

Using satellite-based air quality global models to estimate surface PM_{2.5} concentrations and avoidable mortality in Colombia

Laura A. Rodriguez-Villamizar¹, Luis Carlos Belalcazar-Ceron², María Paula Castillo² Edwin Ricardo Sanchez², Víctor Herrera³ Dayana Milena Agudelo-Castañeda⁴

1 Department of Public Health, Universidad Industrial de Santander, Bucaramanga, Colombia

2 School of Engineering, Universidad Nacional de Colombia, Bogotá, Colombia

3 Faculty of Health Sciences, Universidad Autónoma de Bucaramanga, Bucaramanga, Colombia

4 Department of Civil and Environmental Engineering, Universidad del Norte, Barranquilla, Colombia

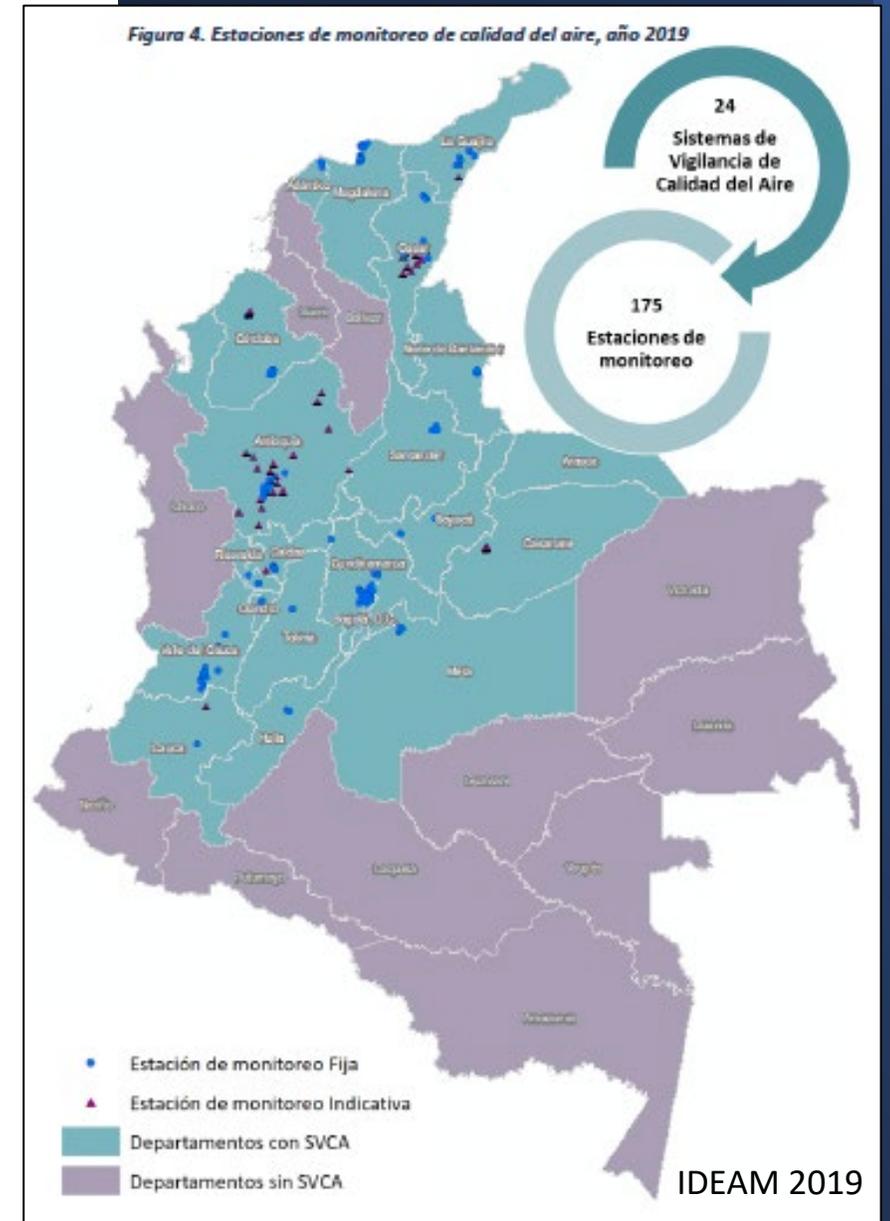
GEOHealth Hub Colombia

On behalf of the "Air quality and urban environmental health in five cities in Colombia" project team



