



Supplement of

On the use of lithogenic tracer measurements in aerosols to constrain dust deposition fluxes to the ocean southeast of Australia

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Table S1. Arizona Test Dust (ATD, n=5, Morton et al., 2013) and LOESS (GeoPT13, n=6, Potts et al., 2003) reference material mean measurements (conc. in ppm), standard deviations (σ) and recoveries (%) calculated for each lithogenic tracer of interest. Average recoveries for both CRMs also shown.

| | Reference | | ATD (measured) | | | GeoPT13 (measured) | | | Both CRMs |
|-----------|-----------|---------|----------------|----------|-----|--------------------|----------|-----|-----------|
| | ATD | GeoPT13 | conc. | σ | % | conc. | σ | % | % |
| Th | 19.4 | 8.1 | 12.3 | 1.0 | 63* | 7.0 | 1.3 | 87 | 87 |
| Ti | 3299 | 2535 | 3013 | 139 | 91 | 2484 | 74 | 98 | 95 |
| Fe | 32922 | 14688 | 27509 | 1619 | 84 | 14115 | 1375 | 96 | 90 |
| Al | 66153 | 32813 | 60256 | 3316 | 91 | 32634 | 3171 | 100 | 95 |

*Reported reference Th concentration in the ATD material is based on one reported analysis and is not part of the consensus data. Only recovery based on GeoPT13 certified Th concentration is considered in the manuscript.

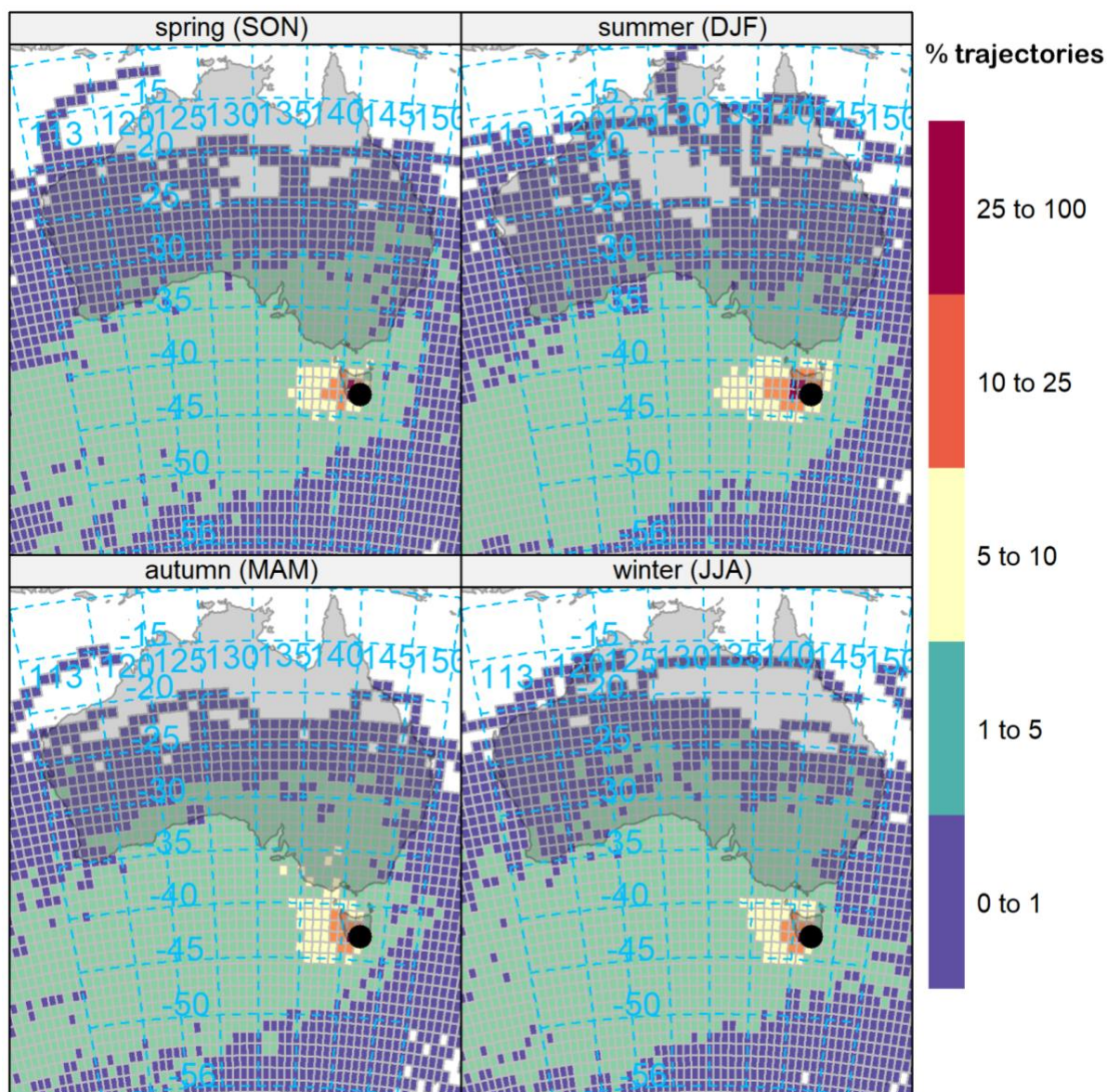


Figure S1. HYSPLIT (NOAA), 168h-air-mass back-trajectory frequency calculated over the study period (October 2016 to March 2022). For each season, the frequency at which a gridded area of the map is crossed by the air-mass arriving at an altitude of 1250 m at the kunanyi/Mt Wellington sampling station is displayed. GDAS meteorological data were used with a resolution of 1x1 degrees.

Rose of Wind direction versus Wind speed in km/h (01 Mar 1961 to 11 Aug 2024)

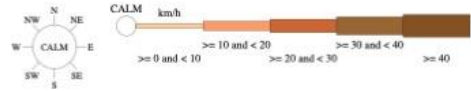
Custom times selected, refer to attached note for details

KUNANYI (MOUNT WELLINGTON PINNACLE)

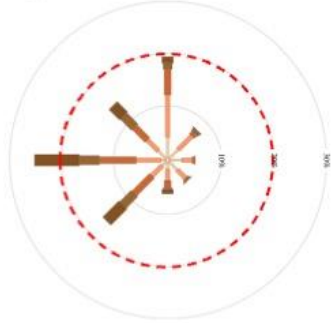
Site No: 094087 • Opened Jan 1961 • Still Open • Latitude: -42.895° • Longitude: 147.2358° • Elevation 1260.4m

