COMP-ECO

# Research Data Management and Data Management Planning

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Delft University of Technology
January 30th, 2024

Go to menti.com

# AGENDA

Let us talk about data

Let us start writing a Data Management Plan

# WHAT DO WE CONSIDER AS 'DATA'?

All research output necessary to validate and reuse the results of a project

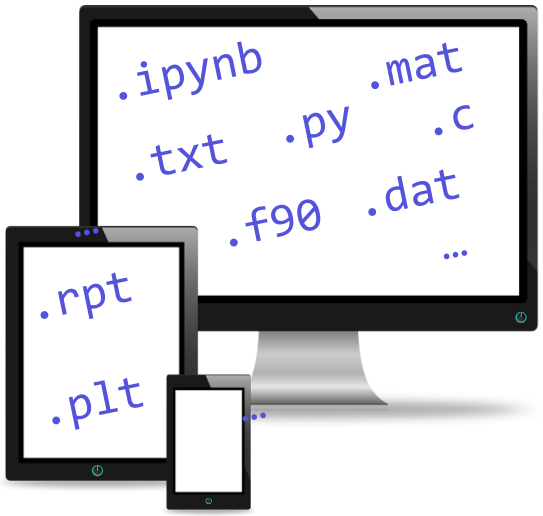
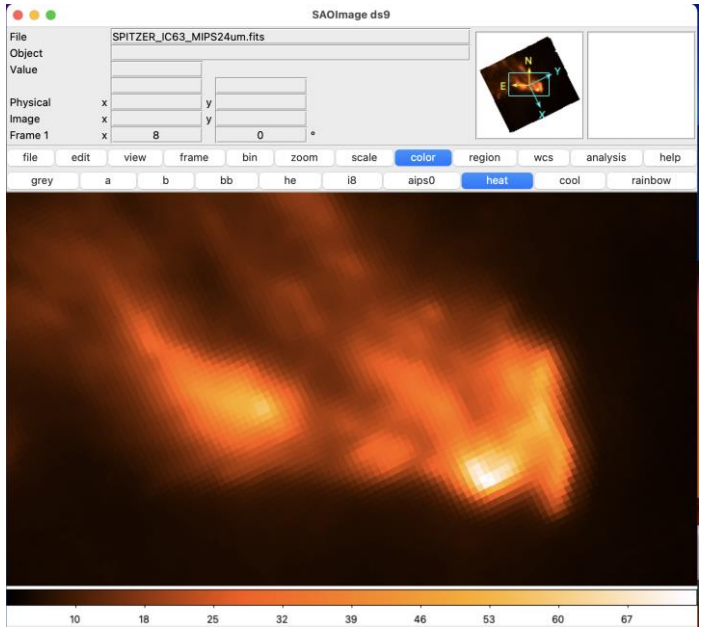



Image by mmi9 from Pixabay

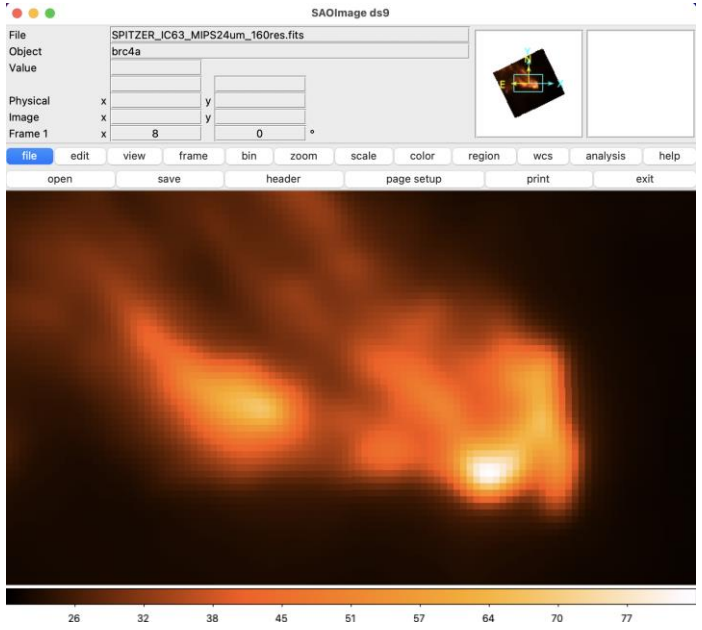
Image by OpenClipart-Vectors from Pixabay

Funded by the European Union

## Raw data




## Processed data #1




## Processed data #2

| #wave | #flux_density | #unc_flux_density |
|---|---|---|
| #um | #MJy/sr | #MJy/sr |
| 3.6 | 1.31e-06 | 3.97e-08 |
| 4.5 | 4.44e-07 | 1.33e-08 |
| 5.8 | 3.44e-06 | 1.21e-07 |
| 8.0 | 6.95e-06 | 2.10e-07 |
| 24.0 | 3.54e-06 | 3.62e-07 |
| 70.0 | 1.45e-05 | 2.18e-06 |

Accompanied by documentation files and processing scripts

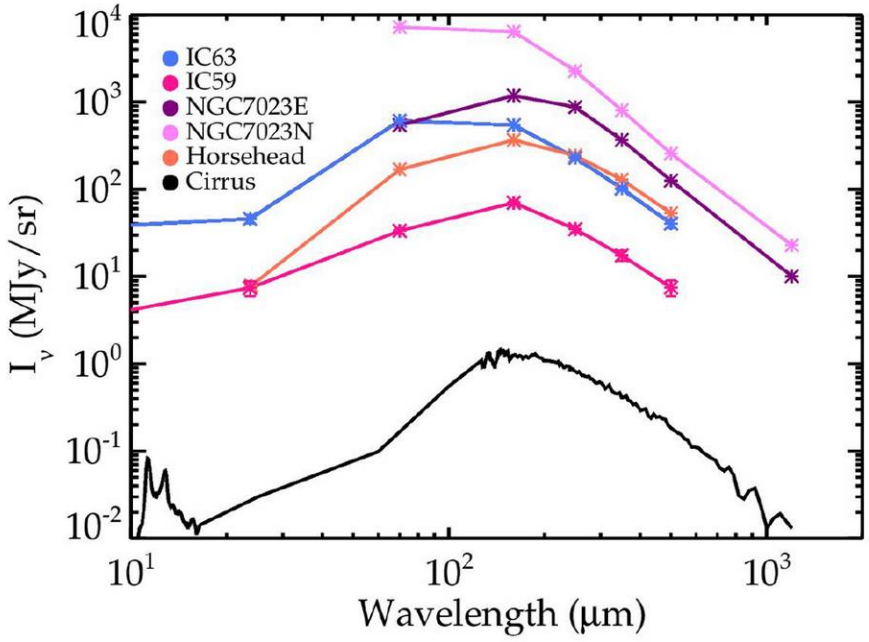
Funded by the European Union

## Processed data #2

| #wave | #flux_density | #unc_flux_density |
|---|---|---|
| #um | #MJy/sr | #MJy/sr |
| 3.6 | 1.31e-06 | 3.97e-08 |
| 4.5 | 4.44e-07 | 1.33e-08 |
| 5.8 | 3.44e-06 | 1.21e-07 |
| 8.0 | 6.95e-06 | 2.10e-07 |
| 24.0 | 3.54e-06 | 3.62e-07 |
| 70.0 | 1.45e-05 | 2.18e-06 |

...

