

AEROSOL TRENDS OVER MEGACITIES BASED ON SPACE MONITORING USING MODIS AND MISR



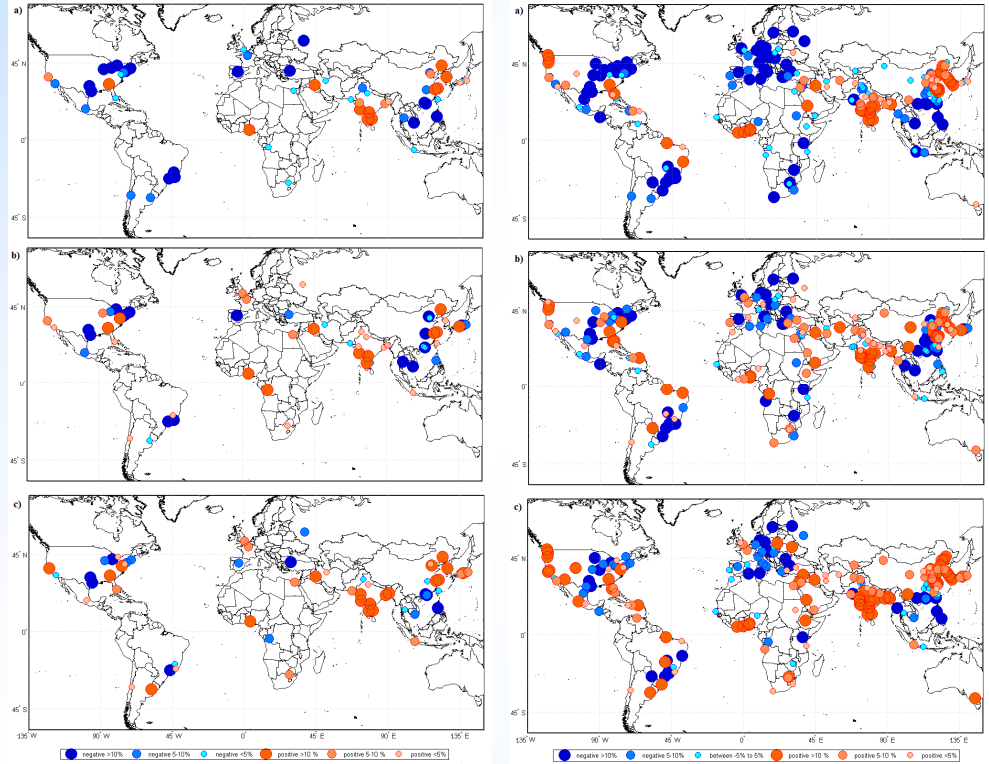
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Space monitoring of aerosol optical depth (AOD) trends over megacities can serve as a potential space indicator of global anthropogenic air-pollution changes. Three space aerosol sensors, MODIS - Terra, MODIS - Aqua and MISR, were used in order to study recent decadal trends of AOD over megacities around the world. Space monitoring of AOD trends has the advantage of global coverage and applies the same approach to detecting AOD trends over different sites. In spite of instrumental and time differences among the three sensors investigated, their global pictures of AOD trends over the 189 largest cities in the world are quite similar. The increasing AOD trends over the largest cities in the Indian subcontinent, the Middle East, and North China can be clearly seen. By contrast, megacities in Europe, the north-east of US, and South-East Asia show mainly declining AOD trends. In the cases where all three sensors show similar signs of AOD trends, the results can be considered as reliable. This is supported by the observed trends in surface solar radiation, obtained by using network pyranometer measurements in North and South China, India, and Europe. In the cases where the three sensors show differing signs of AOD trends (e.g. South America), additional research is required in order to verify the obtained AOD trends.

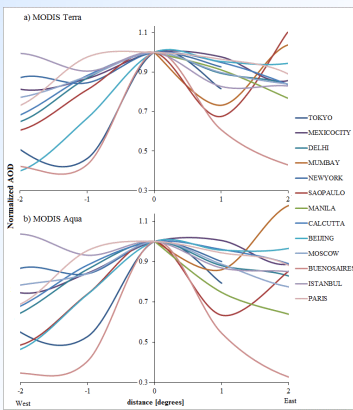
References

Alpert, P., Shvainshtein, O., Kishcha, P. AOD trends over megacities based on space monitoring using MODIS and MISR. American Journal of Climate Change, 117-131, doi:10.4236/ajcc.2012.13010, 2012.

