

The NASA Multi-Angle Imager for Aerosols (MAIA) Mission: Project Updates, User Needs, and Simulated Data

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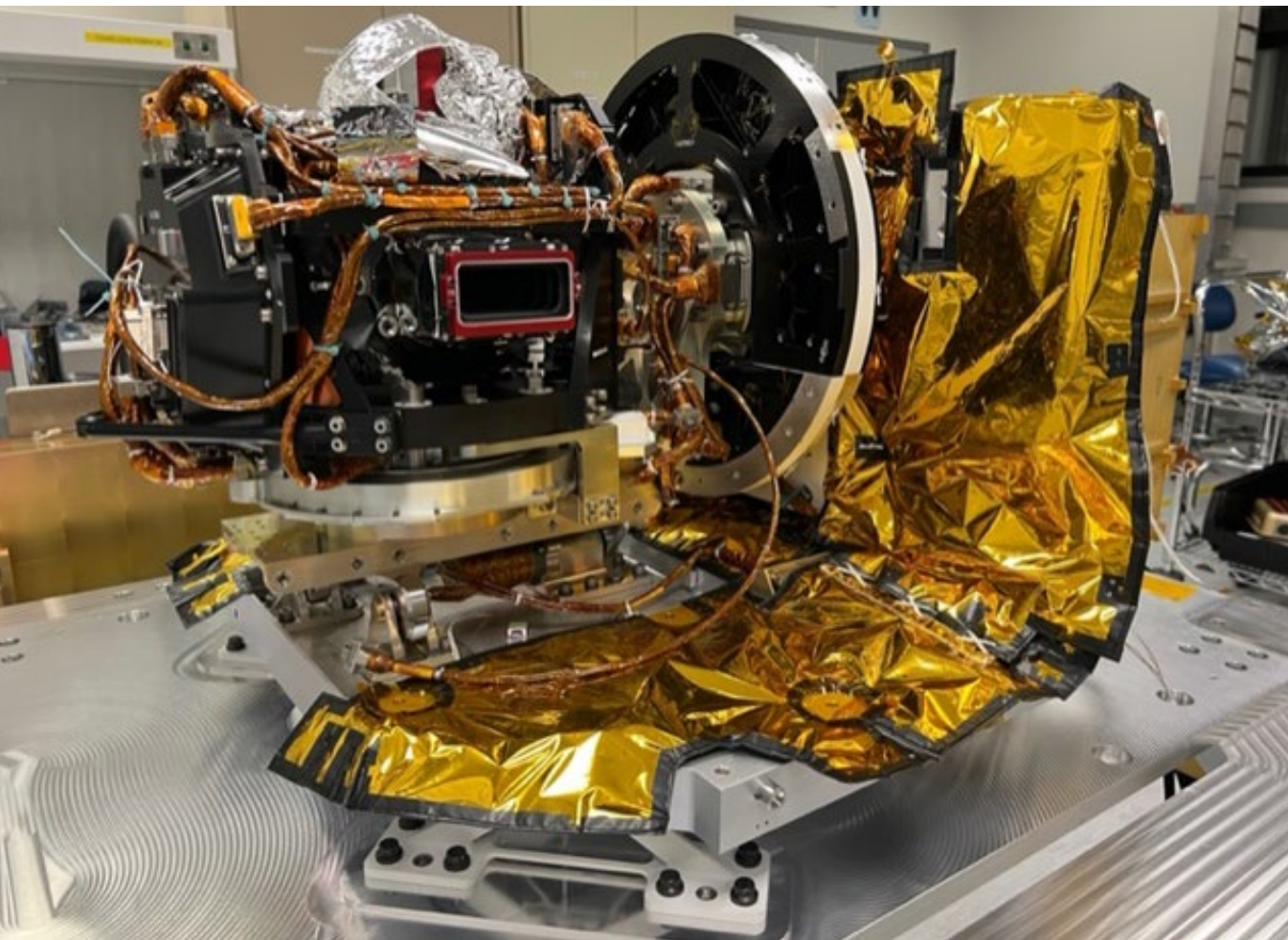
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1. The Multi-Angle Imager for Aerosols (MAIA)

