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Supplement of

An 11-year global gridded aerosol optical thickness reanalysis (v1.0) for atmospheric and climate sciences

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Supplemental Material

Table S1. Regional multipliers for smoke emission based on the FLAMBE 2-day-maximum MODIS fire hot spot signal and for dust erodibility based on Ginoux et al., 2001.

| region | Smoke emission | Dust erodibility |
|----------------|-------------------------|--|
| Africa North | 0.8 | 25N north x0.4, 20N-25N x1.0, 20N south x2.0 |
| Africa South | 0.18 | 2.0 |
| Australia | 1.0 | 0.5 |
| Ctrl. America | 0.5 | 2.0 |
| CONUS | 0.6 | 2.0 |
| East Asia | 1.0 | 2.0 |
| Eurasia Boreal | 30E east x0.6 west x1.0 | N/A |
| EUR-Medit | 0.7 | 2.0 |
| India | 1.0 | 2.0 |
| Ins. SE Asia | 0.8 | N/A |
| N. Am. Boreal | 0.7 | N/A |
| Pen. SE Asia | 0.43 | N/A |
| SW Asia | 1.0 | 1.5 |
| South America | 0.3 | 0.5 |
| Other | 1.0 | 2.0 |

Table S2. Statistics of the reanalysis total AOT at 550 nm compared with AERONET L2 6-hr-average data for DJFMAM of 2003-2013. “Mean” and “Median” are the means and medians of the reanalysis regional AOTs. “AMean” and “AMedian” are the means and medians of the regional AERONET AOTs. Also shown are the bias and root mean square error (“RMSE”) and the square of the Pearson correlation coefficient (r^2). “Slope” and “Intercept” are the corresponding Theil-Sen linear regression parameters. “N” is the total number of 6-hourly paired AERONET data in the region for validation.

| region | Mean | Median | AMean | AMedian | Bias | Rmse | r^2 | Slope | intercept | N |
|-----------------|------|--------|-------|---------|-------|------|-------|-------|-----------|--------|
| Africa North | 0.36 | 0.24 | 0.40 | 0.27 | -0.04 | 0.25 | 0.68 | 0.88 | 0.01 | 42962 |
| Africa South | 0.14 | 0.13 | 0.15 | 0.13 | -0.01 | 0.08 | 0.45 | 0.61 | 0.05 | 7934 |
| Australia | 0.07 | 0.06 | 0.07 | 0.05 | 0.00 | 0.05 | 0.37 | 0.72 | 0.02 | 11103 |
| Ctr. America | 0.16 | 0.12 | 0.18 | 0.12 | -0.02 | 0.11 | 0.71 | 0.64 | 0.04 | 12093 |
| EAST CONUS | 0.12 | 0.11 | 0.11 | 0.09 | 0.01 | 0.06 | 0.65 | 0.86 | 0.03 | 39244 |
| East Asia | 0.34 | 0.27 | 0.40 | 0.29 | -0.06 | 0.25 | 0.61 | 0.63 | 0.08 | 26993 |
| Eurasian Boreal | 0.16 | 0.13 | 0.17 | 0.13 | -0.02 | 0.09 | 0.57 | 0.58 | 0.05 | 24149 |
| EUR-Medit | 0.15 | 0.13 | 0.15 | 0.12 | 0.00 | 0.08 | 0.57 | 1.72 | -0.07 | 79008 |
| Indian | 0.37 | 0.34 | 0.42 | 0.38 | -0.05 | 0.19 | 0.54 | 0.62 | 0.10 | 18770 |
| Ins. SE Asia | 0.18 | 0.16 | 0.23 | 0.18 | -0.05 | 0.13 | 0.37 | 0.44 | 0.07 | 4448 |
| N. Am. Boreal | 0.11 | 0.10 | 0.09 | 0.07 | 0.02 | 0.05 | 0.46 | 0.70 | 0.05 | 10460 |
| ocean | 0.12 | 0.10 | 0.10 | 0.07 | 0.02 | 0.07 | 0.68 | 0.56 | 0.06 | 15645 |
| Pen. SE Asia | 0.44 | 0.36 | 0.50 | 0.42 | -0.06 | 0.21 | 0.66 | 0.75 | 0.05 | 12146 |
| S. America | 0.10 | 0.09 | 0.09 | 0.07 | 0.01 | 0.07 | 0.23 | 0.42 | 0.06 | 17563 |
| SW. Asia | 0.38 | 0.32 | 0.35 | 0.29 | 0.02 | 0.20 | 0.54 | 0.84 | 0.07 | 10496 |
| WEST CONUS | 0.10 | 0.10 | 0.08 | 0.06 | 0.03 | 0.06 | 0.30 | 0.68 | 0.05 | 32145 |
| Globe | 0.20 | 0.13 | 0.21 | 0.12 | -0.01 | 0.14 | 0.71 | 0.94 | 0.01 | 365159 |

