Prelaunch status of the Multi-Angle Imager for Aerosols (MAIA) satellite instrument and ground-based air pollution monitoring network

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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. To address this issue, the MAIA-Earth Venture Instrument (EVI) investigation will use spaceborne and in-situ air quality data and birth, death, and hospitalization records to link inhalation of total and speciated PM with adverse health outcomes. The investigation is part of the broader MAIA mission, which is being implemented as a partnership between NASA and Agenzia Spaziale Italiana (ASI). ASI is contributing the spacecraft, mission operations center, and launch, and is also coordinating surface-based air pollution monitoring activities and complementary scientific investigations in Italy. MAIA launch into polar Earth orbit is expected to occur no earlier than late 2025.

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) make use of focal plane polarizers and a dual-photoelastic modulator system to determine the degree and angle of linear polarization with high accuracy. Preflight performance data from the as-built instrument are being used to inform the radiometric, polarimetric, and geometric calibration algorithms and lookup tables.

MAIA instrument data will be used to retrieve column-integrated aerosol properties at 1 km spatial resolution within a globally distributed set of target areas located in North America, South America, Europe, the Middle East, Africa, and Asia. Estimation of near-surface PM_{10}, $PM_{2.5}$, and speciated (sulfate, nitrate, organic carbon, elemental carbon, and dust) $PM_{2.5}$ mass concentrations will employ geostatistical regression models that use the retrieved aerosol parameters, chemical transport model outputs, meteorological data, and land-use information as PM predictors. Measurements from a network of surface monitors, including those that measure particle chemical speciation, are used to calibrate the regression models. Operational PM monitors are employed where available, though many target areas have required deployment of equipment by the MAIA-EVI project. Prelaunch acquisitions and analyses of the surface monitor data are currently underway.

Preferred mode of presentation: Invited