Evaluation of an aerosol height retrieval algorithm for Sentinel-5 Precursor: Application to O2 A band observations from GOME-2

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We are developing a retrieval setup for the operational Aerosol Layer Height product for TROPOMI on the Sentinel-5 Precursor mission (launch early 2016). TROPOMI is a nadir-viewing grating spectrometer measuring in the ultraviolet, visual, near infrared and shortwave infrared wavelength range. The Aerosol Layer Height algorithm makes a spectral fit of reflectance of the oxygen A absorption band at 760 nm. The aerosol profile is parameterised by a single scattering layer with constant aerosol volume extinction coefficient and a fixed pressure thickness. The algorithm's target parameter is the height of this layer. We will introduce the algorithm and show case studies with O2 A band observations from GOME-2 to illustrate the algorithm's expected performance. Particular attention is given to the role of the surface albedo in the retrieval. Case studies include comparisons of the retrieved height parameter with lidar measurements.

We find that the surface albedo plays an ambiguous role. On the one hand, retrieving the surface albedo simultaneously with aerosol layer height and aerosol optical thickness improves convergence of the retrieval. We can understand this from retrieval simulations, because current surface albedo climatologies have associated uncertainties that are still so large that they cause non-convergent retrievals when the surface albedo is fixed. On the other hand, a model error in the assumed profile (namely a single uniform layer vs a complex aerosol extinction profile) is partly absorbed by the surface albedo when this parameter is fitted, which in turn causes biases in retrieved aerosol layer pressure. This is expected in view of the correlations between errors in fit parameters and the effect is relatively small for elevated layers. In case of boundary later aerosols near the surface, the effect becomes surprisingly large such that the retrieved height of the single layer can not anymore b e interpreted as an effective or average height parameter.

The current Aerosol Layer Height product will be particularly suited for retrieving the height of optically thick and elevated layers. Anticipated applications of the product are providing aerosol height information for aviation safety and improving interpretation of the Absorbing Aerosol Index.