CAPRI Introduction

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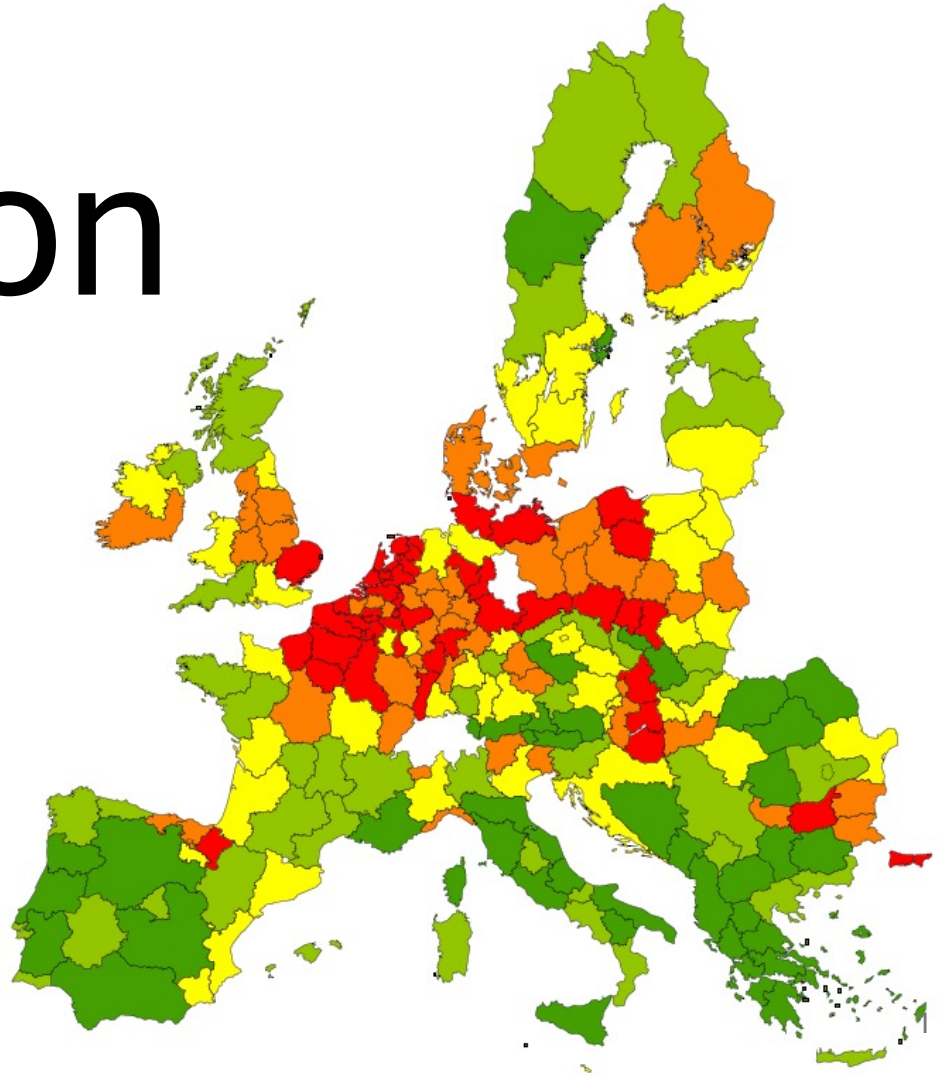


1. Setting up the System

More information in CAPRI Modelling System Documentation (Britz. 2014):
https://www.capri-model.org/lib/exe/fetch.php?media=docs:capri-documentation.pdf

Outline

- **Setting up the System**
- **Structure of CAPRI**
- **CAPRI Graphical User Interface (GUI)**
  - Start the GUI
  - Adjust the settings
  - Tasks in the GUI
- **Running Your First Simulation**
  - Scenario Settings
  - Run a Policy Scenario
  - Run a Policy Reform Scenario
  - Run Scenarios Without the Market Model

CAPRI Environment Setup Guide using a zip(tar) file from the stick

This guide walks you through setting up the CAPRI environment using Docker and connecting to it via Visual Studio Code. Before you begin, ensure **Docker Desktop** is installed. **Windows users** may need to restart after installation or even install updates. (how to see also Link – Option B)

01

Check Your System & Download the Correct Image

CAPRI Docker images come in two versions — download the one matching your processor:

- **Mac:** Apple menu → About This Mac → Chip/Processor. "Intel" = AMD64; "Apple M1/M2/M3/M4" = ARM64.
- **Windows:** Start → System Information → System Type. "x64-based PC" = AMD64 (most common); "ARM64-based PC" = ARM64.
- **Linux:** Run uname -m in Terminal. x86_64 = AMD64; aarch64 = ARM64.

Copy the correct file: capri_v8-arm64.tar (ARM64) or capri_v8-amd64.tar (AMD64) from the stick.

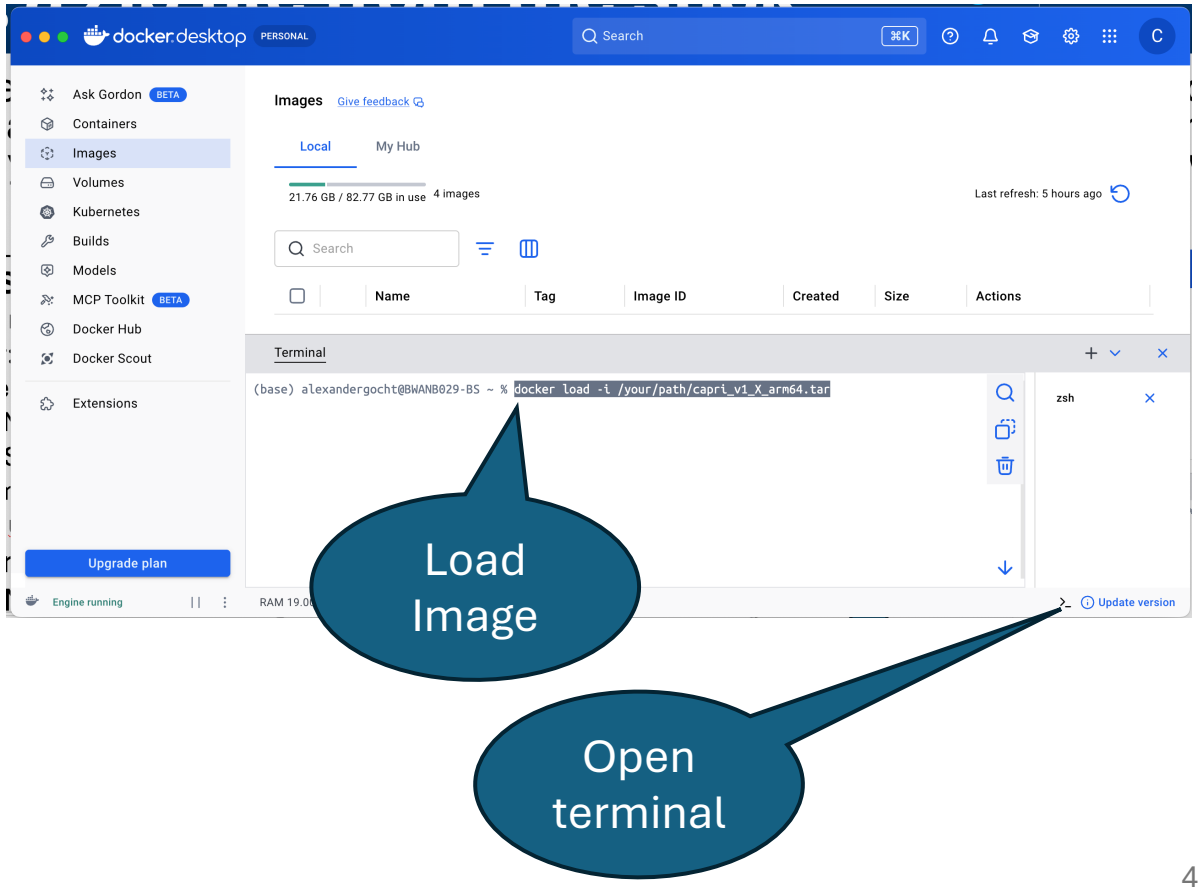
02

Load the Docker Image

Open your terminal (Command Prompt/PowerShell on Windows; Terminal on Mac/Linux) and run the appropriate command, replacing /your/path/ with the actual folder where you saved the file:

- **AMD64:** docker load -i /your/path/capri_v1_X_amd64.tar
- **ARM64:** docker load -i /your/path/capri_v1_X_arm64.tar

Press Enter. This may take a few minutes. On success, the terminal will confirm: Loaded image: capri_v1_X_XXX64 X=use the highest number



CAPRI Environment Setup Guide using a zip file from the stick

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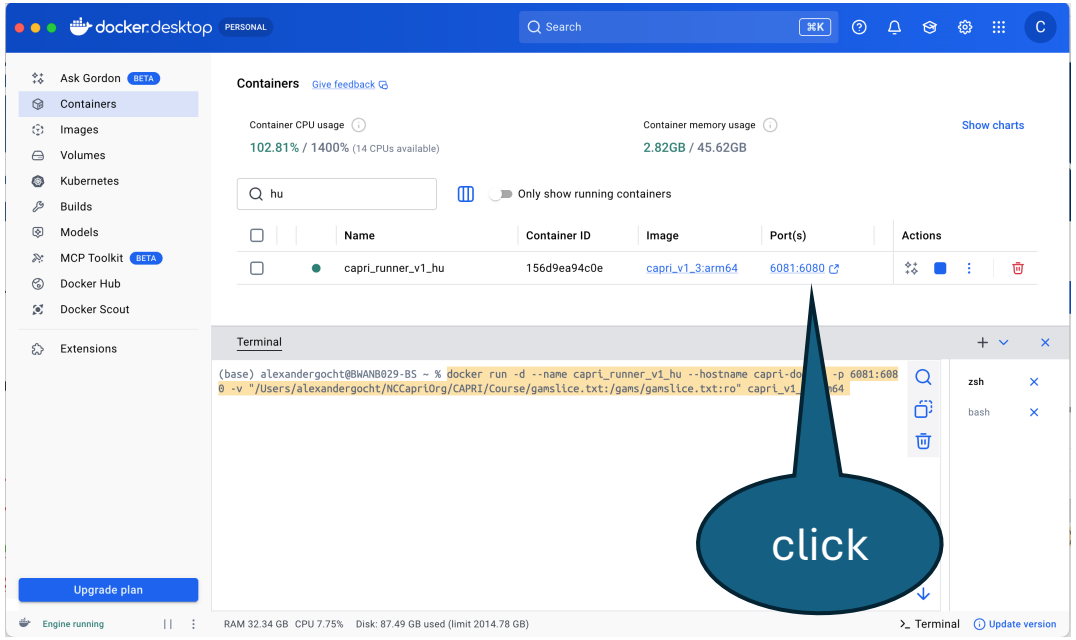
Either open Docker Desktop and navigate to terminal (see slide before).
Click Run to launch the container. Link the license file.
Run the image by

```
docker run -d --name capri_runner_v1 --hostname capri-docker -p 6080:6080 -v "/Users/alexandergocht/NCCapriOrg/CAPRI/Course/gamslice.txt :/gams/gamslice.txt:ro" capri_v1_3:amd/arm64
```

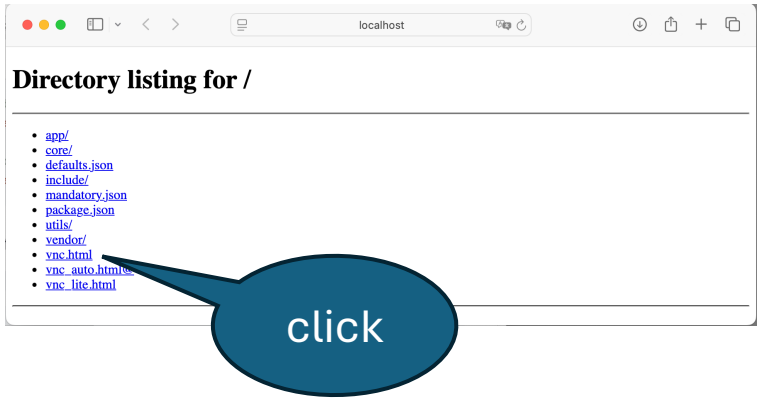


04

Access the CAPRI GUI. Open any web browser (Chrome, Firefox, Safari) and navigate to:

http://localhost:6080/vnc.html and click on vnc.html

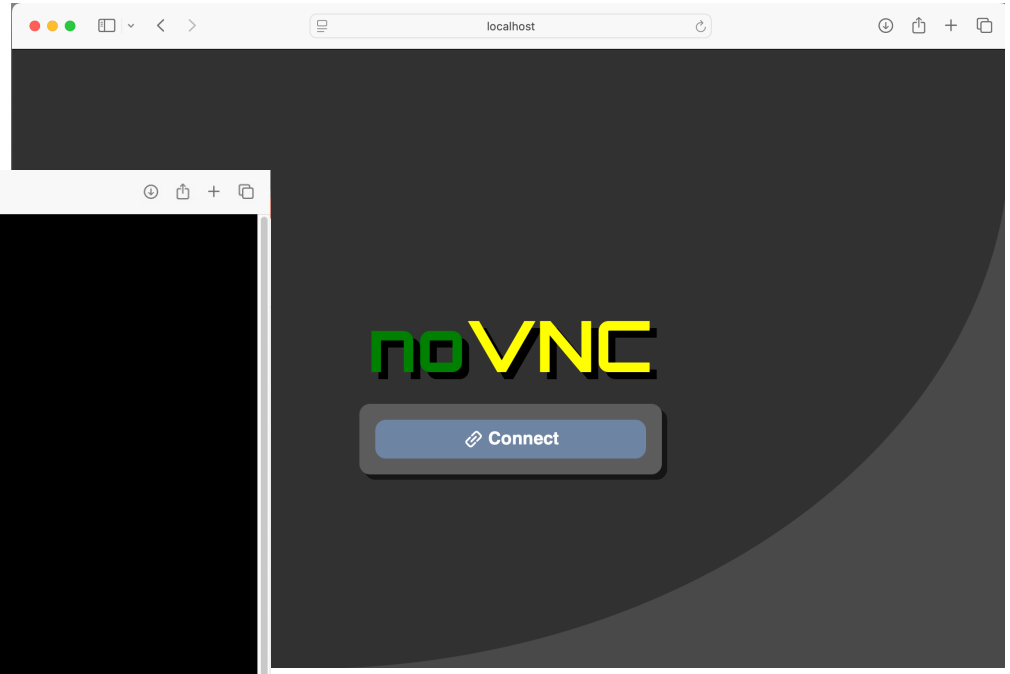
The CAPRI Graphical User Interface will load in your browser, and you are ready to use the software.