Table S3. Same as Table S2, except for total AOT at 550 nm during JJASON of 2003-2013.

| region | Mean | Median | AMean | AMedian | Bias | Rmse | r ² | Slope | intercept | N |
|-----------------|------|--------|-------|---------|-------|------|----------------|-------|-----------|--------|
| Africa North | 0.32 | 0.27 | 0.34 | 0.27 | -0.02 | 0.20 | 0.57 | 0.81 | 0.05 | 39732 |
| Africa South | 0.21 | 0.17 | 0.23 | 0.19 | -0.03 | 0.09 | 0.77 | 0.76 | 0.02 | 8312 |
| Australia | 0.09 | 0.07 | 0.11 | 0.07 | -0.01 | 0.07 | 0.59 | 0.71 | 0.01 | 13889 |
| Ctr. America | 0.18 | 0.14 | 0.20 | 0.15 | -0.02 | 0.10 | 0.59 | 0.67 | 0.04 | 9339 |
| EAST CONUS | 0.16 | 0.13 | 0.18 | 0.13 | -0.01 | 0.09 | 0.70 | 0.91 | 0.01 | 49820 |
| East Asia | 0.28 | 0.21 | 0.37 | 0.22 | -0.09 | 0.31 | 0.61 | 0.52 | 0.08 | 26487 |
| Eurasian Boreal | 0.14 | 0.12 | 0.15 | 0.12 | -0.01 | 0.08 | 0.64 | 0.67 | 0.04 | 41112 |
| EUR-Medit | 0.17 | 0.14 | 0.17 | 0.14 | -0.01 | 0.08 | 0.58 | 1.00 | 0.00 | 109530 |
| Indian | 0.45 | 0.41 | 0.48 | 0.43 | -0.03 | 0.24 | 0.55 | 0.65 | 0.12 | 11248 |
| Ins. SE Asia | 0.27 | 0.22 | 0.37 | 0.26 | -0.10 | 0.29 | 0.44 | 0.49 | 0.08 | 3906 |
| N. Am. Boreal | 0.11 | 0.09 | 0.09 | 0.06 | 0.01 | 0.08 | 0.64 | 0.80 | 0.03 | 19900 |
| ocean | 0.12 | 0.09 | 0.10 | 0.07 | 0.02 | 0.06 | 0.70 | 0.59 | 0.05 | 16470 |
| Pen. SE Asia | 0.28 | 0.22 | 0.33 | 0.22 | -0.04 | 0.18 | 0.70 | 0.59 | 0.08 | 5468 |
| S. America | 0.20 | 0.11 | 0.22 | 0.12 | -0.02 | 0.14 | 0.82 | 0.71 | 0.03 | 23262 |
| SW. Asia | 0.45 | 0.40 | 0.41 | 0.36 | 0.04 | 0.16 | 0.64 | 0.86 | 0.09 | 14128 |
| WEST CONUS | 0.11 | 0.10 | 0.09 | 0.07 | 0.02 | 0.07 | 0.39 | 0.76 | 0.04 | 43166 |
| Globe | 0.19 | 0.14 | 0.20 | 0.13 | -0.01 | 0.14 | 0.67 | 1.05 | 0.00 | 435769 |

Table S4. Same as Table S2, except for fine mode AOT at 550 nm during DJFMAM of 2003-2013.

