Elevate research projects with
Quarto

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1 Content

```
1  https://vhgauto.quarto.pub/seminario2-gulich/
```

2 Introduction

> **Research project**
>
> To estimate water quality indicators in Paraná River middle basin for algorithm development using satellite remote sensing techniques

Collaborative website with automatic running, interactive and open source.

2.1 Front page

- Authors
- Affiliation
- Last modified date
- Keywords
- More resources links

2.2 Table of content

- Sections and subsections

- Ease website navigation

- Variable content according to the development

Contenido

1 Introducción
2 Área de estudio
3 Materiales y métodos
4 Muestreos
5 Resultados
6 Firmas espectrales
7 Discusión
8 Objetivos
9 Ejecución
10 Algoritmos
11 Contacto

2.3 Notebooks

- Source code description

- Processing data justification

- Calculus methodology explanation to promote reproducibility

Notebooks
- Lectura de datos
- Extracción de reflectancia
- Caracterización de las muestras
- Ejecución automática
- Article Notebook

2.4 **References**

- Formatted references according to desired style (`.csl`)

- Reference preview on citation hover

Referencias

[1]   United Nations General Assembly, «Work of the Statistical Commission Pertaining to the 2030 Agenda for Sustainable Development», 2017.

[2]   M. Bonansea *et al.*, «Evaluating the feasibility of using Sentinel-2 imagery for water clarity assessment in a reservoir», *Journal of South American Earth Sciences*, vol. 95, nov. 2019, doi: 10.1016/j.jsames.2019.102265.

[3]   M. H. Gholizadeh, A. M. Melesse, y L. Reddi, «A Comprehensive Review on Water Quality Parameters Estimation Using Remote Sensing Techniques», *Sensors (Switzerland)*, vol. 16, n.º 8, 2016, doi: 10.3390/s16081298.

[4]   A. Ferral *et al.*, «In-Situ and Satellite Monitoring of Water Quality of an Eutrophic Lake with an Artificial Air Diffusion System», *IEEE Latin America Transactions*, vol. 16, pp. 627-633, 2018, doi: 10.1109/TLA.2018.8327422.

2.5 Maps, tables & interactive plots

- Results visualization
- Correlation between parameters exploration
- Spectral properties description
- Sample site location
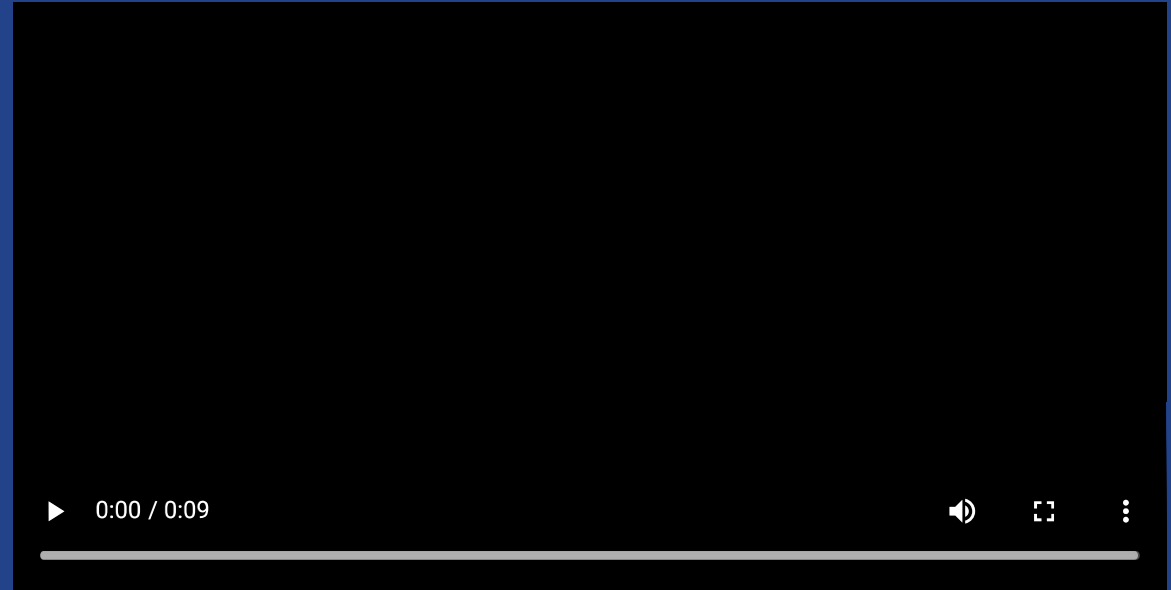
Web site

```
1  https://vhgauto.quarto.pub/gistaq-parana/
```

