PyTelTools: Python scripts and GUI to automate Telemac post-processing tasks

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Compagnie Nationale du Rhône (CNR)

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Python Telemac Tools

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Project initiation

Compagnie Nationale du Rhône (CNR)

- 1st producer of exclusively renewable energy in France
- 18 hydroelectric facilities on the Rhône River (3000 MW)
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Needs and purpose

- Develop non-existing features, customize it for modeller needs
- Automate and chain Telemac post-processing tasks
- Do not substitute for common post-processing graphical softwares

Python Telemac Tools

Developement Guidelines

- extensible
- customizable
- accessible, easy to use
- robustness
- open-source

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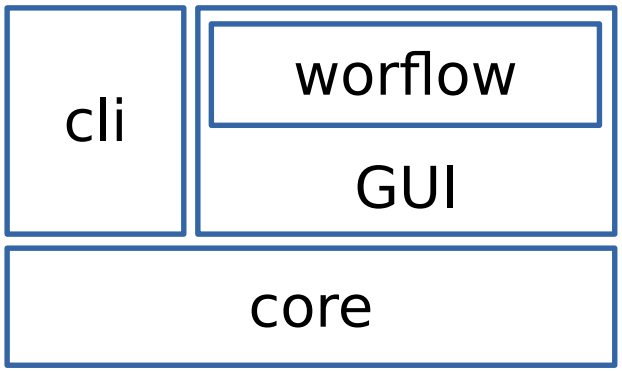

Implementation overview

- **core**
  - parsers, base classes, ...
  - mathematical and spatial calculations
- Command Line Interface (**CLI**)
  - multiple arguments
  - easily adapted, snippets (being implemented)
- Graphical User Interface (**GUI**)
  - classic interface
  - **Workflow** : automate, chain and monitor tasks

Documentation and installation

Installation

- Prerequisites: Python3
- Packages: see requirements.txt (numpy, matplotlib, PyQt5, ...)
- Installation procedure:

```
# user install
pip install -e git://github.com/CNR-Engineering/PyTelTools.git#egg=PyTelTools --user
# default install (needs to be root)
pip install -e git://github.com/CNR-Engineering/PyTelTools.git#egg=PyTelTools
```

Documentations

- User: `https://github.com/CNR-Engineering/PyTelTools/wiki`
- Developper: `https://cnr-engineering.github.io/PyTelTools`

Classification of post-processing tasks

- File conversions (shp, vtk, ...)

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	ID	Name	Unit
1	U	VITESSE U	M/S
2	V	VITESSE V	M/S
3	S	SURFACE LIBRE	M
4	B	FOND	M
5	W	FROTTEMENT	

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1	H	HAUTEUR D'EAU	M
2	M	VITESSE SCALAIRE	M/S
3	I	DEBIT SUIVANT X	M2/S
4	J	DEBIT SUIVANT Y	M2/S
5	Q	DEBIT SCALAIRE	M2/S
6	C	CELERITE	M/S
7	F	FROUDE	
8	US	VITESSE DE FROT.	M/S
9	TAU	CONTRAINTE	PASCAL
10	DMAX	DIAMETRE	MM

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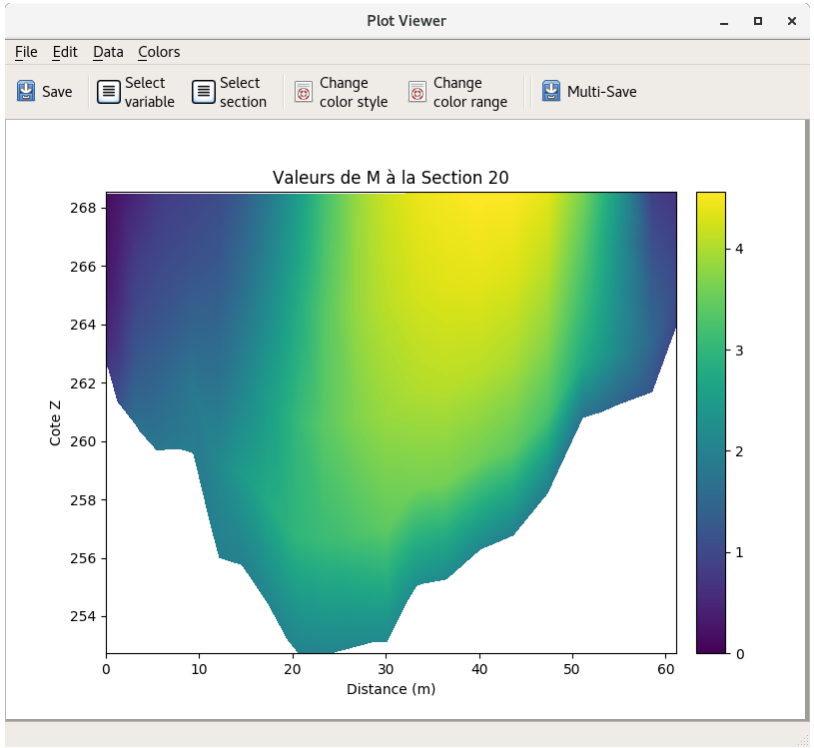

