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Supplement of

Surface erythemal UV irradiance in the continental United States derived from ground-based and OMI observations: quality assessment, trend analysis and sampling issues

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1 **Table S1. The 31 ground observational sites from UVMRP and their geographical information.**

Station ID	Location	Latitude (°N)	Longitude (°W)	Elevation (m)
AZ01	Flagstaff, AZ	36.06	112.18	2073
CA01	Davis, CA	38.53	121.78	18
CA21	Holtville, CA	32.81	115.45	-18
CO01	Nunn, CO	40.81	104.76	1641
CO11	Steamboat Springs, CO	40.46	106.74	3220
CO41	Lamar, CO	38.07	102.62	1131
FL01	Homestead, FL	25.39	80.68	0
GA01	Griffin, GA	33.18	84.41	267
IL01	Bondville, IL	40.05	88.37	213
IN01	West Lafayette, IN	40.47	86.99	216
LA01	Baton Rouge, LA	30.36	91.17	6
MD01	Queenstown, MD	38.92	76.15	5
MD11	Beltsville, MD	39.01	76.95	64
ME11	Presque Isle, ME	46.70	68.04	155
MI01	Pellston, MI	45.56	84.68	230
MN01	Grand Rapids, MN	47.18	93.53	424
MT01	Poplar, MT	48.31	105.10	634
MS01	Starkville, MS	33.47	88.78	88
NC01	Raleigh, NC	35.73	78.68	120
ND01	Fargo, ND	46.90	96.81	275
NE01	Mead, NE	41.15	96.49	355
NM01	Las Cruces, NM	32.62	106.74	1317
NY01	Geneva, NY	42.88	77.03	219
OK01	Billings, OK	36.60	97.49	317
ON01	Toronto, ON	43.78	79.47	210
TX21	Seguin, TX	29.57	97.98	172
TX41	Houston, TX	29.72	95.34	76
UT01	Logan, UT	41.67	111.89	1369
VT01	Burlington, VT	44.53	72.87	390
WA01	Pullman, WA	46.76	117.19	805
WI01	Dancy, WI	44.71	89.77	381

1 **Table S2. Regression statistics and other validation statistics for evaluating OMI OP_FS and Noon_FS EDR with 31 ground**
2 **observational sites using different spatial collocation distances and temporal averaging windows. Values in the parenthesis are for**
3 **the Noon_FS EDR evaluation.**

statistics ^a	D = 50 ^b				D = 25	D = 10
	5 min ^c	10 min	30 min	60 min	5 min	5 min
N	100836	100860	100932	100978	67362	17412
R	0.90(0.88)	0.90(0.89)	0.90(0.89)	0.92(0.91)	0.90(0.88)	0.91(0.89)
Slope	0.89(0.87)	0.90(0.89)	0.93(0.92)	0.97(0.96)	0.9(0.88)	0.91(0.89)
Intercept	20.1(24.8)	18.7(22.8)	15.9(19.7)	14.0(17.6)	19.5(24.6)	18.9(23.7)
MB	8.0(8.9)	8.0(9.0)	8.6(9.8)	10.3(12.3)	8.5(9.2)	9.1(9.7)
RMSE	34.9(41.5)	33.7(39.9)	31.6(37.6)	30.6(36.4)	35.1(42.5)	34.8(42.1)

4 ^aN is the total number of data pairs between OMI and ground observation for 31 sites altogether. R, slope, and intercept are
5 the values obtained from the linear regression. MB and RMSE represent the mean bias and root-mean-square error as calculated
6 in Eq. (1) and (3), respectively.

7 ^bD = 50, 25 and 10 are the spatial collocation distances (D = 50 km, 25 km and 10 km) between an OMI ground pixel center
8 and a ground observational site.

9 ^c5, 10, 30 and 60 are the temporal averaging windows ($\Delta T = \pm 5, 10, 30$ and 60 minutes) around OMI overpass time or local
10 solar noon time.

