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Developments in the Aerosol Layer Height Retrieval Algorithm for the Copernicus Sentinel-4/UVN Instrument

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The Sentinel-4 mission is a part of the European Commission's Copernicus programme, the goal of which is to provide geo-information to manage environmental assets, and to observe, understand and mitigate the effects of the changing climate. The Sentinel-4/UVN instrument design is motivated by the need to monitor trace gas concentrations and aerosols in the atmosphere from a geostationary orbit. The on-board instrument is a high resolution UV-VIS-NIR (UVN) spectrometer system that provides hourly radiance measurements over Europe and northern Africa with a spatial sampling of 8 km. The main application area of Sentinel-4/UVN is air quality.

One of the data products that is being developed for Sentinel-4/UVN is the Aerosol Layer Height (ALH). The goal is to determine the height of aerosol plumes with a resolution of better than 0.5 - 1 km. The ALH product thus targets aerosol layers in the free troposphere, such as desert dust, volcanic ash and biomass during plumes. KNMI is assigned with the development of the Aerosol Layer Height (ALH) algorithm. Its heritage is the ALH algorithm developed by Sanders and De Haan (ATBD, 2016) for the TROPOMI instrument on board the Sentinel-5 Precursor mission that is to be launched in June or July 2016 (tentative date).

The retrieval algorithm designed so far for the aerosol height product is based on the absorption characteristics of the oxygen-A band (759-770 nm). The algorithm has heritage to the ALH algorithm developed for TROPOMI on the Sentinel 5 precursor satellite. New aspects for Sentinel-4/UVN include the higher resolution (0.116 nm compared to 0.4 for TROPOMI) and hourly observation from the geostationary orbit.
The algorithm uses optimal estimation to obtain a spectral fit of the reflectance across absorption band, while assuming a single uniform layer with fixed width to represent the aerosol vertical distribution. The state vector includes amongst other elements the height of this layer and its aerosol optical thickness. We will present the development work around the ALH retrieval algorithm in the framework of the Sentinel-4/UVN instrument. The main challenges are highlighted and retrieval simulation results are provided. Also, an outlook towards application of the S4 bread board algorithm to Sentinel-5 Precursor data later this year will be discussed.