3 Motivation

Research project typical life journey.
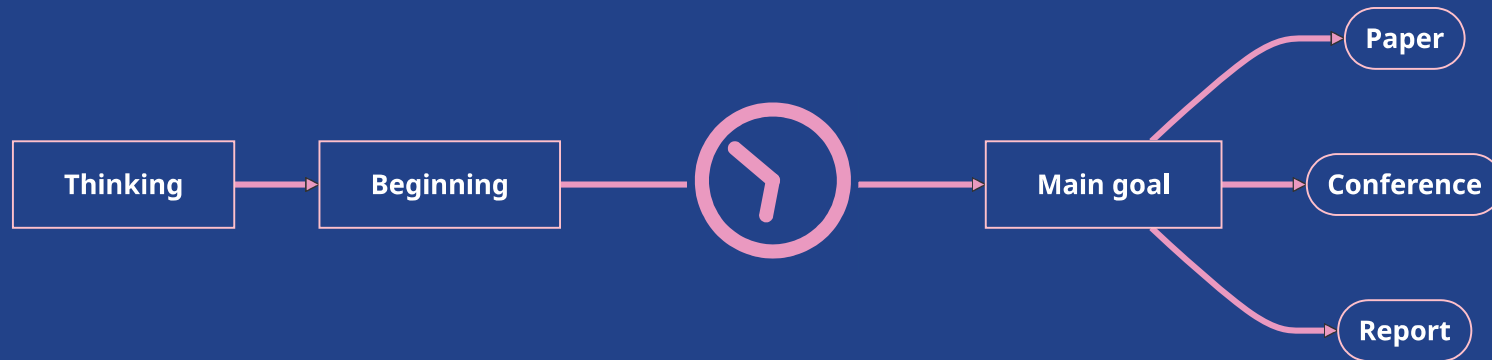
- Water sampling
- Physicochemical test
- Partial results analyses
- Reference reading
- Other tasks

3.1 During the project development

- Dynamic document, that adapts to the current project state.

- Easy access site to check the latest results.

- Unified reference search.

- Script code execution and results reproducibility.

- All project members can work seamless and without problems and no fear of disarranging the document.

- Consultation resource and to admire all the effort done.
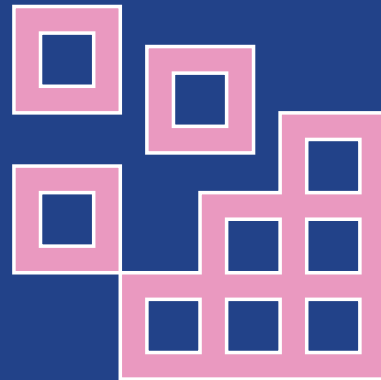
4 **Tools**

- R y Python: reading and data collection; processing and results storage; plots, tables and maps generation.

- Git y GitHub: version control management and project members collaboration.

- Quarto: to content compilation and website publishing.
  - `manuscript` allows website creation with an emphasis in reproducibility and targeted to scientific and academic documents.

4.1 **R**

targets allows automatic functions execution and dependencies management between them.

Check current workflow state and execute only outdated targets.

File monitoring and code re-execution when change detection.