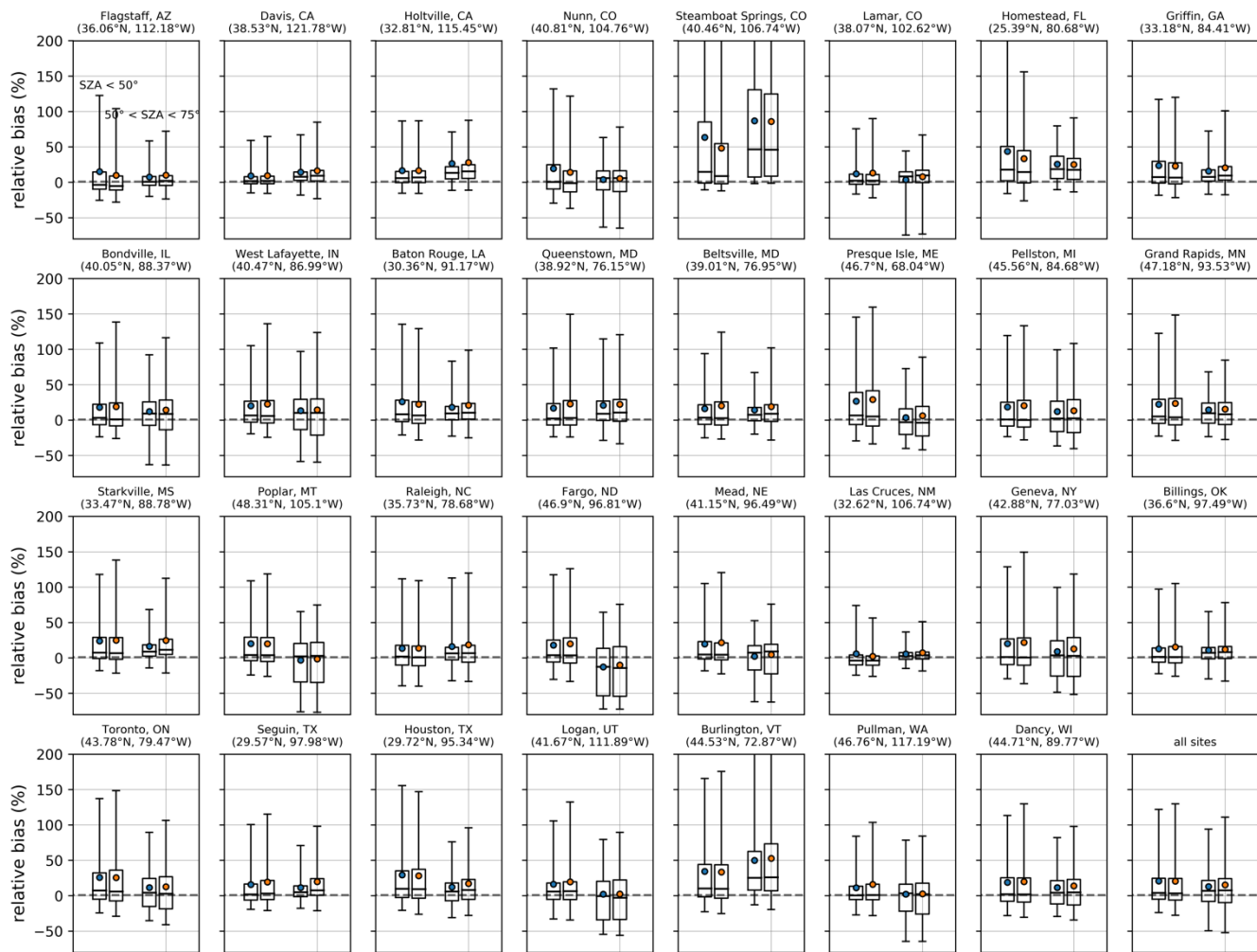
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1 **Table S3. Ratios of the local solar noon time EDR and overpass time EDR (Noon_FS/OP_FS) for both OMI and ground**
2 **measurements at each site (column 2 and 3), which are shown as mean \pm standard deviation with the median in the parenthesis. The**
3 **frequency (%) of the ratio from ground data less than 1 at each site is also included (column 4). Also shown are the median ratios**
4 **for OMI and ground observational EDR comparison at both overpass and local solar noon time (column 5 and 6) with standard**
5 **deviation in the parenthesis.**

