CSE-583 Final Project

PyWRIS

A Python Package for India Water Resource Information System (WRIS) Data

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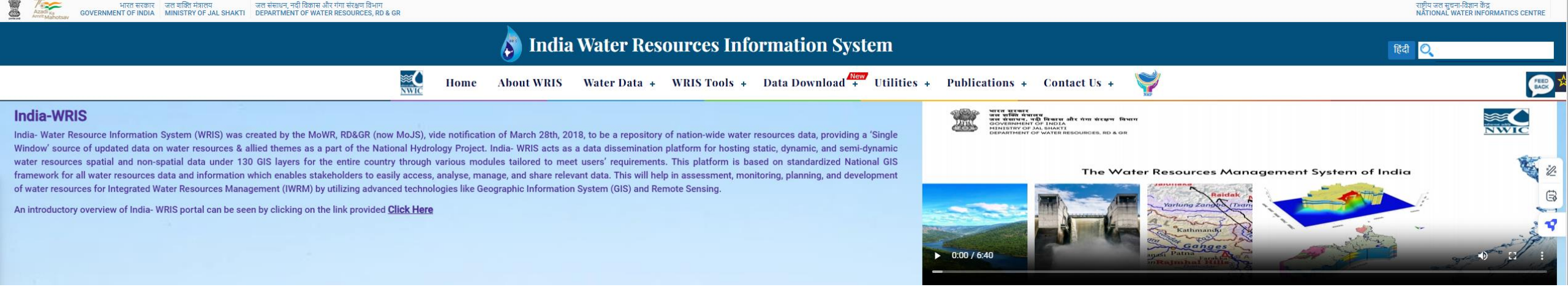
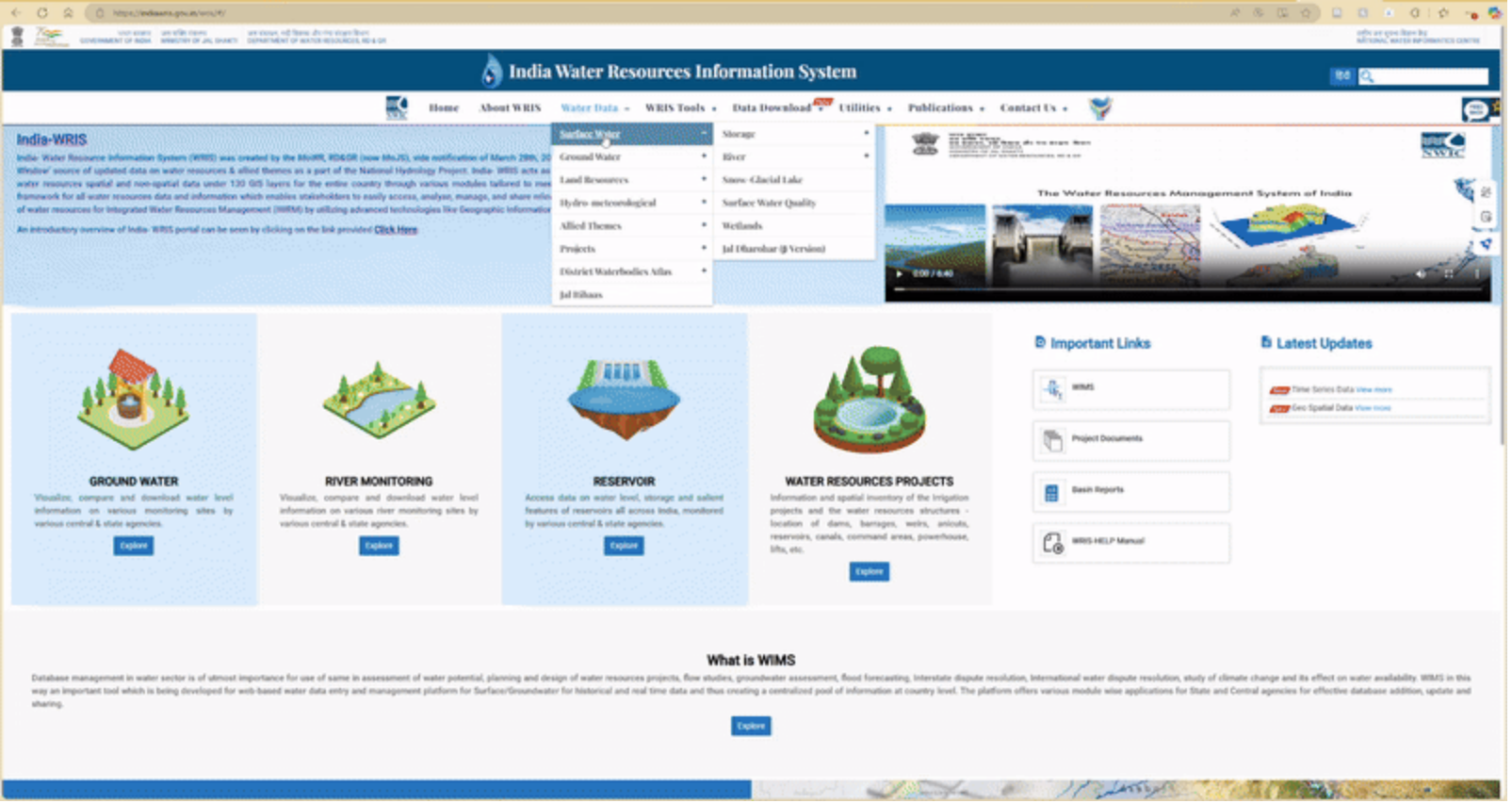


