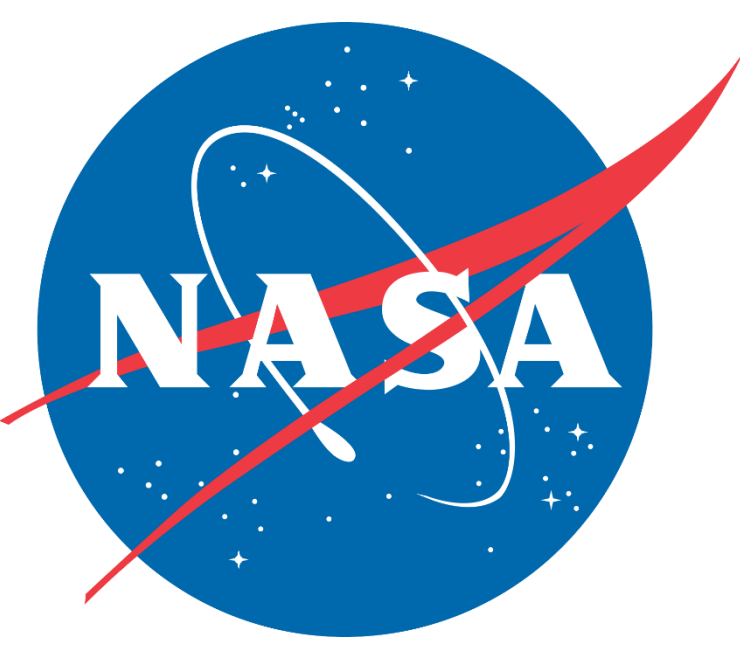# Innovative Earth Science Applications to Support Air Quality Management and Public Health

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National Aeronautics and Space Administration

INTRODUCTION

❖ The World Health Organization underscored the need to support such technologies – such as smartphone apps, digital platforms, **big data**, and artificial intelligence – in a cautious and ethical manner to address urgent health challenges and protect the global community.

❖ Incorporating innovative data and technological sources – like **NASA Earth-observing satellite data** – will enhance our understanding of One Health challenges and provide a multi-dimensional and holistic evaluation of emerging environmental health risks.

PURPOSE:

❑ **Share information about NASA's Health and Air Quality Applications Program**

❑ **Illustrate through three supported projects the societal benefit of Earth-observation data to strengthen public health surveillance, policy decision-making, and community engagement through the One Health paradigm**

NASA HEALTH AND AIR QUALITY APPLICATIONS

This program promotes using Earth observation data in air quality management and public health communities, including:

❖ Examining toxic and pathogenic exposures and health-related hazards such as strategies for risk characterization and mitigation.

❖ Integrating Earth observations and models into the implementation of air quality standards, policy, and regulations for economic and human welfare.

❖ Addressing effects of climate change on public health and air quality to support managers and policy makers in their planning and preparations.

ONE HEALTH APPLICATIONS

Through multidisciplinary collaborations, scientists and community practitioners can identify environmental risk factors and develop novel approaches and interventions, linking human, animal, and environmental health.

CONCLUSIONS

❖ Satellite data, which form part of the **One Health toolkit**, can offer researchers a holistic perspective of how the changing Earth's systems can influence human and animal health.

❖ By forming **multidisciplinary teams** across sectors and geographic regions, researchers and community stakeholders can leverage expertise, share resources, and together develop timely, cost-effective solutions to mitigate exposure risk of environmental hazards.