## Finalized data



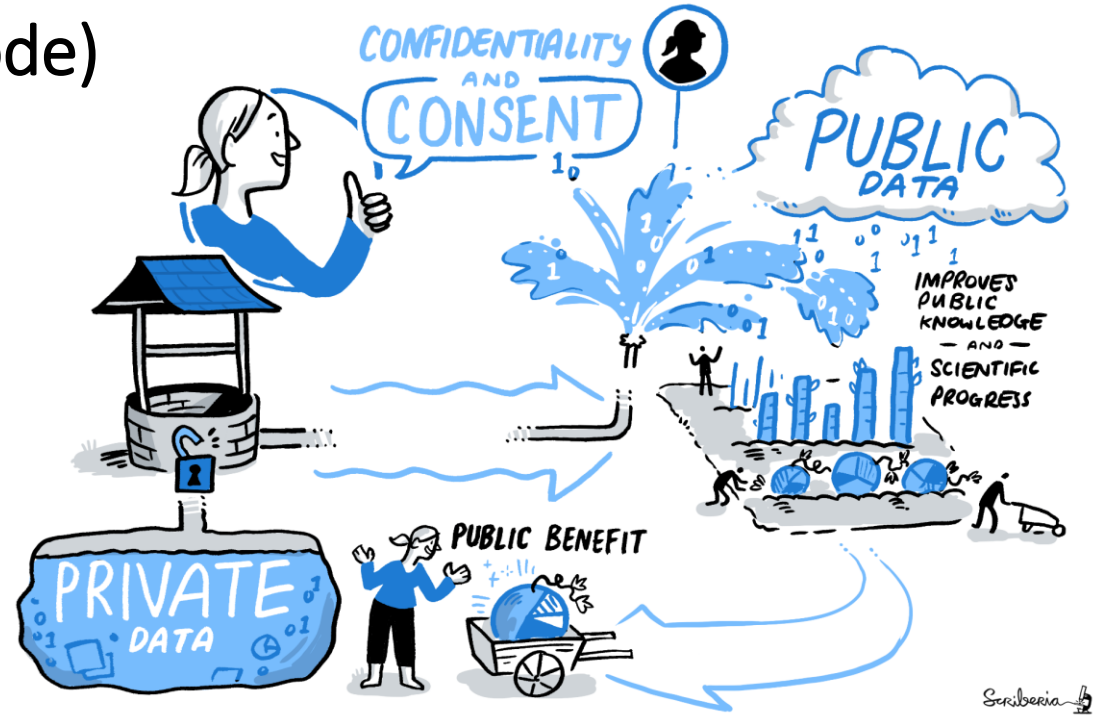

https://doi.org/10.1051/0004-6361/201832808

Accompanied by documentation files and processing scripts

# WHAT IS DATA STEWARDSHIP?

It is about taking care of data (incl. code)

- Data type
- Policy and regulations
- Tools and software
- Storage and access
- Backups
- Transfer and exchange
- Publishing and archiving




https://doi.org/10.5281/zenodo.3695300

## During research and after research…

# Findable – Accessible – Interoperable – Reusable

## During research and after research…

# Findable – Accessible – Interoperable – Reusable

Avoid data breaches and data losses

## During research and after research…

# Findable – Accessible – Interoperable – Reusable

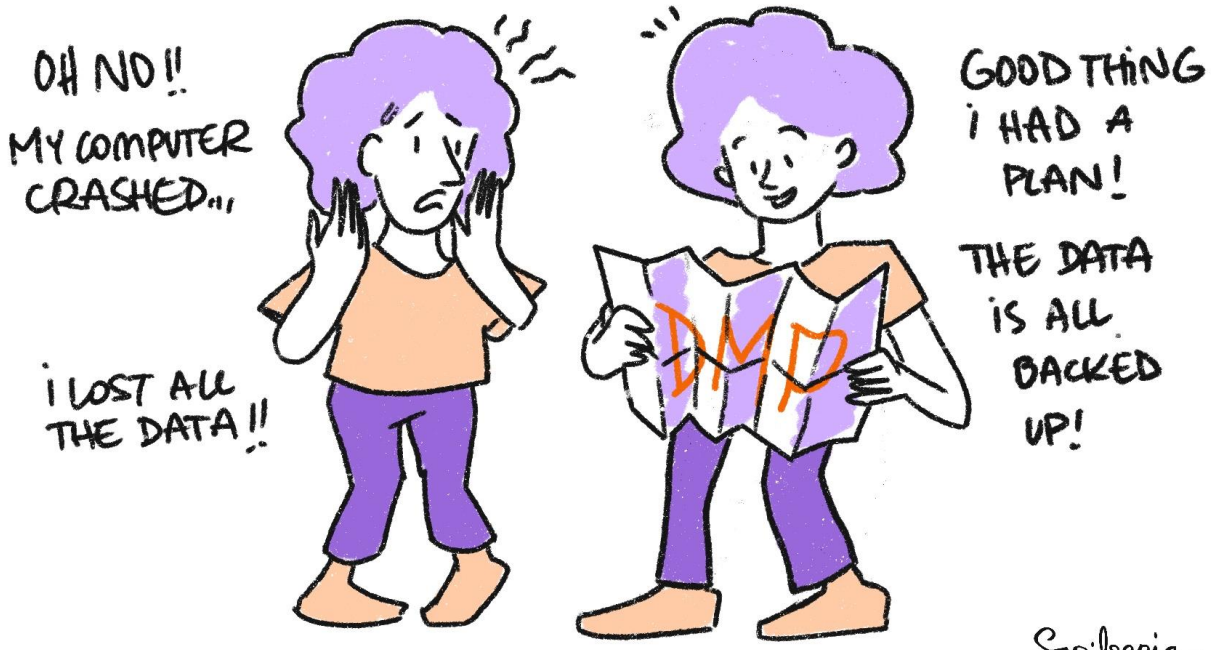
Avoid data breaches and data losses
Make the data/code understandable

## During research and after research…

# Findable – Accessible – Interoperable – Reusable

Avoid data breaches and data losses
Make the data/code understandable
Make the research reproducible and/or replicable

# WHAT IS A DATA MANAGEMENT PLAN (DMP)?




https://doi.org/10.5281/zenodo.3695300

# LET US DRAFT A DMP!

- Think about a research project
- Go to dmponline.dcc.ac.uk

# Plan to make data work for you

Data Management Plans that meet institutional funder requirements.

