eLTER Science Conference - 2025 - Tampere,FI

Analyzing Remote Sensing Data with R

Getting Started

This Github repository lists the preparatory steps in advance of the workshop, and contains the practice exercises that will be covered.

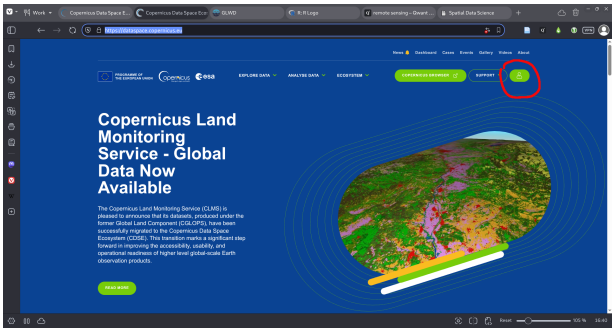
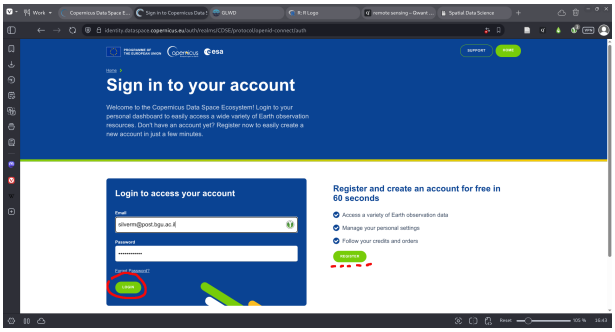
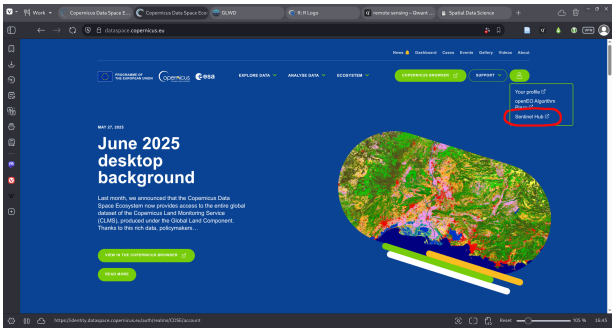
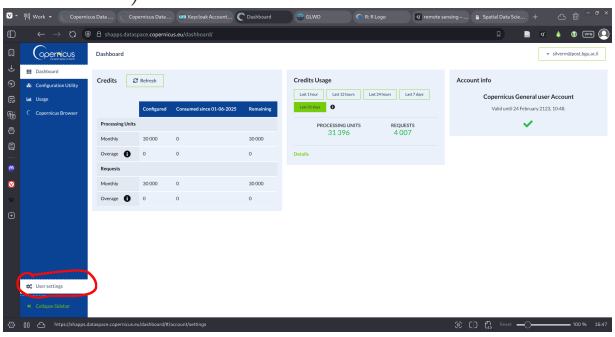
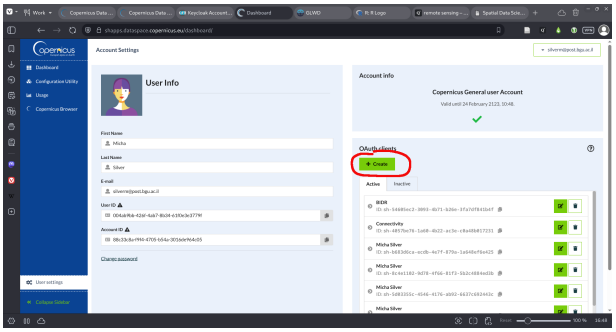
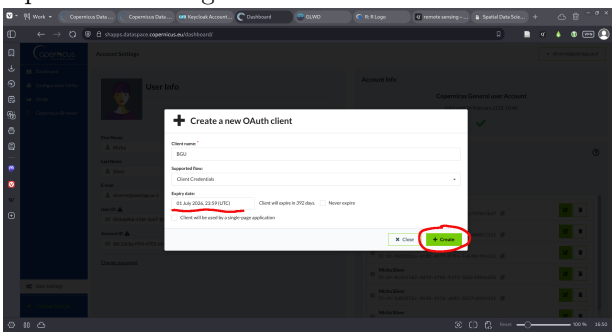
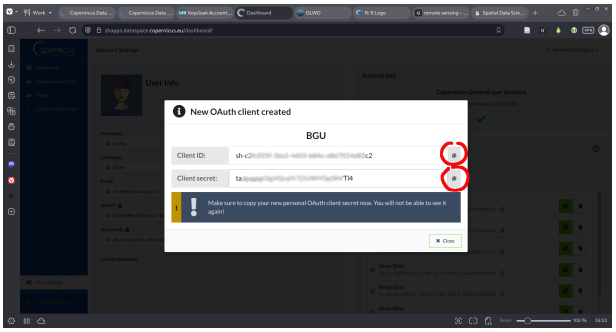
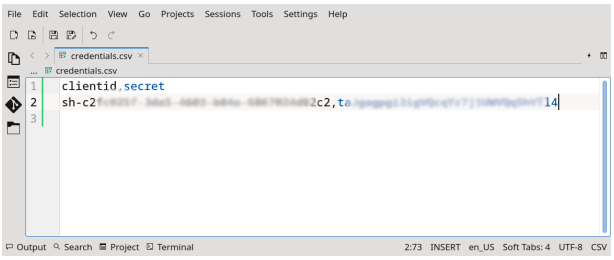
Required Software

