33 ± 0.11 | 1.00 | 96.61 | 124.84 | -28.24 | 29 |
| BC2 | BC2 | 11 | 0.15 ± 0.03 | 0.92 | 16.44 | 2.55 | 13.89 | -84 |
| BC3 | BC3 | 11 | 1.02 ± 0.44 | 0.05 | 0.72 | 0.71 | 0.02 | -2 |
| OP | OP | 11 | 0.90 ± 0.24 | 0.94 | 65.36 | 63.11 | 2.25 | -3 |
| TC | TC | 11 | 0.70 ± 0.08 | 0.98 | 233.93 | 160.97 | 72.96 | -31 |
| OC | OC | 11 | 0.51 ± 0.11 | 0.94 | 185.44 | 95.97 | 89.47 | -48 |
| BC | BC | 11 | 1.42 ± 0.29 | 0.91 | 48.49 | 64.99 | -16.51 | 34 |
| PM10 | |  |  |  |  |  |  |  |
| OC1 | OC1 | 11 | 0.01 ± 0.05 | 0.89 | 8.18 | 0.09 | 8.09 | -99 |
| OC2 | OC2 | 11 | 0.08 ± 0.05 | 0.92 | 47.66 | 2.72 | 44.94 | -94 |
| OC3 | OC3 | 11 | 0.48 ± 0.11 | 0.95 | 44.49 | 20.00 | 24.49 | -55 |
| OC4 | OC4 | 11 | 0.83 ± 0.15 | 0.22 | 11.60 | 9.58 | 2.02 | -17 |
| BC1 | BC1 | 11 | 1.29 ± 0.10 | 1.00 | 88.18 | 110.23 | -22.05 | 25 |
| BC2 | BC2 | 11 | 0.18 ± 0.05 | 0.72 | 15.64 | 2.84 | 12.80 | -82 |
| BC3 | BC3 | 11 | 1.27 ± 0.45 | -0.24 | 0.73 | 0.88 | -0.15 | 20 |
| OP | OP | 11 | 1.02 ± 0.35 | 0.84 | 63.65 | 68.03 | -4.38 | 7 |
| TC | TC | 11 | 0.69 ± 0.05 | 1.00 | 216.48 | 146.27 | 70.21 | -32 |
| OC | OC | 11 | 0.57 ± 0.10 | 0.94 | 175.58 | 100.36 | 75.23 | -43 |
| BC | BC | 11 | 1.28 ± 0.37 | 0.77 | 40.90 | 45.91 | -5.01 | 12 |
| All | |  |  |  |  |  |  |  |
| OC1 | OC1 | 22 | 0.02 ± 0.03 | -0.29 | 8.32 | 0.15 | 8.17 | -98 |
| OC2 | OC2 | 22 | 0.09 ± 0.15 | 0.11 | 48.89 | 3.68 | 45.21 | -92 |
| OC3 | OC3 | 22 | 0.44 ± 0.13 | 0.74 | 46.94 | 19.70 | 27.24 | -58 |
| OC4 | OC4 | 22 | 0.78 ± 0.15 | 0.27 | 11.90 | 9.17 | 2.72 | -23 |
| BC1 | BC1 | 22 | 1.31 ± 0.10 | 1.00 | 92.39 | 117.54 | -25.14 | 27 |
| BC2 | BC2 | 22 | 0.17 ± 0.04 | 0.79 | 16.04 | 2.70 | 13.35 | -83 |
| BC3 | BC3 | 22 | 1.15 ± 0.45 | -0.09 | 0.73 | 0.79 | -0.07 | 9 |
| OP | OP | 22 | 0.96 ± 0.30 | 0.88 | 64.51 | 65.57 | -1.06 | 2 |
| TC | TC | 22 | 0.70 ± 0.06 | 0.99 | 225.21 | 153.62 | 71.59 | -32 |
| OC | OC | 22 | 0.54 ± 0.11 | 0.93 | 180.51 | 98.16 | 82.35 | -46 |
| BC | BC | 22 | 1.35 ± 0.33 | 0.82 | 44.69 | 55.45 | -10.76 | 24 |