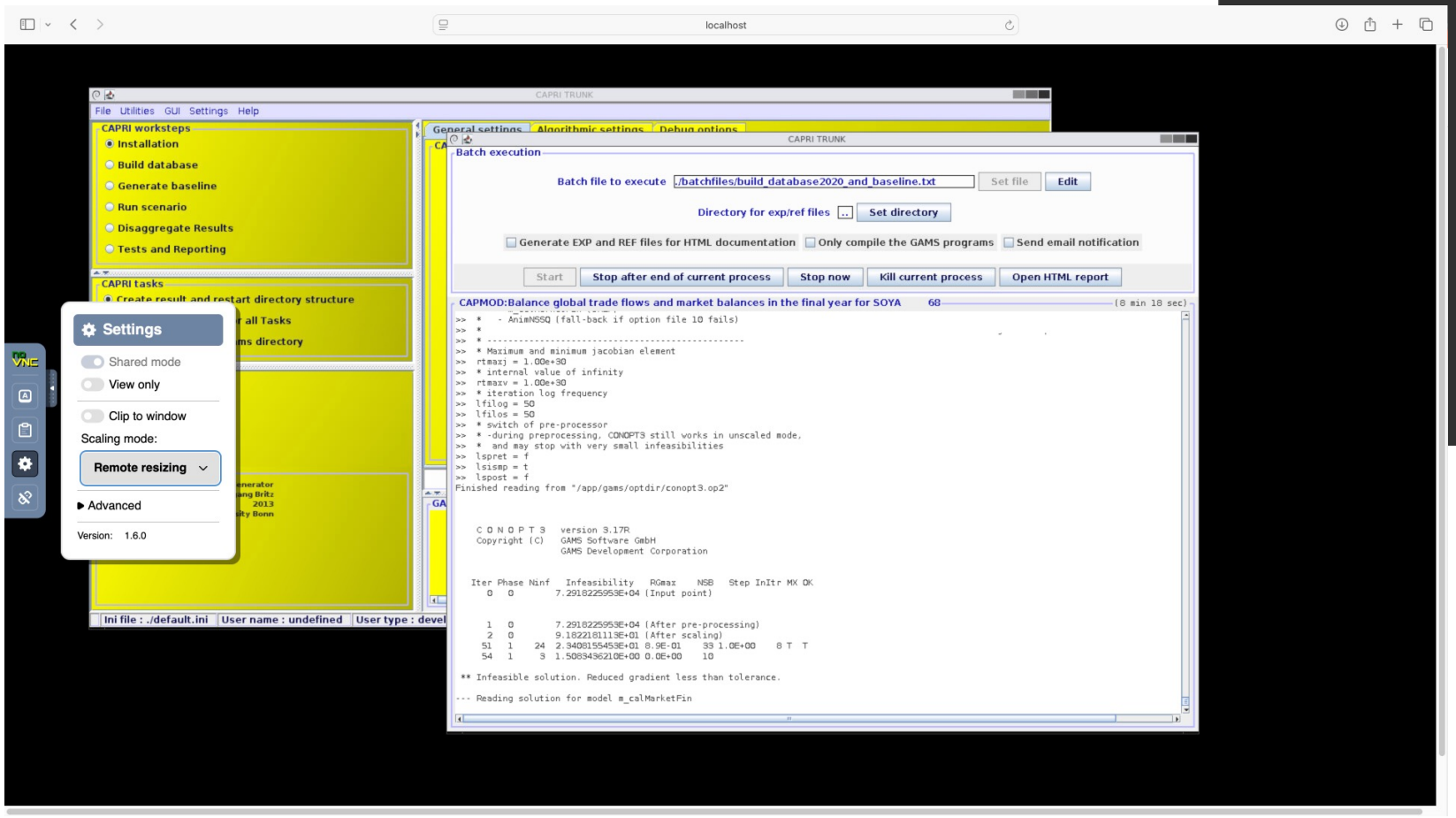


CAPRI Environment Setup Guide using a zip file from the stick

05

Click on Connect, and you should see a batch execution form and the yellow CAPRI Graphical User Interface (GUI)

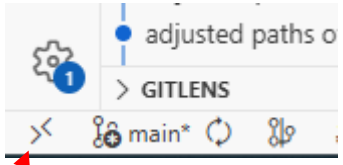




Editing Files with Visual Studio Code

To comfortably view, edit, and save project files inside the running CAPRI environment, connect VS Code directly to the Docker container using the **Dev Containers** extension.

1	2	3
Prepare VS Code Ensure **Visual Studio Code** is installed and open it. Look for the green >< icon in the **very bottom-left corner** of the VS Code window (Open a Remote Window) and click it. From the menu that appears at the top, select **Attach to Running Container**.	**Connect to the CAPRI Container** After clicking **Attach to Running Container**, a list of your active Docker containers will appear. Select the CAPRI container — it typically has a randomly generated name (e.g., focused_turing) next to the capri_v8 image name. A new VS Code window will open, connected directly to the inside of your Docker container.	**Open Your Working Directory** In the new VS Code window, click **Open Folder** in the Explorer pane (or go to **File → Open Folder**). Type /app/ into the path bar and click **OK**. All your project files will appear on the left side of the screen.



Important Note on Saving Your Work: Changes saved in VS Code are saved *inside the running container* and are persistent as long as you use that specific container. However, they do not alter the original .tar image file downloaded in Part 1. Back up your up your /app/ directory contents if you plan to delete the container entirely.

2. Structure of CAPRI

More information in CAPRI Modelling System Documentation (Britz. 2014):
https://www.capri-model.org/lib/exe/fetch.php?media=docs:capri-documentation.pdf

