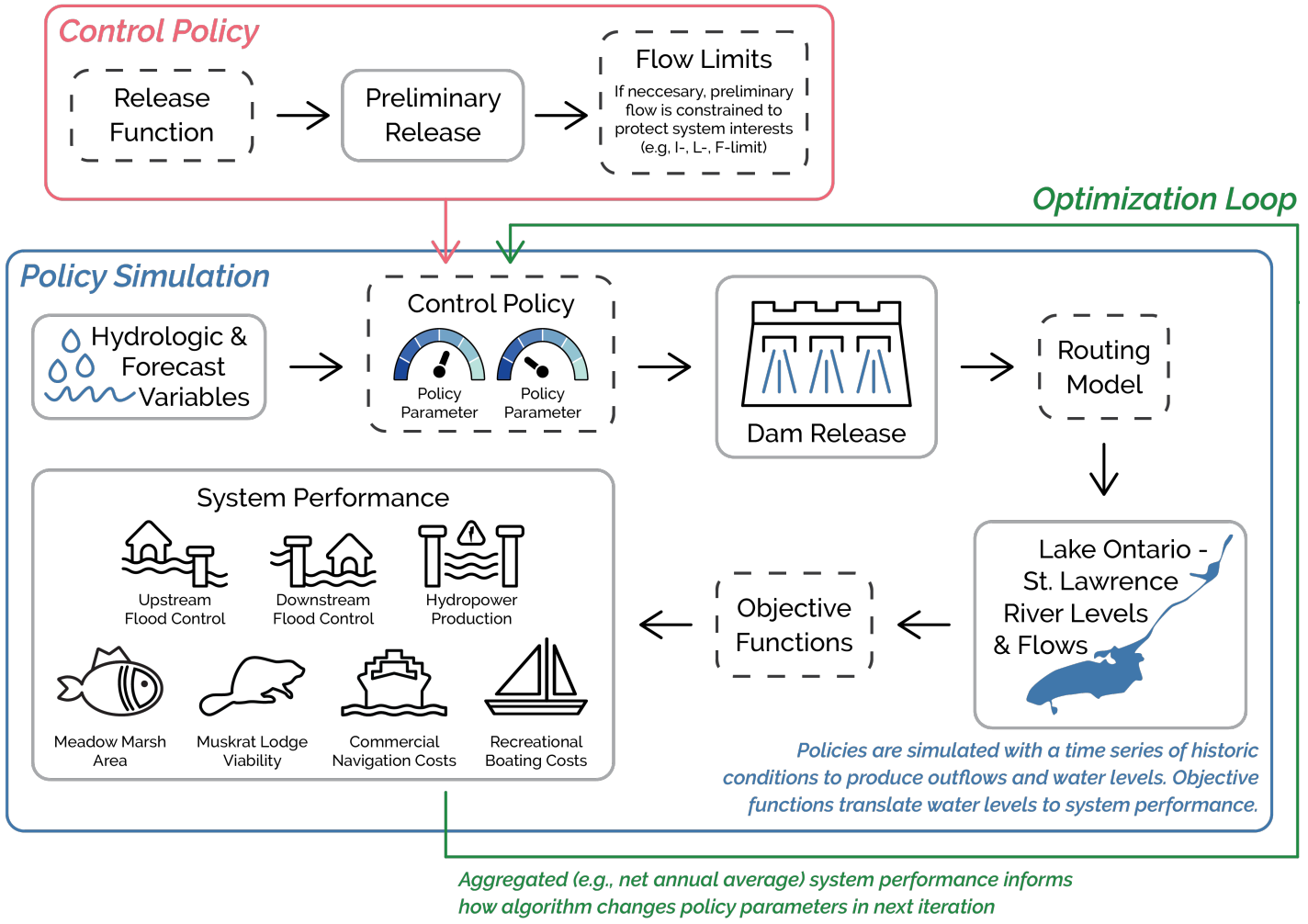
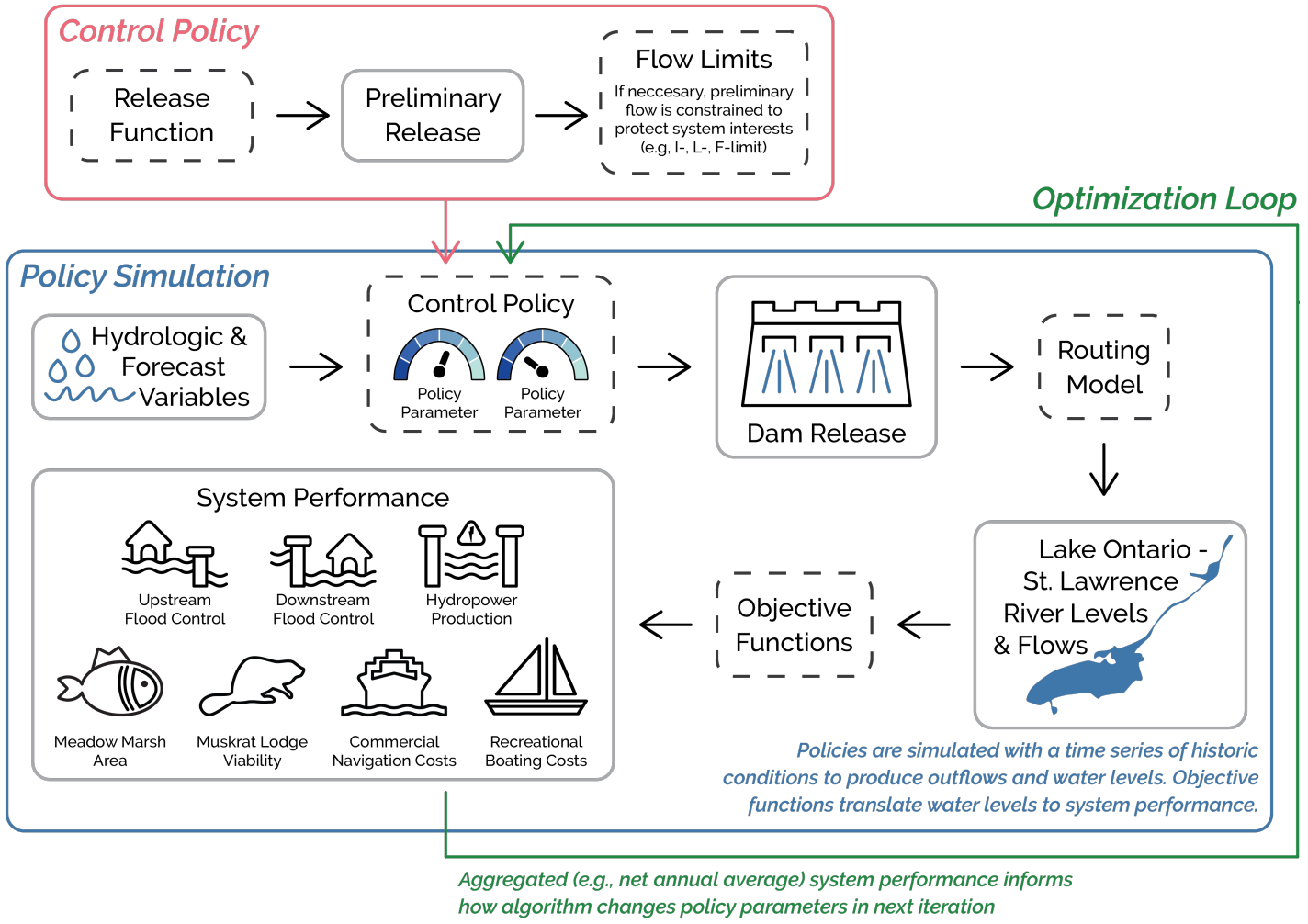
3 major components:

- Simulating a control policy
- Evaluating a control policy's performance
- Optimizing control policy parameters



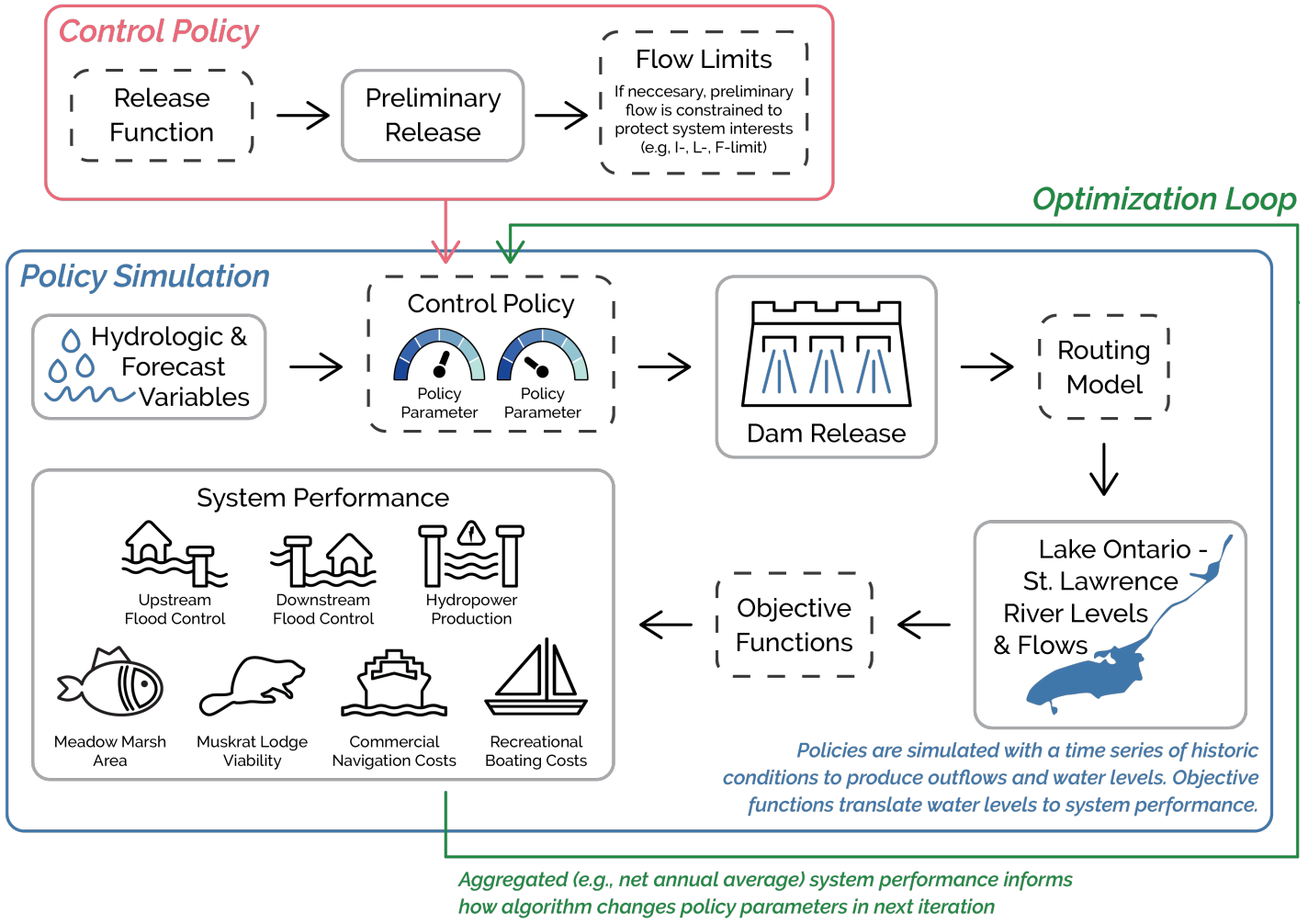
Simulating a control policy

- What is a control policy?
  - A **release function** calculates a preliminary outflow
  - Flow **limit function** adjusts the preliminary outflow (*if necessary*) and returns the final outflow
- Final outflow is **routed** through the system



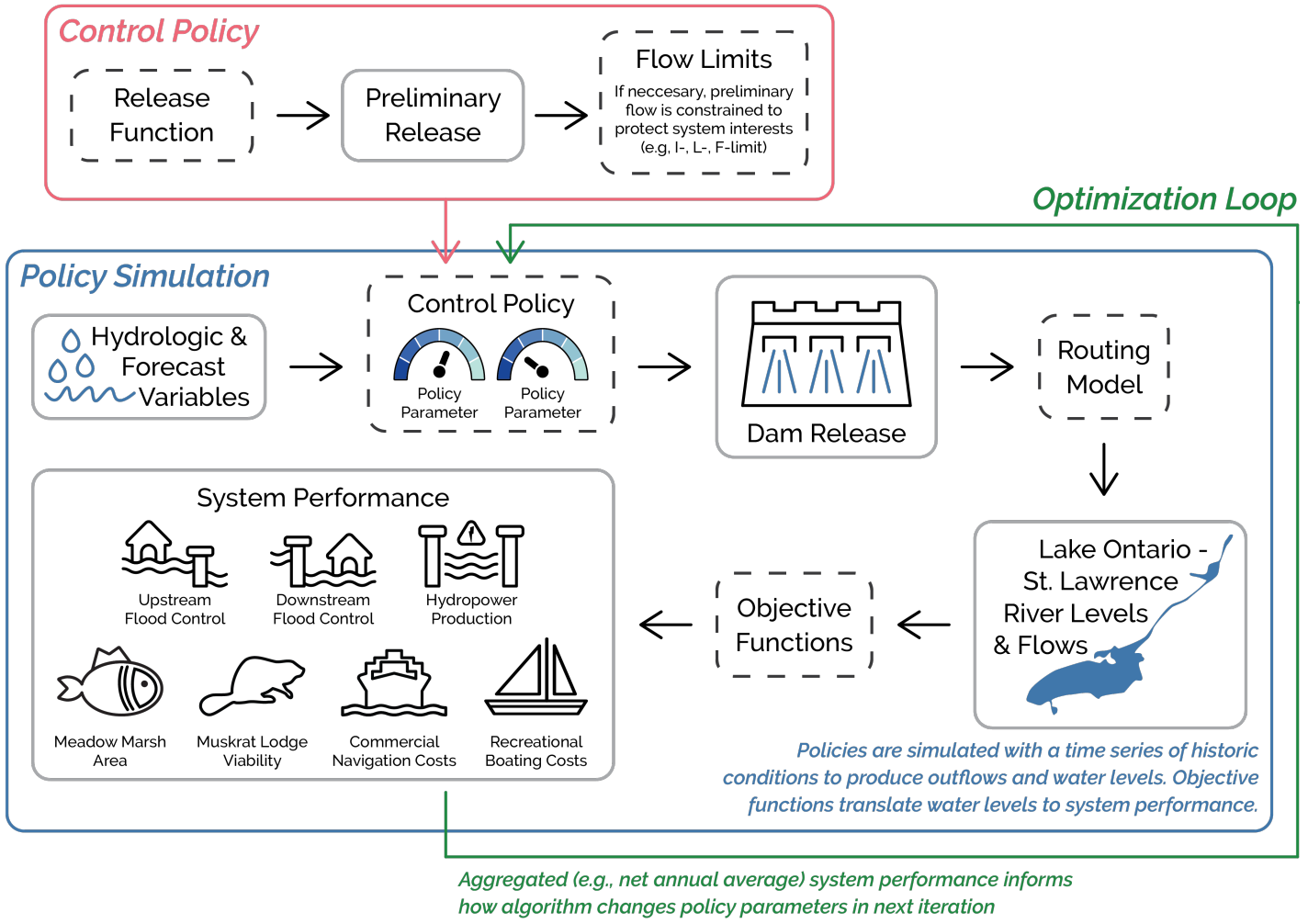
Evaluating a control policy's performance