Each workshop participant should do the following on her laptop:

- Install a recent version of `R`, for your operating system from CRAN
- Windows users should add the Rtools toolchain;
  - from: RTools
  - matching the version of `R` that was installed
- Install RStudio™ from Posit
- Once `R` is installed, the following packages should also be added:
  - `terra`(Hijmans (2025)), `sf`, `remotes`, `CDSE`(Karaman (2025)), `rOPTRAM`(Silver, Beiden, and Karnieli (2023)), `leaflet`, `ggplot2`;
  - At the R command line or in RStudio™ run:
  - `install.packages(c("terra", "sf", "remotes", "ggplot2", "leaflet"), dependencies = TRUE)`
  - `remotes::install_github("zivankaraman/CDSE")`
  - `remotes::install_github("ropensci/rOPTRAM")`

Authentication on Copernicus DataSpace (CDSE)

- Browse to CDSE portal
- Follow steps below to register on CDSE and prepare clientid and secret.
- Save both the clientid and secret to a `csv` text file.

CDSE Authentication	Steps
	
Browse to portal	Register for an account (or Login if you already have an account)
	
Go to Sentinel Hub	Open User settings
	
Create a new OAuth client	Set expiration date and click Create
	
Copy both the clientid and the secret…	… and **save** to `credentials.csv` file

Workshop Exercise

Code and data

The exercise focuses on Doñana Park in Spain. (Green et al. (2024)).

Each participant can download the exercises and data in advance in one of three ways:

- Particpants who are familiar with `git` can clone the repository:

```
git clone https://github.com/micha-silver/elter-2025-R-workshop.git
```

- The same result can be achieved within RStudio™ by starting a new Version Control based project, pointing to the same repository;
- Otherwise, the workshop material can be downloaded as a zip archive from here;

Put your `credentials.csv` file into the same directory as the exercise.

Start RStudio™ and load the project "elter-2025-R-workshop".

Exercises

- Load packages, set parameters;
- Query CDSE catalog for available images;
- Filter for low cloud cover, and only a single Copernicus tileId;
- Loop over list of available images;
  - Derive MNDWI index for each image date;
  - Threshold MNDWI to obtain open water surfaces (Xu (2006));
- Plot time series of MNDWI values;
- Prepare OPTRAM model from list of available dates;
  - Derive soil moisture for one date using OPTRAM model coefficients.

License

References

Green, Andy J., Carolina Guardiola-Albert, Miguel Ángel Bravo-Utrera, Javier Bustamante, Antonio Camacho, Carlos Camacho, Eva Contreras-Arribas, et al. 2024. "Groundwater Abstraction Has Caused Extensive Ecological Damage to the Doñana World Heritage Site, Spain." *Wetlands* 44 (2): 20. https://doi.org/10.1007/s13157-023-01769-1.

Hijmans, Robert J. 2025. *Terra: Spatial Data Analysis*. https://CRAN.R-project.org/package=terra.

Karaman, Zivan. 2025. *CDSE: Copernicus Data Space Ecosystem API Wrapper* (version 0.2.1). https://doi.org/10.32614/CRAN.package.CDSE.

Silver, Micha, Ron Beiden, and Arnon Karnieli. 2023. "rOPTRAM: An r Package for Preparing Soil Moisture Grids Based on the OPTRAM Model." Ben Gurion University. https://doi.org/https://doi.org/10.5281/zenodo.13257767.

Xu, Hanqiu. 2006. "Modification of Normalised Difference Water Index (NDWI) to Enhance Open Water Features in Remotely Sensed Imagery." *International Journal of Remote Sensing* 27 (14): 3025–33. https://doi.org/10.1080/01431160600589179.