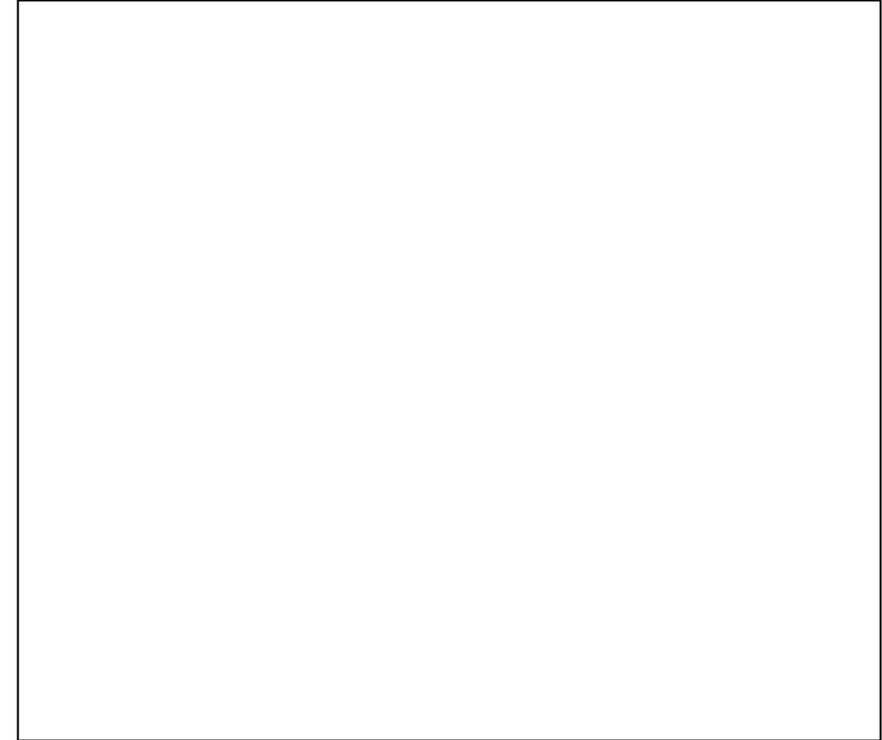
Rational for using satellite-based data

- Colombia has a national air quality network composed of **24 surveillance systems and 175 monitoring stations** of which 92 monitored PM_{2.5} in 2019.
- The region contributes to biomass burning aerosol, associated to PM, which occurs mainly in **locations far from existing monitoring stations.**
- Large cities have automatic air quality monitoring networks and medium-sized and smaller cities perform periodic manual measurements that are not readily available. **For 2019, 69 monitoring stations from 28 cities had available information with good quality.**