- Control policy returns a time series of quarter-monthly water levels and flows
- Performance indicator models translate levels and flows into a **time series of system impacts**



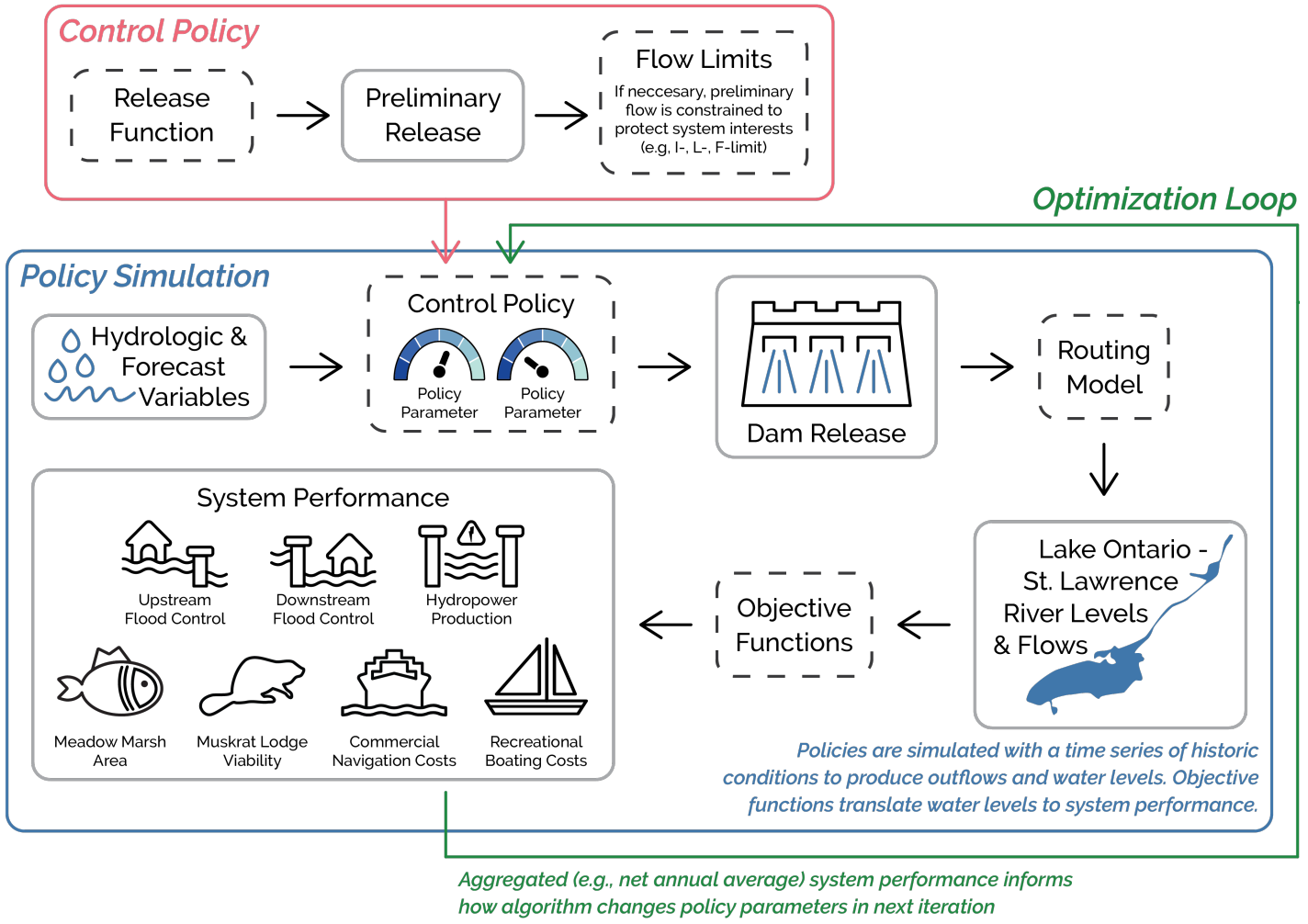
Optimizing control policy parameters

- The time series of system impacts is aggregated to the optimization algorithm
- For upstream flooding, the total number of homes flooded in each year is summed, then the average across all years is returned (i.e. **net annual average**)



