



Global Air Quality and Health: Lessons from HAQAST-funded Research in Latin America

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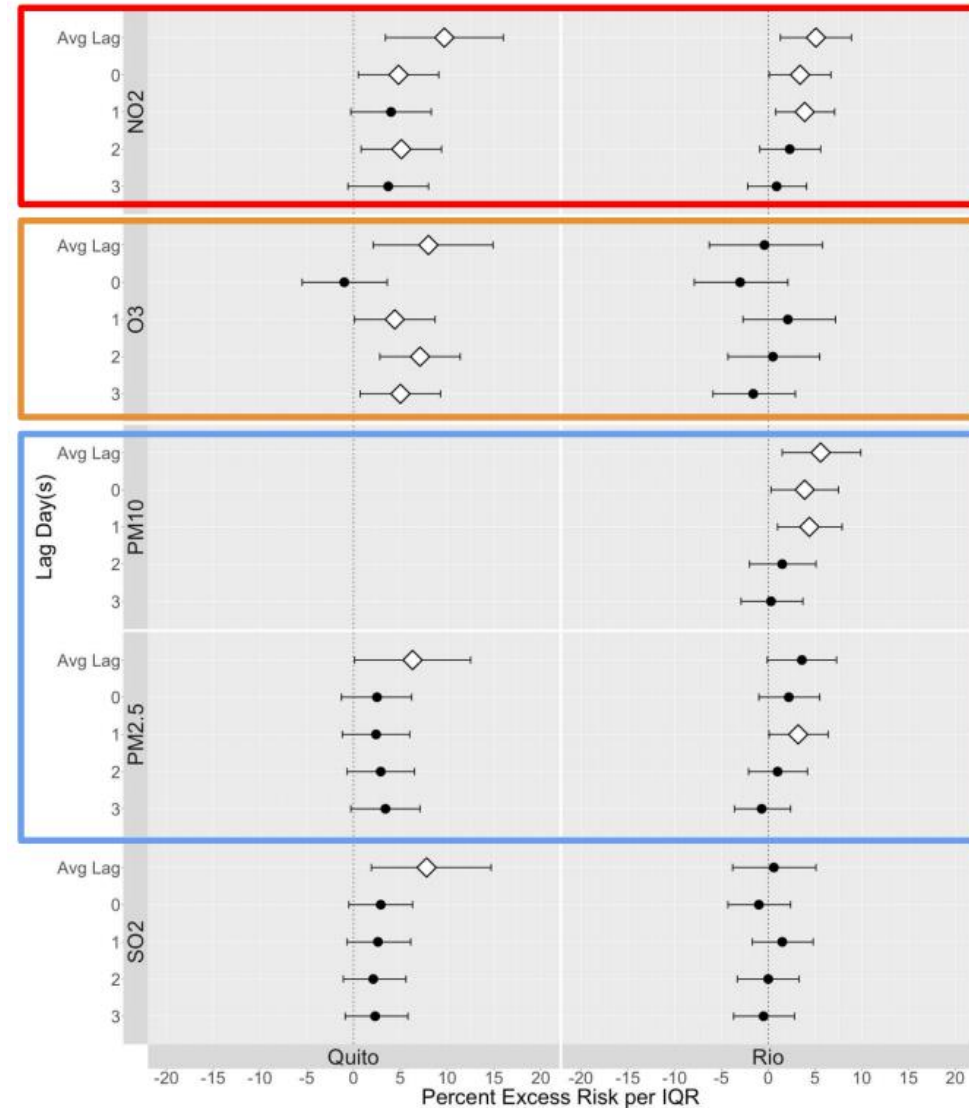
Key Lessons from HAQAST-funded Applied Research in Latin America

1. Providing locally-derived estimates of the health impacts of outdoor air pollution was essential to enabling efforts to increase utilization of satellite data, and other NASA data products, in Latin American cities.
2. Ongoing stakeholder engagement throughout the applied research process greatly broadens the impact of the work.
3. Specific lessons on NO₂, air pollution forecasting, and risk communication in Latin American cities.