Outline: Structure of CAPRI

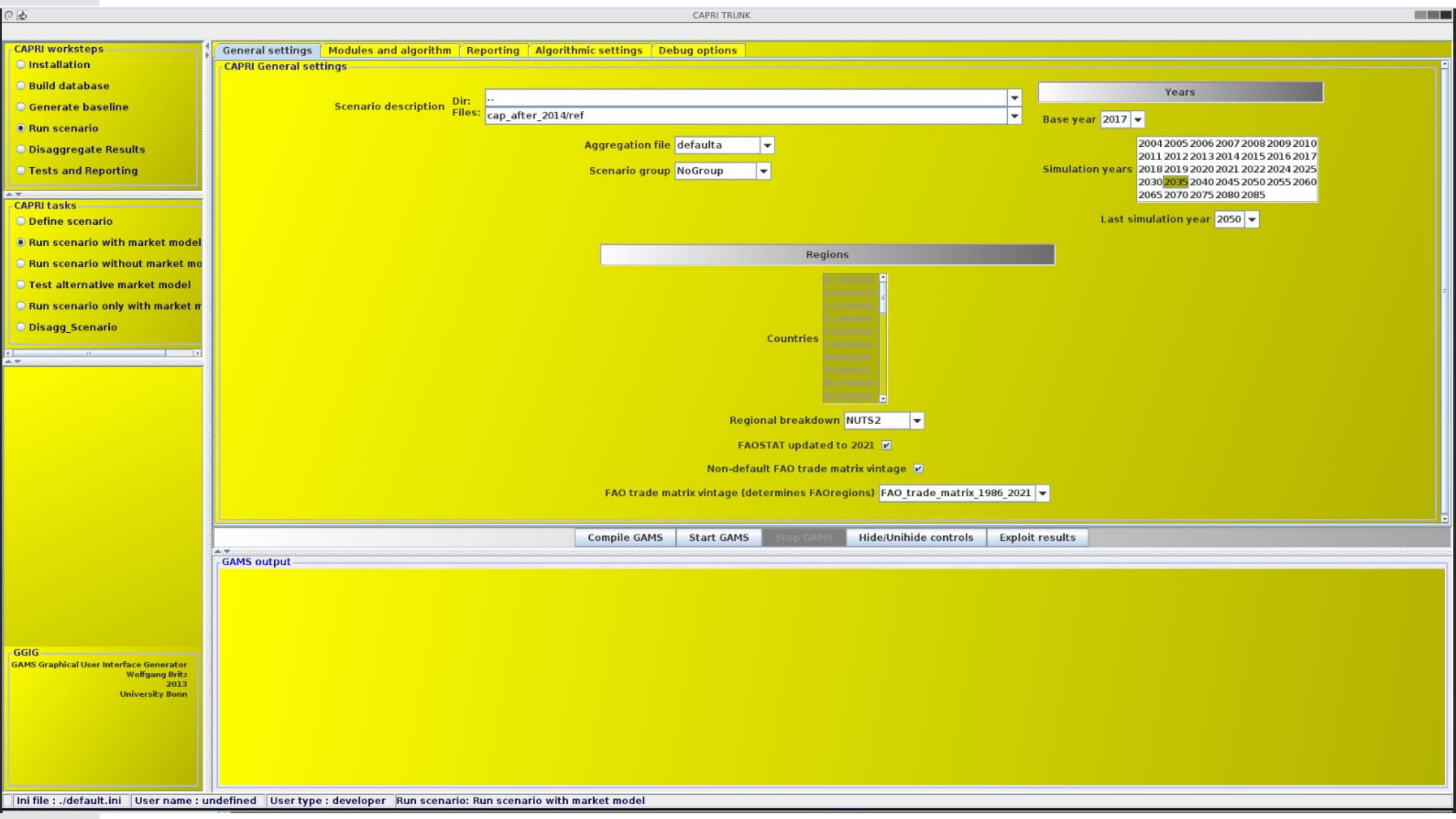
A. Technical implementation

B. Physical organization of files and folders

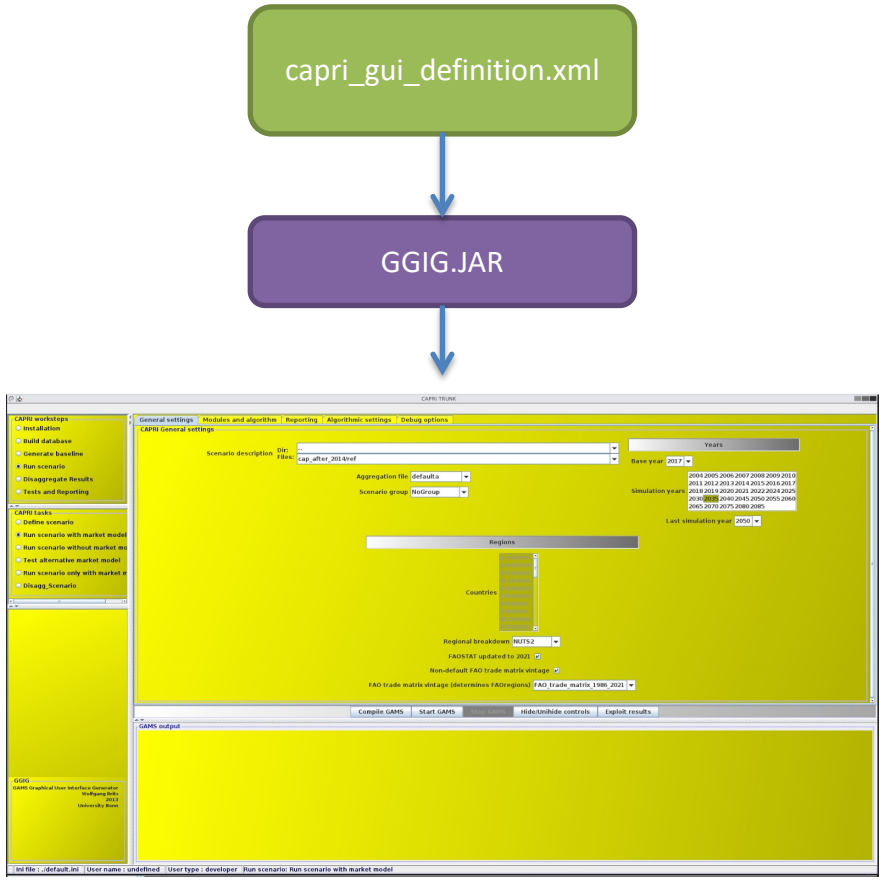
C. Logical organization of CAPMOD.gms

D. Exercises

(… and NOT how the economic model is structured in terms of equations and variables)

