

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2021-219

Anonymous Referee #2

Referee comment on "Dust transport and advection measurement with spaceborne lidars ALADIN, CALIOP and model reanalysis data" by Guangyao Dai et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-219-RC2>, 2021

In the present manuscript, Guangyao Dai and coauthors track a Saharan dust plume across the Atlantic Ocean and calculate the dust horizontal fluxes. The novel approach in their manuscript is the combination of two satellites (CALIPSO and Aeolus) measuring at different wavelengths. To bridge the gap between the overpasses of the two satellites ERA5 model reanalysis and HYSPLIT trajectories are used. However, the satellite data are not treated in a correct manner with the result that the whole proposed method is not valid. Therefore, I have to reject the manuscript.

The following points underline my decision and may help the authors to improve their work:

- Aeolus is providing the circular co-polarized component of the backscatter and not the total backscatter coefficient. The missing cross-polarized component is not negligible in dust cases as used in the manuscript. You are missing a significant part of the backscatter coefficient at 355 nm.
 - CALIPSO measures the backscatter coefficient at 532 and 1064 nm, but not the extinction. The extinction provided by CALIPSO is retrieved by multiplying the backscatter coefficient with the aerosol-type-dependent lidar ratio. Therefore, the extinction coefficient is not an independent quantity. For your inversion calculation, you need independent measurements of the extinction coefficient, either by high spectral resolution (HSRL) or Raman lidar measurements.
 - Following point 1 and 2, the main part of your data procedure, the calculation of the dust volume concentration is not correct. It can not be done in the presented manner. This is not an easy point to correct and leads to my decision to reject the paper.
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- The horizontal flux is not well defined. The horizontal velocity is a vector with two components (East-West, North-South), so the horizontal flux should have a direction. If

you just take the absolute value of the velocity, your flux may have different directions at every point. What does this help us in understanding the dust transport?

- Your result, that the minimum flux occurs at dust emission (line 271 and 322) is misleading. Why should the flux be lowest at emission? Looking at your back trajectories (Fig. 8a) indicates that a significant amount of dust originated from regions west of the track on 15 June. This dust is not observed on 15 June, but on 16 June leading to a greater horizontal flux.
- The combination of the two satellites is a great new idea. However, you should highlight the scientific question behind. You speak about ocean fertilization, but it remains open, which amount of dust is deposited to the Ocean. With Fig. 11, you show the low chlorophyll concentration in the studied area, but you do not quantify the effect of the discussed dust event on the ocean fertility. Your description remains very general stating that dust add nutrients to the Ocean.