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Vertical profiles of aerosol chemical species concentration retrieved through synergy of spaceborne lidar and polarimeter observations

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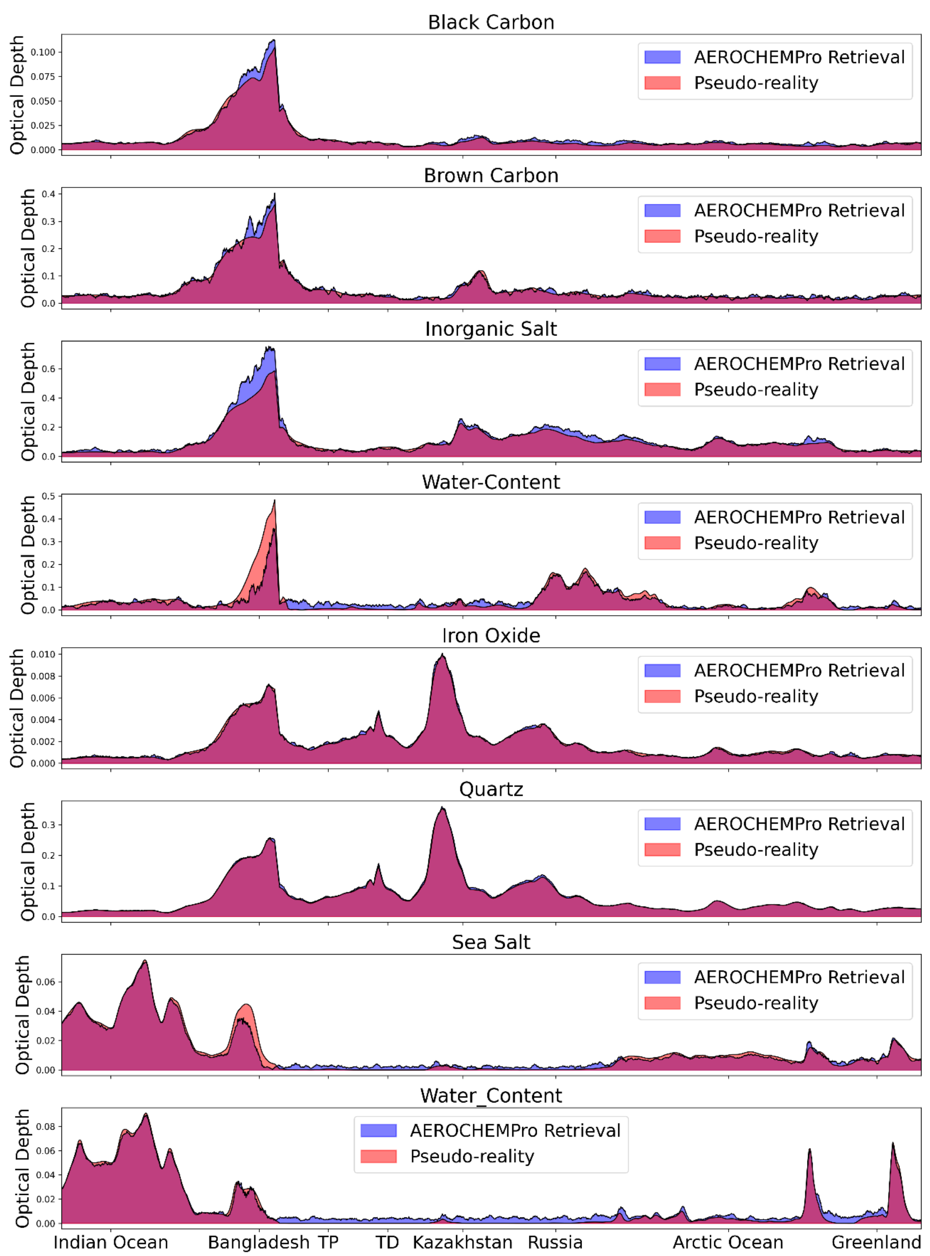

Figure S1. Aerosol optical depth at 532 nm of individual aerosol chemical species along the transect (Indian Ocean to Greenland), comparing AEROCHEMPro retrievals and Pseudo-reality simulations. Panels include: black carbon, brown carbon, inorganic salt, water content associated with fine particles, iron oxide, quartz, sea salt and water content associated with it

Figure S1 presents an AEROCHEMPro product derived from the state-vector variables, similarly to Fig. 10. The aerosol optical depths (AODs) of the individual chemical species derived from the AEROCHEMPro retrieval, assuming vertically constant mixing ratios within each mode, are calculated by multiplying the fraction ($Frac_i$) of each chemical species by the corresponding retrieved modal AOD (Fig. 9b). This derived product is indicated in the scheme of Fig. 4.

A detailed comparison of individual chemical species' AOD at 532 nm (Fig. S1 in the Supplement) further demonstrates the method's sensitivity. Black carbon (BC) and brown carbon (BrC) show prominent peaks over Bangladesh, matching the pseudo-reality in both magnitude and structure. While inorganic salt (IS) shows broader enhancements into Central Asia, a high spatial correlation exists between BC, BrC, and IS AODs due to common combustion sources. This validates the retrieval's use of a unified fine-mode vertical distribution. Furthermore, AEROCHEMPro effectively captures the predominance of iron oxide (IO) and quartz (Qz) in dust- active regions like the Taklamakan Desert, as well as sea salt (SS) and coarse water (WC_C) signatures in maritime environments.