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Comment on nhess-2020-397

Anonymous Referee #1

Referee comment on "Evaluation of Mei-yu heavy-rainfall quantitative precipitation forecasts in Taiwan by a cloud-resolving model for three seasons of 2012–2014" by Chung-Chieh Wang et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2020-397-RC1, 2021

In this study, the authors evaluated the performance of the quantitative precipitation forecasts (QPFs) by a high-resolution CRM during the mei-yu seasons of Taiwan in 2012-2014, using categorical statistics. The results showed that the QPF skill is better for larger precipitation events, and improved compared to previous results. In addition, case analysis indicates that the strength of the high-resolution CRM lies in an improved ability to capture smaller scale processes for the phase-locked rainfall systems. These findings verify that the high-resolution CRM has good potential application in actual QPF during the mei-yu seasons of Taiwan. However, some major issues need to be clarified.

General comments:

- It needs to give more explanation for the novelty of this study. As mentioned in the introduction, the purpose of this study is to clarify the dependency property in categorical scores of QPF and whether the skill of the high-resolution CRM is better than those in previous studies, although the studied object is changed from typhoons to mei-yu systems. This purpose has been basically fulfilled by W15 and W16. Therefore, they should not be considered as the novelty of this study, unless the study can prove the CReSS is sensitive to different weather systems. However, from the conclusions, the higher-resolution CReSS primarily improved the forecast skill of the phased-locked topographic rainfall, as it better resolves the terrain and related small scale processes, which means the improvement of QPF caused by this CRM is not attributed to a better capture of the evolution of mei-yu front.
- Regard the QPF skill of the CReSS on different categories of rainfall events, this study shows a better QPF skill for larger rainfall events. However, this phenomenon may also happen for other high-resolution models, as a higher resolution permits the model to

capture more small scale processes to improve convection development, and thus, more rainfall production. To a certain extent, this can be indicated by Figure 3 which shows that the QPF skill of the "All" category (the black lines) has a smaller success ratio (about false alarm) than those of large rainfall categories (A and A plus; the orange and red lines) for high rainfall thresholds (such as larger than 100 mm). It means that the high-resolution CReSS not only produces larger rainfall for large rainfall events, which leads to a higher TS scores, but also produces larger rainfall for small rainfall events, which leads to a smaller success ratio. Thus, this study needs to clarify more about the advantage of the CReSS model, apart from the resolution.

- As discussed in section 4, the QPF error is also attributed to the forecast error on the evolution of mei-yu front. This error may lead to a worse QPF, as the location and timing of large rainfall can be completely incorrect. What is the cause of this error? Is it related to the boundary condition or the domain processes simulated by the CReSS? The answer of this issue can clarify the novelty of this study, as it is about the QPF associated with the mei-yu front.
- The comparative analysis or verification is based on a key indicator, the TS score. However, how large the value of TS score could be defined as skillful or a good skill? The study mentioned that when TS is larger than 0.15 it can be indicated "some predictive skill" (in line 228). Is there any objective definition or reference from operational prediction to support that?

Specific comments:

- There are many places in the article that are not clearly expressed or improper use of vocabulary, which require major revisions. For examples (not exhausted), the sentences in lines 27-28 ("weaker events"->"smaller rainfall events"?), 35-40 ("where"->"when"?), 68 ("to hit"-> "that hit"?), 77 ("or event magnitude"->"or rainfall magnitude"?), 89 ("whether …" ?), 110-114 ("which are also run …"-> "which are applied for the model run …"?), 117-118 ("doubled the resolution"->"increase the resolution"?), 125-130 ("used include …"-> "used for QPF verification include …"?).
- The manuscript uses too many abbreviations, which makes the readers hard to get the meaning of the sentences conveniently. Please delete the abbreviations which appear not frequently in the manuscript.
- Figure 3: Please explain more why after the rainfall events have been categorized into different rainfall magnitude events (A-D), different rainfall thresholds are still needed for each magnitude event.
- Figure 5: Why not put the CReSS results along with these model results for comparison? Are these models at a resolution of 5 km? If so, the comparison in the TS scores between the CReSS and these models is discounted, as their resolution are different.
- Lines 556-557: Did these previous results come from forecasts of an equal resolution (2.5 km)?