4.2 R
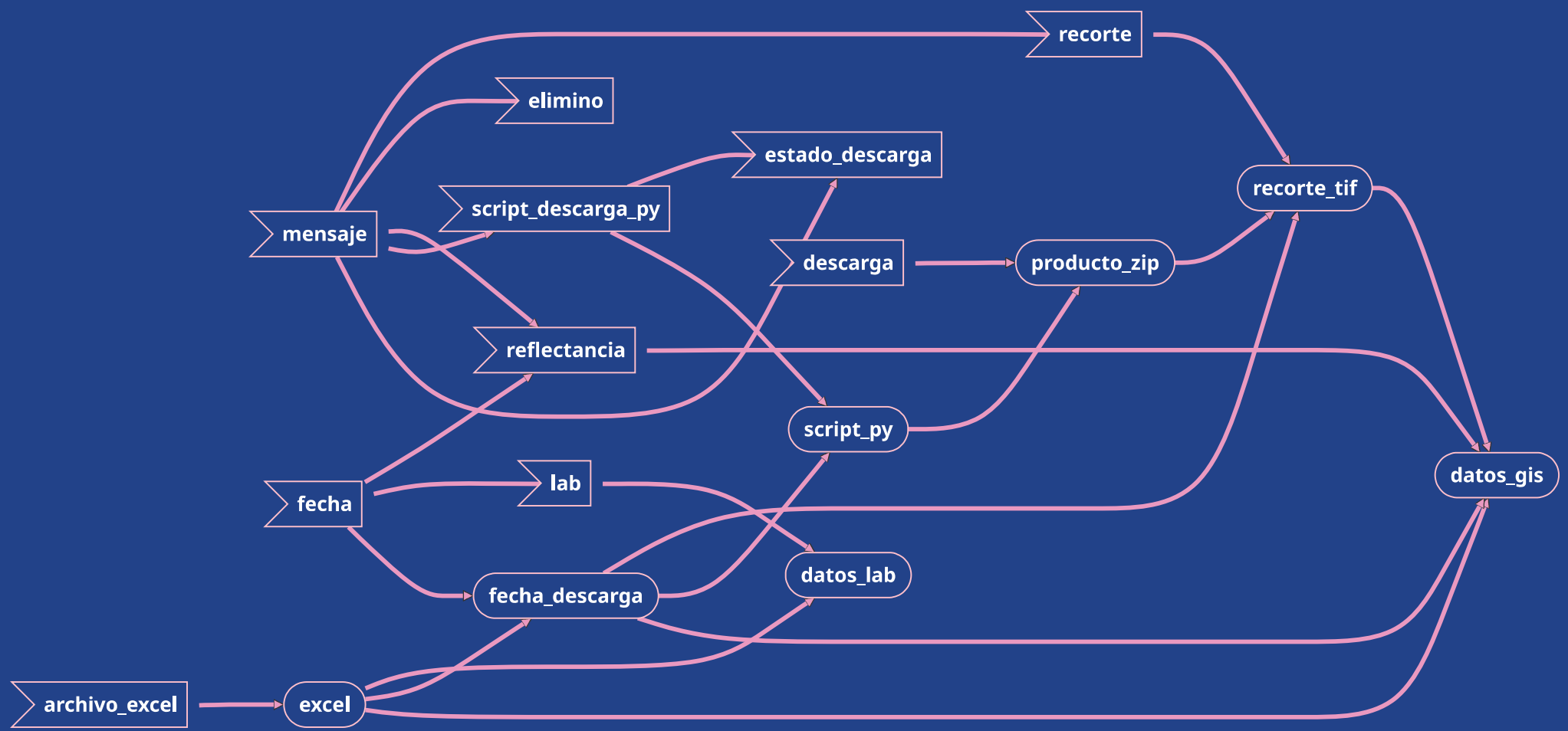
4.3 R

renv execution environment management, package version and its dependencies.

Log file that allows environment reproducibility.
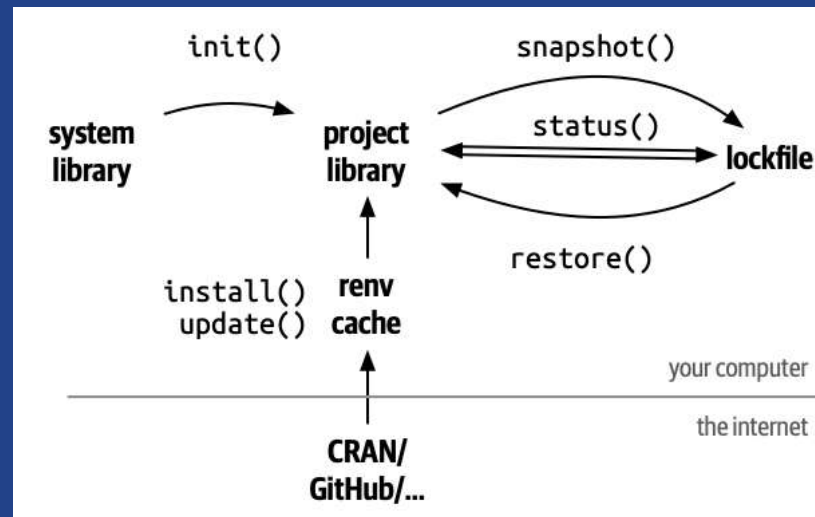
4.4 R

tidyverse with multiple packages for general purpose data processing and manipulation.