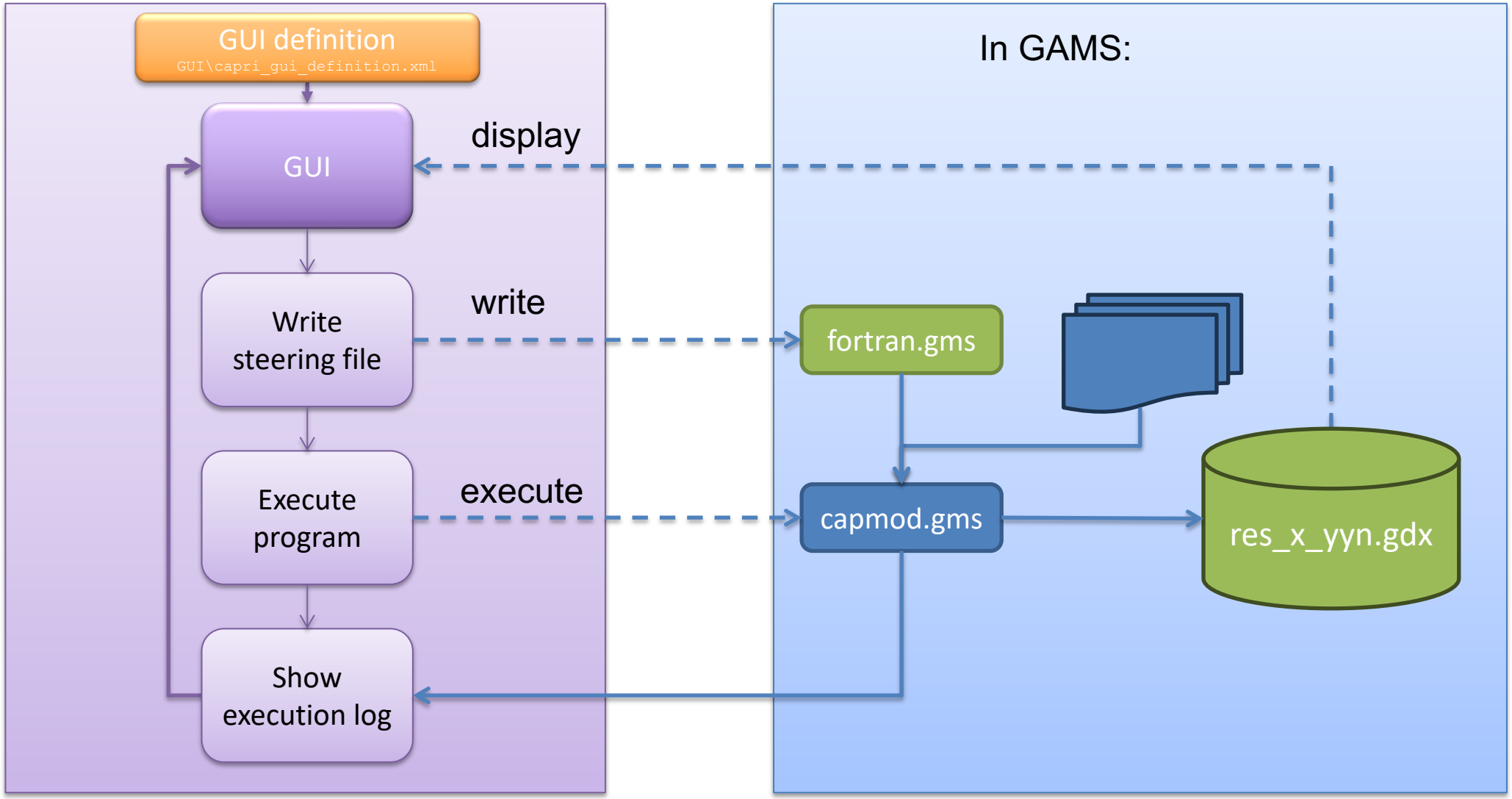

CAPRI TRUNK
CAPRI worksteps
Installation
Build database
Generate baseline
Run scenario
Disaggregate Results
Tests and Reporting
CAPRI tasks
Define scenario
Run scenario with market model
Run scenario without market mo
Test alternative market model
Run scenario only with market m
Disagg_Scenario
GGIG
GAMS Graphical User Interface Generator
Wolfgang Britz
2013
University Bonn
General settings
Modules and algorithm
Reporting
Algorithmic settings
Debug options
CAPRI General settings
Scenario description
Dir: ..
Files: cap_after_2014/ref
Aggregation file defaulta
Scenario group NoGroup
Years
Base year 2017
Simulation years 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2024 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075 2080 2085
Last simulation year 2050
Regions
Countries
Regional breakdown NUTS2
FAOSTAT updated to 2021
Non-default FAO trade matrix vintage
FAO trade matrix vintage (determines FAOregions) FAO_trade_matrix_1986_2021
Compile GAMS
Start GAMS
Stop GAMS
Hide/Unihide controls
Exploit results
GAMS output
Ini file : ./default.ini
User name : undefined
User type : developer
Run scenario: Run scenario with market model

Generating a GUI

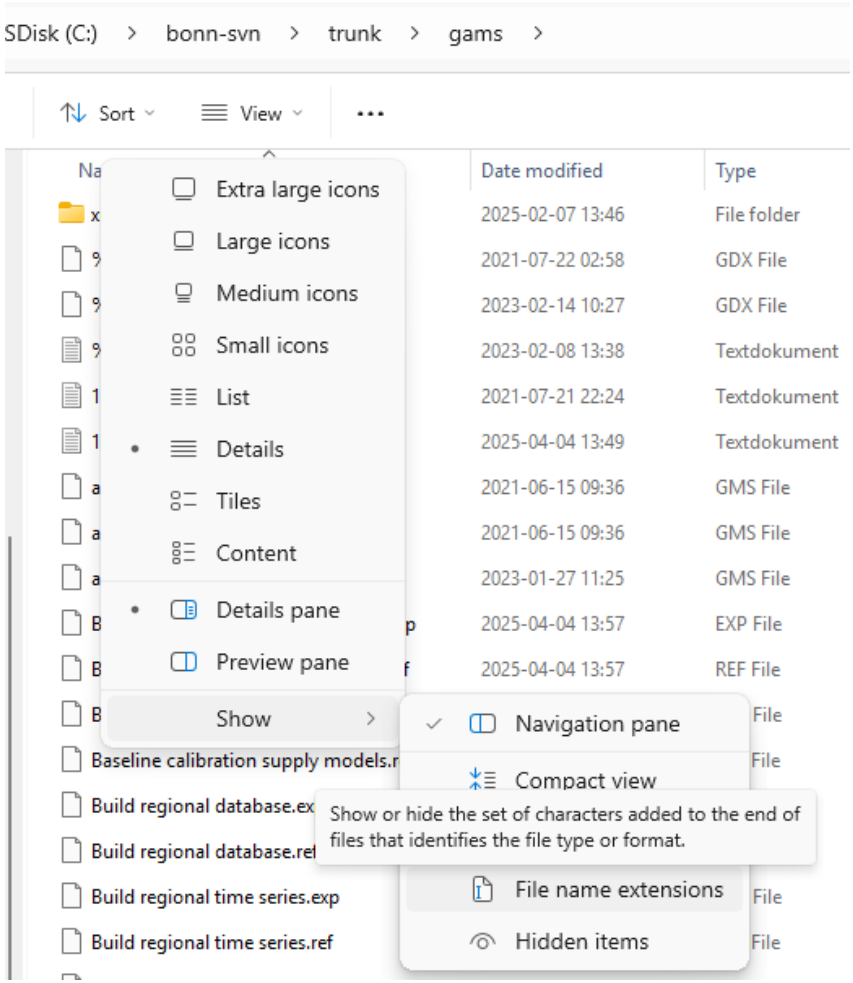


- The GUI is generic
- XML-files define
  - Controls to display
  - Programs to run
  - Reports (views)
- This ”is” not CAPRI
- It is difficult to use CAPRI without it!
- The engine under the hood is a set of GAMS programs