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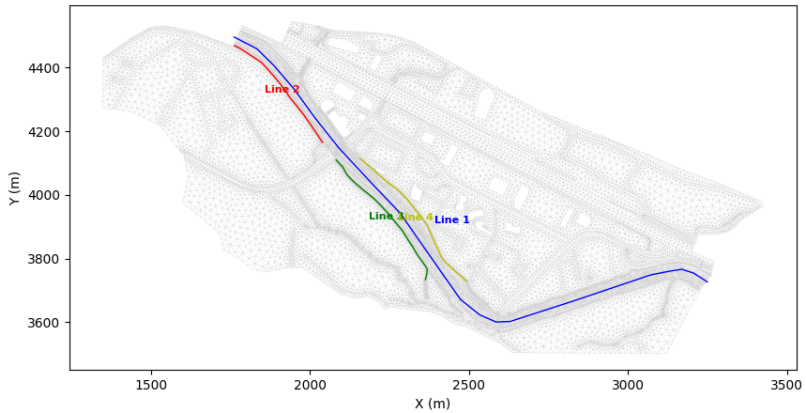

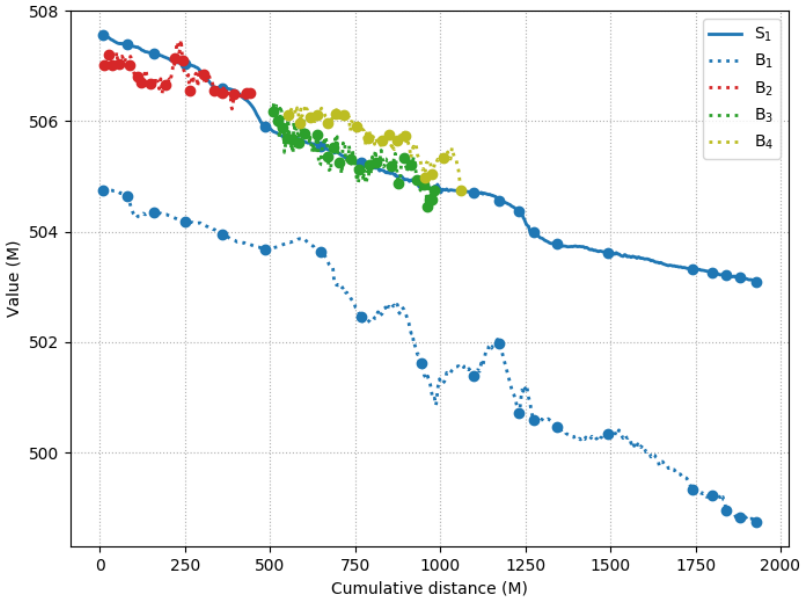

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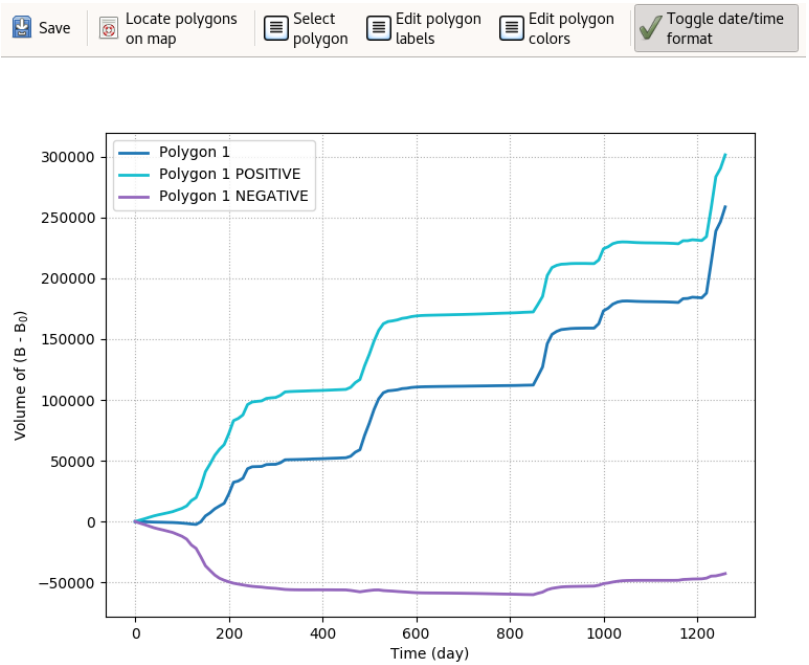

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- Compute volume, flux
- Others: comparison criteria (MAD, BSS, ...)

Philosophy and practice

Applications

- sensitivity analysis, calibration processes, ...
- write similar post-processing files (slf, CSV)
- export plots, produce maps in mass

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Main workflow features

