

Review comments for “The analogue method for precipitation prediction: finding better analogues situations at a sub-daily time step” by Horton et al.

Recommendation: Major revision

The authors introduced a moving time window (MTW) for the analogue method so that better analogues at a different hour can be found for precipitation prediction in contrast to the use of analogues at fixed hours of the day in standard analogue method. They found that the MTW with the shorter archive on a sub-daily time step improved the analogy criterion values across the entire distribution of analogue dates and the skill of precipitation prediction in comparison with the standard analogue method with longer archive on a daily time step. In particular, the improvement in prediction skill is greater for days with heavy precipitation. The topic is important and has great implications for operational precipitation forecasting and impact studies associated with the hydrological community. The only constraint is that the implementation of such method requires the availability of sub-daily time series, which may not always exist.

I have several major comments. First, some necessary information regarding the presented analyses should be provided. For example, what season are the results shown in Figures 4, 5, 6, 7, 8, 10 based on? The authors mentioned in Table 1 that the selection of analogue candidate is limited to the 4 months centered around the target date for every year. However, it is not clear what season the presented analyses focused on. Also, it seems to me that the entire assessment is performed in the prognosis context. The authors mentioned “prediction” several times throughout the paper. No matter for a 47-year archive (1961-2008) or reduced 25-year archive (1982-2007), it is not clear if the authors used part of the archive for calibration and part of the independent period for validation. If it is real “prediction”, what period of data is the prediction performed on? All these details should be clearly described in the method section. Second, the paper, especially the results and discussion sections, is not well structured. These sections are divided into many small sub-sections. The content should be better organized and integrated to convey clear message. One example is, the discussion of Figure 4 and 5 appears in both section 3.1 and 3.3. Third, the text needs to be improved in terms of the logic, transition, grammar and wording. Some sentences are really long, confusing, and quite hard to understand (see some specific comments below).

Specific comments:

1. P1, line 6-7: confusing sentence, how about “the main reason for the use of daily precipitation time series is the length of their available archives, ...”
2. P1, Line 7-9: “However, it is ... at a different time of day”. Long and confusing sentence. should rephrase it.
3. P2, Line 22-23: “since they are based on observed situations with consistent spatial distribution” – consistent with what? Do you mean between target day and analogue dates? “as long as the analogue dates chosen for a region are the same” – same compared to what? When the target day changes, I think the analogue dates will change accordingly.

4. P3, Line 2: “even for much higher orders of magnitude” – do you mean even longer archive?
5. P3, Line 2-4: “Hopefully” – better to use “fortunately” based on context. Also, need reference for the statement “it appears that ... 10° to 20°”.
6. P3, Line 16-19: “Therefore, if the reduction of the archive ... to an increase in performance”. – very confusing sentence, please consider rephrasing it.
7. P3, line 25: “similar conclusions” – what is the conclusions? - in creasing the prediction skill?
8. P5, line 11-12: why MTW can not be applied to the 2nd level of analogy?
9. P.6, line 9 for Figure 2: why not just keep candidate 24-h precipitation fixed from 6h to 30h, but allowed to choose the analogues on 6h, 12h, 18h, 24h, 30 h for both Z500 and Z1000? That allows you to choose the analogues on multiple time steps but within the 24-h window consistent with conventional method. What is the purpose to have the varying 24h precipitation totals if the main objective is to find the better analogues to predict the same target day precipitation?
10. P6, Line13: confusing sentence “no constraint ... in order to restrict.”
11. P6, Line 27- 33, it is not clear how the method is implemented. The authors should provide a diagram to show the method. More details are preferred, such as do you just pick one best grid among four, what time lapse is allowed, how the temporal profile of best proxy is used to disaggregate? If you use the proxy variables from NCEP/NCAR reanalyses, why not directly use the precipitation from NCEP/NCAR reanalyses?
12. P7, line 13: Is the four points for geopotential height used to calculate the height gradient in both directions?
13. P8, Line 9: what does “globally significant” mean? Significant at what level?
14. P8, section 3.2.1: It is not clear to me how the distribution of the analogy criterion for different analogue ranks is constructed. So for any target day, if 50 analogue dates are selected (50 ranks in total), each analogue date should have only one S1 value based on their similarity in geopotential fields.
15. P9, line 6: “the number of candidate situations did not increase”, but from table 3, N1 for 2Z-2MI is larger than N1 for 2Z.
16. P9, Line 10-11: could this because RMSE is not a good metric to assess the similarity for moisture fields?
17. P9, Line 13: why it is “prediction”? I think the entire assessment so far is in a prognosis context. Do you reselect the analogue dates for blue bar (MTW algorithm) in Fig. 4 and 5?
18. P9, Line 15: It will be good to test if the improvements of MTW and MTW-r over the static approach is significant?
19. P9, section 3.3.1: Fig.11 also indicates that the spread of difference of the CRPSS performance score is quite larger. It is not correct to say that the performance score was improved for days with high precipitation. The statement should be based on the average performance. Again, for Fig.11, it is not clear to me what each point represents. Do the points represent the analogue dates with precipitation amount in the specific categories? Then the total number of pints in figures are equal to the total number of analogues selected?

20. P9, section 3.3 and 3.3.1: when author say “prediction skill”, does the author mean the use of calibrated parameters for independent data set?
21. Same as #10, it would be good to show a map about the method 2 to help the reader understand what is concluded in section 3.4 and table 5.