An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



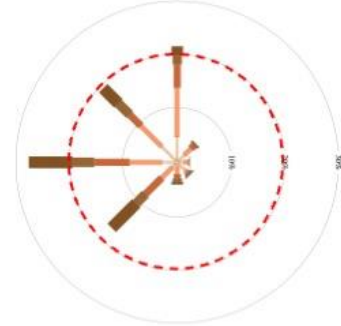
January



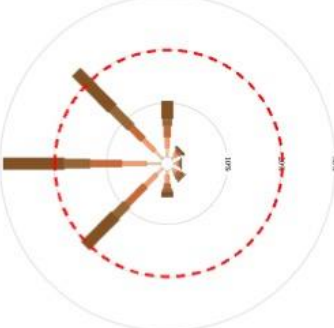
February



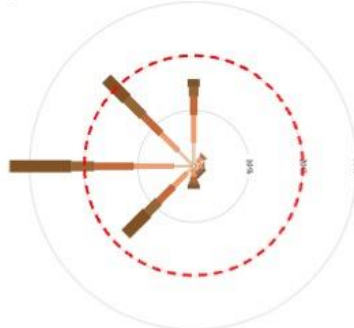
March



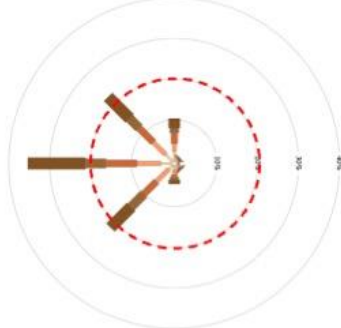
April



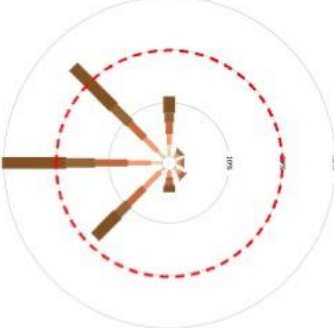
May



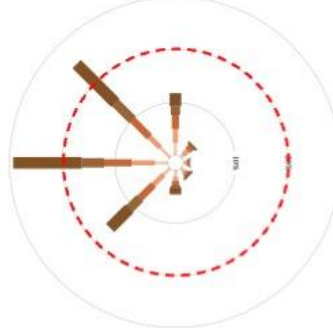
June



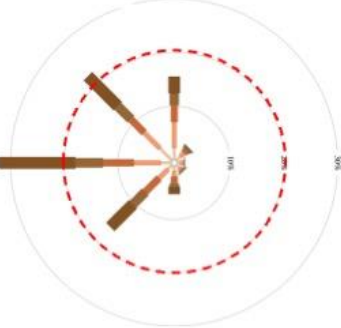
July



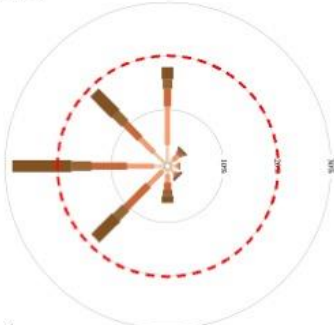
August



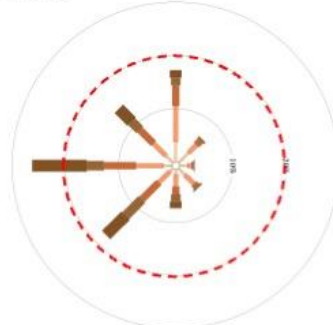
September



October



November



December



Figure S2. Monthly mean wind speed and direction measured at kunanyi / Mt Wellington between 1961 and 2024. Reproduced by permission of Bureau of Meteorology, © 2023 Commonwealth of Australia.

Table S2. Concentrations of total Al, Fe, Th and Ti concentrations (in ppm) measured in eleven individual NGSa soil samples collected in South Australia (SA), Victoria (VIC), and Western Australia (WA) and sieved to <63 μm . Mean and standard deviation (σ) values are shown for each region and mean, median and standard deviation, for all samples.

| Region | Abbreviated ID | NGSA site ID | Al | Fe | Th | Ti |
|--|----------------|---------------|-------|-------|----|-------|
| SA | 23 | 2007190223 | 22220 | 19362 | 13 | 9032 |
| | 26 | 2007190326 | 41613 | 22293 | 5 | 2594 |
| | 43 | 2007190743 | 39924 | 20788 | 6 | 2461 |
| | 56 | 2007190256 | 24990 | 19626 | 15 | 7371 |
| | 88 | 2007190188 | 43743 | 39422 | 15 | 5328 |
| | | regional mean | 34498 | 24298 | 11 | 5357 |
| | | σ | 10083 | 8533 | 5 | 2898 |
| VIC | 62 | 2007190162 | 1895 | 942 | 5 | 533 |
| | 64 | 2007190964 | 62994 | 33011 | 10 | 3829 |
| | 74 | 2007191374 | 54367 | 25061 | 14 | 4926 |
| | 93 | 2007190493 | 38617 | 15759 | 7 | 4539 |
| | | regional mean | 39468 | 18693 | 9 | 3457 |
| | | σ | 27006 | 13775 | 4 | 2001 |
| WA | 28 | 2007190028 | 53945 | 30708 | 13 | 3995 |
| | 29 | 2007190029 | 39857 | 21807 | 8 | 2835 |
| | | regional mean | 46901 | 26258 | 11 | 3415 |
| | | σ | 9962 | 6294 | 4 | 820 |
| All | | mean | 38560 | 22616 | 10 | 4313 |
| | | median | 39924 | 21807 | 10 | 3995 |
| | | σ | 17085 | 10012 | 4 | 2372 |
| Mean metal concentration in UCC (McLennan, 2001) | | | 80400 | 45000 | 11 | 41000 |

Table S3. Average total concentrations (ppm) of Cu, Cr, Mn, Ni, Pb and Zn measured in Australian soil from South Australia, Victoria, and Western Australia based on the of eleven NGSA soil samples (samples ID as per Table S2) collected sieved to <63 μm . Standard deviation (σ) values are shown for each region and mean, median and standard deviation, for all samples. Data is consistent with reported range from NGSA (<https://www.ga.gov.au/about/projects/resources/national-geochemical-survey/atlas>)

| Region | Co | Cu | Cr | Mn | Ni | Pb | Zn |
|---------------------------------|-----------|-------------|-------------|---------------|-------------|------------|-------------|
| South Australia | 7 | 12 | 30 | 354 | 12 | 14 | 48 |
| σ | 3 | 5 | 5 | 153 | 5 | 7 | 13 |
| Victoria | 8 | 15 | 35 | 340 | 17 | 14 | 38 |
| σ | 5 | 11 | 20 | 207 | 11 | 8 | 23 |
| Western Australia | 10 | 29 | 92 | 385 | 38 | 13 | 48 |
| σ | 3 | 12 | 34 | 134 | 16 | 1 | 6 |
| All regions together | 8 \pm 4 | 16 \pm 10 | 43 \pm 28 | 353 \pm 161 | 18 \pm 13 | 14 \pm 7 | 44 \pm 17 |
| UCC content (McLennan, 2001) | 17 | 25 | 83 | 600 | 44 | 17 | 71 |

Table S4. Elemental ratios of lithogenic tracers (X = Fe, Th, Ti) in kunanyi/Mt Wellington aerosol samples calculated using Al as the crustal reference element. Thorium was only analyzed during analytical runs undertaken from 2020 onward, hence data is missing for all samples analyzed prior to this date.

