Review 2

Comments from the reviewers are reproduced below in black, while our responses are in blue.

The authors have constructed an aspect ratio product using cloud cell size and estimated cloud top height for MODIS and GOES retrievals, the latter also offering a day-night product. A diurnal analysis shows a robust pattern of increasing aspect ratio from sunrise until a few hours after noon, then an afternoon decrease, and a stable signal overnight. This pattern is regionally consistent in the SE Pacific study region, and temporally consistent for the five years of GOES data, though ENSO does appear to modify the mean aspect ratio. Cloud amount modulates the amplitude of the diurnal cycle of aspect ratio to some extent, but the study suggests that the aspect ratio diurnal cycle may be an intrinsic feature of Sc clouds, mostly invariant to other controlling factors.

This study produces unique and valuable results concerning the process-scale properties of marine stratocumulus. Successful modeling of such clouds is essential for accurate climate and weather forecasting, and these emergent features offer a great baseline for comparing model results with reality. The study is well presented, with excellent figures. The language could benefit from additional copy-editing, but is not problematic. The paper is well-constructed overall, the results are well supported, and the work is in no need of major methodological changes, however a few minor revisions would benefit the work.

First of all, we would like to thank the reviewer for his/her appraisal of our work and the many positive and useful suggestions.

Please note that we have also modified the title of the article, changing “stratocumuli” to “stratocumulus” since it represents more as an adjective rather than a noun in this context. Additionally, the Abstract has been revised to highlight the temporal evolution of the AR rather than its absolute values, ensuring alignment with the reviewers' feedback and the nuanced discussion in our results.

We answer the remarks, point by point in the following.

Main points:

Scene selection: Can you add a few words on why you chose the domain sizes, and whether results are sensitive to this decision?

The choice of 300km has been based on previous literature to compare with state of the art, and has been shown to be suitable to detect organization around cell size. We also have tested the sensitivity of cell size detection regarding the size of scene. For a set of scenes (66 cases), we have derived at the cell scale from 600kmx600km scenes, and compared it to the cell scales derived from the 4 corresponding 300kmx300km scenes (Figures R1 and R2).The methodology is able to detect the same small scales we detect in the smaller scenes and increasing the size doesn't impact small scales detection.