Executing GAMS from the GUI

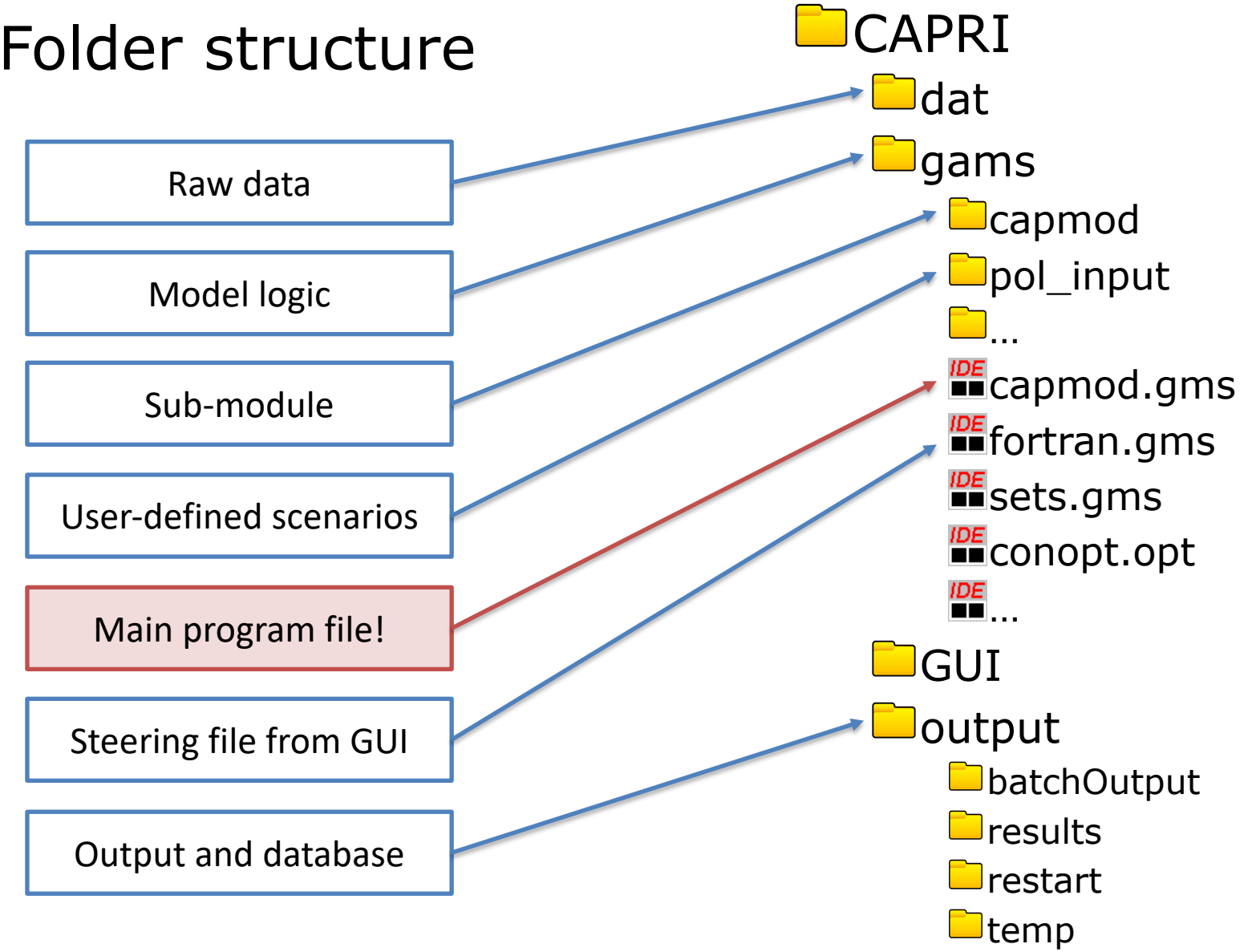


File types

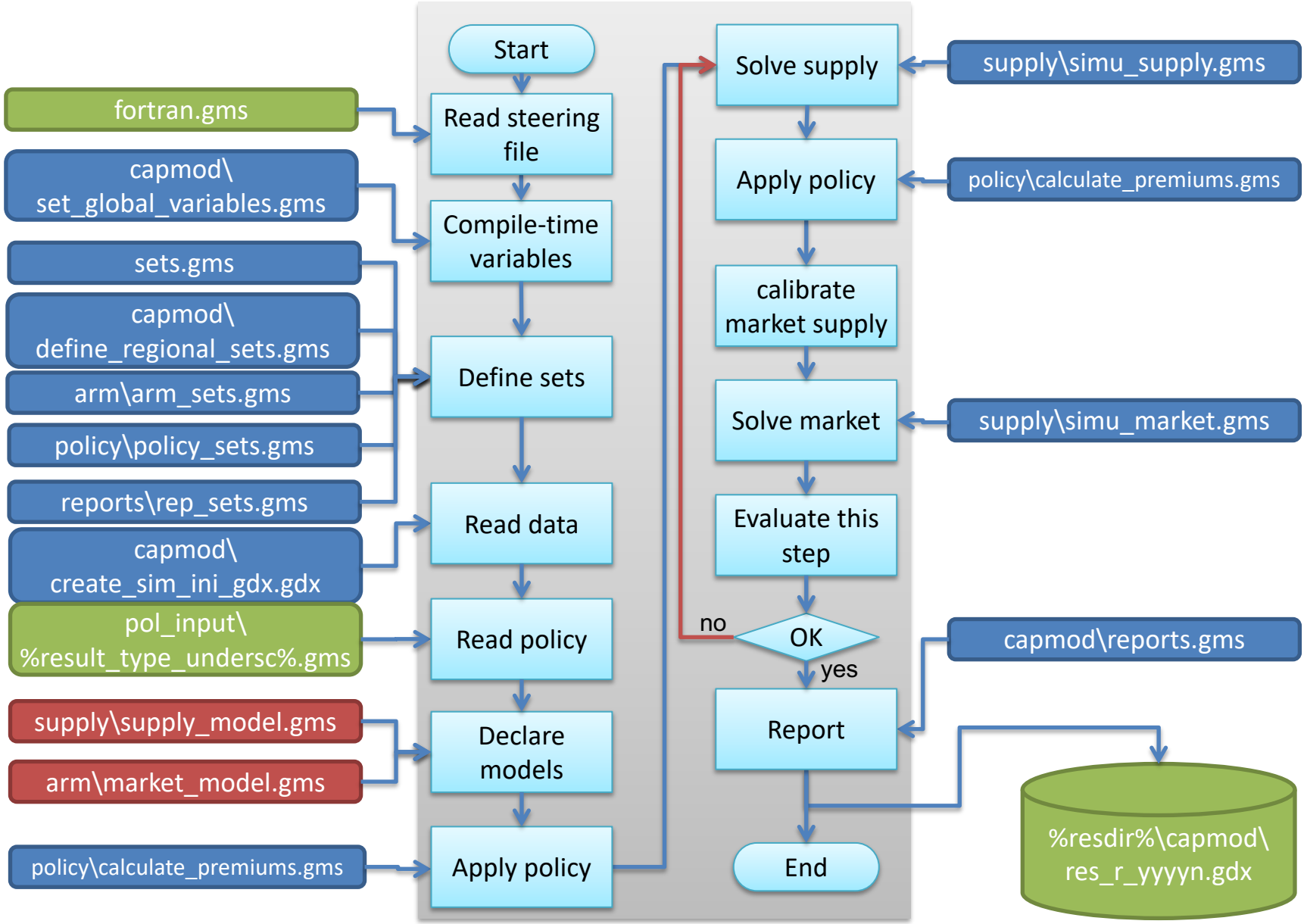


File suffix	Content type
.GMS	Model code in the language GAMS. Plain text file.
.GDX	Gams Data eXchange. Input or output data for GAMS. Binary file.
.LST	Program log from GAMS, containing compilation information and some program output.
.OPT	GAMS file that contains instructions (OPTions) for the model solver(s). Variations op1, op2, …
.XML	Extended Markup language. Textfiles with instructions for the GUI.
.XLSX	Microsoft Excel files. Some raw data comes in this format.
.PDF	Portable Document Format. Mostly model documentation.
.BAT, .CMD	Windows command files, used to execute pre-defined windows commands
…	GAMS internal .ref, .exp, .lxi, .log, …

Folder structure



Program flow of CAPMOD.gms



Exercise 1: Open and inspect sets.gms

sets.gms contains the definitions of many set elements in CAPRI. It is a good place to look if you wonder what some abbreviation means.

a) Open *"sets.gms"* and find out what the set element " "UVAG" means.

_____

b) Find at least three sets where this element is a member.

_____

_____

_____

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Exercise 2: Locating and inspecting the iteration loop in capmod.gms

a) Find the places where the iteration loop starts and ends in capmod.gms
   a) Start line nr: _____
   b) End line nr: _____

b) In which line is simu_supply included?
   Answer: _____

c) In which line is simu_market included?
   Answer: _____

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Exercise 3: The GUI definition files

Check what GUI does when running a scenario:

a) Open ”capri_gui_definition.xml” (use a text editor)
b) Search for ”<name>Run scenario without market”
c) Also check the value of ”<gamsFile>” _____
d) Also check the value of ”<incfile>” _____
e) Also check the value of ”<resdir>” _____
f) Look a few lines below at ”<gdxSymbol>” _____