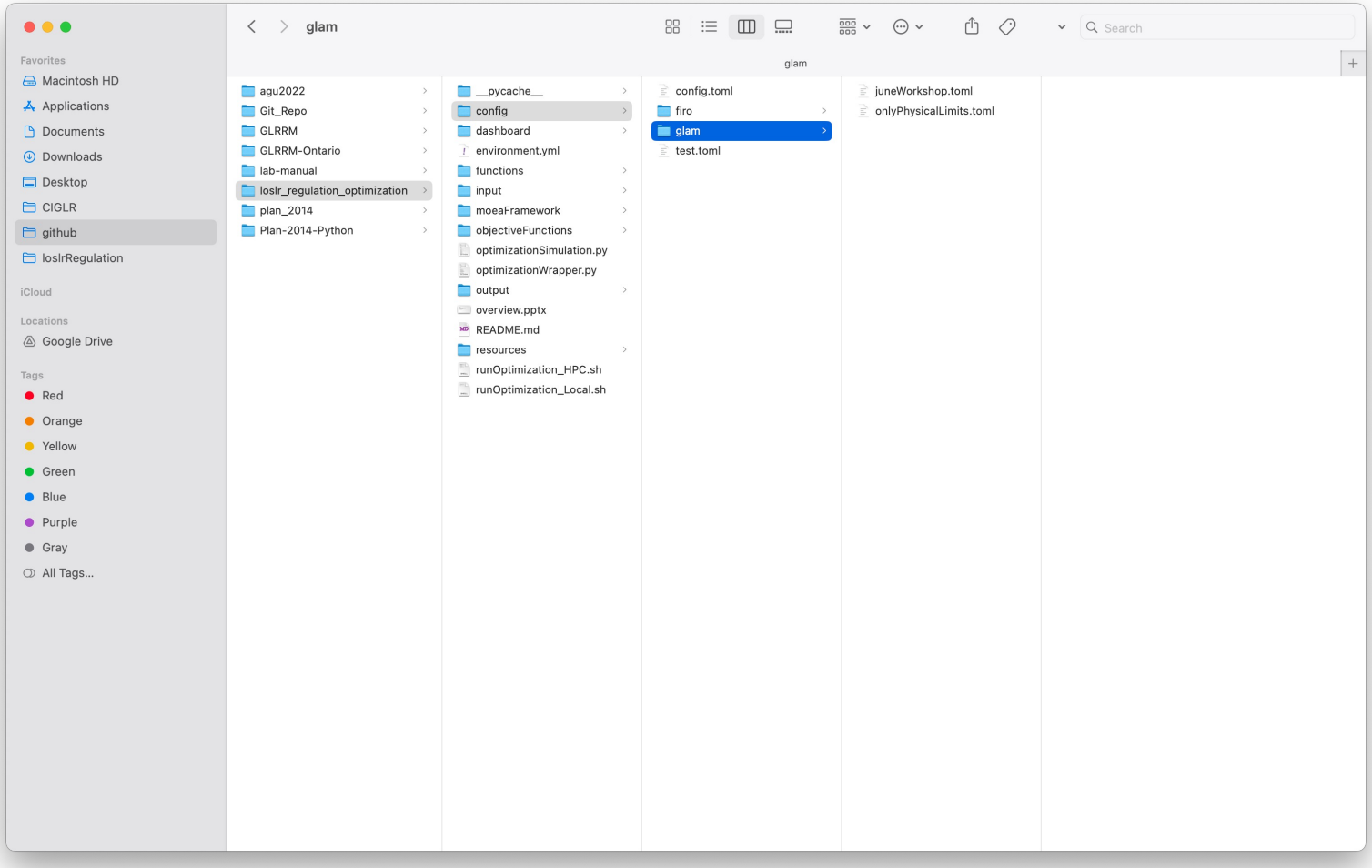
Optimizing control policy parameters

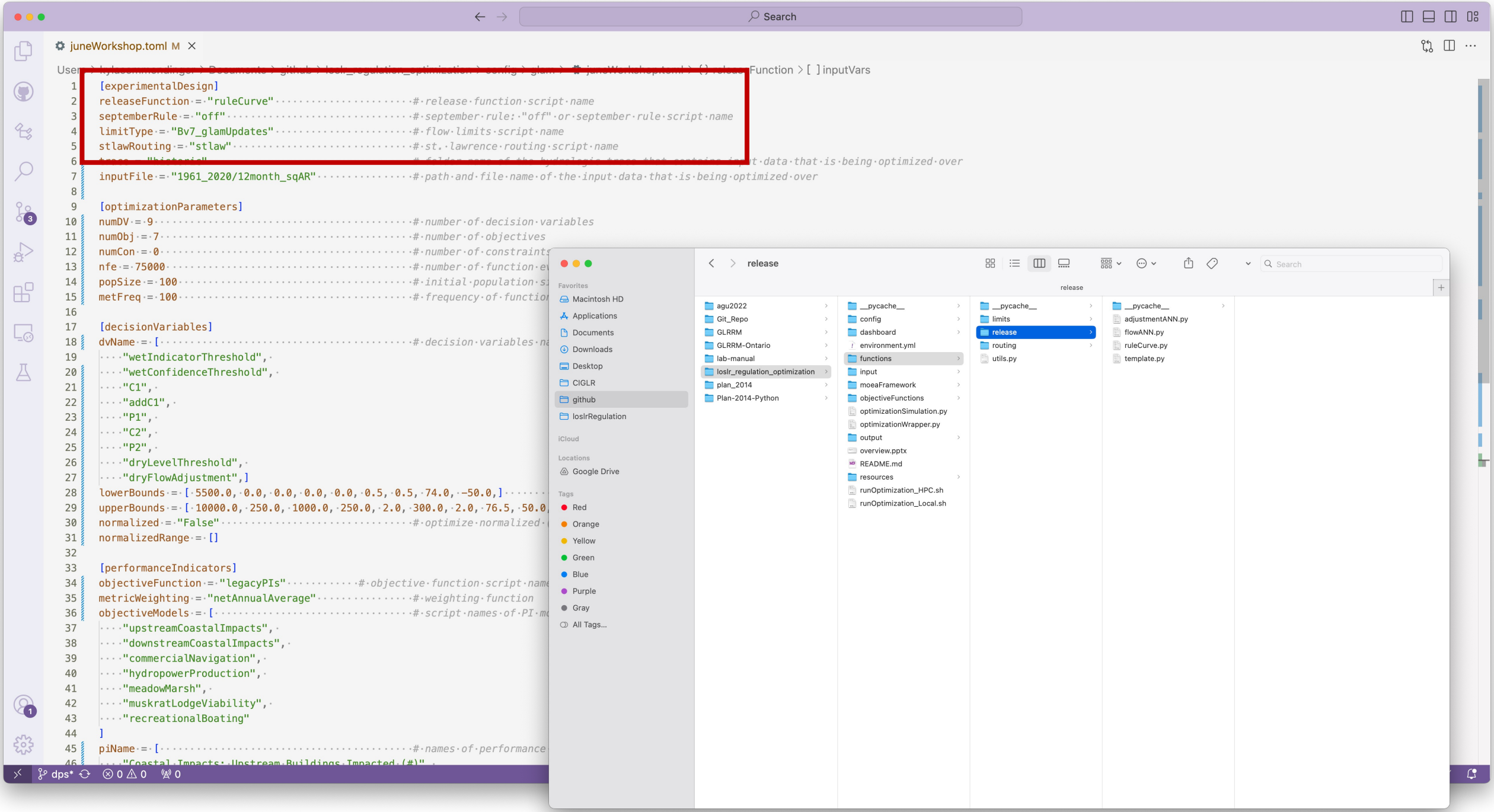
- Optimization algorithm sees 1 value for each objective
- Algorithm uses performance to inform how it changes the dials in the next iteration or function evaluation



Running an experiment:

- Configuration files setup the experiment and are written in TOML
  - Specify the release function, flow limit function, routing scheme, and objective functions
  - Setup the optimization parameters (e.g. number of function evaluations)