www.nasa.gov

One Health Connections across Scientific Disciplines

Advancing Air Quality Assessments to Protect US Military Personnel
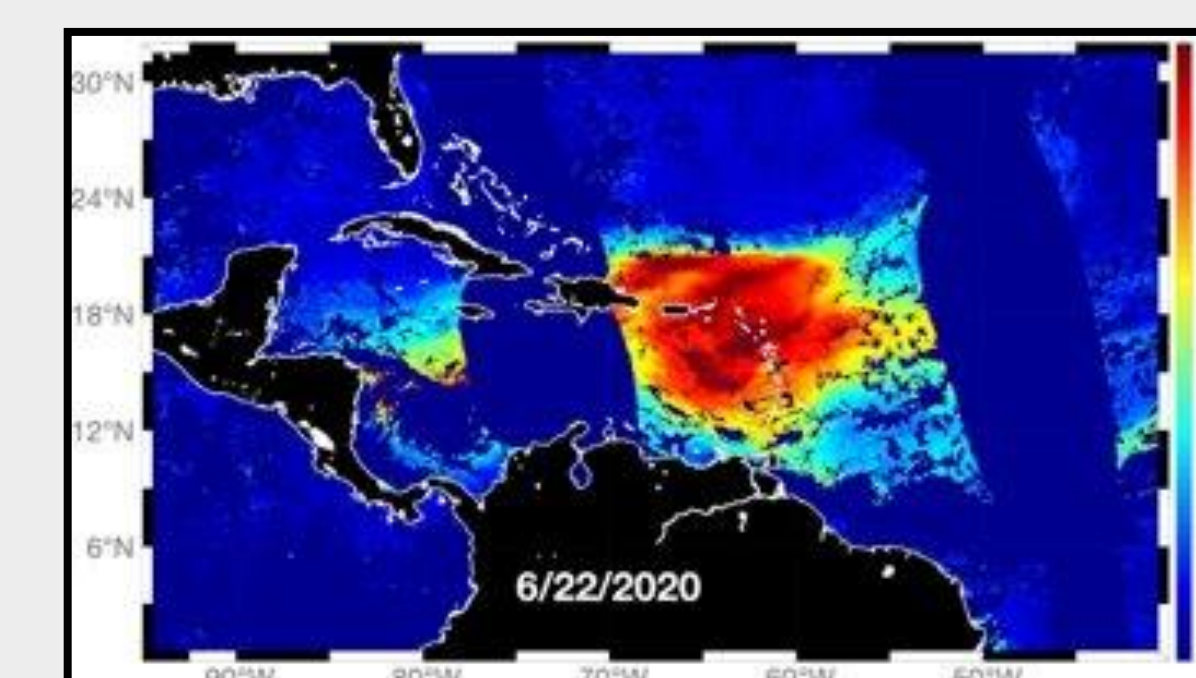