| region | Mean | Median | AMean | AMedian | Bias | Rmse | r ² | Slope | intercept | N |
|-----------------|------|--------|-------|---------|-------|------|----------------|-------|-----------|--------|
| Africa North | 0.11 | 0.07 | 0.11 | 0.07 | 0.00 | 0.10 | 0.46 | 0.99 | 0.01 | 42962 |
| Africa South | 0.11 | 0.09 | 0.08 | 0.06 | 0.03 | 0.06 | 0.44 | 0.87 | 0.03 | 7934 |
| Australia | 0.04 | 0.03 | 0.03 | 0.02 | 0.01 | 0.03 | 0.46 | 0.99 | 0.00 | 11103 |
| Ctr. America | 0.10 | 0.06 | 0.10 | 0.05 | 0.00 | 0.09 | 0.74 | 0.86 | 0.01 | 12093 |
| EAST CONUS | 0.08 | 0.06 | 0.07 | 0.05 | 0.02 | 0.04 | 0.65 | 1.11 | 0.01 | 39244 |
| East Asia | 0.23 | 0.16 | 0.24 | 0.14 | -0.02 | 0.17 | 0.62 | 0.76 | 0.03 | 26993 |
| Eurasian Boreal | 0.10 | 0.08 | 0.10 | 0.07 | -0.01 | 0.06 | 0.60 | 0.71 | 0.02 | 24149 |
| EUR-Medit | 0.08 | 0.07 | 0.08 | 0.06 | 0.00 | 0.05 | 0.48 | 1.29 | -0.01 | 79008 |
| Indian | 0.24 | 0.21 | 0.22 | 0.17 | 0.02 | 0.15 | 0.49 | 0.72 | 0.08 | 18770 |
| Ins. SE Asia | 0.14 | 0.12 | 0.14 | 0.10 | 0.01 | 0.10 | 0.36 | 0.62 | 0.05 | 4448 |
| N. Am. Boreal | 0.06 | 0.05 | 0.05 | 0.04 | 0.01 | 0.03 | 0.54 | 0.80 | 0.02 | 10460 |
| ocean | 0.05 | 0.04 | 0.04 | 0.02 | 0.01 | 0.04 | 0.72 | 0.91 | 0.01 | 15645 |
| Pen. SE Asia | 0.40 | 0.32 | 0.37 | 0.28 | 0.03 | 0.19 | 0.67 | 0.85 | 0.07 | 12146 |
| S. America | 0.05 | 0.05 | 0.05 | 0.04 | 0.01 | 0.04 | 0.38 | 0.69 | 0.02 | 17563 |
| SW. Asia | 0.13 | 0.11 | 0.10 | 0.09 | 0.03 | 0.07 | 0.26 | 0.81 | 0.04 | 10496 |
| WEST CONUS | 0.05 | 0.05 | 0.04 | 0.03 | 0.02 | 0.03 | 0.28 | 0.82 | 0.02 | 32145 |
| Globe | 0.11 | 0.07 | 0.11 | 0.06 | 0.01 | 0.09 | 0.67 | 1.23 | 0.00 | 365159 |

Table S5. Same as Table S2, except for fine mode AOT at 550 nm during JJASON of 2003-2013.

