Measuring daytime changes in airborne particles shows true 24-hour reflected sunlight average

August 16 2013

The quantity of tiny airborne particles can change dramatically throughout the day near major urban or industrial areas, as seen in these photos of New York City. Accounting for these variations is critical to scientists when studying daily reflected sunlight in urban areas and its impact on the climate.

Tiny airborne particles of pollution—known as aerosols—vary significantly throughout the day, according to a new study by Pacific Northwest National Laboratory scientists. Researchers showed that a single measurement of aerosol properties once a day is often insufficient to capture the effect of the airborne particles on the atmospheric energy budget. Particularly true near urban areas where pollution is strongest, the daytime particle changes may be large. PNNL scientists, in collaboration with NOAA's Earth System Research Laboratory and the

University of Colorado, showed that changes over a 24-hour period can affect the amount of sunlight reflected back to space, heating up the atmosphere.

"Measuring strong daytime changes in the number of airborne particles is beyond the current capabilities of many satellite-based measurements," said Dr. Evgueni Kassianov, PNNL scientist and lead author of the study. "Our results show these changes can significantly modify the amount of solar energy reflected back into space in the vicinity of large sources of urban emissions. These changes should be taken into consideration when evaluating climate model predictions."

On a clear day, you can see forever, or so the song goes. On the other hand, on a hazy day visibility can be quite impaired. This wide variability can occur during a single 24-hour period and is greatly influenced by the amount of aerosols, tiny particles of pollution or dust suspended in the atmosphere. Sampling the light-reflecting and scattering properties of aerosols only once during the day may provide misleading calculations of their warming and cooling influence on the atmosphere. This study shows that the minimum amount of sampling required to minimize those errors is twice per day. Results from this study provide important observational information to improve model-based estimates of the aerosol impact on the Earth's energy budget.

The team used aerosol data measurements collected during the Two-Column Aerosol Project (TCAP) research campaign, supported by the U.S. Department of Energy's Atmospheric Radiation Measurement (ARM) Climate Research Facility. TCAP studied the evolution of the optical and microphysical properties of atmospheric particles transported from North America over the Atlantic, and their impact on the radiation energy budget. TCAP's location was of particular interest because it is downwind of several large metropolitan areas, including Boston and New York City, providing the opportunity to measure the effects of urban and

industrial emissions. The team evaluated 29 clear-sky and partly cloudy days, evaluating the temporal variability of aerosol optical properties, such as optical depth, single-scattering albedo, and asymmetry factor. Researchers performed radiative transfer calculations using the data collected during TCAP and demonstrated that large errors in aerosol radiative forcing can occur if the particles are under-sampled during the day.

Researchers plan to apply their approach to similar datasets collected from Earth's surface and from space. This will provide important observations for model-based estimates of the aerosol impact on the Earth's energy budget at both regional and global scales.

More information: Kassianov E, et al. 2013. Do Diurnal Aerosol Changes Affect Daily Average Radiative Forcing?, *Geophysical Research Letters*, 40, 3265-3269. DOI: 10.1002/grl.50567. onlinelibrary.wiley.com/doi/10 … 2/grl.50567/abstract

Provided by Pacific Northwest National Laboratory

Citation: Measuring daytime changes in airborne particles shows true 24-hour reflected sunlight average (2013, August 16) retrieved 27 April 2024 from https://phys.org/news/2013-08-daytime-airborne-particles-true-hour.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.