| Sample ID | Date | Season | Fe_Al | Th_Al* | Ti_Al |
|-----------|------------|--------|-------|----------|-------|
| MW04 | 05/11/2016 | Spring | 1.03 | 3.90E-05 | 0.02 |
| MW05 | 12/11/2016 | Spring | 1.14 | 9.61E-05 | 0.08 |
| MW06 | 20/11/2016 | Spring | 1.16 | 1.00E-04 | 0.07 |
| MW08 | 03/12/2016 | Summer | 0.61 | | 0.08 |
| MW10 | 18/12/2016 | Summer | 0.45 | | 0.02 |
| MW11 | 24/12/2016 | Summer | 0.45 | | 0.02 |
| MW13 | 07/01/2017 | Summer | 1.15 | 1.51E-04 | 0.08 |
| MW15 | 14/01/2017 | Summer | 0.86 | 1.09E-04 | 0.07 |
| MW17 | 26/01/2017 | Summer | 0.54 | | 0.03 |
| MW18 | 04/02/2017 | Summer | 0.94 | 1.28E-04 | 0.08 |
| MW19 | 11/02/2017 | Summer | 0.44 | | 0.01 |
| MW20 | 19/02/2017 | Summer | 0.88 | 1.51E-04 | 0.09 |
| MW21 | 27/02/2017 | Summer | 0.89 | 1.29E-04 | 0.09 |
| MW23 | 13/03/2017 | Autumn | 0.56 | 1.22E-04 | 0.06 |
| MW24 | 20/03/2017 | Autumn | 0.45 | | 0.02 |
| MW25 | 26/03/2017 | Autumn | 0.46 | | 0.07 |
| MW26 | 01/04/2017 | Autumn | 0.52 | | 0.03 |
| MW28 | 09/04/2017 | Autumn | 0.28 | | 0.01 |
| MW41 | 29/10/2017 | Spring | 0.39 | | 0.03 |
| MW43 | 11/11/2017 | Spring | 0.50 | | 0.02 |
| MW44 | 18/11/2017 | Spring | 0.42 | | 0.03 |
| MW45 | 25/11/2017 | Spring | 0.44 | | 0.01 |
| MW46 | 02/12/2017 | Summer | 0.63 | 8.68E-05 | 0.04 |
| MW49 | 16/12/2017 | Summer | 0.97 | 1.60E-04 | 0.09 |
| MW50 | 13/12/2017 | Summer | 0.73 | | 0.02 |
| MW51 | 14/12/2017 | Summer | 0.86 | | 0.03 |
| MW52 | 15/12/2017 | Summer | 1.05 | | 0.02 |
| MW53 | 16/12/2017 | Summer | 1.22 | | 0.08 |
| MW54 | 17/12/2017 | Summer | 0.87 | | 0.03 |
| MW55 | 18/12/2017 | Summer | 1.00 | | 0.03 |
| MW58 | 24/12/2017 | Summer | 0.83 | 1.42E-04 | 0.09 |
| MW59 | 31/12/2018 | Summer | 0.74 | 1.42E-04 | 0.08 |
| MW60 | 06/01/2018 | Summer | 0.88 | 1.46E-04 | 0.08 |
| MW61 | 14/01/2018 | Summer | 0.79 | 1.40E-04 | 0.10 |
| MW62 | 20/01/2018 | Summer | 0.80 | 1.21E-04 | 0.07 |
| MW63 | 28/01/2018 | Summer | 1.13 | 8.86E-05 | 0.07 |
| MW64 | 04/02/2018 | Summer | 0.96 | 1.02E-04 | 0.08 |
| MW66 | 17/02/2018 | Summer | 0.83 | 1.20E-04 | 0.10 |

| | | | | | |
|---------|------------|--------|------|----------|------|
| MW67 | 24/02/2018 | Summer | 0.89 | 8.58E-05 | 0.06 |
| MW68 | 03/03/2018 | Summer | 0.88 | 1.60E-04 | 0.08 |
| MW71 | 25/03/2018 | Summer | 0.67 | 1.82E-04 | 0.08 |
| MW72 | 01/04/2018 | Autumn | 0.82 | 1.86E-04 | 0.07 |
| MW82 | 04/01/2019 | Summer | 0.81 | | 0.08 |
| MW83 | 07/01/2019 | Summer | 1.23 | | 0.09 |
| MW84 | 13/01/2019 | Summer | 0.83 | | 0.09 |
| MW85 | 19/01/2019 | Summer | 0.80 | | 0.07 |
| MW86 | 23/01/2019 | Summer | 0.90 | | 0.08 |
| MW87 | 26/01/2019 | Summer | 0.66 | | 0.08 |
| MW88 | 30/01/2019 | Summer | 0.78 | | 0.08 |
| MW89 | 02/02/2019 | Summer | 0.68 | | 0.09 |
| MW90 | 05/02/2019 | Summer | 0.97 | | 0.09 |
| MW91 | 08/02/2019 | Summer | 0.92 | | 0.07 |
| MW92 | 12/02/2019 | Summer | 0.92 | | 0.11 |
| MW94 | 17/02/2019 | Summer | 0.89 | 1.65E-04 | 0.07 |
| MW96 | 04/03/2019 | Autumn | 0.59 | 1.64E-04 | 0.07 |
| MW97 | 14/03/2019 | Autumn | 0.98 | 1.40E-04 | 0.10 |
| MW98 | 24/03/2019 | Autumn | 0.73 | 1.60E-04 | 0.08 |
| MW99 | 01/04/2019 | Autumn | 0.85 | 1.65E-04 | 0.10 |
| MW100 | 09/04/2019 | Autumn | 0.76 | 1.36E-04 | 0.08 |
| MW111 | 04/11/2019 | Spring | 0.61 | 1.74E-04 | 0.07 |
| MW112 | 13/11/2019 | Spring | 0.60 | 5.65E-05 | 0.03 |
| MW113 | 24/11/2019 | Spring | 0.65 | 1.53E-04 | 0.07 |
| MW114 | 01/12/2019 | Summer | 1.34 | 1.25E-04 | 0.07 |
| MW115 | 08/12/2019 | Summer | 0.70 | 1.43E-04 | 0.06 |
| MW116 | 14/12/2019 | Summer | 1.04 | 9.64E-05 | 0.06 |
| MW118 | 20/12/2019 | Summer | 0.79 | 1.81E-04 | 0.08 |
| MW119 | 31/12/2020 | Summer | 0.74 | 1.38E-04 | 0.07 |
| MW120 | 08/01/2020 | Summer | 0.92 | 1.36E-04 | 0.08 |
| MW120_2 | 13/01/2020 | Summer | 0.77 | 1.25E-04 | 0.10 |
| MW121 | 16/01/2020 | Summer | 0.78 | 1.36E-04 | 0.06 |
| MW122 | 19/01/2020 | Summer | 0.69 | 1.14E-04 | 0.07 |
| MW123 | 25/01/2020 | Summer | 0.64 | 1.27E-04 | 0.09 |
| MW124 | 01/02/2020 | Summer | 0.54 | 1.50E-04 | 0.06 |
| MW125 | 07/02/2020 | Summer | 0.81 | 8.85E-05 | 0.07 |
| MW126 | 14/02/2020 | Summer | 0.68 | 1.31E-04 | 0.08 |
| MW127b | 01/03/2020 | Autumn | 0.91 | 1.60E-04 | 0.08 |
| MW128 | 06/03/2020 | Autumn | 0.91 | 2.33E-05 | 0.07 |
| MW129 | 14/03/2020 | Autumn | 0.79 | 1.55E-04 | 0.08 |
| MW130 | 20/03/2020 | Autumn | 0.81 | 1.61E-04 | 0.07 |
| MW131 | 27/03/2020 | Autumn | 0.71 | 2.09E-04 | 0.09 |
| MW132 | 12/04/2020 | Autumn | 0.69 | 1.07E-04 | 0.07 |

