HELMHOLTZ

ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

Reproducibility and Open Science

Bernadette Fritzsch

Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung Bremerhaven
Computing and Data Center

DOI 10.48440/os.helmholtz.060

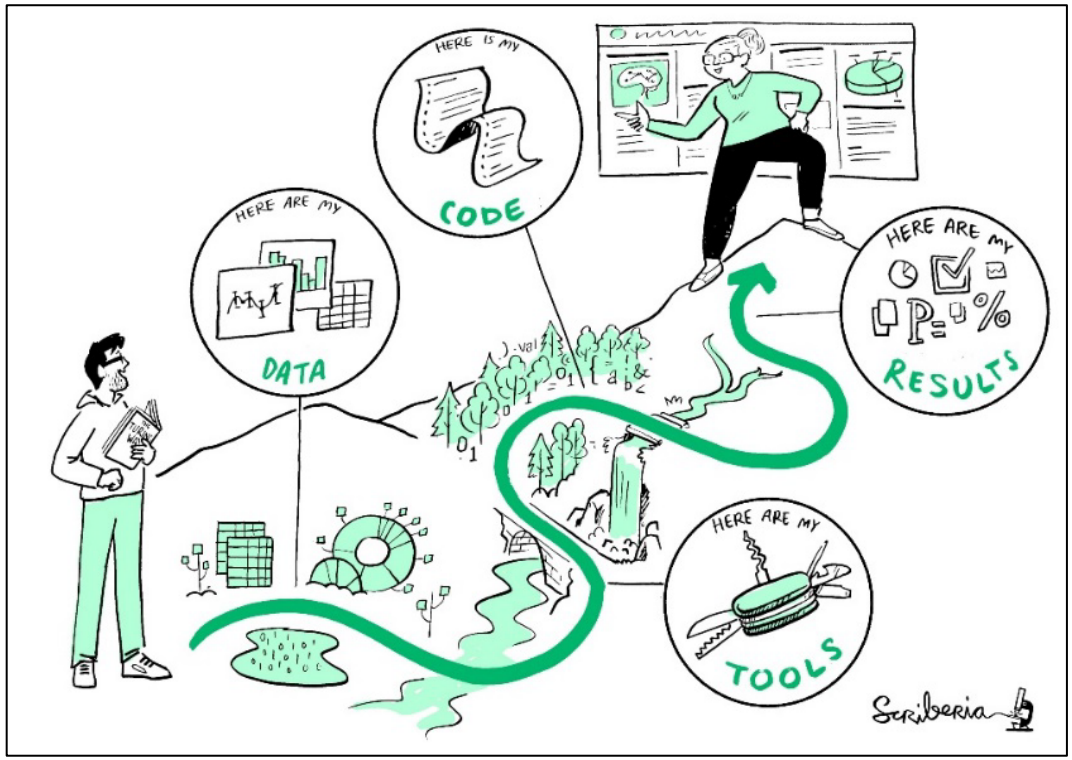
Intro

how are open science and reproducibility linked to each other

Open science and reproducibility are closely linked as they both strive for greater transparency and accountability in scientific research. Open science promotes sharing and collaboration in the scientific process, while reproducibility requires that results can be independently verified through repeating the experiment. By making research more open and accessible, open science helps to increase reproducibility and build trust in scientific findings.

https://chat.openai.com/chat

Openess and Reproducibility



The Turing Way Community, & Scriberia. (2019). Illustrations from the Turing Way book dashes. Zenodo. https://doi.org/10.5281/zenodo.3332808

Reproducibility

Reproducibility is the ability to recalculate a figure from data, parameters and programs

(Schwab M, et al., 2000)

Reproducibility is the ability of independent investigators to draw the same conclusions from an experiment by following the documentation shared by the original investigators.

(Gundersen, O.E., 2021)

- Repeatability (same team, same experimental setup
- Reproducibility (different team, same experimentatl setup)
- Replicability (different team, different experimentatl setup)

(ACM, 2020, https://www.acm.org/publications/policies/artifact-review-and-badging-current)

Reproducibility

Reproducibility is the ers and programs

Reproducibility is the ame conclusions from an experiment b inal investigators.

- Repeatability (same
- Reproducibility (diffe
- Replicability (differer

(ACM, 2020, https://www.acm.org/publications/policies/artifact-review-and-badging-current)