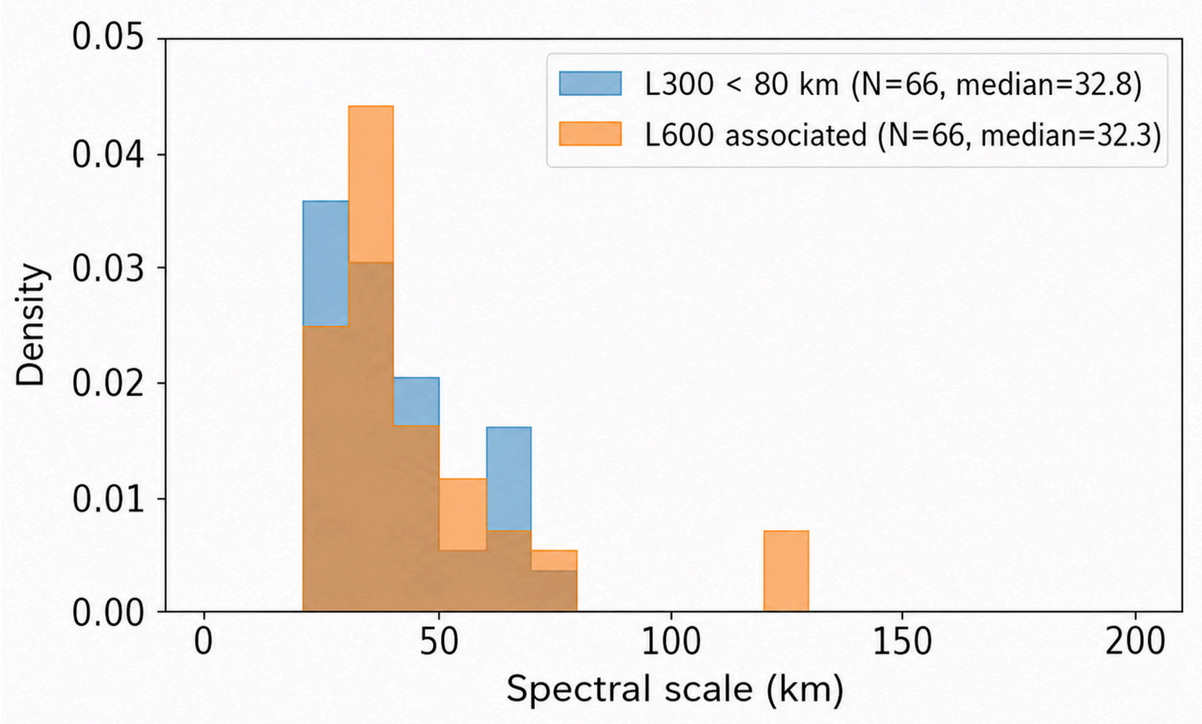

Figure R1: Regarding 300kmx300km scenes with a cell size inferior to 80km, 95.5% of the associated 600kmx600km scene still detect a cell size inferior to 80km.

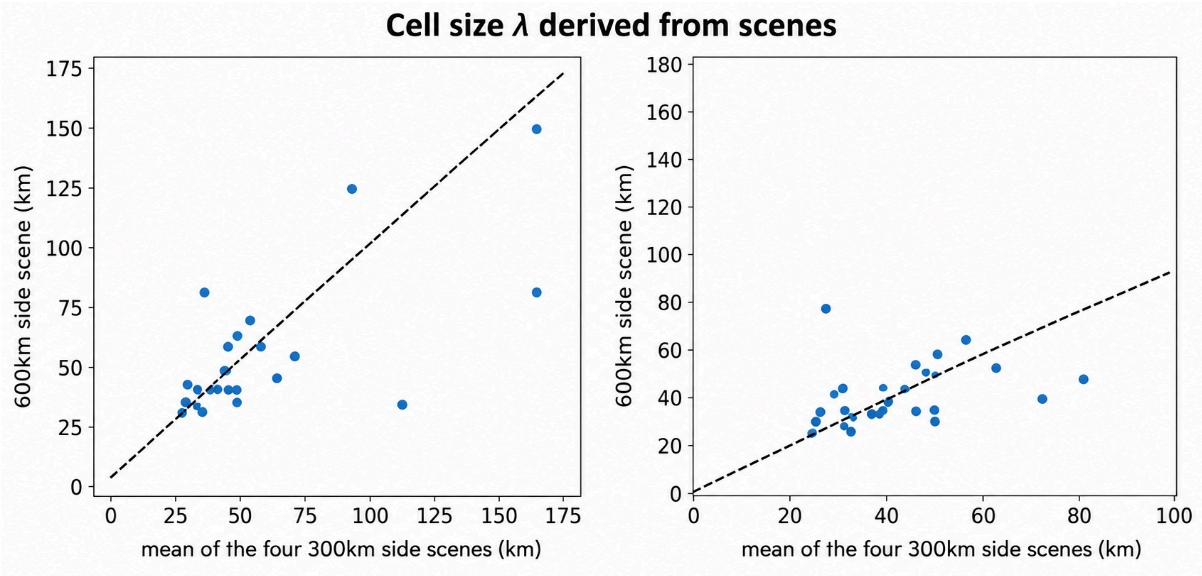

Figure R2: Correlation between the cell size derived from the 600kmx600km scene and the mean of the cell sizes obtained from the 4 corresponding 300kmx300km scenes. Correlation is even better when restricting the analysis to $\lambda \leq 80$km.

Paragraph on line 161: How is the 45% threshold determined? Also, how are you interpolating the gaps. Linear 2-D? Maybe be a little more explicit describing this so it could be more accurately reproduced.

Thank you for your comment and suggestion.
First, note that missing values mostly affect the LWP field and not the ΔTb one, which are the most widely used data in our article. For the LWP, it is due to issues we mentioned in the manuscript such as thin clouds or clear sky zones. We didn't want a higher percentage (≥ 50%) since it would mean we "created" more information than we have from the retrieval.

Actually, when looking at the full 6 years dataset, the preprocessing step (with the cloud mask and setting LWP to zero in clear sky zone) is filling most part of the cloud scenes. We end with a very small amount of scenes with missing values, and if so there are in a very small proportion (see Figure R3). Therefore the 45% threshold is particularly cautious and we can limit it to 10% threshold.

