

Reply Letter

Response to Reviewer #1

REVIEWER # 1

We must thank Reviewer #1 for providing us with useful comments for improving the quality of the paper. We have gone through the comments and have made revisions accordingly.

Comments to the Author

The authors have revised the model structure, parameters and principles in this manuscript. Through RAB and RAM, global and local spatial features are captured simultaneously, while spatiotemporal expressivity is enhanced. These two new mechanisms effectively improve the accuracy of rainfall prediction. However, there are still few problems:

1. Page2 Line50, ‘...the same echo with large-scale size and long-range movement between the adjacent time, more useful spatial information can be extracted, which leads to more accurate predictions in those regions...’. From the ground truth given in this paper, the non-heavy rainfall echoes also have a large-scale size and long-range movement between adjacent time. The reason why RAB has better effect on heavy rainfall needs to be explained

Reply: Thanks for your question. As our paper mention:

“The attention similarity from Region Attention (ours) in Figure 3(c) compares the difference between regions with flexible size and position. Due to the irregular shape of radar echo and different distribution, RAB can capture the correlation between the different radar echoes better.” (In line 150 on page 8.)

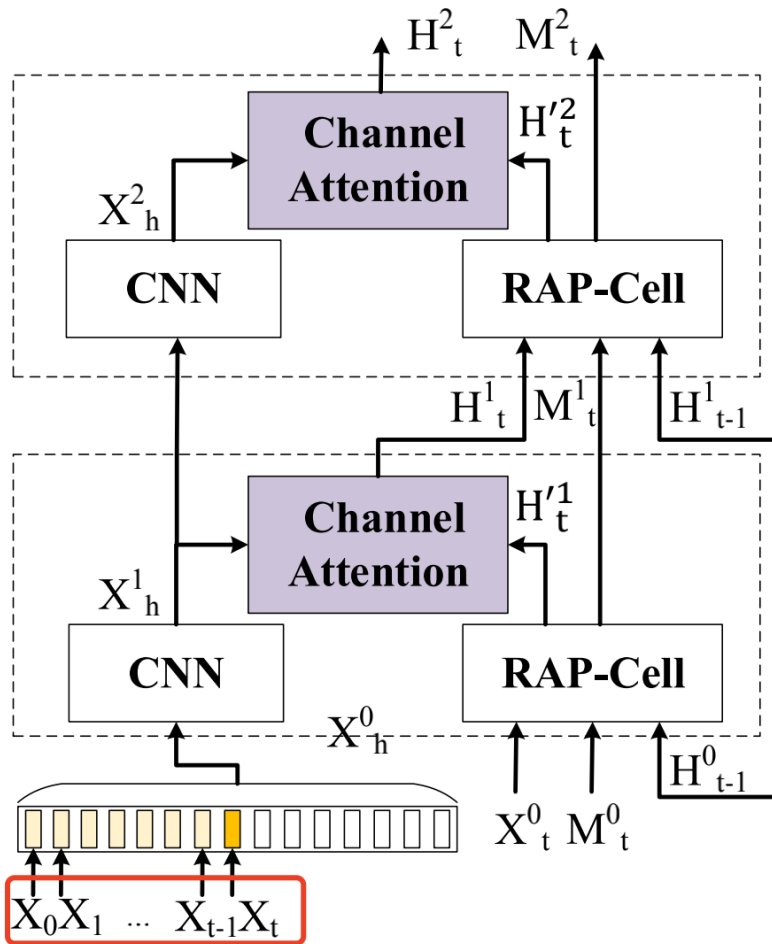
RAB has the advantage of extracting the spatial representation of the irregular-shaped object. In different ranges of reflectivity, we notice that radar echoes with high reflectivity have more stable appearance and shape. Therefore, their information is more easily extracted. We have explained it as follows:

“Especially, the information of radar echoes with high reflectivity is more easily extracted because they have a more stable appearance and shape. RAM has more contribution to improving the performance in these regions with heavy rainfall”

The details can be found in line 153 on page 8.