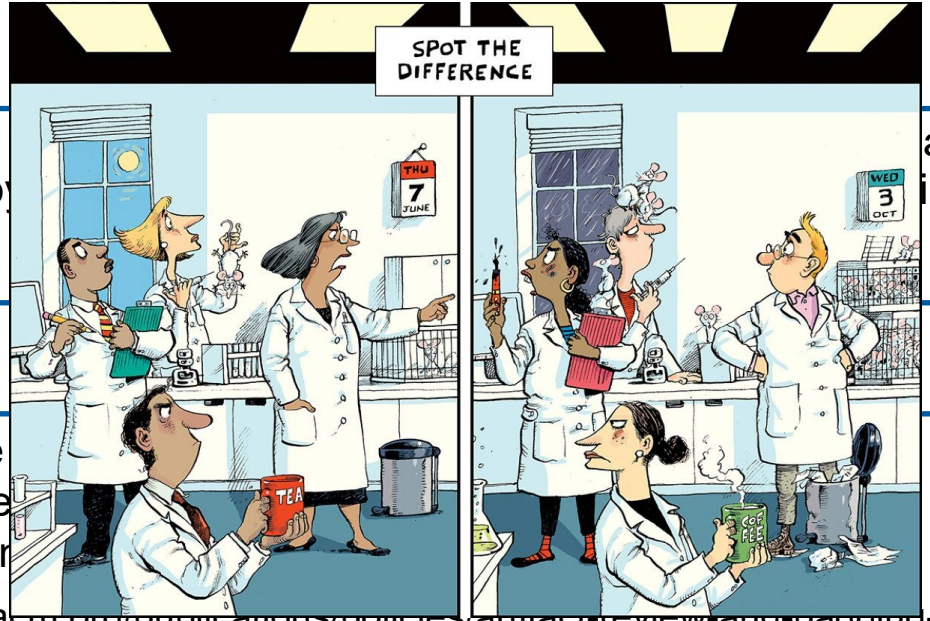
nature > comment > article

COMMENT | 21 July 2020

The best time to argue about what a replication means? Before you do it

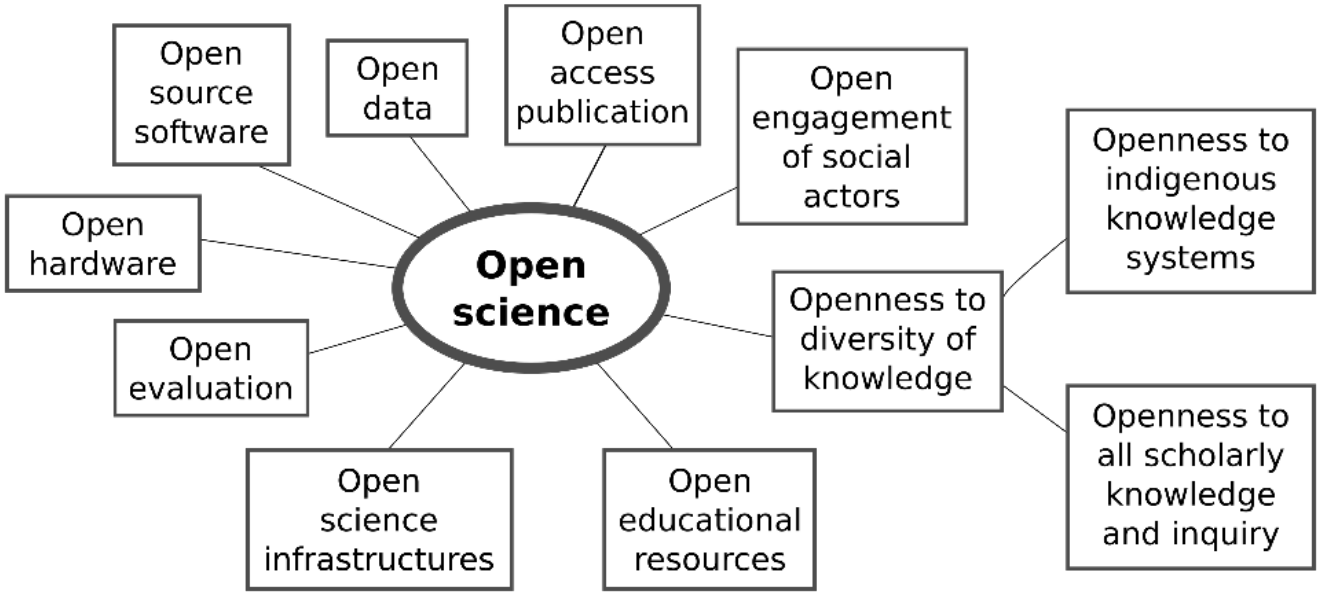
To avoid stalemates and provide lessons, replicators and original researchers must reach agreement on a study design and set out expectations ahead of time.

Brian A. Nosek & Timothy M. Errington

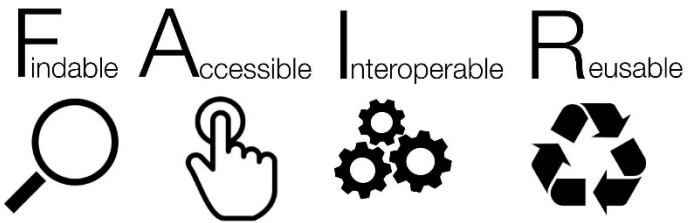


Aus: https://www.nature.com/articles/d41586-020-02142-6

Open Science



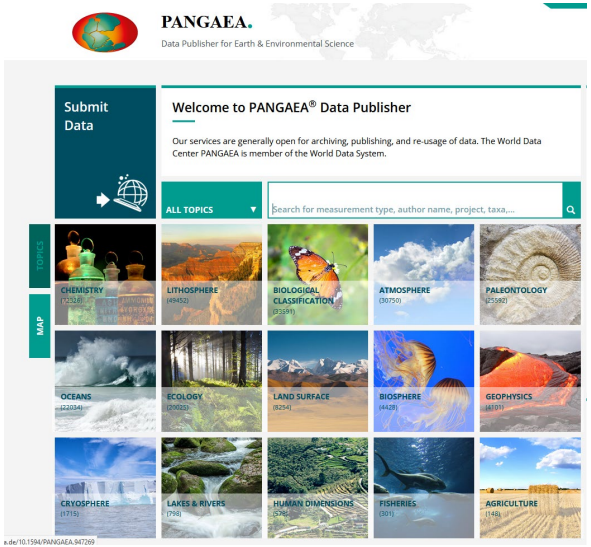
Data



Sangya Pundir; CC BY SA 4.0,
https://commons.wikimedia.org/w/index.php?curid=53414062