Sign in | Create account

* Email

* Password

Forgot password?

Remember email

Sign in

- or -

Sign in with your institutional credentials

DMPonline helps you to create, review, and share data management plans that meet institutional and funder requirements. It is provided by the Digital Curation Centre (DCC).

125 996 Users

329 Organisations

141 621 Plans

89 Countries

# DATA/CODE COLLECTION/GENERATION

For example:

- Tabular data from fatigue experiments in .csv format
- X-ray computed tomography measurements in image .tif format
- Measurement data of aircraft emissions obtained on-site, in .nc4 format
- Library developed in Python for distributed real-time calculation processes
- Modules developed in C++ and MATLAB built upon open-source code
- Video recordings in .mp4 format of interactions between robots and human
- Simulation data of a jet flame in .cngs format using Ansys CFX solver
- Processed Particle Image Velocimetry measurements of a cavity model in .dat format
- Deep learning model for predictive maintenance developed in Python using tensorflow
- Analysis/visualization scripts developed in Python

# DOCUMENTATION - README

Preview | Code | Blame | 137 lines (78 loc) · 5.12 KB

```
<!---
    This is a README.md template for releasing a code project in a GitHub/Gitlab repository.
    Under each section you can find commented text with explanation on what to add in each section.
    Please modify the sections depending on needs, and delete all commented text once the README is done.
-->

# Model name or Project Name

<!--- Add here a badge for the ArXiv identifier of the pre-print version of the paper/journal-article
    related to this code project (arXiv:YYMM.NNNNN) (if applicable) e.g.:

    [![Paper](http://img.shields.io/badge/Paper-arXiv.YYMM.NNNNN-B3181B?logo=arXiv)](https://arxiv.org/abs/...)
-->

<!--- Add here the hyperlink to the finalized version of the paper/journal-article related to this project
    (the DOI link provided by the journal publisher after peer-review acceptance) (if applicable) e.g.:

    This repository is the official implementation of the following paper.

    * Paper title: [Paper Title](https://doi.org/YYMM.NNNNN)
-->


## Description

<!--- Provide description of the contents of the code repository
    * Provide information about what the code does
    * Provide links for demos, blog posts, etc. (if applicable)
    * Mention any caveats and assumptions that were considered
-->
```

Markdown

README template for code

README template for data

README template for machine learning

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# DOCUMENTATION – EXPERIMENTAL DATA

Original plan/protocol. A permanent fixed record of the design of the experiment (goal, team involved, procedure, instrumentation, testing, benchmarking). This file should also point out to the data dictionary and the file naming conventions used. See a template in Markdown (using the Code tab) here

Logbook and dictionary. Have two documentation files per experiment:

1) Logbook: record of *in-situ* settings and configuration of each individual experiment that together with the original plan/protocol- provides sufficient information to enable the reproduction of the experimental results (*what* was modified from the original plan?)

2) Dictionary: a spreadsheet with the definition of variables (for example: location, instruments, dimensions, resolution, aircraft type, studied pollutants, etc.); the units and precision for the numerical variables; the categories for categorical data; any encoding used (e.g., for qualitative variables); etc.

# Data dictionary example

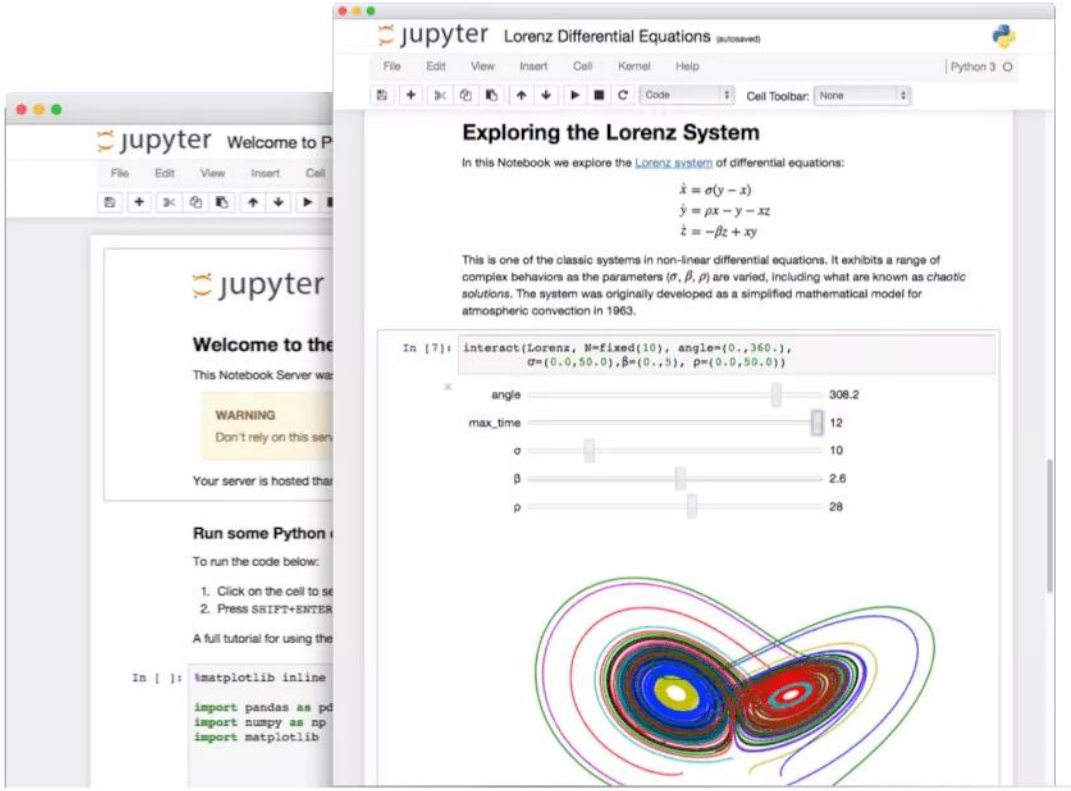
| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | sample | timepoint | cont | pore_size | MHC | Naph | Phen | Anth | Fluor | Pyr | Bact |
| 2 | T1_0.1-A | 1 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | T1_0.1-B | 1 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | T1_0.1-C | 1 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | T1_0.1+A | 1 | 1 | 0.1 | 3600 | 0.21 | 6.1 | 4.5 | 6.4 | 5.8 | 0 |
| 6 | T1_0.1+B | 1 | 1 | 0.1 | 3600 | 0.16 | 6.1 | 4.5 | 6.2 | 5.7 | 0 |
| 7 | T1_0.1+C | 1 | 1 | 0.1 | 3100 | 0.14 | 5.3 | 3.9 | 5.2 | 4.8 | 0 |
| 8 | T1_2-A | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | T1_2-B | 1 | 0 | 2 | 43 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | T1_2-C | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | T1_2+A | 1 | 1 | 2 | 4600 | 0.26 | 7.5 | 5.7 | | | |
| 12 | T1_2+B | 1 | 1 | 2 | 3900 | 0.2 | 6.5 | 4.9 | | | |
| 13 | T1_2+C | 1 | 1 | 2 | 3200 | 0.12 | 6.1 | 4.8 | | | |
| 14 | T1_30-A | 1 | 0 | 30 | 21 | 0 | 0 | 0 | | | |
| 15 | T1_30-B | 1 | 0 | 30 | 89 | 0 | 0 | 0 | | | |
| 16 | T1_30-C | 1 | 0 | 30 | 75 | 0 | 0 | 0 | | | |
| 17 | T1_30+A | 1 | 1 | 30 | 4000 | 0.21 | 7.1 | 5.6 | | | |
| 18 | T1_30+B | 1 | 1 | 30 | 4000 | 0.26 | 7 | 5.4 | | | |
| 19 | T1_30+C | 1 | 1 | 30 | 3500 | 0.18 | 5.9 | 4.5 | | | |
| 20 | T2_0.1-D | 2 | 0 | 0.1 | 0 | 0 | 0 | 0 | | | |
| 21 | T2_0.1-E | 2 | 0 | 0.1 | 0 | 0 | 0 | 0 | | | |
| 22 | T2_0.1-F | 2 | 0 | 0.1 | 0 | 0 | 0 | 0 | | | |
| 23 | T2_0.1+D | 2 | 1 | 0.1 | 1600 | 0.1 | 5.4 | 4.3 | | | |
| 24 | T2_0.1+E | 2 | 1 | 0.1 | 1600 | 0.089 | 4.1 | 3.5 | | | |
| 25 | T2_0.1+F | 2 | 1 | 0.1 | 1400 | 0.073 | 5.2 | 4.3 | | | |
| 26 | T2_2-D | 2 | 0 | 2 | 0 | 0 | 0 | 0 | | | |