| region | Mean | Median | AMean | AMedian | Bias | Rmse | r ² | Slope | intercept | N |
|-----------------|------|--------|-------|---------|-------|------|----------------|-------|-----------|--------|
| Africa North | 0.12 | 0.10 | 0.08 | 0.07 | 0.04 | 0.09 | 0.29 | 1.10 | 0.02 | 39732 |
| Africa South | 0.16 | 0.13 | 0.16 | 0.11 | 0.01 | 0.07 | 0.77 | 0.87 | 0.02 | 8312 |
| Australia | 0.05 | 0.03 | 0.06 | 0.03 | -0.01 | 0.04 | 0.62 | 0.84 | 0.00 | 13889 |
| Ctr. America | 0.07 | 0.06 | 0.07 | 0.05 | 0.00 | 0.06 | 0.44 | 0.77 | 0.01 | 9339 |
| EAST CONUS | 0.13 | 0.10 | 0.12 | 0.08 | 0.01 | 0.07 | 0.70 | 1.12 | 0.00 | 49820 |
| East Asia | 0.20 | 0.13 | 0.25 | 0.12 | -0.05 | 0.24 | 0.65 | 0.62 | 0.04 | 26487 |
| Eurasian Boreal | 0.10 | 0.08 | 0.10 | 0.07 | 0.00 | 0.06 | 0.68 | 0.78 | 0.02 | 41112 |
| EUR-Medit | 0.10 | 0.09 | 0.10 | 0.08 | 0.01 | 0.06 | 0.51 | 1.15 | 0.00 | 109530 |
| Indian | 0.30 | 0.26 | 0.25 | 0.18 | 0.04 | 0.18 | 0.48 | 0.69 | 0.11 | 11248 |
| Ins. SE Asia | 0.23 | 0.18 | 0.26 | 0.15 | -0.03 | 0.23 | 0.44 | 0.59 | 0.06 | 3906 |
| N. Am. Boreal | 0.08 | 0.06 | 0.06 | 0.04 | 0.01 | 0.07 | 0.64 | 0.99 | 0.01 | 19900 |
| ocean | 0.05 | 0.04 | 0.04 | 0.02 | 0.01 | 0.04 | 0.72 | 0.81 | 0.02 | 16470 |
| Pen. SE Asia | 0.24 | 0.17 | 0.22 | 0.12 | 0.02 | 0.14 | 0.74 | 0.75 | 0.07 | 5468 |
| S. America | 0.16 | 0.07 | 0.15 | 0.07 | 0.01 | 0.12 | 0.84 | 0.95 | 0.01 | 23262 |
| SW. Asia | 0.18 | 0.17 | 0.15 | 0.13 | 0.03 | 0.07 | 0.34 | 0.65 | 0.08 | 14128 |
| WEST CONUS | 0.07 | 0.06 | 0.06 | 0.04 | 0.02 | 0.06 | 0.44 | 1.04 | 0.02 | 43166 |
| Globe | 0.12 | 0.08 | 0.11 | 0.07 | 0.01 | 0.10 | 0.65 | 1.33 | -0.01 | 435769 |

Table S6. Same as Table S2, except for coarse mode AOT at 550 nm during DJFMAM of 2003-2013.

| region | Mean | Median | AMean | AMedian | Bias | Rmse | r ² | Slope | intercept | N |
|-----------------|------|--------|-------|---------|-------|------|----------------|-------|-----------|--------|
| Africa North | 0.25 | 0.14 | 0.29 | 0.18 | -0.05 | 0.22 | 0.60 | 0.77 | 0.01 | 42962 |
| Africa South | 0.04 | 0.03 | 0.07 | 0.06 | -0.04 | 0.06 | 0.38 | 0.31 | 0.01 | 7934 |
| Australia | 0.04 | 0.03 | 0.04 | 0.03 | 0.00 | 0.04 | 0.15 | 0.40 | 0.02 | 11103 |
| Ctr. America | 0.06 | 0.05 | 0.08 | 0.07 | -0.02 | 0.06 | 0.26 | 0.25 | 0.04 | 12093 |
| EAST CONUS | 0.04 | 0.04 | 0.05 | 0.03 | 0.00 | 0.03 | 0.29 | 0.45 | 0.02 | 39244 |
| East Asia | 0.12 | 0.09 | 0.16 | 0.12 | -0.05 | 0.16 | 0.32 | 0.42 | 0.04 | 26993 |
| Eurasian Boreal | 0.06 | 0.05 | 0.07 | 0.05 | -0.01 | 0.05 | 0.25 | 0.38 | 0.03 | 24149 |
| EUR-Medit | 0.07 | 0.05 | 0.07 | 0.05 | 0.00 | 0.05 | 0.60 | 2.15 | -0.05 | 79008 |
| Indian | 0.13 | 0.10 | 0.20 | 0.15 | -0.07 | 0.13 | 0.53 | 0.53 | 0.01 | 18770 |
| Ins. SE Asia | 0.04 | 0.03 | 0.09 | 0.08 | -0.05 | 0.07 | 0.02 | 0.08 | 0.03 | 4448 |
| N. Am. Boreal | 0.05 | 0.05 | 0.04 | 0.03 | 0.01 | 0.03 | 0.21 | 0.50 | 0.03 | 10460 |
| ocean | 0.07 | 0.06 | 0.06 | 0.05 | 0.01 | 0.05 | 0.53 | 0.25 | 0.05 | 15645 |
| Pen. SE Asia | 0.04 | 0.03 | 0.13 | 0.12 | -0.09 | 0.11 | 0.15 | 0.15 | 0.01 | 12146 |
| S. America | 0.05 | 0.04 | 0.04 | 0.03 | 0.01 | 0.05 | 0.03 | 0.18 | 0.03 | 17563 |
| SW. Asia | 0.25 | 0.19 | 0.26 | 0.19 | -0.01 | 0.18 | 0.51 | 0.77 | 0.04 | 10496 |
| WEST CONUS | 0.05 | 0.05 | 0.04 | 0.03 | 0.01 | 0.04 | 0.18 | 0.51 | 0.03 | 32145 |
| Globe | 0.09 | 0.05 | 0.11 | 0.06 | -0.02 | 0.11 | 0.62 | 0.85 | 0.01 | 365159 |