Detail from: The Turing Way Community, & Scriberia. (2019). Illustrations from the Turing Way book dashes. Zenodo. https://doi.org/10.5281/zenodo.3332808

Data



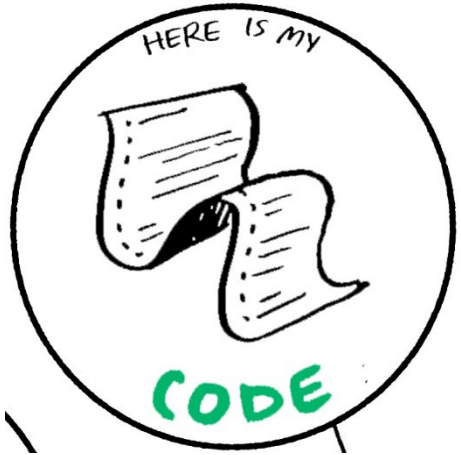
1. **Zabel, M (2022):** Pore water and solid phase data from deep-sea trench sediments
   Size: 17 datasets
   https://doi.org/10.1594/PANGAEA.947269 – Download – Score: 1.8

2. **Hoppmann, M; Kuznetsov, I; Fang, Y-C et al. (2022):** Processed data of CTD buoys 2019O1 to 2019O8 as part of the MOSAiC Distributed Network
   Related to: **Hoppmann, M; Kuznetsov, I; Fang, Y-C et al. (2022):** Mesoscale observations of temperature and salinity in the Arctic Transpolar Drift: a high-resolution dataset from the MOSAiC Distributed Network. *Earth System Science Data*
   Krumpen, T; Sokolov, V (2020): The Expedition AF122/1 : Setting up the MOSAiC Distributed Network in October 2019 with Research Vessel AKADEMIK FEDOROV. *Berichte zur Polar- und Meeresforschung = Reports on Polar and Marine Research*
   Size: 8 datasets
   https://doi.org/10.1594/PANGAEA.940320 – Download – Score: 1.8

3. **Dorschel, B; Hehemann, L; Viquerat, S et al. (2022):** The International Bathymetric Chart of the Southern Ocean Version 2 (IBCSO v2)
   Size: 50 data points
   https://doi.org/10.1594/PANGAEA.937574 – Download – Score: 1.0

4. **Weber, ME (2021):** Antiphased dust deposition and productivity in the Antarctic Zone over 1.5 million years
   Size: 12 datasets
   https://doi.org/10.1594/PANGAEA.939650 – Download – Score: 1.8

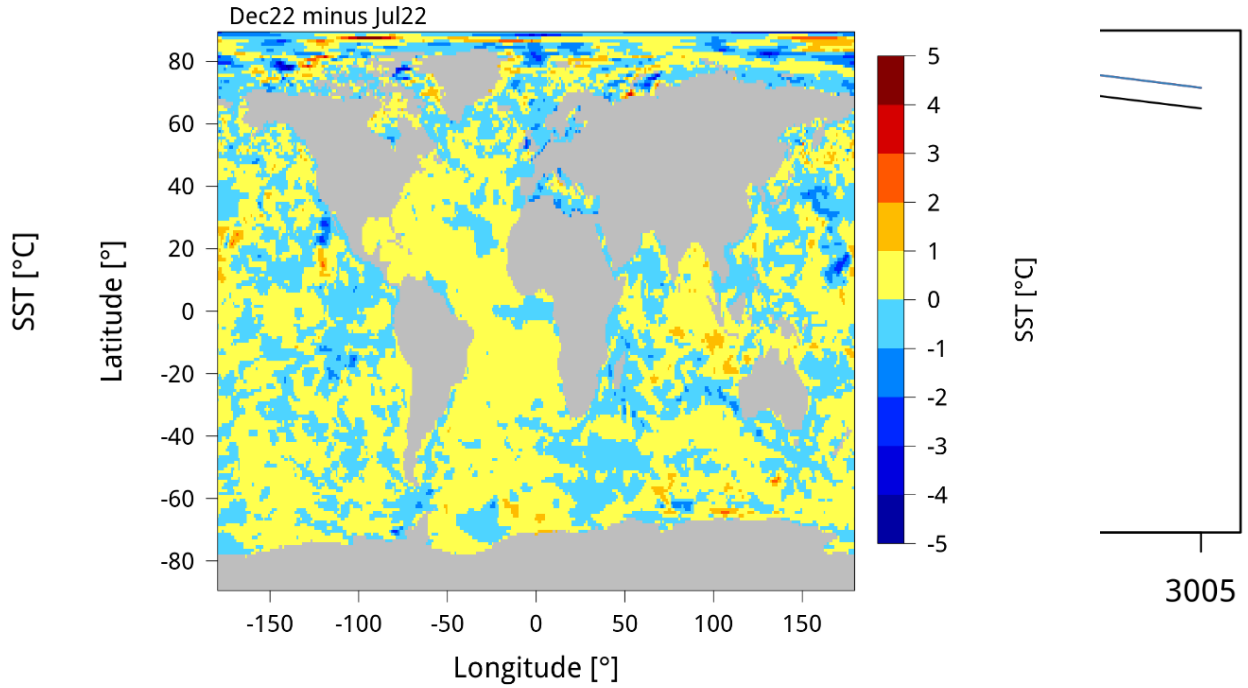
Software



Detail from: The Turing Way Community, & Scriberia. (2019). Illustrations from the Turing Way book dashes. Zenodo. https://doi.org/10.5281/zenodo.3332808

