Author Comment on EGUsphere-2025-2645

Cloud Base Height Determines Fog Occurrence Patterns in the Namib Desert

Deepanshu Malik, Hendrik Andersen, Jan Cermak, Roland Vogt, and Bianca Adler

We sincerely thank both referees for their thoughtful and constructive reviews. Their comments and suggestions have helped us substantially improve the scientific significance, structure, and clarity of the manuscript. In particular, their feedback guided us to: (i) place greater emphasis on the quantification and interpretation of spatial dynamics; (ii) clarify the role of the CBH–RH relationship as validation; (iii) restructure long sections for readability; and (iv) add schematic figures illustrating fog life cycle processes.
Below, we provide point-by-point responses to all comments. Changes made in the manuscript are indicated with references to sections, line numbers, and figures of the revised manuscript.

Response to Referee #1 (RC 1)

RC1.1 - General Comment:

This study presents an analysis of cloud base height (CBH) and CBH time tendency for clouds along the Namib Desert coast. The methods are reasonable. I had a hard time following all of the process-based reasoning and 1 diagram may be helpful in this regard. I am highly skeptical that the CBH-RH relationships represent a novel contribution to the field. Overall, I think that the paper could be publishable with revisions, but I find the scientific significance of the manuscript to not be as high as I would expect for an article published in ACP. Possibly the significance could be increased with revision.

Author Response:
We thank the referee for their positive assessment of the methodological approach and for highlighting areas where the manuscript could be improved, particularly regarding the CBH–RH analysis and the process-based reasoning. In the revised manuscript, we have reframed the CBH–RH slope analysis as a validation of established boundary-layer theory rather than as a novel contribution. The intention was not to present the CBH–RH relationship as a novel finding, but rather to emphasize its utility as an approach for estimating CBH. Corresponding changes have been incorporated into the title, abstract, and Section 3.3. In addition, Section 3.2.2 has been reorganized into shorter thematic subsections, and a conceptual schematic illustrating the fog life cycle (Figure 7) has been added to clarify the process-based discussion. All these changes are explained in detail with specific comments below. We believe these revisions improve both the clarity and the significance of the study, and we hope they adequately address the referee’s concerns.

RC1.2.1 - Major Comments:

Comment 1:

The authors find, through fitting, that the CBH rises ~22m for every 1% change in surface RH. Much is made of this result. While the authors acknowledge that this result is qualitatively consistent with expectations, I think it is important to note that it is also quantitatively consistent with expectations. Using the approximate equation LCL [km] = (T-Td)/8 and a formulation for Td (dewpoint temperature) in terms of RH and T, I likewise find that the CBH rises ~23m for every 1% change in surface RH (when T=25°C). This suggests to me that all the authors have really done is show that the boundary layer is indeed typically well-mixed during fog and low cloud events. As such, we can apply known equations about the relationship between surface conditions and cloud base height. I don't think that this result needs to be highlighted so strongly (it's even in the title) and instead could possibly even be presented first and then applied to all met stations so that an even more comprehensive look at cloud base climatology in the region could be conducted.

Author Response:

We agree with the referee's assessment and have revised the manuscript to reduce the emphasis on the CBH–RH relationship as a novel result. Instead, we now present it as a validation and quantification of the skill in estimating CBH using RH. The observed slope (~23 m per 1% RH) is explicitly noted as being consistent with the theoretical lifting condensation level.

To reflect this change, we have adjusted the title, abstract and Section 3.3, as follows:
Title: "Cloud Base Height Determines Fog Occurrence Patterns in the Namib Desert"
Abstract (Lines 7-9): "Quantile regression highlights the tight relationship between cloud base height and near-surface relative humidity (r ≈ -0.76) that is expected in well-mixed boundary layers, which can therefore be employed to estimate cloud base height across FogNet sites"
Section 3.3 (Lines 286-287): "This slope is nearly identical to the theoretical lifting condensation level estimate of ≈23 m per 1 %RH at 25,°C (Bolton, 1980; Lawrence, 2005)".

We also acknowledge the referee's suggestion to first present the CBH–RH relationship and then extend it to all stations. This approach was already embedded in the original manuscript (section 3.3 - Estimated CBH), where the CBH–RH relationship was introduced in Figure 9 (scatter plots) and subsequently applied to all stations in Figure 10 (histograms). The corresponding discussion highlights that the high density of estimated CBH values at lower altitudes during fog events over nearly a decade (1 July 2014 – 31 December 2023) reflects the climatological perspective of this analysis.
However, we recognise that this point was not made sufficiently clear in the original text and should be done more explicitly in separate subsection. Therefore, we have revised the manuscript to explicitly clarify this connection and introduced a new subsection 3.3.1 (Regional Applicability) with an additional Figure 11 and subsequent changes are as follows:

Lines 314-318: “The quantile regression trained on Coastal Met data was applied to estimate cloud base height (CBHe) using the entire RH time series (nearly 10 years) from all FogNet stations. Figure 10 shows the decadal density distributions of RH and CBHe during satellite observed FLC events and during fog events observed through FogNet measurements. Across all stations except Gobabeb (GB) and Garnet Koppie (GK), nearly all fog events exhibit an RH > 98 %, and peaking near 100 %, and corresponding to low CBHe values of around 50–70 m AGL (after accounting for the 44.3 m bias), which is expected during fog”

