RESPONSE TO REFEREE 1 (RC1)

First of all, we would like to thank the reviewer for dedicating his/her time to reading and providing feedback to improve the content of this work. Please find below the responses and explanations provided by authors (in regular font) to the reviewer's comments (in bold).

RC1 : Lines 124-125: "In all cases, the sun pixels are considered as clear sky pixels in the segmented image". If the sun is in FOV, the pixels are expected to saturate in 30 sec. What are the saturation charges of the camera (CCD or CMOS) in ADU (Analog to Digital Unit)? Please clarify the meaning of levelling the pixels into the 'sun' category.

Response 1 : Levelling the pixels into the "sun" category refers to how the image segmentation algorithm classifies the sun's pixels. Given the extreme brightness of the sun, the algorithm will identify and label those pixels as belonging to the "sun" category. This helps isolate the sun from other pixels and can be used to track or process the sun separately from the rest of the image.

Reuniwatt's camera relies on a (High Dynamic Range) HDR acquisition algorithm. The cloudy scene is captured multiple times with different exposure levels. The images are then combined to minimize as much as possible the saturated areas, especially around the sun. The exact exposition parameters are not provided.

RC1 : Lines 149-150: "To crop the observed image, we have selected a 70° radius angle around the zenith, which is equivalent to the angle chosen in the Reuniwatt algorithm" What is the logic to reducing FOV to 140°? As can be seen in Figure 2(a), in the white circle still building can be seen in the FOV.

Response 2 : A field of view (FOV) angle of 140° was selected to minimize the loss of information by eliminating only a small portion of the image, primarily containing the highest number of objects and pixels deformations at the horizon, while retaining the maximum amount of data on the cloud coverage present at the site. The limitation of removing certain objects led to the implementation of an additional processing step, specifically the creation of an object mask.

RC1 : Figure 3: Figure fonts are too small to be visible. The title of each image should be date in YYYY-MM-DAY and time in HH:MM:SS format with x and y axes values as the pixel number. I can see they are full images but do not have a size of 2kx2k; please clarify. How accurately do you generate the red circle in the images? What is the spatial resolution of the all-sky imagers used in this work?

Response 3 : The font size and number of images displayed in Figure 3 have been adjusted to make them more visible.
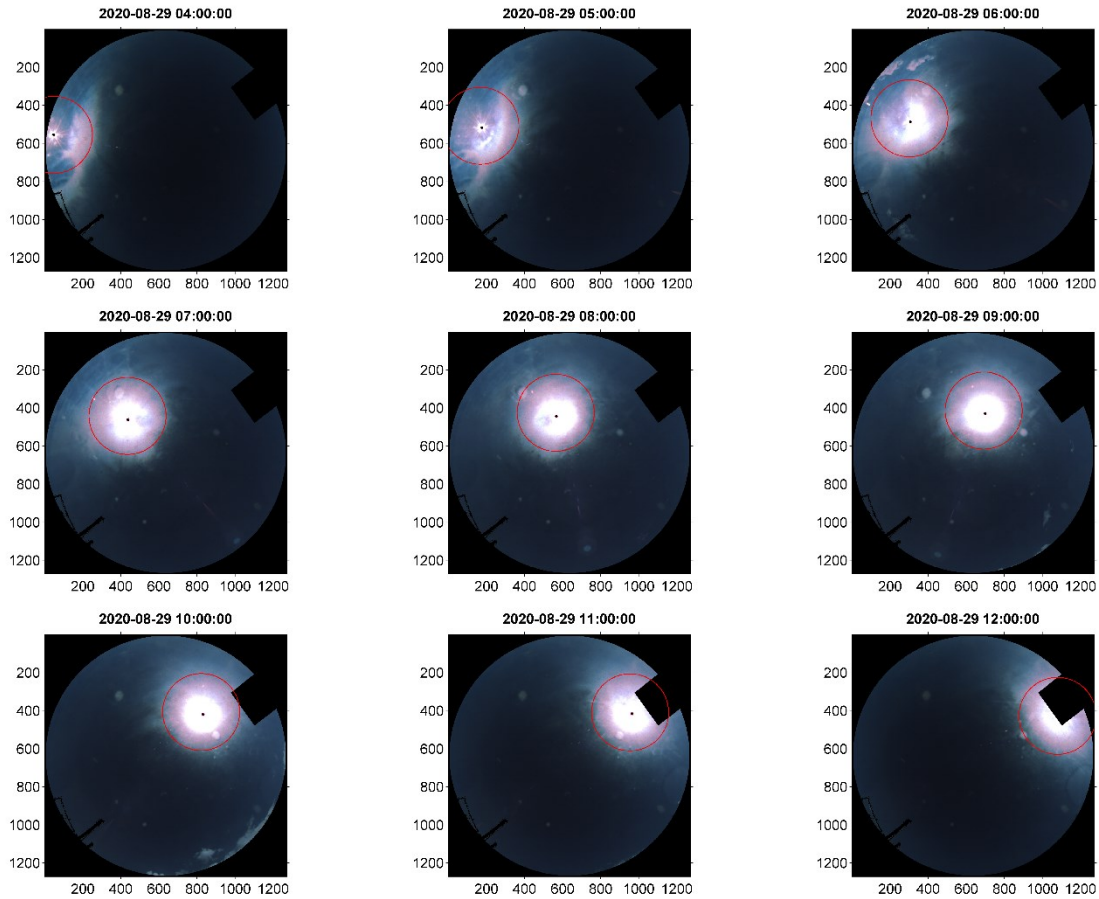
Figure 3. Simulated trajectory of the sun (red circle) on 29/08/2020, every hour from 4:00 to 12:00 (UTC).

