Dear Referee #3,

We thank you for the positive feedback and critical comments on the manuscript! In the following, the authors will reply to those. Next to the review comments, some more changes to the manuscript have been done:

1. Subsection *2.2.9 Meteorological Instrumentation* was placed in the beginning of section 2.2, i.e. this section is now 2.2.1. The reason for this is that in the following the deposition velocity is always investigated first, followed by the mass concentration and the mass deposition flux.
2. The sections 3.1 and 3.2 were changed to always fulfill the order: Deposition velocity, mass concentration, mass deposition flux.
3. The abbreviations for the deposition flux, the mass concentration and the mass deposition flux were changed to $v_{d,method}$; M_{method} and F_{method} in the whole manuscript to make the text better readable.

General comments:

Reviewer:
Also, there is a need to make the text more easily readable and concise in the technical parts.
Response:
The authors revised the technical part of the paper to make it more readable. An overview over the measurements site and the instruments as well as a scheme on data evaluation was added. The used acronyms were simplified. In detail, the following passages were changed/ extended:
We changed Figure 1 that way that we excluded the position of the station and inserted it in a new Figure 2 showing the coastline of the island Sao Vicente and a picture of the measuring tower with the position of the different instruments. Furthermore, a scheme (Figure 3) was inserted showing the used instruments for the different parameters (deposition velocity, mass concentration and mass deposition flux) including the abbreviations used later in the text. Table 2 was skipped. The following text was included to describe the two new Figures:
At the end of section 2.1: "*Figure 2 shows the coastline of the island Sao Vicente with the CVAO marked as red square and a picture of the measuring tower including an overview of the position of the used instruments that are explained in more detail in the following.*"
At the beginning of section 2.2: "*In Figure 3, a scheme is shown including the instruments used to obtain the deposition velocity, mass concentration and mass deposition flux of mineral dust and the abbreviations used later in the text. Two devices were used to measure the deposition velocity and will later be referred to micrometeorological (mm) and profile method (pm). Three devices including one or two instruments were used to obtain the mass concentration of mineral dust and the methods are using the different instruments are called microphysical (mp), optical (op) and gravimetrical (gr). Four combinations of the devices of the first two parameters were used to obtain the mass deposition flux of mineral dust. For the mass concentration and mass deposition flux of mineral dust, also a model was used which will be described later.*"

Reviewer:
Finally, what I feel is missing from the summary/conclusions, is the authors' recommendation on how and why to choose one of these methodologies (maybe give a preference in one of the methods) for a potential interested researcher and the addition of previous work on these methodologies. The authors have made a small comment on the preferred methodology (MMe+Cmass,PMSDmd), but I would suggest devoting more text in their conclusion and associate it to previously published work. Such conclusion would add to the scientific merit of the paper and will dissociate it from being another application of methods and models.
Response:
Although this paper compares different measurement techniques to each other, it is not the scope of the paper to give a recommendation. The authors included advantages and disadvantages in the summary/conclusions part with the preferred method for these measurements but also explained that another method may be more appropriate for other locations:
"*Comparing the methods to each other, the optical and the gravimetrical method are easiest to handle. However, the optical method is inaccurate by determining the mass concentration of mineral dust due to assumption of the mass absorption coefficient. Using the Berner impactor needs time consuming evaluation and supervision of the low time resolved measurements. The most sophisticated method is the microphysical one with highly infrastructural effort and very sensible devices. However, the latter measurements can be performed online and autonomously. For the purpose of this paper it is the preferred method because it yields the most detailed information and highest data availability.*"
"*For the current paper, the combination of the micrometeorological and the microphysical method are the preferred one due to availability of detailed information. However, this shall not be a recommendation for other measurements. Depending on the location, infrastructure and outer conditions, another combination may be more preferable to obtain a high data set on mass deposition fluxes of mineral dust*."

Specific comments:

Reviewer:
Abstract: The conclusion provided in lines 16-20, that compares the modelled with the measured deposition fluxes, does not provide any scientifically important information. The use of a regional dust model in this work is purely auxiliary, and if a different dust model was used, it would lead to a different percentage of compliance with the measurements. I would suggest adding a sentence on the preference on one of the observational methodologies, based on the experience gained from this work
Response:
The specific value of 5% was removed from the text because it is not presented later in the text. Instead a more detailed information on why the model is used is given:
"*This model was used as it describes the AOD's and mass concentrations realistic compared to the measurements and because it was run for the time period of the measurements.*"

Reviewer:
Section 3.1.1 (now section 3.2.1): Even though this method appears to be the most prominent one, the assumption on the shape of the particles (spheres as shown in Equation 4 (now 15)) does induce some

errors in the calculated fields. Even though such errors cannot be quantified, they are worth mentioning in the document. Dubovic et al. (2006) discuss the effect of nonsphericity in remote sensing of desert dust.