Lines 326-341: “Furthermore, to assess the regional applicability of the CBH–RH relationship for distinguishing fog from low clouds in the satellite-derived FLC product, a monthly climatology of observed fog nights and potential fog nights was constructed for all FogNet stations over the period from July 2014 to December 2023 (Figure 11). In Figure 11, the comparison between ground-observed fog nights (green bars) and potential fog nights derived from CBHe (green line) shows strong agreement in both seasonal and spatial patterns over the decade, underscoring the applicability of the CBHe-based approach, despite minor deviations. In contrast, the potential low-cloud night pattern (grey line) displays a distinct seasonal phase shift and higher values during months of reduced fog occurrence, indicating periods when stratus clouds remain elevated above the surface rather than forming ground-level fog. In this framework, a night was classified as potential fog in the FLC retrieval when CBHe dropped below 80 m AGL for at least one timestep, corresponding to conditions where the cloud base effectively reaches the surface. Conversely, potential low-cloud nights were identified when CBHe remained above 100 m AGL throughout the night, ensuring that only elevated stratus events were included. These thresholds are consistent with the RH–CBHe distributions shown in Figure 10, where observed fog typically coincides with RH > 97 % and CBHe between 50–100 m AGL. Overall, this analysis highlights that the quantile regression-based relationship between CBH and RH can be effectively used to estimate CBHe and thereby separate fog from low stratus clouds across the FogNet network. This finding reinforces the central premise of this study that cloud base height determines fog occurrence patterns in the Namib Desert. The applicability of this approach is further demonstrated and validated through a case study in the following section.”

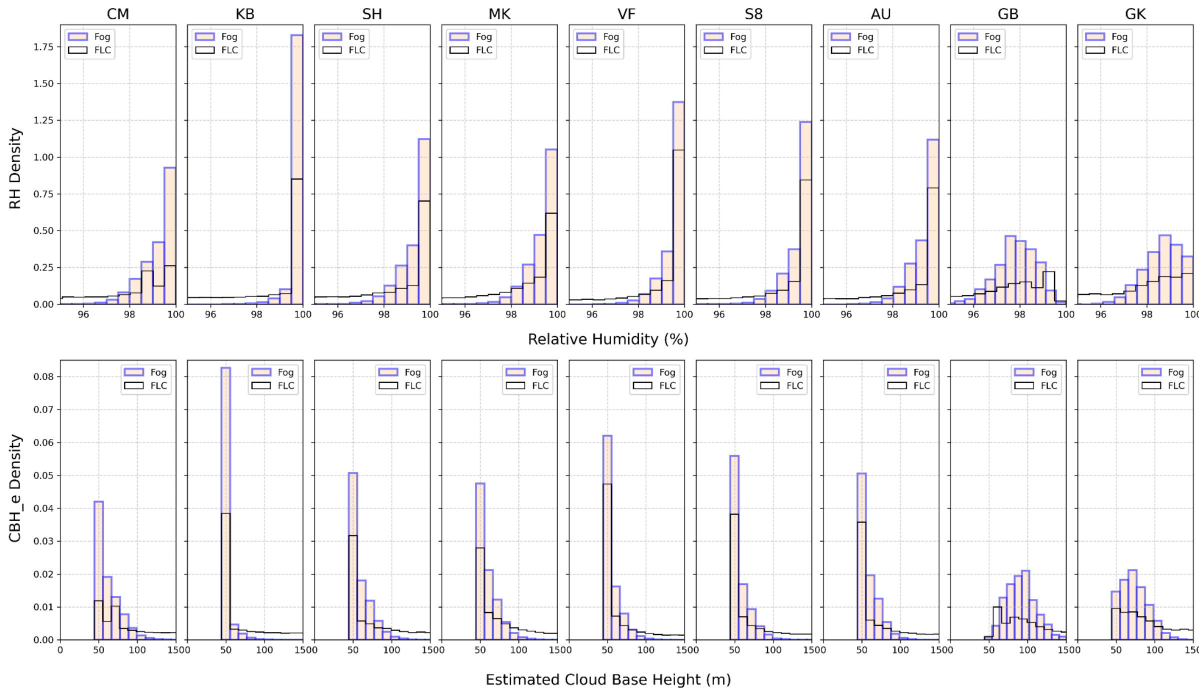

Figure 10 : Density histograms of RH (upper panel) and (CBHe) (bottom panel) during fog event and satellite derived fog and low cloud (FLC) occurrences across different FogNet stations from 2014-07-01 to 2023-12-31.