File Edit Format View Help

```
Timepoint: 1: six weeks; 2: three months; 3: six months
cont: 0: non-contaminated, 1:contaminated
pore_size: in micrometers (filter)
All chemical data are in mg/ Kg soil
MHC: Mineral Hydrocarbons
Naph: Naphtalin
Phen: Phenanthren
Anth: Anthracen
Fluor: Fluoranthen
Pyr: Pyren
Bact: 16S rRNA copies/ gr soil; primers: XXXX (Ref)
```

Zormpa, Eirini, & Martinez-Lavanchy, Paula. (2022, June 13). EMBL-EBI Bioinformatics for PIs 2022: Planning your data management session. Zenodo. https://doi.org/10.5281/zenodo.6637453

# DOCUMENTATION - TOOLS



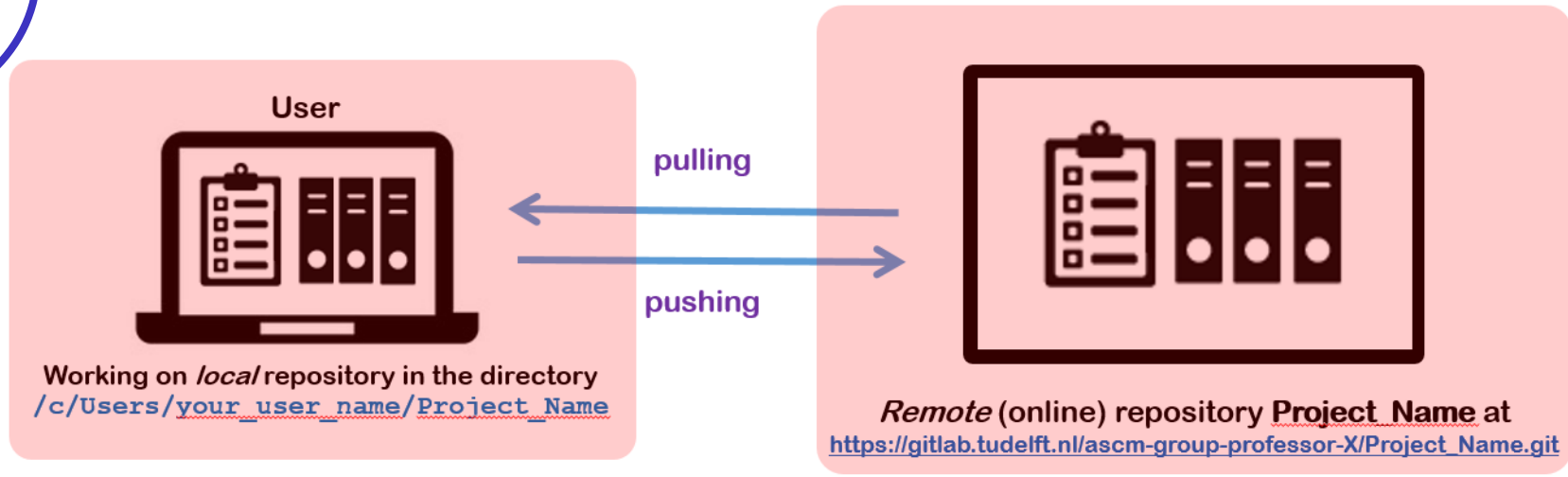

https://jupyter.org/

[Jupyter Notebooks]
[Quarto]
[Electronic Lab Notebooks]