| | | | | | |
|--------|------------|--------|------|----------|------|
| MW134 | 26/04/2020 | Autumn | 0.78 | 6.63E-05 | 0.07 |
| MW136 | 11/05/2020 | Autumn | 0.48 | | 0.04 |
| MW137 | 17/05/2020 | Autumn | 0.54 | 2.62E-04 | 0.06 |
| MW138 | 24/05/2020 | Autumn | 0.49 | 2.03E-03 | 0.07 |
| MW139 | 01/06/2020 | Winter | 0.60 | 1.10E-04 | 0.07 |
| MW140 | 07/06/2020 | Winter | 0.26 | 2.14E-04 | 0.02 |
| MW141 | 15/06/2020 | Winter | 0.27 | 2.12E-05 | 0.01 |
| MW142 | 22/06/2020 | Winter | 0.23 | 4.63E-05 | 0.02 |
| MW144 | 15/07/2020 | Winter | 0.26 | 3.64E-05 | 0.01 |
| MW145 | 25/07/2020 | Winter | 0.63 | 2.59E-03 | 0.08 |
| MW146 | 05/08/2020 | Winter | 0.13 | 7.78E-05 | 0.01 |
| MW147 | 19/08/2020 | Winter | 0.33 | 1.48E-04 | 0.03 |
| MW148 | 02/09/2020 | Spring | 0.59 | 1.46E-04 | 0.07 |
| MW150 | 12/09/2020 | Spring | 0.82 | 1.43E-04 | 0.07 |
| MW152 | 06/10/2020 | Spring | 0.28 | 5.94E-05 | 0.02 |
| MW153 | 21/10/2020 | Spring | 0.78 | 6.00E-05 | 0.05 |
| MW155 | 04/11/2020 | Spring | 0.71 | 8.04E-05 | 0.08 |
| MW156 | 09/11/2020 | Spring | 0.64 | 9.93E-05 | 0.07 |
| MW157 | 26/11/2020 | Spring | 0.56 | 7.90E-05 | 0.06 |
| MW159 | 22/12/2020 | Summer | 0.88 | 1.13E-04 | 0.09 |
| MW160 | 31/12/2020 | Summer | 1.02 | 9.30E-05 | 0.08 |
| MW161 | 08/01/2021 | Summer | 0.92 | 9.49E-05 | 0.07 |
| MW164 | 31/01/2021 | Summer | 0.46 | 6.42E-05 | 0.03 |
| MW165 | 06/02/2021 | Summer | 0.55 | 8.15E-05 | 0.06 |
| MW166 | 17/02/2021 | Summer | 0.73 | 6.88E-05 | 0.07 |
| MW167 | 03/03/2021 | Autumn | 0.87 | 1.50E-04 | 0.08 |
| MW168 | 19/03/2021 | Autumn | 0.83 | 8.58E-05 | 0.10 |
| MW169 | 02/04/2021 | Autumn | 0.76 | 1.70E-04 | 0.06 |
| MW172 | 03/05/2021 | Autumn | 0.42 | 1.16E-04 | 0.03 |
| MW173 | 13/05/2021 | Autumn | 1.10 | 1.65E-04 | 0.03 |
| MW174 | 25/05/2021 | Autumn | 0.23 | 4.74E-05 | 0.02 |
| MW175 | 05/06/2021 | Winter | 0.44 | 2.97E-04 | 0.05 |
| MW177 | 20/06/2021 | Winter | 0.44 | 4.74E-04 | 0.02 |
| MW179 | 11/07/2021 | Winter | 0.56 | 1.96E-04 | 0.02 |
| MW180 | 19/07/2021 | Winter | 0.14 | | 0.00 |
| MW182 | 03/08/2021 | Winter | 0.08 | 8.79E-06 | 0.00 |
| MW184 | 24/08/2021 | Winter | 0.03 | 3.17E-06 | 0.00 |
| MW187 | 13/09/2021 | Spring | 0.22 | 2.67E-04 | 0.02 |
| MW189 | 27/09/2021 | Spring | 0.25 | 4.81E-05 | 0.02 |
| MW190 | 04/10/2021 | Spring | 0.58 | 2.19E-05 | 0.02 |
| MW193 | 06/11/2021 | Spring | 0.59 | 1.14E-04 | 0.05 |
| MW194a | 15/11/2021 | Spring | 0.18 | 2.86E-05 | 0.00 |
| MW194b | 25/11/2021 | Spring | 0.33 | 1.10E-04 | 0.02 |

MW195

04/12/2021

Summer

0.77

1.61E-04

0.09

Table S5. Lithogenic deposition fluxes ($FLith_{(X)}$, $mg\ m^{-2}\ d^{-1}$) calculated based on the analysis of individual tracer “X” (X=Al, Fe, Th or Ti) in aerosol samples collected at kunanyi/Mt Wellington. $FLith_{(X)}$ are calculated based on the relative abundance of each tracer in the UCC (McLennan, 2001). The average of all four $FLith_{(X)}$ for a single sample is called $FLith_{(Av)}$ and is displayed with its standard deviation (σ). Dates correspond to the sample’s mid-sampling collection time. Thorium was only analyzed during analytical runs undertaken form 2020 onward, hence data is missing for all samples analyzed prior to this date.