**Table S6.** Comparison of no decarbonatation (noDC) and decarbonatation (DC) procedures on OC, BC and TC (OC + BC) measurements at Dakar.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Comparison** | | | **Filter** | **Mean ratio** | Correlation | Mean values | | | |
| **noDC** | **DC** | | **n** | **DC/noDC** | r2 | noDC | DC | noDC - DC | Difference (%) |
| PM2.5 | | |  |  |  |  |  |  |  |
| OC1 | OC1 | | 13 | 1.08 ± 1.08 | 0.25 | 4.47 | 2.98 | 1.49 | -33 |
| OC2 | OC2 | | 13 | 0.99 ± 0.29 | 0.30 | 27.63 | 26.56 | 1.07 | -4 |
| OC3 | OC3 | | 13 | 0.97 ± 0.26 | 0.13 | 27.85 | 25.96 | 1.89 | -7 |
| OC4 | OC4 | | 13 | 0.46 ± 0.09 | 0.06 | 11.38 | 5.13 | 6.25 | -55 |
| BC1 | BC1 | | 13 | 1.21 ± 0.34 | 0.19 | 45.78 | 53.11 | -7.33 | 16 |
| BC2 | BC2 | | 13 | 0.17 ± 0.08 | 0.31 | 10.18 | 1.39 | 8.79 | -86 |
| BC3 | BC3 | | 13 | 1.23 ± 0.46 | -0.21 | 0.54 | 0.63 | -0.09 | 16 |
| OP | OP | | 13 | 0.68 ± 0.39 | 0.23 | 17.66 | 9.93 | 7.72 | -44 |
| TC | TC | | 13 | 0.93 ± 0.23 | 0.37 | 127.82 | 115.75 | 12.07 | -9 |
| OC | OC | | 13 | 0.82 ± 0.24 | 0.22 | 88.98 | 69.67 | 19.31 | -22 |
| BC | BC | | 13 | 1.20 ± 0.21 | 0.51 | 38.84 | 46.08 | -7.25 | 19 |
| PM10 | | |  |  |  |  |  |  |  |
| OC1 | | OC1 | 13 | 0.05 ± 0.05 | 0.35 | 3.95 | 0.06 | 3.89 | -98 |
| OC2 | | OC2 | 13 | 0.05 ± 0.01 | 0.29 | 28.80 | 1.27 | 27.53 | -96 |
| OC3 | | OC3 | 13 | 0.61 ± 0.19 | 0.11 | 25.79 | 14.86 | 10.93 | -42 |
| OC4 | | OC4 | 13 | 0.70 ± 0.22 | -0.34 | 13.49 | 9.01 | 4.48 | -33 |
| BC1 | | BC1 | 13 | 1.05 ± 0.11 | 0.94 | 45.54 | 48.44 | -2.91 | 6 |
| BC2 | | BC2 | 13 | 0.27 ± 0.10 | 0.93 | 6.98 | 1.59 | 5.38 | -77 |
| BC3 | | BC3 | 13 | 1.61 ± 0.37 | 0.61 | 0.54 | 0.84 | -0.30 | 56 |
| OP | | OP | 13 | 0.82 ± 0.52 | 0.42 | 13.30 | 9.60 | 3.70 | -28 |
| TC | | TC | 13 | 0.62 ± 0.05 | 0.96 | 125.08 | 76.16 | 48.93 | -39 |
| OC | | OC | 13 | 0.41 ± 0.06 | 0.87 | 85.94 | 34.45 | 51.49 | -60 |
| BC | | BC | 13 | 1.08 ± 0.15 | 0.77 | 39.15 | 41.71 | -2.56 | 7 |
| All | | |  |  |  |  |  |  |  |
| OC1 | | OC1 | 26 | 0.72 ± 1.00 | 0.15 | 4.21 | 1.52 | 2.69 | -64 |
| OC2 | | OC2 | 26 | 0.52 ± 0.52 | -0.01 | 28.22 | 13.91 | 14.30 | -51 |
| OC3 | | OC3 | 26 | 0.79 ± 0.29 | 0.20 | 26.82 | 20.41 | 6.41 | -24 |
| OC4 | | OC4 | 26 | 0.58 ± 0.21 | 0.22 | 12.43 | 7.07 | 5.36 | -43 |
| BC1 | | BC1 | 26 | 1.13 ± 0.26 | 0.58 | 45.66 | 50.78 | -5.12 | 11 |
| BC2 | | BC2 | 26 | 0.22 ± 0.10 | 0.45 | 8.58 | 1.49 | 7.09 | -83 |
| BC3 | | BC3 | 26 | 1.42 ± 0.45 | 0.26 | 0.54 | 0.74 | -0.20 | 36 |
| OP | | OP | 26 | 0.75 ± 0.46 | 0.32 | 15.48 | 9.77 | 5.71 | -37 |
| TC | | TC | 26 | 0.78 ± 0.23 | 0.43 | 126.45 | 95.96 | 30.50 | -24 |
| OC | | OC | 26 | 0.62 ± 0.27 | 0.26 | 87.46 | 52.06 | 35.40 | -40 |
| BC | | BC | 26 | 1.14 ± 0.19 | 0.63 | 38.99 | 43.90 | -4.90 | 13 |