# DOCUMENTATION – VERSION CONTROL

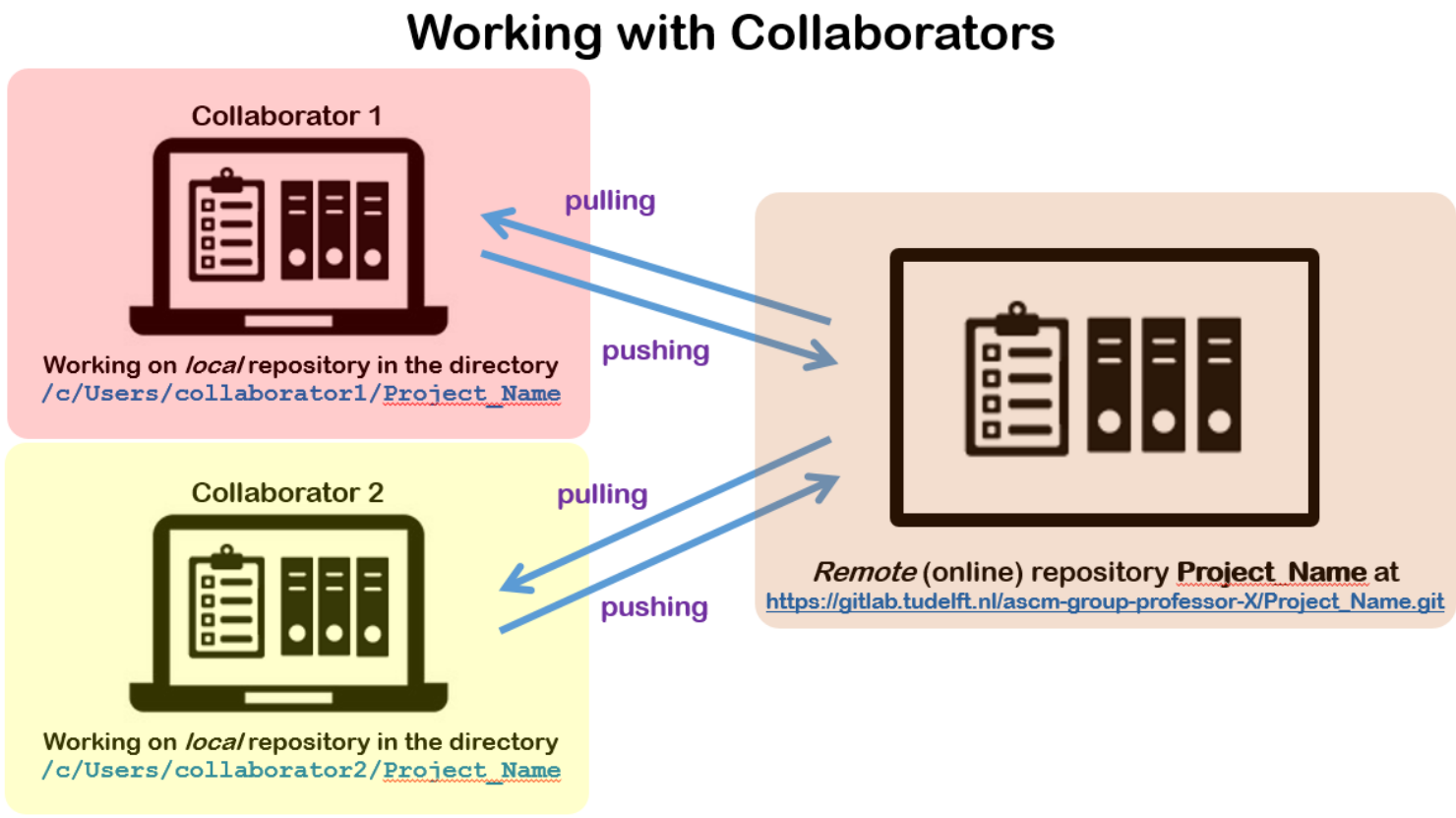
Git
SVN

## Working Individually



# DOCUMENTATION – VERSION CONTROL

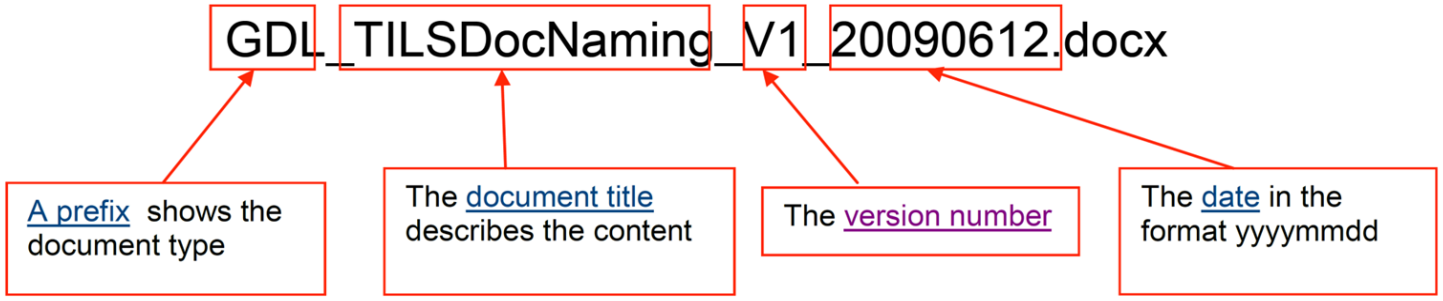
Git
SVN



# INDIRECT DOCUMENTATION

## TILS Document Naming Convention

Document naming for the TILS Division should follow this convention:




http://www.data.cam.ac.uk/files/gdl_tilsdocnaming_v1_20090612.pdf

https://github.com/HeatherAn/recommended-coding-practices/blob/main/13-Naming-Conventions.md

https://datamanagement.hms.harvard.edu/plan-design/file-naming-conventions

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https://github.com/cookiecutter/cookiecutter

https://gitlab.tudelft.nl/handrewsmancil/improving-coding-practices-training

https://drivendata.github.io/cookiecutter-data-science/

```
├── LICENSE
├── Makefile           <- Makefile with commands like `make data` or `make train`
├── README.md          <- The top-level README for developers using this project.
├── data
│   ├── external       <- Data from third party sources.
│   ├── interim        <- Intermediate data that has been transformed.
│   ├── processed      <- The final, canonical data sets for modeling.
│   └── raw            <- The original, immutable data dump.
│
├── docs               <- A default Sphinx project; see sphinx-doc.org for details
│
├── models             <- Trained and serialized models, model predictions, or model summaries
│
├── notebooks          <- Jupyter notebooks. Naming convention is a number (for ordering),
│                         the creator's initials, and a short `-` delimited description, e.g.
│                         `1.0-jqp-initial-data-exploration`.
│
├── references         <- Data dictionaries, manuals, and all other explanatory materials.
│
├── reports            <- Generated analysis as HTML, PDF, LaTeX, etc.
│   └── figures        <- Generated graphics and figures to be used in reporting
│
├── requirements.txt   <- The requirements file for reproducing the analysis environment, e.g.
│                         generated with `pip freeze > requirements.txt`
│
├── setup.py           <- Make this project pip installable with `pip install -e`
├── src                <- Source code for use in this project.
│   ├── __init__.py    <- Makes src a Python module
│   │
│   ├── data           <- Scripts to download or generate data
│   │   └── make_dataset.py
│   │
│   ├── features       <- Scripts to turn raw data into features for modeling
│   │   └── build_features.py
│   │
│   ├── models         <- Scripts to train models and then use trained models to make
│   │   │                 predictions
│   │   ├── predict_model.py
│   │   └── train_model.py
│   │
│   └── visualization  <- Scripts to create exploratory and results oriented visualizations
│       └── visualize.py
│
└── tox.ini            <- tox file with settings for running tox; see tox.testrun.org
```

For experimental data: **separate** raw, from processed data and go for a **hierarchical structure**

```
|-- original plan/protocol
|
|-- data/
|     |-- logbook
|     |-- dictionary
|     |-- raw/ (in raw/ subdivide the data corresponding to each experiment)
|     |     |-- location
|     |           |-- aircraft
|     |                 |-- engine
|     |                       |-- pollutant
|     |-- processed/
|     |     |-- location
|     |           |-- aircraft
|     |                 |-- engine
|     |                       |-- pollutant
|     |-- finalized/
|-- docs/
```

