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Advancing retrieval techniques for polarimetric remote sensing of atmospheric aerosols

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In the 2020s, a number of satellites with Multi-Angle Polarimetric (MAP) instruments will be launched, such as METOP-SG from ESA/EUMETSAT with the 3MI polarimeter, the NASA PACE mission with onboard the SPEXone and HARP-2 polarimeters, the ESA CO2M-mission, and in the late 2020s the NASA ATMOS mission. MAP measurements provide the largest information content on aerosol properties from a passive remote sensing point of view, and allow accurate retrieval of aerosol optical properties (optical thickness, single scattering albedo, phase function) and microphysical properties (size distribution, refractive index, shape), needed for climate and air quality research. So, the expectation is that the quality of aerosol remote sensing measurements will advance significantly in the coming years. To cope with the increased information content of MAP instrumentation advanced retrieval algorithms need to be (further) developed. Here, full inversion approaches are needed that consider a continuous space of aerosol microphysical properties (size distribution, refractive index), instead of using standard aerosol models, and to properly account for land or ocean reflection by retrieving land or ocean parameters simultaneously with aerosol properties. Currently, there are two full inversion algorithms that have proven capability at a global scale: the Generalized Retrieval of Aerosol and Surface Properties (GRASP) algorithm [1,2,3,4], developed at University of Lille and the GRASP-SAS company, and the Remote Sensing of Trace gas and Aerosol Products (RemoTAP) algorithm [5,6,7,8], developed at SRON Netherlands Institute for Space Research. This presentation focuses on the development and application of the SRON-RemoTAP algorithm for aerosol retrievals. First, we discuss the performance of RemoTAP for POLDER-3/PARASOL retrievals and evaluate the performance against AERONET. Next, we will provide a detailed comparison between RemoTAP and GRASP as performed within the ESA HARPOL (Harmonizing and advancing retrieval approaches for present and future polarimetric space-borne atmospheric missions) project (www.sron.nl/harpol). The RemoTAP – GRASP comparison is performed for both simulated and real measurements. For PARASOL retrievals, we show the comparison between RemoTAP and GRASP over AERONET stations as well as for a year of global data. From the comparison, we conclude that comparison between RemoTAP and GRASP, as well as the comparison of the individual algorithms against AERONET, has significantly improved during the HARPOL project.

Keywords: aerosol retrieval, RemoTAP, GRASP.

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