Scott Mackey, https://www.adlibsoftware.com/blog/authors/scott-mackey.aspx

Example



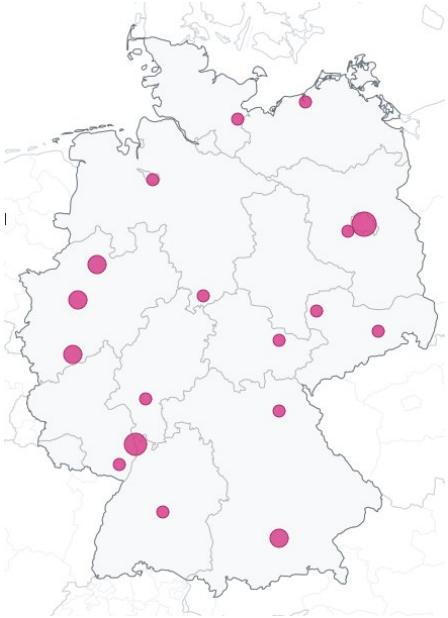
AWI-CM1-REcoM (cdanek@awi.de)

Open Science in Helmholtz

https://os.helmholtz.de/en/open-science-in-helmholtz/open-science-policy

German Reproducibility Network

- https://reproducibilitynetwork.de/



RN DE German Reproducibility Network

info@reproducibilitynetwork.de
Subscribe to our mailing list: grn@lists.lrz.de

Researchers

We **support researchers** in educating themselves about open science practices, and founding local open science communities.

Reproducibility Initiatives

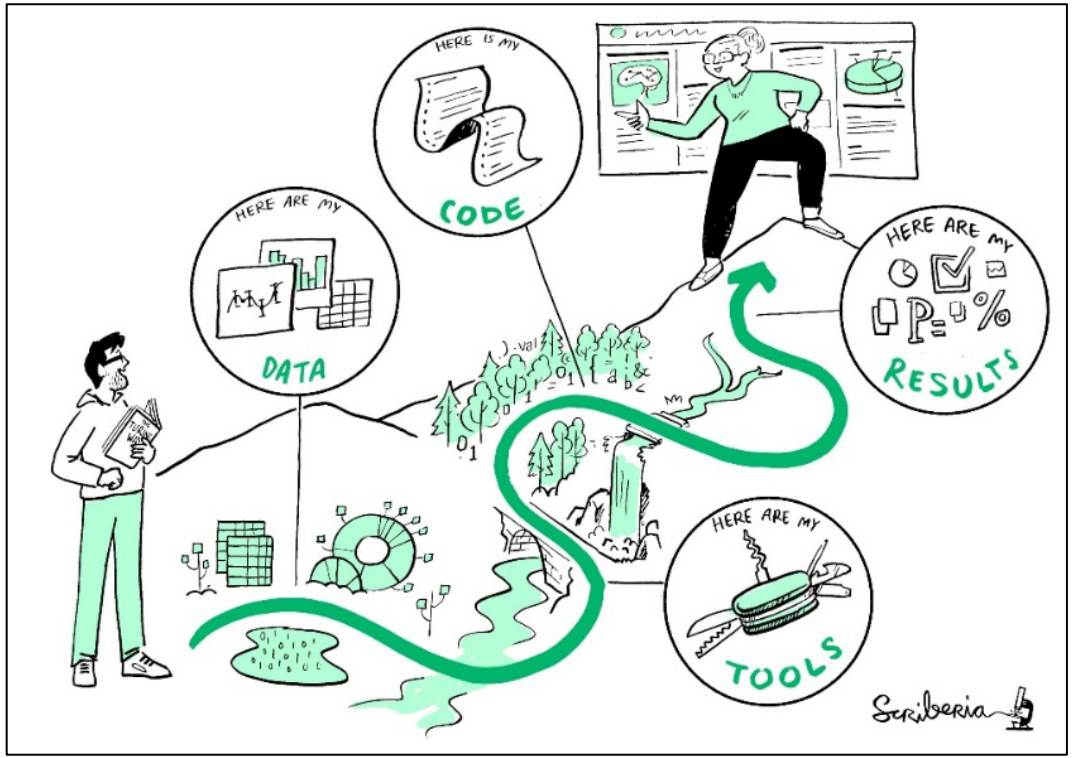
We **connect local or topic-centered Reproducibility Initiatives** to a national network, and foster connections between them.

Institutions

We **advise institutions** on how to embed open science practices in their work.

Other Stakeholders

We **represent the open science community** toward other stakeholders in the wider scientific landscape.