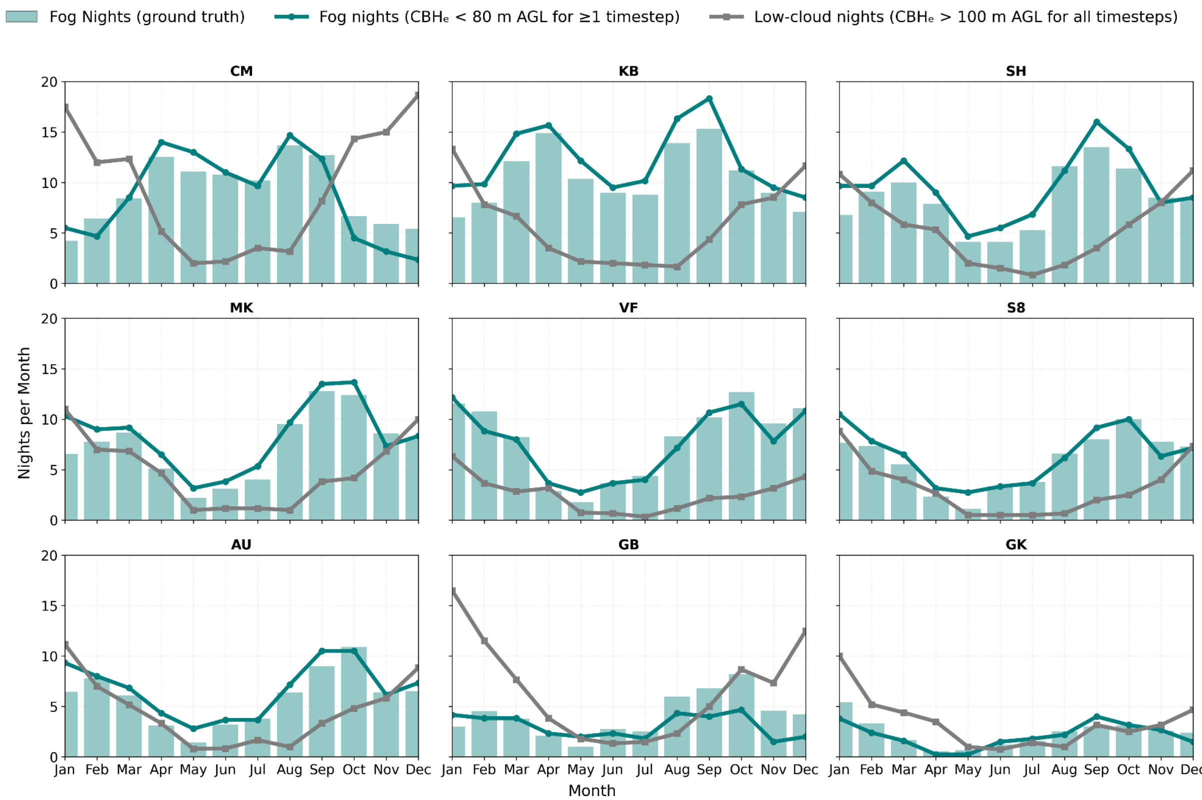

Figure 11. Monthly mean number of observed fog nights and potential fog nights at FogNet stations from July 2014 to December 2023. Observed fog nights (ground truth) are shown as green bars. The green line represents potential fog nights derived from FLC retrievals where CBHe < 80 m AGL for at least one timestep during a night, and the grey line represents potential low-cloud nights where CBHe > 100 m AGL for all timesteps of a night.

Comment 2:

I appreciate the efforts the authors have made to infer processes driving the cloud/fog lifecycle, but I had a really hard time following the logic of their conclusions. In general, I think the manuscript could be improved by breaking up long paragraphs into shorter paragraphs with distinct themes. This is particularly true in section 3.2.2 where the paragraph runs to 40 lines. I also think that a diagram could help explain some of the authors' ideas.

Author Response:

We thank the referee for appreciating our discussion of the processes and for motivating us to conceptualize them through the use of a diagram. In response, we have restructured Section 3.2.2 by breaking the original long paragraph into three shorter, thematic paragraphs. To support this restructuring, we have also added a conceptual diagram (Figure 7) summarizing the dominant processes and our proposed modifiers influencing CBH lowering and lifting. The revised section now begins with a general setup of the processes, followed by a discussion of the known processes established in literature (P1 in Figure 7), and concludes with our interpretation of the observations in the Namib (P2 in Figure 7).

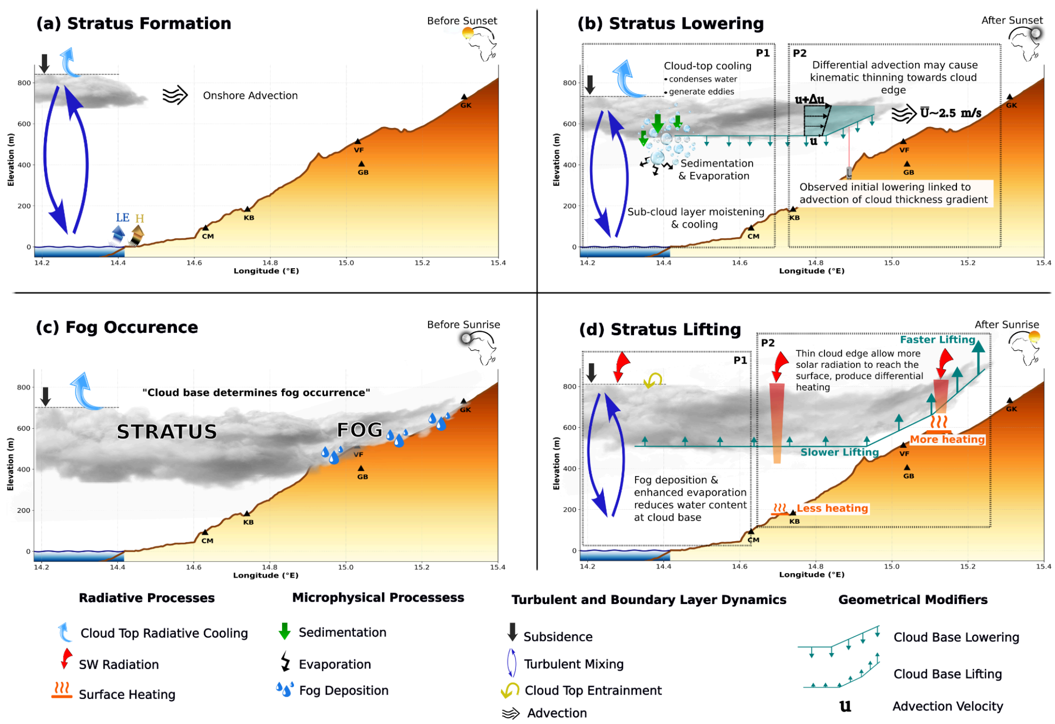

Figure 7: Conceptual diagram of the nocturnal evolution of fog and stratus in the Namib and the associated dominant processes. (a) Stage before sunset, (b) stratus lowering after sunset, (c) fog occurrence during the night and early morning, and (d) fog dissipation after sunrise. Here, P1 are the known processes established in literature and P2 are the findings interpreted in this study.

