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Geoscientific Model Development Discussions

Interactive comment on "Development of "Physical Parametrizations with PYthon" (PPPY, version 1.1), and its usage to reduce the time-step dependency in the ICE microphysical scheme" *by* Sébastien Riette

Anonymous Referee #1

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The paper describes a workflow and a set of Python scripts for debugging isolated units of large-scale (i.e., NWP/GCM) atmospheric models that are predominantly written in Fortran. The presented workflow focuses on subgrid or column-wise parameterisations of physical processes. The key highlighted feature of the presented tool, named PPPY, is the ability to interact with units of unmodified compiled Fortran code. As hinted in the title, the work was motivated by the goal of exploring time-step dependency of the small-scale process representations. The paper and the supplemented source code depicts the ability to employ the tool with multiple microphysical schemes

and multiple simulation frameworks including AROME/Meso-NH and WRF. There are two case-study analyses presented focusing on the ICE cloud microphysics parameterisation and on the BSB2010 hydrometeor sedimentation scheme. Discussed Python scripts are available for download and released under an open-source license.

My assessment of the manuscript is generally negative. Although the key deficiencies lie in the content, it is hard not to mention first that the manuscript seems to have been submitted prematurely. The abstract and first paragraph end with ellipses (!), there are abundant grammatical errors and typos, oftentimes the language used is casual (e.g., "*I will just list rapidly the most important ones*") and numerous statements are strikingly vague (e.g., "*the tool can be used in 0D and 1D mode, with schemes coming from different models and with different time-advance methods to produce different kind of plots*"; "*it led to problems maybe specific to our environment or source code*").

The content of the paper encompasses atmospheric modelling techniques and technicalities of Python-Fortran interfacing. None of these two subjects are covered in sufficient detail in my opinion (perhaps focusing on just one of those would be a path forward)? Noteworthy, already the title of the paper implies description of improvements to a particular microphysical scheme. These improvements, described in section 3.1, are presented as purely textual description with vague statements, e.g. „*the graupel growth mode choice was updated. It is now more continuous and, hence, less time-step dependent*". Such approach does not match GMD's standards aimed at clarity with respect to model formulation and versioning. The author does explicitly state that the "*purpose of the paper is not to give an extended review of all the modifications*", yet in my opinion the way the model development is documented in the paper goes against GMD policies.

The Python-Fortran interfacing subject, covered in section 2, is presented with similar level of vagueness. The key components of the presented software included in the 11k LOC ctypesForFortran.py file are not discussed at all. Overall, I expect that independent use of the presented PPPY package, would not be easier than obtain-

ing analogous functionality “from scratch” using a general-purpose Python package providing abstractions for interfacing compiled code (e.g., CFFI which has numerous documented examples depicting its usage with Fortran code and NumPy arrays).

Although, in principle, I would be reluctant to call something “too basic”, reading the manuscript I felt puzzled with regard to the intended audience of the paper. I feel confident that GMD readers do not require repeated verbose explanations on what numerical diffusion is and why it vanishes for integer Courant numbers. The same concerns such statements as: „*Python was chosen because it allows to make plots ...*”, “*the computational time can be large when very small time steps are used*” or “*One process must take into account that a given specie can be consumed or produced, in the same time, by another process*”.

Below, I am listing some more specific comments that perhaps can be helpful for the author, and that support my opinion outlined above:

- avoid frequent use of the word "tool" (over 40 occurrences including all but one sentences of the abstract)
- avoid ellipses
- do not use programming notation such as “1.E-5” in the text
- time step vs. time-step, etc - please be consistent
- ensure the use of the words “statistical” and “physical” is justified for all its occurrences
- please do not call something “classical” without reason
- following phrases have certainly better alternatives: “home made”, “some behaviors of a scheme”, “object made from a class”, “intensity of the 0D simulations”,

“more the content is important, more the fall is rapid”, “weak content”, “leads to do approximately the same computation”, “content is artificially put higher”

- capitalise Python
- use vector graphics for figures
- ensure consistency in bibliographic entries: abbreviated (with dots or without) and non-abbreviated journal names

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