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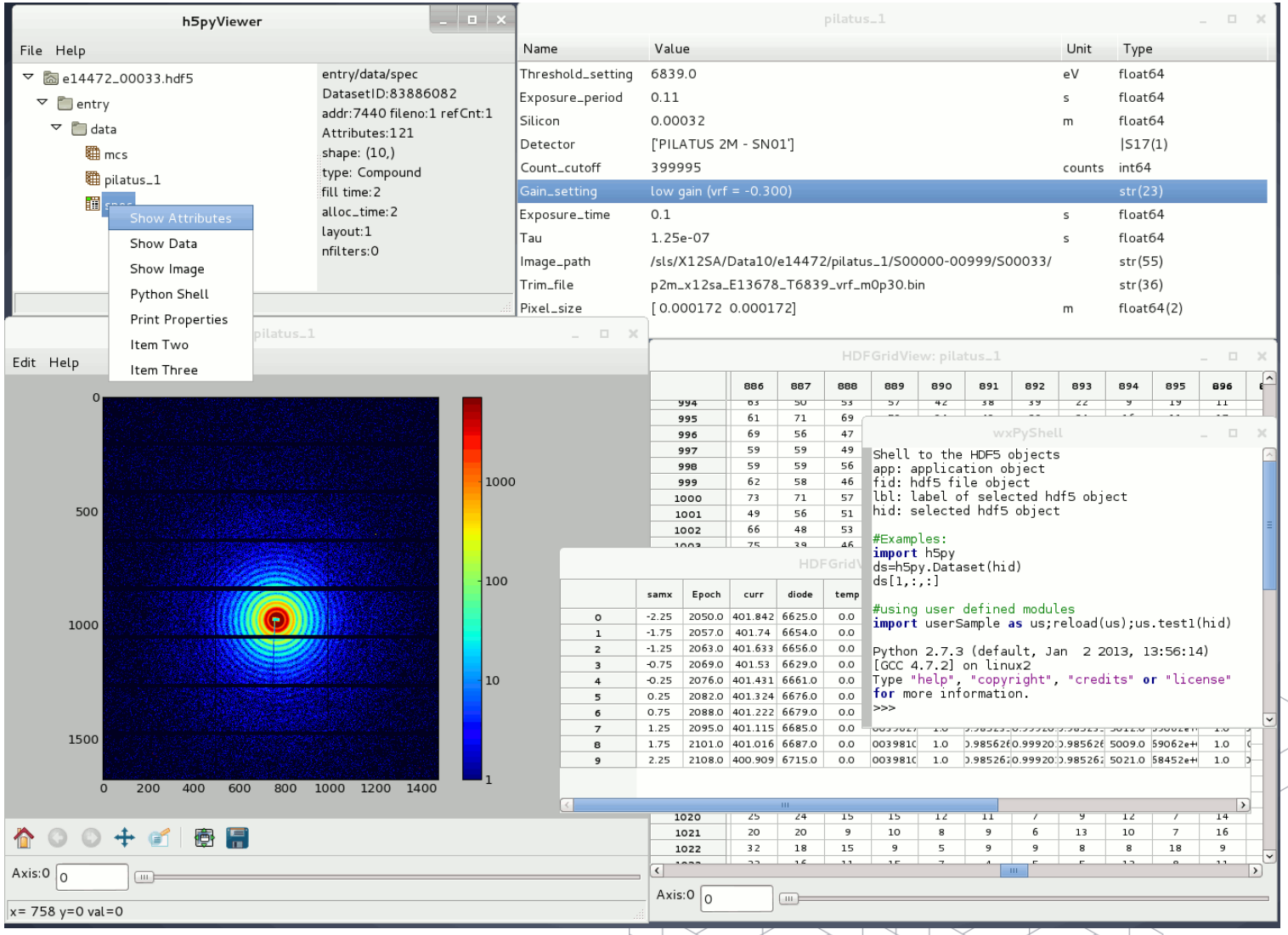
# METADATA




https://pypi.org/project/h5pyViewer/

# DATA STORAGE

## 3-2-1 Rule

3 copies

2 storage media

1 copy in a different (physical) location

# DATA STORAGE

Institutional workstations & laptops

Optical Storage (e.g., CDs, DVDs)

External Drives & Thumbdrives (e.g., HDD, USB)

Institutional network drives

Cloud storage  (e.g., Onedrive, AWS)

Other cloud services (e.g. MS Teams)

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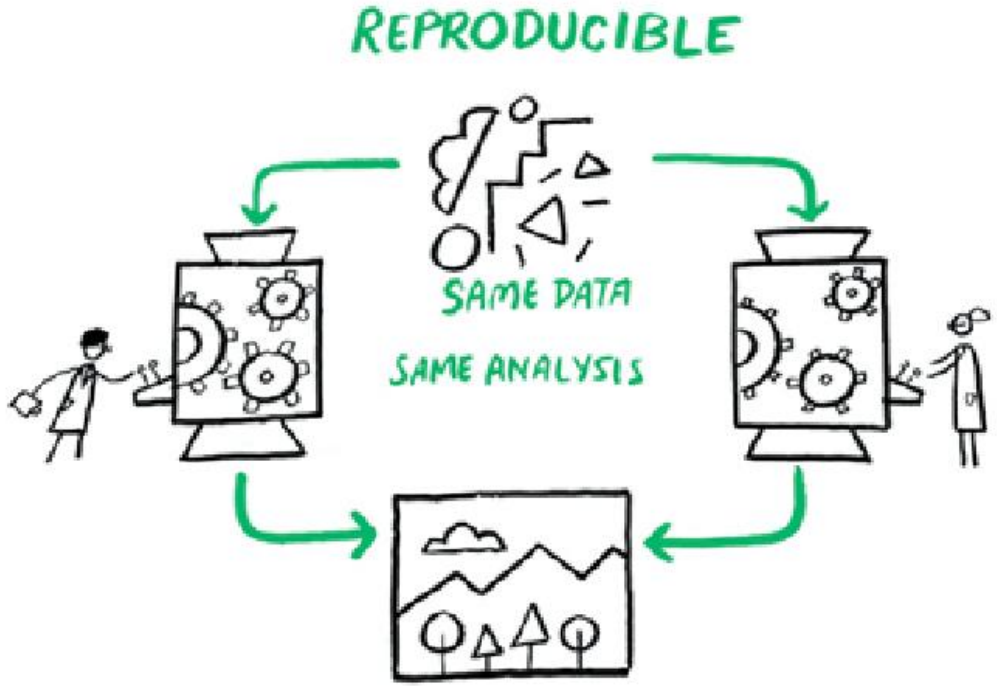
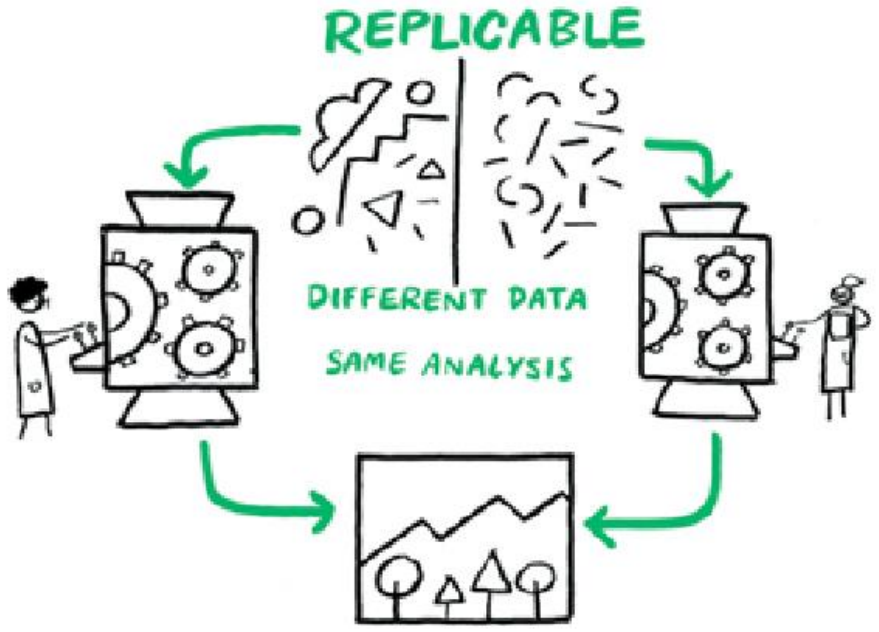
# WHAT DATA/CODE SHOULD BE PRESERVED FOR THE LONG-TERM?




