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Presented at the 4th meeting of the **NASA Health & Air Quality Applied Science Team (HAQAST4)**¹

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REMOTE SENSING & CLIMATE ACTION

How can Satellite-Derived Data Sets Support the United Nations Sustainable Development Goals?

Abstract

Annual estimates of the concentration levels of particulate matter -smaller than 2.5 microns ($PM_{2.5}$)- have been derived, from data sets retrieved from current NASA instruments & missions, to produce maps of Mexico, Burkina Faso, and Nigeria.

Results shown on *Images 1, 2 & 3* on the right have greatly contributed to climate change mitigation initiatives with a focus on Health & Air Quality. Actions focused on improving local air quality, such as introducing sustainable transport alternatives and cleaner fuels, directly support the Paris Agreements and the substantial reduction of greenhouse gas emissions required to solve the global climate crisis, while advancing multiple United Nations Sustainable Goals, including 3,11,13 & 17.

However, full potential of remote sensing for climate leadership & environmental applications is yet to be tapped into. Greater awareness of existing NASA tools, trainings, and applications, through stakeholder engagement, would enhance existing sustainable development initiatives from civil, public, private, and academic sectors.

Acknowledgements

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Download poster from:
<https://haqast.org/haqast-4/>

I. Introduction

The United Nations Sustainable Development Goals on Good Health & Well-Being (SDG 3) and on Sustainable Cities & Communities (SDG 11) use the concentration levels of $PM_{2.5}$ in the air over human settlements as an indicator of progress, due to its direct correlation to detrimental health incidences among populations exposed to high levels of air pollution, with the eldest and youngest being most vulnerable. In 2016, 91% of the world population did not have access to clean air, as defined by the World Health Organization's² (WHO) guidelines on air quality. During the same year, outdoor air pollution caused 4.2 million premature deaths².

Many regions of the world lack air quality monitors on ground, or have very few of them. Although not a substitute for ground measurements, existing NASA remote sensing data sets & tools can be used to estimate plenty of environmental indicators to identify potentially hazardous areas. Insight gained can and must be used to raise awareness among

influencers and stakeholders in order to detonate conversations around health & air quality, and this way lead the community forward on the road to a sustainable future.

II. Tools

Maps of Mexico, Burkina Faso, and Nigeria were developed using the following tools & methods:

- ✓ Advanced NASA Applied Remote Sensing Training (ARSET³)
- ✓ QGIS Geospatial Software
- ✓ World Health Organization's 2014 data sets, based on NASA Instruments & Missions Aqua, MISR, MODIS, Terra, and CALIPSO.

Climate Leadership

Climate Reality Leadership Corps

The Climate Reality Leadership Corps⁵ mobilizes over 11,000 Climate Activists, trained by former USA Vice President Al Gore himself. Results shown on *Images 1 & 2* were used by Climate Reality Leaders to engage a former President of Mexico, and the Princess of Burkina Faso, whom we greeted in the United Nations headquarters in New York City.



Team 54 Project

Team 54 is on a quest to raise awareness and action on climate change, by mobilizing over 135,000 members in 170 nations to make Earth green again. Efforts have been recognized by the President of the United



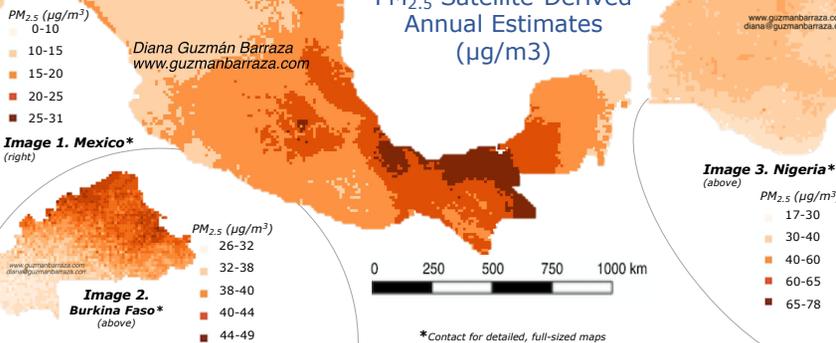
Nations General Assembly. The maps of Nigeria & Burkina Faso shown on *Images 2 & 3* were used to engage government authorities.

Citizen Observatory of the Air Quality of the Metropolitan Area of Monterrey (OCCAMM)



The Air Observatory in Monterrey, is an example of organized Climate Leadership, where civil, academic, and private sectors are actively collaborating to solve the air quality problem of our city. The observatory is working to integrate urban, infrastructure, and mobility development plans, facilitate transition into cleaner fuels, develop regulatory framework proposals, and raise awareness; actions that will ultimately restore clean air in our metropolitan area, and reduce greenhouse gas emissions that lead to climate change.

III. Results: $PM_{2.5}$ Satellite-Derived Annual Estimates ($\mu g/m^3$)



IV. Discussion

- ✓ *Images 1, 2 & 3* show that in most of Mexico, Burkina Faso, and Nigeria, respectively, the annual concentration levels of $PM_{2.5}$ exceeded the safe limit -established by the WHO to be $10\mu g/m^3$ ².
- ✓ In Mexico, the south east region in the vicinity of the Gulf of Mexico -where the oil & gas industry is prominent- shows dangerous levels of $PM_{2.5}$.
- ✓ In central Nigeria, the region in the vicinity of Kaduna stands out for its alarmingly high levels of $PM_{2.5}$ while the northern areas of both Nigeria and Burkina Faso are most affected by $PM_{2.5}$, possibly due to their proximity to the Sahara Desert.
- ✓ Air quality is influenced by climate, and generally worsened by climate change. Climate change alters atmospheric chemistry and removal processes -such as ventilation, dilution, and precipitation- which in general, worsens air quality⁴.
- ✓ By providing insight on air quality, the results shown on *Images 1, 2 & 3* went on to support global climate leaders to engage stakeholders and influencers, raise awareness, and reduce greenhouse gas emissions to clean the air around their communities, protect the health of loved ones, and contribute towards solving the global climate crisis. This way, SDGs 3, 11, 13, and 17, on health, communities, climate action, and partnerships are directly supported.

V. Conclusions

Data retrieved from NASA instruments and missions greatly supports actions required to achieve the UN SDGs, giving insight on common interests to multiple stakeholders and influencers. Enriching data sets are yet to be fully tapped into. Further public awareness of relevant trainings & tools would increase environmental applications, which would in turn support continuation of funds for such missions and tools.

VI. References

1. NASA Health & Air Quality Applied Science Team: <https://haqast.org/haqast-4/>
2. World Health Organization: <http://www.who.int/> [Accessed 14 July 2018]
3. NASA ARSET: <https://arset.gsfc.nasa.gov/> [Accessed 14 July 2018]
4. Fiore AM et al; J Air Waste Manag Assoc; 65(6):645-85 (2015)
5. Climate Reality Project: <https://www.climateallianceproject.org/> [Accessed 14 July 2018]