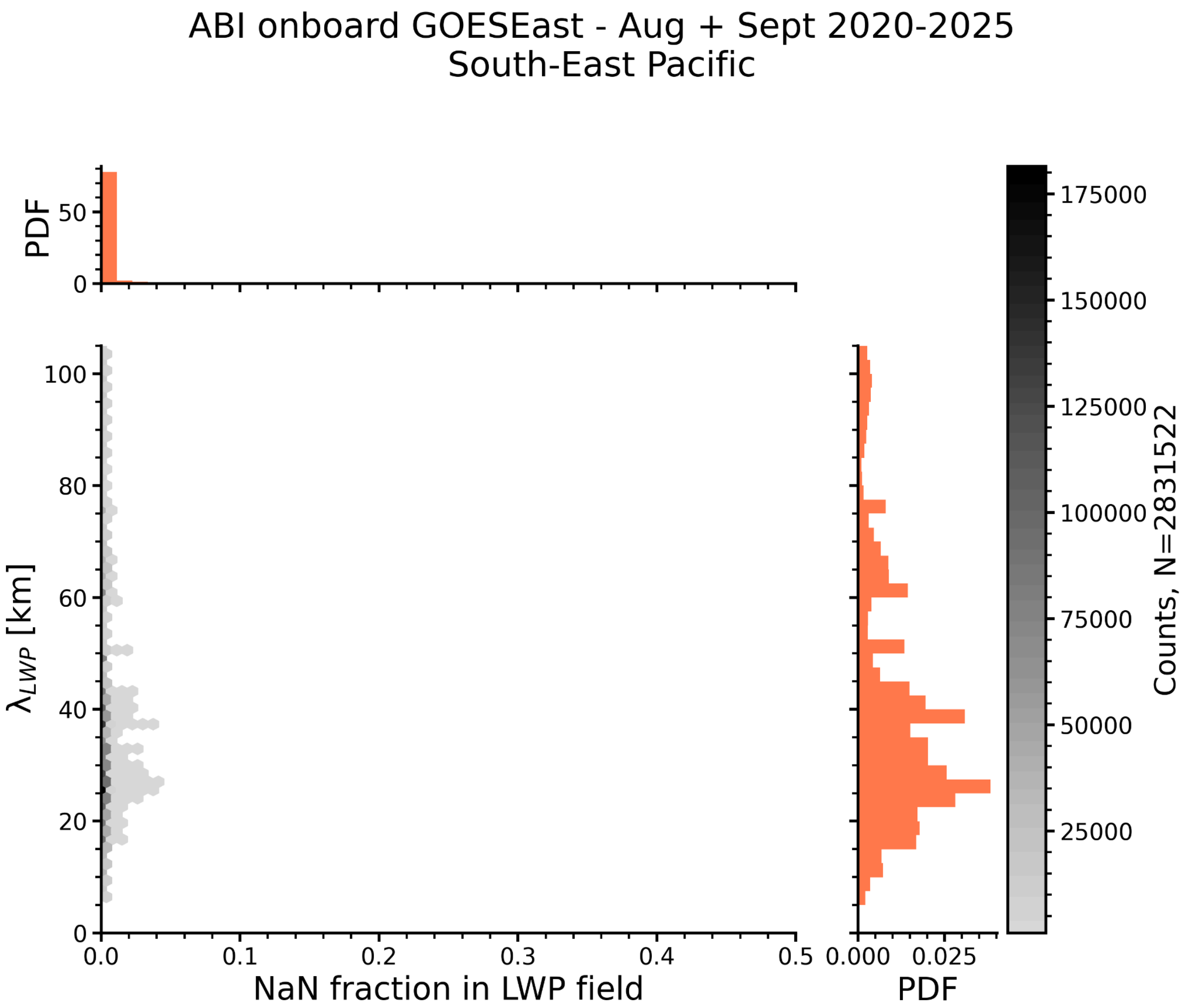

Figure R3: Values λLWP computed in view of proportion of missing values of the cloud scenes. Computations were performed for each scene individually, for the full 6 years dataset.

We add this explanation in Lines 165-170 of the revised manuscript "The filling procedure corresponds to a nearest-neighborhood local averaging interpolation constrained to small spatial scales. Each NaN pixel is replaced by the mean of the valid neighboring pixels within a moving square window of size 3×3 pixels. The local averaging is computed using a generic filter with mirrored boundary conditions to avoid edge artefacts. If no valid neighboring pixels were available inside the 3x3 window, the pixel is set to 0. Scenes without missing values are kept unchanged".