Problem Statement

- **India WRIS** (Dept. Water Resources, Govt. of India) hosts a rich variety of **Hydrological Data related to India** – e.g. Reservoir, groundwater, rainfall, soil moisture data etc.
- However, its GUI heavy interface **is slow**, **not ideal for research applications.**
- **Objective:** Create **a solution for accessing India WRIS data** that is **open-access, programmatic**, **fast**, and **scalable.**



https://indiawris.gov.in/wris/#/

Data retrieval time:

30s – 5mins +

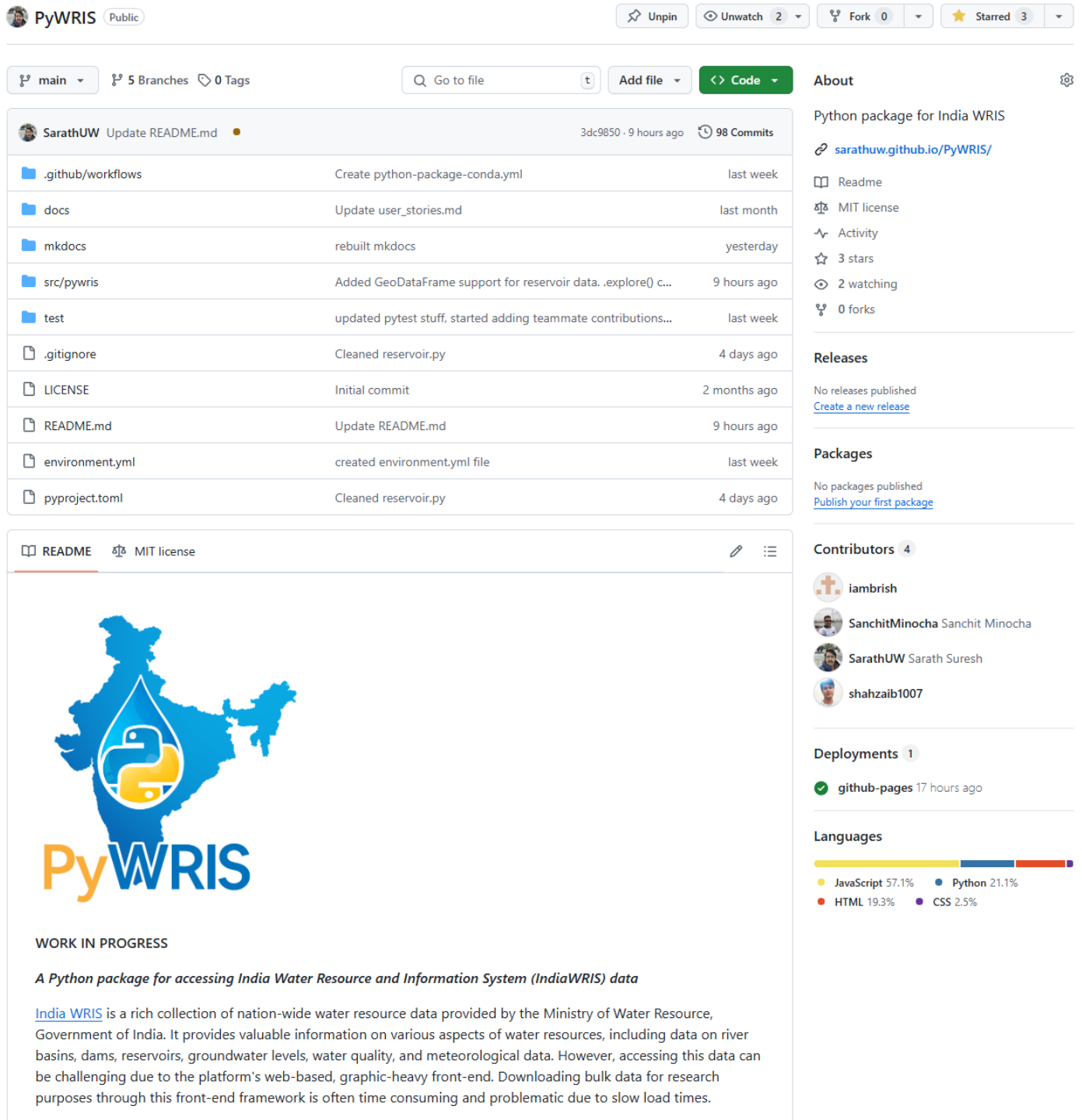
India WRIS Issues:

- Extremely rich, **heavy GUI** – slow load times
- **Multiple steps** to access and download data – including **survey form**.
- **Not possible to automate** data download for research (e.g. for daily cron jobs).

PyWRIS

https://github.com/SarathUW/PyWRIS

- A **python package** for intuitive, fast access to India WRIS data.
- Uses **Web Scraping** for data retrieval.
- **Query directly with** the India **WRIS database** to retrieve data.
- Eliminating delay caused by front-end GUI.
- **Optimized for Jupyter** – supports rich hypertext formatting.
- **Easy plotting**, **filtering** and comparison functionality.
- Automated unit tests, conda deployment (under works)



PyWRIS

Human Centric Use Cases:

PyWRIS requires some knowledge of coding, but we will include thorough documentation

- **Water researchers**: fetch country-wide data quickly, create interactive plots on changes over time
- **Agriculture professionals**: predict trends for water storage over seasons, plan for water shortages
- **Government (water management)**: generate periodic reports, track real-time reservoir levels, communicate across states

PyWRIS - Technologies:

Data Handling

pandas GeoPandas

Visualisation

plotly matplotlib

Documentation

MKDOCS GitHub Pages

Web Scraping

Requests package.

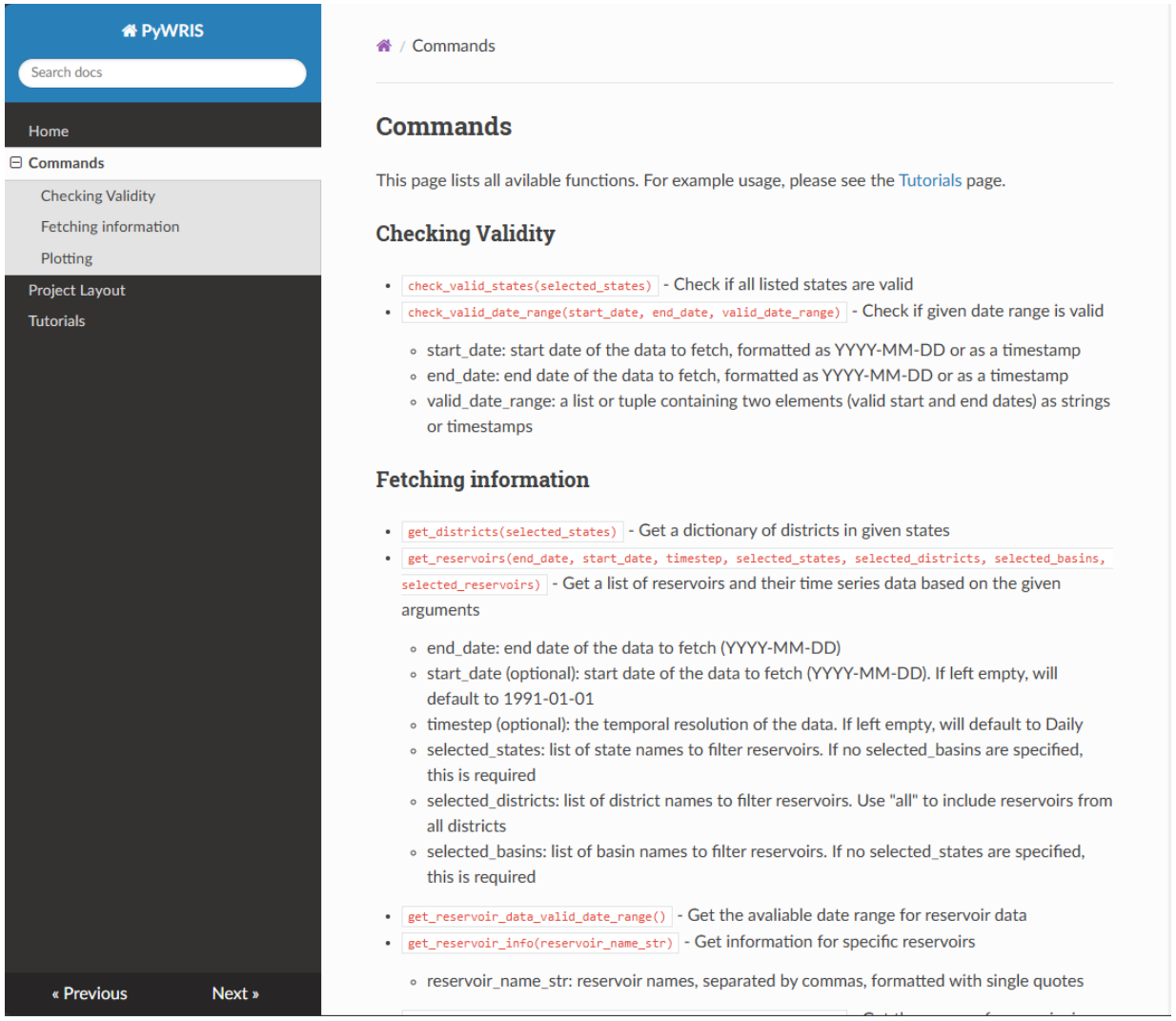
Jupyter Support:

Rich Hypertext

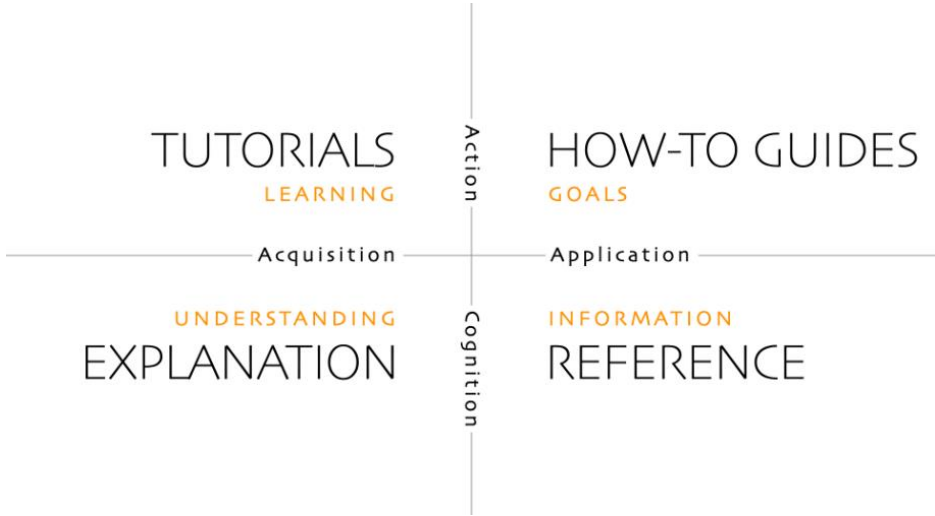
Challenges:

- **Structuring** PyWRIS **in a modular, scalable format.**
- **India WRIS has over 20** different **data products,** with different types of data.