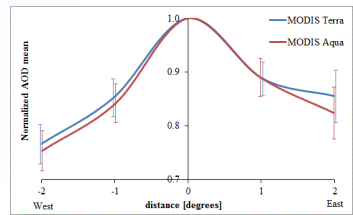


The global distribution of AOD tendencies during the 8-year period 2002-2010 over the 58 largest world cities with population exceeding five million, based on AOD data sets of (a) MODIS - Terra, (b) MODIS - Aqua and (c) MISR. The magnitude and sign of AOD tendencies are designated by circles of different diameters and colors, as shown in the bottom panel. Blue shades designate declining AOD trends, while orange shades designate increasing AOD trends.

The global distribution of AOD tendencies during the 8-year period 2002-2010 over the 189 largest world cities with population exceeding two million, based on AOD data sets of (a) MODIS - Terra, (b) MODIS - Aqua and (c) MISR.



Examples of the latitudinal distribution of 8-year normalized mean AOD over 13 megacities based on (a) MODIS - Terra and (b) MODIS - Aqua data sets. AOD was normalized on that over the megacity center.



Latitudinal distributions of a normalized AOD averaged over the top 26 megacities. The error bars show the standard error of the mean.

List of the world largest cities sorted by population in descending order, including AOD trend (α) and its standard deviation (S_α), average AOD (τ) and its standard deviation (S_τ)

№	Population [million]	Country	City	Latitude	Longitude	MODIS-Terra		MODIS-Aqua		MISR	
						$\alpha \pm S_\alpha$ [%]	$\tau \pm S_\tau$ [%]	$\alpha \pm S_\alpha$ [%]	$\tau \pm S_\tau$ [%]	$\alpha \pm S_\alpha$ [%]	$\tau \pm S_\tau$ [%]
1	34.00	Japan	Tokyo	35.70	139.72	-2.56 ± 0.32	0.283 ± 0.017	5.78 ± 0.74	0.295 ± 0.019	-7.15 ± 1.05	0.189 ± 0.014
2	24.20	Korea (South)	Seoul	37.57	126.98	-0.67 ± 0.10	0.391 ± 0.028	3.58 ± 0.51	0.413 ± 0.029	-2.62 ± 0.42	0.271 ± 0.021
3	24.20	China	Canton (Guangzhou)	23.13	113.26	-17.46 ± 1.83	0.489 ± 0.026	-18.24 ± 1.86	0.460 ± 0.025	-2.69 ± 0.35	0.414 ± 0.025
4	23.40	Mexico	Mexico City	19.43	-99.13	-10.49 ± 1.16	0.174 ± 0.010	-3.11 ± 0.31	0.198 ± 0.01	-12.35 ± 1.50	0.179 ± 0.011
5	23.20	India	Delhi	28.61	77.23	-3.29 ± 0.22	0.650 ± 0.022	-1.03 ± 0.07	0.648 ± 0.021	-2.73 ± 0.19	0.411 ± 0.015
6	22.80	India	Mumbai	18.98	72.83	17.42 ± 0.82	0.338 ± 0.009	20.63 ± 0.88	0.330 ± 0.008	15.94 ± 0.88	0.355 ± 0.010
7	22.20	USA	New York	40.72	-74.00	-11.49 ± 1.55	0.198 ± 0.013	-3.35 ± 0.47	0.197 ± 0.014	-13.46 ± 1.96	0.163 ± 0.012
8	20.90	Brazil	Sao Paulo	-23.55	-46.63	-6.10 ± 1.32	0.102 ± 0.011	-5.25 ± 0.96	0.119 ± 0.011	-13.63 ± 2.13	0.121 ± 0.009
9	19.60	Philippines	Manila	14.58	120.97	-21.31 ± 2.98	0.197 ± 0.014	-14.73 ± 1.62	0.234 ± 0.014	-5.02 ± 0.71	0.207 ± 0.015
10	18.40	China	Shanghai	31.20	121.50	12.68 ± 1.20	0.755 ± 0.034	10.60 ± 1.02	0.772 ± 0.035	0.64 ± 0.08	0.434 ± 0.027
166	2.28	Israel	Tel-Aviv-Jaffa	32.07	34.76	1.43 ± 0.13	0.243 ± 0.011	13.94 ± 1.12	0.221 ± 0.009	-14.85 ± 1.21	0.236 ± 0.010
167	2.25	USA	Portland	45.52	-122.64	26.94 ± 4.79	0.062 ± 0.006	58.57 ± 9.65	0.063 ± 0.006	12.19 ± 1.62	0.085 ± 0.006