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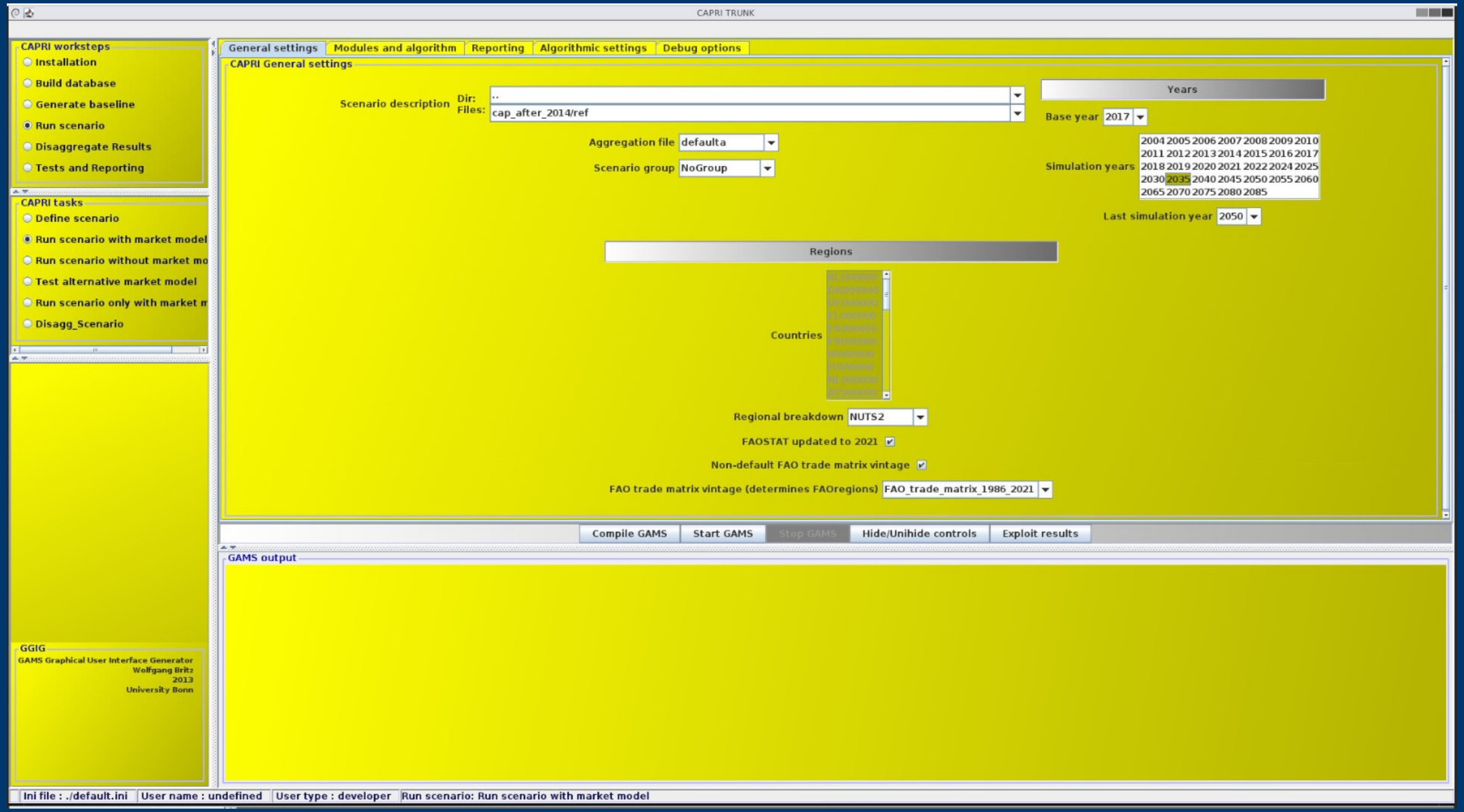
3. CAPRI Graphical User Interface (GUI)

More information in CAPRI Modelling System Documentation (Britz. 2014):
https://www.capri-model.org/lib/exe/fetch.php?media=docs:capri-documentation.pdf

CAPRI Graphical User Interface (GUI)



- Hands-on:
  - Settings
  - Text Editor
  - GDX Viewer
  - …

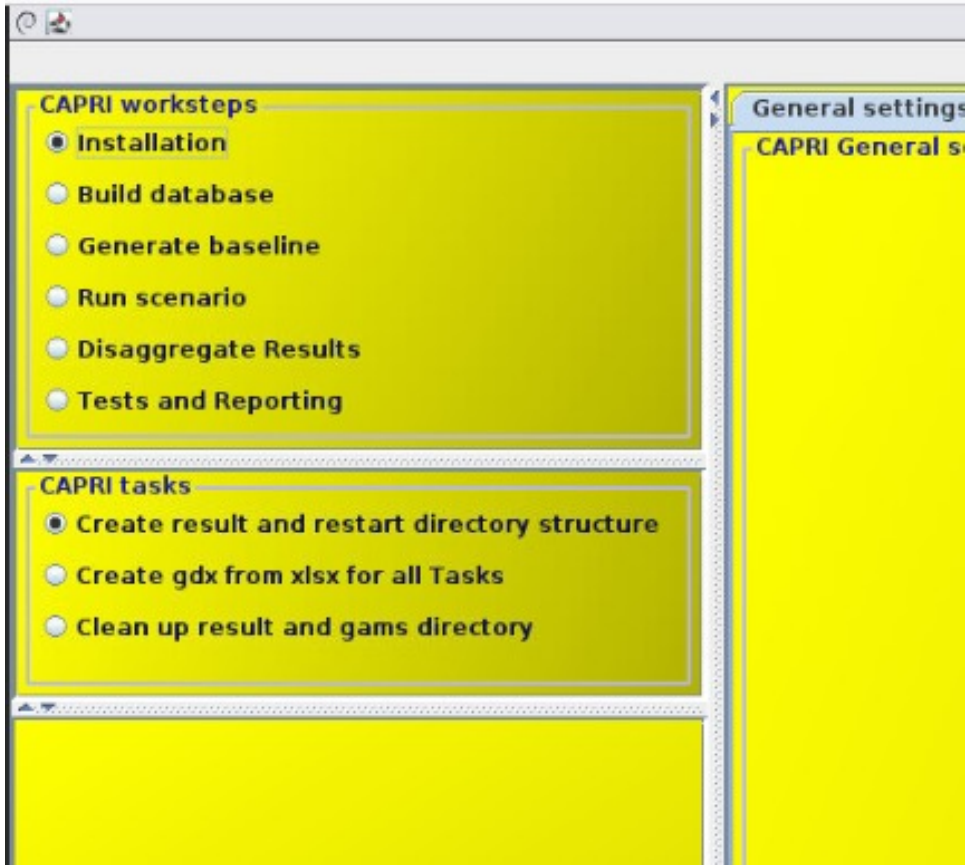
Work Steps and Tasks in GUI

Tasks in the GUI

- the work steps you will see in the GUI depends on your chosen user type

5 different Work steps, each with specific Tasks

(we will only focus on the Run Scenarios step)

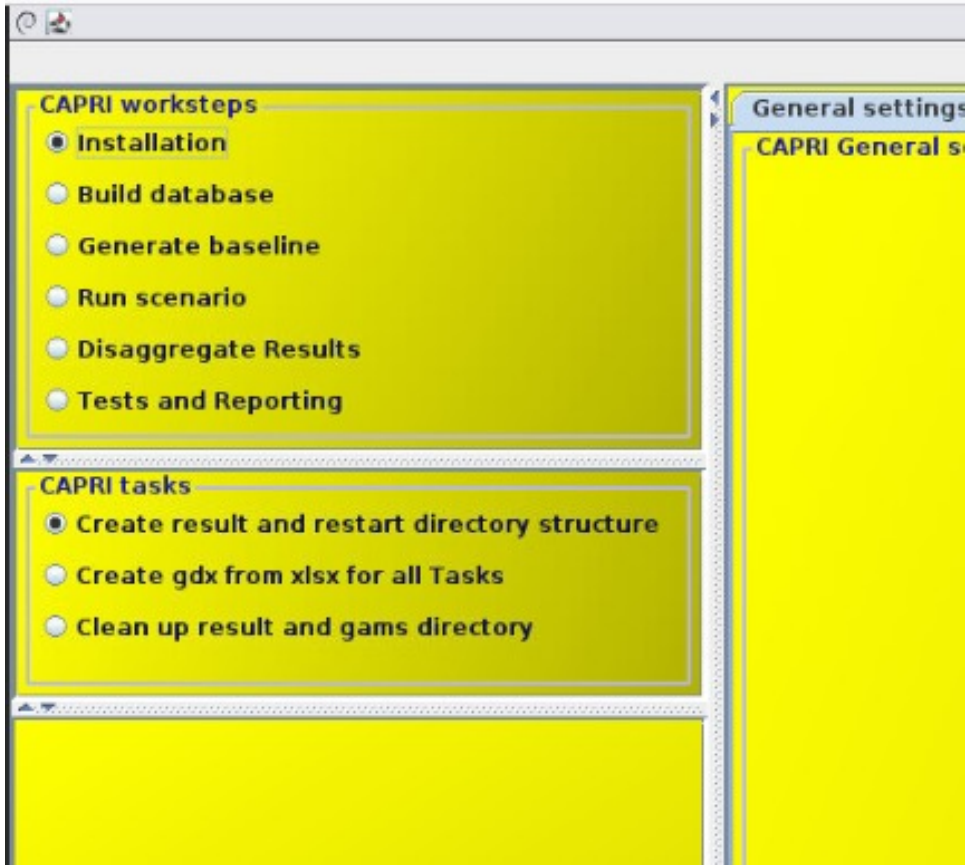


Tasks in the GUI

1. Installation work step

Only one task – Create result and restart directory structure

- The task generates the folder structure for your results
- Restart is generated for system testing purposes and is not of interest for this course
- This work step generates the CAPRI database