- easy-to-use graphical interface to build pipelines
- visualize progress in real time
- ability to re-use and share pipelines

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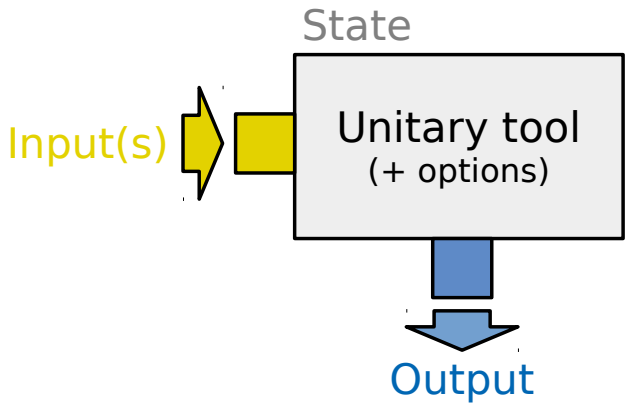
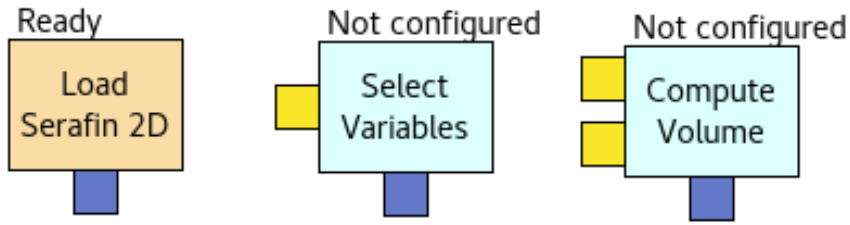
Two levels of automation

- **Mono**: configure and chain tasks to be run on a single simulation
- **Multi**: run over a set of simulations

Conceptual model

- Each **unitary tool**:
  - State (Not configured, Ready, Sucess)
  - Options (configure)
  - Input(s)/Output





