

Interactive comment on “Influence of spatial heterogeneity of local surface albedo on the area-averaged surface albedo retrieved from airborne irradiance measurements” by E. Jäkel et al.

Anonymous Referee #2

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The manuscript entitled “Influence of spatial heterogeneity of local surface albedo on the area-averaged surface albedo retrieved from airborne irradiance measurements” by E. Jäkel, M. Wendisch, and B. Mayer can be published in the Atmospheric Measurement Techniques after taking into account several minor comments. The objective of the paper is very important and the material can be very useful to the research community. In this paper authors investigated the effect of local surface albedo heterogeneity and aerosol parameters on the retrieved area-averaged surface albedo from airborne

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upward and downward irradiance measurements. For this purpose authors use the 3D radiative transfer model to simulate different surface albedo and atmospheric correction. They developed an integrative method to retrieve the area-averaged albedo based on airborne observation of upward and downward fluxes and numerical simulation by 1D radiative transfer model. Overall the paper is very well written and organized. The equations, tables and figures are nicely organized. However, the paper can be significantly shortened and unnecessary details can be removed, so it would be easier for the reader to follow the main points in the paper. I would recommend to include some discussion of influence of single-scattering albedo and asymmetry parameter on the area-retrieved albedo, critical distance, and parameterization describing by the eq. 12. In my opinion at least scattering albedo, related to absorbing properties of aerosols, has significant impact on surface albedo retrieved from airborne observation of upward and downward fluxes.

In the mind of this reviewer, the paper is publishable subject to taking into account the following specific remarks: Page 7461, line 18, it is true but only in the first approximation, which should be mentioned.

Page 7461, between 5 and 20. Could you add information about albedo implementation in the 3-D Monte Carlo, is it Lambert or BRDF?

Page 7463, line 19, some reference to these values should be provided here. $\alpha=1.3$ and $\beta=0.044$ are long-term mean values or estimated for specific day? What kind of lidar was used, elastic or Raman and so on?

Page 7463, line 21, why you assumed such single-scattering albedo and asymmetry parameter? Could you provide some information about sensitivity study of both optical quantities on results presented in the section 3?

Page 7466, line 18, Why the water albedo is fixed? What about water BRDF and strong albedo dependence from solar and viewing zenith angle? For large zenith angle water albedo can be significantly larger than assumed 0.026.

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Page 7467, line 16, The sentence: "The larger the flight altitude the larger is the critical distance" not clear, should be revised.

Page 7468, eq. 12. Could you add information about range of the AOD and delta parameter for which this parameterization is correct? For example, for $\delta=2$ and $\text{AOD}=0$ we get $d/z_{\text{fligh}}=-0.8$ which is wrong.

Page 7468, line 21-25, "For wavelengths lower than 400 nm, where Rayleigh scattering is predominated, and for wavelength regions with strong molecular absorption, Eq. (12) should not be applied" It means that Rayleigh scattering is not taken into account in the 3D model? It would be strange because this effect is relatively simple to implemented in the radiative transfer model. It is not clear here.

Page 7470, line 16 and 22, Why the different asymmetry parameter is assumed here 0.65 instead of 0.75. One more time could you addend some discussion of impact of g and ω on the area-averaged albedo retrieval?

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 7457, 2012.