The Turing Way Community, & Scriberia. (2019). Illustrations from the Turing Way book dashes. Zenodo. https://doi.org/10.5281/zenodo.3332808

Thank you for attention

References

- Nosek, B.; Errington, T. (2022) "The best time to argue about what a replication means? Before you do it." Nature **583**: 518-520. doi:10.1038/d41586-020-02142-6
- Schwab, M, Karrenbach N, Claerbout J. (2000). Making scientific computations reproducible. doi:10.1109/5992.881708
- Gundersen O. E. (2021). The fundamental principles of reproducibility. doi:10.1098/rsta.2020.0210
- ACM Artifact Review and Badging. https://www.acm.org/publications/policies/artifact-review-and-badging-current
- The Turing Way Community et al. (2019). The Turing Way: A Handbook for Reproducible Data Science, Zenodo doi:10.5281/zenodo.3233986

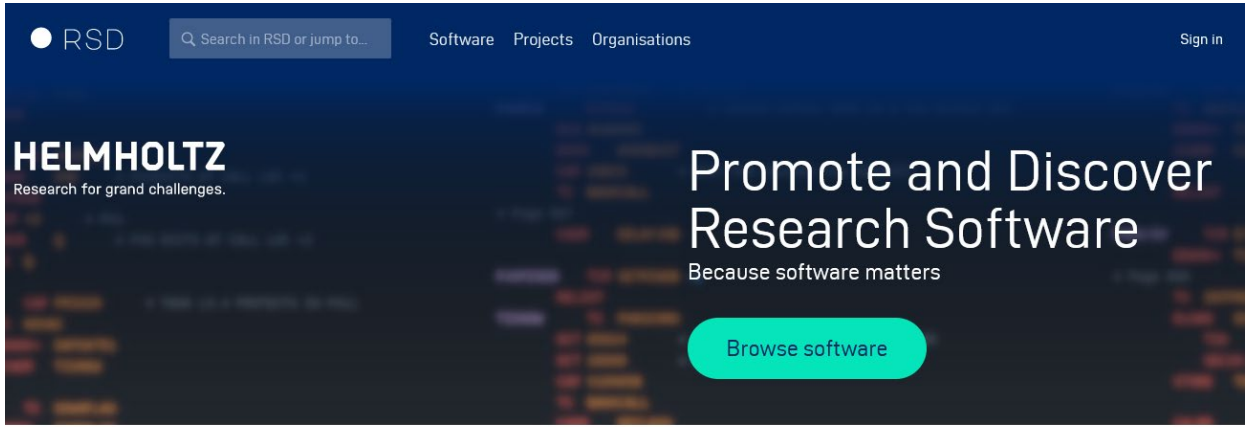
Data


nfdi
Nationale
Forschungsdaten
Infrastruktur


NFDI4Earth

Software

- Visibility of Research Software
- SW publication
- Awards

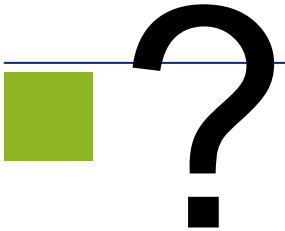


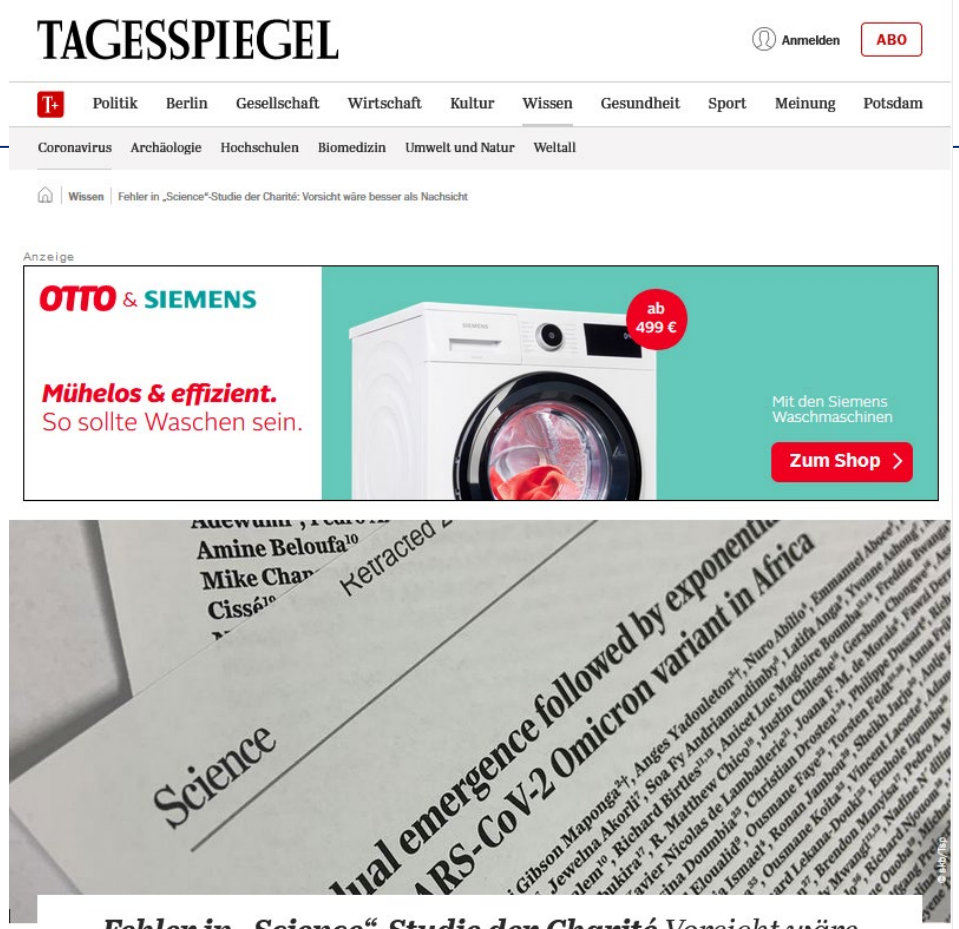
Software Spotlights

The latest outstanding software product developed in Helmholtz.