To derive the equation for simulating the sun's trajectory in the image, we manually recorded samples of the sun's center positions in the images, under the condition that sun's center was visible. Subsequently, we performed equation fitting tests to optimize the determination of the most accurate sun position (red circle).

The raw images have a resolution of 2048 × 2048 pixels, while the preprocessed images, after cropping and excluding areas affected by pixel distortions near the horizon and object interferences around the site, have a resolution of 1271 × 1271 pixels.

RC1 : Section 2.4.3 and Table 2: How the absolute threshold for cloud and blue sky was generated as shown in Table 3?

Response 4 : The threshold values are visually identified through photo-interpretation of the pseudo-colored images (Fig. 4b), by comparing them with the real images (Fig. 4a). One of the main reasons for generating the pseudo-colored images is to facilitate this comparison.

RC1 : Figure 4: What are the advantages of giving pseudo color to the images? What is the unit of the scale shown in Figures 4b-e?

Response 5 : The advantages of giving pseudo color image have already been answered previously (Response 4).

The color scale in Figures 4b-e is dimensionless, as it represents the ratio of radiometric values (pixel values ranging from 0 to 255, corresponding to an 8-bit image) of the red and blue bands of the image (R/B).

Please find below the additional information.
"Figure 4. Intermediate image processing results at Moufia Saint-Denis - 30/09/2019 at 09:54:00 (UTC). (a) Cropped image containing the solar mask represented by the red circle, and the object mask in black. (b) Multi-color image processed using the absolute thresholding method. (c) Tricolor image processed with the absolute

thresholding method. (d) Multi-color image processed using the differential thresholding method. (e) Tricolor image processed using the differential thresholding method. The color scale (dimensionless) represents the ratio of radiometric values of the red and blue bands".

RC1 : Section 2.6: what are xi and yi in the equations? Please mention them in the manuscript.

Response 6 : As recommended by the referee, the following paragraph has been included. "xi and yi represent the algorithms that were compared (e.g., xi for Elifan and yi for Reuniwatt; or xi for Elifan or Reuniwatt and yi for MSG)".

RC1 : Lines 261-280: What is the area covered by MSG in 3x3 pixels vis-à-vis the area covered by a ground-based imager considered for this comparison? As correctly said "Increasing the window size tends to amplify the differences between camera and satellite observations." Therefore, before concluding that 3x3 pixels of MSG cover the same area, discussion on the area covered by the ground based observation needs to be compared with the MSG observations rather than trying different window sizes.

Response 7 : Regarding the field of view of the all-sky camera and the use of the 3x3 window, additional information has been provided. The observation radius of the camera depends on two parameters: the cloud height and the camera's field of view. In our case, it is primarily determined by the zenith angle of 70°, as represented by the formula below.

$$observation\ radius = cloud\ height \times \tan(70°) \approx 5,5\ km$$

Given that the cloud height over Réunion island is frequently observed at 2 km above surface level (Durand et al., 2021), and the 3x3 pixel window used by the MSG satellite covers a radius of approximately 4.5 km, this value is quite similar to the one obtained from ground-based observations.

Durand, J., Lees, E., Bousquet, O., Delanoë, J., Bonnardot, F. Cloud Radar Observations of Diurnal and Seasonal Cloudiness over Reunion Island. Atmosphere, 12, 868. https://doi.org/10.3390/atmos12070868, 2021

RC1 : Line 37: Please provide a reference for. "Generally, clouds cover more than half of the Earth's surface"

Response 8 : The reference (Liu et al., 2023) has been added to the paper.

Liu, H., Koren, I., Altaratz, O., and Chekroun, M. D.: Opposing trends of cloud coverage over land and ocean under global warming, Atmos. Chem. Phys., 23, 6559–6569, https://doi.org/10.5194/acp-23-6559-2023, 2023

RC1 : Line 71: every 15 mn should be every 15 minutes. You may use minutes or min throughout the manuscript.

Response 9 : The notation « 15 mn » has been replaced by « 15 min ».

RC1 : Line 94 and 103: Generally, we follow (latitude, longitude) unless it becomes necessary to interchange them to convey a specific message. Be consistent in the manuscript text and Table 1 while mentioning lat, lon. How authors found a three-digit accuracy in lat. and long values?

Response 10 : Thank you for your valuable observation. The notation « lon, lat » will be swapped to "lat, lon". The assignment of coordinates with precision of three digits is not adequate; therefore, we have reduced the precision to two digits.

RC1 : Lines 100-101: "Our study contributes to filling the gap in our understanding of this site, allowing for inter-comparison of ground-based instruments with spatial observations" may be rephrased for clarity.

Response 11 : Please find the improved version below.
"Our study contributes to advancing the understanding of this site by facilitating the comparative analysis of ground-based instruments and spatial observations".

RC1 : Line 114: Camera FOV is 180° for a fish-eye lens. What do authors mean by FOV of 360° x 180° around the site?

Response 12 : The sentence has been rephrased to avoid misunderstanding. "360° x 180° represents spherical view angle of the camera".

RC1 : Lines 198-199: correct "Bleu Sky" to "Blue Sky"

Response 13 : « Bleu Sky » has been corrected to « Blue Sky ».

RC1 : Figure 4: I cannot see the "red circle, and the object mask in black" in Fig. 4a.

Response 14 : To ensure better coherence in the order of figure presentation, we have changed the notation from Fig. 4 to Fig. 3 (line 155). Additionally, the quality of the latter has been enhanced to improve the visibility of the masks (sun and object).

RC1 : Line 282: Figs. 7 and 8

Response 15 : Figs. 7 and 8 have been considered in the paper.