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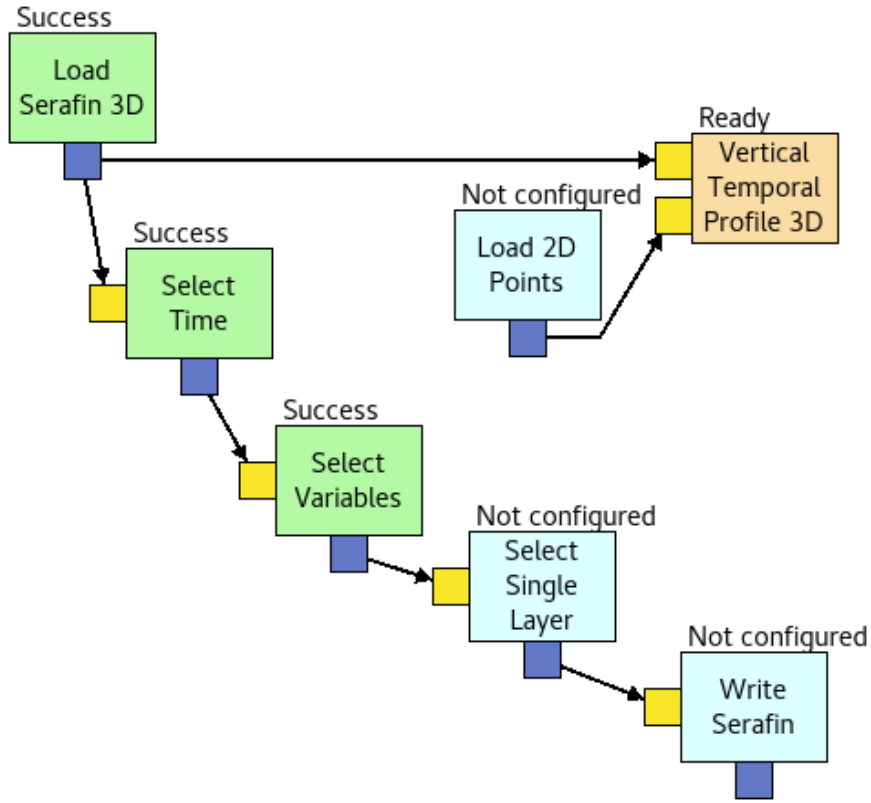
  - data-type correctness
  - junction
  - data flows downward
  - filters
  - commutativity is sometimes possible (flexibility)