Particulate matter (PM) air pollution is estimated to cause over 4 million premature deaths every year. However, the impacts of different types of PM (i.e., mixtures with different proportions of sulfates, nitrates, organic carbon, black/elemental carbon, and dust) is less understood. The NASA Multi-Angle Imager for Aerosols (MAIA), currently scheduled for launch circa 2024, will seek to understand the health effects of different types of PM. The satellite instrument will collect multiangular, multispectral, and polarimetric observations over a set of Primary Target Areas (PTAs), from which speciated PM concentrations will be derived. Epidemiologists on the MAIA Science Team will use this data to conduct studies connecting particle mixtures to health outcomes.



2. Project Updates



The MAIA instrument in the lab at JPL. Note that the cover is not on the instrument for this photo, allowing you to see the cabling and gimbals.

In November 2021, discussions were initiated with the Italian Space Agency (ASI), who has expressed interest in contributing one of their PLATINO spacecraft as the host platform for MAIA. In June 2022, NASA and ASI started work on an agreement that would enable hosting MAIA on an Italian spacecraft. ASI is also exploring possible provision of portions of the ground system and launch. The expected launch date under this agreement would be 2024.

The MAIA data system and installation of supplemental surface monitors is also proceeding on schedule. The monitors funded by the MAIA project include 6 SPARTAN stations, 9 AMOD mass/speciation monitors, a network of 11 PurpleAir low-cost monitors in Ethiopia, and 4 real-time black carbon aethalometers. Installation of all monitors is expected to be complete by the end of this year.

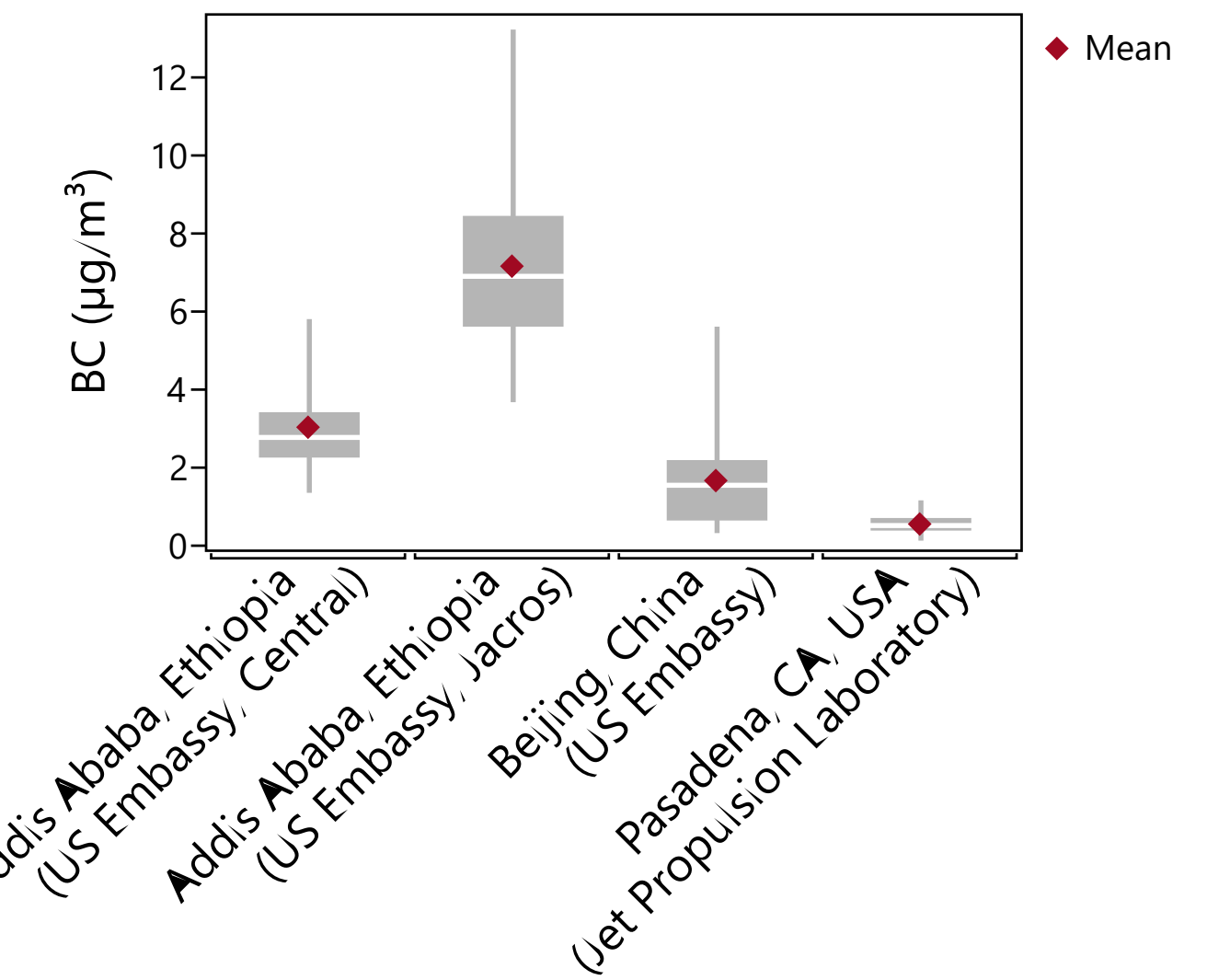
National Aeronautics and Space Administration
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The MAIA satellite instrument has been assembled at JPL. It is currently undergoing environmental testing, which simulates the stresses of launch and the space environment to ensure it will function as designed once launched. The instrument will be fully tested and ready for delivery before the end of fall.