*The Turing Way* project illustration by Scriberia. Used under a CC-BY 4.0 licence. DOI: 10.5281/zenodo.3332807.

Funded by the European Union

# Journal Article

## Data/code that can be published

https://doi.org/10.4121/14827680.v1

**Data underlying the publication: "A Computationally Efficient Moving Horizon Estimator for UWB Localization on Small Quadrotors""**

doi: 10.4121/14827680.v1

Cite

DATASET

by Sven Pfeiffer, Christophe de Wagter, Guido de Croon

This Dataset contains the data files used for simulations in the publication "A Computationally Efficient Moving Horizon Estimator for Ultra-Wideband Localization on Small Quadrotors" (2021) by S. Pfeiffer, C. de Wagter and G.C.H.E de Croon.

The logs were collected in two different UWB modes (TWR and TdoA) and on 6 different trajectories (Square, Triangle, Octagon, Hourglass, Star, Random). UWB data was gathered with 8 anchors positioned roughly in the corners of a cube. Two of the files do not contain complete UWB data and are marked with the suffix "_BAD".

The data was recorded on a Crazyflie 2.1 in the TU Delft "Cyberzoo" indoor flight arena using the scripts found at https://github.com/Huizerd/crazyflie-suite. The code used for the simulations in the paper can be found at https://github.com/SUPfeiffer/uwb-simulator.

This dataset contains the following files:
- anchor_positions.yaml : This file contains the location of the UWB anchors in Cyberzoo coordinates
- date_time_mode_trajectory.csv : The log files

TU Delft Delft University of Technology

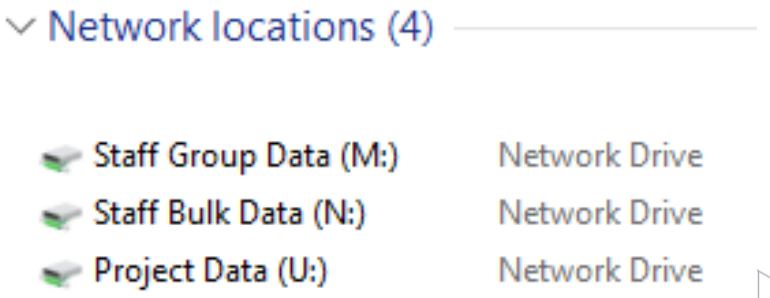
CATEGORIES
Aerospace Engineering

KEYWORDS
quadrotor, quadrotor localization, State Estimation, Ultra Wide Band, UWB Applications

LICENCE
CC0

EXPORT AS...
RefWorks, BibTeX, Reference Manager, Endnote, DataCite, NLM, DC, CFF

## Data/code that CANNOT be published



Funded by the European Union

# Supporting data for ultrasonic guided wave and electro-mechanical reactance tests on a full scale composite torsion box panel

Example of published data via the 4TU.ResearchData

https://doi.org/10.4121/uuid:8c743b60-69f3-4f59-b738-8f58b784bb9f

doi: 10.4121/uuid:8c743b60-69f3-4f59-b738-8f58b784bb9f

Cite

DOI (persistent identifier) of the dataset

DATASET

by Pedro Carvalho

The data refers to ultrasonic guided wave (GW) measurements on a full-scale composite torsion box stiffened panel. The panel was subjected to realistic low-energy impacts in different critical locations in order to obtain barely-visible impact damage (BVID) of different severities. The purpose of the study was to assess the diagnostic capabilities of the GW based structural health monitoring (SHM) system, which was designed according to a newly developed systematic multi-parameter methodology. Hence, the diagnostic capability assessment served also the purpose of validating the SHM system design methodology. The data in this dataset was collected in the Netherlands Aerospace Centre – NLR, located in Marknesse, the Netherlands, and was integrated in the Thermoplastic Affordable Primary Aircraft Structure 2 (TAPAS 2) project, financed by the Netherlands Enterprise Agency of the Ministry of Economic Affairs

HISTORY
2019-01-28 first online, published, posted

Metadata items compatible with that of web search engines

PUBLISHER
4TU.Centre for Research Data

FORMAT
media types: application/pdf, application/x-matlab-data, application/zip, text/csv

REFERENCES
https://doi.org/10.1002/stc.2340

DOI of the related article

FUNDING
- The Netherlands Enterprise Agency of the Ministry of Economic Affairs

ORGANIZATIONS
TU Delft, Faculty of Aerospace Engineering, Department of Aerospace Structures and Materials

CONTRIBUTORS
Benedictus, R. (Rinze)
Groves, R.M. (Roger)

TU Delft Delft University of Technology

USAGE STATS
99 downloads 601 views

CATEGORIES
Aerospace Engineering
Construction Materials Performance and Processes

KEYWORDS
Barely-visible impact damage (BVID), Composite primary structure, Structural health monitoring (SHM), System design, Ultrasonic guided wave (GW)

LICENCE
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EXPORT AS...
RefWorks, BibTeX, Reference Manager, Endnote, DataCite, NLM, DC, CFF

Funded by the European Union

# Data from: 30 years of large river restoration: how long do restored floodplain channels remain suitable for targeted rheophilic fishes in the lower river Rhine?

doi: 10.4121/12999575.v2

Cite

DATASET
version 2

by T. Stoffers, F.P.L. Collas, A.D. Buijse, G.W. Geerling, L.H. Jans, N. van Kessel, J.A.J. Verreth, Leopold Nagelkerke

The ecological efficacy of river restoration projects may change over time, resulting in the loss of their ecological function for targeted species. The goal of this study was to evaluate the rheophilic nursery function of restored floodplain channels over time, by analysing 30 years of monitoring data from 12 restoration projects in the lower river Rhine.