Unlocking Opportunities for Meaningful Engagement

“Yes, but what does it look like in our city...”

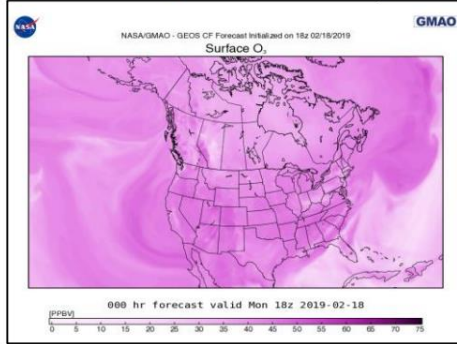


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NASA AQ Forecast System

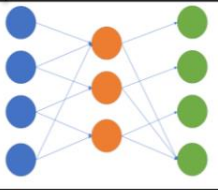


Forecasts via
NASA Fluid &
WRI Resource
Watch

Tailored Forecasts
via API

Surface AQ Data
openaq

Machine
Learning



AQ Observations



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Partners Decision Making



Valeria Diaz, Quito Air Quality Monitoring Coordinator, Environmental Secretariat, Ecuador



Felipe Mandarin, Instituto Pereira Passos, Rio de Janeiro City Government, Brazil



Gabriel Okello & Kellen Nyamurungi Namusisi, African Centre for Clean Air (ACCA), Kampala, Uganda

Bolivia

Marcos Andrade, Karen Crespo, Armando Rodriguez, Academics and Non-Profit in Bolivia (La Paz, Santa Cruz, Cochabamba)

Partner Applications

AQ Forecasts & Alerts



Mitigation Planning



Data

HAQI/ AQI
Verification

Data



Satellite Data

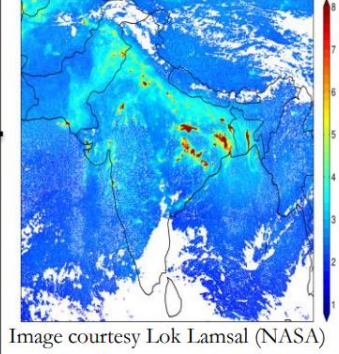
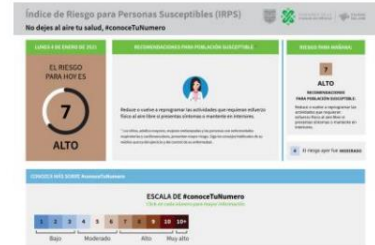


Image courtesy Lok Lamsal (NASA)

HAQI/AQI



Low-Cost Sensors



Photo from Clarity Movement
<https://www.clarity.io/>



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“Locally-generated associations of air quality and health opens the door for adoption of further air quality and health interventions.”

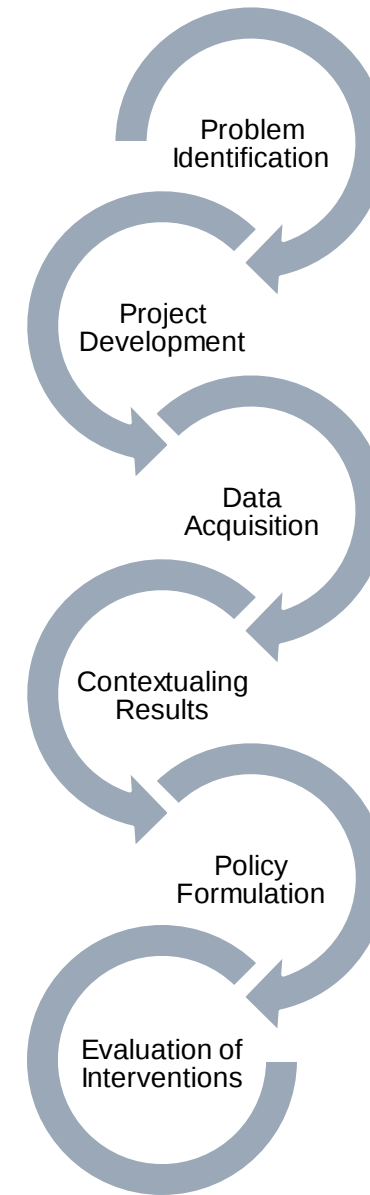


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Principles to Broaden the Impact of our Research