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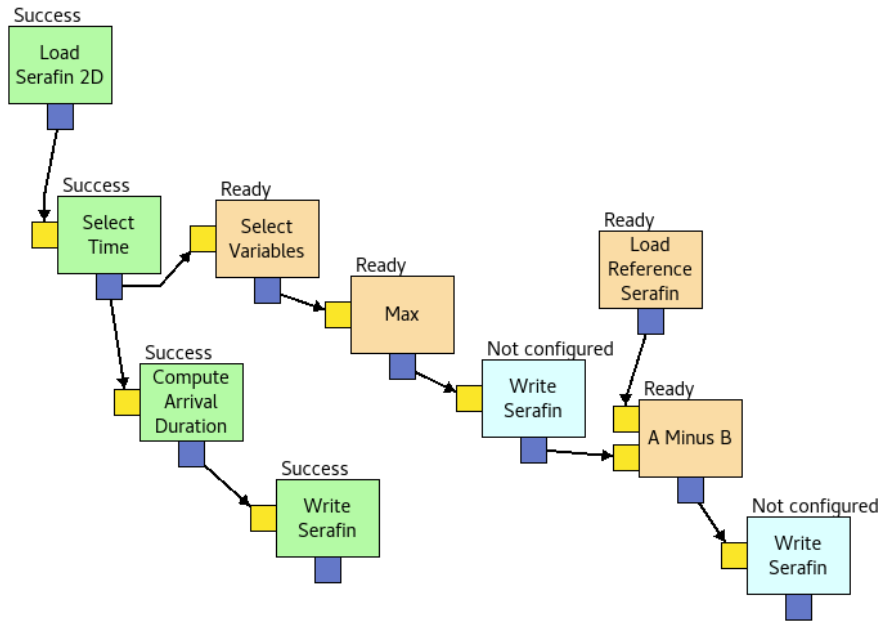
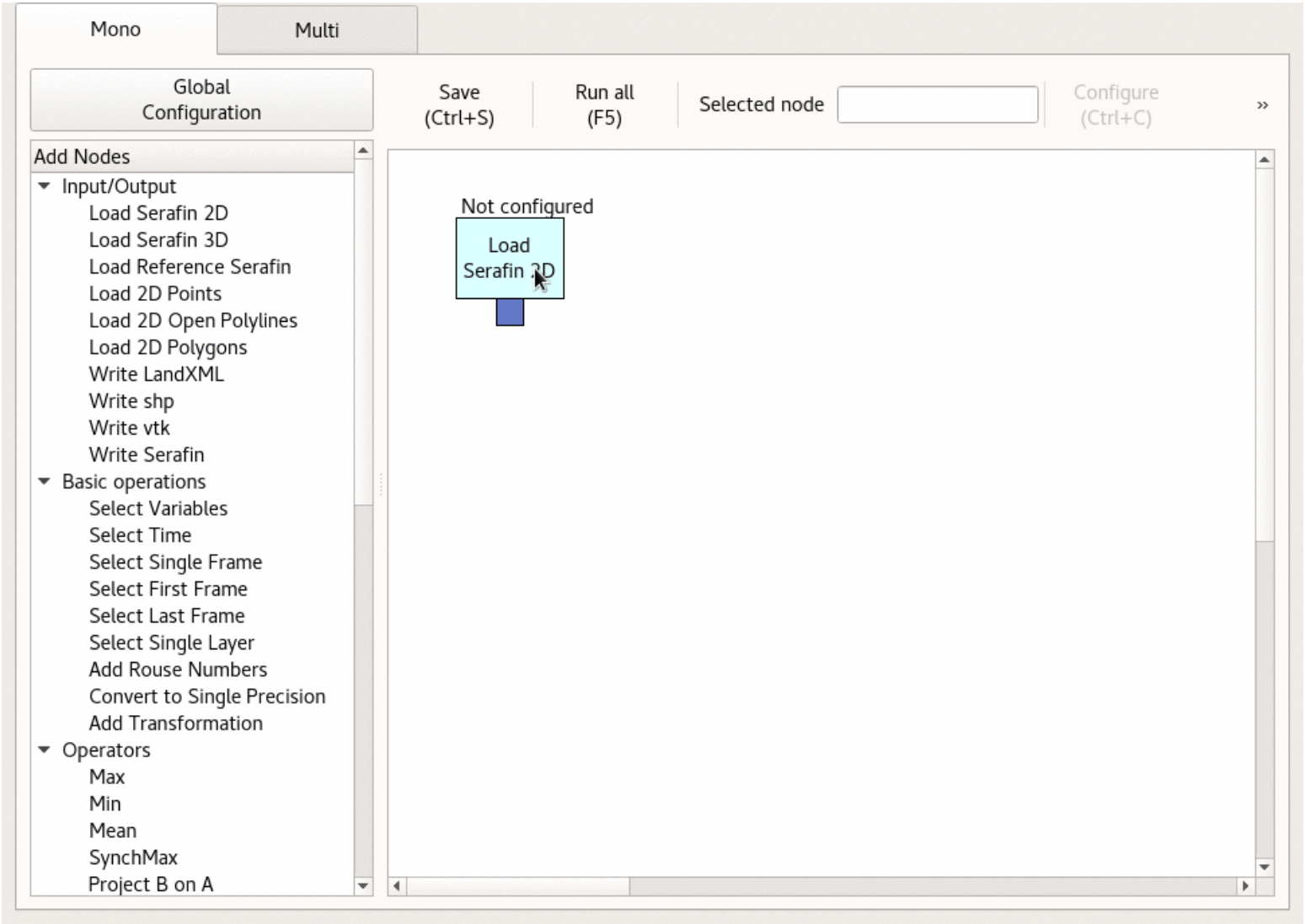
  - commutativity is sometimes possible (flexibility)
  - reproductability (project file)
  - reentrancy (intermediate files)