Following is restructured section 3.2.2 into short paragraphs:

Paragraph 1: “To date, no study has specifically observed stratus base lowering and lifting in the Namib or examined the processes governing them. However, research from other regions provides important insights. The diurnal evolution of the stratus base in our study can be understood as the outcome of multiple interacting mechanisms. These include microphysical and radiative controls, turbulent and boundary-layer dynamics, and, as we propose here, additional modifiers linked to cloud geometry. While the first two categories are well established in the fog literature, the latter represents a hypothesis emerging from our observations in the Namib. The schematic in Figure 7 summarizes dominant processes for different stages in the fog life cycle. In Figure 7 (b, d), these established processes (P1) are shown alongside our proposed modifiers (P2), together illustrating the mechanisms of cloud base lowering and lifting throughout the fog life cycle. It is important to note that Figure 7 represents a simplified230 conceptualization of stratus onshore advection from the west, though advection from the northwest or north in this region can also occur without altering the relevance of the processes and drivers illustrated.”

Paragraph 2: “Stratus lowering is primarily driven by the redistribution of moisture within the boundary layer, with subsequent evaporation of cloud droplets below the cloud base, which cools and moistens the sub-cloud layer. This process can occur either through turbulent mixing where droplets are transported downward by eddies generated by strong cloud-top cooling (Pilié et al., 1979; Dupont et al., 2012; Wagh et al., 2021; Fathalli et al., 2022; Singh et al., 2024), or through gravitational settling when droplets grow large enough to fall out of the cloud (Dupont et al., 2012; Pope and Igel, 2024). Stratus lifting, on the other hand, typically occurs after sunrise and is associated with surface heating and wind shear increase turbulent kinetic energy, deepening the boundary layer and entraining drier air into the cloud. This enhances droplet evaporation and reduces liquid water content at cloud base, progressively decoupling the cloud layer from the surface (Dupont et al., 2012; Singh et al., 2024). This results in a rapid lifting of the cloud base and, ultimately, fog dissipation.”

Paragraph 3: “Beyond these established mechanisms, our analysis points to geometrical modifiers of the advected cloud deck. Unlike regions such as Central Europe, where stratus lowering frequently occurs under quasi-stationary cloud conditions (Dupont et al., 2012), the Namibian stratus is subject to significant advection (Andersen et al., 2019; Spirig et al., 2019), raising the possibility that the observed CBH lowering and lifting in the Namib is also influenced by the geometry of the advected stratus. One potential factor is the presence of horizontal gradients in cloud thickness, especially near cloud edges, arising from e.g. relative displacement or kinematic thinning caused by differential advection speeds of the cloud top versus the base (e.g. 2 m s−1 near the surface and 4 m s−1 at stratus top as documented by Spirig et al., 2019). Such gradients may give the impression of CBH lowering/lifting in ceilometer observations, as the passage of a sloping cloud base over the measuring instrument can mimic vertical motion even if only horizontal advection occurs. The delay observed in the onset and peak of the lowering phase at Coastal Met and Gobabeb in Figure 6(b) may therefore reflect the timing of cloud edge passage over these stations, which broadly coincides with the typical start of the FLC life cycle at these locations (Andersen and Cermak, 2018; Andersen et al., 2019). Considering the distance between these locations would yield an estimated average advection speed of ≈2.5 m s−1. The stronger lifting rates observed at inland stations in Figure 6 likely result from thinner cloud and interconnected processes: inland sites such as Gobabeb and Garnet Kopie are likely to be frequently embedded within the cloud layer and thus closer to the cloud top, where thinner stratus overhead allows more solar radiation to reach the surface, enhancing surface heating, boundary-layer deepening, and cloud lifting……."

RC 1.2.2 - Specific Comments:

Comment 1:
Lines 196-197: I'm not sure what is meant by this sentence. If vertical evolution is variable (which I take to mean that different parts of profile evolve differently) then why would CBH variability be sufficient. I think I am misinterpreting the sentence. Please clarify.

Author Response:
We thank the referee for pointing out this ambiguity and are happy to clarify. The sentence in the manuscript – *"the vertical evolution of Namib fog during its life cycle can feature considerable variability and that this variability can be captured well by the estimated CBH change rates"* – is intended to convey that our rolling regression based CBH rate of change calculation (Section 2.5) is able to capture the vertical fluctuations in CBH recorded by instrument (Figure 5). We have revised the sentence in the manuscript to make this point clearer (Line 199: "This case illustrates that the vertical evolution of Namib fog during its life cycle can feature considerable fluctuations and that this variability can be captured well by the estimated CBH change rates").

