

Dear reviewer,

We like to thank you for your helpful comments on our paper titled “Vertical wind retrieved by airborne lidar and analysis of island induced gravity waves in combination with numerical models and in-situ particle measurements”.

The original comments are in bold, followed by our replies and a marked-up version of the manuscript indicating the changes introduced according to the answers .

Reviewer #2

1. Page 2 line 23-27 sentence too long split off into two or three sentence to clarify the statement

The sentence was reformulated in the following way:

“During the SAMUM-2 campaign, a large eddy simulation (LES) study was performed in the Cape Verde region (Engelmann et al., 2011). This study showed that a flat island with the characteristics of the Santiago Island (Cape Verde) can induce the generation of gravity waves and enhance the aerosol downward mixing, only through its heat island effect, without taking into account its orography.”

2. Page 5 line 13-17 split off the sentence

The sentence was reformulated in the following way:

“Because the DWLs measure relative speed between the instrument and the sensed atmospheric volume, the retrieval of the wind speed requires knowing the aircraft speed component of the measurement. This calculation requires especially accurate measurements of the aircraft speed, orientation, and DWL relative position with respect to the aircraft.”

3. Page 5 error introduced by the horizontal wind into the vertical wind component

The error introduced by the horizontal wind is discussed in the section 2.3. The following clarification was introduced:

“Corrections to the LOS speed resulting from a non-zero nadir angle are discussed in Sec. 2.3.”

4. Page 6 time resolution of angle measurements

The following clarification was introduced:

“The Falcon IRS system provides yaw angle measurements at a rate of 20 Hz, and pitch and roll measurements at 50 Hz. These measurements are then averaged for 1 s to match the DWL accumulation time.”

5. Page 9: Eq (7) is missing

The equation number was wrong. Eq. (7) was changed to Eq. (6) and Eq. (6) to Eq. (5).

6. Page 9: line 3-6 split off the sentence

The sentence was rearranged as follows:

“For each flight, surface returns (land and sea) corresponding to measurements in scanning operation mode were used to retrieve the mounting angle. Only the retrievals corresponding to flight altitudes higher than 5000 m and with vertical aircraft speeds lower than 0.05 m s⁻¹ were included in the calculation.”

7. Page 11 line 15: fig. 3b instead off fig. 4

Fig. 4 was changed to Fig. 3b.

8. Page 12: line 26 fig S1=?

Fig. S1 refers to the first supplemental figure.

9. Page 13: please introduce first the Scorer-parameter, (Eq. 7) earlier (at line 5)

Fig. 6b (Scorer parameter plot) is now introduced after the theoretical introduction of the Scorer parameter.

10. Page 16: line 23: fig S2=?

Fig. S2 refers to the second supplemental figure.

**11. Page 19: line 9: what is meant by low humidity conditions? (free troposphere?)
please specify**

The following clarification was introduced:

“Dry atmospheric conditions are required in order to avoid the hygroscopic growth of aerosol particles, which otherwise would lead to a wrong flux estimation. The exact relative humidity threshold under which hygroscopic growth can be neglected varies according to the aerosol type. For the case of sea salt and desert dust, hygroscopic growth can be safely neglected for a relative humidity below 50% (e.g. Engelmann et al., 2008; Kaaden et al., 2008).”

12. Figure S1 and S2 are not clear

After trying different ways to present the flight paths and measurements, we decided to leave it as it is. Although a 3D view of the flight track adds complexity, a 2D plot cannot capture the different flight levels and changes in the measurement pattern.

13. Figure 1: abbreviation DEM?

The following clarification was introduced in the Fig. 1 caption:

“DEM is Digital Elevation Model.”

References

Engelmann, R., Wandinger, U., Ansmann, A., Müller, D., Žeromskis, E., Althausen, D. and Wehner, B.: Lidar Observations of the Vertical Aerosol Flux in the Planetary Boundary Layer. J. Atmos. Oceanic Technol., 25, 1296–1306, doi: <http://dx.doi.org/10.1175/2007JTECHA967.1>, 2008.

Kaaden, N., Massling, A., Schladitz, A., Müller, T., Kandler, K., Schütz, L., Weinzierl, B., Petzold, A., Tesche, M., Leinert, S., Deutscher, C., Ebert, E., Weinbruch, S., and Wiedensohler, A.: State of mixing, shape factor, number size distribution, and hygroscopic growth of the Saharan anthropogenic and mineral dust aerosol at Tinfou, Morocco, Tellus, 1600–0889, 2008.