BC components were assumed to consist of the sum of the three BC fractions obtained by TOR minus the pyrolysis correction (OP) so that BC = BC1 + BC2 + BC3 – OP. OC components were assumed to consist of the four fractions plus the pyrolysis correction obtained by TOR so that OC = OC1 + OC2 + OC3 + OC4 + OP.

3.1. Blank values and detection limits for carbonaceous elements

A lower concentration of species in aerosol samples require low and stable blank values for analysis. Two parameters must be determined: (1) mean value of blanks and (2) the standard deviation (SD) of the blanks (to determine the DL). Because the magnitude of SD normally increases with the magnitude of the blank value, the blank value must be small. Table S7 summarizes the quality control measurements on BC and OC determinations performed at Bamako and Dakar sites in 2009. The average DRI instrument DL for TC, BC and OC was 0.45, 0.13 and 0.33 μg.cm-2, respectively. These values are close to what the manufacturer reported. The obtained field blanks DL, on the other hand, are approximately 20 times higher for OC and 10 times higher for BC, indicating high field contamination.

3.2. Uncertainties for carbonaceous elements

The estimated uncertainty is calculated using the following equation given by Chow et al. [79]:

|  |  |
| --- | --- |
|  | (2) |

where CV is the coefficient of variance for the replicate analysis, DL is the measured detection limit and is the average filter blanks. The uncertainty on measured TC with the TOR method was less than 10%.

As part of the THERMAL method quality control, filter blanks and instrument calibration were analyzed for two groups of samples: One for low carbon mass (< 25 µgC) and one for high carbon level (> 25 µgC). Before each analysis cycle, the instrument was calibrated by manually injecting sucrose into the analyzer. Table S7 shows good agreement between measured and target sucrose masses for both carbon calibrations, with a ratio close to unity indicating excellent instrument calibration. When compared to the DRI analyzer (TOR method), the Carbon analyzer (THERMAL method) has lower detection limits. The THERMAL method produced an uncertainty of 5% using equation (2).

It should be noted that the uncertainties in BC and OC for both THERMAL and TOR methods are site-dependent and thus depend on the degree of mixing sources.

