The paper makes an important contribution to the literature and can provide input to the modeling community regarding the sea-salt emissions.

Some minor comments before publication:

Using ECMWF model constraints for RH would not necessarily remove clouds from L2A measurements (it is well-known that clouds are not well-represented in models)

AR: In this study, it is considered that clouds should be adequately removed as far as possible to retain aerosol extinction/backscatter coefficients, and to avoid the clouds' possible impact on the marine aerosol optical properties-wind relationship exploration.

According to the recommendation in Flamant et al. (2020), which is the Aeolus Level-2A Algorithm Theoretical Basis Document, there is a high probability that a cloud be present if RH > 94%. Because of this probability of cloud existence under the atmospheric condition of high RH, the Aeolus L2A aerosol optical properties data bins with RH > 94% were eliminated to avoid the clouds' impact.

Actually, the RH data from ECMWF model is considered as the auxiliary criterion in the cloud screening procedure, while the backscatter ratio is the main criterion as it is from Aeolus measurement. In the revised manuscript, we put the "backscatter ratio" before the "RH" both in Fig. 2 (Fig. 1 in the old version) and in the relevant description to clarify the order of importance, which are shown as below:

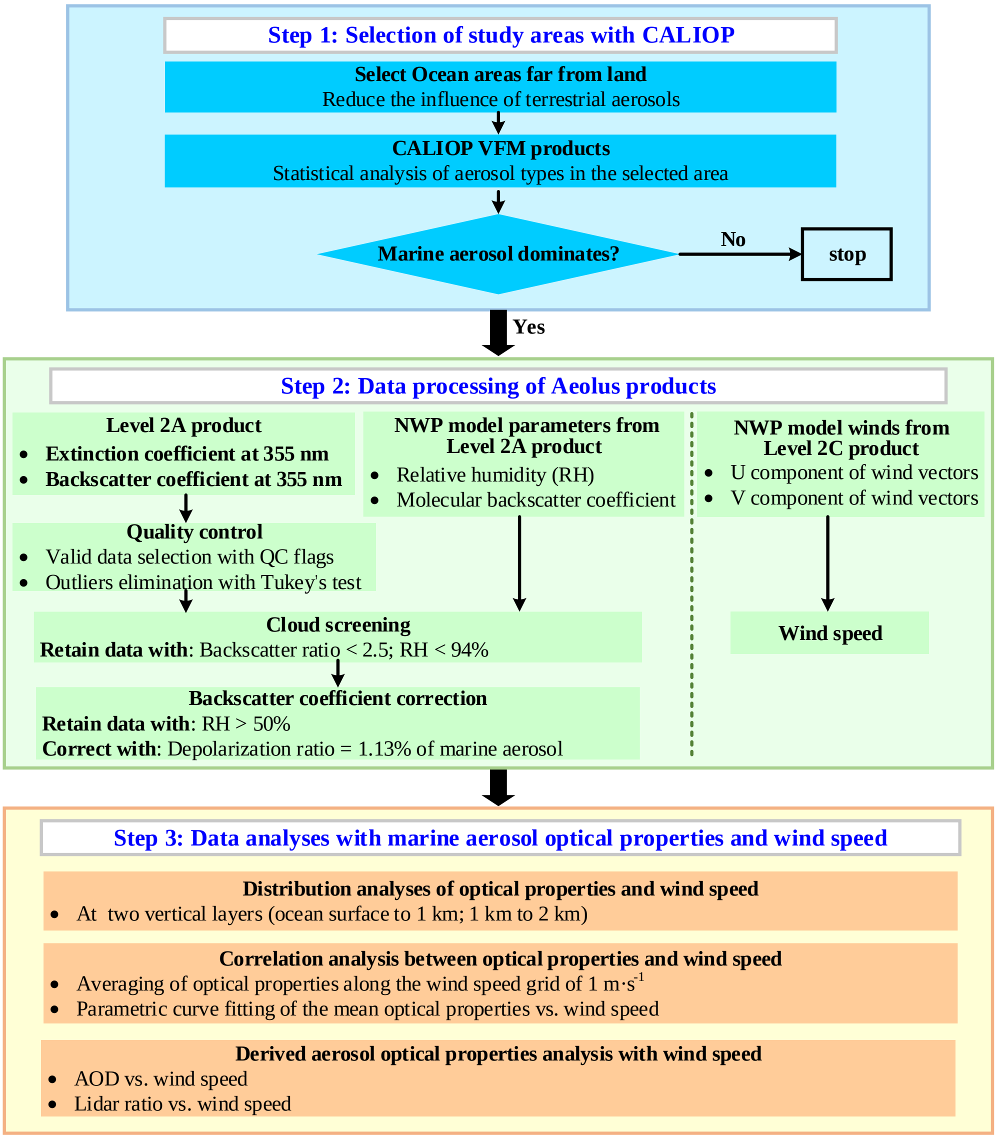

Figure 2: Flowchart of the study methodology

"It is considered that a cloud is quite likely to exist if the backscatter ratio (BR) (total backscatter coefficient/molecular backscatter coefficient) at 355 nm is larger than 2.5 or the RH is larger than 94% (Flamant et al., 2020). Therefore, in this study, when the BR is larger than 2.5 or the RH is higher than 94%, the corresponding data bin is regarded as cloud contaminated and is eliminated."