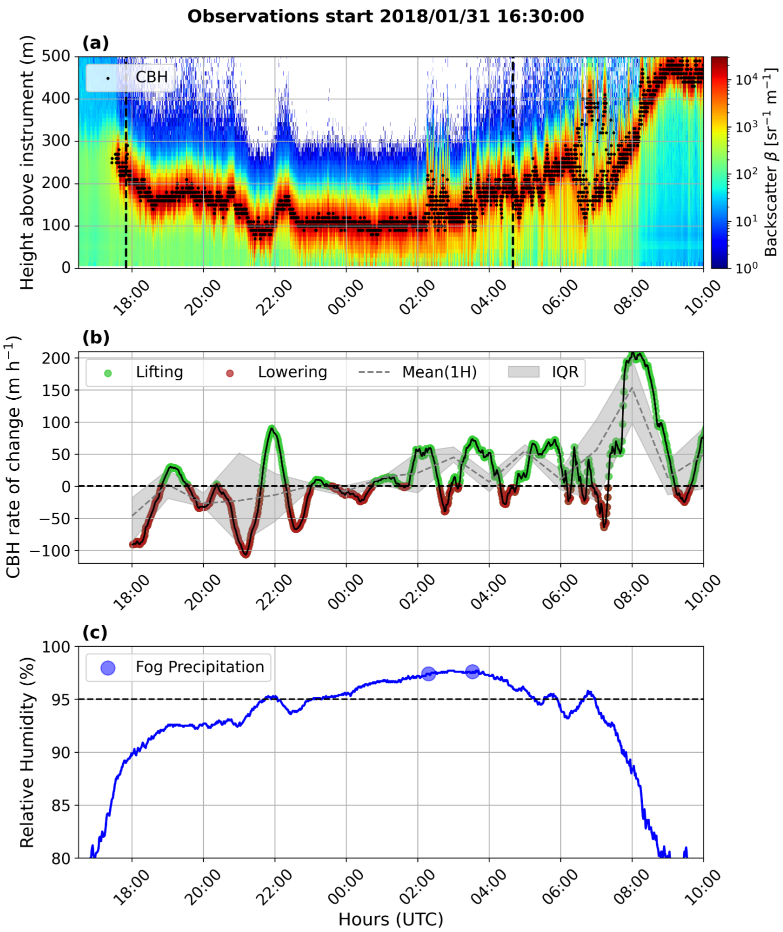

Figure 5. Time series analysis of the fog life cycle at the Coastal Met station on 31-01-2018. (a) Backscatter intensity (sr−1 m−1) with CBH markers, illustrating fog evolution. Dashed lines indicate the times of sunrise and sunset. (b) CBH rates of change (m h−1) with lifting (green) and lowering (red), alongside the hourly mean (dashed) and interquartile range (shaded). (c) RH (%) with fog precipitation indicated by blue markers. The figure captures key phases of fog occurrence, development, and dissipation.

Comment 2:
Lines 233-236: How exactly would CBH rate of change vary spatially as a result of this process? I'm having a hard time visualizing this idea.

Author Response:
We recognize that the discussion of this process may have been difficult to understand in our initial version of the manuscript. To address this, we have added a conceptual figure (Figure 7b) and expanded the explanation in the manuscript for clarity (Lines 247–253). In brief, spatial gradients in cloud thickness near the cloud edge can create the appearance of CBH lowering in ceilometer observations. This effect arises because the passage of a sloping cloud base over the instrument may mimic vertical motion during advection. Consequently, under advective conditions, the locally quantified CBH rate of change can vary spatially depending on whether the observing instrument is located under the cloud edge. For example, at 21:00 UTC in Figure 6(b), the CBH lowering rate is more pronounced at the inland site (GB) than at the near-coastal site (CM), indicating the presence of a sloped cloud edge over the inland site.

Comment 3:
Line 239: Can the authors explain more clearly why a temporal delay in lowering is indicative of an increasingly thick stratus that is advected over the locations?

Author Response:
We thank the referee for this comment. This point is closely related to our previous response regarding spatial variability of CBH rate of change. More specifically, in Figure 6b, the temporal delay between the two lowering peaks (CM: 16:00 UTC and GB: 21:00 UTC) reflects the passage of a sloped cloud edge first over CM and later over GB. At 21:00 UTC, the cloud at GB is thinner than at CM because GB is still within the region of the sloped cloud edge. Thus, the temporal delay in CBH lowering is indicative of the advected, sloped structure of the stratus cloud and can be conceptualised in Figure 7.

Comment 4:
Lines 243-244: Would the RH-CBH analysis suggest that decoupling is not occurring?

Author Response:

We thank the referee for this valuable comment and have clarified the description of the decoupling process. The regression between CBH and RH is now performed separately for night hours (22:00–07:00 UTC) and morning hours (07:00–11:00 UTC) to examine how the CBH–RH relationship varies under different boundary-layer conditions.

Figure 9 now focuses on night hours (22:00–07:00 UTC), showing strong agreement between CBH and RH, indicative of coupling under a well-mixed nocturnal layer (as previously described).

In contrast, the weaker CBH–RH relationship during daytime (07:00–11:00 UTC), shown in the newly added Appendix Figure A2, along with the positive bias between observed CBH and CBHe in Appendix Figure A3, indicates that the well-mixed assumption breaks down after sunrise. This is further exemplified in the case study presented in Figure 12(b), where the magenta line (CM observation) and the blue line (CM estimation) closely overlap during the night, indicating strong coupling between the observed CBH and CBH estimated from RH. After 07:00 UTC, following sunrise, the lines begin to diverge, showing that the CBH–RH relationship no longer holds, indicative of decoupling of layers.

Based on literature, this behavior suggests a transient separation between the surface-heated mixed layer and the cloud-driven turbulent layer aloft, consistent with findings in fog and stratus transitions and coastal stratocumulus regimes (Nicholls, 1984; Turton and Nicholls, 1987; Koraˇcin et al., 2001; Yang et al., 2021). The observed daytime bias may arise from both surface heating, which modifies the subcloud structure, and entrainment at the cloud top, which influences cloud base evolution. In the absence of vertical thermodynamic profiles, the relative contributions of these processes cannot be quantified; we therefore present this as a literature-supported interpretation describing a temporary morning decoupling.

The revisions made in the manuscript in response to this point are as follows:

Lines 279-283: The regression is also performed separately for night hours (22:00–07:00 UTC) and morning hours (07:00–11:00 UTC) to examine how the CBH–RH relationship varies under different boundary-layer conditions. In particular, a weakening of this relationship is expected during morning hours due to a transient separation between the surface-heated convective layer and the cloud–subcloud turbulent layer aloft, as described in fog–stratus transition and coastal stratocumulus regimes (Nicholls, 1984; Turton and Nicholls, 1987; Koraˇcin et al., 2001; Yang et al., 2021).

