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**Software Management Plan made with Netherlands eScienceCenter Template Version 2023**

**Software Management Plan**

**WAM2layers**

**(TUD, WUR, eSc)**

Open Science, software quality, and software sustainability are key elements in eScience Center projects. They enable verification, reproducibility, and transparency in all phases of the research process, and maximize the chance for adoption, reuse and impact of software created in the projects.

Our Research Software Engineers put substantial effort into creating open, high-quality, and sustainable software. To allow community contributions and adoption of the software by others, all software will use permissive open-source licences (research software developed by the eScience Center will be licensed under the Apache 2.0 licence) and source code will be published in publicly accessible repositories such as GitHub.

In addition, during the project software will be made to align with the FAIR4RS software principles[[1]](#footnote-1) and be made available in the Research Software Directory[[2]](#footnote-2). This makes the software findable for search engines, enables software citation, and adds relevant metadata such as information on authorship, documentation, related projects, tools and publications.

The long-term sustainability of the software developed in eScience Center projects is the responsibility of the Lead Applicant. This template should be used to describe the measures that will be taken, both during and after the project, to ensure the usability and availability of the software beyond the duration of the project itself. These measures may be taken directly by the Lead Applicant, project partners, or their institutes, but we strongly suggest to also involve external organizations or communities.

The questions that follow should be interpreted in the broadest sense, as there is no one-size-fits-all solution for long-term software sustainability. However, you should describe each of the measures as concretely as possible. In each case you should specify which action will be taken at which moment; likewise, in each case you should make clear with whom or with which institute the responsibility for ensuring sustainability lies. It is encouraged, though not required, to make these responsibilities explicit in the form of one or more letters of support.

This SMP follows the requirements from the Practical Guide to Software Management Plans[[3]](#footnote-3), co-developed by the eScience Center and the National Research Council (NWO).

**1. Please provide a brief description of your software, stating its purpose and intended user community.**

*WAM2layers (*[*https://github.com/WAM2layers/WAM2layer*](https://github.com/WAM2layers/WAM2layers)*s) can be used to determine where precipitation originally evaporated (backtracking), or where evaporated moisture eventually ends up (forward tracking). It’s written for researchers in earth system sciences that seek to understand the complex interactions between land and atmosphere*.

**2. Which version control system will you use to manage your source code?**

*We use git for version control. We will follow the* [*semantic version guidelines*](https://semver.org/) *to label our releases. Releases will be made on an irregular schedule (whenever we see fit). Only the latest version will be maintained.*

**3. How will you make your software publicly available? Please provide links to the software if this is already the case.**

*The code is hosted on* [*GitHub*](https://github.com/WAM2layers/WAM2layers)*. Every release is also published on* [*Zenodo*](https://zenodo.org/record/7010595#.Y4oKDn3MJEY) *and pushed to* [*PyPI*](https://pypi.org/project/wam2layers/)*. Publishing on Zenodo results in having a DOI for the code. Pushing to PyPI results in that WAM2layers can be installed as a package (pip install).*

**4. What licence will your software have?**

*The Apache Licence 2.0:* [*https://github.com/WAM2layers/WAM2layers/blob/main/LICENSE*](https://github.com/WAM2layers/WAM2layers/blob/main/LICENSE)

**5. What measures will be taken during the project to ensure the long-term sustainability of the software developed in the project? (max. 300 words)**

* *A RSE from the Netherlands eScience Center is allocated to the project to co-develop the software during the project and help maintain it afterwards.*
* *A community will co-develop the software and help maintain it afterwards.*
* *On ReadTheDocs* [*https://wam2layers.readthedocs.io/en/latest/*](https://wam2layers.readthedocs.io/en/latest/) *a developers guide is available where we also explain how to make a release of the software. Black and isort are the packages to apply to improve code formatting before a release is done.*

**6. What measures will be taken to support the software after completion of the project? (max. 300 words)**

* The long term maintenance will be done by the developers of the WAM2layers 3.0 version. They will meet at least twice a year to work on the maintenance of the model. They meet in June and December (i.e. start of the meteorological summer and winter, respectively).
* We have an active GitHub discussion forum where we invite users to introduce themselves, contribute and share experiences.

**7. What resources are needed to ensure the long-term usability and availability of the software, and how will these resources be funded or obtained? (max. 300 words)**

*Besides the time commitment specified under point 6, no specific resources are required.*

**8. Are there other measures that will be taken to promote the software’s longevity? (max. 300 words)**

*Besides the dedication of the core developers stipulated under point 6, we will periodically search for additional funding to enhance the software’s capabilities.*

**9. How will your software be documented? Please provide a link to the documentation, if available.**

*Documentation is built using Sphinx and published on ReadTheDocs* [*https://wam2layers.readthedocs.io/en/latest/*](https://wam2layers.readthedocs.io/en/latest/)

**10. How will your software document its installation requirements? Please provide a link to the installation documentation, if available.**

*On the Readthedocs we provide guidance on how to install the software. The software is based on Python and dependencies are automatically installed or it is indicated in the requirement section in the documentation.*

**11. How will you enable citation of your software by users? Please provide a link to software citation data and/or DOI if available.**

*After big changes we make a release of the latest version and couple it to a DOI on Zenodo.*

*Our latest release and its related citation can be found on Zenodo here:* [*WAM2layers | Zenodo*](https://zenodo.org/record/7010595#.Y4nYzxTMI2w)

*Citation info on GitHub can be found here:* [*WAM2layers/CITATION.cff at main · WAM2layers/WAM2layers (github.com)*](https://github.com/WAM2layers/WAM2layers/blob/main/CITATION.cff)

**12. How will your software be tested? Please provide a link to automated testing results, if available.**

*In place:*

* *We provide the data for a test case on a small domain.*
* *We have runtime validation using pydantic for the configuration file*
* *We’ve added utilities to verify that the preprocessed data adhere to the prescribed format*

*Planned:*

* *It would be good to add some regression tests: a small test case with sample data to verify that output is not modified after code changes. This is on our to do list.*
* *We are planning to upload benchmark datasets to 4TU.ResearchData.*
* *It would be good to add unit tests for core functionality.*

**13. How will your software be packaged and distributed? Please provide a link to available packaging information (e.g. entry in a packaging registry, if available).**

* *We will periodically (i.e., before each release) check whether new dependencies were introduced, and if so, whether they have a compatible license.*
* *Packaging with standard python build tools (setuptools), published to PyPI with twine.*

1. <https://doi.org/10.15497/RDA00068> [↑](#footnote-ref-1)
2. <https://research-software-directory.org/> [↑](#footnote-ref-2)
3. <https://doi.org/10.5281/zenodo.7038280> [↑](#footnote-ref-3)