The MAIA camera has also undergone pre-launch calibration and testing.



An image taken by the MAIA camera in the lab during calibration.

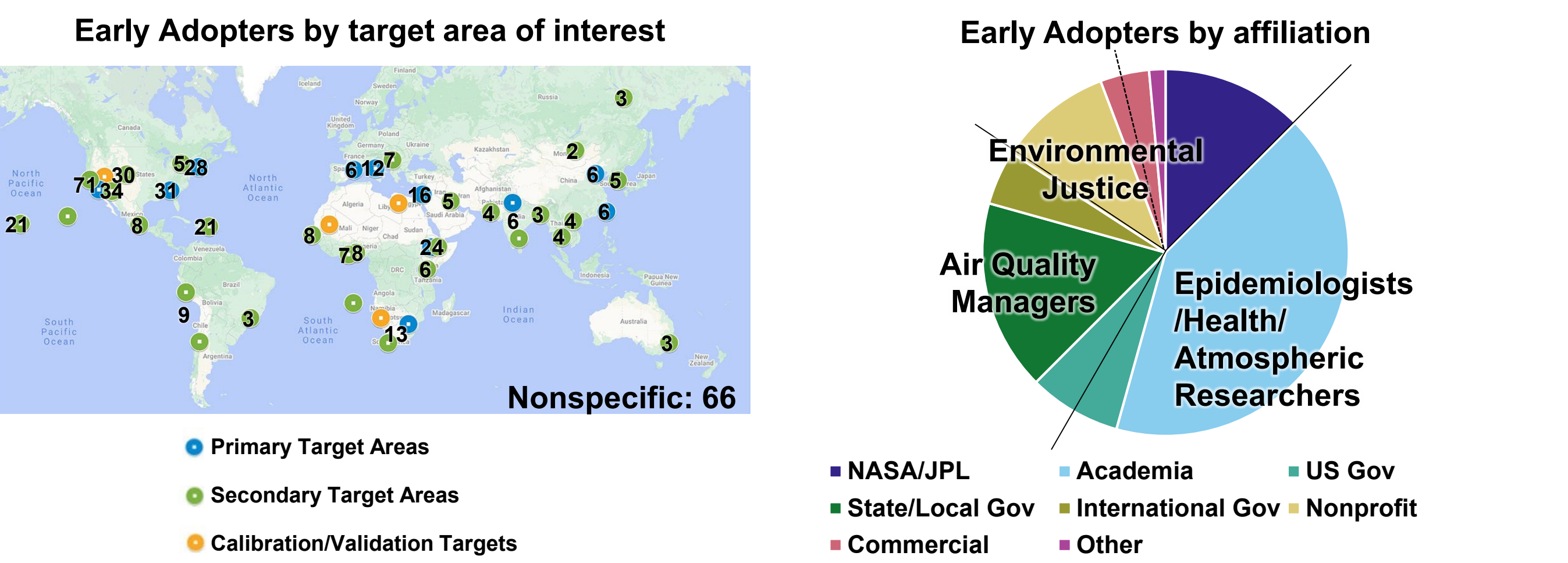


Preliminary results from the black carbon aethalometers installed by the MAIA project in various locations. This data covers the time period April-May 2022.

3. Understanding MAIA User Needs

The MAIA Early Adopters Program give stakeholders and potential data users opportunities to get involved