



The EarthCARE L2 lidar retrieval chain

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The Earth Clouds Aerosol and Radiation Explorer (EarthCARE) mission is a combined ESA/JAXA mission to launch in early 2020 and has been designed with sensor-synergy playing a key role. The mission consists of a cloud-profiling radar (CPR), a high-spectral resolution cloud/aerosol lidar (ATLID), a cloud/aerosol imager (MSI), and a three-view broadband radiometer (BBR) covering both LW and SW bands. The mission will deliver a suite of cloud, aerosol and radiation products to enable the study of the interactions between the three.

In order to achieve the aims of the EarthCARE mission, a system of individual instrument geophysical algorithms (L2a) and (L2b) synergetic (e.g. multi-instrument algorithms) are being developed. The L2a algorithms are standalone but they also must fit into the overall (fundamentally synergetic) retrieval process as their outputs are often used as high level inputs for L2b algorithms (e.g. the Lidar Target classification and Radar target classification can be combined to a Lidar+Radar target classification).

The ATLID instrument is a 355nm, polarization sensitive, high-spectral resolution (HSRL) lidar. ATLID will provide atmospheric attenuated backscatter profiles with a vertical resolution of about 100 m from ground to an altitude of 20 km and 500m from 20km to 40km altitude. Primary ATLID products are profiles of particle extinction and backscatter coefficients, lidar ratio, and linear depolarization ratio as well as the aerosol optical thickness (AOT) at 355 nm.

The design of the ATLID L2a retrieval chain is driven by the expected signal-to-noise ratio of the ATLID instrument and the EarthCARE requirements. Three separate (but interdependent) processors have been created in order to retrieve the atmospheric state. As a first step, a feature mask algorithm (A-FM) has been created to separate regions with particle return from molecular backscatter regions only. This will enable the development of binning strategies to minimize the number of shots to bin to achieve a given SNR. The second processor will provide the best possible profile information (A-PRO) at the highest possible resolution and the third derives the layer information(A-LAY), which is a direct input to the synergistic MSI-ATLID (L2b) algorithms.

In this presentation an introduction to the planned L2a retrieval algorithms for the EarthCARE lidar ATLID is given. The operation of the different processors and interconnection will be illustrated using simulated signals generated using the EarthCARE simulator corresponding to a number detailed frame-sized (6000km) scenes. The work described in this presentation was conducted as part of ESA/ESTEC contract No. 4000112018/14/NL/CT