The Aqua-Terra CTH disparity in Figure 5a looks like a sensitivity/calibration issue perhaps? Any insights into this?

The CTH Product is used only for MBL depth estimation and corresponds to Figure 5b rather than 5a.

We believe MODIS hyperspectrality leads to lower values near clear sky area and at cloud edges, lowering the mean values of CTH (see Figure R4). As Figure 11 of the manuscript shows, CF is larger at 10:30 (Terra) than 13:30 (at Aqua overpass time). This explains why the discrepancy is even more seen with Aqua because of a larger proportion of clear sky area.

Maybe I missed it somewhere in the text, but did you match the CTT spatial scales between MODIS and ABI before calculating CTH? Differing resolutions will likely cause differing CTT distributions.

We do not use CTT for ABI. CTT is only used for MODIS MBL estimation using the Eastman et al 2016 method. Regarding CTH values, we have looked at the two MODIS Product 'Cloud_Top_Height' at 5km and 'cloud_top_height_1km' , but the difference in resolution didn't solve the issue of drastic low values (～500m and below) near clear sky zone and at cloud edges (Figure R4).

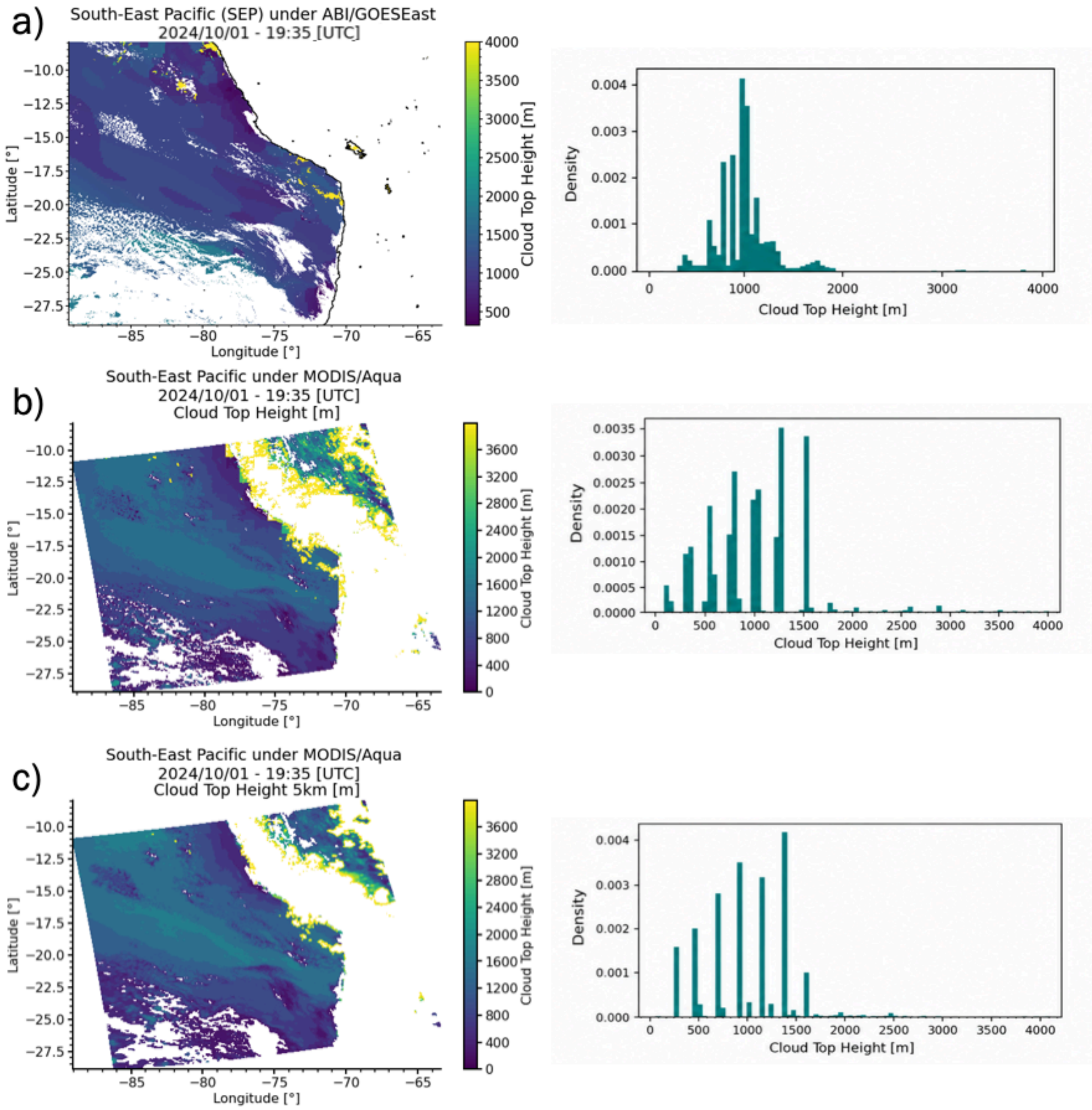

Figure R4: Cloud Top Height field (left column) and its corresponding values distribution (right column) using CTH from a) EUMETSAT NowCasting Product with GOES-East b) Cloud Top Height at 1-km resolution from LEOCAT (1km resolution) with Aqua and c) Cloud Top Height at Retrieved Cloud Top Pressure Level from MODIS (5km resolution) with Aqua.

Please reference the data sources for the points listed from lines 95 to 112.