Station ID	Ground ratio (Noon_FS/OP_FS)	OMI ratio (Noon_FS/OP_FS)	Frequency (Ground)	OP_FS ratio (OMI/Ground)	Noon_FS ratio (OMI/Ground)
AZ01	1.43 \pm 1.56 (1.17)	1.23 \pm 0.22 (1.16)	14.6	0.98 (0.48)	0.98 (0.44)
CA01	1.94 \pm 28.8 (1.10)	1.18 \pm 0.21 (1.11)	12.8	1.04 (0.31)	1.04 (0.35)
CA21	1.18 \pm 0.36 (1.12)	1.17 \pm 0.16 (1.12)	8.5	1.07 (0.46)	1.09 (0.44)
CO01	1.59 \pm 4.67 (1.11)	1.17 \pm 0.22 (1.10)	21.8	1.02 (0.52)	1.01 (0.51)
CO11	1.51 \pm 1.51 (1.17)	1.21 \pm 0.23 (1.14)	20.4	1.23 (0.88)	1.18 (0.82)
CO41	1.19 \pm 0.53 (1.1)	1.15 \pm 0.16 (1.10)	17.6	1.04 (0.36)	1.04 (0.42)
FL01	1.79 \pm 3.07 (1.24)	1.25 \pm 0.20 (1.19)	23.1	1.18 (0.61)	1.15 (0.56)
GA01	1.43 \pm 2.28 (1.19)	1.22 \pm 0.18 (1.18)	20.7	1.07 (0.47)	1.08 (0.47)
IL01	1.42 \pm 4.01 (1.13)	1.18 \pm 0.19 (1.12)	23.5	1.05 (0.50)	1.04 (0.56)
IN01	1.28 \pm 1.47 (1.10)	1.15 \pm 0.16 (1.10)	25.8	1.08 (0.47)	1.07 (0.54)
LA01	1.52 \pm 2.12 (1.17)	1.22 \pm 0.19 (1.16)	21.7	1.08 (0.51)	1.08 (0.52)
MD01	1.30 \pm 2.1 (1.11)	1.17 \pm 0.17 (1.11)	22.6	1.05 (0.47)	1.06 (0.54)
MD11	1.31 \pm 2.47 (1.12)	1.19 \pm 0.21 (1.12)	25.5	1.05 (0.41)	1.05 (0.49)
ME11	1.26 \pm 0.72 (1.11)	1.18 \pm 0.22 (1.10)	26.3	1.02 (0.50)	1.02 (0.57)
MI01	1.25 \pm 1.57 (1.08)	1.13 \pm 0.16 (1.08)	27.7	1.02 (0.48)	1.01 (0.53)
MN01	1.75 \pm 26.7 (1.10)	1.15 \pm 0.20 (1.09)	24.7	1.07 (0.44)	1.06 (0.50)
MT01	1.18 \pm 1.08 (1.06)	1.11 \pm 0.16 (1.05)	25.9	1.03 (0.50)	1.03 (0.52)
MS01	1.38 \pm 1.56 (1.16)	1.22 \pm 0.20 (1.16)	22.6	1.08 (0.44)	1.08 (0.52)
NC01	1.36 \pm 2.37 (1.13)	1.19 \pm 0.19 (1.13)	22.9	1.04 (0.50)	1.03 (0.51)
ND01	1.34 \pm 7.94 (1.08)	1.14 \pm 0.17 (1.08)	25.2	1.01 (0.52)	1.01 (0.57)
NE01	1.23 \pm 0.73 (1.11)	1.16 \pm 0.17 (1.11)	21.9	1.06 (0.43)	1.06 (0.48)
NM01	1.35 \pm 1.39 (1.17)	1.22 \pm 0.20 (1.16)	11.6	0.98 (0.36)	0.98 (0.30)
NY01	1.33 \pm 0.93 (1.14)	1.20 \pm 0.22 (1.13)	27.7	1.02 (0.53)	1.01 (0.61)
OK01	1.22 \pm 0.89 (1.09)	1.14 \pm 0.14 (1.10)	22.4	1.03 (0.39)	1.03 (0.44)
ON01	1.34 \pm 1.37 (1.12)	1.17 \pm 0.20 (1.11)	27.0	1.06 (0.48)	1.05 (0.55)
TX21	1.37 \pm 2.58 (1.14)	1.22 \pm 0.18 (1.16)	22.3	1.03 (0.41)	1.05 (0.49)

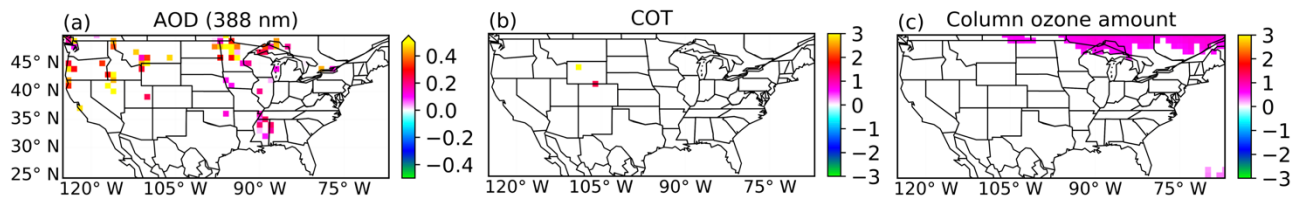
TX41	1.55 ± 6.24 (1.18)	1.24 ± 0.19 (1.18)	24.6	1.09 (0.56)	1.09 (0.57)
UT01	1.26 ± 0.91 (1.11)	1.17 ± 0.18 (1.12)	18.9	1.05 (0.49)	1.05 (0.55)
VT01	1.25 ± 0.88 (1.07)	1.13 ± 0.19 (1.07)	32.2	1.16 (0.65)	1.17 (0.68)
WA01	1.19 ± 0.62 (1.08)	1.14 ± 0.17 (1.08)	25.9	1.01 (0.42)	1.01 (0.47)
WI01	1.30 ± 1.48 (1.10)	1.18 ± 0.25 (1.09)	27.2	1.03 (0.48)	1.03 (0.51)