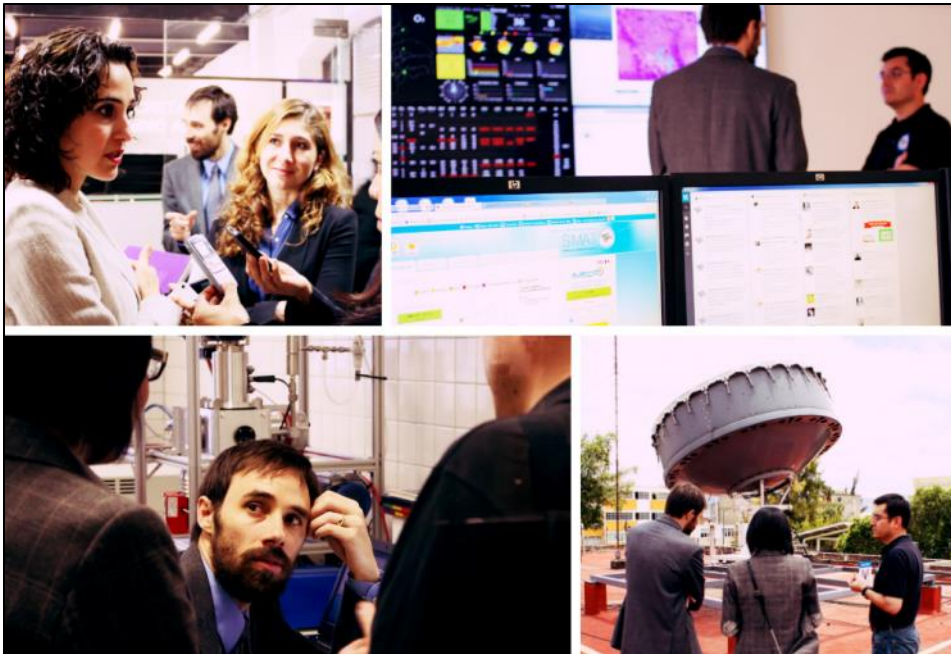
“Consistent stakeholder engagement throughout the applied research process, from study design through implementation, leads to broader impacts for our research.”



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Ongoing Stakeholder Engagement Leads to [Often Unexpected] Broader Impacts



(1) Assessed, and reported to stakeholder agency leadership, the adequacy of the existing ground-based air quality monitoring networks:

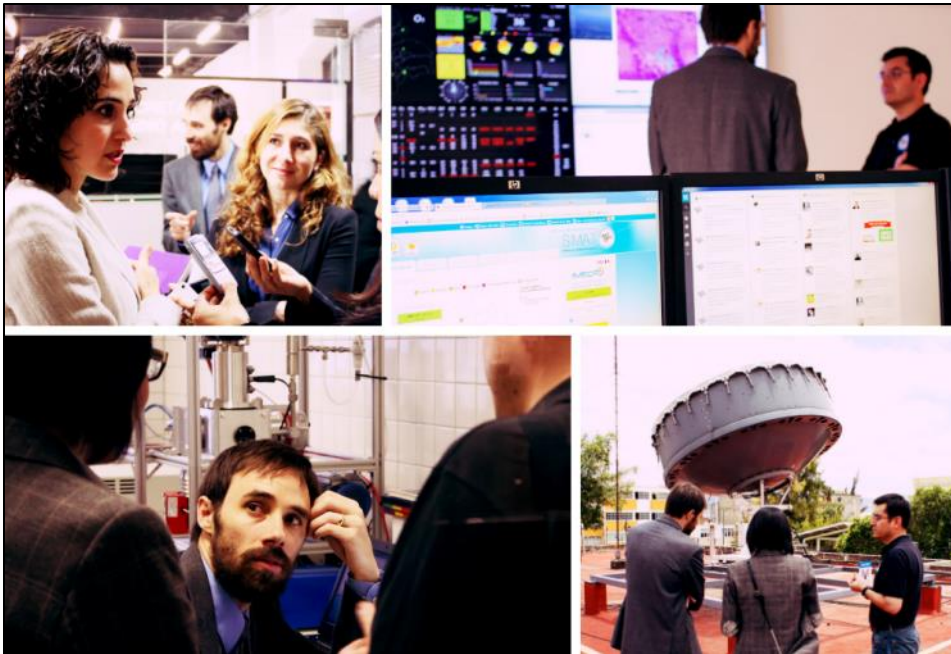
- Explored how satellite data could potentially inform placement of pilot sensors to explore expansion of existing monitoring network.
- Added cardiovascular health outcomes to planned project to determine whether additional PM_{2.5} monitoring is warranted.



