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Interactive comment on "pyPI (v1.3): Tropical Cyclone Potential Intensity Calculations in Python" *by* Daniel M. Gilford

Anonymous Referee #2

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This paper documents PyPI, a Python port/update of a commonly used set of Fortran and Matlab utilities maintained by Kerry Emmanuel's group. The author first discussed the algorithmic implementation of the PI calculations and then highlights a couple brief examples/applications of the code using reanalysis data.

While the code or PI theory certainly isn't new, the author notes that the implementation of the algorithm itself has historically been relatively opaque. I particularly appreciated the noting of simplifications/approximations (e.g., the hard-coded Rd/Rv ratio corrected, the LCL estimation, etc.), which are generally buried in code and rarely discussed in scientific publication.

I will note that the paper itself reads a bit more like a software documentation or user guide than a traditional scientific paper. Personally, I feel this is acceptable for a journal

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such as GMD and find the effort to make software open source laudable. Traceability is going to grow more important over coming years, particularly as data volumes get large enough that archiving post-processed data is not feasible (i.e., the version of software used to process data can be tagged, such that a reader can download the raw source data plus software and recreate published findings). Some reviewers may have other opinions on the utility of such publications.

In general, I find the paper thorough, clean, and relatively pleasant to read. I feel it is acceptable for publication in GMD after some minor revisions, generally focused on some clarification of some points raised by the manuscript.

Minor comments:

Line 40 (etc.). I am not sure directly linking web addresses (see also 47-48) is useful in-line. I routinely stumble upon dead links in papers published even a few years ago. My suggestion would be archiving a version of the Matlab/FORTRAN in the PyPI repository for posterity if the authors (i.e., Kerry Emanuel) are OK with it. Otherwise, web links should probably be moved to footnotes.

Line 68. Semantics, but I might refer to this as cyclones resulting *indirectly* in response to the energy imbalance. It is deep convective overturning that is the primary manifestation; TCs form in such environments (e.g., you can still simulate reasonable heat transport without explicitly simulating TCs in low-resolution models).

Line 147. There are numerous algorithms for computing CAPE in use. Many models (e.g., WRF, MPAS) have in-line diagnostic calculations (such that CAPE can be directly output from the model) while other packages (e.g., MetPy, SHARPpy, NCL) have routines for calculating CAPE offline (from profiles of T, q, etc.) as well. Does the specific choice of CAPE calculation matter? Does the method here differ from others? If one were to "plug in" the CAPE calculation from SHARPpy, would the results change?

Line 241. While it almost certainly doesn't matter in practice, 0.5 hPa (half a millibar)

strikes me as a bit large for a convergence tolerance. What is the increase in iterative cost in using a 0.05 hPa tolerance? Do the answers change at all?

Lines 281. Any idea how this timing compares to the Fortran or Matlab code? I assume the timing is quite poor for Matlab given its generally high level of abstraction, which might make PyPI look even better.

Line 289. In addition to the CBLAST reference, George Bryan wrote a very nice (and thorough) paper regarding this ratio that would be worth directing readers towards for more information (doi:10.1175/MWR-D-11-00231.1).

The LaTeX equations need a bit of work. This is probably something that can be handled in the proof stage, but Eqs. 8 and 14 have vertically compressed exponents. For functions like exp and log, the convention is to use the \exp{...} notation, which removes the italics. Eqns. 5, 9, and 10 should use \left(and \right) to vertically extend the parentheses. Eqn. 14 is difficult to read.

Line 306-307. Could include an estimate of the underestimation here. If dissipative heating is excluded the PI is about 70% of the "full" value?

Line 350. Based on later text, I assume this is a monthly average for MERRA2, but might be helpful to mention that here.

Line 376. Compared to 6-hourly? Daily?

Temperature units are inconsistent. I understand this is probably because inputs are in degC to be more "observational" but having degC as inputs and then outflow temperature be an output in K feels risky. Are there error checks in PyPI to ensure unit correctness? Luckily temperature degC/K is a pretty easy one to handle in the troposphere.

Typographical errors and grammar:

This is a commentary on style, but I found that the first-person pronouns coupled to

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frequent references to previous papers by the author make the manuscript read a bit more like a user guide. Sentences like "I developed (PyPI...) to meet these needs." are an example. This is really up to editorial discretion, but (while I am typically a proponent of active voice) I think writing the paper in a passive voice might read a bit more traditionally like a peer-reviewed manuscript given the subject material.

Line 21. Earth should be capitalized.

Line 39. "Kerry" is colloquial, would replace with either full name or "the author."

Line 50. Need for *a* transparent...

Line 465. Instead of tilde, using "approximately"?

Line 483. ... used, but under-documented, in the

Eq. 14. Subscript "d"

Fig. 6. "Widen" longitudinal extent of panels to take advantage of whitespace.

The Zenodo link for the software is referenced in-line quite a bit. It is probably redundant since the point of the paper is to document the code at the Zenodo link (so referencing itself is circular). I would remove these references and just keep the DOI in the acknowledgments/data availability.

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