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flowANN.py
ruleCurve.py
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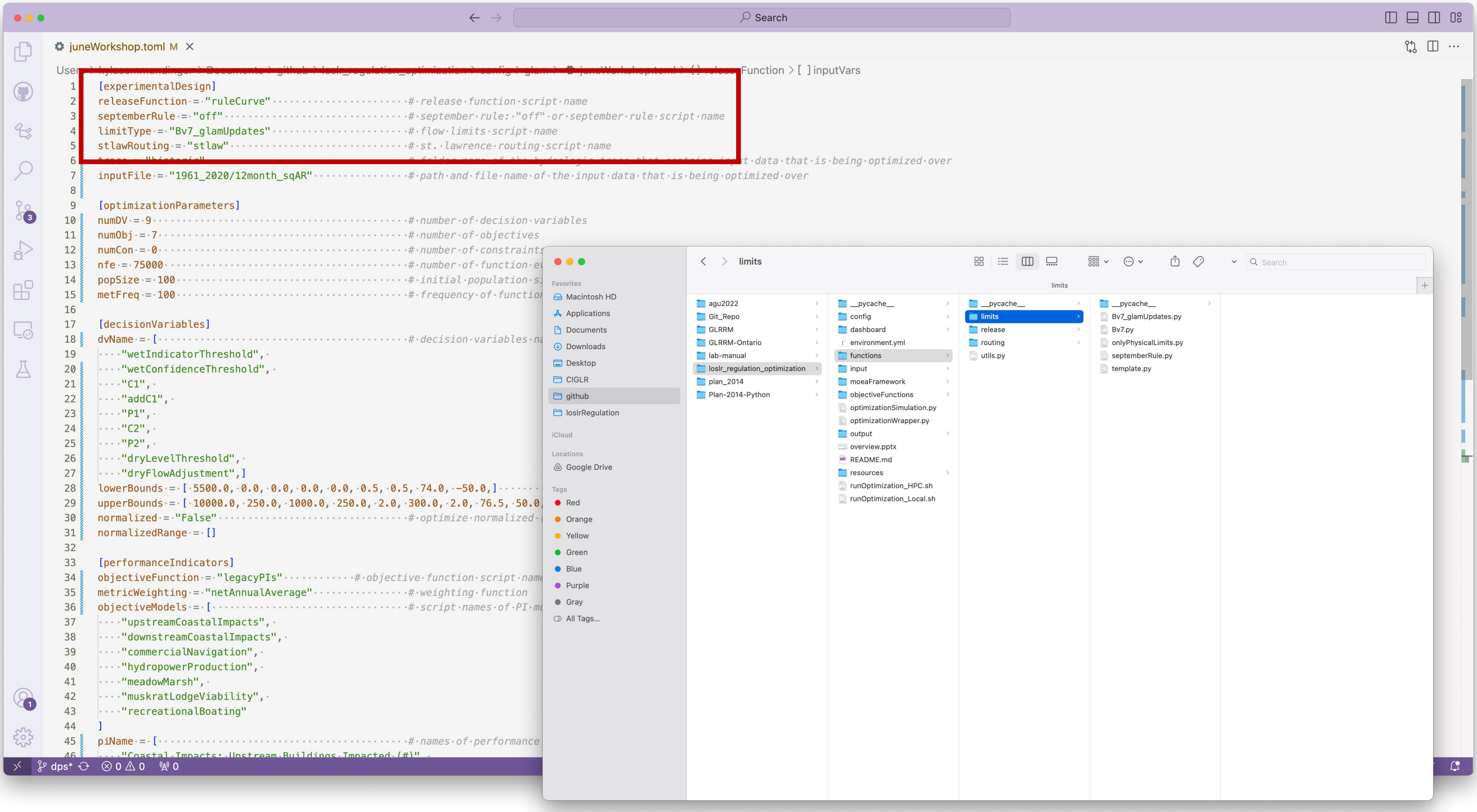
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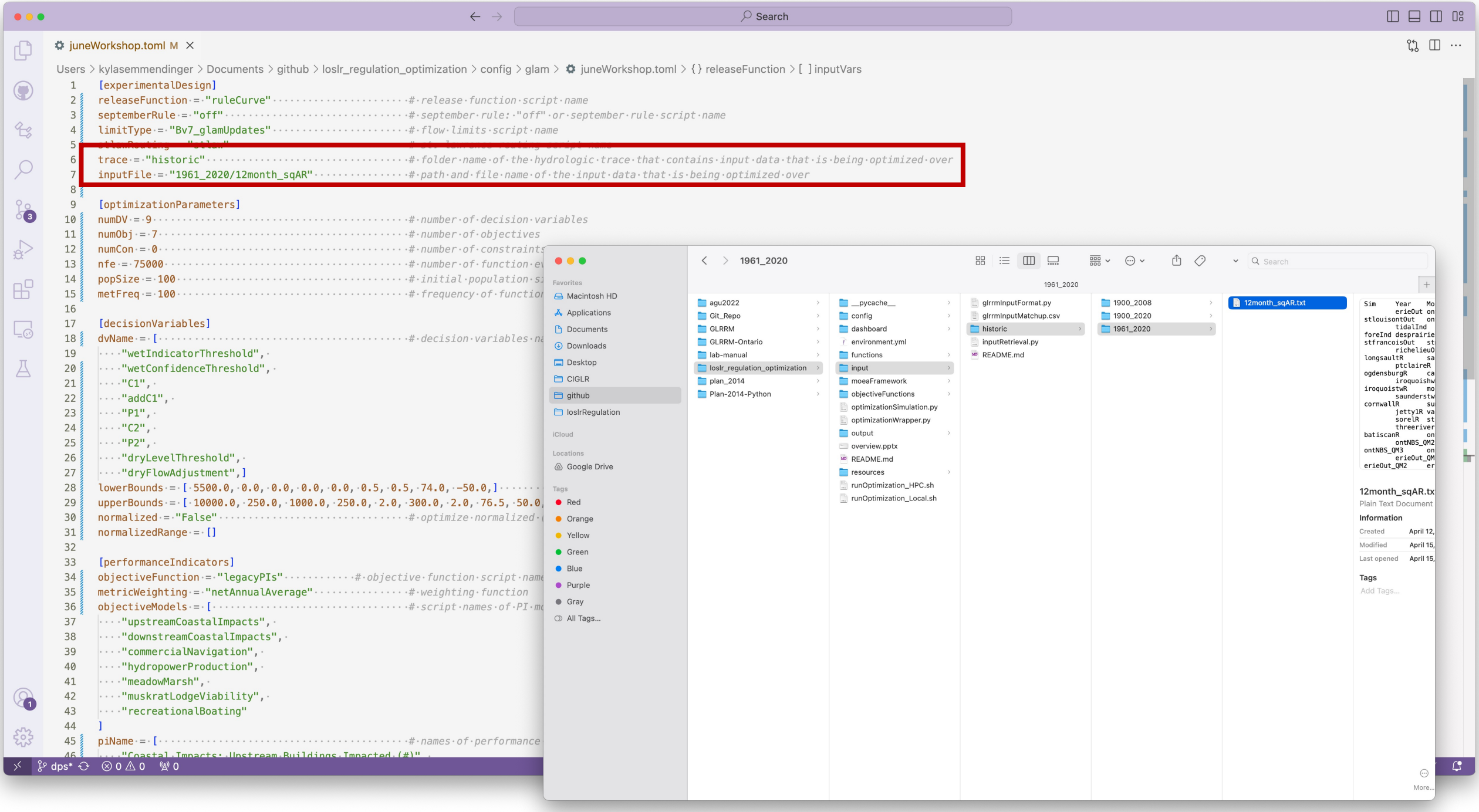
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Users > kylasemmendinger > Documents > github > loslr_regulation_optimization > config > glam > juneWorkshop.toml > { } releaseFunction > [ ] inputVars
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More...