**Table S7.** Quality control performance measures for carbonaceous analyses in Bamako and Dakar.

|  |  |  |  |
| --- | --- | --- | --- |
| **DRI instrument (TOR)** |  |  |  |
| *Instrument blank (µg.cm-2)* | **TC** | **BC** | **OC** |
| Average | 0.13 | 0.01 | 0.12 |
| Standard deviation | 0.15 | 0.04 | 0.11 |
| Detection limit | 0.45 | 0.13 | 0.33 |
| Number of samples | 16 | 16 | 16 |
| *Field blank (µg.cm-2)* | **TC** | **BC** | **OC** |
| Average | 4.29 | 0.63 | 3.66 |
| Standard deviation | 2.85 | 0.53 | 2.36 |
| Detection limit | 8.55 | 1.59 | 7.08 |
| Number of samples | 36 | 36 | 36 |
|  |  |  |  |
| **Carbon analyzer (Thermal)** |  |  |  |
| *Calibration (sucrose)* | low carbon (< 25µgC) | High carbon (> 25µgC) |  |
| Ratio of sucrose to mass target | 1.02 | 1.04 |  |
| Standard deviation | 0.05 | 0.04 |  |
| Number of samples | 23 | 22 |  |
| *Field blank (µg.cm-2)* | **TC** | **BC** | **OC** |
| Average | 1.62 | 0.69 | 0.93 |
| Standard deviation | 0.74 | 0.63 | 0.68 |
| Detection limit | 2.22 | 1.89 | 2.04 |
| Number of samples | 22 | 15 | 15 |

3.3. Comparison between Thermal-Optical Reflectance (TOR) and THERMAL (THE) methods

Using 24-hour PM samples from the two sites, an intercomparison of the TOR and THERMAL methods with no-decarbonatation procedure was performed.

In both Bamako and Dakar samples, TC values obtained by the TOR method were close (difference less than 10%) to those obtained by the THERMAL method, with a slope close to unity (Figure S4). These findings are consistent with those reported in the literature. There are differences between the two methods when it comes to EC and OC. For Dakar samples, OC TOR was around 0.94 times the value of OC THERMAL, against 0.85 for Bamako samples. This implies that, despite differences in charring correction and temperature protocol (Table S4) in the TOR method, the two methods are comparable in term of OC analysis. As shown in Figure S4, EC values are affected by the analytical method used, possibly due to variable source contributions. EC concentrations measured using the TOR method are higher than those obtained using the THERMAL method. The ratio of EC TOR to EC THERMAL in Dakar samples was 1.03 and 1.29 in Bamako samples. These findings indicate that the differences between these two analytical methods are more pronounced in Bamako than in Dakar. Three factors account for the difference:

* The first one is susceptible to the presence of components such as brown carbon in carbonaceous aerosol [80], as brown carbon has the potential to influence splitting between OC and EC (or black carbon BC) due to light absorption and medium thermal reactivity. Indeed, some brown carbon can be classified as OC and the rest as EC [81]. Brown carbon was shown to be emitted primarily by incomplete combustion, such as domestic fires, with the Bamako site being heavily influenced by this source [8]. Using different methods, Hitzenberger et al[40] discovered comparable elemental carbon concentrations from diesel traffic sources. This finding is consistent with Dakar samples being significantly influenced by diesel emissions (EC TOR to EC THERMAL ratio of 1.03 was found).
* The second factor is related to aerosols mixing state. As shown in Figure S4, the EC TOR to EC THERMAL ratio decreases from Bamako, which is heavily influenced by dust, to Dakar, which is heavily influenced by traffic diesel. The presence of dust particles in Bamako samples was assumed to affect thermal optical measurements, contributing to the observed large EC concentration variations.
* Third and final hypothesis is that the EC THERMAL is more sensitive to combustion aerosols of fossil fuel origin [82], because this source is more abundant in Bamako than in Dakar.



**Figure S4.** Comparison between the Thermal-Optical Reflectance (TOR) and the THERMAL (THE) methods at the two sites for TC, OC and EC (or BC). The linear regression results are displayed, S being the slope for Dakar (SDakar) and Bamako (SBamako) with zero intercept.

