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MAIA Aerosol Retrieval: Algorithm Development and Test

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NASA's Multi-Angle Imager for Aerosols (MAIA) instrument is currently planned to launch into sun-synchronous Earth orbit in late 2024 aboard a spacecraft provided by the Italian Space Agency. The primary objective of the MAIA Earth Venture Instrument investigation is to investigate the health effects of exposure to different types of airborne particulate matter. This requires the derivation of aerosol microphysical properties and abundances from MAIA's radiometric and polarimetric multi-angle measurements of scattered sunlight. Ten of the instrument's 14 spectral bands, ranging from the ultraviolet to shortwave infrared, will be used in the retrievals, along with polarimetric measurements in two visible and one shortwave infrared band. To this end, we have developed the Level-2 aerosol inversion algorithm, which combines the use of MAIA measurements, a priori constraints on the spatial variations of aerosol properties, and climatological AErosol RObotic NETwork (AERONET) information on aerosol types and fine mode aerosol fraction. We conducted retrieval tests using airborne measurements collected by the Airborne Multiangle SpectroPolarimetric Imager (AirMSPI) and satellite-borne measurements acquired by the POLarization and Directionality of the Earth's Reflectances (POLDER) as proxies for MAIA data. Retrieval comparisons were made against reference aerosol products from AERONET and the Generalized Retrieval of Atmosphere and Surface Properties (GRASP) algorithm. To improve computational processing speed, we plan to use a neural-network (NN) to train the radiative transfer (RT) module, which is expected to reduce the retrieval time by up to two orders of magnitude. The accuracies of the NN-RT module and the NN-RT based aerosol retrieval are assessed by comparing their output against the results from using the full RT calculation.

Keywords: multi-angle polarimetry, inversion algorithm, aerosols, radiative transfer