| Sample ID | Date | $Flith_{(Al)}$ | $Flith_{(Fe)}$ | $Flith_{(Th)}$ | $Flith_{(Ti)}$ | $Flith_{(Av)}$ | σ |
|-----------|------------|----------------|----------------|----------------|----------------|----------------|----------|
| MW04 | 05/11/2016 | 0.33 | 0.77 | 0.10 | 0.16 | 0.34 | 0.31 |
| MW05 | 12/11/2016 | 0.58 | 1.51 | 0.42 | 0.86 | 0.84 | 0.48 |
| MW06 | 20/11/2016 | 0.28 | 0.74 | 0.21 | 0.38 | 0.40 | 0.24 |
| MW08 | 03/12/2016 | 1.88 | 2.64 | | 3.06 | 2.53 | 0.60 |
| MW10 | 18/12/2016 | 1.79 | 1.86 | | 0.68 | 1.44 | 0.66 |
| MW11 | 24/12/2016 | 3.80 | 3.92 | | 1.72 | 3.15 | 1.24 |
| MW13 | 07/01/2017 | 1.60 | 4.23 | 1.81 | 2.48 | 2.53 | 1.19 |
| MW15 | 14/01/2017 | 0.26 | 0.51 | 0.21 | 0.35 | 0.33 | 0.13 |
| MW17 | 26/01/2017 | 0.97 | 1.21 | | 0.54 | 0.91 | 0.34 |
| MW18 | 04/02/2017 | 0.42 | 0.90 | 0.40 | 0.69 | 0.60 | 0.24 |
| MW19 | 11/02/2017 | 0.97 | 0.97 | | 0.25 | 0.73 | 0.42 |
| MW20 | 19/02/2017 | 0.83 | 1.66 | 0.94 | 1.48 | 1.23 | 0.41 |
| MW21 | 27/02/2017 | 2.04 | 4.18 | 1.98 | 3.64 | 2.96 | 1.12 |
| MW23 | 13/03/2017 | 3.11 | 3.99 | 2.86 | 3.71 | 3.42 | 0.52 |
| MW24 | 20/03/2017 | 2.63 | 2.69 | | 1.29 | 2.20 | 0.80 |
| MW25 | 26/03/2017 | 1.26 | 1.32 | | 1.78 | 1.45 | 0.29 |
| MW26 | 01/04/2017 | 1.49 | 1.78 | | 0.81 | 1.36 | 0.50 |
| MW28 | 09/04/2017 | 8.41 | 5.50 | | 1.87 | | |
| MW41 | 29/10/2017 | 2.00 | 1.77 | | 1.16 | | |
| MW43 | 11/11/2017 | 5.67 | 6.53 | | 2.58 | 4.93 | 2.08 |
| MW44 | 18/11/2017 | 3.62 | 3.52 | | 1.80 | 2.98 | 1.02 |
| MW45 | 25/11/2017 | 5.13 | 5.21 | | 1.21 | 3.85 | 2.28 |
| MW46 | 02/12/2017 | 1.07 | 1.54 | 0.69 | 0.91 | 1.05 | 0.36 |
| MW49 | 16/12/2017 | 1.57 | 3.48 | 1.88 | 2.62 | 2.39 | 0.85 |
| MW50 | 13/12/2017 | 3.87 | 6.46 | | 1.86 | 4.07 | 2.31 |
| MW51 | 14/12/2017 | 0.37 | 0.73 | | 0.20 | 0.43 | 0.27 |
| MW52 | 15/12/2017 | 1.18 | 2.84 | | 0.53 | 1.52 | 1.19 |
| MW53 | 16/12/2017 | 0.11 | 0.31 | | 0.17 | 0.20 | 0.10 |
| MW54 | 17/12/2017 | 1.93 | 3.84 | | 1.11 | 2.30 | 1.40 |
| MW55 | 18/12/2017 | 3.57 | 8.18 | | 2.14 | 4.63 | 3.16 |
| MW58 | 24/12/2017 | 0.47 | 0.89 | 0.50 | 0.81 | 0.67 | 0.22 |
| MW59 | 31/12/2018 | 1.07 | 1.83 | 1.15 | 1.60 | | |
| MW60 | 06/01/2018 | 1.02 | 2.06 | 1.12 | 1.64 | 1.46 | 0.48 |
| MW61 | 14/01/2018 | 1.31 | 2.38 | 1.38 | 2.44 | 1.88 | 0.62 |

| | | | | | | | |
|---------|------------|------|-------|------|-------|------|------|
| MW62 | 20/01/2018 | 1.74 | 3.21 | 1.59 | 2.36 | 2.23 | 0.74 |
| MW63 | 28/01/2018 | 0.50 | 1.30 | 0.33 | 0.69 | 0.70 | 0.42 |
| MW64 | 04/02/2018 | 1.23 | 2.70 | 0.94 | 2.05 | 1.73 | 0.80 |
| MW66 | 17/02/2018 | 1.29 | 2.46 | 1.16 | 2.62 | 1.88 | 0.76 |
| MW67 | 24/02/2018 | 0.16 | 0.33 | 0.10 | 0.19 | 0.20 | 0.10 |
| MW68 | 03/03/2018 | 1.07 | 2.15 | 1.28 | 1.72 | 1.55 | 0.48 |
| MW71 | 25/03/2018 | 0.92 | 1.42 | 1.26 | 1.45 | 1.26 | 0.24 |
| MW72 | 01/04/2018 | 0.30 | 0.56 | 0.42 | 0.43 | | |
| MW82 | 04/01/2019 | 3.43 | 6.40 | | 5.71 | | |
| MW83 | 07/01/2019 | 1.14 | 3.22 | | 1.94 | 2.10 | 1.05 |
| MW84 | 13/01/2019 | 3.73 | 7.14 | | 6.90 | 5.92 | 1.90 |
| MW85 | 19/01/2019 | 2.01 | 3.70 | | 2.70 | 2.81 | 0.85 |
| MW86 | 23/01/2019 | 1.84 | 3.80 | | 2.91 | 2.85 | 0.98 |
| MW87 | 26/01/2019 | 6.83 | 10.36 | | 10.49 | 9.23 | 2.08 |
| MW88 | 30/01/2019 | 2.24 | 4.00 | | 3.54 | 3.26 | 0.91 |
| MW89 | 02/02/2019 | 2.21 | 3.45 | | 4.05 | 3.24 | 0.94 |
| MW90 | 05/02/2019 | 1.65 | 3.67 | | 2.84 | 2.72 | 1.02 |
| MW91 | 08/02/2019 | 0.25 | 0.52 | | 0.33 | 0.37 | 0.14 |
| MW92 | 12/02/2019 | 0.10 | 0.21 | | 0.22 | 0.18 | 0.07 |
| MW94 | 17/02/2019 | 0.57 | 1.16 | 0.70 | 0.82 | 0.81 | 0.26 |
| MW96 | 04/03/2019 | 6.30 | 8.52 | 7.78 | 8.82 | 7.85 | 1.12 |
| MW97 | 14/03/2019 | 0.98 | 2.22 | 1.04 | 1.94 | 1.55 | 0.63 |
| MW98 | 24/03/2019 | 0.54 | 0.91 | 0.65 | 0.86 | 0.74 | 0.17 |
| MW99 | 01/04/2019 | 0.86 | 1.68 | 1.06 | 1.71 | 1.33 | 0.43 |
| MW100 | 09/04/2019 | 0.44 | 0.77 | 0.45 | 0.73 | | |
| MW111 | 04/11/2019 | 3.66 | 5.13 | 4.80 | 5.11 | | |
| MW112 | 13/11/2019 | 1.15 | 1.60 | 0.49 | 0.60 | 0.96 | 0.51 |
| MW113 | 24/11/2019 | 3.98 | 5.97 | 4.57 | 5.33 | 4.96 | 0.87 |
| MW114 | 01/12/2019 | 0.13 | 0.40 | 0.12 | 0.18 | 0.21 | 0.13 |
| MW115 | 08/12/2019 | 1.11 | 1.78 | 1.20 | 1.35 | 1.36 | 0.30 |
| MW116 | 14/12/2019 | 0.19 | 0.46 | 0.14 | 0.24 | 0.26 | 0.14 |
| MW118 | 20/12/2019 | 2.07 | 3.78 | 2.82 | 3.17 | 2.96 | 0.71 |
| MW119 | 31/12/2020 | 1.58 | 2.70 | 1.64 | 2.25 | 2.04 | 0.53 |
| MW120 | 08/01/2020 | 2.80 | 5.90 | 2.87 | 4.55 | 4.03 | 1.48 |
| MW120_2 | 13/01/2020 | 2.23 | 3.92 | 2.09 | 4.18 | 3.11 | 1.10 |
| MW121 | 16/01/2020 | 7.13 | 12.71 | 7.30 | 8.97 | 9.03 | 2.59 |
| MW122 | 19/01/2020 | 1.65 | 2.63 | 1.42 | 2.24 | 1.98 | 0.55 |
| MW123 | 25/01/2020 | 3.42 | 4.99 | 3.27 | 5.78 | 4.36 | 1.22 |
| MW124 | 01/02/2020 | 3.05 | 3.76 | 3.44 | 3.59 | 3.46 | 0.31 |
| MW125 | 07/02/2020 | 1.51 | 2.81 | 1.00 | 2.13 | 1.86 | 0.78 |
| MW126 | 14/02/2020 | 1.21 | 1.91 | 1.19 | 1.83 | 1.54 | 0.39 |
| MW127b | 01/03/2020 | 0.24 | 0.51 | 0.29 | 0.40 | 0.36 | 0.12 |
| MW128 | 06/03/2020 | 1.42 | 2.97 | 0.25 | 1.82 | 1.61 | 1.12 |