terra for geographic data processing and vector and raster reading.

corrr linear correlation coefficient calculation.

4.5 R

ggplot2 for basic plot creation (`.png`).

ggiraph for interactive plot creation (`.html`).

leaflet for interactive map creation (`.html`).

4.6 PYTHON

Copernicus Data Space

**PROGRAMME OF
THE EUROPEAN UNION**

- Collection
- Processing level
- Region of interest
- Time range
- Credentials
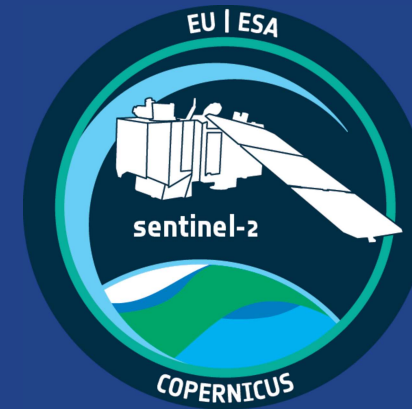
4.7 **GIT**

Version control management and simultaneous collaboration between project members.

`github` cloud storage service.

`branch` per member, so each one works in a specific section without interfering with the remaining repository.

`pull request` to request adding changes.

`merge` to combine changes once checked and accepted.

4.8 QUARTO

- Combines code execution by programming language and narrative text to create a product in multiple formatted options

- Offers a publishing platform for the output and to access it as a website

4.9 QUARTO

4.10 QUARTO

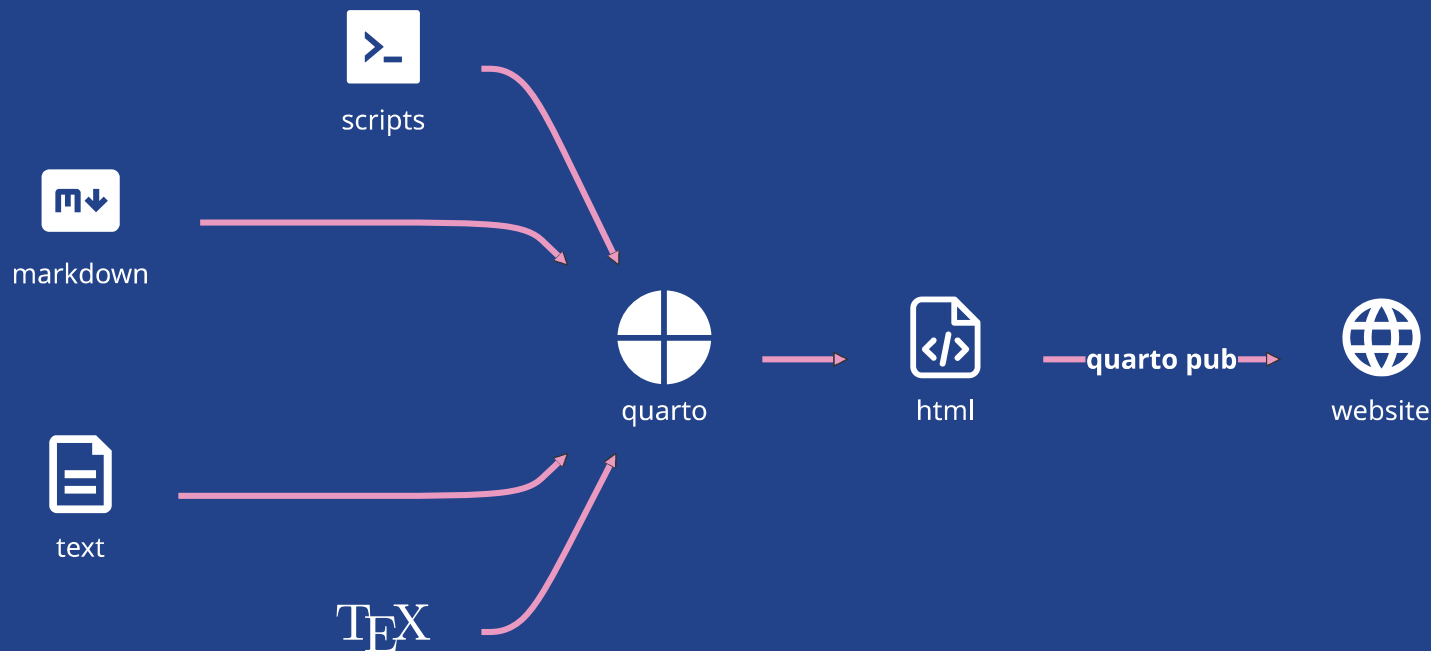- **Manuscript** is design for scientific document authoring, with emphasis in reproducibility, since it encourages the readers to explore processing scripts (notebooks).