To avoid overloading the text, we prefer to keep information in the Data Availability. Nevertheless, we add a sentence that highlights this point. "Reader may refer to the

"Data Availability" part for references of the data sources" in Line 94 of the revised manuscript.

It's clear that the AR follows the cell width in Figures 6 and 8, but why not at least show the cycles of CTH as well? This would allow the reader to better gauge the contributions of CTH and lambda. Same for Figures 13 and 14.

In Lines 314-315 of the revised manuscript we calculate the relative evolutions of MBL depth, indicating the evolution of AR is primarily constrained by the cell size. We believe these lines give the information and adding more Figures would overload the manuscript.

The reader can also see the diurnal cycle of MBL in Appendix.

The figures do a good job in showing that the temporal evolution of AR is driven primarily by cell size. Could you set up a similar argument when looking at the spatial fields in Figure 9, where we could also compare the spatial distributions of Lambda and CTH? This would allow us to see whether the spatial distributions are also driven by cell size.

We show here the large-scale situation for the cell size (Figure R5) and the MBL depth (Figure R6) for both the nighttime and afternoon plateau. We put it only in the review in order not to overload the manuscript.

The conclusions we made regarding the diurnal cycle of AR are shown here as well, with a spatial organisation of the cell scale that really look alike the one from the AR, with a general amplification of the value across the basin rather than a change in large-scale pattern. The two situations of MBL are really similar.

