EDITOR

Response: We thank the editor for the comments that have improved our manuscript in terms of its accessibility, clarity, and connection to past studies. We provide our responses below in italicized bold font. All changes to the manuscript can be identified in the version submitted using Track Changes.

Review of Revised Submission "Measurement Report: Characterization of Aerosol Hygroscopicity over Southeast Asia during the NASA CAMP^{2}Ex Campaign" by Lorenzo et al.

Editor

March 1, 2025

Thanks for your revised manuscript. I had another read and found some more minor issues which should be addressed before final publications. See comments below.

- A few clarifications concerning Table 3:

* In Burgos et al. (2019), different set-ups of f(RH) measurements were summarized. The DOE system provides PM1/PM10 measurements of f(RH) while other systems provide whole-air values of f(RH). For example, in Zieger et al. (2010) for the Arctic (see https://acp.copernicus.org/articles/10/3875/2010/acp-10-3875-2010.html), it is not "<1000nm" (as stated in the column description) but "whole-air". Please revise.

Response: The table was deleted and is now included in Section 3.1.1 instead. The following text was added to the 4th paragraph of the introduction. "Observed and simulated aerosol hygroscopicity using aforementioned parameters are greater in clean marine air masses (f(RH=85 %/RH=40 %) = 2.10 - 2.30 for PM_1) compared to air masses over land and near terrestrial biogenic sources (f(RH=85 %/RH=40 %) = 1.29 - 2.10 for PM_1), which are secondary organics precursors, and from biomass burning (f(RH=85 %/RH=40 %) = 1.02 – 2.10 for PM_1) (Swietlicki et al., 2008; Duplissy et al., 2011; Petters and Kreidenweis, 2007; Burgos et al., 2019; Titos et al., 2021; Gomez et al., 2018). Only the Arctic has aerosol hygroscopicity values (f(RH=85 %/RH=40 %) = 2.70 for PM_1 and f(RH=85 %/RH=40 %) = 3.00 for whole-air samples) greater than in clean marine regions (Delene and Ogren, 2002; Zieger et al., 2010)."

* Why do you add values for "new particle formation"? I don't really see this discussed?

Response: The row for new particle formation has been removed from Table 1.

* As also the first reviewer pointed out: It would make more sense to have a more specific table with f(RH) and g(RH) values for marine and marine polluted (or biomass burning) environments. Please also use original references. You could add your observations to the same table for a better comparison ("this study").

Response: A revised table that includes the CAMP²Ex air mass f(RH) values was added in Section 3.1.1. and is now named Table 2. The table with instrument specifications is now labeled as Table 1. The original references for the f(RH) from Past Studies are now included in the table caption.

Table 2: Hygroscopicity values of various aerosol types based on selected summary studies for measured g(RH) (Swietlicki et al., 2008) and f(RH) (Eldering et al., 2002; Doherty et al., 2005; Liu and Li, 2018; Dumka et al., 2017; Gogoi et al., 2015; Burgos et al., 2019; Titos et al., 2021) and modeled κ (Pringle et al., 2010) and CAMP²Ex f(RH) values for air masses (Hilario et al., 2021): Maritime Continent (MC), East Asia (EA), peninsular Southeast Asia (PSEA), West Pacific (WP), and Other, and their associated source.

	Past Studies			Air Masses Affecting CAMP²Ex
Aerosol Type	*g(RH=90%)* (10 - 500 nm)*	*f(RH=85%/RH=40%)** (< 1000 nm)*	*κ**** (5 - 500 nm)*	*f(RH=82 ± 10 %/RH<40%)** (< 5000 nm)*
Clean Marine	*1.62 - 2.14*	*2.10 - 2.30*	*0.92*	*1.49 (WP)*
Polluted Marine	*1.00 - 1.76*	*1.73 - 2.20*	*0.59*	*1.23 (Other)*
Urban Continental	*1.00 - 1.68*	*1.38 - 1.60*	*0.21 - 0.36*	*1.20 - 1.38 (EA, PSEA)*
Aged Biomass	*1.15 - 1.30*	*1.02 - 2.1****	*< 0.1*	*1.05 (MC)*

**Mean values from various ground-based sites*

***Median values*

****Gomez et al., 2018 mean (f(RH=85%/RH=25%))*

*****Mean surface values*

- Line 173-176: There is some repetition here about the verification using hydrophilic PSLs. Please combine. In addition, are they really hydrophilic? It is a plastic and should not be hygroscopic. Please double-check what you used.

