Ref.: MWR-D-16-0093
Monthly Weather Review

After carefully considering the reviews of your manuscript, "Global Optimization of the Analogue Method by Means of Genetic Algorithms", an editorial decision of Major Revision has been reached. The reviews are included below.

Both reviewers suggest your work could be an interesting and useful contribution. Although the work needed to improve clarity and precision in the presentation is non-trivial, as elucidated by reviewer 2, it appears to me that the revisions are primarily editorial. I expect that addressing the reviewers' comments will result in a stronger contribution.

I invite you to submit a revised paper by Aug 16, 2016. If you anticipate problems meeting this deadline, please contact me as soon as possible at Hacker.MWR@ametsoc.org to discuss an extended due date.

Along with your revision, please upload a point-by-point response that satisfactorily addresses the concerns and suggestions of each reviewer and the Editor. To help the reviewers and Editor assess your revisions, our journal recommends that you cut-and-paste the reviewer and Editor comments into a new document. As you would conduct a dialog with someone else, insert your responses in a different font, different font style, or different color after each comment. If you have made a change to the manuscript, please indicate where in the manuscript the change has been made. (Indicating the line number where the change has been made would be one way, but is not the only way.) Although our journal does not require it, you may wish to include a tracked-changes version of your manuscript. You will be able to upload this as "additional material for reviewer reference." Should you disagree with any of the proposed revisions, you will have the opportunity to explain your rationale in your response. No separate cover letter to me is needed unless it contains essential information that does not appear in your reply.

Before submitting your revision, please carefully review the AMS Guidelines for Revisions found at http://www.ametsoc.org/PUBSrevisions to be sure you have complied with all instructions for quick processing of your revised manuscript.

Please note that figure source files formatted for publication must be uploaded for ALL revisions. Ensure that your figures adhere to the requirements for Journals authors: http://www.ametsoc.org/PUBSfigures

Please enter the figure number in the description field when uploading your figure files (or on the Attach Files page after upload). This is required even if the figure number is already in the file name.

When you are ready to submit your revision, go to http://mwr.edmgr.com/ and log in as an Author. Click on the menu item labeled "Submissions Needing Revision" and follow the directions for submitting the file.

Thank you for submitting your manuscript to MWR. I look forward to receiving your revision.

With best regards,

Dr. Josh Hacker
Editor
Monthly Weather Review

REVIEWER COMMENTS

Reviewer #1:
This is an interesting paper that shows the genetic algorithms (GA) are a valuable way to select predictors for analog forecasts for weather. GA is the focus of this particular paper; apparently other papers by the authors discuss the analog weather forecast results in more detail.

There are a variety of evolutionary-like methods in the literature: genetic algorithms (GA), genetic programming (GP), gene-expression programming (GEP), etc. The approach used here is GA with fixed chromosome size. Although I am personally in the GEP camp, I find that their GA results are exciting and valuable.

Their results are intriguing - - I might try it myself. The authors discuss a dizzying array of GA procedures - - apparently all are needed to get the method to work successfully. The authors also do sensitivity studies to see which evolutionary procedures are most effective. The result is a nice set of recommendations that other researchers could use to good advantage. They also suggest new evolutionary methods, such as adding a gene for adaptive search radius to the chromosome, which allows the GA method to transition from exploration of a large global solution space initially to exploitation of the local solution space.

The authors want to thank the reviewer for his positive feedback and his corrections.

Suggestions:
line - comment
49 - Another analog-method researcher is Delle Monache. For example:

Vanvyve, E., Delle Monache, L., Rife, D., Monaghan, A., Pinto, J., 2015.
Wind resource estimates with an analog ensemble approach. Renewable Energy, 74, 761-773.

Alessandrini, S., Delle Monache, L., and Nissen, J, 2014. Probabilistic power prediction with an analog ensemble. Accepted to appear on Renewable Energy.

Delle Monache, L., Eckel, T., Rife, D., and Nagarajan, B., 2013. Probabilistic weather prediction with an analog ensemble. Monthly Weather Review, 141, 3498-3516

Delle Monache, L., Nipen, T., Liu, Y., Roux, G., Stull, R., 2011. Kalman filter and analog schemes to post-process numerical weather predictions. Monthly Weather Review, 139, 3554-3570

References to these works were added and some differences in the method were commented.