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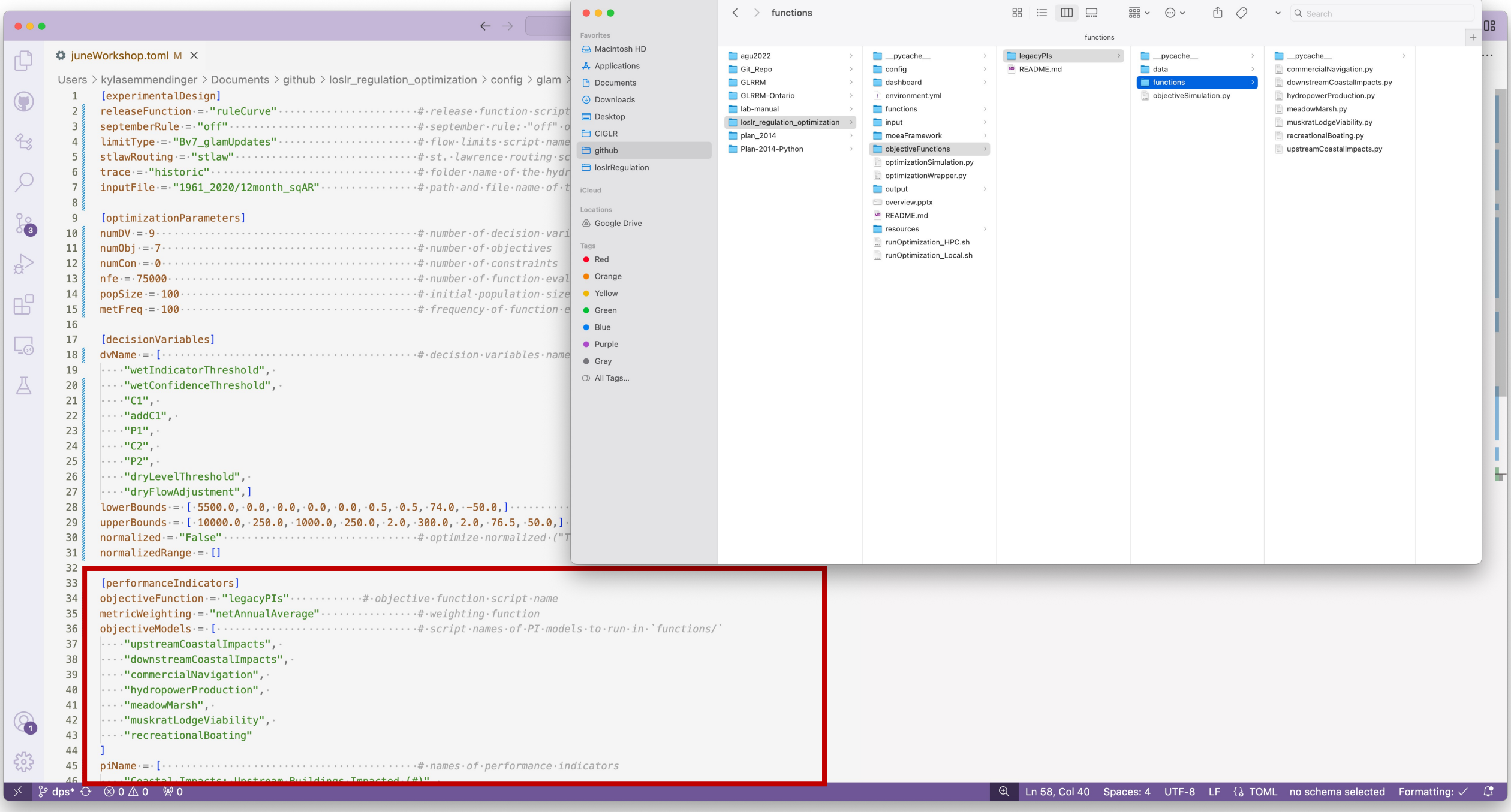
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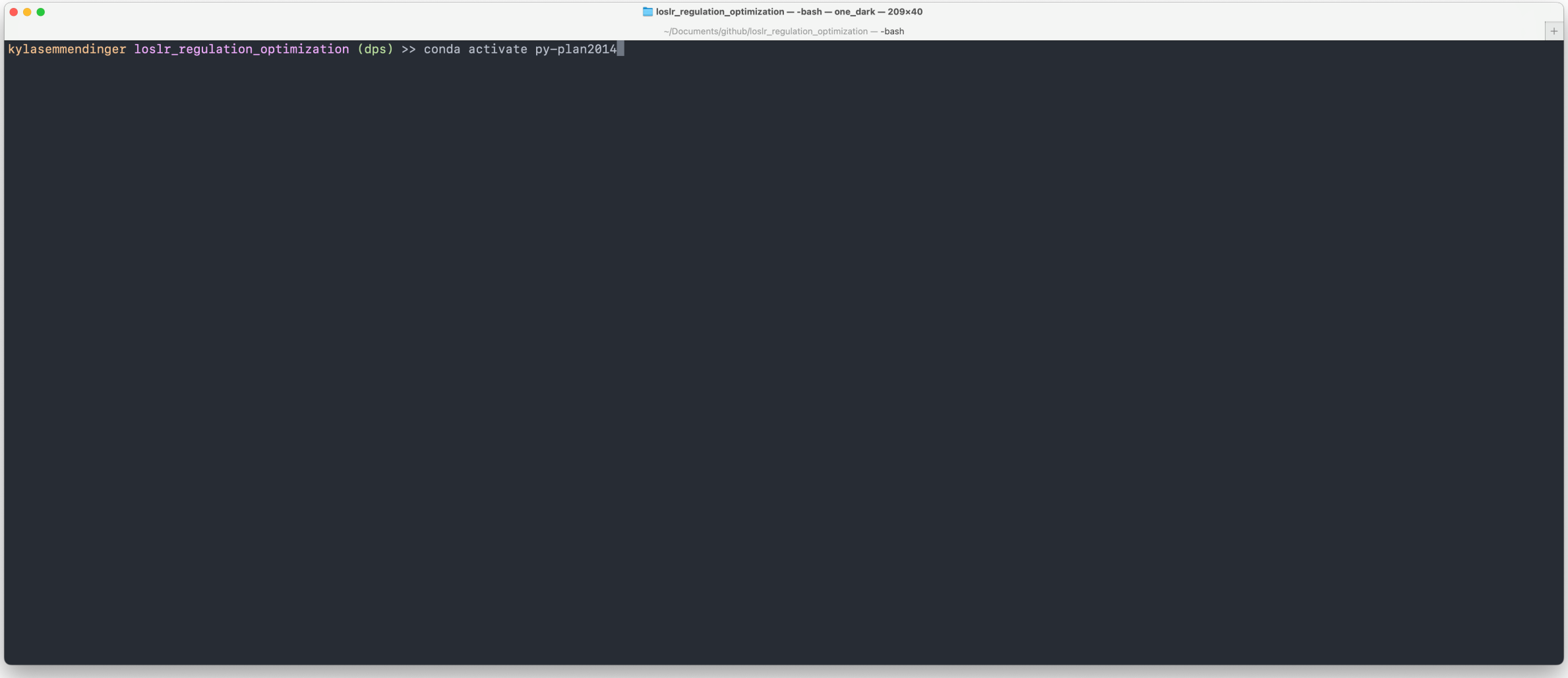
Running the optimization



