



The retrieval of cloud-top pressure of multilayer clouds using combined measurements of MERIS and AATSR onboard ENVISAT

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Measurements of the Medium Resolution Imaging Spectrometer (MERIS) within the oxygen *A* band at 762nm are operationally used for the retrieval of cloud-top pressure. A validation with airborne LIDAR measurements revealed a high accuracy (~ 25 hPa) of the cloud-top pressure product in case of low, single-layer clouds. However, problems arise in presence of multilayered clouds, as the single channel within the oxygen *A* band does not allow the identification of multiple cloud layers. The retrieved cloud height thus represents the effective single layer height, located in-between the true cloud layers.

This problem can be resolved by combining MERIS observations with measurements in the thermal infrared spectral range. Since clouds are strongly absorbing at infrared wavelengths, the cloud-top temperature of even optically thin clouds can be determined and related to cloud-top pressure using the respective temperature profile. The Advanced Along Track Scanning Radiometer (AATSR) onboard ENVISAT provides radiance measurements in the thermal infrared region that can easily be combined with MERIS observations, as both are nadir viewing, imaging instruments with a similar spatial resolution of ~ 1 km. The synergetic measurements can be used for the retrieval of the height of two cloud layers in case the upper layer is optically thin ($\tau \leq 5$).

The retrieval algorithm is based on the Optimal Estimation technique using radiative transfer simulations of the Matrix Operator Model (MOMO).