618 - change "chromosome" to "gene", because the adaptive-search-radius gene is just one position in a chromosome that includes many other genetic loci.

In the case of the "chromosome of adaptive search radius", there is one search radius value for every gene of the main chromosome. It is thus indeed a full chromosome, in opposition to the "individual adaptive search radius", such as the "chromosome of adaptive mutation rate" by Bäck, 1992. Thus, the term chromosome seems justified to us.

624 - please define (remind the readers) the meanings of Pmut, Gm and omega.

The definitions have been added

Minor changes & typos
57 - change "when" to "if"
466 - change "variants" to "variant"
523 - remove the word "a"
525 - change to "... allows one to highlight ..."

These elements were fixed, thanks.

Reviewer #2: MAJOR COMMENTS

This manuscript proposed an interesting idea: using genetic algorithms to optimize predictors of an analog-based method. However, the manuscript has several significant deficiencies and therefore I am recommending major revisions.

The authors want to thank the referee for his detailed corrections.

In the literature, several algorithms based on the analog concept can be found. These algorithms differ at times significantly in their philosophy and implementation. The authors refer to their method as "The Analogue Method" but fail to recognize that the algorithm they used is just one of the several proposed analog-based approach. In the title, abstract, and throughout the manuscript, they should refer to the analyzed method as "an analog method" (or "analogue" of they prefer).

This has been changed, thanks.

The authors often mention results that they are familiar with in absolute terms, neglecting several other contributions on analog methods (see specific comments below).

We added more references to other contributions and use more relative terms.

Introduction: the authors completely missed a body of work on analog method, some of which has been published on MWR. See Delle Monache et al. 2013 MWR (141, 3498-3516) and Hamill et al. 2015 MWR (143, 3300-3309). The authors need to refer to these contributions and references therein and explain how the method they propose differs from it.

We added the suggested references and commented on some differences. However, as we work here in a perfect prog context, and not in a MOS context (as the suggested authors do), we don't go too far into the comparison.

What are the computational requirements to run GA for analog-predictor optimization? This is an important factor to evaluate the merit of the proposed approach.

We added a note in the introduction and conclusion to make it clear that it is only intensive for calibration, not in real-time forecasting. Moreover, more information on the computational requirements needed for this study were added in the section "Assessment process and results".

The description of GA is way too long and needs to be significantly shortened.

The description of GAs has been shortened by removing duplications, general descriptions or too

specific details. Many equations of less relevant operator versions were also removed.

The baseline sequential method is not described.

It has now been added in the introduction

The authors need to explain much more in details the application considered,
in addition to "precipitation forecasting over a subcatchment (Binn-Simplon region) in the Swiss Alps".

A new "Case study and data" section was added.

467-470: the goal described here is questionable; the authors must provide evidence of the benefit of the proposed analog-predictor optimization, and show if it is statistically significant or not.

A new "Illustration of application" sub section in the "Use of GAs of optimize AMs" section was added to illustrate the gain obtained by the optimization and its statistical significance.

467-470: the authors must clearly describe which predictors they are considering and which ones are selected by the GA procedures.

A description has been added in the beginning of section "Assessment process and results".

The authors should provide a physical explanation, when possible, of why specific predictors are selected.

The choice of the predictors is not changed by GAs in this study. The predictors of the considered AMs are now described in the extended method description.

482-483: I disagree with the authors. "The magnitude of the improvement" is indeed very important to determine if this is a valid contribution deserving publication on MWR.

This has been changed.

The data set used for training and testing of the algorithm must be described in details.

A subsection describing data was added in section "Case study and data".

"Submitted" papers cannot be cited.

They are now removed.

Throughout the manuscript, there are several awkward or unclear sentences that need to be revised by a technical writer. The following is a list (not comprehensive) of these sentences that must be revised:
- 46
- 51
- 93
- 96
- 111-112 (English too colloquial, not appropriate for a scientific document)
- 118-119
- 127

- 133
- 150-151
- 180-181
- 183-184
- 192
- 315
- 417-418
- 427-428
- 442
- 460-461
- 475
- 479
- 511-512
- 521-522
- 546-547
- 620
- 639

These sentences were improved. The paper has also been reviewed by a professional service (see certificate).