Reference: *Flamant, P. H., Lever, V., Martinet, P., Flament, T., Cuesta, J., Dabas, A., Olivier, M., Huber, D., Trapon, D., and Lacour, A.: Aeolus Level-2A Algorithm Theoretical Basis Document, version 5.7, https://earth.esa.int/eogateway/documents/20142/37627/Aeolus-L2A-Algorithm-Theoretical-Baseline-Document (last access: 9 November 2022), 2020.*

It is better to use marine particle depolarization at 355nm from the Delian model (Floutsi et al., 2023). Gross' paper reports depol values at 532nm (even though the difference is not large, 1.3 vs 2%).

AR: Thanks for the suggestion. We have re-processed all the results with the marine particle depolarization at 355nm of 1.3 % from Floutsi et al. (2023). The figures and the relevant descriptions have been replaced and rephrased in the revised manuscript.

CALIPSO cannot verify the presence of a specific aerosol type, since the aerosol type is inferred based on assumptions on the surface type. Even though the regions selected are dominated by marine particles, it is better to rephrase as it concerns CALIPSO and further validate through a global model that there are no other types present (e.g. from ship emissions).

AR: According to Kim et al. (2018), the aerosol types discrimination of CALIPSO is based not only on surface type, but also on the particulate depolarization ratio, integrated attenuated backscatter coefficient at 532 nm, layer top altitude and layer base altitude. As shown below, Fig. 1 is Fig. 1 in Kim et al. (2018), which presents the Flowchart of the CALIPSO aerosol subtype selection scheme for tropospheric aerosols and the method was well studied and discussed in this paper. Therefore, the aerosol types discrimination of CALIPSO is not totally based on assumptions, but mainly infers from the lidar measurement and combines with the assumptions on the surface type. It is considered that the aerosol subtype data provided from CALIPSO is reasonable.

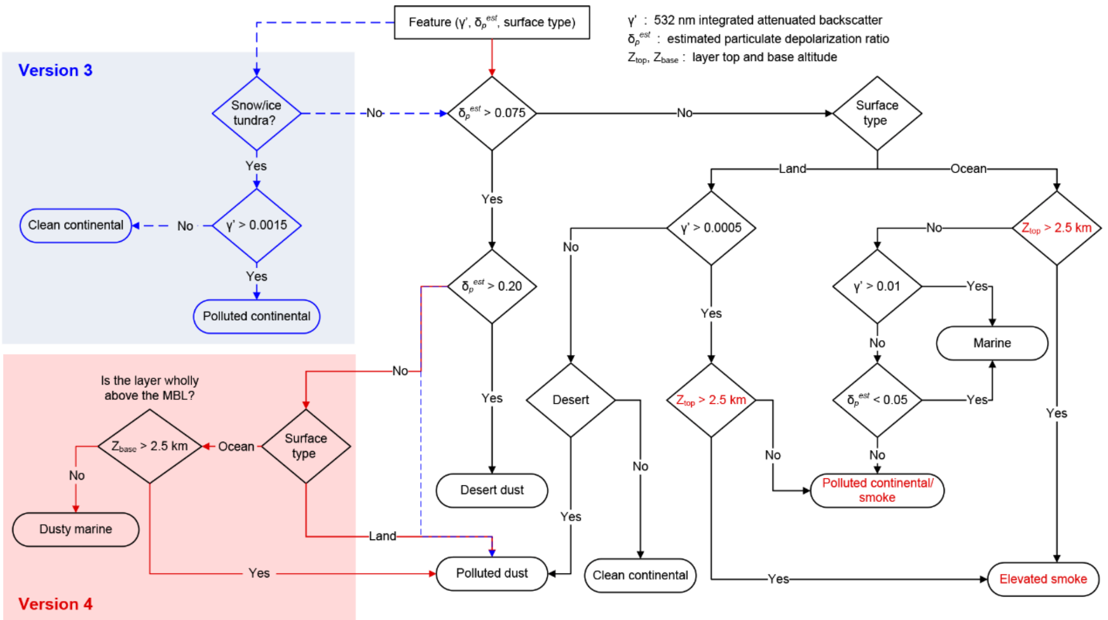

Figure 1: Flowchart of the CALIPSO aerosol subtype selection scheme for tropospheric aerosols (Fig. 1 from Kim et al. (2018)).

As for the shipping emission aerosol, the Intergovernmental Panel on Climate Change (IPCC) Fifth

Assessment Report provided the average value of international shipping emission aerosols, which is 5.5 $Tg \cdot yr^{-1}$ with the minimum of 3.6 $Tg \cdot yr^{-1}$ and the maximum of 8.7 $Tg \cdot yr^{-1}$. Comparing to the estimated sea spray aerosol emission of 1400-6800 $Tg \cdot yr^{-1}$, it is considered that the shipping emission aerosol is negligible.