Response:

Particle number size distributions were corrected for particle shape by converting the particle size scale to a volume equivalent diameter (cf. Equations 1 & 2 in Section 2.2.5 (old Section 2.2.4)). Consequently calculated volume and mass concentration (Equation 15 (old Equation 4)) are corrected for shape effects. We included a sentence at the end of the paragraph:

"*Since the particle number size distribution was converted to volume equivalent diameters (cf. Equations 1 and 2) the resulting mass concentration is corrected for shape effects*."

The reference to Dubovik in Section (3.3.3) is misleading since it links the effects of particle shapes to optical properties measured with remote sensing techniques. We changed the sentence (page 33047 line 5) to:

"*Unfortunately, there is no thorough information available on the three-dimensional particle shape of Saharan mineral dust, which would allow estimating the uncertainty in in-situ measured volume concentration. For remote sensing a spheroidal model can be used as a replacement for nonspherical particles as shown in Dubovik et al. (2006). Similar investigations for in-situ techniques would require a detailed analysis of SEM pictures and in-situ measured particle size distributions to get a statistics on shape factors, what is out of the scope of this manuscript*."

Reviewer:

Section 3.2 (now Section 3.1): The algorithm for the dry deposition velocity (Equation 7 (now 4)) should not be referred to Heinold et al. (2007). The authors should replace this reference with the following: "The dry deposition velocity (vd) is based on the resistance approach of Slinn and Slinn (1980) as implemented by Kumar et al. (1996)". The references are included at the end of this review.

Response:

The reference was changed to Slinn and Slinn (1980) and Kumar et al. (1996) as suggested.

Reviewer:

Section 4.3: Please explain the meaning of the DOY values shown in Periods 1 to 4. If the DOY is Day Of Year, then what is the value 36.5? If that is the Julian day, why entering in February by 5 days when in section 4 (Results) the events of the high dust concentration end in day 32?

Response:

DOY is the day of year that starts counting with 1 at January 1st. The dust episode ended on January 31, but passive sampling was carried out until February 5th. Thus the following sentence was added before explaining the periods:

"*Opposite to the time series that show dust concentrations until the last day of January (DOY 31.95), these data include also dust free days of February.*"

Reviewer:

Technical corrections Page 33029, line 2: "... the total error for cmass,PMSD results…"

Response:

The phrase was changed accordingly.

Reviewer:

Page 33039, title of section 3.1.2: I believe that the variable name should be cmass,SOAP in the parenthesis.

Response:

Changed to M_{op} (old cmass,SOAP).

Reviewer:

Page 33042, equation 11: Please explain in the text the variables w' and Ts'.

Response:

The single presentation of w' and Ts' is wrong. Equation 8 (old Equation 11) was changed using the variable of the sensible heat flux H, which is approximated with the covariance of w and Ts ($\overline{w'T_s'}$) as explained in the text included before Equation 6 (old Equation 9):

"*The covariance of T_s and w yields the buoyancy flux, which is related to the sensible heat flux H. As the sensible heat flux cannot be determined directly due to a lack of a direct fast response measurement of temperature T, the buoyancy flux using the sonic temperature T_s instead of the virtual temperature T_v (Foken, 2008) is calculated. The covariance of U and w yields the momentum flux M, from which the friction velocity u_* is calculated by*:"

Reviewer:

Page 33044, line 12: Please add a reference to equation 17.

Response:

The reference of Stull 1988 was added.

Reviewer:

Page 33045, line 13: cmass,DMSD should be replaced by cmass,PMSDmd.:

Response:

Changed to M_{mp} (old cmass,PMSDmd).

References:

Foken, T.: Micrometeorology, Springer, Berlin-Heidelberg, Germany, 308 pp., 2008.

Kumar, N., Lurmann, F.W., Wexler, A.S., Pandis, S., Seinfeld, J.H.: Development and application of a three dimensional aerosol model. In: Presented at the A&WMA Specialty Conference on Computing in Environmental Resource Management, Re-search Triangle Park, NC, 24 December 1996.