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|-------|------------|------|------|------|------|------|------|
| MW129 | 14/03/2020 | 1.64 | 2.98 | 1.91 | 2.63 | 2.29 | 0.62 |
| MW130 | 20/03/2020 | 1.05 | 1.95 | 1.27 | 1.35 | 1.40 | 0.38 |
| MW131 | 27/03/2020 | 1.93 | 3.13 | 3.04 | 3.31 | 2.85 | 0.62 |
| MW132 | 12/04/2020 | 0.21 | 0.32 | 0.16 | 0.30 | 0.25 | 0.08 |
| MW134 | 26/04/2020 | 0.13 | 0.24 | 0.06 | 0.21 | 0.16 | 0.08 |
| MW136 | 11/05/2020 | 0.06 | 0.06 | | 0.04 | 0.06 | 0.01 |
| MW137 | 17/05/2020 | 0.74 | 0.92 | 1.45 | 0.94 | 1.01 | 0.31 |
| MW138 | 24/05/2020 | 0.08 | 0.08 | 1.15 | 0.10 | 0.35 | 0.53 |
| MW139 | 01/06/2020 | 0.31 | 0.43 | 0.26 | 0.43 | 0.36 | 0.09 |
| MW140 | 07/06/2020 | 0.08 | 0.05 | 0.13 | 0.03 | 0.07 | 0.04 |
| MW141 | 15/06/2020 | 1.09 | 0.67 | 0.17 | 0.23 | 0.54 | 0.43 |
| MW142 | 22/06/2020 | 0.91 | 0.49 | 0.32 | 0.32 | 0.51 | 0.28 |
| MW144 | 15/07/2020 | 0.83 | 0.49 | 0.23 | 0.22 | 0.44 | 0.29 |
| MW145 | 25/07/2020 | 0.08 | 0.11 | 1.53 | 0.13 | 0.46 | 0.71 |
| MW146 | 05/08/2020 | 0.70 | 0.21 | 0.41 | 0.11 | 0.36 | 0.26 |
| MW147 | 19/08/2020 | 0.35 | 0.27 | 0.39 | 0.19 | 0.30 | 0.09 |
| MW148 | 02/09/2020 | 0.82 | 1.12 | 0.90 | 1.08 | 0.98 | 0.14 |
| MW150 | 12/09/2020 | 0.30 | 0.55 | 0.32 | 0.40 | 0.39 | 0.12 |
| MW152 | 06/10/2020 | 1.85 | 1.19 | 0.82 | 0.77 | 1.16 | 0.50 |
| MW153 | 21/10/2020 | 0.82 | 1.48 | 0.37 | 0.79 | 0.86 | 0.46 |
| MW155 | 04/11/2020 | 0.62 | 1.00 | 0.37 | 0.93 | 0.73 | 0.29 |
| MW156 | 09/11/2020 | 2.71 | 3.96 | 2.02 | 3.79 | 3.12 | 0.92 |
| MW157 | 26/11/2020 | 1.54 | 1.97 | 0.92 | 1.80 | 1.56 | 0.46 |
| MW159 | 22/12/2020 | 0.30 | 0.61 | 0.26 | 0.54 | 0.43 | 0.17 |
| MW160 | 31/12/2020 | 0.33 | 0.76 | 0.23 | 0.51 | 0.45 | 0.23 |
| MW161 | 08/01/2021 | 1.08 | 2.27 | 0.77 | 1.49 | 1.40 | 0.65 |
| MW164 | 31/01/2021 | 0.80 | 0.85 | 0.39 | 0.51 | 0.64 | 0.22 |
| MW165 | 06/02/2021 | 1.00 | 1.26 | 0.61 | 1.12 | 1.00 | 0.28 |
| MW166 | 17/02/2021 | 1.48 | 2.48 | 0.77 | 2.06 | 1.70 | 0.74 |
| MW167 | 03/03/2021 | 0.50 | 0.99 | 0.56 | 0.73 | 0.69 | 0.22 |
| MW168 | 19/03/2021 | 2.10 | 3.99 | 1.36 | 4.13 | 2.90 | 1.38 |
| MW169 | 02/04/2021 | 0.74 | 1.29 | 0.94 | 0.93 | 0.98 | 0.23 |
| MW172 | 03/05/2021 | 4.56 | 4.37 | 3.99 | 3.06 | 3.99 | 0.67 |
| MW173 | 13/05/2021 | 0.35 | 0.88 | 0.43 | 0.21 | 0.47 | 0.29 |
| MW174 | 25/05/2021 | 1.75 | 0.94 | 0.62 | 0.56 | 0.97 | 0.55 |
| MW175 | 05/06/2021 | 0.41 | 0.41 | 0.91 | 0.38 | 0.53 | 0.25 |
| MW177 | 20/06/2021 | 0.15 | 0.15 | 0.52 | 0.06 | 0.22 | 0.20 |
| MW179 | 11/07/2021 | 0.37 | 0.48 | 0.55 | 0.14 | 0.39 | 0.18 |
| MW180 | 19/07/2021 | 0.46 | 0.15 | | 0.04 | 0.21 | 0.22 |
| MW182 | 03/08/2021 | 1.52 | 0.28 | 0.10 | 0.14 | 0.51 | 0.68 |
| MW184 | 24/08/2021 | 2.10 | 0.17 | 0.05 | 0.06 | 0.59 | 1.01 |
| MW187 | 13/09/2021 | 1.66 | 0.84 | 3.33 | 0.50 | 1.59 | 1.26 |
| MW189 | 27/09/2021 | 1.30 | 0.75 | 0.47 | 0.45 | 0.74 | 0.40 |