- Offers multiple static outputs that follow an specific template from a magazine.

- It allows to deploy the website in Quarto Pub or GitHub Pages .

- In combination with targets, plots/tables/maps are regenerated with new data input, or script modification, updating the results.

4.11 QUARTO

File and directories tree.

```
 1  quarto_manuscript
 2  ├── bibliography
 3  │   ├── ieee.csl
 4  │   └── reference.bib
 5  ├── data
 6  │   ├── laboratory.csv
 7  │   └── reflectance.csv
 8  ├── plot
 9  │   ├── boxplot.png
10  │   └── time_series.png
11  ├── manuscript.qmd
12  ├── notebooks
13  │   ├── plots.qmd
14  │   └── data_reading.qmd
15  ├── _publish.yml
16  ├── raster
17  ├── scripts
18  │   ├── functions.R
19  │   └── support.R
20  ├── vectors
21  ├── _quarto.yml
22  └── _targets.R
```

4.12 QUARTO

```
manuscript.qmd
1  ---
2  title: Research Project
3  author: Víctor Gauto
4  date: last modified
5  ---
6
7  # Introducción
8
9  **Paraná River** has <i>water</i>.
10
11  ```{r}
12  ggplot(data, aes(x, y)) +
13    geom_point()
14  ```
```

4.13 QUARTO

```
_quarto.yml

 1  project:
 2    type: manuscript
 3
 4  manuscript:
 5    article: manuscrito.qmd
 6    notebooks:
 7      - notebooks/data_reading.qmd
 8
 9  format:
10    html:
11      lang: es
12      include-in-header:
13        - extras/favicon.html
14      theme:
15        - extras/my_style.scss
16      toc: true
17      code-link: true
18      code-copy: true
19      tbl-cap-location: margin
20      fig-cap-location: bottom
21      bibliography: bibliography/reference.bib
22      csl: bibliography/ieee.csl
23      html-math-method: katex
```

4.14 QUARTO

```
_publish.yml
1  - source: project
2    quarto-pub:
3      - id: ff90d76c-20c0-4210-8791-5d868ede4c50
4        url: https://vhgauto.quarto.pub/gistaq-parana
```

5 Conclusion

The **Research Project** development allowed us to learn a new set of tools.

6 Future improvements

- Rewrite functions used by targets.
    - Define arguments clearly.
    - Return descriptive messages during runtime and in case of errors.
    - Incorporate website rendering.
- Optimize satellite data download, avoiding to get the entire product.
    - Google Earth Engine.
    - rsi package.
- Organice website visual features (colors, fonts, styles, margins) in the `.scss` file.
- Use the full potential of **Manuscript**, so the results are created by the notebooks.

Thanks for your time

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/vhgauto

7 Resources

Download

This presentation repository

Reproducible Manuscripts with Quarto - posit::conf(2023)

Quarto for Academics | Mine Çetinkaya-Rundel

Quarto | Get started

Quarto Manuscripts

The {targets} R package user manual

Introduction to renv

R for Data Science (2e)

ggiraph-book

Quarto: The Definitive Guide

Website repository

Quarto Extensions

Official repository for Citation Style Language (CSL) citation styles

The End