

Jet Propulsion Laboratory
California Institute of Technology

NASA's Multi-Angle Imager for Aerosols: Addressing the Health Impacts of Particulate Air Pollution

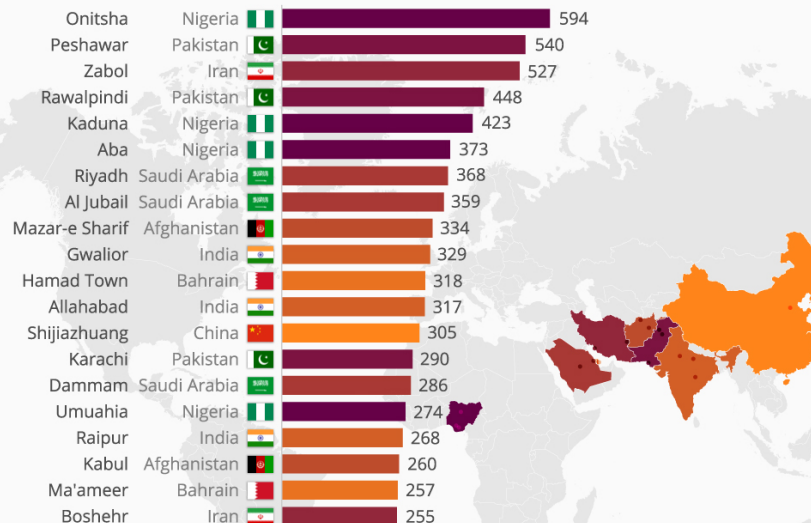
Abigail Nastan, David J. Diner, and the MAIA Team
HAQAST5, January 4, 2018

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Government sponsorship acknowledged.

90% of the world's urban population lives in areas exceeding WHO's air quality guidelines

The 20 Worst Cities Worldwide For Air Pollution

Annual mean micrograms per cubic metre of PM10 in cities worldwide



@StatistaCharts Source: WHO

statista

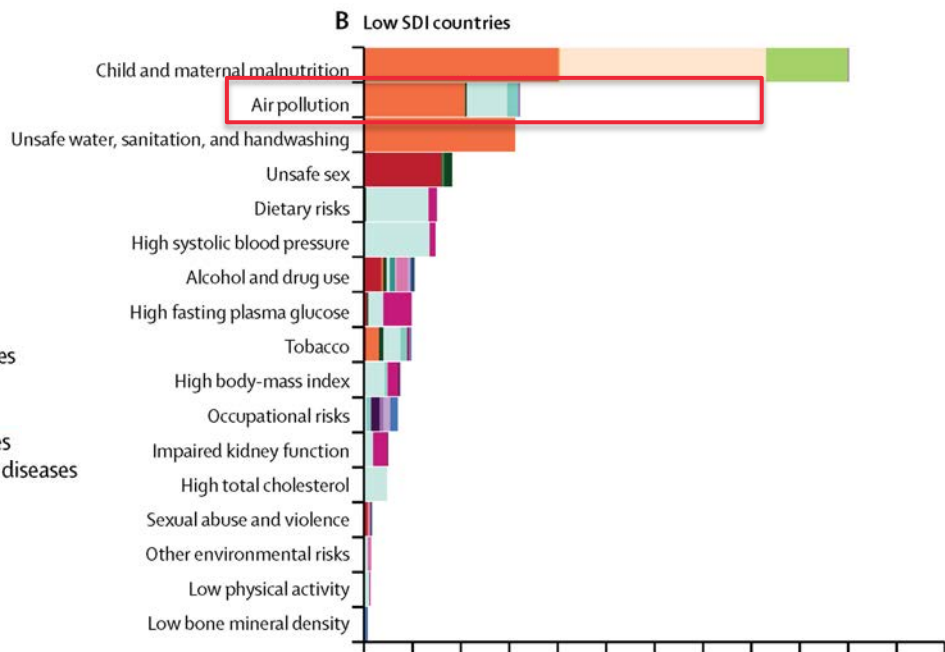
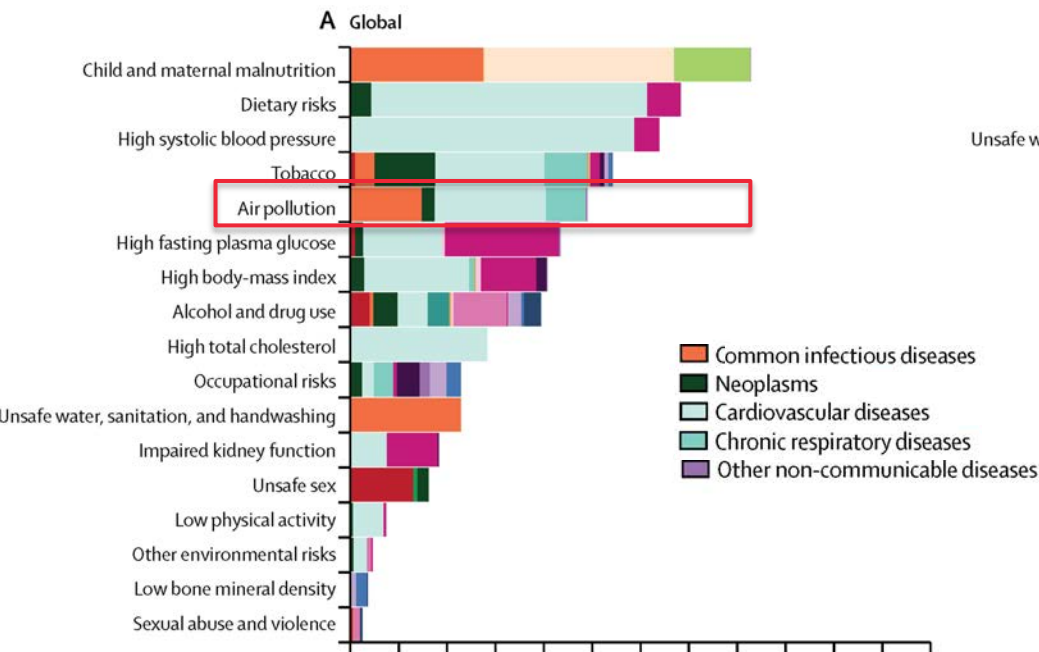
Niall McCarthy



