Table S1: The Comparison of the online (ACSM) and offline (Filters) mass concentrations of various chemical components for PM$_{1.0}$.

<table>
<thead>
<tr>
<th>Species</th>
<th>NO$_3$</th>
<th>SO$_4$</th>
<th>NH$_4$</th>
<th>Org/OC</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope</td>
<td>0.939</td>
<td>0.901</td>
<td>1.092</td>
<td>2.774</td>
<td>1.244</td>
</tr>
<tr>
<td>Slope_std</td>
<td>0.089</td>
<td>0.159</td>
<td>0.104</td>
<td>0.918</td>
<td>0.136</td>
</tr>
<tr>
<td>R$^2$</td>
<td>0.978</td>
<td>0.927</td>
<td>0.978</td>
<td>0.801</td>
<td>0.971</td>
</tr>
<tr>
<td>Intercept</td>
<td>-0.186</td>
<td>-0.316</td>
<td>0.089</td>
<td>-0.929</td>
<td>-1.146</td>
</tr>
<tr>
<td>T-statistic</td>
<td>6.390</td>
<td>24.294</td>
<td>-7.838</td>
<td>-3.851</td>
<td>-0.261</td>
</tr>
<tr>
<td>P-value</td>
<td>2.38E-05</td>
<td>3.22E-12</td>
<td>2.80E-06</td>
<td>2.31E-03</td>
<td>7.98E-01</td>
</tr>
</tbody>
</table>

Table S2: The Comparison of the online (ACSM and MAAP) and offline (Filters) mass concentrations of various chemical components for PM$_{2.5}$.

<table>
<thead>
<tr>
<th>Species</th>
<th>NO$_3$</th>
<th>SO$_4$</th>
<th>NH$_4$</th>
<th>Org/OC</th>
<th>eBC/EC</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope</td>
<td>0.884</td>
<td>0.989</td>
<td>0.958</td>
<td>2.111</td>
<td>1.550</td>
<td>1.135</td>
</tr>
<tr>
<td>Slope_std</td>
<td>0.100</td>
<td>0.241</td>
<td>0.149</td>
<td>1.272</td>
<td>0.441</td>
<td>0.172</td>
</tr>
<tr>
<td>R$^2$</td>
<td>0.968</td>
<td>0.870</td>
<td>0.942</td>
<td>0.548</td>
<td>0.830</td>
<td>0.945</td>
</tr>
<tr>
<td>Intercept</td>
<td>-0.394</td>
<td>-0.477</td>
<td>0.161</td>
<td>-0.103</td>
<td>0.013</td>
<td>-1.126</td>
</tr>
<tr>
<td>T-statistic</td>
<td>9.137</td>
<td>15.513</td>
<td>-3.754</td>
<td>-4.941</td>
<td>-6.949</td>
<td>1.376</td>
</tr>
<tr>
<td>P-value</td>
<td>5.08E-07</td>
<td>9.11E-10</td>
<td>2.41E-03</td>
<td>3.42E-04</td>
<td>1.01E-05</td>
<td>1.92E-01</td>
</tr>
</tbody>
</table>

Table S3: The Comparison of the online (ACSM and MAAP) and offline (Filters) mass concentrations of various chemical components for PM$_{2.5}$.

<table>
<thead>
<tr>
<th>Species</th>
<th>NO$_3$</th>
<th>SO$_4$</th>
<th>NH$_4$</th>
<th>Org/OC</th>
<th>eBC/EC</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope</td>
<td>0.931</td>
<td>0.856</td>
<td>1.163</td>
<td>1.994</td>
<td>1.577</td>
<td>1.352</td>
</tr>
<tr>
<td>Slope_std</td>
<td>0.242</td>
<td>0.259</td>
<td>0.229</td>
<td>0.324</td>
<td>0.150</td>
<td>0.266</td>
</tr>
<tr>
<td>R$^2$</td>
<td>0.748</td>
<td>0.687</td>
<td>0.838</td>
<td>0.612</td>
<td>0.821</td>
<td>0.508</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.809</td>
<td>0.260</td>
<td>0.012</td>
<td>1.104</td>
<td>0.003</td>
<td>4.614</td>
</tr>
<tr>
<td>T-statistic</td>
<td>-3.628</td>
<td>-0.484</td>
<td>-1.116</td>
<td>-6.361</td>
<td>-5.578</td>
<td>-6.312</td>
</tr>
<tr>
<td>P-value</td>
<td>1.10E-02</td>
<td>6.46E-01</td>
<td>3.07E-01</td>
<td>1.17E-06</td>
<td>8.42E-06</td>
<td>1.11E-06</td>
</tr>
</tbody>
</table>