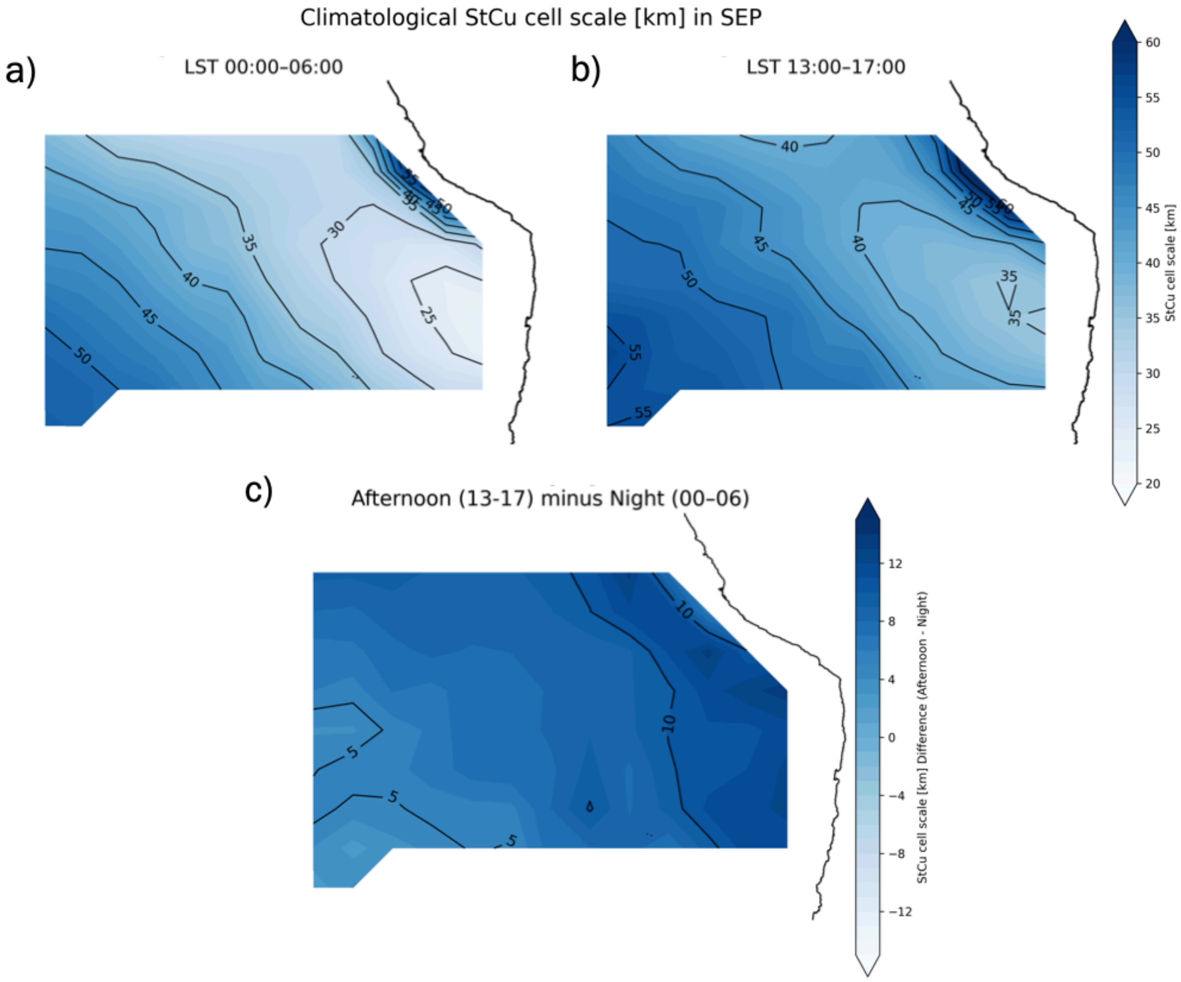

Figure R5: Same as Figure 9 of the preprint but for λΔTb.