PyWRIS - Documentation: Diátaxis framework



4 main sections:



We currently have **Tutorials** and **Reference**

Next steps: **Explanation** and **How-to Guides**

PyWRIS - Functionalities

```
1 hf1
```
[34] ✓ 3.5s

Rich HyperText support for **Jupyter**

PyWRIS HydroFrame

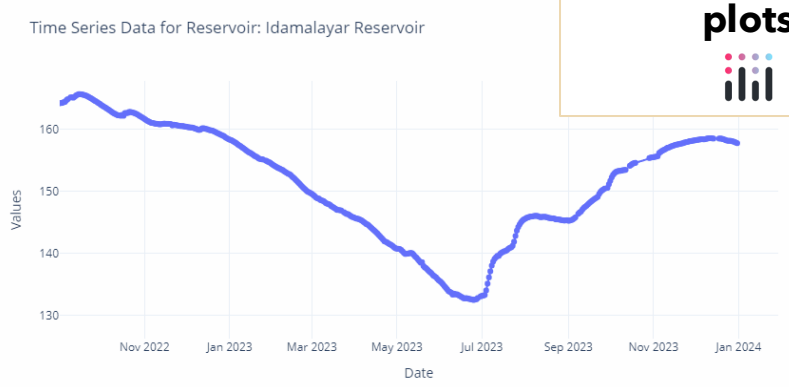
Downloaded Data: **Reservoirs**
Reservoir count: 18

States: (3)
- ▶ **Kerala**
- ▶ **Tamil Nadu**
- ▶ **Uttar Pradesh**

Quick help:
Reservoir data:
- HydroFrame.reservoirs: *Dictionary of Reservoir objects*
- HydroFrame.reservoir_gdf: *GeoDataFrame of static reservoir data*
- HydroFrame.reservoir_rawData: *DataFrame of complete reservoir data*
- Preset Plots:
  - HydroFrame.reservoir_gdf.explore(): *Interactive map with reservoir data*
  - HydroFrame.reservoirs['Reservoir Name'].plot(): *Time Series plots of individual reservoir data*

Click for PyWRIS documentation

```
1 hf1.reservoirs['Idamalayar Reservoir'].plot(columns = ['Level'])
```
[7] ✓ 0.3s