2. Build database work step

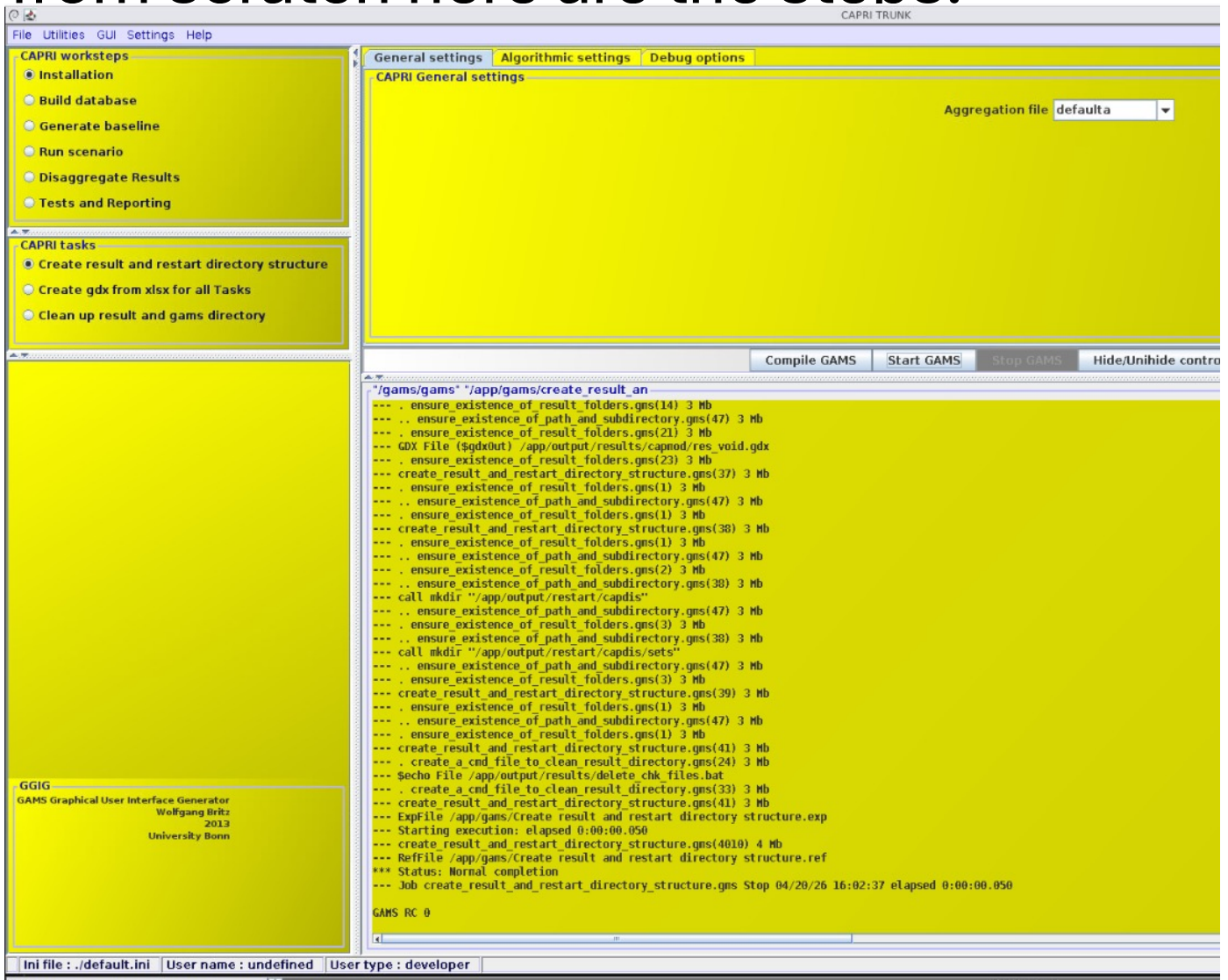
Harmonizes the data (on e.g., agricultural land use, production quantities and prices from FAOSTAT, EUROSTAT) to be a complete and consistent dataset

There is no need to run those two tasks because you already have result files in your CAPRI folder for this course.

Tasks in the GUI

* But if you want to run CAPRI from scratch here are the steps:

1) Select the task “Create result and restart directory structure” and click ***Compile GAMS.*** (Normally you will get the message “Normal Completion” in the output window)
2) Then click ***Start GAMS***, and wait for a “Normal Completion” again



Errors:

- If you can not see other work steps after Installation – restart GUI
- Check again that you have the correct JAVA and GAMS version
- Try to download CAPRI again and redo the installation process
- If it still doesn’t work contact the course team.

Tasks in the GUI

3. Generate Baseline work step

- A baseline projection for the chosen simulation year is generated based on a mix of trends, expert knowledge and automated checks that assures logical consistency. It is updated continuously and serves as the point of reference in our ex-ante analysis.
- You will not need to perform this work step – the baseline files are already included in the CAPRI database

4. Run Scenario work step

- In this work step the scenarios are simulated.
- This step is the focus of this course and will be described later

5. Tests and Reporting work step

- Here the results of the CAPRI model can be tested with regards to for example stability when using different computers. This is used by developers in a process of improving and identifying development needs of the model.

Tasks in the GUI

Exercise 6: Define a reference scenario, running the supply model

1. Start the Docker. Go to the workstep ”Run scenario”, task ”Run scenario without market model”. From the cap_after_2023 directory select the ref file.
2. Include an additional result type identifier under the Debug options!
3. Make sure that on “Modules and algorithm” the “non-Default reference scenario for carbon accounting” is selected – res_2_1730cap_after_2023_refdefaulta
4. Select only one country (any), base year 2017, simulation year 2035, run! (click on Start GAMS)
5. Verify that a new *fortran.gms* was written in the gams folder.

   4.1 Find your scenario name in that file!

   4.2 Find *“$setglobal countries”* and check that your country appears there

5. Look at the *output\results\capmod* folder to find the gdx file.

References

1. Britz, W., & Witzke, H. P. (2014). CAPRI Model Documentation 2014. University of Bonn. https://www.capri-model.org/lib/exe/fetch.php?media=docs:capri-documentation.pdf
2. CAPRI Course Overview page. https://www.capri-model.org/ts/dokuwiki/doku.php?id=start
3. European Commission. *Common Agricultural Policy (CAP) overview.* https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview_en
4. Jansson, T., Nordin, I., Wilhelmsson, F., Witzke, P., Manevska-Tasevska, G., & Weiss, F. (2021). *Coupled agricultural subsidies in the EU undermine climate efforts*. Applied Economic Perspectives and Policy, 43(4), 1503–1519. https://doi.org/10.1002/aepp.13092