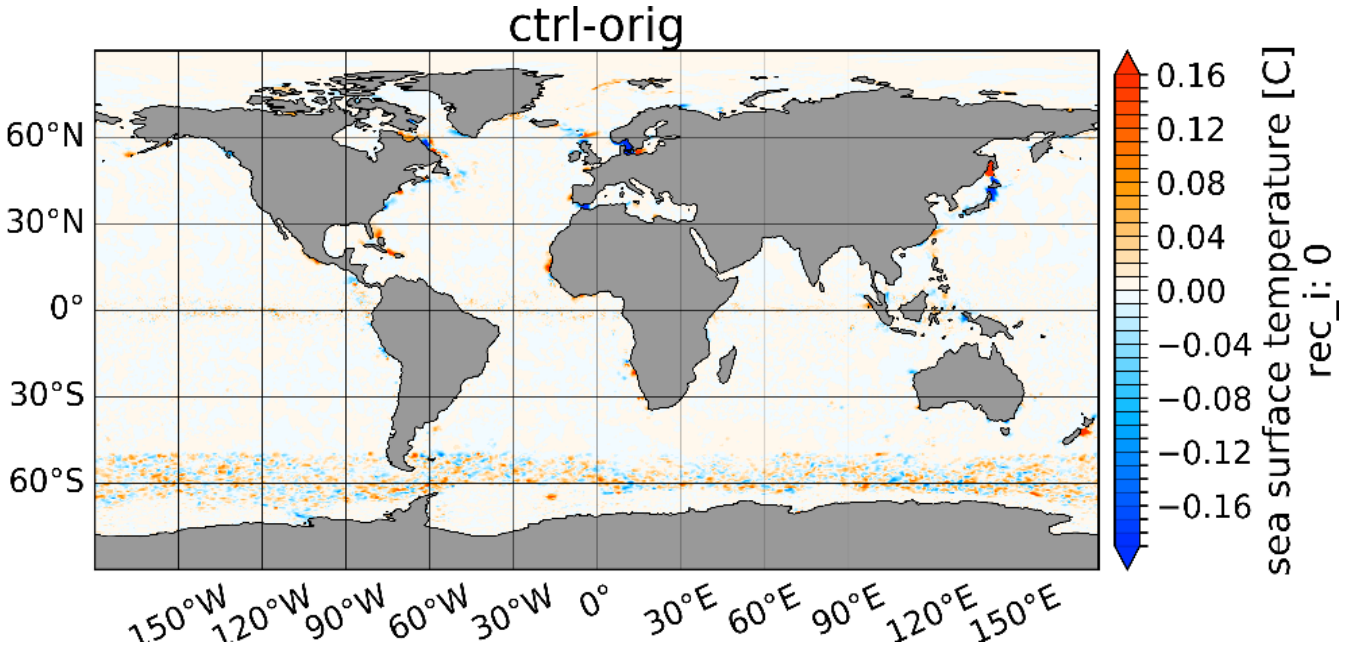
HPC

- HPC – oft Repeatability
- Allerdings kann bei Computersimulationen die Forschungsumgebung nicht dauerhaft unverändert gelassen werden. → ACM-Kategorie der Replizierbarkeit.
- Welche Abweichungen sind tolerierbar? Bitweise Reproduzierung oftmals nicht oder mit extrem hohem Aufwand möglich
- Was muss alles dargelegt werden, um Reproduzierbarkeit zu gewährleisten?
- Datenbank über gestartete Simulationen: Codebasis, Umgebung. Purpose, projekt, Autor, git Version der Modelle, checksum der binaries, Aussage über Diffs zwischen git und der Version beim Nutzer, verwendete Librarieversionen
-




TAGESSPIEGEL
Anmelden
ABO
Politik Berlin Gesellschaft Wirtschaft Kultur Wissen Gesundheit Sport Meinung Potsdam
Coronavirus Archäologie Hochschulen Biomedizin Umwelt und Natur Weltall
Wissen | Fehler in „Science"-Studie der Charité: Vorsicht wäre besser als Nachsicht
Anzeige
OTTO & SIEMENS
Mühelos & effizient.
So sollte Waschen sein.
ab 499 €
Mit den Siemens Waschmaschinen
Zum Shop
Science
Retracted
Amine Beloufa[10]
Mike Chan
Cissé[10]
ual emergence followed by exponent
ARS-CoV-2 Omicron variant in Africa
Fehler in „Science"-Studie der Charité Vorsicht wäre besser als Nachsicht
Fehler passieren. Auch dumme. Auch Wissenschaftlern. Eine Lehre aus dem jüngsten der Charité ist, dass Vorabveröffentlichungen trotz aller Kritik Schaden abwenden können.