Satellite-based air quality global models used

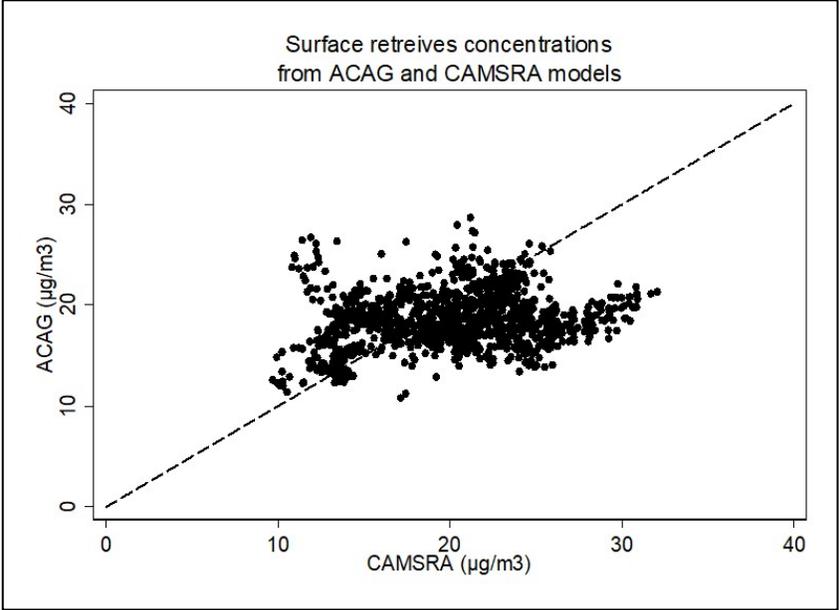
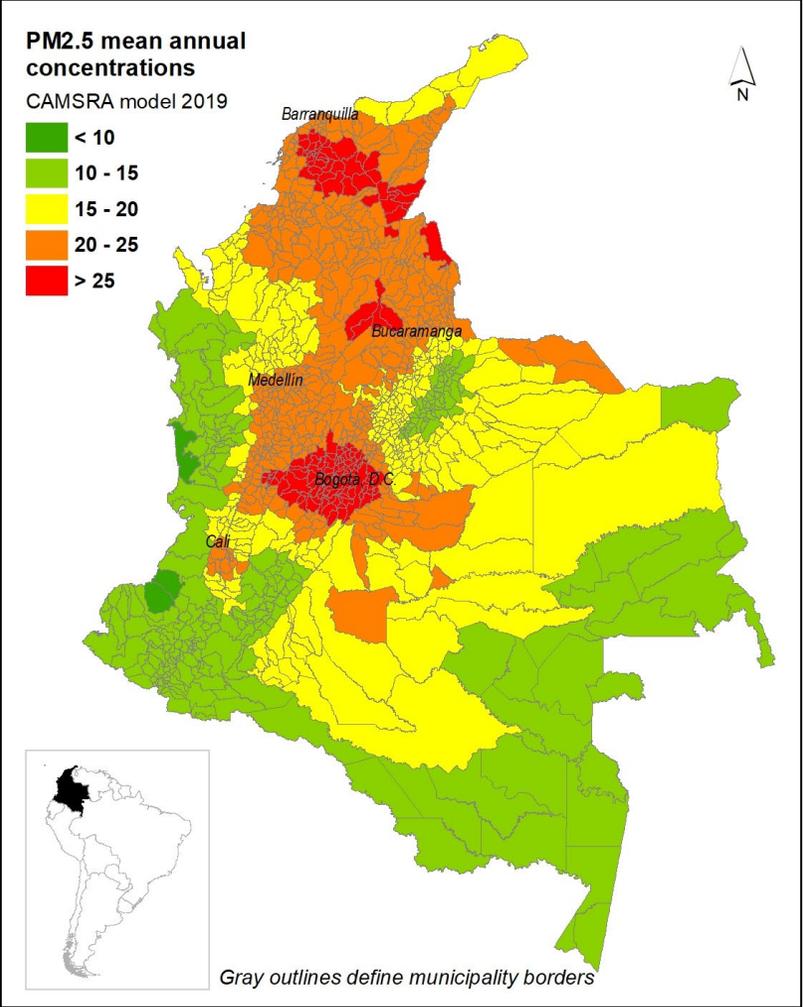
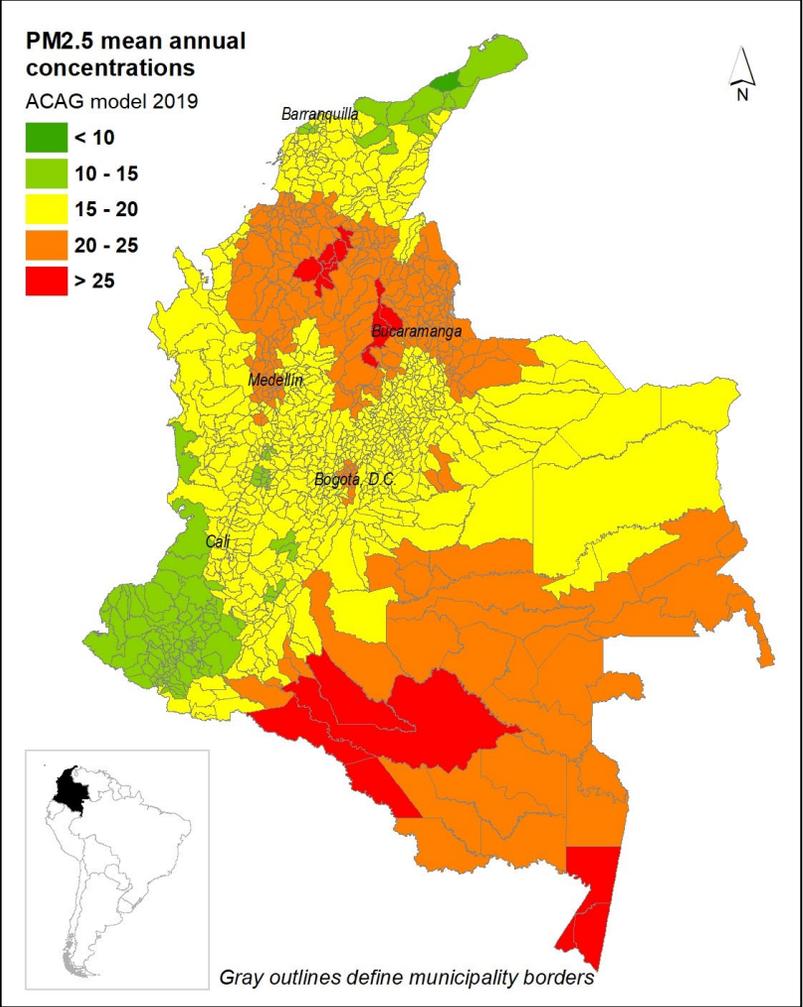
- Surface PM_{2.5} concentrations at 0.1° x 0.1° resolution were obtained from the Atmospheric Composition Analysis Group at Washington University (**ACAG**) model (van Donkelaar et al., 2021) and Copernicus Atmospheric Monitoring Service -CAMS- Reanalysis (**CAMSRA**) (Inness et al., 2019).
- The PM_{2.5} concentrations were averaged per year for each municipality between **2014-2019**
- **Comparison of data from monitoring stations** reporting PM_{2.5} was compared with ACAG and CAMSRA estimated surface concentrations in **28 municipalities for 2019**.
- Annual mortality data 2014-2019 by municipality of residence and pooled effect estimates for total, natural and specific causes of mortality (Chen & Hoek, 2020) – Pope et al., 2020) were used to calculate the number of **annual avoidable deaths** related to the excess of PM_{2.5} concentration over the **mean annual national standard of 25 µg/m³ and projected 2030 standard (WHO interim target 3) of 15 µg/m³**.



