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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "The seasonal vertical distribution of the Saharan Air Layer and its modulation by the wind" *by* C. Tsamalis et al.

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General comments:

Being one of the key parameters for a number of processes concerned with the tropical Atlantic, 3D distributions of Saharan dust aerosols are of particular interest. The two-wavelength polarization sensitive lidar CALIOP, launched on board CALIPSO in April 2006, is a very powerful tool for study of 3D aerosol distributions at global scale.

As for lidar data, spatial distribution of aerosols is usually analyzed with parameters related to the backscattering or the extinction coefficient. The authors of the discussion paper have chosen the Dust Occurrence Frequency (DOF) for their investigation. At first sight, such a choice is quite surprising because optically thick and optically thin



layers are not distinguished by the DOF as it would be, for example, with the integrated attenuated backscatter or the aerosol optical depth. The validity of the authors' choice is proved by their results, which are interesting, fruitful and consistent.

I recommend that the paper be published in ACP after minor revisions.

Specific comments:

1) Page 4735, Eq. (1). Equation (1) needs thorough explanations in the text. I suppose that "total number of layers in the bin(x,y)" is computed using the parameter "Number_Layers_Found" of the "Column Record" of the "Lidar Cloud & Aerosol Level 2 layer products". And, the "number of layers(x,y,z)" is computed using the parameters "Layer_Top_Altitude" and "Layer_Base_Altitude" of the "Layer Record". The problem is that there are a number of possibilities to assign values of the "number of layers(x,y,z)". I suppose that the DOF are computed for each pair of (x,y) according to the example given in the comment figure (aerosols were observed only two times at the bin(x,y)).

If the example is not in agreement with the authors' computing, it means that even an experienced reader can be misled and Eq. (1) really needs thorough explanations.

2) Figures 2 and A1 - A4. Personally, I do not consider Figs. 2 and A1 - A4 as noisiness. The authors of the discussion paper imposed the threshold of 240 layers to the bin of 1°. Assuming the Poisson statistics, the statistical significance of the "total number of layers" is sufficient. At the same time, an experienced reader can see the natural fluctuations of the number of dust layers on the figures.

3) Page 4747, lines 24 - 30. The way, the effective dry deposition velocity was computed, will be clearer if the authors will add the corresponding equation.

4) Figures 3 – 6. Generally, the DOF distributions are in very good agreement with the MODIS AOD at 550 nm. At the same time, there are some differences, for example, Fig. 3 (MAM, 20° W) and Fig. 4 (JJA, 20° W). It means that further investigations of the same kind but using layers optical depth or layers integrated-attenuated-backscatter

should be fruitful. (The aim of this comment is just to encourage the authors to perform further work. It does not cast any doubt on good quality of the work under reviewing.)

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| | 1st time | | 2nd time | | |
|---|---|---|---|---|---|
| | | number of layers(x,y,z) | | number of layers(x,y,z) | DOF |
| $z_{12}$ | Layer_ Top_Altitude | 1 | Layer_ Top_Altitude | 1 | 0.66 |
| $z_{11}$ | | 1 | | 1 | 0.66 |
| $z_{10}$ | | 1 | | 1 | 0.66 |
| $z_9$ | | 1 | Layer_ Base_Alitiude | 1 | 0.66 |
| $z_8$ | | 1 | | 0 | 0.33 |
| $z_7$ | | 1 | | 0 | 0.33 |
| $z_6$ | | 1 | | 0 | 0.33 |
| $z_5$ | | 1 | Layer_ Top_Altitude | 1 | 0.66 |
| $z_4$ | | 1 | | 1 | 0.66 |
| $z_3$ | | 1 | | 1 | 0.66 |
| $z_2$ | | 1 | | 1 | 0.66 |
| $z_1$ | Layer_ Base_Altitud e | 1 | Layer_ Base_Altitude | 1 | 0.66 |
| | | | | | |
| Number_ Layers_ Found | | 1 | | 2 | |
| total number of layers in the bin(x,y) = 3 | | | | | |

**Fig. 1.**