Repeatability



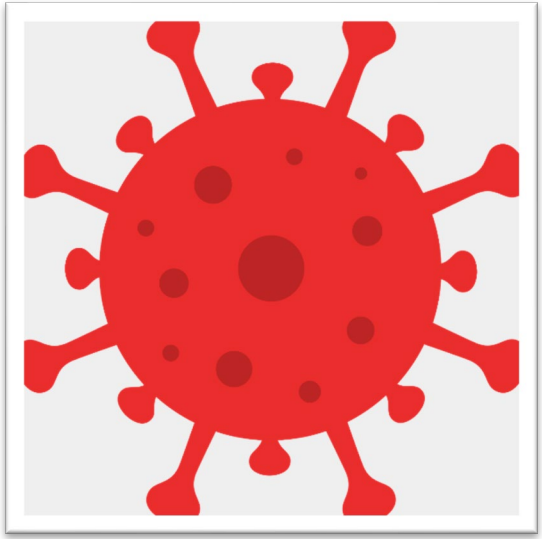
https://github.com/FESOM/fesom2/issues/145, P. Scholz

Open Science

About me

„Niemand ist gegen Irrtümer gefeit; das Große ist, aus ihnen zu lernen“
Karl Popper, 1973, Objektive Erkenntnis

Einleitung



https://pixabay.com/de/vectors/coronavirus-symbol-corona-virus-5107715/

https://www.flickr.com/photos/140988606@N08/44244851400

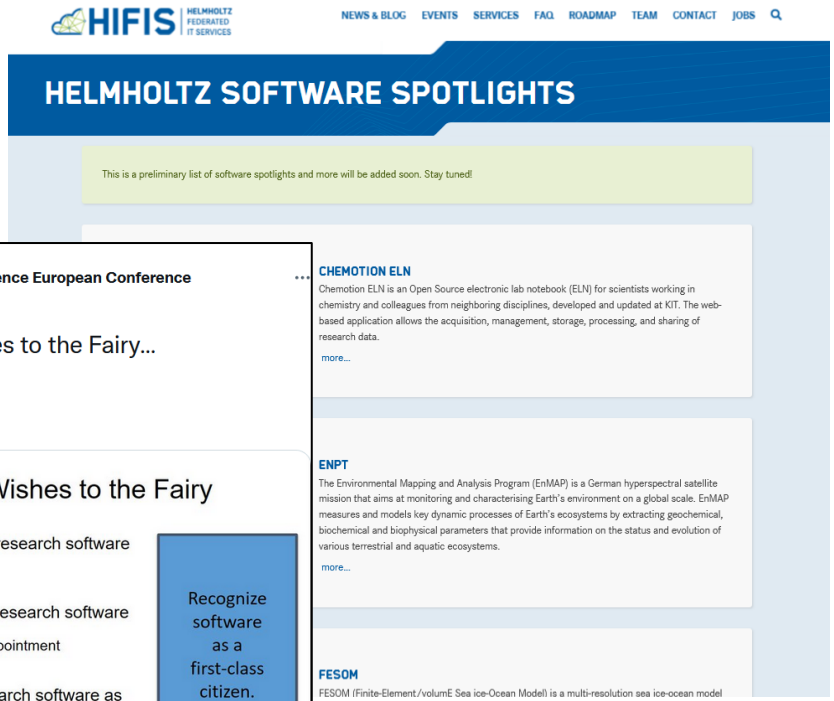
Sichtbarkeit von Software (und Daten)

- Leuchtturmprojekte
  https://www.hifis.net/spotlights.html

- Preise:
  - Open Science Awards for Research Software
  - CampusSource Award

- Softwarepublikation
  - „Make your code ready for publication“

- Indikatorik



https://twitter.com/Osec2022/status/1489956652581281792?t=cvVbyDGzUyc-c5w6BIIQ2g&s=19

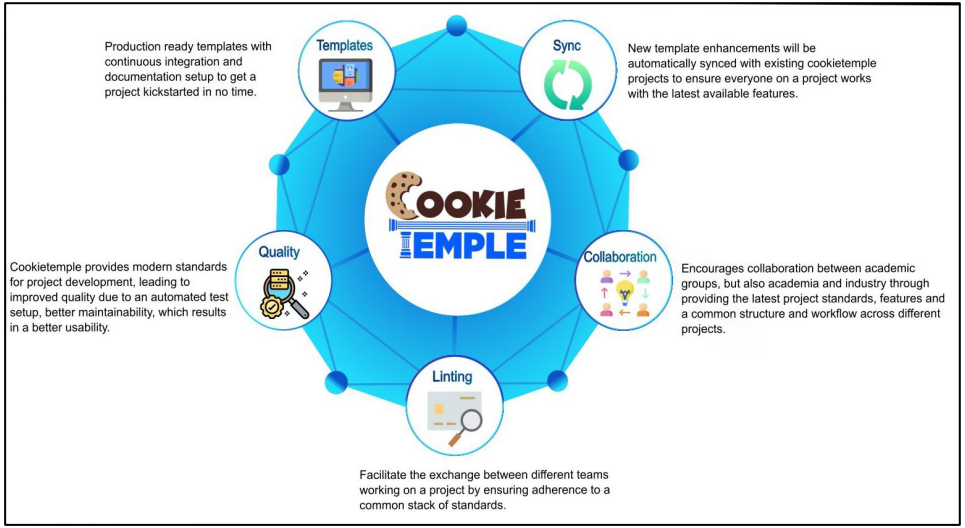
OpenAI chatbot

- how can i make my research more reproducible?
- There are several steps you can take to make your research more reproducible:
- Document your research process: Keep detailed notes on all aspects of your research process, including the specific methods, algorithms, and data sources you used. This will allow others to replicate your work more easily.
- Use open-source tools and software: By using open-source tools and software, you can ensure that others have access to the same tools you used in your research.
- Share your data: Consider sharing your data publicly, either through a repository or by publishing it alongside your research. This will allow others to confirm your results and build upon your work.
- Use a version control system: Using a version control system, such as Git, wil allow you to track changes to your code and data over time. This can help others understand your research process and replicate your work.
- Write clear and detailed documentation: Provide clear and detailed documentation for your research, including a detailed description of your methods, data sources, and analysis. This will make it easier for others to understand and replicate your work.
- Use a standardized reporting format: Consider using a standardized reporting format, such as the Data Management and Sharing Plan (DMP) or the Research Compendia format, to ensure that your research is easily reproducible.
- By following these steps, you can make your research more reproducible, which will help to ensure the credibility and integrity of your work.

