Hydrology and
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Discussions

Interactive comment on "Optimising predictor domains for spatially coherent precipitation downscaling" *by* S. Radanovics et al.

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Summary: This study presents an optimization algorithm for predictor domains for precipitation downscaling. The method is applied to 608 target zones (obtained from Safran) in France. The authors optimize the locations and sizes of individual geopotential predictor domains, and use these domains as data pool for the analogue downscaling method. The spatial distribution of the shapes and locations of these domains are discussed, and analyzed regarding optimization parameters and archive length. The authors conclude that the extended version of the growing rectangular domain algorithm finds the most relevant predictor domain and improves the prediction skill.

The study covers an interesting subject which is rarely addressed. However, some

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comments need to be addressed to clarify the approach, results, and their analysis. I think the following issues must be discussed in more detail:

1. The computational cost of the algorithm seems to be comparatively low, but the optimization is restricted only to the geopotential predictor domain. What are the reasons for your decision? Is the method not applicable for more complex predictors (domains)?

2. Why did you use ERA reanalysis data and not ERA-Interim?

3. In the first paragraph in Section 2.1.2 (L 18/19) you write "These as well as the case study zones are colored in Fig. 1". It is not obvious what you are referring to, the relevance maps (which you have mentioned in the sentence before), the country border or the Safran zones.

4. In Section 2.2 you need to give a short overview of the downscaling method before describing each step in detail.

5. On Page 4024 (L9-18) the Teweles and Wobus criteria is introduced, what measures the similarity of zonal- meridional gradients between 'different points' of the predictor domain. Do you mean the gradient between each grid point and its surrounding neighbors? If not, what do you mean with "between different points"?

6. Is there a reason why the grid for the relevance maps consists of a 2x2 ERA40 grid? Why not just taking one grid cell?

7. The optimization method extend the predictor domain in all 4 directions by adding on grid point and then selects the best domain according to the CRPS. Thus, the predictor domains can only take rectangular shapes. However, most patterns in the relevance plots show a concave shape, which are difficult to capture by this method. You probably receive better results, if each grid cell is allowed to extend the domain and not only the entire box. This would guarantee to find non-rectangular shapes as they appear in the plot.

8. In the last paragraph of Section 3.2.1 the differences in the skills between the best

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and the fifth best domain is discussed, and differences are very small. At some locations the domains have different aspect ratios, but the performance is almost the same. Could you please discuss in more detail why there is almost no difference. (Maybe this is related to the correlation length).

9. I had really difficulties to understand the Figures 5-8. Could you please describe the figures in more detail.

10. On P4034/L2 you write: "... comprise the large scale grid cell". I do not understand what you are referring to. Do you mean "... comprises only of one large scale grid cell."?

11. The optimization method has been started from different starting points and the same predictor domains have been found (P4034/L11-26). This is probably not always the case and should therefore be discussed.

12. P4034/L21: "... indeed better domains can be found if more possible domains are explored through the extended algorithm and ...". What are better domains? (downscaling results, spatial pattern etc.) I can't see why these patterns should be better.

13. How much better are the optimized domains compared to other (arbitrary) domains or even one grid point?

14. In the conclusion you write: " . . . that the performance of this method (common predictor domain) is far from optimal ...". You need to prove that the proposed method is indeed better than other methods. Without any results it is nearly impossible to see why the proposed method is superior.

SPECIFIC COMMENTS

1. P 4018 line 4: Please write "Model Output Statistics (MOS)"

2. P 4019 lines 4-5: Please make two sentences: " . . . here precipitation. These predictors should be ..."

3. P 4019 line 19: Please change to " Some studies tested . . ."

4. P 4019 lines 21-26: "... close to the target location, and therefore ...", "... likely to be sufficient. The predictor domains ..."

5. P 4019 lines 25-29: Please write something like "... Italy and compared the performance with those of all groups together."

6. P 4020 L 1: What do you mean with center?

7. P 4020 L 2: What do you mean with "... benefit from individual prediction domains"?

8. P 4020 L 21: Change "will be" to "is"

9. P 4020 L 21: Change to "... question: Is ..."

10. P 4021 L18: "... are used as predictand ..."

11. P 4025 L 11: "... pressure levels, time and the number of analogues at each step . . . . . ., where they were ...", "It has also to be noted, that ..."

12. P 4025 L 23: Change to "Heaviside"

13. P 4026 L 1: "... as described in Hersbach (2000). The CRPS ..."

14. P 4026 L 17: Change "spatial unit" to "location"

15. P 4027 L 13: "For these 4 resulting domains the CRPS are calculated ..."

16. P 4027 L 14: "... is then used ..."

17. P 4027 L 19: Is there so much improvement using 5 domains? In the result section you describe that there are hardly any differences.

18. P 4028 L 17-22: This is a very long sentence.

19. P 4029 L 5: "... (cf. Fig. 1) calculated from the 20 yr ..."

20. P 4037 L 5: . . . this choice. The Saone case study zone is situated north ..."

21. P 4037 L 7-8: "... while the rest is the same ..."

22. P 4037 L 14: Please change the expression "... validity of the assumption ..."

23. P 4038 L 4: "dsclim" in italics

24. P 4040 L 9: "guaranteed"

25. Figure 1: Enlarge the figure and better highlight the corresponding zones in the map. It is really difficult to locate the zones.

26. Figures 3-11: It would be better to provide a discrete color scale.

27. Figure 7-8: Please provide the outline of France in the inlets (like in figure 7a)

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