with the project before launch, providing feedback on the projects' plans and data products. MAIA Early Adopters have contributed valuable information about their use cases and needs through four Early Adopters workshops and several conference town halls, seminars, etc. that have taken place since 2019.

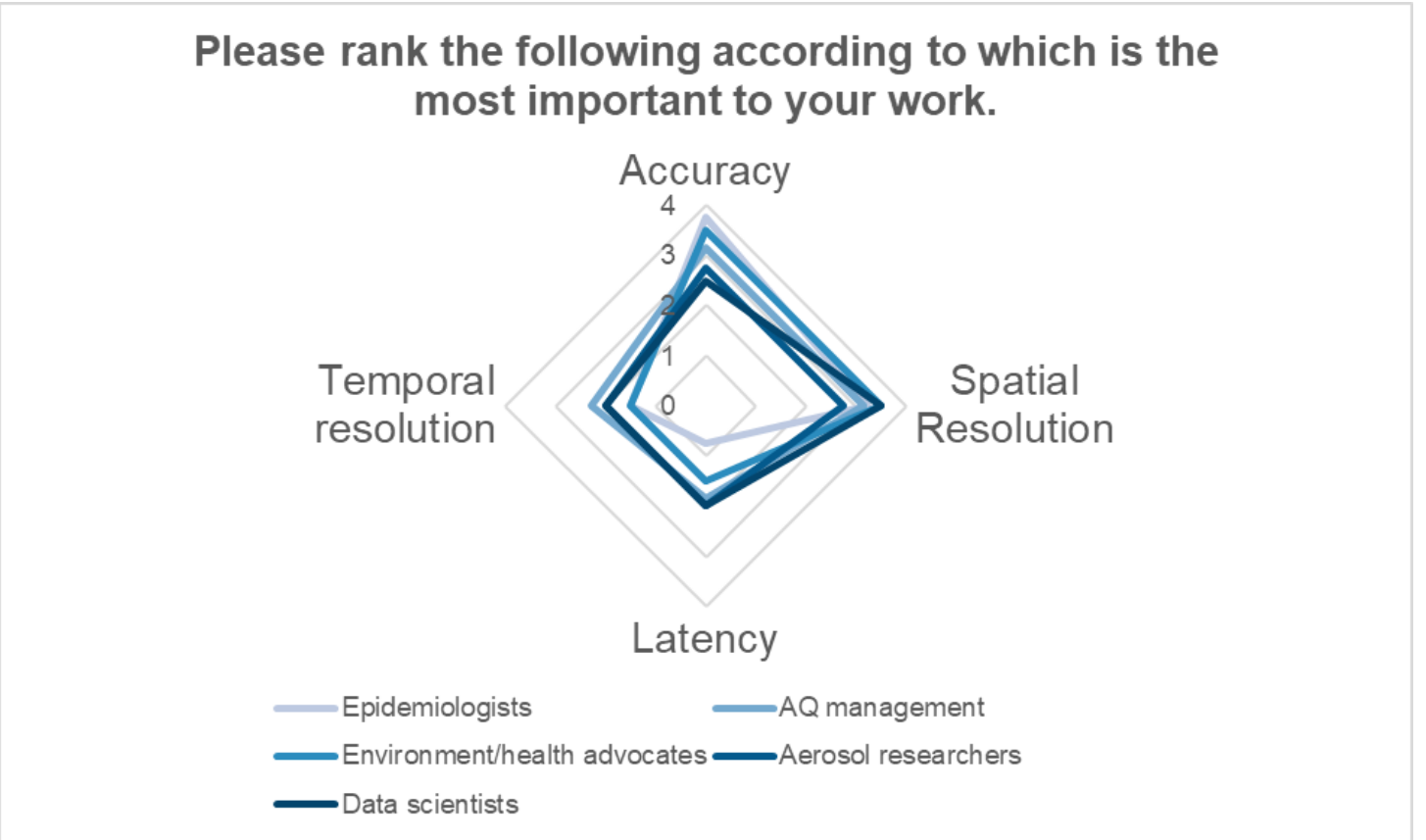
Early Adopters' needs vary depending on their community and geographic interests. See below for the makeup of the MAIA Early Adopters.



