Supplement of

Dynamics of gaseous oxidized mercury at Villum Research Station during the High Arctic summer

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Supplemental Information - Dynamics of gaseous oxidized mercury at Villum Research Station during the High Arctic summer

Figure S1. Overview of meteorological parameters measured during the 2019 campaign including (a) wind direction (°) in black, (b) wind speed (m s⁻¹) in red, and (c) snow depth (m) in blue. The areas shaded in blue indicate Events 1a, 1b, and 2, respectively.

Figure S2. Hourly air mass back-trajectories for August 26, 2019. The top panels show back-trajectories colored coded by arrival time. The bottom panels show the boxplots of the altitude (m) of each hourly back-trajectory binned in ten-hour increments. The whiskers represent the 5th and 95th percentiles, the filled boxes represent the 25th and 75th percentiles, and the circle represents the median.
Figure. S3. Overview of meteorological parameters measured during the 2020 campaign including (a) wind direction (°) in black, (b) wind speed (m s\(^{-1}\)) in red, and (c) snow depth (m) in blue. The areas shaded in blue indicate Events 3, 4, 5a, and 5b, respectively.

Figure. S4. Hourly air mass back-trajectories for July 19–21, 2020 (a–c). The top panels show back-trajectories colored coded by arrival time. The bottom panels show the boxplots of the altitude (m) of each hourly back-trajectory binned in ten-hour increments. The whiskers represent the 5\(^{th}\) and 95\(^{th}\) percentiles, the filled boxes represent the 25\(^{th}\) and 75\(^{th}\) percentiles, and the circle represents the median.
Figure. S5. Contour plots of trajectory derived meteorological parameters (a) H\textsubscript{2}O mixing ratio for the 2019 campaign and (b) H\textsubscript{2}O mixing ratio for the 2020 campaign. Event periods are outlined in red. The x-axis displays arrival time at Villum, the y-axis displays hours backward in time for each trajectory, and the color bar represents the meteorological parameter.

Table S1. Statistics for ground level meteorological parameters, mercury species, aerosol properties, and accumulated precipitation. The top number represents the median while the bottom number is the median absolute deviation.

|                      | Event 1a | Event 1b | Event 2 | Event 3 | Event 4 | Event 5a | Event 5b | 2019 Non-Events | 2019 Events | 2020 Non-Events | 2020 Events |
|----------------------|----------|----------|---------|---------|---------|----------|----------|-----------------|-------------|-----------------|-------------|
| GEM                  | 1.49     | 1.38     | 1.47    | 1.71    | 1.76    | 1.54     | 1.51     | 1.56            | 1.48        | 1.95            | 1.56        |
|                      | 0.09     | 0.04     | 0.02    | 0.13    | 0.09    | 0.02     | 0.05     | 0.08            | 0.04        | 0.32            | 0.06        |
| GOM                  | 2.69     | 3.97     | 1.65    | 35.13   | 8.78    | 9.10     | 11.33    | 0.00            | 2.18        | 2.02            | 10.28       |
|                      | 1.24     | 1.59     | 0.62    | 13.98   | 2.38    | 2.43     | 2.21     | 0.00            | 0.87        | 0.83            | 2.89        |
| PHg                  | N/A      | N/A      | N/A     | 0.17    | 0.83    | <LOD     | -1.07    | N/A             | N/A         | 1.43            | 1.14        |
|                      | N/A      | N/A      | N/A     | 0.54    | 0.49    | N/A      | 0.33     | N/A             | N/A         | 0.49            | 0.34        |
| Radiation            | 122.62   | 219.01   | 77.75   | 142.05  | 264.05  | 216.09   | 233.06   | 56.35           | 108.72      | 155.38         | 223.10      |
|                      | 85.69    | 127.97   | 70.73   | 76.53   | 105.80  | 98.12    | 104.82   | 39.38           | 85.07       | 73.88           | 101.56      |
| Ozone                | 35.85    | 42.70    | 31.89   | 26.69   | 25.30   | 30.01    | 31.38    | 30.10           | 34.31       | 24.37           | 29.05       |
|                      | 4.97     | 0.60     | 2.62    | 0.79    | 1.65    | 0.94     | 2.58     | 4.50            | 2.11        | 2.64            |             |
| H\textsubscript{2}O Mixing Ratio | 2.89   | 2.67     | 3.01    | 3.83    | 4.61    | 4.55     | 2.91     | 3.51            | 2.93        | 4.23            | 3.87        |
|                      | 0.19     | 0.07     | 0.19    | 0.04    | 0.23    | 0.34     | 0.22     | 0.12            | 0.19        | 0.56            | 0.73        |
| Acc. Precipitation   | 6.75     | 2.50     | 7.50    | 10.90   | 8.90    | 12.95    | 11.15    | 8.98            | 6.60        | 14.65           | 11.15       |
|                      | 2.35     | 0.50     | 5.50    | 4.10    | 1.90    | 3.40     | 2.90     | 6.02            | 3.30        | 6.15            | 3.05        |
| BC                   | 7.30     | 16.44    | 3.80    | 9.43    | 10.12   | 4.07     | 2.00     | 1.22            | 4.73        | 2.58            | 4.23        |
|                      | 4.94     | 1.32     | 0.59    | 0.87    | 1.20    | 0.63     | 0.47     | 1.06            | 2.79        | 2.33            | 2.54        |
| N\textsubscript{Coarse} | 3.92   | 7.19     | 1.99    | 2.13    | 2.50    | 0.77     | 0.58     | 0.46            | 2.26        | 0.61            | 0.91        |
|                      | 2.82     | 0.95     | 0.13    | 0.45    | 0.47    | 0.18     | 0.04     | 0.34            | 1.42        | 0.47            | 0.39        |
| Temperature          | 2.16     | 2.19     | 0.34    | 3.61    | 8.26    | 10.81    | 10.45    | -0.09           | 1.68        | 3.78            | 9.58        |
|                      | 0.83     | 0.13     | 1.11    | 0.62    | 1.50    | 1.27     | 1.16     | 0.43            | 1.23        | 3.28            | 1.72        |
| RH                   | 62.96    | 62.98    | 76.91   | 80.10   | 71.35   | 52.35    | 37.30    | 95.70           | 67.83       | 85.55           | 52.87       |
|                      | 5.33     | 4.73     | 7.82    | 2.20    | 4.28    | 3.79     | 4.65     | 1.82            | 8.53        | 9.20            | 14.59       |
| Wind Speed           | 4.46     | 10.30    | 2.27    | 3.85    | 2.32    | 9.30     | 8.63     | 4.42            | 3.43        | 3.04            | 6.70        |
|                      | 2.58     | 1.28     | 1.01    | 0.48    | 0.58    | 1.05     | 0.77     | 1.43            | 2.02        | 1.09            | 2.98        |