Response: The sentences have been combined "System response was verified in flight by introducing hydrophobic PSL spheres into the sample stream to ensure that the nephelometers were consistent and an f(RH) value of 1.0 is observed." And the sentence with the hydrophilic PSLs was deleted.

- In your equations, you are using for the scattering enhancement an italic "f". Please also use it within the text, to make sure that the scattering enhancement is a function.

Response: The f in f(RH) has been replaced by an italicized "f" for the 139 instances that f(RH) appears in the text and the captions.

- For all figures showing boxplots/errorbars and linear regressions: Please add information on how they were retrieved and what is shown.

Response: This was added to the caption for Figures 2, 3, and 6 "(boxes correspond to the 25th to 75th percentile of the data, the red line is the 50th percentile, the whiskers represent 1.5 * the interquartile range, the red crosses are the outliers, and when the notches in the boxplots do not overlap there is 95 % confidence that the medians of the boxplots are different)".

- Some of the figure captions could be improved by using a descriptive title (and not start with the temporal resolution of a certain quantity). See https://www.atmospheric-chemistry-and-physics.net/submission.html#figurestables

Response: The following captions were edited:

Figure 2. "Distribution of f(RH=82 % ± 10 %/RH<40 %) 1 s data at 550 nm"

Figure 3. The following descriptive title was added "Physicochemical properties of air masses." The words "1 s" were removed from the first sentence of the caption.

Figure 4. The following descriptive title was added "Effect of organic mass fraction on f(RH)."

Figure 5. The following descriptive title was added "Aerosol types based on particle optical data."

Figure 6. The following descriptive title was added "Physicochemical properties of air masses with sub-1 f(RH)."

Figure 8. The following descriptive title was added "Effective particle density and f(RH)."

Figure 10. The following descriptive title was added "Volume size distributions for the tropical cyclone-induced convection case study." And the words "the tropical cyclone-induced convection case study" were removed from the next sentence.

Figure 11. The following descriptive title was added "Volume size distributions for the shallow convection case study." And the words "the shallow convection case study" were removed from the next sentence.

- In Figure 1, please add the corresponding wavelength of f(RH) to the caption. The counts relate to what time average? I am also a bit confused by the RH histogram and the f(RH) values in the

histogram above: Is f(RH) shown at variable RH (as shown in the RH histogram below) or shown at f(RH=82/40) as mentioned in the text. Please make this clear in the figure and caption.

Response: The wavelength "at 550 nm" was added after the two instances of f(RH) mentioned in the caption. The text in Figure 1 was updated to note the RH values used to derive f(RH) f(RH=82 % ± 10 %/RH<40 %). The word "ambient" before "relative humidity (RH") was also added for a clearer description of the plot of ambient RH measurements that correspond to the f(RH) data. The captions in Figures 2, 4 to 9 and 13 were also updated to include "RH=82 % ± 10 %/RH<40 %"

- Figure 2: Same here, mention which RH and wavelength is shown here.

Response: The RH and wavelength values for f(RH) were added accordingly to this figure caption as well for the figure captions in Figures 4 to 9 and 13.

- Figure 3: Please describe properly panel b (e.g. acronyms, y-axis, etc).

