

CloudSat Project

A NASA Earth System Science Pathfinder Mission

Level 2B CWC-RO P_R04 Data Issues

Radar forward model attenuation in liquid cloud

Opened: 09/21/11	Severity: Major
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The 2B-CWC-RO algorithm estimates liquid cloud properties using a radar forward model which includes the effects of attenuation by liquid cloud droplets. An error related to the calculation of the attenuation has been identified in the forward model. Due to a sign error, values for the two-way transmission in the forward model may be larger than 1.0. As a result, the forward-modeled attenuated reflectivity values can be larger than the unattenuated values.

An evaluation shows that effective radii and liquid water contents are typically underestimated by the retrieval as a result of the forward model error. These effects are most pronounced for those profiles containing dBZe > -15 (i.e., those profiles which likely contain precipitation).

This forward model is also used in the 2B-CWC-RVOD algorithm. The forward model is being corrected as part of the R05 product release. Note that this issue does not affect retrieved ice cloud properties.

Multi-phase cloud columns

Opened: 10/22/07	Severity: NORMAL
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The 2B-CWC-RO algorithm has separate retrievals for liquid and ice clouds; the current algorithm does not attempt to retrieve both solid and liquid microphysical properties simultaneously in the same cloud column. Instead, separate retrievals are performed assuming that the entire cloud column is liquid-only and ice-only, and the two sets of results are combined into a composite profile according to a simple temperature relation (since we do not have an independent source of phase information). Ice-phase results are used for cold temperatures, liquid-phase results for warm temperatures, and a linear combination of the two are used in an

intermediate temperature range, yielding an approximate mixed-phase solution. Future versions of the algorithm will likely take more sophisticated approaches to handling cloud columns with multiple phases based on limited information. The composite profile variable names all begin with "RO_"; the separate liquid-only and ice-only retrieval variable names begin with "LO_RO_" and "IO_RO_", respectively.

Additional Comment:

One consequence of this retrieval approach is that, for the case of ice cloud overlying lower liquid cloud, the liquid phase retrieval most likely overestimates the amount of attenuation of the radar beam in the cloud column above the liquid layers. This attenuation issue will be addressed in the future versions of the algorithm.

Retrieval failure in regions of high Z (precipitation)

Opened: 08/13/13	Severity: MAJOR
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The liquid and ice cloud retrievals used in 2B-CWC-RO assume distributions of cloud particles without substantial numbers of larger precipitation particles. The LWC retrieval in particular often fails (does not converge) for profiles containing high radar reflectivities (say, above 0 dBZe); this is most likely due to the presence of precipitation-sized particles, which the retrieval is unable to fit using the assumed distribution of cloud particles. Because the large precipitation particles dominate the radar signal, a more sophisticated retrieval (likely involving additional data streams) will be necessary to retrieve cloud properties in the presence of precipitation. Bits 0 and 1 in RO_CWC_Status indicate the failure of the LWC and IWC retrievals; bit 2 indicates possible precipitation in the profile (radar reflectivity > - 15 dBZe).