Preset Interactive **plots** using plotly

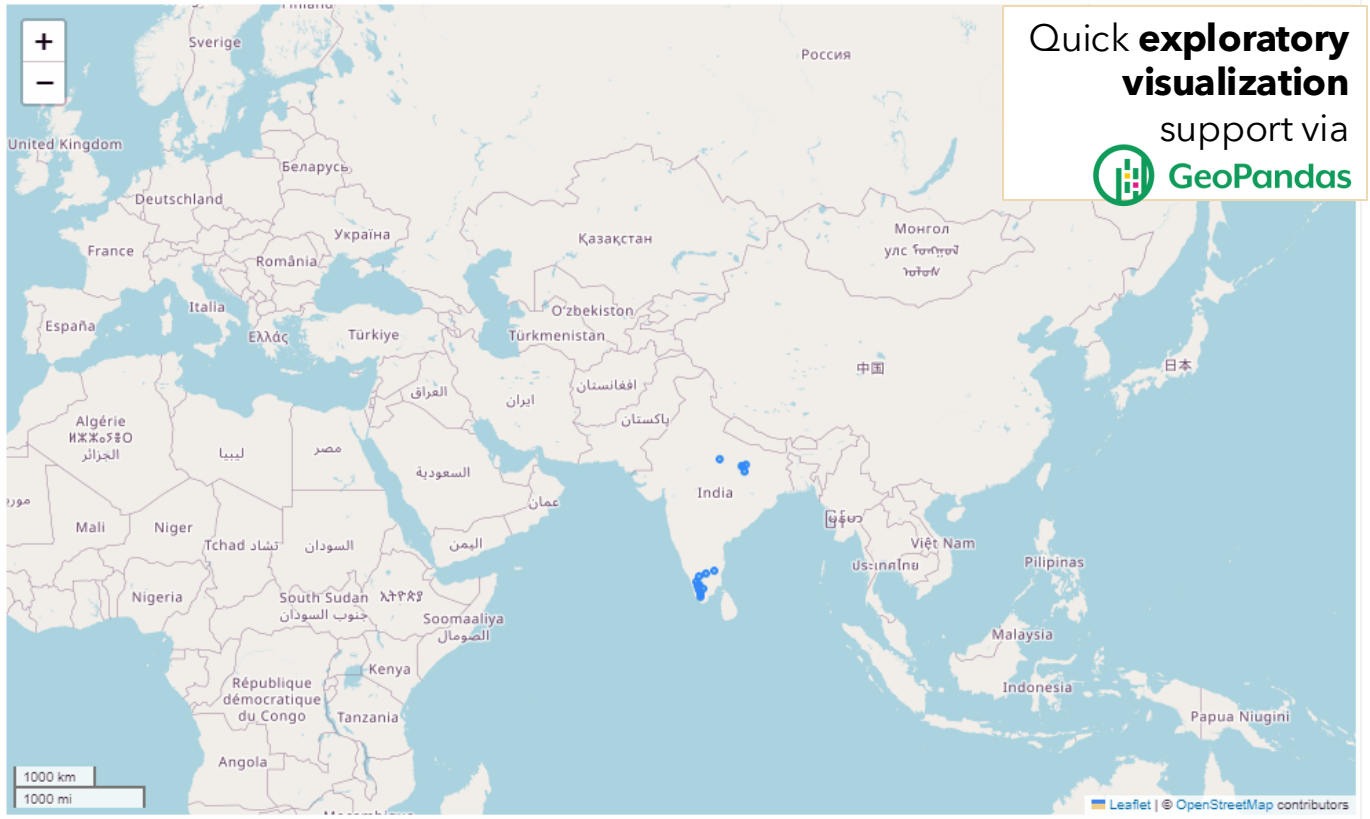
pandas

Full **Data provided as