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Cirrus cloud properties from combined IIR and lidar observations of CALIPSO

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Cirrus clouds are of particular importance for the understanding and the survey of climate change due to their impact on the Earth radiation budget. However, their optical and microphysical properties are still poorly known. The NASA-CNES CALIPSO mission provides new pieces of information by combining the three-channel Imaging Infrared Radiometer (IIR) (8.65, 10.6 and 12.05 μm) measurements and the CALIOP lidar range-resolved observations. Cirrus clouds optical depth is retrieved in the visible spectrum (532 nm) from the CALIOP lidar and in the thermal infrared (12 μm) from the IIR. The latter is inferred from the effective emissivity, whose retrieval takes advantage of the sensitive scattering layers detection met in the CALIOP analysis. Comparisons of Version 3 IIR and CALIOP cirrus optical depths show the very good sensitivity of the IIR retrievals (down to 0.05 visible optical depth).

In addition, cirrus microphysical properties (size and ice water path) are derived from the IIR by using a split window technique which has long been applied to space-borne passive thermal imagers observations in such clouds. In our approach, the ice cloud microphysical properties are derived from two microphysical indices, defined as the ratio of the effective infrared optical depths in the two pairs of channels 10.6-12.05 μm and 8.65-12.05 μm. Look-up tables are then used to retrieve the effective size of the cirrus ice crystals and the ice water path (IWP) for a preferred crystal model.

The analysis performed in the Version 3 IIR operational algorithm will be presented and the sources of uncertainty will be discussed. Results will be shown, including comparisons with CALIOP retrievals and MODIS collection 5 products. The Version 3 IIR and CALIOP products are available at NASA Langley ASDC and ICARE data center.