- The Authors are not familiar with the AMS style. They should follow the guidelines in the AMS Authors' Guide. E.g.:
 * Throughout the manuscript: change "Sect."to "section"
* Spell out numbers lower than 10 (e.g., line 121)
* Use "e.g., " or "i.e., " throughout the manuscript

This has been fixed.

Line 50: the authors seem to contrast the proposed method to NWP models; however, there are analog-based methods (e.g., Delle Monache et al. 2011, 2013 MWR; Hamill and Whitaker 2006; Hamill et al. 2015) that rely on NWP data (i.e., they can be considered "hybrid" methods, combining NWP and statistical methods). Clarify this to the reader.

This sentence has been removed. Moreover, the use of AMs as MOS technique is now commented in the method description.

58-59: The statement is not true. E.g., See Junk et al. Meteorologische Zeitschrift (24, 361-379), who have proposed fully automated analog-predictor optimization procedures.

We added a paragraph on that in the introduction. However, the approach proposed by Junk is a brute force on the weighting between the predictors. It is thus not a global optimization technique that allows optimizing the choice of the pressure level and time of the predictors, neither the domain of analogy or the number of analogues.

68-69: No true. See above.

Still, we think it's correct, according to the previous answer.

138: This statement is incorrect.

The sentence was changed, and references added.

ADDITIONAL EDITS

- 86: simplex à simple.

It is indeed "simplex". We changed it to "simplex algorithm" in order to be more clear.

- 105-106: described sections do not reflect sections in the manuscript.

The description was not wrong, but it has now been simplified in order to avoid misunderstandings.

- Section 2: the analog method is poorly described.

The description has been significantly extended.

- 113: "that are most similar"…to what?

The sentence has been changed.

- 116: "typically"…for what?

The sentence has been changed.

- 121: The word "parameterization" is not used with the same meaning as typically used in NWP, which is what most of MWR readers are familiar with. The authors likely meant "procedures".

This has been changed to "configuration", "options" or "variants" according to the context.

- 125: "target date": define.

A description has been added.

- 125: what is the lead time of the forecast, i.e., how many hours out in the future these forecasts go?

We do work here in the perfect prognosis framework, and not as a MOS approach. Thus, there is no lead time. A clarification on the perfect prognosis context has been added.

- 126: "S1": define.

The equation has been added.

- 185-186: temperature is a continuous variable.

We meant that the choice of the meteorological variable is not continuous, not the variable itself. We changed it to "choice of the meteorological variable" instead of "geopotential, or temperature".

- 189: you need to define also lambda.

This has been removed in order to shorten the description of GAs.

- 193-196: this sentence seems out of context.

This has been removed in order to simplify the description of GAs.

- 198: divergences à differences.

Changed.

- 217: what is meant with "applied to floating-point coding"?

This has been removed in order to simplify the description of GAs.

- 256: "…zero probability of being selected". Why?

All details have been removed in order to shorten the description of GAs.

- 430: "temporal window" is never defined.

A definition has been added in the introduction, and the term was changed specifically in this paragraph with "hours of observation".

- 433: Provide an estimate of how expensive they are. Is the proposed system feasible for real-time operations?

As stated previously, we added a note in the introduction and conclusion to make it clear that it is only intensive for calibration, not in real-time forecasting.

- 463: "sometimes": too vague.

The sentence has been changed.

- Figs. 2, 3: describe them and comment on the presented results.

More description was added.

- 495: where?

A reference to the section has been added.

- 508: very vague. Avoid this kind of statements.

It has been removed

- 517: "last box in the figure". Say which one.

The figure number was added.

- 552-553: is not clear which are the predictors that are discussed here.

More description was added.

- 561: how long?

We here refer to the convergence in terms of number of optimizations ending with the same result, independently of time.

- 566: why "new"?

"new" because it's an operator that we developed during this study. However, this is already mentioned in the description of the operator, and thus is has been removed here.

- 589: "longer optimization". The authors need to be more specific!

More information on time and requirements were added here and elsewhere in the document.

- Fig. 1: add "." at end of caption.

Fixed.

- Fig. 2: what do the circles represent? Explain in caption.

Fixed.

- Fig 4 (and similar figures): to improve the readability, the information listed in table 1 could be added directly to the figure or the figure caption.

We followed this advice and removed all tables in order to integrate the data in the figures.