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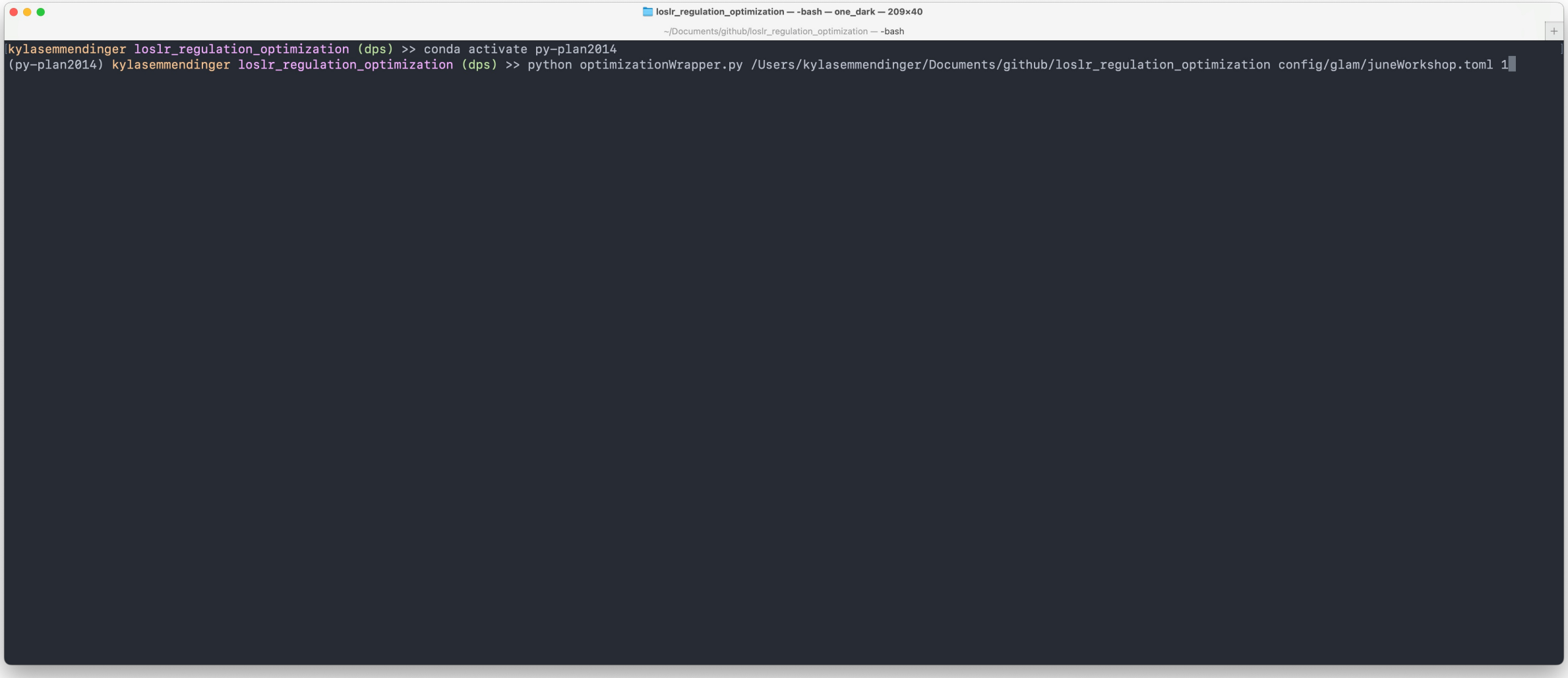