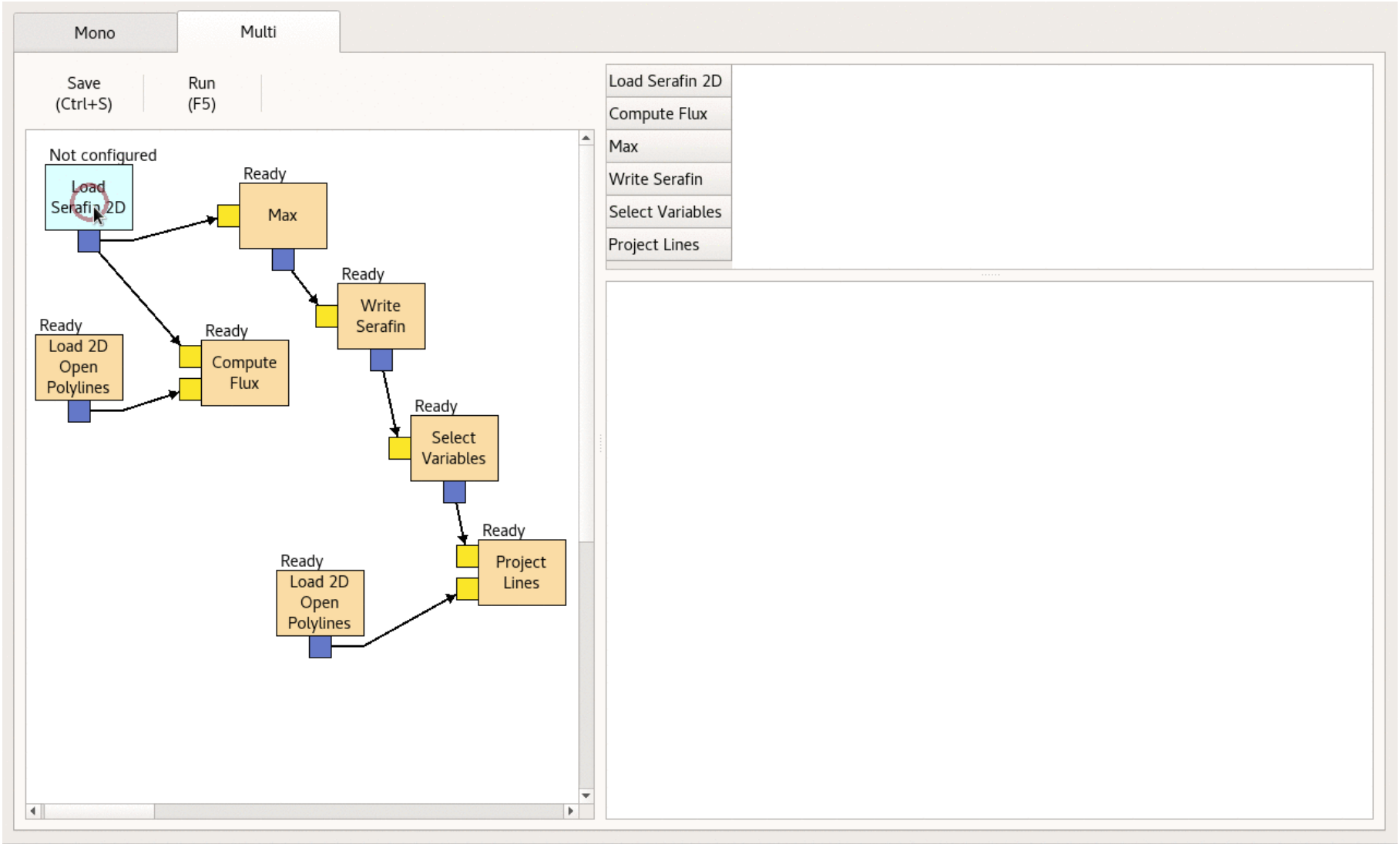
Demo on Mono view



Repeat over multiple simulation

- Prerequisites
  - the graph is already configured
  - input data are mostly identical and follows a naming convention
- repeat over this serie of simulations
- parallelize on multiple CPU
- monitoring: status table, log events

Demo on Multi view



Conclusion

- Python scripts developped from scratch for Telemac post-processing
- accessible through a GUI
- open-source, modest contribution
- different levels of automation (workflow)
- Some **improvements**:
  - compare to measurements, implementation, ...
  - Unify more Mono and Multi implementation
- Coming **new features** depends on needs (mostly new plots)

Thank you

```
try:
    PyTelTools.presentation()
    print('Thank your for your attention!')
except QuestionException:
    print('I will do it now!')
print('My work is done')
```

References

Luc Duron and Yishu Wang.

Equations integrated in PyTelTools.

August 2017.

URL: https://github.com/CNR-Engineering/PyTelTools_media/raw/master/latex/equations.pdf.

Luc Duron and Yishu Wang.

Mathematical definitions for PyTelTools.

August 2017.

URL: https://github.com/CNR-Engineering/PyTelTools_media/raw/master/latex/mathematical_definitions.pdf.

Yishu Wang.

PyTelTools: workflow for water flow, August 2017.

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