Comments from Sylwester Arabas

Thank you for addressing the reviewers' comments in the revised manuscript and for providing the point-by-point reply. Let me also underline that I am sorry that the review process took longer than expected. Congratulations for excellent reviewers' scoring: in six out of eight received marks the paper was ranked as "Excellent".

Below, I'm listing technical remarks I'm hereby asking to address before moving on with acceptance, typesetting and publication:

1. Please attach a version number for the software release, e.g. v1.0 and ensure that the same version number and license metadata are featured on Zenodo. As of now, the GitHub repository has a release without an explicit number, while the only tag indicates a pre-release: v0.8-alpha.

There is now a new release on GitHub named fast-barnes-py v1.0.0 with a corresponding tag v1.0.0. The corresponding archive on Zenodo uses the same name.

2. While it is in not required for publication, I highly recommend to consider disseminating the software as a Python package (by including a setup.py, __init__.py, pyproject.toml files). This way, users could easily import the code with proper version identification. This would also enable dissemination of the code on PyPI.org or conda forge package sites.

The interpolation code is available on PyPI.org as Python package fast-barnes-py. The current version number is 1.0.0.
This is now also mentioned in the "Code and data availability" section. For some unknown reason the latexdiff program did not highlight this difference – just to let you know.

3. According to the GMD guidelines (https://www.geoscientific-model-development.net/about/manuscript_types.html#item2), the following applies to papers submitted as "Development and technical paper": "If the main intention of an article is to make a general (i.e. model independent) statement about the usefulness of a new development, but the usefulness is shown with the help of one specific model, the model name and version number must be stated in the title." Please thus append to the title a phrase or a subtitle featuring the version number, e.g.: "Fast approximate Barnes interpolation and its Python/Numba implementation fast-barnes-py v1.0" (or alike).

The title is now "Fast Approximate Barnes Interpolation: Illustrated by Python/Numba Implementation fast-barnes-py v1.0".

4. Language/typesetting remarks (disclaimer: I'm not a native speaker; note also that as any other accepted GMD manuscript, the paper will go through English copy-editing before galley proofs):

Corrected as suggested, unless commented otherwise below.

- p1/l15: change "commonly" to "jointly"
- p4/l85: rephrase around "writes" (?), e.g. with "can be expressed as" or "reduces to"
Rephrased with "becomes".
- p5/l88: remove "better"
- p6/l97: comma after "definition"
- p7/l140: comma after "distribution", rephrase around "even equality holds"
Rephrased to "In the special case of using a normal distribution with mean 0 and variance \sigma^2, we can even formulate a convolutional expression that is equal to Barnes interpolation. Refer to appendix C for more details.
- p9/l191: comma before "the outer loop"
- p10/l193: change "After," into "Subsequently, "
- p10/l201: write "NaN" without italics
- p11/l207: change "in the further discourse" to "hereinafter"
- p11/l207: change "in an experimental setup" to "on a dataset" (otherwise unclear if experimental refers to testing or measurements)
- p12/l220: change "reduce the unsteadiness of purely interpreted" to "achieve compiled-code performance using ordinary"
- p12/l225: change "Barnes' " into "Barnes " (as used elsewhere)?
- p13/l236: comma after "In this sense"
- p13/l247: comma after "For smaller grid sizes"
- p16/l283: change "Summarized can be stated that" to "In summary, " or "In summary, there are ... that determine"
- p17/l309: comma after "Therefore"
- p17/l317: change "This finds also its visual correspondence" to "A corresponding feature is visible" (?)
- p18/Table 4: rephrase "Key numbers"
- p18/Table 4: change "in dependency" to "as a function of" or alike
Changed figure caption of Table 4 to "Signal width parameter T and effective Gaussian width \sigma_eff respective tail value \tilde{\alpha} of the original and the optimized convolution algorithm as a function of the number of performed convolutions n, where N = 3490, grid size 2400 x 1200, resolution = 32 points/° and \sigma = 1.0°.
- p19/l327: change "data, which is" into "data, which are" or "dataset which is"
- p19/l333: change "effortful" into "costly" or alike
Rephrased to "…an already costly algorithm becomes even more expensive."
- p22/l371: remove "intelligent"
- p22/l373: rephrase to "Another error reduction technique which is effective..."
- p23/l389: change "which promise" into "which offers"
- p24/l414: change "earlier" to "in the paper"
- p24/l109: move "Getreuer" out of the parentheses

5. Reading through the final sentences of the conclusions, I found it a bit puzzling to discern which sentences refer to the paper and which refer to outlined future endeavors. Perhaps naming the section "Summary and outlook", and separating the summary from the outlook remarks in a clearer manner would improve flow?

This can in fact be better structured. Renamed the paragraph as proposed to "Summary and Outlook" and inserted an empty line between the two parts.

6. Algorithms: please add a number for the algorithm on page 2 and use it when referring to it (all other algorithms are numbered).

The naive algorithm is now labeled with "Algorithm A" and the convolutional algorithm with "Algorithm B", whereas its sub-procedures are named "Algorithm B.1, B.2 and B.3". In this way it is clear for the reader that the B-algorithms build together a program unit.

7. Figures: please use vector graphics format instead of raster graphics (e.g., by saving to pdf, postscript or svg formats).

I agree, vector graphic formats are resolution independent. Unfortunately most figures are were created by Python's matplotlib and are therefore raster images. However, the used figures are stored in lossless .png format and have a resolution of 300dpi, if printed with a width that corresponds to the column width of GMD papers.

8. "Python" remarks:

- p15/l259 (computational cost increases in Python): if the code is compiled by Numba/LLVM, this would not be a Python behavior anymore - please clarify.

Good remark. I noticed this effect in fact also in my Java implementation and thus it seems to be a general behavior. I dropped therefore the reference to Python programming language.

- p10/l195 & p12/l221 (potential for concurrent computations): just a comment for future developments (outside of the scope of the paper) - it seems likely that Numba `prange` constructs could facilitate introducing concurrency in the code (see https://numba.pydata.org/numba-doc/latest/user/performance-tips.html#parallel-true) by just changing selected `range` statements into `numba.prange` (akin to OpenMP directives).

I agree, this is subject for future work.

- Also, please consider either specifying or allowing users of the package to specify performance-oriented `njit` parameters such as `error_model='numpy'` (instead of the default 'python') and `fastmath=True` (assuming the code does not rely on NaN propagation, etc) - again, this is just a comment, outside of scope of the paper.

Thanks for the hints, this is subject for future work.

9. Appendices: please consider changing the nested numbering in appendices (A: A1, A2, A3) into Appendix A, Appendix B and Appendix C.

Done as proposed.

10. In the bibliography:

- for Bentley 75, please replace the url with https://doi.org/10.1145/361002.361007
- for Bergthórsson et al., please correct the DOI to:
https://doi.org/10.3402/tellusa.v7i3.8902
- for Daley, the DOI refers to a review of the book, and not the book itself

- for Gwosdek et al., please correct DOI to https://doi.org/10.1007/978-3-642-24785-9_38
- for Koppert, please consider adding an URL:
https://ams.confex.com/ams/84Annual/techprogram/paper_71789.htm
- for Wells 86, the "dx." in the URL can be removed

Thanks for double checking the links. Corrected as suggested.