Note that not all MAIA Early Adopters fall into the three categories listed on the chart at right, but those are the largest user communities by number.

While many of the Secondary Target Areas (green targets on the map at left) were added by request from Early Adopters, the community has been made aware that it may not be possible to process the MAIA surface-level PM concentration product in STAs; it will certainly be available in PTAs. Therefore the needs of some interested in the STAs may geared toward creating their own PM models with MAIA data as input. The Level 2 aerosol product has been designed with this use case in mind.

MAIA has no plans (or funding) to create near-real time data products. Due to its low-Earth orbit, MAIA can also only produce daily averaged PM data. While self-selection is no doubt a factor, the Early Adopters community's needs match up well with these limitations, prioritizing accuracy and spatial resolution (right).



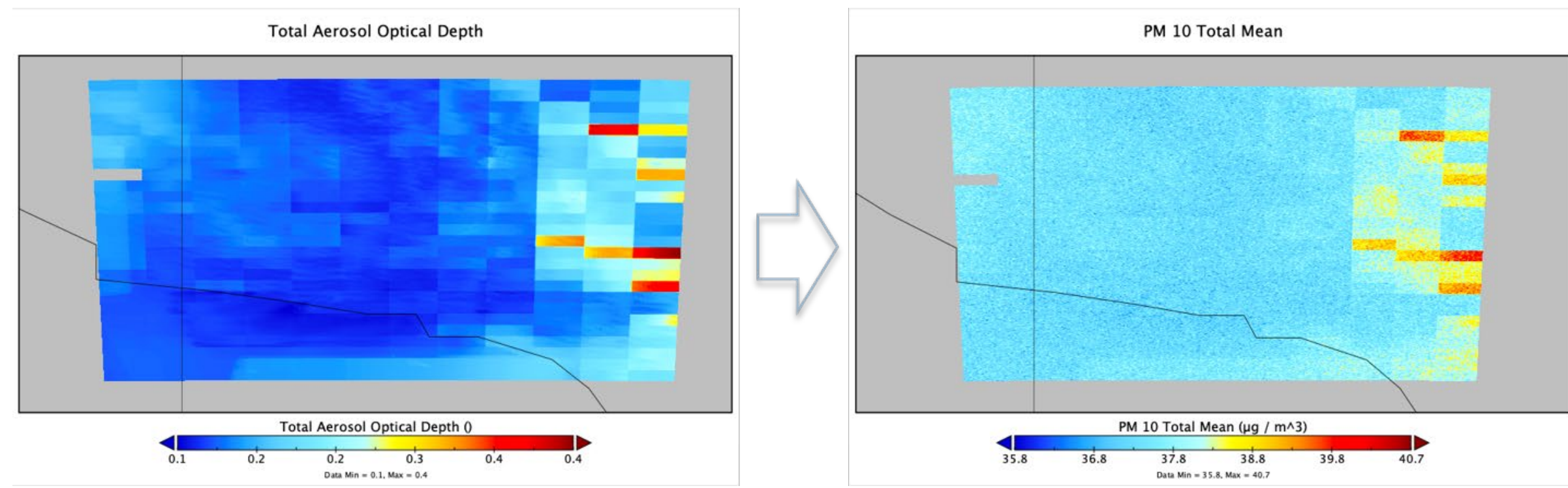
Early Adopters use a wide variety of data tools and have varying previous experience with NASA data. Compatibility with GIS programs and the ability to export data in CSV form are high priorities. During the August 2022 MAIA-TEMPO Environmental Justice Workshop, users ranked their level of concern about various data-related tasks from 0 (low) to 10 (high), see chart below. Concerns varied significantly across user communities. Air quality/aerosol researchers only expressed significant concern about deriving actionable information (which was also a concern among all other user communities), while environmental justice representatives were the only community to express major concern about finding the products online. Download speeds were not very concerning (MAIA data will be available in the cloud for viewing and analysis). This information can be used to guide future tool development and capacity building activities.

	Everyone	EJ/ citizen science	AQ Management	AQ/aerosol research	Epidemiology/ health research	I work at NASA/JPL	Other/ unspecified
Finding the products online	3.3	9.5	4.1	1.3	5	2	0.7
Adequate internet speeds for download	1.5	0.5	3.3	0.2	0.5	0.5	0
Compatibility with software/process/system	4.2	4.5	5.6	2.7	2	7.5	1.7
Time to learn new software/tools	4.8	8	5.3	3.1	8.5	9	0
Finding resources to learn about the products	4.2	5	5.1	2	7	6.5	2.3
Time to process into needed information	5.9	9.5	5.6	6.1	8	5.5	8