Table S2. Statistics for trajectory derived meteorological parameters and altitude. The top number represents the median while the bottom number is the median absolute deviation. For the percent above the mixed layer, and percent in cloud, the units are percentage of time.
| Event 1a | Event 1b | Event 2 | Event 3 | Event 4 | Event 5a | Event 5b | 2019 Non-Events | 2019 Events | 2020 Non-Events | 2020 Events |
|----------|----------|---------|---------|---------|---------|---------|----------------|-------------|----------------|-------------|
| Temperature | -1.85 | -6.35 | -1.05 | 1.05 | 0.15 | 4.15 | -5.15 | -1.75 | -1.95 | 1.95 | 0.65 |
|           | 3.00 | 6.00 | 4.70 | 2.50 | 3.10 | 4.00 | 9.20 | 2.30 | 3.80 | 2.60 | 4.20 |
| RH       | 82.00 | 70.60 | 74.60 | 95.60 | 89.60 | 84.40 | 71.90 | 89.20 | 78.80 | 87.70 | 83.50 |
|          | 14.00 | 17.30 | 15.50 | 3.50 | 9.00 | 10.50 | 20.50 | 7.90 | 15.50 | 10.20 | 13.80 |
| Radiation | 107.70 | 121.15 | 84.20 | 145.90 | 185.40 | 142.90 | 189.00 | 106.5 | 102 | 169.40 | 170.90 |
|          | 66.40 | 93.50 | 72.60 | 67.65 | 89.40 | 103.60 | 133.00 | 63.1 | 70.4 | 95.20 | 103.30 |
| Altitude | 941.70 | 1986.25 | 1162.80 | 831.20 | 1145.70 | 855.80 | 2098.25 | 652.00 | 1048.30 | 539.80 | 1251.20 |
|          | 523.50 | 781.85 | 734.70 | 355.15 | 575.80 | 382.40 | 1030.50 | 598.20 | 635.80 | 418.40 | 647.30 |
| H₂O Mixing Ratio | 3.00 | 1.90 | 3.00 | 3.90 | 3.30 | 4.90 | 2.00 | 3.20 | 2.90 | 4.00 | 3.40 |
|          | 0.80 | 0.70 | 0.80 | 0.70 | 0.40 | 0.90 | 1.40 | 0.50 | 0.80 | 0.70 | 1.00 |
| % above Mixed Layer | 90.72 | 93.80 | 89.47 | 96.70 | 98.71 | 83.59 | 97.00 | 70.49 | 90.54 | 79.59 | 94.32 |
| % in cloud | 22.67 | 11.67 | 14.28 | 52.58 | 38.32 | 20.37 | 14.68 | 29.61 | 19.15 | 32.59 | 27.37 |