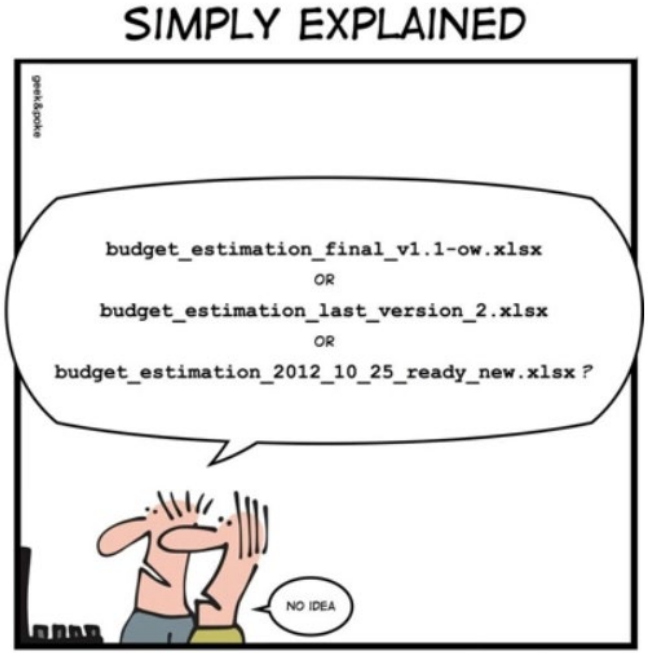
SW

- Container (singularity, …)
- Nix https://blog.devgenius.io/reproducibility-with-nix-991ad466c92e, https://nixos.org/ reproducible builds and deployment, https://zero-to-nix.com

Ein Ziel – viele Schritte

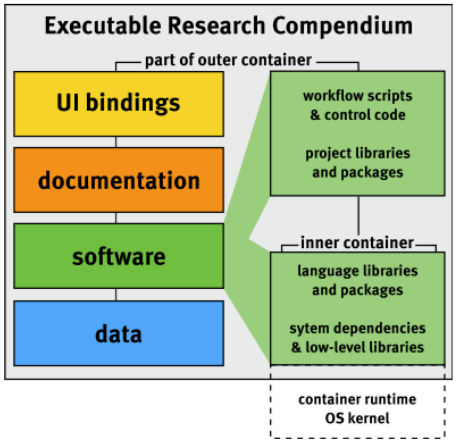


L. Heumos, https://cookietemple.com

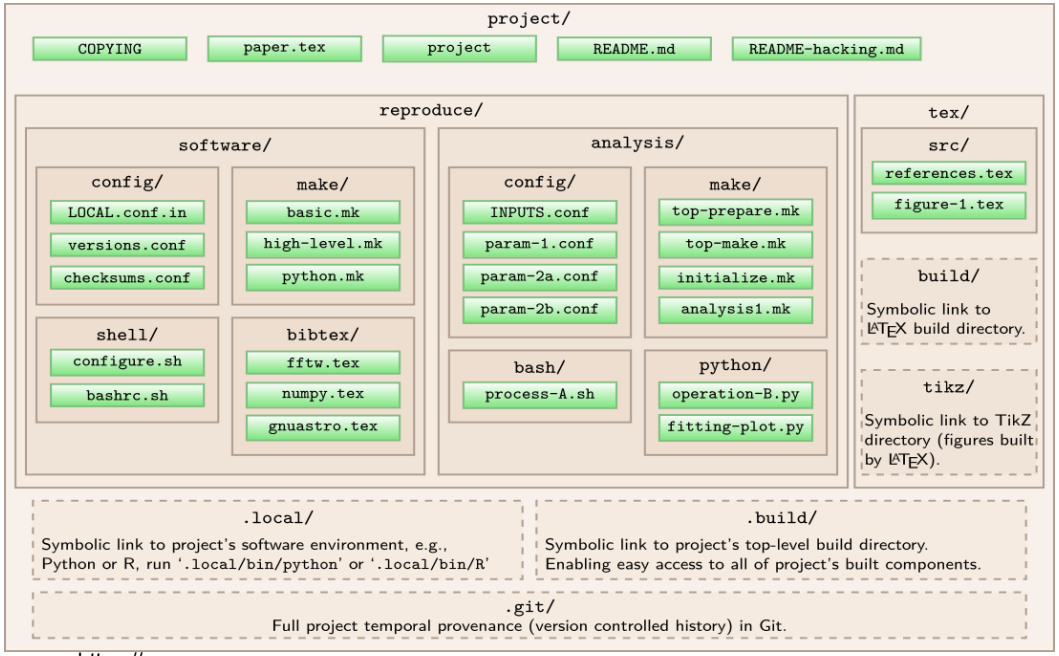


https://geek-and-poke.com

Research Compendia



Nüst, D., 2021, https://doi.org/10.5281/zenodo.5108218



https://maneage.org