4. MAIA Simulated Data

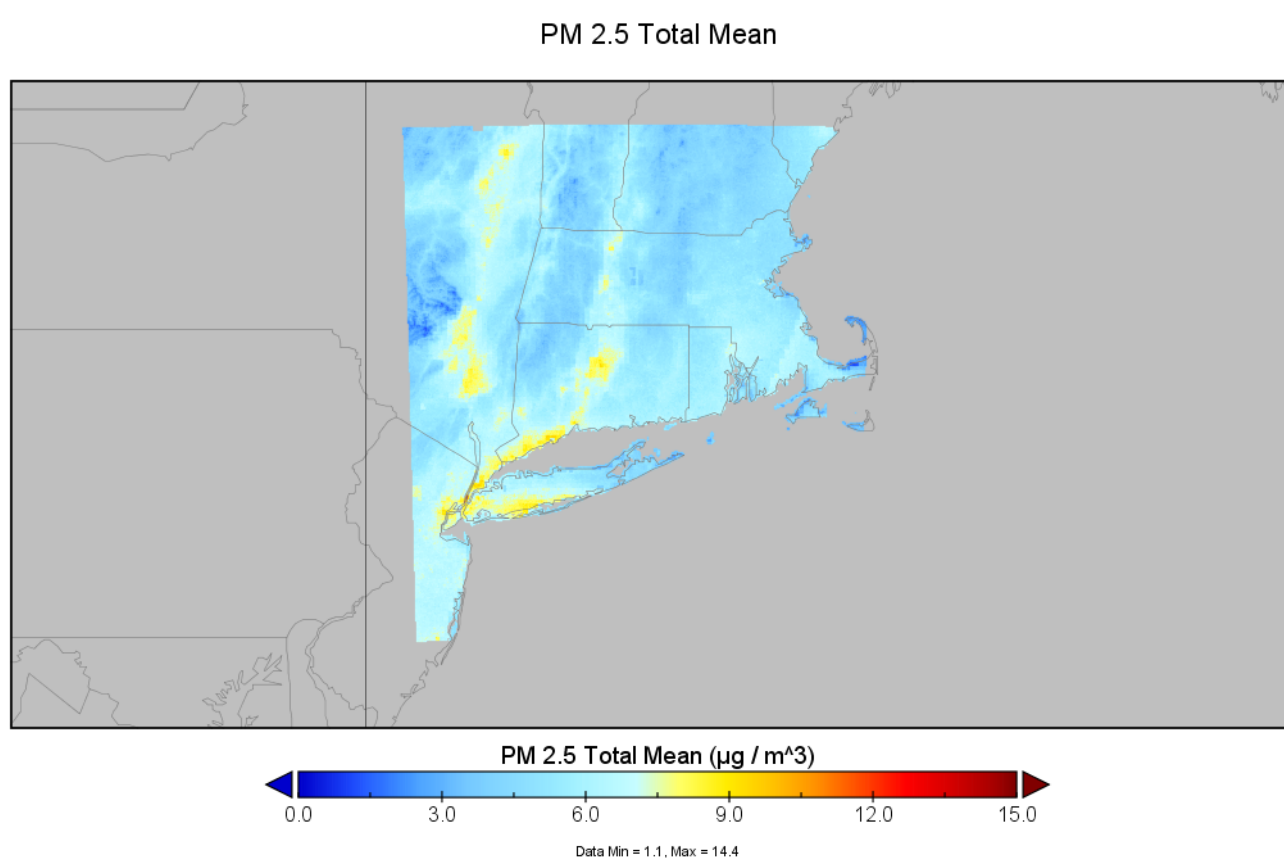
Simulated Data is intended to help Early Adopters make preparations for the actual MAIA data after launch. Simulated Data can be used to check compatibility of the data products against current systems, write code to process MAIA files, or simply to better understand what the MAIA data will have to offer.

The first version of the MAIA Simulated Data, made available in Fall 2021, is the result of basic software tests of the MAIA data system. The contents of the files are not meant to represent reality in any way, but they still provide insight into the structure of the files and the included parameters.



Plots made with the currently available version of the MAIA Simulated Data (aerosol product, left, and Level 2 PM product, right).

Currently, the MAIA team are working on making a new dataset available that will give a more realistic picture of what to expect from MAIA data. MAIA Science Team member Dr. Yang Liu has generously offered to make available a dataset created for the New York City Health Department, which provides MAIA-like results for the USA-Boston target area (which also covers New York City) daily for the year 2018, created from a combination of WRF-Chem modeling and GOES-16 satellite data.



An example of total PM2.5 results from Dr. Yang Liu's MAIA-like dataset covering the USA-Boston target area. This plot is of daily-averaged results from January 7, 2018.

5. For More Information

If you would like to join the MAIA Early Adopters mailing list, please fill out the (very simple) form at <https://go.nasa.gov/3SZO3ta> (or scan the QR code to the right) and email it to abigail.m.nastan@jpl.nasa.gov. Upon joining, you'll receive invitations to all future MAIA Early Adopters events and notification of data releases, etc.

If you'd like to receive a copy of the Simulated Data discussed in section 4, as well as all future releases of the data, please fill out the data access agreement at <https://go.nasa.gov/3ry4cdv> (or scan the QR code to the right), which outlines the acceptable use of the Simulated Data, and email it to abigail.m.nastan@jpl.nasa.gov.

For more information about the MAIA target areas, data products, and mission approach, check the MAIA website: <https://maia.jpl.nasa.gov>.

And please feel free to email me any time with MAIA questions!

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