

ATLID Algorithms applied to ALADIN

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The Atmospheric Laser Doppler Instrument (ALADIN) is the world's first space-based Doppler wind lidar. ALADIN operates at 355nm and its main product is line-of-sight wind profiles. ALADIN directly detects the Doppler shift of the return signals using a variation of the High Spectral Resolution Lidar technique (HSRL), two main detection channels are used, a 'Mie' and a 'Rayleigh'-channel. ATLID (Atmospheric Lidar) is the lidar carried by the Earth Clouds and Radiation Explorer (EarthCARE) mission. EarthCARE is a joint ESA-JAXA mission and will embark a cloud/aerosol lidar (ATLID) as well as a cloud-profiling Radar (CPR) a multispectral imager (MSI) and a three-view broad-band radiometer (BBR). ATLID is a HSRL systems, however, unlike ALADIN (which is optimized for wind measurements), ATLID is optimized exclusively for cloud and aerosol observations.

Both ALADIN and ATLID face similar challenges when it comes to the retrieval of aerosol and cloud properties. The most important challenge is the fact that the SNR ratios of the backscatter signals are low compared to e.g. those associated with terrestrial lidars. The low SNR of the atmospheric signals creates difficulties when using standard HSRL inversion methods. Along-track averaging can increase the SNR, however, the presence of clouds (and inhomogeneities in general) may lead to large biases in the retrievals.

Cloud and 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 suitable binning of the data. Two of these algorithms 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 targets at high-resolution. A-PRO (using A-FM as input) uses a multi-scale optimal-estimation approach 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 are in the process of being introduced into the L2a operational processor. In this presentation, AEL-FM and AEL-PRO will be described and representative results presented and discussed.