Source: van Donkelaar et al. 2021

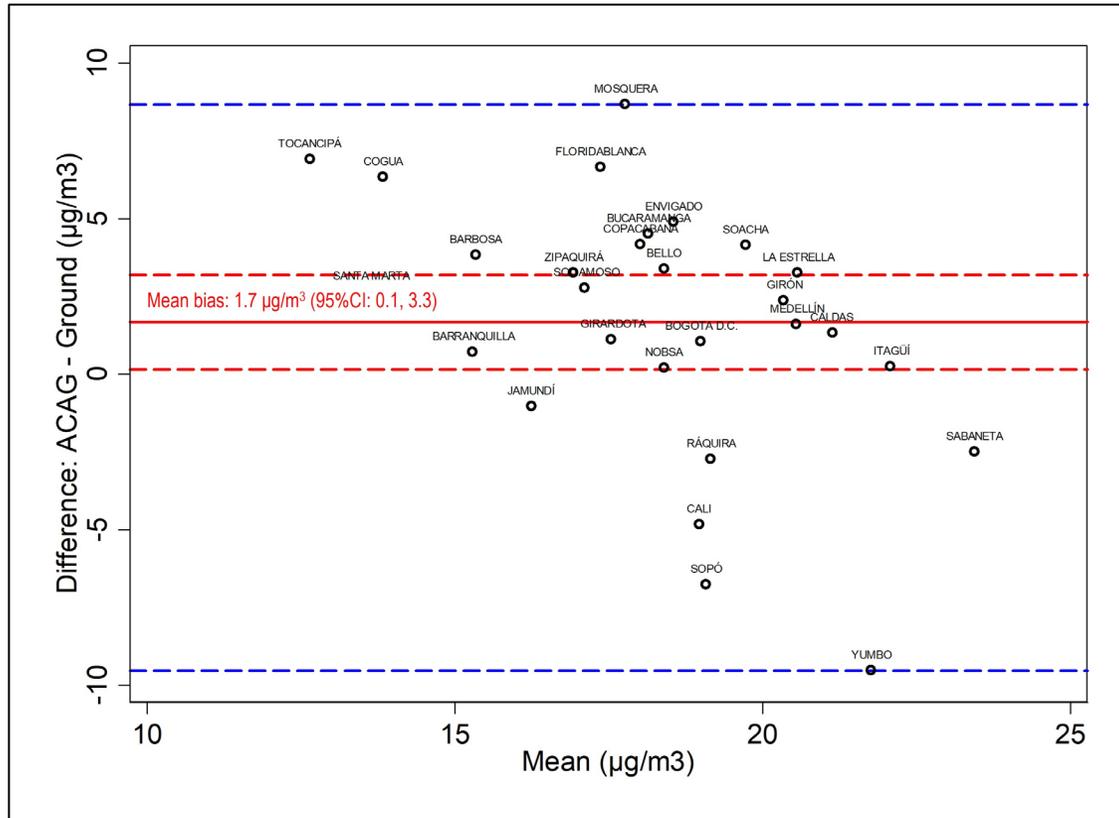
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Estimated surface PM_{2.5} concentrations (μg/m³) using ACAG and CAMSRA models – Colombia 2019

