

hess-2024-58

Title: Review of Gridded Climate Products and Their Use in Hydrological Analyses Reveals Overlaps, Gaps, and Need for More Objective Approach to Model Forcings

Author(s): Kyle R. Mankin et al.

MS type: Review article

Iteration: Revision

Authors' Response:

All editor and reviewer comments are addressed below. In addition, all references were reformatted according to journal guidelines.

Reviewer Comments: RC1: 'Comment on hess-2024-58', Anonymous Referee #1, 09 Sep 2024

The authors have made minor changes to the manuscript, which while they do improve certain aspects, I think the edits were not substantial enough to make this a considerably more impactful paper. Figure 1 is now a publishable figure and the addition of recommendations in the abstract and conclusion is useful. However, I still believe that the authors could have made an effort to add synthesis and summary in section 4. Many paragraphs are a series of sentences describing the findings of previous studies and include no original interpretation. This paper can be published in its present state, but in my opinion its value and contribution to hydrologic sciences is somewhat limited.

RESPONSE: We reviewed the synthesis in section 4 in response to this comment, and we disagree that there is no original interpretation. The authors of individual papers summarized study results toward the objectives of their individual studies, but further interpretation was often needed to reframe and synthesize the results in a manner that contributed to the objectives of this paper. Many of the summarized results in this paper are not just restatements of prior results.

Probably the most meaningful response we can provide to the “somewhat limited value and contribution” comment is the following. In the short time that the preprint has been online, we have already received a positive reader comment:

“I wanted to thank you because it was really helpful to me and concisely summarized the findings of a lot of literature, and pointed me to some studies that I was not previously aware of.”

This directly aligns with the objective of this paper. It appears that in this regard, the paper is already being successful.

This reader also provided 3 references for our consideration (2 of which were relevant and added in the latest revision [tables 1, 3, and 4, fig 1, and sections 4.1, 4.2, and 4.6]):

“...if it's not too late to add, and I realized it probably is, I found a few more papers that you might want to consider citing. You correctly noted that in the paper that there's not many studies validating gridded humidity datasets, but I did find a few that you didn't cite, but that have been very helpful to me in choosing which humidity datasets might work best in different situations.”

Minor comments:

In the abstract, you define R and G early. Then you keep redefining it in parentheses throughout the rest of the abstract. Either just use R and G later in the text or delete it altogether.

RESPONSE: Abstract revised to use R and G.

First sentence in section 4.1: fewer implies plural. I suggest you just lead with “One of the 28 studies” instead of putting it in parentheses at the end of the sentence. This will make your point more succinct and impactful.

RESPONSE: Reworded, as suggested: “Two of the 29 studies summarized in Table 4 assessed and compared...”.

Reviewer Comments: RC3: 'Comment on hess-2024-58', Anonymous Referee #3, 10 Aug 2024

Minor revisions - add additional summarizing text and concrete examples at various points to guide the reader.

Referee Report: hess-2024-58-referee-report.pdf.

Major comments

1. The authors provide a valuable service to the hydrologic modeling community. Firstly, simply listing the major differentiating features of these spatial climatic datasets can assist researchers in evaluating their own methods (for example, I was not aware that there was such a degree of variability in latency). Secondly, this summary of available modern datasets can facilitate an improved dataset selection and justification process in future studies.
2. At several points the manuscript resembles a laundry list of findings derived from a review of data sources or other studies. This is partly unavoidable due to the nature of the analysis, but the authors can assist a reader by inserting additional summary text before and/or after the paragraphs in which the resources or findings are listed (see minor comments for line 274, 291, and 295).
3. As a reader I found the use of example research applications very grounding, since much of the paper is, by necessity, composed of high-level summarizing. I have noted some places where I think additional concrete examples or context would be useful.

RESPONSE: These overarching comments are addressed specifically below.

Minor comments

Line No. Comment

93 Make sure column headers are included on each page where Table 1 appears.

RESPONSE: Agreed. I am certain this will be addressed in the final proof editing process.

119 Make sure column headers are included on each page where Table 2 appears.

RESPONSE: Agreed. I am certain this will be addressed in the final proof editing process.

130 Rephrase with semicolons: "Reanalysis systems use various models, observational datasets, and assimilation methods; can generate many climate variables with inter-dependent variable consistency; and provide near-real-time datasets with latency periods from hours to months."

RESPONSE: Edited as suggested.

140 Make sure column headers are included on each page where Table 3 appears.

RESPONSE: Agreed. I am certain this will be addressed in the final proof editing process.

149 "merging other data sources" - consider specifying that they are other data sources with complimentary advantages or disadvantages.

RESPONSE: Nice addition. Added, with slight revision: "...other data sources with complimentary advantages to reduce errors or biases".

152 How do they estimate accuracy and bias (i.e., do they train the predictions on a training set and leave out certain ground stations or satellite observations as a test set for calculating error)?

RESPONSE: Each dataset handles this somewhat differently, so this general statement is a marker for the reader to investigate any selected dataset. Tried to address this with the following: "Each dataset follows a different workflow in developing the integrated product; in general, the primary method (in this article, the first abbreviation letter) is enhanced somewhat sequentially with various interpolation or bias-correction schemes using the secondary dataset(s)."

164 Consider rephrasing: "Many characteristics of gridded datasets influence the best product for a given application or research question."