Table S4: The Molar mass concentrations (Mol m$^{-3}$) from Filter samples.
<table>
<thead>
<tr>
<th>Date</th>
<th>Molar mass (Mol m(^{-3}))</th>
<th>Cation PM(_{1.0})</th>
<th>Anion PM(_{1.0})</th>
<th>Cation PM(_{2.5})</th>
<th>Anion PM(_{2.5})</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021-5-10</td>
<td>0.026</td>
<td>0.042</td>
<td>0.029</td>
<td>0.055</td>
<td></td>
</tr>
<tr>
<td>2021-5-11</td>
<td>0.053</td>
<td>0.070</td>
<td>0.065</td>
<td>0.095</td>
<td></td>
</tr>
<tr>
<td>2021-5-12</td>
<td>0.038</td>
<td>0.059</td>
<td>0.042</td>
<td>0.085</td>
<td></td>
</tr>
<tr>
<td>2021-5-13</td>
<td>0.045</td>
<td>0.066</td>
<td>0.059</td>
<td>0.089</td>
<td></td>
</tr>
<tr>
<td>2021-5-14</td>
<td>0.079</td>
<td>0.100</td>
<td>0.102</td>
<td>0.133</td>
<td></td>
</tr>
<tr>
<td>2021-5-15</td>
<td>0.068</td>
<td>0.087</td>
<td>0.090</td>
<td>0.115</td>
<td></td>
</tr>
<tr>
<td>2021-5-16</td>
<td>0.019</td>
<td>0.038</td>
<td>0.021</td>
<td>0.059</td>
<td></td>
</tr>
<tr>
<td>2021-5-17</td>
<td>0.030</td>
<td>0.045</td>
<td>0.036</td>
<td>0.061</td>
<td></td>
</tr>
<tr>
<td>2021-5-18</td>
<td>0.035</td>
<td>0.054</td>
<td>0.042</td>
<td>0.071</td>
<td></td>
</tr>
<tr>
<td>2021-5-19</td>
<td>0.048</td>
<td>0.067</td>
<td>0.056</td>
<td>0.089</td>
<td></td>
</tr>
<tr>
<td>2021-5-20</td>
<td>0.049</td>
<td>0.068</td>
<td>0.076</td>
<td>0.100</td>
<td></td>
</tr>
<tr>
<td>2021-5-21</td>
<td>0.004</td>
<td>0.020</td>
<td>0.003</td>
<td>0.030</td>
<td></td>
</tr>
<tr>
<td>2021-5-22</td>
<td>0.010</td>
<td>0.025</td>
<td>0.013</td>
<td>0.034</td>
<td></td>
</tr>
<tr>
<td>2021-5-23</td>
<td>0.022</td>
<td>0.037</td>
<td>0.033</td>
<td>0.058</td>
<td></td>
</tr>
</tbody>
</table>

Slope: 1.070, 1.005  
R\(^2\): 0.992, 0.958  
Intercept: 0.015, 0.029  
T statistic: -27.330, -18.207  
P value: 7.170E-13, 1.238E-10

Table S5: The Molar mass concentrations (Mol m\(^{-3}\)) from ACSM measurements.
Figure S 1 Intercomparison and correlation of two collocated TOF-ACSM with PM$_{2.5}$ measurements. The light shades represent the 95% confidential interval.

Figure S 2 The correlation between the PM$_{1.0}$ and PM$_{2.5}$ measured by Filters. The light shades represent the 95% confidential interval.
Figure S 3 The ACSM measured hourly chemical mass concentration fraction of the NR-PM$_{1.0}$ and NR-PM$_{2.5}$, and the corresponding mass concentration of each components.

Figure S 4 The daily mass fraction of the PM$_{1.0}$ (left in light colour) and PM$_{2.5}$ (right in dark colour) measured by Filters. The total mass was labelled in red at the top of the bar.

Figure S 5 The average mass fraction of each species in the PM$_{1.0}$ and PM$_{2.5}$ measured by Filters, and the PM$_{2.5}$ mass fraction of the total PM$_{2.5}$ Gravimetric mass.
Figure S 6 Time series of the differences (y axis at the left) between the ACSM and MARGA in PM$_{2.5}$ mass concentration colored by the wind direction.