

Interactive comment on “The albedo properties of four clean stratocumulus clouds studied during the VOCALS-REX field campaign” by B. Parkes et al.

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Received and published: 15 March 2013

There is a general lack of information relating to what the purpose of this paper is. For example, 1.1) Why is it important to compare the two methods of calculating albedo? A) The paper is designed to validate the DE approximation of albedo using data from VOCALS. If shown to be suitable the DE method could be used to give an albedo value in simulations of stratocumulus decks without the need of a radiative transfer model.

1.2) What implications do the conclusions have? A) The delta-Eddington approximation can be used as a method of calculating the albedo in a microphysical model and that assumptions within the DE method are valid.

1.3)How does this work compare to previous studies? A) No other studies have to the authors knowledge performed analysis using two instrument sets on the same aircraft therefore comparison is difficult.

1.4)What is novel about the work done in this study? First work using two independent methods on one platform and the first work to validate the DE method on clouds observed during VOCALS-REx

2) I have concerns about the method used to derive cloud optical depth, and hence the cloud albedo from the Cloud Droplet Probe (CDP). In equation (2) the effective radius should be representative of that near cloud top, whereas the authors use that derived from droplet size spectra measurements made lower down within the cloud layer, where the effective radius will presumably be smaller. I am also very dubious about the derived LWP measurements which are also used in equation (2). The LWP is assumed to be the LWC data measured at the aircraft flight level in the cloud layer multiplied by the cloud thickness below the aircraft. Even if one thinks of an idealised stratocumulus cloud that exhibits a triangular adiabatic LWC profile, then this assumption will only be correct if the aircraft is flying at a certain level within the cloud, which is almost certainly not the case. The authors could look at how the derived LWP compares to the integrated LWC made from aircraft profiles through the depth of the cloud layer e.g. at 1200 to 1400 seconds in Fig 1. The authors also assume a constant value of the asymmetry factor in equation (1). They could actually calculate this by including the measured drop spectra in Mie scattering calculations, although the same caveats about the data not being representative of that at cloud top would still exist. All of these factors lead me to suspect that there is a much larger uncertainty in the albedo and LWP derived from the cloud microphysical data than is indicated by the error bars shown in figures 3 and 4. A) The LWP is now calculated using both methods to give the albedo using several approximations within the DE method. Furthermore uncertainties have been recalculated and an expanded section has been added to the manuscript.

2.2) In addition, I am also unsure of how the radiometric albedo measurements are

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actually made. Are these made by the aircraft overflying the same cloud layer that is analysed for the in-situ cloud microphysical measurements? A) The radiometric albedo is calculated using in situ radiometers see Slingo et al 1982. The calculation of the uncertainties in the radiometric albedo are also described in section 2.2

3) For cloud segment 1, the authors show poor agreement in the albedo calculated from the two methods, and attribute this to the high solar zenith angle. It is also the case where the aircraft was flying lower down in the cloud layer for the cloud microphysics measurements, and so may be subject to enhanced biases in the derived optical depth than the other cases for some of the reasons mentioned in point 2. A) The cloud segment identified as segment 1 in the draft has been removed as part of the expansion to 9 clouds (originally 11 however two have been removed as the SZA in those cases is above 65 degrees).

4) The authors have used a very limited observational dataset. From the 13 research flights made with the FAAM BAe-146 aircraft only four cloud segments are analysed. The authors select these cloud segments based on requirements to have “good CDP and radiometric data with satellite coverage and contain little to no coastal pollution”.

4.1) Firstly no satellite data is used in the paper so why is it a constraint? A) This is a mistake and the reference to satellite data has been removed.

4.2) Secondly why do the authors only look at clean cases, where contrasting this with more polluted cases near the coast would be of interest? A) As part of the expansion to 9 clouds several polluted cases are now used.

4.3) Thirdly why not use all research flights to increase the number of cases, so that any conclusions made are more robust? A) Clouds are now analysed from six flights B408, B413, B414, B417, B418, B419. No suitable long in cloud legs exist in the other flights.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 30021, 2012.

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