DataFrames** for easy analysis

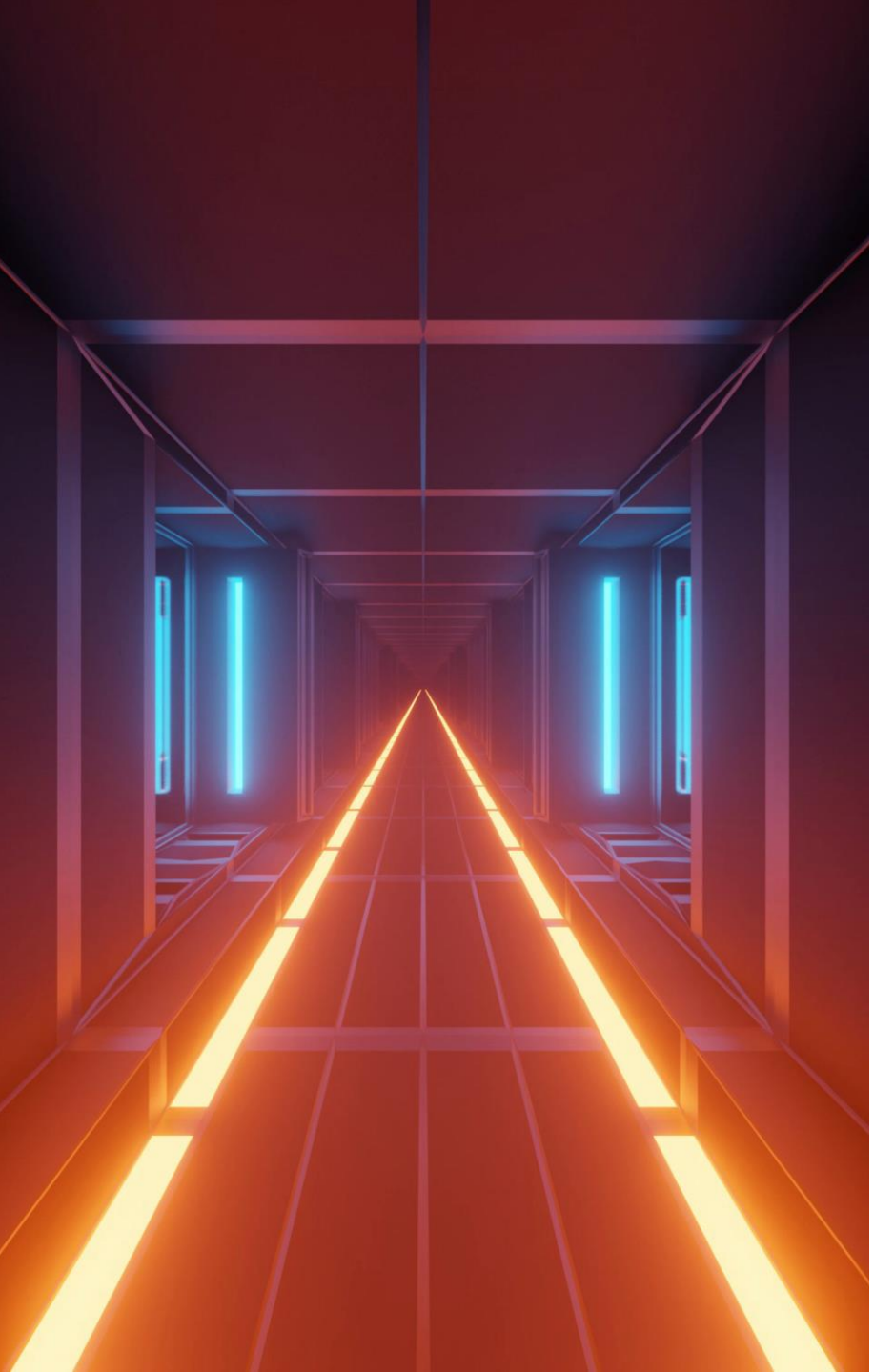
```
1 hf1.reservoir_gdf
```
[27] ✓ 0.0s Python