HISTORY
2020-09-29 first online
2020-09-30 published, posted

PUBLISHER
4TU.ResearchData

FORMAT
csv txt R

ORGANIZATIONS
Aquaculture and Fisheries, Wageningen University & Research
Department of Animal Ecology and Physiology, Institute for Water and Wetland Research, Radboud University
Department of Freshwater Ecology and Water Quality, Deltares
Department of Environmental Science, Institute for Water and Wetland Research, Radboud University
Ministry of Infrastructure and Water Management, Rijkswaterstaat
Bureau Waardenburg, Ecology and Landscape

WAGENINGEN UNIVERSITY & RESEARCH

USAGE STATS
1349 views 1 citations

CATEGORIES
Fisheries Sciences

KEYWORDS
cyclic rejuvenation, habitat succession, nursery area, river management, river rehabilitation, riverine fishes

GEOLOCATION
The lower river Rhine

TIME COVERAGE
1989-2019



EXPORT AS...
RefWorks, BibTeX, Reference Manager, Endnote, DataCite, NLM, DC, CFF

DATA - restricted access

Reason
Request from the researcher. In order to obtain the data, please contact WUR-Library (data.library@wur.nl)

▶ Request access to data.

Example of published metadata with the data available upon request

https://doi.org/10.4121/12999575.v2

# LBoW - Linear Buoyancy Wave Package

doi: 10.4121/21711227.v1

Cite

SOFTWARE

by Dries Allaerts

LBoW is a python package for solving linear buoyancy wave problems, like for example uniform stratified flow over a bell-shaped hill. The software presents a semi-analytical implementation of linear theory for stratified flow (i.e., the Taylor-Goldstein equation).

Checkout the README.md file for installation instructions, software requirements, etc. More information as well as the latest version of the software can be found in the GitHub repository

HISTORY
2022-12-13 first online, published, posted

PUBLISHER
4TU.ResearchData

FORMAT
Python package (compressed into one zip file)

REFERENCES
https://github.com/DriesAllaerts/lbow

ORGANIZATIONS
TU Delft | Faculty of Aerospace Engineering | Department of Flow Physics and Technology

TU Delft Delft University of Technology

USAGE STATS
13 downloads 155 views

CATEGORIES
Mechanical Engineering
Aerospace Engineering
Environmental Engineering
Atmospheric Sciences

KEYWORDS
Atmospheric gravity waves, Linear theory, Wind energy

LICENCE
Apache-2.0

EXPORT AS...
RefWorks, BibTeX, Reference Manager, Endnote, DataCite, NLM, DC, CFF

DATA

FILES
1,213,759 bytes mds lbow-0.1.0.zip

Example of published code via the 4TU.ResearchData-Github integration

https://doi.org/10.4121/21711227.v1

# EXAMPLES OF PUBLISHED DATA AND CODE

Code:

4TU.ResearchData repo: https://doi.org/10.4121/21711227.v1 Github repo: https://github.com/DriesAllaerts/lbow
4TU.ResearchData repo: https://doi.org/10.4121/16764238.v1 Github repo: https://github.com/bartroot/GSH
4TU.ResearchData repo: https://doi.org/10.4121/13387985.v1 Github repo: https://github.com/ROOSTER-fleet-management/rooster_fleet_manager (in this case more detailed documentation is shared via Github pages: https://rooster-fleet-management.github.io/rooster_fleet_manager/)

Data:

https://doi.org/10.4121/21667796.v1
https://doi.org/10.4121/uuid:5deaf8cf-ec57-4e33-86c4-8253a00df1d4
https://doi.org/10.4121/16437297.v1
https://doi.org/10.4121/uuid:edfc5304-39ed-4556-a95a-f8b3313f7cfc

Funded by the European Union

# CITATION METADATA

## Back end

<metadata xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:dc="http://purl.org/dc/elements/1.1/" xmlns:dcterms="http://purl.org/dc/terms/"
xmlns="http://dublincore.org/documents/dcmi-terms/">

<dcterms:title> Investigation of fatigue crack growth in a single cycle by means of acoustic emission
</dcterms:title>

<dcterms:identifier>https://hdl.handle.net/10411/20730</dcterms:identifier>
<dcterms:creator>Pascoe, John-Alan</dcterms:creator>
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<dcterms:creator>Alderliesten, René</dcterms:creator>
<dcterms:publisher>DataverseNL</dcterms:publisher>
<dcterms:issued>2016-04-13</dcterms:issued>
<dcterms:modified>2016-04-18T15:21:40Z</dcterms:modified>
...

</metadata>

## Front end (repository website)

# Data Repositories

| Platform | Storage space | Max file size | Metadata Quality | ID | Location Storage |
|---|---|---|---|---|---|
| 4TU.ResearchData<br><br>http://data.4tu.nl | - 1 TB per TU Delft user per year<br>- Public | 10 GB | High | DOI | Netherlands |
| Zenodo<br><br>https://about.zenodo.org/ | - 50 GB per upload<br>- "No" limit on # of datasets (donate)<br>- Public and Private | None | High | DOI | CERN Data Center |
| Figshare<br><br>https://figshare.com/features | - Private: 20 GB per user<br>- Public: Unlimited<br>- Public and Private | 5 GB | Low | DOI | Amazon Web Services |
| DataverseNL<br><br>https://dataverse.nl/ | - "No" limit (fair use)<br>- Public and Private | 2 GB | High | Handle | Netherlands (DANS) |
| Open Science Framework<br><br>https://osf.io/ | - Adds-on limits<br>- Public and Private | 5 GB (add-on for larger files) | Medium | DOI | Google Cloud Amazon Glacier |

# Code Repositories

| Platform | Features | Max project size | Max file size | Supports |
|---|---|---|---|---|
| Github<br><br>https://github.com/ | - Unlimited number of collaborators (free and paid plans)<br>- Public: unlimited number of projects (free)<br>- Private: unlimited number of project (paid) | 1 GB | 100 MB | Git<br>SVN |
| Bitbucket<br><br>https://bitbucket.org | - 5 collaborators in public and private projects (free and paid plans). More must be paid.<br>- Public: unlimited number of projects (free and paid)<br>- Private: unlimited number of projects (free and paid) | 1(2) GB | None | Git<br>Mercurial<br>SVN<br>SourceForge |
| GitLab<br><br>https://gitlab.com/ | - Unlimited number of collaborators (free and paid plans)<br>- Public: unlimited number of projects (free and paid)<br>- Private: unlimited number of projects (free and paid) | 10 GB | None | Git |

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COMP-ECO