RESPONSE: Edited as suggested.

175 In this paragraph, consider adding a sentence describing what fraction of datasets include a single variable (e.g., P) versus multiple variables.

RESPONSE: Unless I'm reading this comment incorrectly, this is already answered in the third column of Tables 1, 2, and 3, where the specific variables in each gridded dataset are listed.

186 Consider adding another example: calculations of the recurrence interval of a flood of a given severity.

RESPONSE: Nice. Added, as suggested.

218-220 I find these example research applications helpful and would recommend adding at least one of to each of the subsections in Section 3, Considerations for Use. Alternatively, you could put several different example applications and what features they might prioritize somewhere earlier in Section 3.

RESPONSE: All 3.x subsections already had some number of practical examples, and these were augmented judiciously with new examples or applications.

247 Make sure column headers are included on each page where Table 4 appears.

RESPONSE: Agreed. I am certain this will be addressed in the final proof editing process.

274 This paragraph is a bit of a laundry list of different findings. To some extent this is unavoidable with this type of review work, but additional summarizing could help the reader. Consider this revision of the topic sentence: "Accuracy and agreement of gridded datasets of air temperature (T) at 2 m above ground (Table 4), about crop canopy height, were dependent on many factors, including spatial region of interest and topography."

RESPONSE: Revision adopted, as suggested. Some of your other suggestions also helped clarify pieces of this summary. The take-home message (last sentence) is that T datasets are pretty good except in mountains (another reference was added to demonstrate challenges in mountain regions).

279 Does the author define "adequate"?

RESPONSE: Not really (no specific criteria was applied even though determining "adequacy" of these datasets for hydrologic modelling was directly specified as an objective of the paper), but I deduce from the figure that seems to be used to support this statement that the Rocky Mountain region shows lower daily rank correlation and higher long-term bias, so that statement was added parenthetically: "...less adequate (lower daily rank correlation, higher long-term bias) in the Rocky Mountains."

291 This summary statement is helpful. Would recommend adding the number of studies ("consensus from these X studies") to this sentence.

RESPONSE: Clarified as follows (added underlined text): "The consensus from these nine studies (discussed in this section and cited in Table 4) suggests...". Two studies (Behnke, Tercek) did not have a hydrologic modeling component (and are not cited in Table 4), so did not inform this consensus. For further clarified, refined the Table 4 caption (with underlined text): "...literature on gridded dataset comparisons for hydrologic modelling".

295 The laundry list problem again - consider adding another summary statement to this section (at the top or bottom). One option would be to frame it from the perspective of a reader looking for the best dataset for their application (i.e., factors X, Y and Z have the biggest impact on dataset accuracy/are most important when choosing a data product).

RESPONSE: Added a concluding summary paragraph to this section: "Overall, the literature suggests the interaction of station density and basin characteristics, primarily topography, is of central importance and can drive performance. In regions with high station density (> 3 per 1000 km²), G datasets or those corrected using G data

(SG, RG, SRG, RSG) perform similarly. However, in areas with lower station density (< 1 per 1000 km²) as well as in higher elevations and topographically complex regions, R datasets perform better. Unadjusted S datasets, without G or R correction, generally were least reliable. Other site and dataset considerations may also be important for specific hydrologic modelling applications and are discussed in the following sections.”

335 Adequate for Q simulation at what river scale?

RESPONSE: Added the range of scales from these studied: “...and spatial scales ranging from 3,000 to 122,000 km²”.

357 "detecting" - unclear word choice. Possibly mean representing?

RESPONSE: Edited as suggested.

368 Could use another summary statement for this section.

RESPONSE: Added additional results from Blankenau et al. (2020) and Ang et al. (2022) to this section as well as a summary statement: “These results indicate that accuracy in climate data translated into accuracy in ET and SWE simulation and suggest that all gridded data be scrutinized, and possibly bias corrected, before use in ET and SWE modeling.”

388 The Hydrologic Coherence Test sounds interesting! Consider including a brief example of how it would be used.

RESPONSE: Perhaps interesting, but perhaps somewhat simplistic. It’s basically looking at independently calibrated model results from various gridded datasets, seeing which one(s) met a given model performance metric (any metric can be used... NSE, KGE, bias, etc.), and excluding the ones that didn’t perform well enough. Basically, if a gridded dataset can’t reproduce the streamflow (or other hydrologic outcome) results, then it should be excluded. I tried to use as few words as possible (added words are underlined) to explain this: “Laiti et al. (2018) demonstrated a Hydrologic Coherence Test (HyCoT), essentially a metric-independent method of comparing gridded datasets according to their performance in a hydrologic model, to exclude meteorological data less capable of reproducing a hydrologic outcome.”

400 "similar climatic setting and hydrologic objectives" - similar to what? Similar to the reader's own research project? Or is this a recommendation to pay more attention to studies that have higher similarity within the datasets they consider?

RESPONSE: The former. Revised: “...with similar climatic setting and hydrologic objectives to the planned investigation.”

420 This is a long and useful list of considerations. Consider adding "especially in areas of high topographic relief" after "derived from ground-based observations".

RESPONSE: Edited as suggested.

425 Consider adding vertical lines to Table A1 to visually separate columns. The word "Data" in "Network Common Data Form" runs into the descriptive text to its right.

RESPONSE: Agreed. I am certain this will be addressed in the final proof editing process.