<u>Lines 290-296:</u> In contrast, the weaker CBH–RH relationship during daytime (Appendix Figure A2) and the positive bias between observed CBH and CBHe (Appendix Figure A3) indicate that the well-mixed assumption breaks down after sunrise. The divergence likely reflects transient decoupling between the surface-heated layer and the cloud-driven turbulent layer aloft, influenced by both surface heating and entrainment drying at the cloud top. n the absence of vertical thermodynamic profiles, the relative contributions of these processes cannot be quantified; therefore, we interpret this daytime divergence as a literature consistent indication of temporary morning decoupling between the surface and cloud layer.

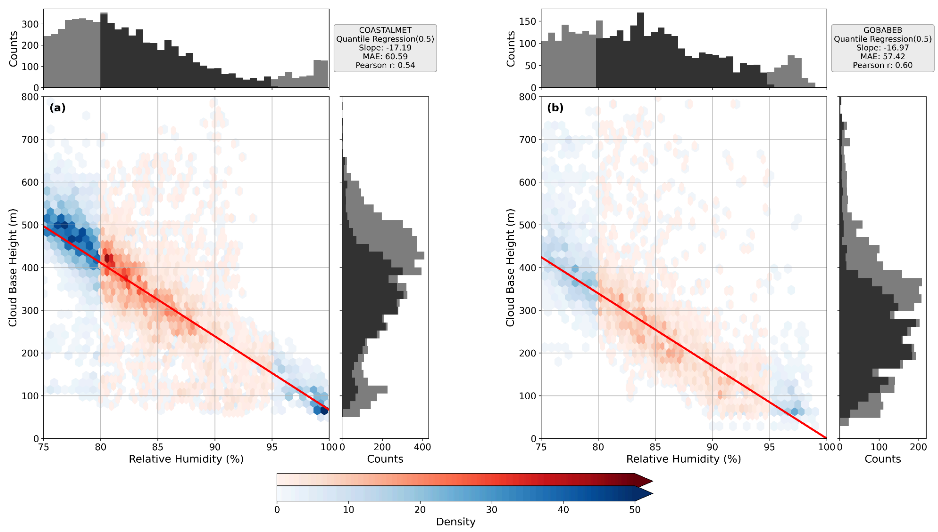

Figure A2: Density scatter plots showing the relationship between CBH and RH during the morning hours (07–11 hrs) for two stations: (a) Coastal Met and (b) Gobabeb. The plots indicate a low correlation and a disagreement of slope with the theoretical expectation (−23 m/%), highlighting the decoupling of the cloud layer from the surface after sunrise. Red shades mark the RH range between 80 % and 95 %, which is used for the 0.5 quantile regression fit (solid red line). Marginal histograms along the top and right axes show the distributions of RH and CBH, respectively, where the black shading corresponds to data within the 80–95 % RH range and their associated CBH values.

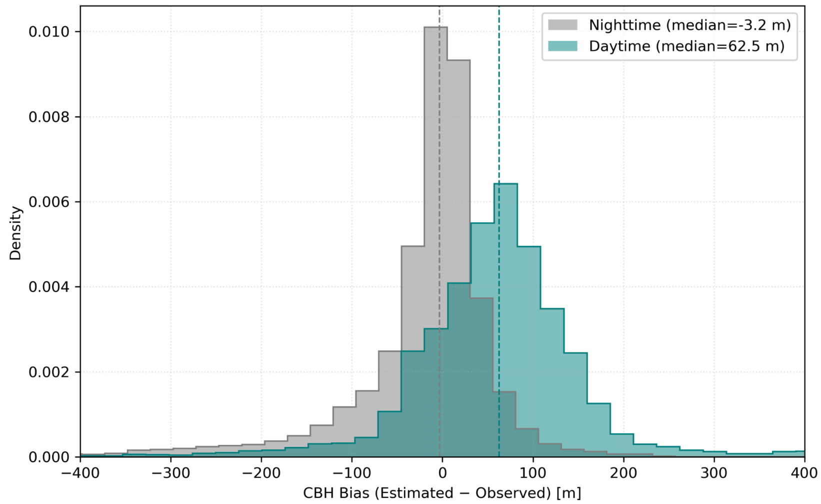

Figure A3: Distribution of CBH bias (estimated minus observed) during nighttime (22:00–07:00 UTC, grey) and daytime (07:00–11:00 UTC, teal green) periods for Coastal Met. The nighttime distribution is centered near zero (median = –3.2 m), indicating good agreement between estimated and observed CBH during nocturnal well mixed boundary layer conditions. In contrast, the daytime distribution shows a rightward shift (median = 62.5 m), reflecting a positive bias in estimated CBHe. This shift can be attributed to the transient decoupling between the surface-heated convective layer and the cloud–subcloud layer aloft that remains mixed primarily by cloud-top radiative cooling after sunrise.

Comment 5:

Lines 345-347: Why exactly does the delay in CBH lowering indicate these things?

Author Response:

We thank the referee for this comment. The temporal delay in CBH lowering, as seen in Figure 6b (CM: 16:00 UTC and GB: 21:00 UTC), reflects the passage of a sloped cloud edge over the stations while advection: first over CM and subsequently over GB. This process is conceptualized in Figure 7b and is consistent with the discussion in Section 3.2.2 (Lines 249–252).