Response: The caption was updated and now includes the instruments ("aerosol mass spectrometer (AMS)", "soot photometer (SP2)", and "particle-into-liquid sampler (PILS) and ion chromatograph") used to derive the aerosol mass fractions. The air mass names and their acronyms, which are listed on the y-axis, were also explicitly stated in the updated the caption (": Maritime Continent (MC), East Asia (EA), Peninsular Southeast Asia (PSEA), West Pacific (WP), and Other").

- Figure 4: Please add the used regression type (orthogonal?) to the caption. As a side note: This is a nice result, you could compare your findings to previous observed f(RH)-organic relationships e.g. given by Quinn et al. (2005), Zhang et al. (2015), and Zieger et al. (2015). See also Figure 3 in Burgos et al. (2020) where these kind of findings are later used to evaluate models.

Response: The caption was updated: Scatter plots of 30 s averaged f(RH=82 % ± 10 %/RH<40 %) and corresponding organic mass fraction contribution to total submicrometer aerosol mass (sum of organic, SO_4^{2-}, NO_3^-, NH_4^+, Cl^-, and black carbon (BC) mass concentration) "and (red) linear regression line and (upper right) corresponding equation and goodness of fit"

The following text was added to Section 3.1.1:

"The relationship between f(RH) and organic mass during CAMP^{2}Ex is similar to those in the Indian ocean during INDOEX (based on calculated f(RH) from estimated γ) (Quinn et al., 2005), which is similarly affected by the outflow of biomass burning."

"This slope for the air masses coming from EA is less steep than the f (RH=85 %/RH=40 %) at 550 nm to organic mass fraction relationship (-1.20 ± 0.04) from a ground station in the populated and growing region of the Yangtze River Delta in China (Zhang et al., 2015), where

organic contributions are lower and mean f(RH) values are higher (1.58 ± 0.12) than the median f(RH) (1.38) during CAMP2Ex for air massed coming from EA."

The third paragraph in the conclusion was updated to include findings from the sources mentioned above. "Without organics, the baseline f(RH) (1.38 – 1.55, Fig. 4), is still lower than measurements from other areas (i.e. ~1.8 from the Yangtze River Delta in China and from INDOEX over the Indian Ocean, 2.19 from SEAC^{4}RS in and around the U.S., ~2.6 from ICARTT over North America and Europe, ~3 from ACE-ASIA over the Yellow Sea and Sea of Japan, and ~3.5 from Melpitz, Germany) (Zhang et al., 2015; Quinn et al., 2005; Shingler et al., 2016a; Zieger et al., 2014) probably due to the presence of elemental carbon, which is the second most dominant aerosol type during the campaign. The unique relationship between organic matter and hygroscopicity in the CAMP^{2}Ex region is important information that can help in model evaluations (Burgos et al., 2020)."

- Figure 5: Please make sure that the corresponding wavelengths are mentioned in the caption.

Response: The wavelengths were added accordingly: (AAE, 470-660 nm) and (SAE, 450-700 nm).

- Figure 8: Regression type?

Response: The following was added to the caption "and with (red) linear regression line and (upper left) corresponding equation and goodness of fit"

- In the data availability statement, could you please be more detailed where the individual datasets can be found? For example, I could not find the f(RH) data on the website stated by just looking at the file names.

Response: The data availability statement has been updated to include more details. "CAMP^{2}Ex data archived per research flight and parameter type can be found at: https://doi.org/10.5067/Airborne/CAMP2Ex_Aerosol_AircraftInSitu_P3_Data_1 (P-3 In-Situ Aerosol Data), https://doi.org/10.5067/Airborne/CAMP2Ex_Cloud_AircraftInSitu_P3_Data_1 (P-3 In-Situ Cloud Data), https://doi.org/10.5067/Airborne/CAMP2Ex_MetNav_AircraftInSitu_P3_Data_1 (P-3 In-Situ Meteorological and Navigational Data), and https://doi.org/10.5067/Airborne/CAMP2Ex_TraceGas_AircraftInSitu_P3_Data_1 (P-3 In-Situ Trace Gas Data)."

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