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|--------|------------|------|------|------|------|------|------|
| MW190 | 04/10/2021 | 0.21 | 0.28 | 0.03 | 0.10 | 0.16 | 0.11 |
| MW193 | 06/11/2021 | 1.23 | 1.66 | 1.05 | 1.28 | 1.31 | 0.26 |
| MW194a | 15/11/2021 | 2.30 | 0.93 | 0.49 | 0.14 | 0.97 | 0.94 |
| MW194b | 25/11/2021 | 1.43 | 1.09 | 1.18 | 0.56 | 1.07 | 0.36 |
| MW195 | 04/12/2021 | 5.49 | 9.67 | 6.62 | 9.64 | 7.85 | 2.13 |

Table S6. Average lithogenic deposition fluxes ($FLith_{(Av)}$, $mg\ m^{-2}\ d^{-1}$) calculated based on the relative abundance of each tracer in the UCC ($FLith_{(Av)}/UCC$, McLennan, 2001) and based on measurements in Australian soil samples ($FLith_{(Av)}/Aus$, this study) together with the associated standard deviations (σ).

| Sample ID | Date | $FLith_{(Av)}/UCC$ | σ | $FLith_{(Av)}/Aus$ | σ |
|------------------|-------------|--------------------------------------|----------------------------|--------------------------------------|----------------------------|
| MW04 | 05/11/2016 | 0.34 | 0.31 | 0.58 | 0.57 |
| MW05 | 12/11/2016 | 0.84 | 0.48 | 1.29 | 0.92 |
| MW06 | 20/11/2016 | 0.40 | 0.24 | 0.62 | 0.45 |
| MW08 | 03/12/2016 | 2.53 | 0.60 | 3.90 | 0.93 |
| MW10 | 18/12/2016 | 1.44 | 0.66 | 2.65 | 1.84 |
| MW11 | 24/12/2016 | 3.14 | 1.24 | 5.71 | 3.76 |
| MW13 | 07/01/2017 | 2.53 | 1.19 | 3.79 | 2.35 |
| MW15 | 14/01/2017 | 0.33 | 0.13 | 0.50 | 0.28 |
| MW17 | 26/01/2017 | 0.90 | 0.34 | 1.61 | 0.97 |
| MW18 | 04/02/2017 | 0.60 | 0.24 | 0.89 | 0.47 |
| MW19 | 11/02/2017 | 0.73 | 0.42 | 1.38 | 1.05 |
| MW20 | 19/02/2017 | 1.23 | 0.41 | 1.79 | 0.77 |
| MW21 | 27/02/2017 | 2.95 | 1.12 | 4.35 | 2.09 |
| MW23 | 13/03/2017 | 3.42 | 0.52 | 5.16 | 2.18 |
| MW24 | 20/03/2017 | 2.20 | 0.80 | 3.97 | 2.56 |
| MW25 | 26/03/2017 | 1.45 | 0.29 | 2.28 | 0.66 |
| MW26 | 01/04/2017 | 1.36 | 0.50 | 2.42 | 1.47 |
| MW28 | 09/04/2017 | 5.26 | 3.28 | 10.27 | 9.10 |
| MW41 | 29/10/2017 | 1.64 | 0.43 | 2.92 | 1.82 |
| MW43 | 11/11/2017 | 4.93 | 2.08 | 8.91 | 5.78 |
| MW44 | 18/11/2017 | 2.98 | 1.02 | 5.37 | 3.47 |
| MW45 | 25/11/2017 | 3.85 | 2.28 | 7.33 | 5.63 |
| MW46 | 02/12/2017 | 1.05 | 0.36 | 1.68 | 1.01 |
| MW49 | 16/12/2017 | 2.39 | 0.85 | 3.51 | 1.71 |
| MW50 | 13/12/2017 | 4.07 | 2.30 | 7.24 | 4.86 |
| MW51 | 14/12/2017 | 0.43 | 0.27 | 0.76 | 0.53 |
| MW52 | 15/12/2017 | 1.52 | 1.20 | 2.68 | 2.15 |
| MW53 | 16/12/2017 | 0.20 | 0.10 | 0.32 | 0.19 |
| MW54 | 17/12/2017 | 2.30 | 1.40 | 4.02 | 2.76 |
| MW55 | 18/12/2017 | 4.63 | 3.16 | 8.05 | 5.90 |
| MW58 | 24/12/2017 | 0.66 | 0.22 | 0.97 | 0.42 |
| MW59 | 31/12/2017 | 1.41 | 0.36 | 2.09 | 0.86 |
| MW60 | 06/01/2018 | 1.46 | 0.48 | 2.16 | 1.00 |
| MW61 | 14/01/2018 | 1.88 | 0.62 | 2.72 | 1.07 |
| MW62 | 20/01/2018 | 2.22 | 0.74 | 3.36 | 1.70 |
| MW63 | 28/01/2018 | 0.70 | 0.42 | 1.09 | 0.80 |