Bobak, CC BY-SA 2.5



Particulate matter (PM) air pollution is the **top environmental risk factor** for disease:



Global Burden of Disease 2016 Risk Factor Collaborators, 2017

Open question: Which **mixtures** of PM constituents are most harmful to humans?



Sulfate, nitrate, BC, OC



BC, OC

NOMAD, CC BY 2.0



Nitrate

Aqua Mechanical, CC BY 2.0



BC, OC, nitrate



Dust

Leaflet, CC BY-SA 3.0

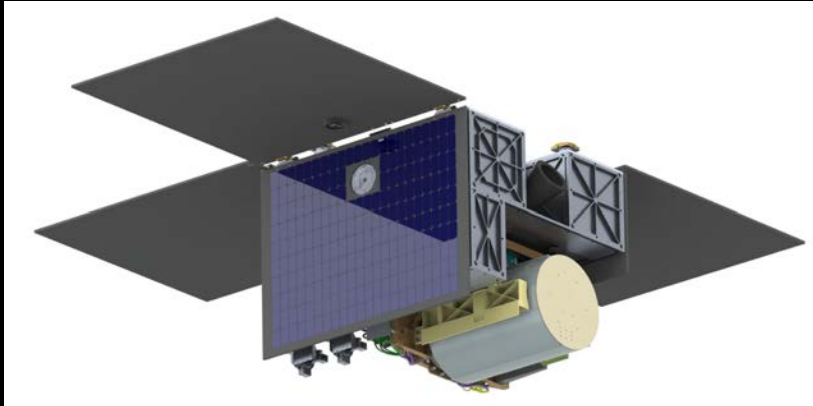
HAQAST5



Sulfate

Multi-Angle Imager for Aerosols (MAIA)

MAIA was selected in 2016, with launch in 2022 (to be confirmed) and a baseline mission of 3 years.



General Atomics

MAIA's science objective is to study the effects of various **types** of PM on:

- ✓ Acute illness and premature death
- ✓ Adverse birth outcomes
- ✓ Chronic disease

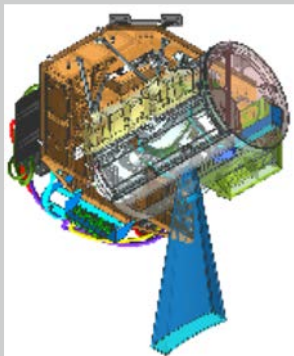
MAIA health studies are planned on PM types for ≥ 10 **Primary Target Areas (PTAs)**

The PTA candidates have been chosen based on:

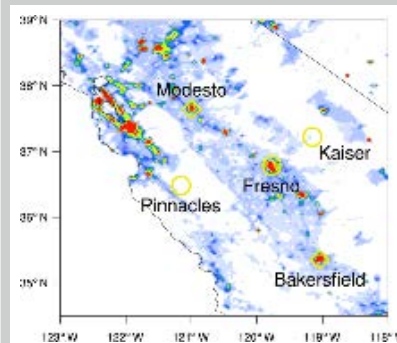
- ✓ Population
- ✓ PM characteristics
- ✓ Surface monitor data
- ✓ Health data
- ✓ Remote sensing considerations



The MAIA investigation concept



L. Tsutsui, KVPR



MAIA instrument

- Calibrated, georectified image data for retrieval of column-integrated AOD, fractional AOD, particle size.

