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Current status of the spaceborne and in-situ observational elements of the Multi-Angle Imager for Aerosols (MAIA) mission

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Exposure to airborne particulate matter (PM) has been associated with a wide variety of health problems. However, the relative toxicity of specific PM types – mixtures of particles having different sizes, shapes, and chemical compositions – is less well understood. As part of NASA's Earth Venture Instrument (EVI) program, the MAIA-EVI investigation will acquire systematic spaceborne and in-situ observations aimed at linking inhalation of PM_{10}, $PM_{2.5}$, and major $PM_{2.5}$ chemical species (sulfates, nitrates, elemental carbon, organic carbon, and dust) with adverse health outcomes [1].

NASA and Agenzia Spaziale Italiana (ASI) recently agreed to implement the MAIA mission as a joint partnership [2], with ASI contributing the PLATiNO-2 spacecraft, Mission Operations Center, and launch. A set of MAIA-ASI science objectives is being established to complement the MAIA-EVI investigation. The NASA-provided satellite instrument contains a 14-wavelength UV-SWIR pushbroom camera that is pointable in both the along-track and cross-track directions. Three of the spectral bands (440, 646, and 1044 nm) include focal plane polarizers. A dual-photoelastic modulator (PEM) system enables measuring the degree and angle of linear polarization with high accuracy. Acquisition of camera calibration and instrument performance data, and environmental testing of the assembled instrument, were completed at JPL in late 2022. Launch is currently anticipated in late 2024. A sun-synchronous polar orbit at 740 km altitude with mid-morning equator-crossing time is planned.

MAIA's satellite-based multiangular, multispectral, and polarimetric imagery will be used to retrieve aerosol properties over a set of Primary Target Areas (PTAs) in the US, Europe, Middle East, Africa, and Asia. In-situ air quality monitors will be used to calibrate geostatistical regression models that incorporate the satellite-based aerosol data, outputs from the WRF-Chem chemical transport model, and ancillary land use information as predictors of daily-averaged PM concentrations, which will be mapped on a 1-km spatial grid. Operational PM speciation monitors are being used where available. Most PTAs, however, have required deployment of PM monitors by the MAIA-EVI project. The surface network is currently acquiring prelaunch data in preparation for the flight mission.

Keywords: MAIA, airborne particulate matter, health outcomes

References

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