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|---------|------------|------|-------|-------|------|
| MW64 | 04/02/2018 | 1.73 | 0.80 | 2.59 | 1.51 |
| MW66 | 17/02/2018 | 1.88 | 0.76 | 2.71 | 1.19 |
| MW67 | 24/02/2018 | 0.20 | 0.10 | 0.31 | 0.20 |
| MW68 | 03/03/2018 | 1.55 | 0.48 | 2.28 | 1.01 |
| MW71 | 25/03/2018 | 1.26 | 0.24 | 1.82 | 0.54 |
| MW72 | 01/04/2018 | 0.43 | 0.11 | 0.63 | 0.25 |
| MW82 | 04/01/2019 | 5.18 | 1.55 | 8.04 | 2.75 |
| MW83 | 07/01/2019 | 2.10 | 1.05 | 3.29 | 1.88 |
| MW84 | 13/01/2019 | 5.92 | 1.90 | 9.06 | 2.83 |
| MW85 | 19/01/2019 | 2.80 | 0.85 | 4.49 | 1.88 |
| MW86 | 23/01/2019 | 2.85 | 0.98 | 4.47 | 1.86 |
| MW87 | 26/01/2019 | 9.23 | 2.08 | 14.41 | 4.14 |
| MW88 | 30/01/2019 | 3.26 | 0.91 | 5.09 | 1.73 |
| MW89 | 02/02/2019 | 3.24 | 0.94 | 4.92 | 1.06 |
| MW90 | 05/02/2019 | 2.72 | 1.02 | 4.22 | 1.80 |
| MW91 | 08/02/2019 | 0.37 | 0.140 | 0.59 | 0.28 |
| MW92 | 12/02/2019 | 0.18 | 0.07 | 0.27 | 0.10 |
| MW94 | 17/02/2019 | 0.81 | 0.25 | 1.20 | 0.57 |
| MW96 | 04/03/2019 | 7.85 | 1.12 | 11.48 | 3.61 |
| MW97 | 14/03/2019 | 1.55 | 0.63 | 2.25 | 1.10 |
| MW98 | 24/03/2019 | 0.74 | 0.17 | 1.08 | 0.39 |
| MW99 | 01/04/2019 | 1.33 | 0.43 | 1.90 | 0.71 |
| MW100 | 09/04/2019 | 0.60 | 0.18 | 0.87 | 0.36 |
| MW111 | 04/11/2019 | 4.67 | 0.69 | 6.81 | 2.10 |
| MW112 | 13/11/2019 | 0.96 | 0.51 | 1.62 | 1.24 |
| MW113 | 24/11/2019 | 4.96 | 0.87 | 7.35 | 2.75 |
| MW114 | 01/12/2019 | 0.21 | 0.13 | 0.32 | 0.25 |
| MW115 | 08/12/2019 | 1.36 | 0.30 | 2.05 | 0.90 |
| MW116 | 14/12/2019 | 0.26 | 0.14 | 0.40 | 0.28 |
| MW118 | 20/12/2019 | 2.96 | 0.71 | 4.32 | 1.62 |
| MW119 | 31/12/2019 | 2.04 | 0.53 | 3.04 | 1.31 |
| MW120 | 08/01/2020 | 4.03 | 1.48 | 5.98 | 3.00 |
| MW120_2 | 13/01/2020 | 3.10 | 1.10 | 4.50 | 1.84 |
| MW121 | 16/01/2020 | 9.03 | 2.59 | 13.63 | 6.58 |
| MW122 | 19/01/2020 | 1.98 | 0.55 | 2.98 | 1.38 |
| MW123 | 25/01/2020 | 4.36 | 1.22 | 6.35 | 2.29 |
| MW124 | 01/02/2020 | 3.46 | 0.30 | 5.16 | 1.89 |
| MW125 | 07/02/2020 | 1.86 | 0.78 | 2.84 | 1.62 |
| MW126 | 14/02/2020 | 1.54 | 0.39 | 2.27 | 0.91 |
| MW127b | 01/03/2020 | 0.36 | 0.12 | 0.53 | 0.24 |
| MW128 | 06/03/2020 | 1.61 | 1.12 | 2.57 | 2.04 |

| | | | | | |
|-------|------------|------|-------|------|------|
| MW129 | 14/03/2020 | 2.29 | 0.62 | 3.35 | 1.35 |
| MW130 | 20/03/2020 | 1.40 | 0.38 | 2.10 | 0.95 |
| MW131 | 27/03/2020 | 2.85 | 0.62 | 4.06 | 1.03 |
| MW132 | 12/04/2020 | 0.25 | 0.07 | 0.37 | 0.17 |
| MW134 | 26/04/2020 | 0.16 | 0.08 | 0.24 | 0.14 |
| MW136 | 11/05/2020 | 0.06 | 0.01 | 0.10 | 0.05 |
| MW137 | 17/05/2020 | 1.01 | 0.31 | 1.44 | 0.39 |
| MW138 | 24/05/2020 | 0.35 | 0.53 | 0.42 | 0.56 |
| MW139 | 01/06/2020 | 0.36 | 0.09 | 0.54 | 0.23 |
| MW140 | 07/06/2020 | 0.07 | 0.04 | 0.11 | 0.07 |
| MW141 | 15/06/2020 | 0.54 | 0.43 | 1.02 | 1.12 |
| MW142 | 22/06/2020 | 0.51 | 0.28 | 0.90 | 0.86 |
| MW144 | 15/07/2020 | 0.44 | 0.29 | 0.81 | 0.81 |
| MW145 | 25/07/2020 | 0.46 | 0.71 | 0.55 | 0.76 |
| MW146 | 05/08/2020 | 0.36 | 0.26 | 0.64 | 0.69 |
| MW147 | 19/08/2020 | 0.30 | 0.09 | 0.47 | 0.27 |
| MW148 | 02/09/2020 | 0.98 | 0.14 | 1.45 | 0.53 |
| MW150 | 12/09/2020 | 0.39 | 0.12 | 0.59 | 0.28 |
| MW152 | 06/10/2020 | 1.16 | 0.50 | 2.00 | 1.68 |
| MW153 | 21/10/2020 | 0.86 | 0.46 | 1.39 | 0.98 |
| MW155 | 04/11/2020 | 0.73 | 0.29 | 1.10 | 0.58 |
| MW156 | 09/11/2020 | 3.12 | 0.92 | 4.70 | 2.18 |
| MW157 | 26/11/2020 | 1.56 | 0.46 | 2.40 | 1.27 |
| MW159 | 22/12/2020 | 0.43 | 0.17 | 0.63 | 0.32 |
| MW160 | 31/12/2020 | 0.45 | 0.23 | 0.69 | 0.44 |
| MW161 | 08/01/2021 | 1.40 | 0.65 | 2.15 | 1.32 |
| MW164 | 31/01/2021 | 0.64 | 0.22 | 1.05 | 0.73 |
| MW165 | 06/02/2021 | 1.00 | 0.278 | 1.55 | 0.82 |
| MW166 | 17/02/2021 | 1.70 | 0.74 | 2.60 | 1.51 |
| MW167 | 03/03/2021 | 0.69 | 0.22 | 1.03 | 0.49 |
| MW168 | 19/03/2021 | 2.90 | 1.38 | 4.25 | 2.19 |
| MW169 | 02/04/2021 | 0.98 | 0.23 | 1.46 | 0.61 |
| MW172 | 03/05/2021 | 3.99 | 0.67 | 6.33 | 3.50 |
| MW173 | 13/05/2021 | 0.47 | 0.29 | 0.75 | 0.56 |
| MW174 | 25/05/2021 | 0.97 | 0.55 | 1.73 | 1.67 |
| MW175 | 05/06/2021 | 0.53 | 0.25 | 0.75 | 0.30 |
| MW177 | 20/06/2021 | 0.22 | 0.20 | 0.30 | 0.21 |
| MW179 | 11/07/2021 | 0.38 | 0.18 | 0.61 | 0.34 |
| MW180 | 19/07/2021 | 0.21 | 0.22 | 0.45 | 0.55 |
| MW182 | 03/08/2021 | 0.51 | 0.68 | 1.07 | 1.68 |
| MW184 | 24/08/2021 | 0.59 | 1.01 | 1.33 | 2.42 |

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|--------|------------|------|------|-------|------|
| MW187 | 13/09/2021 | 1.58 | 1.26 | 2.37 | 1.70 |
| MW189 | 27/09/2021 | 0.74 | 0.40 | 1.32 | 1.23 |
| MW190 | 04/10/2021 | 0.16 | 0.11 | 0.28 | 0.24 |
| MW193 | 06/11/2021 | 1.31 | 0.26 | 2.01 | 0.97 |
| MW194a | 15/11/2021 | 0.97 | 0.94 | 1.91 | 2.41 |
| MW194b | 25/11/2021 | 1.06 | 0.36 | 1.75 | 1.20 |
| MW195 | 04/12/2021 | 7.85 | 2.13 | 11.35 | 4.05 |