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Ongoing Stakeholder Engagement Leads to [Often Unexpected] Broader Impacts



(2) Identified, and provided remedies to, limitations in current “forecasting” that may limit effectiveness of public dissemination of air quality information:

- Conducted quantitative analysis of both existing, and proposed alternative, forecasting approaches using NASA data products (bias-corrected GEOS-CF).

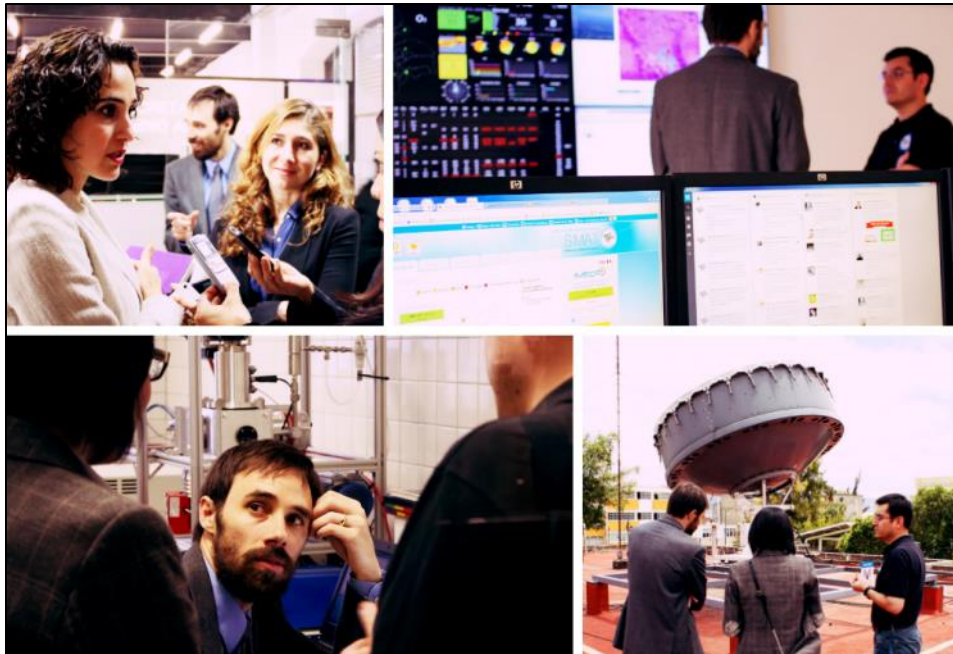
- Made specific recommendations on improving forecasting to agency leadership through written reports and presentations.



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Ongoing Stakeholder Engagement Leads to [Often Unexpected] Broader Impacts



(3) Provided capacity building for civil servants in both research and policy groups:

- Provided training in exposure assessment approaches that can be used for future health and policy studies.
- Provided recommendations and detailed guidance on assessing public utilization of existing air quality dissemination tools.