Figures:

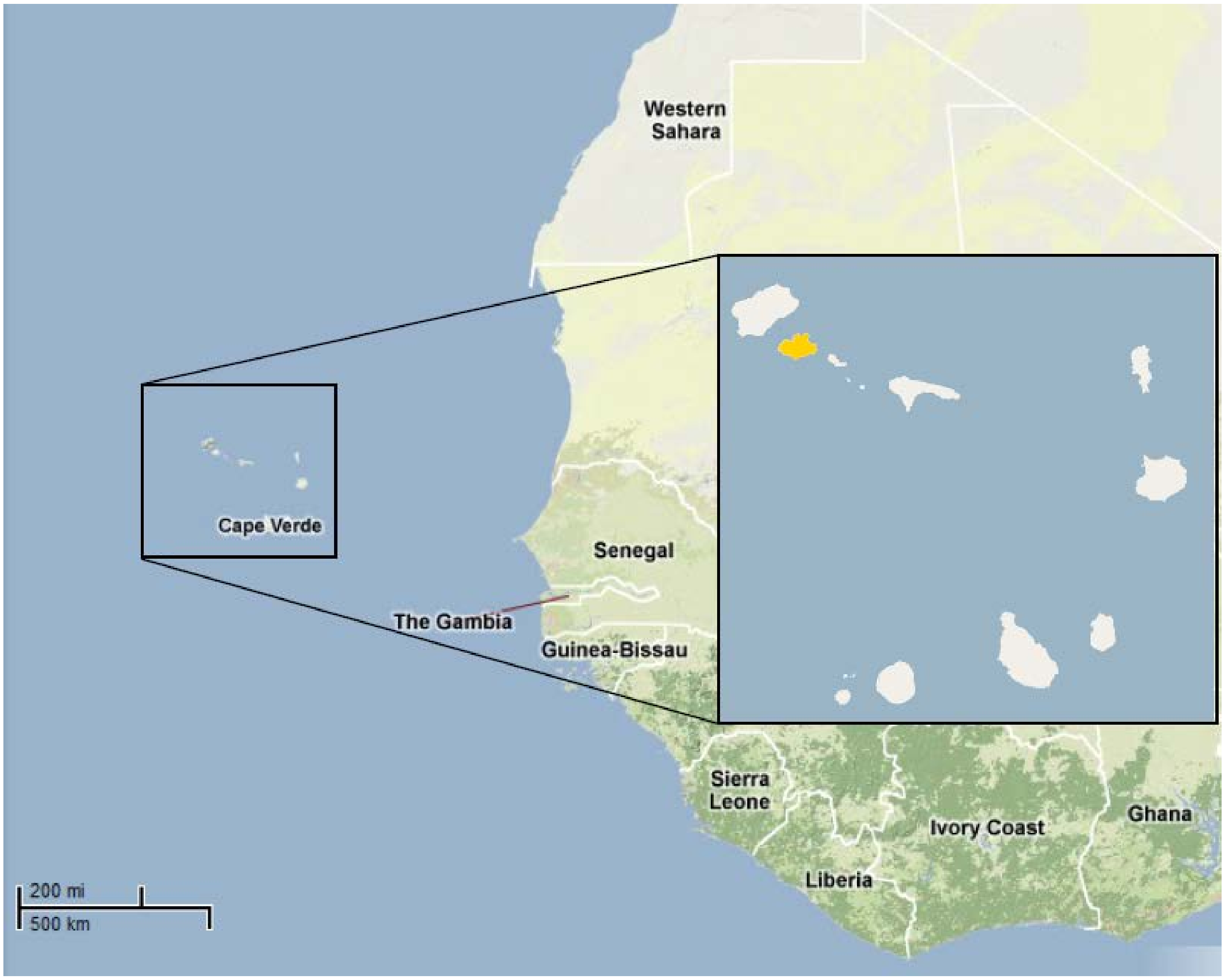

Fig. 1. Geographical position of the Cape Verde Islands ((c) OpenStreetMap and contributors, CC-BY-SA). The orange island shows the position of Sao Vicente.

