

**The authors greatly appreciate the reviewer for taking his/her time to review this manuscript and all the invaluable comments. Simple modifications (e.g. typo) are in red color and other changes are in green color in the response as well as in the revised manuscript.**

1. Line 35, "... add heating as frequent as possible, ..." : why it should be "frequent"? or replace by "as accurately as possible".

It's modified in line 35.

2. Line 86 : add brackets to "Bedka et al. 2016". Same in line 314 for Vicente et al. 2002 and please check citation styles throughout the manuscript.

They are changed in lines 88 and 316 as well as line 93

3. Line 101 : change "... temporal trends of the data were used but, since ..." to "...temporal trends of the data were used, but since ..."

It's modified in line 103.

4. Line 134 : change "... as they progress upwards, ..." to "as clouds develop upwards"

It's modified in line 136.

5. Line 166 : replace "... the magnitude of the gradients are ..." by "... the magnitude of the gradients is..."

It's modified in line 168.

6. Line 166, "... use horizontal gradients" : should it be both horizontal and vertical? Or remove it and please check throughout the manuscript.

It should only be horizontal gradient, therefore it's modified to "horizontal gradient" in line 168.

7. Line 216-218, "However, not all the detection by the method is done early since MRMS product is created not just using high reflectivity, it is rather good at detecting early convection." : need correction here for better understanding.

This sentence is modified to "However, not all the detection by the method is done early since MRMS can also sometimes assign early convection as convective before it produces high reflectivity." in lines 218-220.

8. Line 269, "... due to the IR's 2km resolution ..." : suggestion "due to their relatively lower spatial resolution"

It's modified in line 270.

9. Line 278 : would leave this sentence out.

This sentence is removed.

10. Line 284 : add comma after "... vertical level". Same in line 317 after "...convective regions"

These are modified in line 286 and 319.

11. Line 291 : suggest to add “together” after “... since both clouds were detected”  
It’s modified in line 293.

12. Line 280 and 325 : please add the names of the cities on the map.  
Names of states are added in Figure 3 and 7.

13. Line 327, “during 22:30UTC~22:40UTC” : please use a hyphen. Same in line 337  
They are modified in lines 328-330 and 339.

14. Line 350 : replace by “... decrease with latitude”  
The whole lines 350-354 are modified based on comment 15.

15. Line 348-350 : The effects of solar zenith angle or lower spatial resolution seem to conflict with each other. For this case (greater convective area), then is this probably due to the large SZA as it is in the afternoon? Please clarify.  
These sentences are modified to “This could be due to dependency of lumpiness on some geometrical considerations. Lumpiness is a function of the pixel spatial resolution, differences in optical depth and shadows. Spatial resolution decreases away from the equator, but higher solar zenith angles (due to altitude or time of day) not only increases optical depth, they also increase shadows. While this can of course be dealt with, it was ignored in this study which serves primarily as a proof of concept, as the method generally finds convective core correctly.” in lines 350-354.

16. Line 359-364: The information should be also in the caption of Table 3, and please mention how the values in percentage are calculated. The numbers can be provided here together.  
Caption of Table 3 is modified and the actual numbers to calculate the percentages are added in Table 3.

17. Line 372 : replace “Most of the detection is ...” by “Most of the detection are ...”  
It’s modified in line 375.

18. Line 374 : Tables 1 and 2 don’t have FAR information.  
This sentence is revised based on comment 19.

19. Line 374-375, “Relatively small FAR compared to Tables 1 and 2 would be because Tables 1 and 2 are obtained based on each cloud while FAR and POD are calculated based on each grid point.” : Please give more explanation on this.  
This sentence is modified to “FAR in Tables 1 and 2 (1- overall accuracy values)” in lines 377-378.

20. Line 380 : replace “... which is essentially ...” by “... which are essentially ...”  
It’s modified in line 383.

21. Line 385-386 : what is meant by “a random chance”? Please state explicitly.  
It’s modified in line 389.

22. Line 395 : replace “It is better to not ...” by “It is better not to ...”. Please clarify more on “.. give any information”.

This sentence is modified to “In data assimilation, it is preferable to provide no constraints than to provide the model with the incorrect location of convection.” In lines 399-400.

23. Line 427 : suggest to add “in a more effective way” after “... facilitate cloud tracking”. Please revise this sentence “... helps the accuracy of the detection method when calculating decreases in  $T_b$  of the same cloud.”

“In a more effective way” is added in 431 and the sentence is changed to “helps reduce uncertainties coming from cloud tracking when calculating decreases in  $T_b$  of the same cloud” in lines 431-432.

24. Line 441 : where does the figure “~85%” come from?

The parenthesis “(100%-FAR of 14.4%)” is added in lines 446-447.

25. Line 443-444 : There are already some studies using machine learning algorithms and even deep learning for detecting convective initiation or overshooting cloud tops. Related studies can be mentioned in the Introduction.

“With the recent growing interest in machine learning techniques, many studies have applied machine learning methods in detecting convection (Han et al., 2019; Zhang et al., 2019; Cintineo et al., 2020), but knowledge in physical features of convective clouds is still required to construct a model that correctly learns during training.” is added in lines 64-67 with three new references.

26. Figure 2 : In the 4th box, replace “... at channel 8 and 10 are calculated.” by “... at channel 8 and 10 is calculated.”

Figure 2 is updated.

27. Figure 7, Line 705: replace “Times next to each box represents ...” by “Times next to each box represent ...”. Should “the mature cloud detection method” be “the growing cloud detection method”?

The caption of Figure 7 is modified in lines 709-710 based on these comments.