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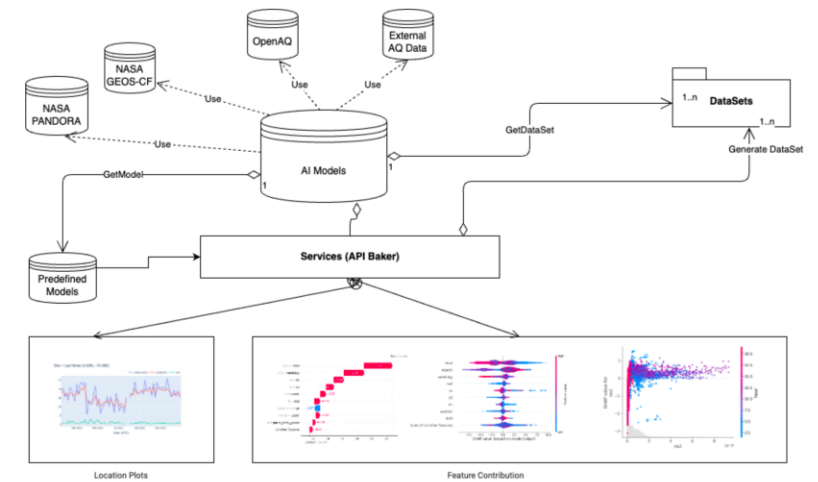
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Project Specific Findings in Latin American Cities

We are on the precipice of dramatically improving how air quality information is relayed to the public that will reduce exposures and better protect public health

Automating local forecasts based on GEOS-CF Along with local observation data

The online platform focuses on generating localized forecasts for selected locations based on NASA GMAO's GEOS-CF and the data is provided to the end users via the api baker



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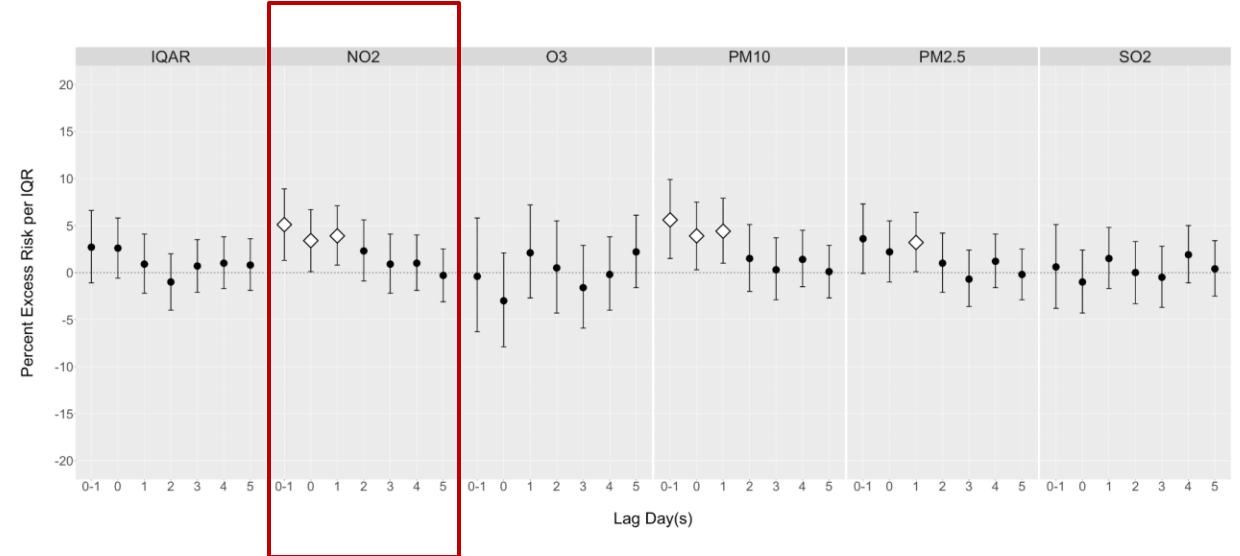
Improved Risk Communication for Outdoor Air Pollution

