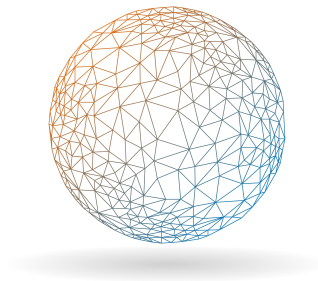


Perspectives and Opportunities to Improve Remote Sensing Services for Air Quality

GARY KLEIMAN, PRINCIPAL

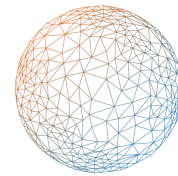


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AIR QUALITY MANAGEMENT
CLIMATE CHANGE MITIGATION

Who will use your data?

- Global research community does a great job of creating globally-optimized remote sensing products based on available, yet limited GLM data
- Local officials often want a product that is optimized for their city and their city alone; not an optimized global product.

Can algorithms be tweaked or customized to do both?



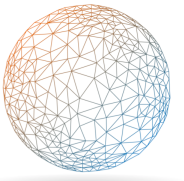
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“Evaluating the Use of Satellite Observations to Supplement Ground-level Air Quality Data in Low- and Middle-Income Countries”

Matthew J. Alvarado, Amy McVey, Jennifer Hegarty, Eben Cross, Christa Hasenkopf, Richard Lynch, Edward Kennelly, Timothy Onasch, Yewande Awe, Ernesto Sanchez-Triana, and Gary Kleiman

(Under Review) Atmospheric Environment - Special Issue: Emerging Strategies to Fill the Gaps in Ground-level Air Quality Data in Low- and Middle-Income Countries

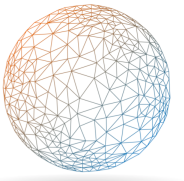
- Explores the current limitations of satellite-derived observations of surface-level PM_{2.5} for air quality monitoring and forecasting in countries with sparse monitoring networks
- To provide guidance for cities heavily impacted by cloud-cover, persistent snow, dust or other conditions that degrade AOD retrievals as to specific approaches that provide the best available match for their circumstances
- ... and of course push for additional ground-level measurements.



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Example General Guidance

- Limited ability to estimate variation of annual-average PM_{2.5} within a city (to estimate chronic health effects) with current satellite AOD data alone.
- Recommend SPARTAN site to directly measure AOD and surface PM_{2.5} relationship to reduce CTM-estimation bias
- Both the CTM-based and statistical are likely have average absolute errors of $\pm 50\%$ within each city for day-to-day variability in PM_{2.5} concentrations.

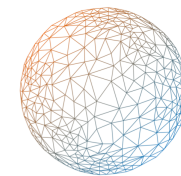


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Example City-specific Guidance

- Satellite-based methods work best for **low altitude, inland cities** (e.g. Hanoi and Delhi)... but still with significant errors (43-60% [38-50%]) in predictions of daily-average PM_{2.5} concentrations at sites within these cities.
- In cities with **persistent wintertime snow cover**, like Ulaanbaatar, all approaches using current satellite AOD data will likely not give accurate annual averages as there is insufficient contrast with the surface to determine AOD for snow-covered surfaces.
- In **coastal cities**, such as Lima, the mix of water and land surfaces within a satellite footprint and persistent clouds may also mean that using current satellite AOD is not an option, as Dark Target algorithms have poor urban coverage and the MODIS Deep Blue algorithm has a coarse spatial resolution (10 km).

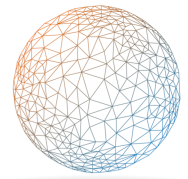
World Bank Global Offices: Opportunity for ground-level PM_{2.5} and AOD measurements?



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Owned and GSDCR Managed	Owned not GSDCR managed	Owned not GSDCR managed (Multitenant High-rise spaces)	Leased (GSDCR managed)
Benin	Niger	Kazakhstan	Ethiopia
Kenya	Togo	Kyrgyz	Lebanon
Madagascar	Georgia	Bolivia	
Mozambique	Moldovia	Colombia	
Nigeria	France	Argentina	
Moscow		Mexico	
Bangladesh		Peru	
Pakistan			
Ethiopia			
South Sudan			
India (Chennai)			

Global Footprint; In-kind support (i.e. Need funding!)



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