Surface PM monitors

- Used to calibrate the aerosol-PM relationships.
- MAIA will use existing PM networks and deploy additional speciation monitors.

WRF-Chem

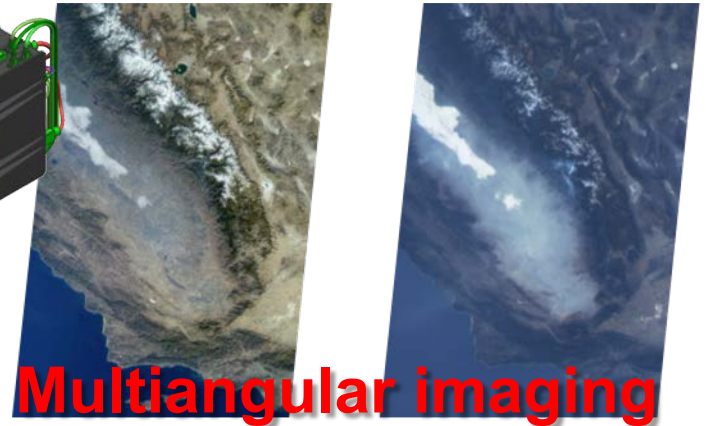
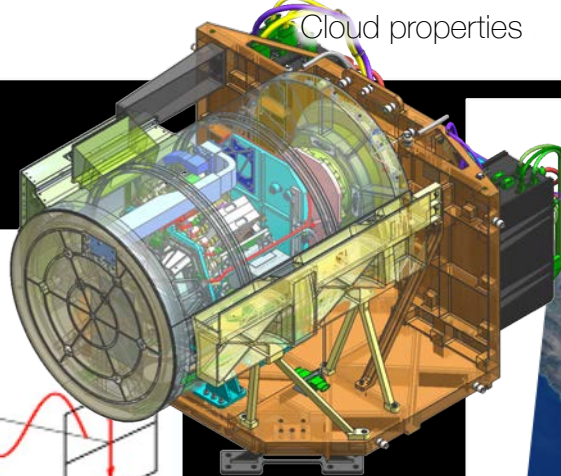
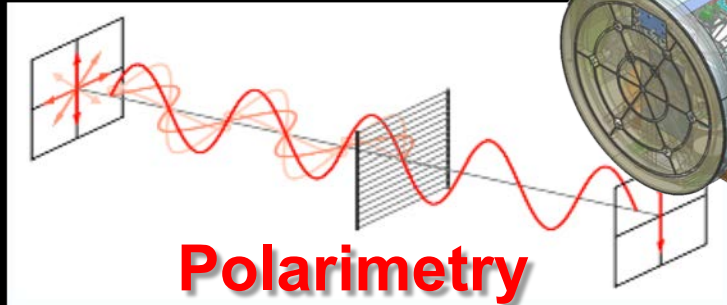
- Constrains aerosol vertical distribution.
- Assists spatial/temporal gap-filling.

Health records

- Obtained from Vital Statistics, hospitals, HMOs, administrative records, cohorts.
- Used to associate PM exposure with health effects.

The MAIA satellite instrument approach combines several remote sensing technologies:

Multispectral imaging



MAIA's Science Team combines data creators, data users, air quality and public health specialists

Principal Investigator	
David Diner	JPL

Co-Investigators: Instrument Characterization	
Carol Bruegge	JPL
Russell Chipman	Univ. of Arizona
Veljko Jovanovic	JPL

Co-Investigators: Aerosol Remote Sensing, Modeling, Validation	
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Michael Garay	JPL
Edward Hyer	Naval Research Lab.
Olga Kalashnikova	JPL
Alexei Lyapustin	GSFC
Randall Martin	Dalhousie University
Jun Wang	University of Iowa
Feng Xu	JPL

Co-Investigators: PM Exposure, Epidemiology	
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Michael Jerrett	UCLA
Yang Liu	Emory University
Bart Ostro	UC Davis
Beate Ritz	UCLA
Joel Schwartz	Harvard University

Collaborators: Air Quality and Public Health	
Sagnik Dey	IIT Delhi
Sina Hashimenassab	SCAQMD
Kembra Howdeshell	NIH
John Langstaff	EPA
Pius Lee	NOAA
Fuyuen Yip	CDC

Next steps...

- Finalize PTA selections
- Begin secondary target selection

AMS Town Hall

NASA's Multi-Angle Imager for Aerosols (MAIA):
Investigating the Health Effects of Particulate Air
Pollution

Tuesday, January 08, 2019, 07:00 - 08:15 AM

North 224A

Questions?

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