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Synergetic cloud top height retrieval for a passive and an active sensor

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The intent of the present study is to combine active and passive measurements to derive a synergetic cloud top height (CTH). The ESA's cloud and aerosol mission EarthCARE is the first satellite mission, which will provide measurements from active sounder and passive imager from one platform. The active backscatter lidar (ATLID) will provide vertical profiles of cloud and aerosol parameters with high spatial resolution. The lidar instrument measures in nadir view, while the passive multi-spectral imager (MSI) has a swath of 150km and a pixel size of 500m. The cloud top height from ATLID will have higher accuracy compared to the cloud top height retrievals from passive instruments. This is true especially for high level cirrus and mid-level altocumulus, which typically stretch over hundreds of square kilometres.

A combined retrieval will be developed which uses the precise cloud top height information from ATLID profiles to adjust the MSI cloud top height product over the entire swath. The stand-alone CTH retrievals from ATLID and MSI are collocated for the nadir pixel and a synergetic product are derived. In a second step, corrections are applied to the whole MSI swath. The synergetic approach is investigated for a large set of cloud data covering a broad variety of atmospheric scenes. We differentiate each cloud observation into a cloud classes based on observations from MSI. With this dataset we will test the calculation of the synergetic cloud top height for the entire MSI swath based on empirical correction.

MODIS on AQUA and CALIPSO built the database for this work. MODIS provides observations similar to MSI. From the CALIOP lidar onboard CALIPSO the 1064-nm elastic backscatter signal is valid as a substitute for the ATLID 355-nm co-polar Mie signal. The 1064-nm signal has a negligible Rayleigh contribution and thus a similar shape in the presence of clouds as the Rayleigh-free filtered ATLID 355-nm co-polar Mie signal.