## Supplementary Information:

### §1 Sampling dates and times

**Table S1.** Sampling dates, times, locations and SHARK component information

<table>
<thead>
<tr>
<th>Impactor 1 sampled volume, L (at 100 L min⁻¹)</th>
<th>Impactor 2 sampled volume, L (at 9 L min⁻¹)</th>
<th>Impactors</th>
<th>Impactor 1 and 2 installed, only sampling</th>
<th>Impactor 1 only installed but not sampling</th>
<th>Impactor 2 only installed but not sampling</th>
<th>Sampling periods</th>
<th>Date (dd/mm/yy)</th>
<th>Site</th>
<th>Windsond?</th>
<th>OPC?</th>
<th>Site</th>
<th>Windsond?</th>
<th>OPC?</th>
</tr>
</thead>
<tbody>
<tr>
<td>12000</td>
<td>-</td>
<td>Impactor 1</td>
<td>14:15-16:15</td>
<td>10:45-16:00</td>
<td>12:21-15:21</td>
<td>Both impactors</td>
<td>11/03/2018</td>
<td>Hyytiälä, (Finland)</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>51000</td>
<td>-</td>
<td>Impactor 2</td>
<td>10:45-16:00</td>
<td>12:21-15:21</td>
<td>20:00-04:30</td>
<td>Both impactors</td>
<td>07/06/2018</td>
<td>Leeds, (UK)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>Impactor 2</td>
<td>2835</td>
<td>1620</td>
<td>4590</td>
<td>Both impactors</td>
<td>23/09/18-24/09/18</td>
<td>Longyearbyen, (Svalbard)</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>Impactor 2</td>
<td>1620</td>
<td>4590</td>
<td>51000</td>
<td>Both impactors</td>
<td>23/09/18-24/09/18</td>
<td>Longyearbyen, (Svalbard)</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Cardington, (UK)**

**Hyytiälä, (Finland)**

**Leeds, (UK)**

**Longyearbyen, (Svalbard)**

**Site:**

**Impactors:**

1. Impactor 1 and 2 installed, only sampling
2. Impactor 1 only installed but not sampling
3. Impactor 2 only installed but not sampling

**Sampling periods:**

1. 14:15-16:15
2. 10:45-16:00
3. 12:21-15:21
4. 20:00-04:30

**Date (dd/mm/yy):**

1. 15/05/2018
2. 11/03/2018
3. 07/06/2018
4. 23/09/18-24/09/18

**Site:**

1. Cardington, (UK)
2. Hyytiälä, (Finland)
3. Leeds, (UK)
4. Longyearbyen, (Svalbard)
Figure S1. Fraction frozen curves for samples collected in Cardington, (UK)

Figure S2. Fraction frozen curves for samples collected in Hyytiälä, (Finland)
Figure S3. Fraction frozen curves for samples collected in Leeds, (UK)

Figure S4. Fraction frozen curves for samples collected in Longyearbyen, (Svalbard)
S3 Aerosol data for Leeds and Longyearbyen

S3.1 Leeds, (UK)

**Figure S5.** Particle number size distribution data for samples collected in Leeds, (UK)

**Figure S6.** Particle surface area size distribution data for samples collected in Leeds, (UK)

**Figure S7.** Particle mass size distribution data for samples collected in Leeds, (UK)
S3.2 Longyearbyen, (Svalbard)

Figure S8. Particle number size distribution data for samples collected in Longyearbyen, (Svalbard)

Figure S9. Particle surface area size distribution data for samples collected in Longyearbyen, (Svalbard)

Figure S10. Particle mass size distribution data for samples collected in Longyearbyen, (Svalbard)