The application of ATLID techniques for aerosol/cloud retrievals to ALADIN

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After much anticipation and several years of delay the ALADIN lidar was launched on the Aeolus platform in August 2018. ALADIN is the world’s first space-based Doppler lidar. It operates at 355nm and its main products are line-of-sight winds. Wind-profiles are derived from the Doppler shift of the backscattered signals. Using a variation of the High Spectral Resolution Lidar technique (HSRL), two detection channels are used, a ‘Mie’-channel and a ‘Rayleigh’-channel. Cloud/aerosol information is also present in the signals, however, ALADIN’s design is optimized for wind observations and the retrieval of aerosol/cloud products is secondary (but important for various applications, e.g. the monitoring of atmospheric composition).

While cloud and aerosol products are secondary products for ALADIN, they are primary products for the EarthCARE lidar ATLID. EarthCARE stands for the Earth Clouds Aerosol and Radiation Explorer and is a joint ESA-JAXA multi-instrument cloud-aerosol-precipitation primarily process study oriented mission planned to be launched in 2022 EarthCARE will embark a lidar called ATLID. ATLID, like ALADIN is a 355 nm HSRL system, but is optimized for cloud/aerosol measurements. Compared to ALADIN, ATLID has a higher spatial resolution, measures the depolarization of the return signal and has a much cleaner Rayleigh- Mie backscatter signal separation. Like ALADIN though, the SNR makes accurate retrievals a challenge. Over the past several years, a suite of cloud/aerosol algorithms have been developed for ATLID that have focused on the challenge of making accurate retrievals of cloud and aerosol extinction and backscatter specifically addressing the low SNR nature of the lidar signals and the need for intelligent binning/averaging of the data. These ATLID approaches have reached a certain stage of maturity; however, they have been tested using mainly simulated data with the aid of the ECSIM multi-instrument end-to-end simulator.

The lessons learned by the application of ATLID-like algorithms on ALADIN data would lead to better ATLID products when it is launched. Further, preliminary work indicates that AT LID-inspired techniques can be successfully adapted to ALADIN measurements and have the potential to lead to improvements in the ALADIN extinction and backscatter products. In this presentation, ATLID-like approaches for ALADIN feature detection and extinction and lidar-ratio retrieval (based on an optimal-estimation approach) will be described. Examples will be presented and compared with observations made using ground-based lidars.