2. Page2 Line53, ‘The representation of moderate and heavy rainfall intensity can be preserved in the predicted unit’. What is the reason that rainstorm information is easier to retain through RAM than others.

Reply: Thanks for your question. The function of RAM is to retain long-term spatial-temporal representations. These representations contain information about rainstorms even though their ratio is very low. The reason why RAM can retain these representations can be found in the structure of RAM as follows:



Specifically, there are two aspects to explain it. Firstly, in terms of the input of RAM, the original input of RAM is $X_{0:t}$. However, the input of traditional ConvRNN is X_t . In other words, the RAM extracts spatial-temporal representation from all historical radar echo maps instead of the current radar map. Besides, in terms of the internal structure of RAM, RAM applies a channel attention mechanism to recall all previous data. By using channel attention, all historical feature maps participate in the calculation and obtain the final output of RAM.

3. Page16 Table 3. The addition of RAM reduces the accuracy of 5dBZ. Please explain the reason.

Reply: Thanks for your question. RAM module can preserve the long-term historical representations by attention mechanism. This mechanism can recall previous information by a similar metric. The more similar to the current representation, the higher probability to be

saved. However, we notice that some radar echoes with low reflectivity usually have more unstable changes compared with those echoes with moderate and high reflectivity. It leads to that the historical representations involving low reflectivity radar echo probably have more difference from the current representation. Therefore, it implies that their similarity is relatively low and the information of low reflectivity is hard to be preserved. The radar echoes with low reflectivity are hard to be predicted also can be shown from the visualization of predictions in Figure 9 (Comparing with RAP-Cell and RAP-Net). It is why the addition of RAM reduces the accuracy of 5 dBZ.

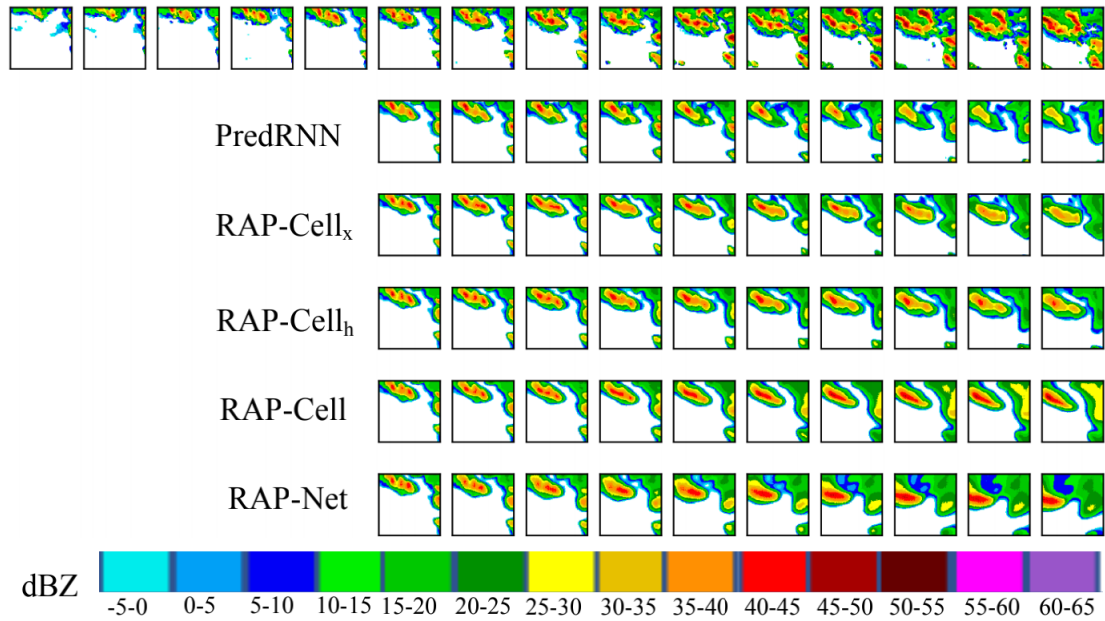


Figure 9. The first row is the reflectivity of ground truth and reminders are the predicted reflectivity of different methods on an example from the RadarCIKM dataset (Best view in color)