RC1.3 - Minor Comments:

Comment 1:
References are needed on Lines 231 (for Central Europe conditions) and Line 256 (low-level easterly winds)

Author Response:
We thank the referee for pointing out the missing references. We have added the relevant citations: Dupont et al. (2012) for Central European conditions (Line 244) and Spirig et al. (2019) for low-level easterly winds (Line 261).

Comment 2:
Lines 226-227: This is an unsatisfying explanation for cloud-base lowering. How can evaporation of water lead to condensation of water at a lower altitude? I typically think of cloud base lowering being driven by either cooling or moistening of the boundary layer. Evaporation of droplets cannot moisten the boundary layer since the water is already present in the layer.

Author Response:
We thank the referee for this very thoughtful comment. The discussion in Lines 234–238 is based on a literature review of established processes contributing to CBH lowering. Cloud-top cooling leads to more condensation at the top of the stratus, and its turbulent mixing into the sub-cloud layer. While we agree with the referee that no moisture is added in the boundary layer itself when drizzle/cloud droplets fall/are mixed into the sub-cloud layer, water is redistributed from within the cloud top into the subcloud layer, moistening and cooling this part of the boundary layer. The stratus therefore grows downward. This mechanism has been established already in 1979 by Pilie et al., and has been confirmed by many studies since, as discussed in the manuscript. We have rephrased our summary regarding this aspect for better clarity.

Following are the updated text in manuscript (Lines 234–238): “Stratus lowering is primarily driven by the redistribution of moisture within the boundary layer, with subsequent evaporation of cloud droplets below the cloud base, which cools and moistens the sub-cloud layer. This process can occur either through turbulent mixing where droplets are transported downward by eddies generated by strong cloud-top cooling (Pilié et al., 1979; Dupont et al., 2012; Wagh et al., 2021; Fathalli et al., 2022; Singh et al., 2024), or through gravitational settling when droplets grow large enough to fall out of the cloud (Dupont et al., 2012; Pope and Igel, 2024)”.

Response to Referee #2 (RC2)

RC2.1 - General Comment:

This paper investigates how cloud base height (CBH) its related with fog occurrence in the Namib Desert, a hyperarid region where fog is a vital source of moisture. Using data from ceilometers and weather stations (FogNet), the authors analyze spatial and temporal patterns of CBH and develop a statistical model to estimate CBH from relative humidity (RH) near the surface. I think the structure of the article, methods, and discussions are of a high standard.

I believe that the main value of the article does not necessarily lie in quantifying the relationship between CBH and RH (although its estimation and validation are important), since this relationship is expected both conceptually and physically. Rather, its value lies in the quantification of spatiotemporal variations (seasonal and daily cycles) and the interpretative efforts of these dynamics.

It is an interesting contribution to a long-standing question in spatial-satellite analysis, concerning whether the low-stratus interacts with the terrain and thus becomes fog. Since RH is a standard measurement within atmospheric/environmental variables, and therefore has greater spatial coverage, it opens up an important avenue for future work and analysis of low-level strata and fog based on comprehensive satellite-ground observation models.

Author Response:

We sincerely thank the referee for their positive evaluation of our work and for highlighting the strengths of the manuscript. We also value the perspective that the broader contribution of this study lies in documenting the spatiotemporal variability of CBH and in providing a framework to interpret the associated dynamics in the Namib Desert. We have adjusted the manuscript to place stronger emphasis on these aspects, while presenting the CBH–RH relationship primarily as a validation tool rather than a novel finding. We are encouraged by the referee's view that our approach can support future efforts to integrate ground-based and satellite observations for improved monitoring of fog and low stratus in data-scarce regions.

RC2.2 - Major Comments:

Comment 1:
Regarding the introduction and main messages, I would emphasize the quantification of spatial dynamics and their interpretations more than the quantification of the CBH-RH relationship itself.

Author Response:
We thank the referee for this suggestion. We agree with the assessment and have revised the manuscript to place greater emphasis on CBH dynamics and processes, while reducing the focus on the CBH–RH relationship as a novel finding. Instead, we now present the CBH–RH analysis primarily as a validation and quantification of the skill in estimating CBH from RH.

To reflect this change, we have adjusted the title, abstract and Section 3.3, as follows:
Title: "Cloud Base Height Determines Fog Occurrence Patterns in the Namib Desert"
Abstract (Lines 7-9): "Quantile regression highlights the tight relationship between cloud base height and near-surface relative humidity (r ≈ -0.76) that is expected in well-mixed boundary layers, which can therefore be employed to estimate cloud base height across FogNet sites"
Section 3.3 (Lines 286-287): "This slope is nearly identical to the theoretical lifting condensation level estimate of ≈23 m per 1 %RH at 25,°C (Bolton, 1980; Lawrence, 2005)"

Comment 2:
I found chapter 2.2 (Ceilometer measurements) somewhat difficult to follow, as there is a lot of data, biases, %, etc. mentioned. Please simplify (It could be a table)

Author Response:
We thank the referee for pointing out the difficulty in following Section 2.2 (Ceilometer measurements). To enhance clarity and readability, we have revised the section and organized the data and related information into a new table (Table 1).

Comment 3:
Chapter 2.4 (FLC Satellite product) It is well presented as a satellite product and its validations, but it is not clear what it will be used for in particular in this research.

Author Response:
We thank the referee for this valuable comment. In this study, the FLC product is used to identify (mask) fog and low-cloud timesteps in the meteorological station data. This allows us to estimate the cloud base height using relative humidity only when fog or low clouds are detected by the satellite, as part of the integrative approach.

In response to this comment, we have added this point in the revised manuscript (Lines 106–107: "In this study, the FLC product is employed to align ground-based measurements with satellite observations by masking fog and low-cloud time steps in the FogNet station records").