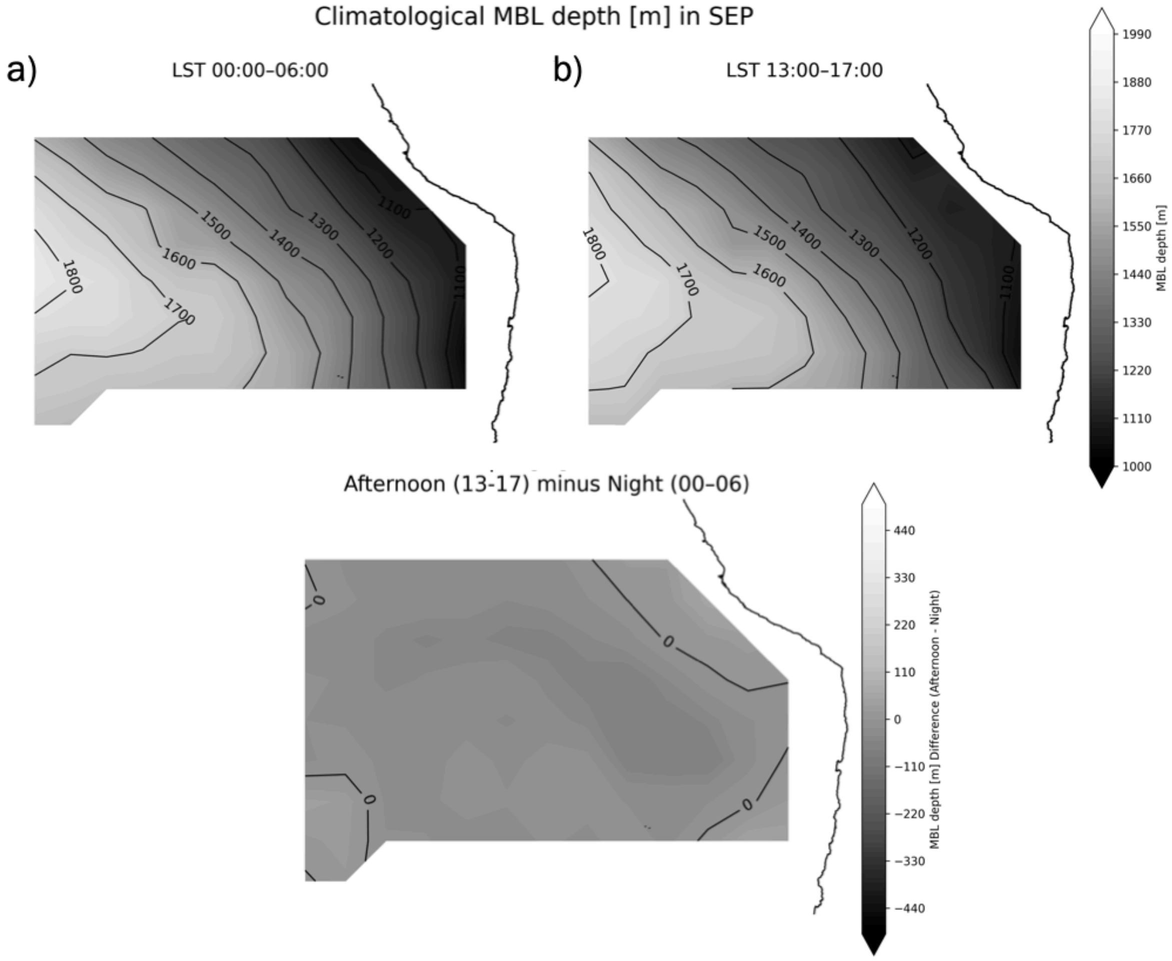

Figure R6: Same as Figure 9 of the preprint but for MBL depth.

Regarding CF in Figure 11: How is CF retrieved? The jump in CF near sunrise and sunset has the look of a low-sun-angle bias in visible data. Is it possible that visible channels are being used for the daylight CF values, but not for night? This could cause the spurious jump in CC during sunrise/sunset. I don't believe that these jumps have been seen in corresponding LWP data, or in any surface observations. They look non-physical.

The Cloud Fraction data we use are from the variable 'Effective Cloudiness' from the L2 Product CTTH: Cloud Top Temperature and Height, computed by the Nowcasting Satellite Application Facility (NWC SAF) from EUMETSAT.

These data are available free of charge, after creation of an account: https://www.nwcsaf.org/ctth_description

The description of the Product indicates Radiances and Brightness Temperatures only in IR have been used for computation. Nonetheless, some low infrared/ near-visible channels are used to compute the product (6.2, 7.0 and 7.3 microns) and their radiances could be responsible for the jumps we perceive at sunrise and sunset. We believe it is due to enhanced 3D radiative effects and dependent on the viewing angle of the satellite .

In fact, many figures show clear non-physical behavior between sunrise and 8 LST, then from 16 LST to sunset. I recommend omitting these distracting, non-physical features, and leaving the figures blank during those times. No data is preferable to wrong data.

We believe these retrieval biases are still part of our results. The fact the peaks are seen only for Q1 curve, that corresponds to more Cumulus like regime enhances the robustness of the evolution for Stratocumulus like regimes.

More of a comment for future work: An obvious place to start looking at modulating factors is upper-level humidity. If the radiative balance at cloud top sets the AR, then increased upper humidity may somewhat mimic an increase in sun angle, since both add downwelling radiation to the cloud top.

Thank you for the insights, that is highly relevant. We indeed plan on working on cloud controlling factors and their impacts on the spatial metrics of StCu patterns in our next paper.

This may be more of a future work comment again, but can you address possible differences in MCC types? Figure 3 shows a pocket of open cells embedded within closed cells. Do open cell aspect ratios behave in the same way as closed? This would be interesting to study given the differences in mechanisms. I recommend mentioning this possibility somewhere in the paper.

Previous studies have shown quite similar behaviour between the two patterns of closed and open cells (Wood and Hartman, 2006 Glassmeier and Feingold, 2017).

It would be indeed really interesting to investigate our diurnal results using precise classification that would work day and night. We have started to work with a deep learning method (Wu et al. 2025) that could work, and aim to investigate it in future studies.

We added a sentence regarding these various cloud regimes around Line 510 of the revised manuscript.

Figure 9 needs latitude-longitude lines.

We adapted Figure 9