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Retrieval of cloud optical properties from infrared hyper-spectral measurements: a new methodology based on a line-by-line multiple scattering code.

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A new methodology to retrieve cloud optical properties using high spectral resolution infrared measurements will be presented. The new method makes use of line by line multiple scattering simulations to retrieve spectrally resolved cloud optical depths. The retrieval requires knowledge of the atmospheric temperature and water vapour profiles and cloud boundaries. Comparing the spectral optical depths with a pre-computed optical depths database the cloud microphysical properties are retrieved.

The new method improves on existing retrieval methods with a more accurate account of the scattering processes and the ability to easily adapt to multiple instruments, platforms and viewing angles. Another important feature of the new technique is that it can be applied to water and ice clouds with multiple crystal shapes as well as aerosol layers.

In the present work the full methodology will be applied to several case studies covering different cloudy sky conditions. The work will be focused to simultaneous ground based, aircraft and satellite hyper-spectral and hyper spatial resolution measurements (i.e. Atmospheric Emitted Radiance Interferometer, Scanning High-resolution Interferometer Sounder, Atmospheric Infrared Sounder) with lidar and radar measurements to validate the retrieval results. A comparison with other cloud property retrieval methodologies is also performed.

The same retrieval algorithm is used for each different sensor allowing a highly consistent comparison.

An investigation on the uncertainties in the infrared retrieved optical depths, effective radii and IWC is also performed.