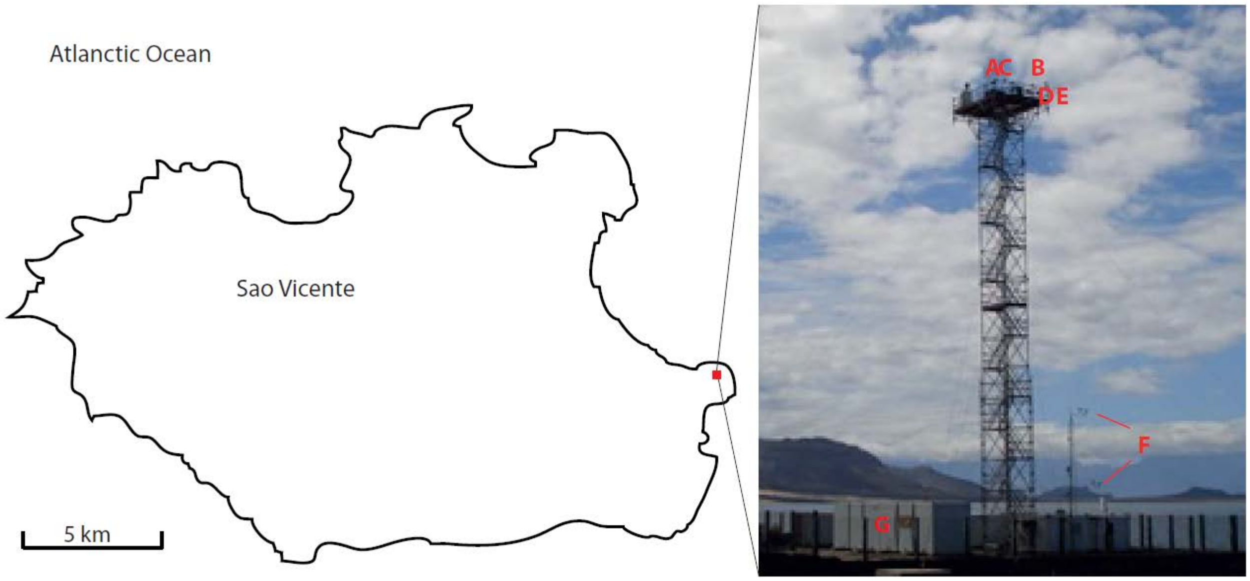

Fig. 2. Position of the Cape Verde Atmospheric Observatory on the island Sao Vicente and a picture of the measuring tower showing the position of the individual instruments.

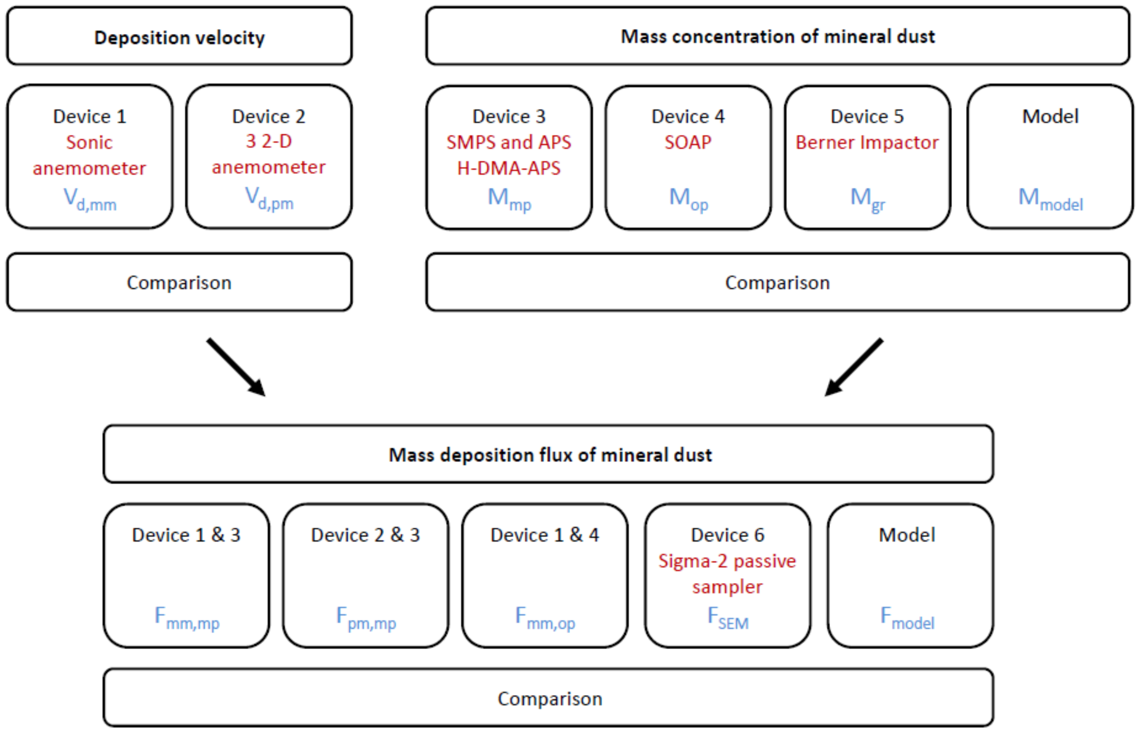

Fig. 3. Scheme of the measuring and evaluation procedure showing the instruments (red) and the used acronyms (blue) for the different methods of the three parameters deposition velocity, mass concentration and mass deposition flux of mineral dust. The methods for the deposition velocity are called micrometeorological (mm) and profile (pm) and for the mass concentration of mineral dust microphysical (mp), optical (op), gravimetrical (gr) and in addition the output of a regional transport model (model) is used. The methods for the mass deposition flux of mineral dust are combinations of the previous methods and additionally from scanning electron microscopy of passive sampled particles (SEM) and from the regional transport model.