Manuscript Reviews
of

Reviews of Manuscript No.: 20108008

Title : Application of the CFS-RegCM Downscaling System for Seasonal Rainfall Forecasts in Vietnam

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Please note that reviewer numbers are assigned by our computer system; no additional reviews are expected

Reviewer # 1

Comments:

This manuscript describes the seasonal forecast system for rainfall in Vietnam by downscaling CFS using RegCM. This is a well-organized and nicely written

manuscript with clear objectives, evaluation analysis method and informative figures. I don't find any grammatical issue as well. In recognition of future works, in the summary section the authors have also identified a number of issues that can be looked into for further improvement of the skills.

I believe, in addition to their earlier works, this manuscript is the only work that describes the dynamical forecast system that uses RegCM to downscale the CFS. Hence, I believe this manuscript will serve a reference and benchmark for future work on seasonal forecasting in the Southeast Asia region, and in Vietnam in particular.

Reviewer # 2

The paper describes the validation and verification of CFS seasonal forecasting system plus that of a RegCM downscaled product over Vietnam. Since the latter is available only for 3 years, the former is done both against a 28yr reforecast product, as well as against a 3 year operational product, as a kind of intermediary for the RegCM to compare against.

The paper is generally well structured and well written, and the topic is of considerable interest though primarily within the region. Not only for Vietnam as the title suggest and the station based validation warrants, but also for its neighbouring countries as addressed by the GPCC validation.

My main reserve for this paper is wrt the probabilistic verification part. Basically all figures except 6 and 10 address a deterministic performance analysis, analysing the systematic biases between the various model implementations and observations (GPCC or stations). The most interesting performance indicator for any seasonal prediction system in my view are the probabilistic skill analysis, using the tercile based PC, HSS and PSS scores (or even better ROCSS and RPSS). These however are only presented for the 3yr CFS_ope operational product. Such skill metrics are very poorly constrained for such a short data set and for such small regions (each only a few gridcells). Computing terciles for a three year period basically means there is only one hit in each category, so in a sense we are talking about n=1 statistics here.... These realy must be presented for the 28yr CFS_rfc too, and then using these results as the primary indicator for CFS skill. Then the same analysis on CFS_ope (and RegCM) can only confirm the emerging picture (or not).

The second issue that requires improvement in my opinion is the evaluation of RegCM which is limited to an assessment of improvements in the spatial distribution of rain. However, dynamical downscaling could also improve the temporal distribution. This in the sense that extremes (p10/p90 or p5/p95) are better reproduced. The added value of downscaling would be much more convincing if this is also adressed. This would also better justify the use of station data (at present they do not add much over using only GPCC).

For further comments see the annotated manuscript.

Reviewer # 4

The paper investigated the feasibility of downscaling using RegCM4.2 regional model and CFS version 2 lateral boundary conditions for producing seasonal rainfall predictions. The paper verified the CFS and RegCM precipitation predictions over Vietnam.

I understand that dynamical downscaling with regional models is one of the important developments in the seasonal prediction application. The paper attempted to apply the RegCM4.2 and CFS version 2 for this purpose, and presented preliminary verifications such as a mean error with the CFS version 2. However, the paper seems not to meet journal's standards of quality. The paper requires clarifications, editorial improvements and reconsideration of procedures for publication. My concerns and comments are given as follows.

Major comments and suggestions.

1.   I would advise the authors to reconstruct paper.

Main focus of this paper is to investigate the feasibility of RegCM downscaling, but the authors discussed the CFS performance by devoting almost half space of the paper. The authors could split this manuscript to two papers (evaluation of CFSv2 and feasibility of RegCM downscaling) and discuss more details in each paper, or omit some results of CFS in this manuscript. It is not necessarily to show all what the authors did; please show only what is important to draw the conclusion in the paper.

Line 343-348: This part describes the unique geographical feature of Vietnam. Please move/merge this part to Introduction (around Line 90).

Line 394-407: This part seems to be "discussion". Please remove this part from Section 4 "Conclusions" and move to somewhere fits for discussion.

Please write description and configuration (experimental setup) in one place.
For example, please merge Line 204-207 and Line 211-216. In Section 2, I would suggest that the authors would describe the downscaling method and evaluation separately, because this part looks complicated.

2.   English would need to be improved overall. Some (but not all) suggestions are given below.

3.   Verification procedures
Line 136-143: Please describe how many members were used for this study. In the seasonal prediction application, the ensemble predictions are usually verified due to its chaotic feature. This study seems to utilize small number ensembles (4 members, Line 149). If the author think this is enough, please give its reason in the manuscript.

Line 173-181: Please clearly describe about bias correction.
In the seasonal prediction, the forecast skills are verified with bias corrections because it is known that the model bias greatly affects its performance. In this study, downscaling predictions are not bias-corrected. Therefore it makes the assessment in this study less useful for real use. For instance, the absolute error (Table 1) may contain the bias error component, which could be removed with the bias correction from hindcasts. This means that assessment of downscaling seasonal predictions needs hindcasts for fair comparison.

Line 193-198: Although Proportion Correction (PC), Heidke Skill Score (HSS), Peirce Skill Score (PSS) are presented for the CFS but not for RegCM forecasts, which is the main focus of this paper.

In addition, I think the probabilistic evaluation is important for the seasonal prediction. I would suggest that the authors conduct more detailed evaluation of the RegCM forecast and comparison with CFS.

Line 278-289: The correlation score may be computed in various ways (Jolliffe and Stephenson 2003). I think that the scores shown in Figure 5 are quite high. Does this contains seasonal component (seasonal cycle)? For this kind evaluation, the seasonal component should be removed (by removing climatological monthly average), otherwise the scores are biased. Please describe how this scores computed in detail.
Paper mainly discusses the mean climate and absolute error. I would suggest that the authors would conduct more detailed verification (with bias correction) to show real benefits. (Please see my comment above.)

4.   Line 257-258: GPCC is dataset based on ground (station) observation. Does this mean that the GPCC is more suitable for this verification? The downscaling is aim to predict finer scale rainfall patterns. I would think the station data may be more suitable for assessing finer scale rainfall skill.

5.   Line 403-404: "In the RegCM_CFS, initial soil moisture conditions are automatically generated using climatological values or were set to zero" Experimental setting including land initialization is vital for this research. The land initial conditions should not be crudely handled in the downscaling.

6.   Figure 11: There is an obvious drift of the precipitation in RegCM predictions as discussed in this paper. The paper said "The clarification of above mentions is beyond the current scopes of this study and will be continued in our further works." in Line 406, but this should not be overlooked, because this might result from experimental misconfigurations. (at least detailed check must be done before publication.)

Minor suggestions
7.   Line 2: In many parts of the paper, some clarifications are needed. for instance, CFS ? CFS version 2
8.   Line 31: again ? against
9.   Line 37: Please remove "can". Please do so in other places.
10.   Line 40: I will suggest to rephrase this part as follows.
 should be used rather than… ? is advantageous to … in prediction seasonal rainfall…
11.   Line 54: including ? , specifically
12.   Line 100: please specify the months of "rainy season" since it is ambiguous.
13.   Line 127: CFS ? CFS v2
14.   Line 132 since ? in
15.   Line 236 fairly ? fairly well
16.   Line 243 reveals ? exhibits or represents.
17.   Line 245 significant ? significantly
18.   Line 255 consistent with ? in good agreement with
19.   Line 353 The RAE equation shown below the line 353 is the "difference" of RAE.
20.   Line 376 Verification for ? Verification of
21.   Line 380 Please correct this sentence, meaning is ambiguous.