Comment 4:

As I find the processes and interpretations very interesting, I suggest incorporating an interpretative figure of these processes (for different time scales), which could be very helpful in understanding what is expressed in the results (especially chapters 3.2.1 and 3.2.2).

Author Response:

We thank the referee for this constructive remark and appreciate the positive feedback regarding the interest in the processes described. To enhance the conceptual understanding of the processes discussed in Section 3.2, we have added a conceptual diagram (Figure 7) illustrating the four states of the fog life cycle. In addition, the discussion in Section 3.2.2 has been reorganized into three concise paragraphs for improved clarity and flow.

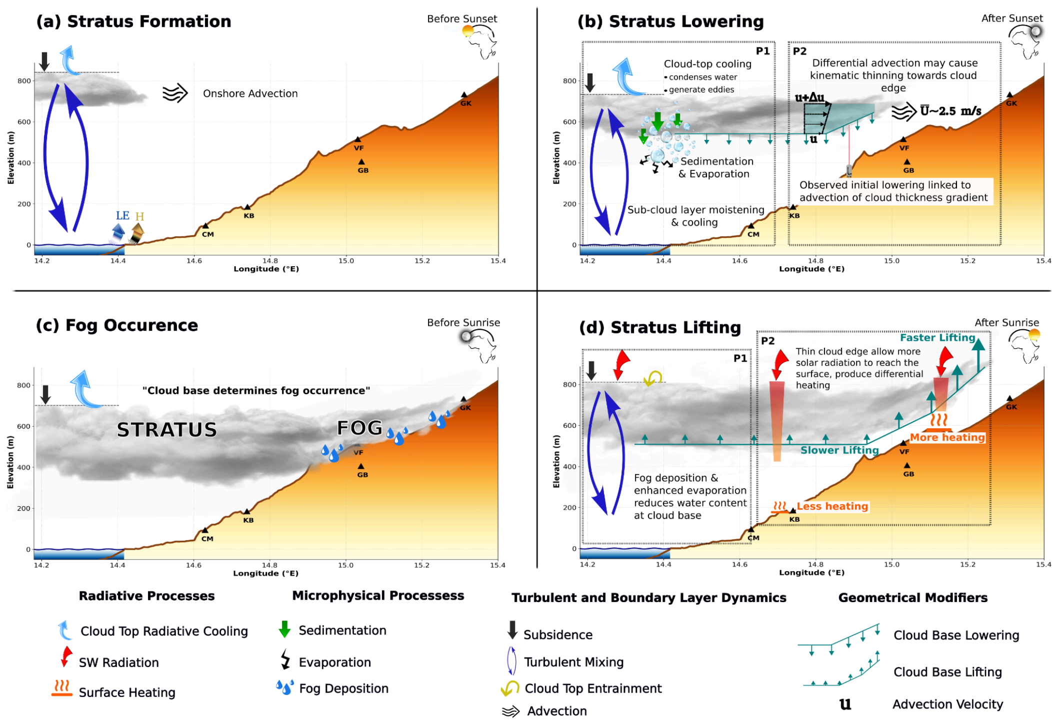

Figure 7: Conceptual diagram of the nocturnal evolution of fog and stratus in the Namib and the associated dominant processes. (a) Stage before sunset, (b) stratus lowering after sunset, (c) fog occurrence during the night and early morning, and (d) fog dissipation after sunrise. Here, P1 are the known processes established in literature and P2 are the findings interpreted in this study.

RC2.3 - Specific Comments:

Comment 1:
Line 45: There are some efforts in Atacama, see https://doi.org/10.1016/j.jhydrol.2021.126190

Author Response:
We thank the referee for this helpful comment. The suggested study has been incorporated into the Introduction (Lines 41–43) to acknowledge recent efforts conducted in the Atacama region.

Comment 2:
Table 1. When latitudes are indicated as °S, I understand that the negative sign would be redundant.

Author Response:
We thank the referee for pointing out the redundancy in the latitude notation in Table 1. The table has been updated accordingly.

Comment 3:
Line 90: indicate the temporal resolution of meteo stations (10 minutes?)

Author Response:
We thank the referee for this comment. The temporal resolution of the meteorological stations is 1 minute, except for the fog precipitation measurements, which are typically recorded with a 30-minute delay. This information has now been included in Section 2.3 of the revised manuscript.

Comment 4:
Line 200: specify which case study you are referring to (there is another case study later in the text)

Author Response:
We thank the referee for this comment. The case study referred to here corresponds to Figure 4 in Section 3.2. The manuscript has been revised to clearly specify each case study in connection with its respective discussion, for example, in Line 201.

Comment 5:
Figure 9. colors and FLC symbolgy can be improve

Author Response:
We thank the referee for this comment. While the current color scheme has been designed to ensure clarity and colorblind-friendly combinations, we have improved the FLC symbology to enhance overall readability.

Major changes in manuscript

1. The emphasis on the CBH–RH relationship has been reduced from being presented as a novelty to serving as a validation of their expected relationship in the Namib Desert. Corresponding changes have been made in the title, abstract, and Section 3.3.
2. The manuscript title has been modified.
3. Section 2.2 (Ceilometer measurements) has been simplified by organizing the data into an additional table (Table 1).
4. Section 3.2.2 has been restructured into short, thematic paragraphs to improve readability.
5. A conceptual figure (Figure 7) has been added to support the discussion of processes in Section 3.2.2.
6. Section 3.3 has been extended by including a subsection 3.3.1 and Figure 11
7. Figure 9 has been updated to show only night-time scatter, instead of scatter for all hours.
8. Appendix Figures A2 and A3 has been added to illustrate the decoupling of layers after sunrise.