	reservoir_name	latitude	longitude	agency	state	state_code	district	block_name	basin	sub_basin	dam_code	frl	live_cap_frl	geometry
0	Idamalayar Reservoir	10.245455	76.746903	CWC	Kerala	KL	Ernakulam	Kotamangalam	West flowing rivers from Tadri to Kanyakumari ...	Periyar and others	D03183	169	1.018	POINT (76.7469 10.24546)
1	Idukki Reservoir	9.788474	76.974747	CWC	Kerala	KL	Idukki	Idukki	West flowing rivers from Tadri to Kanyakumari ...	Periyar and others	D03331	732.43	1.46	POINT (76.97475 9.78847)
2	Parambikulam Reservoir	10.384451	76.807336	CWC	Kerala	KL	Palakkad	Chittur	West flowing rivers from Tadri to Kanyakumari ...	Periyar and others	D00874	556.26	0.38	POINT (76.80734 10.38445)
3	Aliyar Reservoir	10.472668	76.974597	CWC	Tamil Nadu	TN	Coimbatore	Anamalai	West flowing rivers from Tadri to Kanyakumari ...	Varrar and others	D00390	320.04	0.095	POINT (76.9746 10.47267)
4	Kakki Reservoir	9.304659	77.167540	CWC	Kerala	KL	Pattanamthitta	Konni	West flowing rivers from Tadri to Kanyakumari ...	Periyar and others	D03369	981.46	0.447	POINT (77.16754 9.30466)
5	Kallada Reservoir	8.920001	77.124597	CWC	Kerala	KL	Kollam	Punalur	West flowing rivers from Tadri to Kanyakumari ...	Periyar and others	D03104	115.82	0.507	POINT (77.1246 8.92)
6	Lower Bhawani \ Bhavanisagar Reservoir	11.443478	77.068631	CWC	Tamil Nadu	TN	Erode	Satyamangalam	Cauvery Basin	Cauvery Middle	D01078	278.89	0.792	POINT (77.06863 11.44348)
7	Mettur Reservoir	11.886289	77.805044	CWC	Tamil Nadu	TN	Salem	Mettur	Cauvery Basin	Cauvery Middle	D00842	240.79	2.647	POINT (77.80504 11.88629)
8	Periyar Reservoir	9.534959	77.191606	CWC	Kerala	KL	Idukki	Pirmed	West flowing rivers from Tadri to Kanyakumari ...	Periyar and others	D00820	867.41	0.173	POINT (77.19161 9.53496)
9	Sholayar Reservoir	10.320471	76.902715	CWC	Tamil Nadu	TN	Coimbatore	Valparai	West flowing rivers from Tadri to Kanyakumari ...	Periyar and others	D00314	1002.79	0.143	POINT (76.90272 10.32047)
10	RIHAND RESERVOIR	24.136551	82.833914	CWC	Uttar Pradesh	UP	Sonbhadra	Dudhi	Ganga Basin	Sone	D00726	268.22	5.649	POINT (82.83391 24.13655)

```
1 hf1.reservoir_gdf.explore()
```
✓ 0.0s Python



Quick **exploratory visualization** support via GeoPandas



PyWRIS

Way Forward

- **Add more WRIS modules:**
  PyWRIS currently only supports Reservoir data.
- **Add more plotting options:**
  More quick preset plots such as GeoSpatial scatter plots, comparison plots between station points etc.
- **Create Conda Package pipeline:**
  Publishing PyWRIS package to conda-forge for easy downloads.
- **Add more Documentation:**
  Keep adding to documentation website. Migrate from GitHub pages to ReadTheDocs.
- **Outreach - Improve Visibility, Publication**
  Improve public visibility of PyWRIS package and aim for a publication once all modules are completed.