PM$_{2.5}$ concentrations
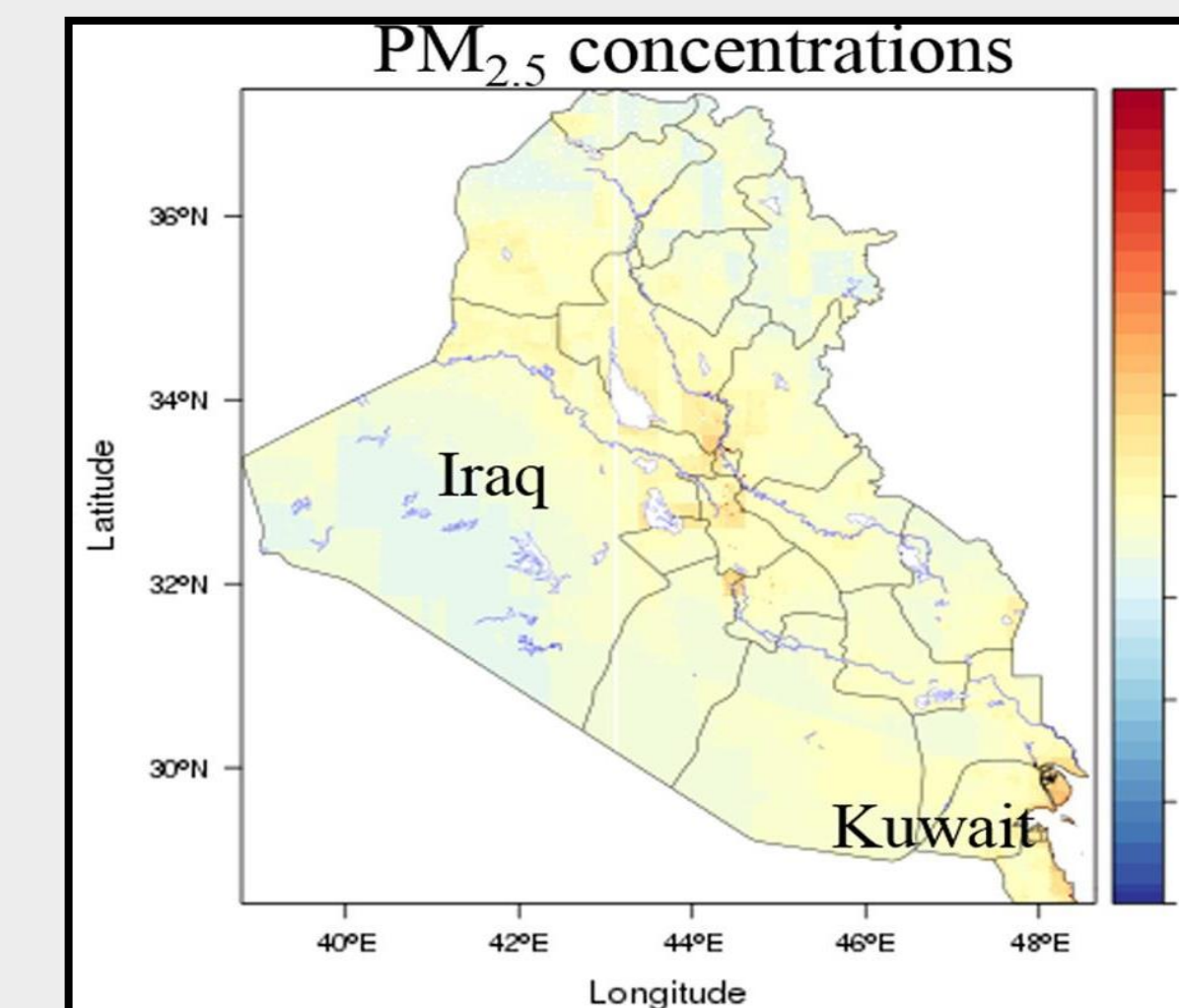
Spatial distribution of predicted mean PM$_{2.5}$ concentrations (μg/m^3) in each 1km^2 grid (2001-2018 avg) in Iraq/Kuwait. Credit: M. Franklin

❖ *Exposure to airborne particulate matter (PM) can cause adverse cardiovascular and respiratory effects on military personnel deployed to US bases in Southwest Asia, Djibouti and Afghanistan (SADA).*

❖ Exposure-related health impact assessments are challenging due to limited ground monitoring and estimations of size- and source-specific PM exposures.

❖ Scientists are using **MODIS/MISR aerosol data**, **MODIS active fire data** and **MERRA-2 data** within a PM exposure tool (SDAQS-SADA) used in research and clinical settings, which enables VA/DoD end-users to make informed decisions about protecting health of current and future deployed military personnel in SADA.

❖ **PI: Meredith Franklin, University of Southern California**

Forecasting Saharan Dust Events in the Caribbean

Suomi NPP VIIRS data (AOD/dust concentration) (Jun 22, 2020). Credit: P. Méndez-Lázaro

❖ *Saharan dust storms, which cross the Caribbean and fertilize soil and coral reefs with nutrients, can adversely impact air quality and human health.*

❖ Limited ground monitoring hinders the ability to predict these dust storms and mitigate health risks to the public.

❖ Scientists use aerosol optical depth data from **MODIS, VIIRS,** and **GOES-16**, for the Experimental Aerosol Monitoring Support Tool on the Caribbean Coastal & Ocean Observing System (CARICOOS) platform, to support decision-making activities with 19 community partnerships for aerosol monitoring and public health advisories in the Caribbean basin.