Table S7. Same as Table S2, except for coarse mode AOT at 550 nm during JJASON of 2003-2013.

| region | Mean | Median | AMean | AMedian | Bias | Rmse | r ² | Slope | intercept | N |
|-----------------|------|--------|-------|---------|-------|------|----------------|-------|-----------|--------|
| Africa North | 0.21 | 0.15 | 0.26 | 0.19 | -0.05 | 0.19 | 0.52 | 0.70 | 0.02 | 39732 |
| Africa South | 0.04 | 0.04 | 0.08 | 0.07 | -0.04 | 0.05 | 0.42 | 0.41 | 0.01 | 8312 |
| Australia | 0.04 | 0.03 | 0.05 | 0.03 | -0.01 | 0.04 | 0.21 | 0.45 | 0.01 | 13889 |
| Ctr. America | 0.10 | 0.07 | 0.12 | 0.08 | -0.02 | 0.07 | 0.68 | 0.63 | 0.02 | 9339 |
| EAST CONUS | 0.03 | 0.03 | 0.05 | 0.04 | -0.02 | 0.04 | 0.26 | 0.42 | 0.01 | 49820 |
| East Asia | 0.08 | 0.06 | 0.11 | 0.09 | -0.04 | 0.12 | 0.11 | 0.26 | 0.04 | 26487 |
| Eurasian Boreal | 0.04 | 0.04 | 0.06 | 0.05 | -0.02 | 0.04 | 0.20 | 0.44 | 0.01 | 41112 |
| EUR-Medit | 0.06 | 0.05 | 0.07 | 0.05 | -0.01 | 0.05 | 0.58 | 0.89 | 0.00 | 109530 |
| Indian | 0.15 | 0.10 | 0.22 | 0.16 | -0.07 | 0.16 | 0.60 | 0.61 | 0.00 | 11248 |
| Ins. SE Asia | 0.04 | 0.04 | 0.11 | 0.10 | -0.07 | 0.11 | 0.04 | 0.14 | 0.02 | 3906 |
| N. Am. Boreal | 0.03 | 0.03 | 0.03 | 0.02 | 0.00 | 0.03 | 0.10 | 0.34 | 0.02 | 19900 |
| ocean | 0.06 | 0.05 | 0.05 | 0.04 | 0.01 | 0.05 | 0.58 | 0.33 | 0.04 | 16470 |
| Pen. SE Asia | 0.04 | 0.03 | 0.11 | 0.10 | -0.07 | 0.10 | 0.08 | 0.08 | 0.02 | 5468 |
| S. America | 0.04 | 0.03 | 0.07 | 0.05 | -0.03 | 0.07 | 0.03 | 0.12 | 0.02 | 23262 |
| SW. Asia | 0.27 | 0.22 | 0.26 | 0.21 | 0.01 | 0.14 | 0.62 | 0.93 | 0.02 | 14128 |
| WEST CONUS | 0.04 | 0.04 | 0.04 | 0.03 | 0.00 | 0.03 | 0.03 | 0.31 | 0.03 | 43166 |
| Globe | 0.07 | 0.04 | 0.09 | 0.05 | -0.02 | 0.08 | 0.61 | 0.87 | 0.00 | 435769 |