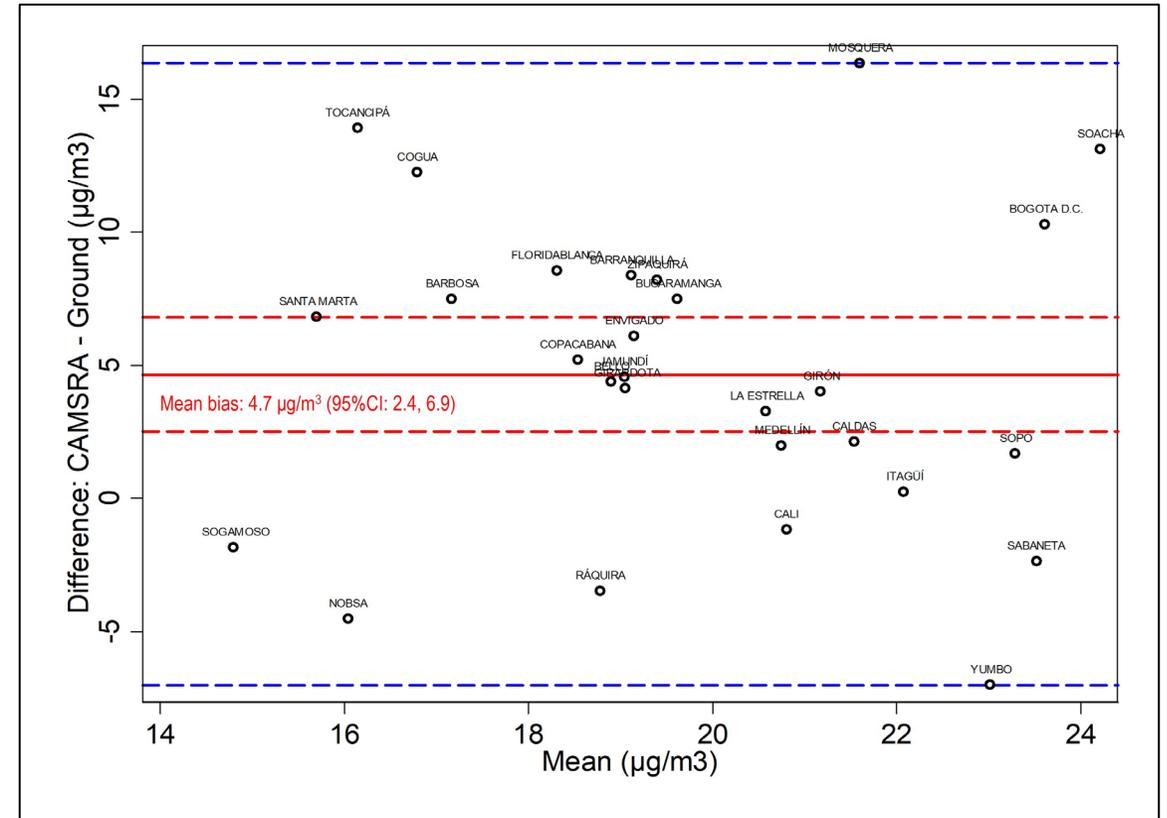


Comparison* with PM_{2.5} ground-monitoring stations in 28 cities for 2019

PM_{2.5} estimates from ACAC model



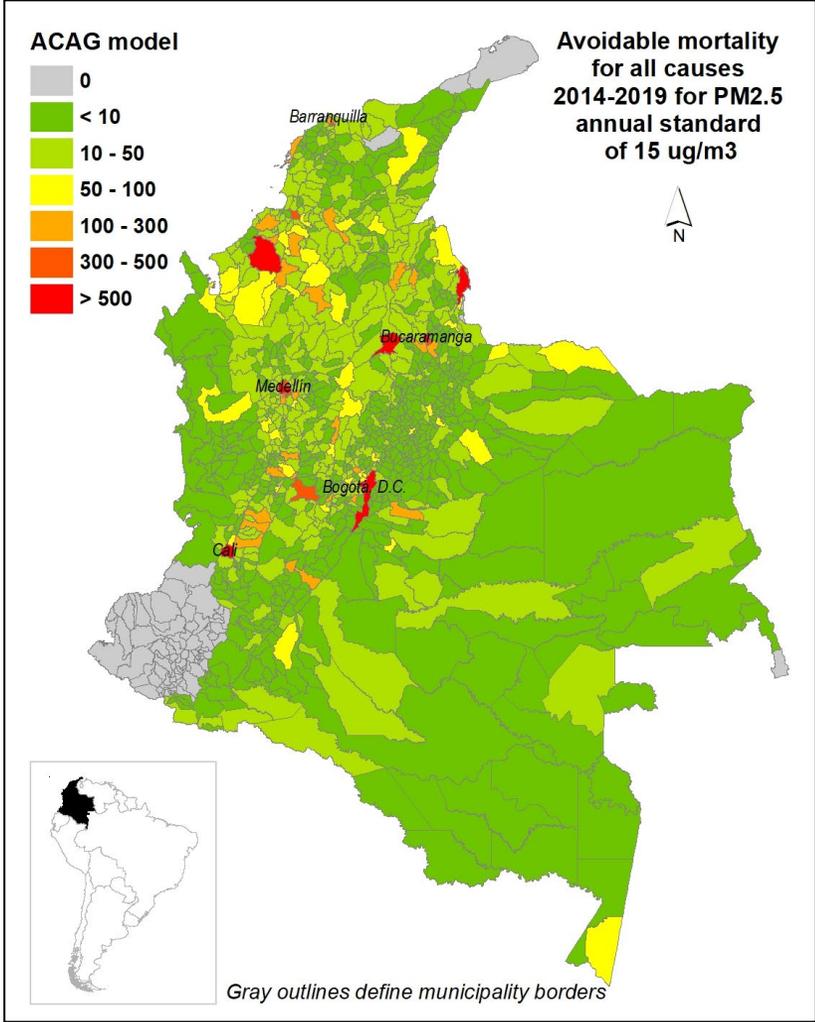
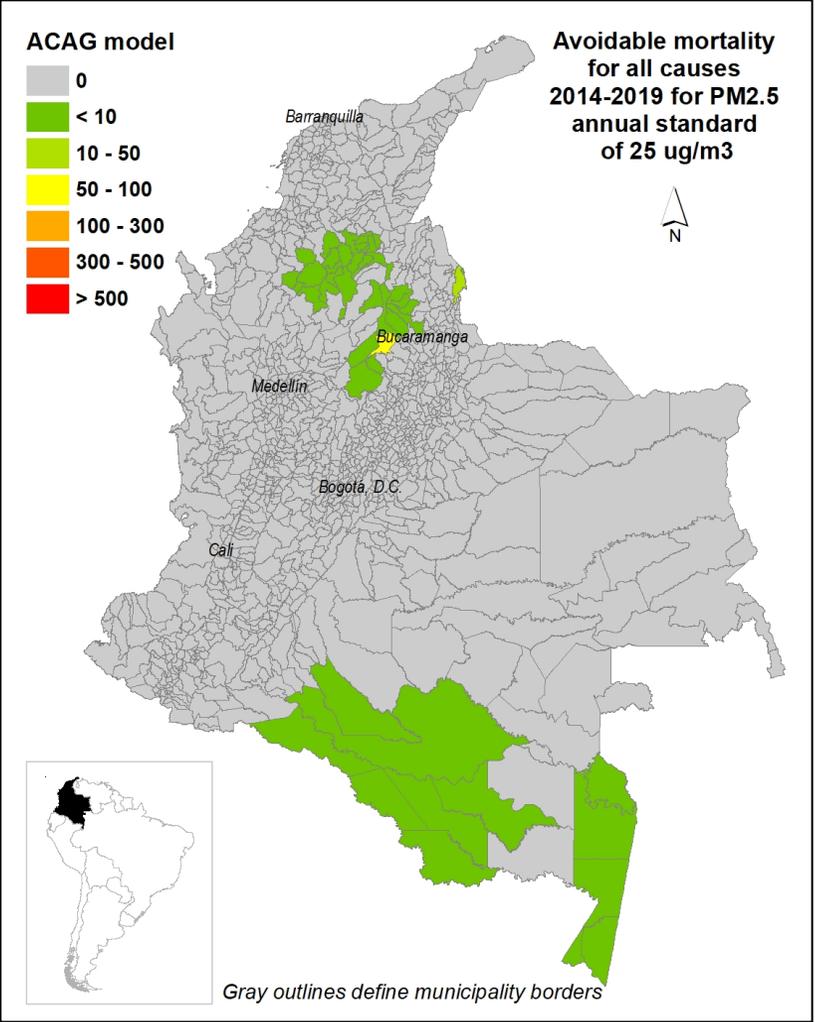
PM_{2.5} estimates from CAMSRA model



*Bland & Altman limits of agreement.

---Red lines correspond mean difference and 95% confidence intervals and ---blue lines range of observations

Estimated avoidable mortality using PM_{2.5} from ACAG model estimates related to current (25ug/m³) and target standard 2030 (15ug/m³) in Colombia 2014-2019



current standard (25ug/m³)
Estimation:
142
avoidable
Deaths

Projected standard 2030 (15ug/m³)
Estimation:
34,341
avoidable
deaths

Using ground-based monitoring data from 28 cities in 2019
only 1 city exceed the current national standard with an estimation of 6 avoidable deaths

Conclusions

Satellite-based air quality global models are useful tools for estimating PM_{2.5} surface concentrations at municipality scale.

For Colombia:

- ACAG model had lower mean-bias compared to ground-concentrations measured by monitoring stations in 2019 and seems to capture effects of fires at the southeast of the country
- Models need to be calibrated with local data for better accuracy
- Avoidable deaths resulting from decreasing current national standard should be considered by decision-makers in line with WHO guidelines.