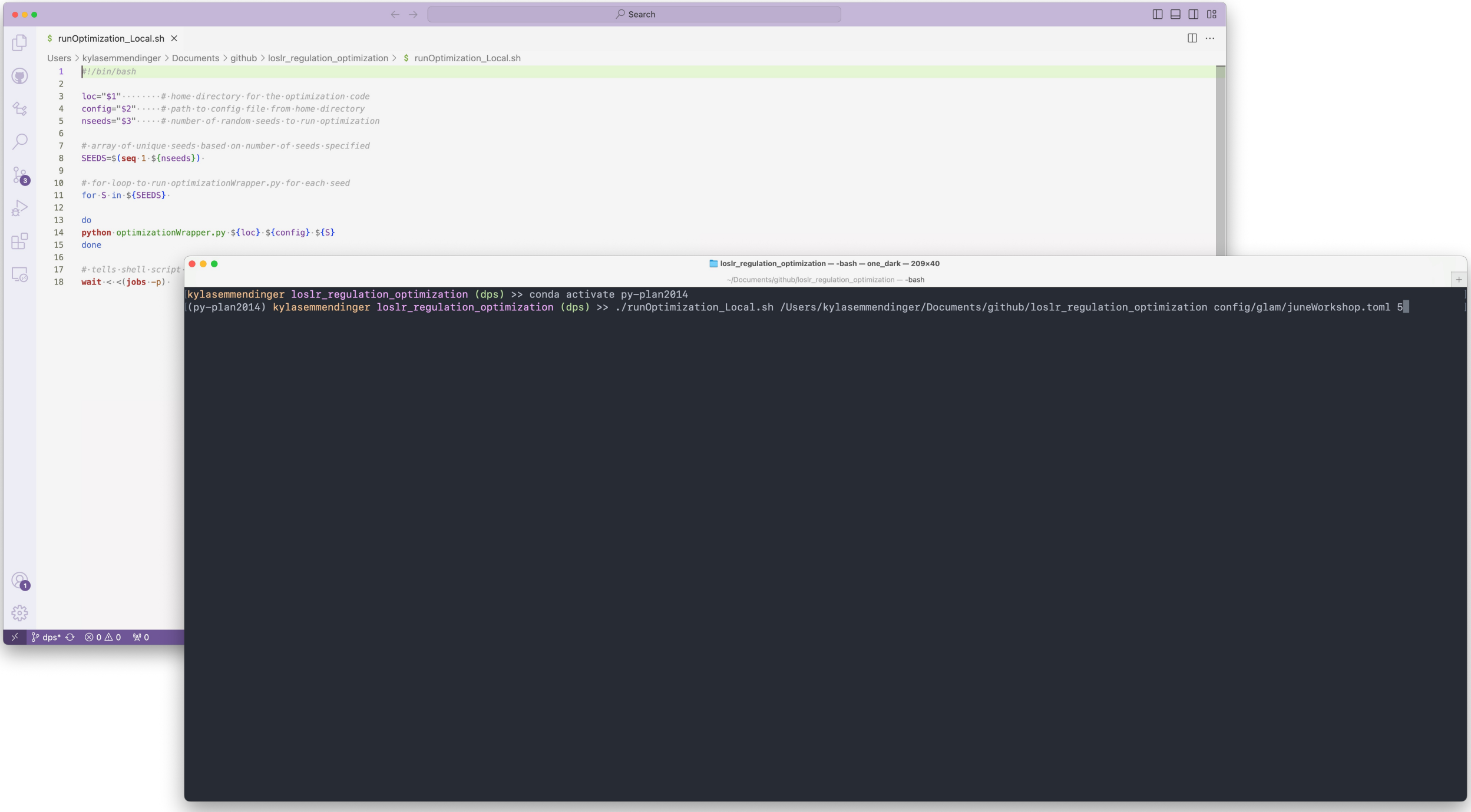
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runOptimization_Local.sh
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config="$2" #·path·to·config·file·from·home·directory
nseeds="$3" #·number·of·random·seeds·to·run·optimization
#·array·of·unique·seeds·based·on·number·of·seeds·specified
SEEDS=$(seq 1 ${nseeds})
#·for·loop·to·run·optimizationWrapper.py·for·each·seed
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do
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done
#·tells·shell·script
wait <(jobs -p)
dps*
0 0
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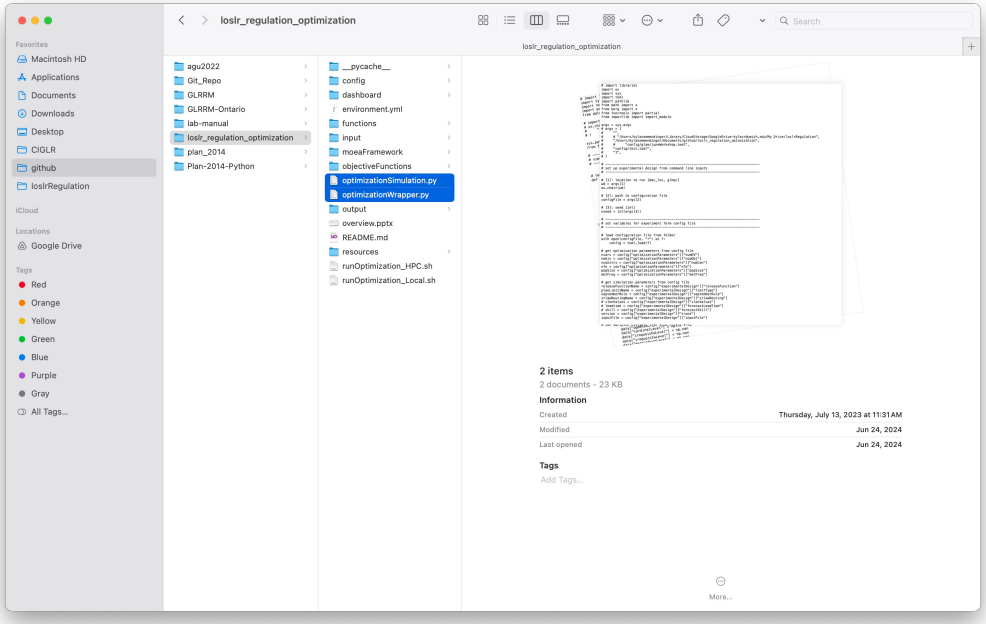
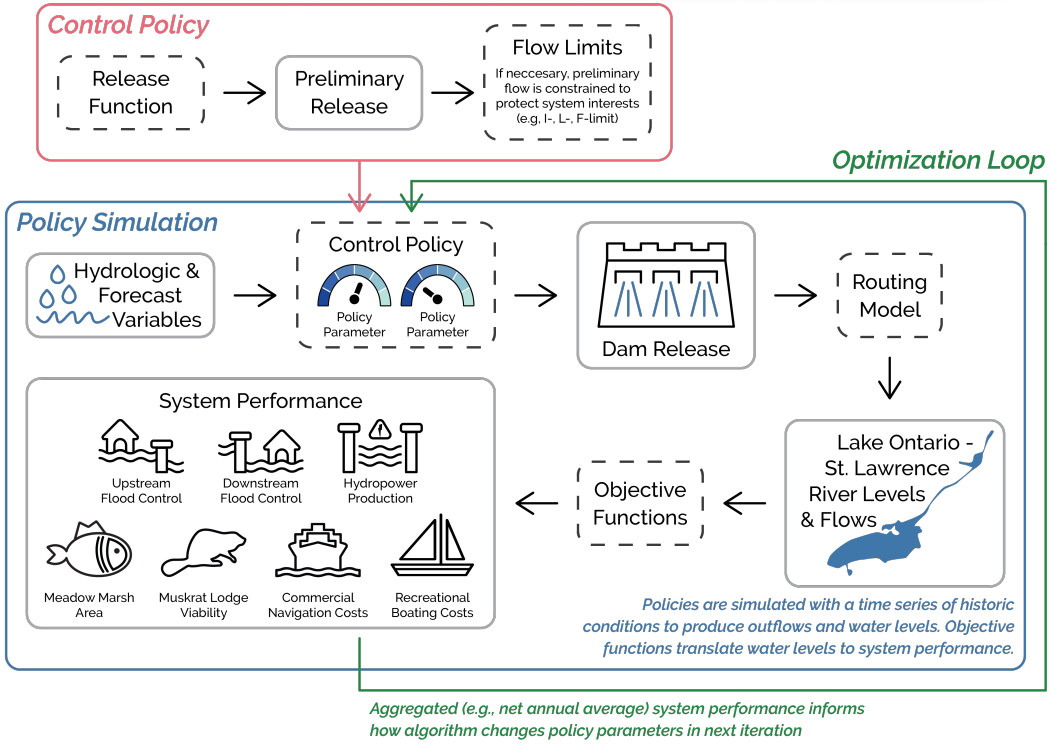
loslr_regulation_optimization — -bash — one_dark — 209×40
~/Documents/github/loslr_regulation_optimization — -bash
kylasemmendinger loslr_regulation_optimization (dps) >> conda activate py-plan2014
(py-plan2014) kylasemmendinger loslr_regulation_optimization (dps) >> ./runOptimization_Local.sh /Users/kylasemmendinger/Documents/github/loslr_regulation_optimization config/glam/juneWorkshop.toml 5

Main scripts

- `optimizationWrapper` sets up the experiment in Borg and calls `optimizationSimulation`
  - Green optimization loop
- `optimizationSimulation` simulates the time series of water levels and system impacts and returns aggregated metrics to Borg
  - Blue simulation loop
- Modules are defined in the `functions/` directory
  - Pink control policy loop (and routing)





Other things to note:

- Syntax might look funky… code has been optimized for speed!
- Have not tested on Windows
  - Pathing might be an issue, just be aware!
- Templates are included to help you write new functions
  - Required outputs are described in each function
- Setting up the many-objective evolutionary algorithm, Borg
  - Documentation is linked in the repo
- Compiling the MOEAFramework (to calculate Borg metrics)
  - Documentation is linked in the repo