ATILD cloud/aerosol algorithms applied to ALADIN

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ALADIN (Atmospheric Laser Doppler Instrument) is the world’s first space-based Doppler wind lidar. It is a direct detection system operating at 355 nm. ALADIN’s primary products are atmospheric 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.

ATLID (Atmospheric Lidar) is the lidar to be embarked on the Earth Clouds and Radiation Explorer (EarthCARE) mission. EarthCARE is a joint ESA-JAXA mission and will embark a cloud/aerosol lidar (ATLID), a cloud-profiling Radar (CPR) a multispectral cloud/aerosol imager (MSI) and a three—view broad-band radiometer (BBR). Both ALADIN and ATLID are HSRL systems, however, ATLID does not measure winds and is optimized exclusively for cloud and aerosol observations. In particular, 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.

With regards to the retrieval of aerosol and cloud properties both lidars face similar challenges. Amongst, these is the fact that the SNR ratio of the backscatter signals is low compared to terrestrial signal, this creates esp. large difficulties when using direct standard HSRL inversion methods. Along-track averaging can increase the SNR, however, the presence of clouds and other inhomogeneities will lead to often very large biases in the retrieved extinction and backscatters if not accounted for in an appropriate manner.

Over the past several years, 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. Two of these ATLID processors are A-FM (ATLID featuremask) and A-PRO (ATLID profile processor)

A-FM uses techniques inspired from the field of image processing to detect the presence of targets at high resolution while A-PRO (using A-FM as input) preforms a multi-scale optimal-estimation technique in order to retrieve both aerosol and cloud extinction and backscatter profiles.

Versions of the A-FM and A-PRO processors have been developed for Aeolus (called AEL-FM and
AEL-PRO, respectively). Prototype codes exist and preliminary versions are in the process of being introduced into the L2a operational processor. In this presentation AEL-FM and AEL-PRO will be described and preliminary results presented and discussed.