Reference: *Kim, M.-H., Omar, A. H., Tackett, J. L., Vaughan, M. A., Winker, D. M., Trepte, C. R., Hu, Y., Liu, Z., Poole, L. R., Pitts, M. C., Kar, J., and Magill, B. E.: The CALIPSO version 4 automated aerosol classification and lidar ratio selection algorithm, Atmos. Meas. Tech., 11, 6107–6135, https://doi.org/10.5194/amt-11-6107-2018, 2018.*

In 4.2 the comparison of Aeolus with CALIPSO on extensive properties (a, b), should be restricted for backscatter only (CALIPSO cannot deliver extinction). Extinction could be evaluated against passive sensors such as MODIS AODs over the region.

AR: The purposes of the section of "Marine aerosol optical depth vs. wind speed" is to compare the AOD-wind speed relationship acquired from Aeolus with the result in a peer reviewed, published work. We quoted the AOD-wind speed relationship in Kiliyanpilakkil and Meskhidze (2011), which is acquired from the combination of AOD at 532 nm from CALIOP and 10 m wind speed from AMSR-E. The reason of choosing the result from Kiliyanpilakkil and Meskhidze (2011) for the comparison is that the AOD data source (from spaceborne lidar observation), the study areas (remote ocean regions globally), and the wind speed range (0 m/s- 29 m/s) of the AOD-wind speed relationship exploration in Kiliyanpilakkil and Meskhidze (2011) are all quite similar with those of this study. This comparison is considered capable to verify the AOD-wind speed relationship from Aeolus, and exactly, further to highlight the advantage of Aeolus on the AOD-wind speed relationship exploration, as the CALIPSO cannot deliver extinction precisely.

Fig. 11 from the revised manuscript (as shown below) shows the comparison between these two relationships. Indeed, AODs provided by CALIPSO-CALIOP are retrieved with the combination of the measurements of total attenuated backscatter coefficients and the assumptions of aerosol lidar ratios. Though the CALIOP AODs are based partly on assumptions, the AOD values from Aeolus are quite close (though slightly higher at low wind speed) to those from CALIOP and the tendencies of the two relationships are similar. The difference between AODs from CALIOP and from Aeolus are discussed in the manuscript as:

"The lower AOD_{mar} from CALIOP after wavelength conversion at low wind speed may arise from using a fixed LR_{mar} of 20 sr at 532 nm used for CALIOP AOD_{mar} retrievals while the LR_{mar} can vary with the particle size. Possible underestimation of the CALIOP retrieved AOD_{mar} at 532 nm is discussed in detail in Kiliyanpilakkil and Meskhidze (2011). Besides, as discussed in Section 4.4.2 of this paper, the particle size and the LR of the marine aerosol will vary with wind speed, so using the CALIOP AOD_{mar} retrieved with the fixed LR_{mar} may generate additional error in the exploration of the relationship between the AOD_{mar} and the wind speed. Therefore, using Aeolus retrieved AOD_{mar}, which is integrated by independently retrieved extinction coefficient without the assumption of LR_{mar}, could make the AOD_{mar} - ws relationship more reliable." From the comparison and the description, the marine AOD-wind speed relationship from Aeolus is verified while the advantage of Aeolus that it can retrieve AOD without any assumptions than CALIOP is illustrated.

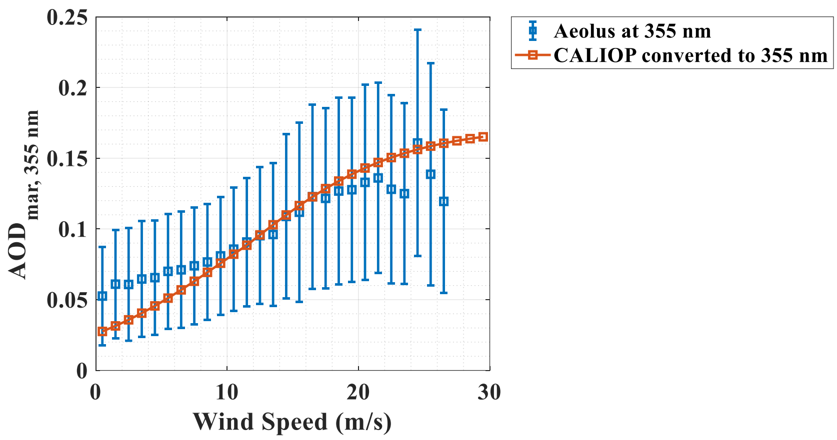

Figure 11: AOD_{mar} at 355 nm versus wind speed. The blue squares and the corresponding error bars represent the AOD_{mar} means and standard deviations along the ws grid of all the three study areas in this study; the red squares and line represent the AOD_{mar} at 355 nm along the ws grid converted from the regressive relationship between the AOD_{mar} at 532 nm and the ocean surface wind speed reported by Kiliyanpilakkil and Meskhidze (2011).

Reference: *Kiliyanpilakkil, V. P. and Meskhidze, N.: Deriving the effect of wind speed on clean marine aerosol optical properties using the A-Train satellites, Atmos. Chem. Phys., 11, 11401–11413, https://doi.org/10.5194/acp-11-11401-2011, 2011.*