**Table S8.** Comparison between measured and PMF calculated concentrations (in ng.m-3) except for PM (in µg.m-3) in Bamako for studied chemical species.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Species** | **Measured** | **PMF modeled** | **r2** | **Uncertainty (%)** |
| PM (µg.m-3) | 430.01 | 380.67 | 0.25 | 11 |
| OC | 98295 | 84466 | 0.44 | 14 |
| BC | 24600 | 20765 | 0.35 | 16 |
| Al | 15457 | 15280 | 0.96 | 1 |
| Fe | 15423 | 15438 | 0.99 | 0 |
| Ca2+ | 5774 | 5775 | 0.98 | 0 |
| SO42- | 3103 | 3078 | 0.97 | 1 |
| K+ | 2952 | 2934 | 0.99 | 1 |
| Cl- | 2953 | 2902 | 0.94 | 2 |
| NO3- | 1649 | 1646 | 0.93 | 0 |
| Na+ | 1541 | 1542 | 0.99 | 0 |
| Ti | 1368 | 1335 | 1.00 | 2 |
| Mg2+ | 672 | 674 | 0.99 | 0 |
| Mn | 229 | 227 | 0.99 | 1 |
| Zn | 144 | 142 | 0.90 | 1 |
| Cr | 73 | 72 | 0.97 | 1 |
| V | 38 | 38 | 1.00 | 1 |
| Cu | 30 | 29 | 0.79 | 3 |
| Ni | 21 | 18 | 0.23 | 15 |
| Rb | 15 | 14 | 0.94 | 1 |
| Co | 6 | 6 | 0.99 | 1 |
| Sb | 4 | 4 | 0.67 | 3 |
| As | 3 | 3 | 0.85 | 3 |
| Cd | 1 | 1 | 0.26 | 1 |
| Be | 0.5 | 0.5 | 0.99 | 4 |
| Se | 0.3 | 0.3 | 0.94 | 0 |
| Tl | 0.2 | 0.2 | 0.92 | 4 |

**Table S9.** Comparison between measured and PMF calculated concentrations (in ng.m-3) except for PM (in µg.m-3) in Dakar for all chemical species.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Species** | **Measured** | **PMF modeled** | **r2** | **Uncertainty (%)** |
| PM (µg.m-3) | 170.36 | 189.67 | 0.82 | 10 |
| OC | 46057 | 47941 | 0.96 | 4 |
| BC | 17131 | 17042 | 0.70 | -1 |
| Ca2+ | 12038 | 12189 | 0.83 | 1 |
| Al | 6934 | 7142 | 0.96 | 3 |
| Cl- | 6074 | 6190 | 0.97 | 2 |
| SO42- | 6073 | 6038 | 0.98 | -1 |
| Fe | 5975 | 5979 | 0.98 | 0 |
| Na+ | 3765 | 3785 | 0.98 | 1 |
| NO3- | 1662 | 1683 | 0.78 | 1 |
| K+ | 829 | 835 | 0.92 | 1 |
| Ti | 583 | 586 | 0.98 | 1 |
| Mg2+ | 549 | 553 | 0.99 | 1 |
| Zn | 160 | 160 | 0.93 | 0 |
| Cu | 130 | 129 | 0.93 | 0 |
| Mn | 105 | 108 | 0.96 | 3 |
| V | 62 | 61 | 0.86 | -2 |
| Ni | 26 | 28 | 0.78 | 7 |
| Cr | 24 | 24 | 0.84 | -1 |
| Rb | 6 | 6 | 0.97 | -5 |
| Sb | 4 | 4 | 0.73 | 3 |
| Co | 3 | 3 | 0.95 | 2 |
| As | 2 | 2 | 0.70 | -5 |
| Cd | 1 | 1 | 0.85 | -2 |
| Se | 1 | 1 | 0.83 | 1 |
| Be | 0.2 | 0.2 | 0.98 | 0 |
| Tl | 0.04 | 0.05 | 0.93 | 4 |

Chart, scatter chart

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**Figure S5.** Time variations of PM2.5, PM10 and TSP components concentrations measured at Bamako between 20 January and 1 February 2009.

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**Figure S6.** Time variations of components in PM2.5, PM10 and TSP concentrations measured at Daker between 1 and 13 December 2009.