❖ **PI: Pablo Méndez-Lázaro, University of Puerto Rico Medical Sciences Campus**

Improving Dust Forecasting for Air Quality and Public Health
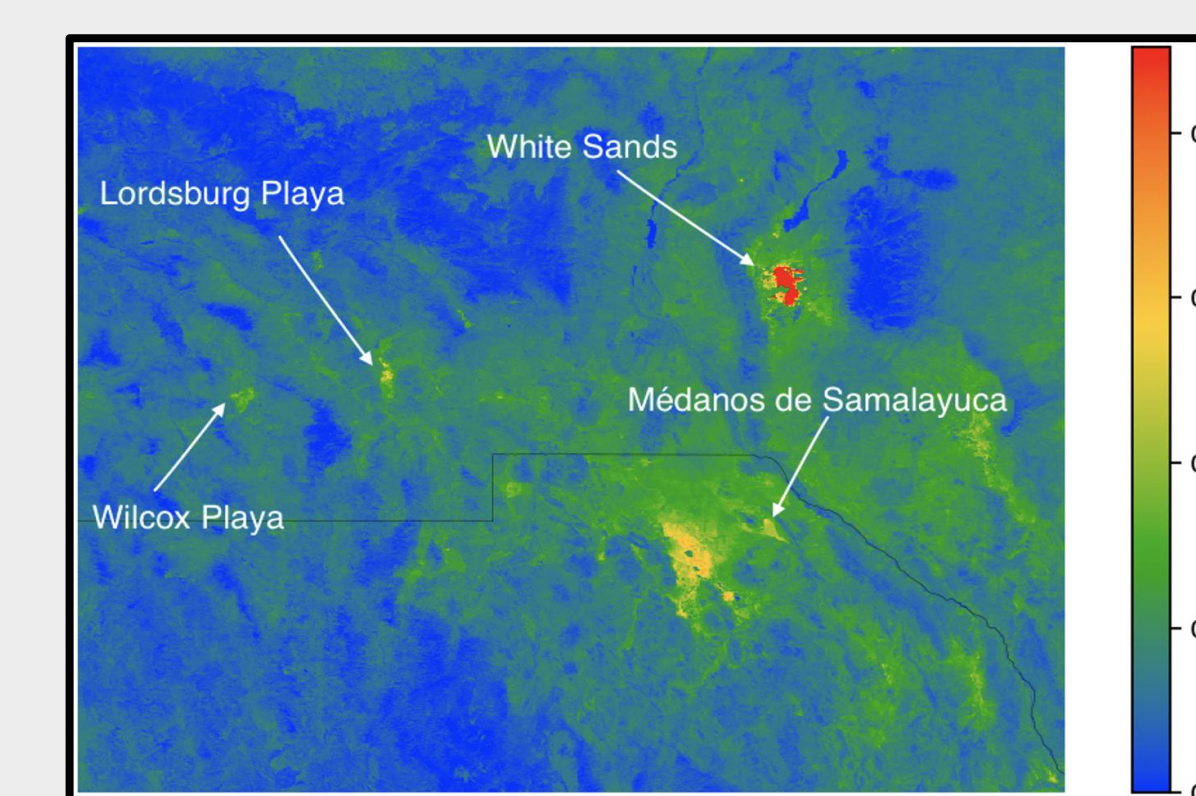
High-resolution albedo-based dust source map of northern Chihuahua, June 2020, using revised Chappell and Webb method. Credit: B. Baker

❖ *The occurrence of dust storms in the southwestern US has doubled between 1990s-2000s, which has increased the incidence of Valley fever infections, highway accidents, and crop and property damages.*

❖ Current forecasting and surveillance activities do not routinely incorporate satellite observations at sufficient spatial and temporal resolution.

❖ Scientists use **MODIS**, **Landsat**, and **OMI** to provide more accurate estimates of dust and NOx emissions for air quality management, public health surveillance, and highway safety in the US.

❖ **PI: Daniel Tong, George Mason University**