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 2 **Figure S1: Box-whisker plots of the relative bias (%) between OMI and ground measured EDR for each site grouped by different**
 3 **SZAs. Blue dots represent the relative bias for OMI overpass time EDR comparison while orange dots represent the local solar noon**
 4 **time comparison. On each box-whisker plot, the left pair shows the data grouped with SZA less than 50° while the right pair is for**
 5 **data grouped with SZA between 50° and 75° . Also shown on each box-whisker plot is the 5th and 95th percentiles (whisker), the**
 6 **interquartile range (box), the median (black line) and the mean (the dot).**

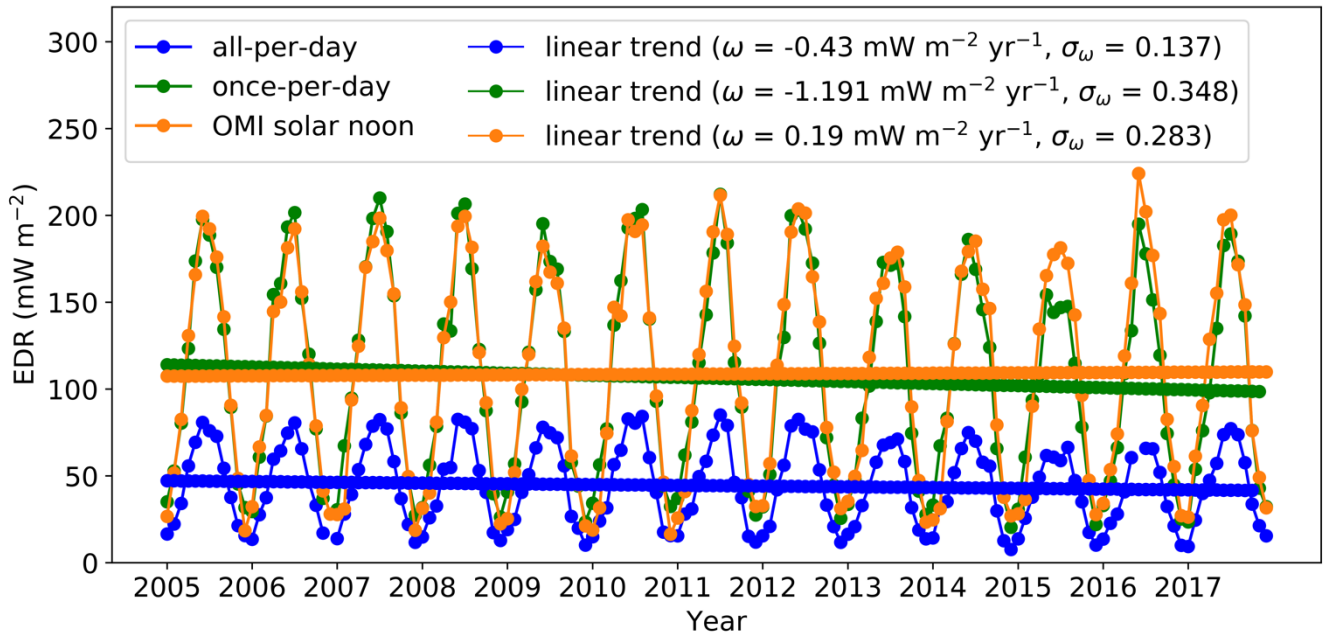
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 2 **Figure S2: (a), (b) and (c) shows the areas with significant trends (95% confidence level) of OMI level 3 AOD at 388 nm, COT and**
 3 **column ozone amount, respectively. The trends in (a), (b) and (c) are calculated as 100 x AOD/year, 100 x COT/year and column**
 4 **DU/yr, respectively.**

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IL01 (Bondville, IL)



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2 **Figure S3: Time series (dotted lines) of monthly OMI level 3 solar noon time full-sky EDR (orange) and ground observational EDR**
 3 **from 2005–2017 using once-per-day (green) and all-per-day (blue) sampling method for site IL01. The once-per-day sampling**
 4 **collects EDR data around local solar noon time while the all-per-day averages all the EDR data in a day. The straight lines are the**
 5 **linear trends derived from Eq. (6).**

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