PM ₁₀	PM _{2.5}	O ₃	NO ₂	SO ₂	Index	Air quality	Health Effects
0 - 50	0 – 25	0 - 100	0 - 200	0 - 20	0 - 40	N1 - Good	-
51 - 100	26 – 50	101 – 130	201 – 240	21 – 40	41 – 80	N2 - Moderate	People in sensitive groups (children, elderly, and/or people with respiratory and heart conditions) may experience symptoms such as dry cough and tiredness. The general population is not affected.
101 - 150	51 – 75	131 – 160	241 – 320	41 – 365	81 – 120	N3 - Bad	The entire population may experience symptoms such as dry cough, tiredness, burning eyes, nose and throat. People in sensitive groups (children, elderly, and/or people with respiratory and heart conditions) may experience more serious health effects.
151 - 250	76 – 125	161 – 200	321 – 1130	366 – 800	121 – 200	N4 - Very Bad	The entire population may experience worsening of symptoms such as dry cough, tiredness, burning in the eyes, nose and throat, as well as shortness of breath and wheezing. Even more serious effects on the health for sensitive groups (children, elderly, and/or people with respiratory and heart conditions).
251 - 600	126 - 300	201 - 800	1131 - 3750	801 - 2620	201 - 400	N5 - Terrible	The entire population may be at serious risk of respiratory and cardiovascular diseases. Increase in premature deaths in people from sensitive groups.



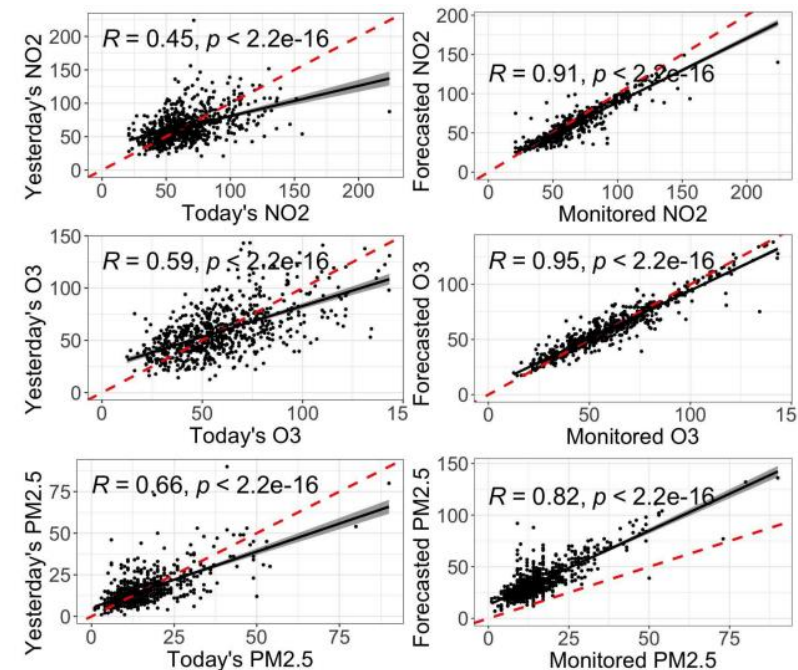
Health Risks from NO₂ not Accounted For in Current Risk Communication

	PM ₁₀	PM _{2.5}	O ₃	NO ₂	SO ₂
Centro	896	NA	143	NA	36
Iraja	497	198	408	8	2
Sao Cristovao	705	NA	275	NA	93
Tijuca	779	NA	251	45	2
All Monitors	569	148	356	15	23



Localized Forecasts Based on GEOS-CF Now Validated and Ready for Utilization

Pollutant	NO ₂		O ₃		PM _{2.5}		PM ₁₀ *	
Forecasting Approaches	Current	GEOS-CF*	Current	GEOS-CF*	Current	GEOS-CF*	Current	GEOS-CF*
NO ₂	0.4	0.91						
O ₃			0.59	0.95				
PM _{2.5}					0.66	0.82		
PM ₁₀							0.65	0.99



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