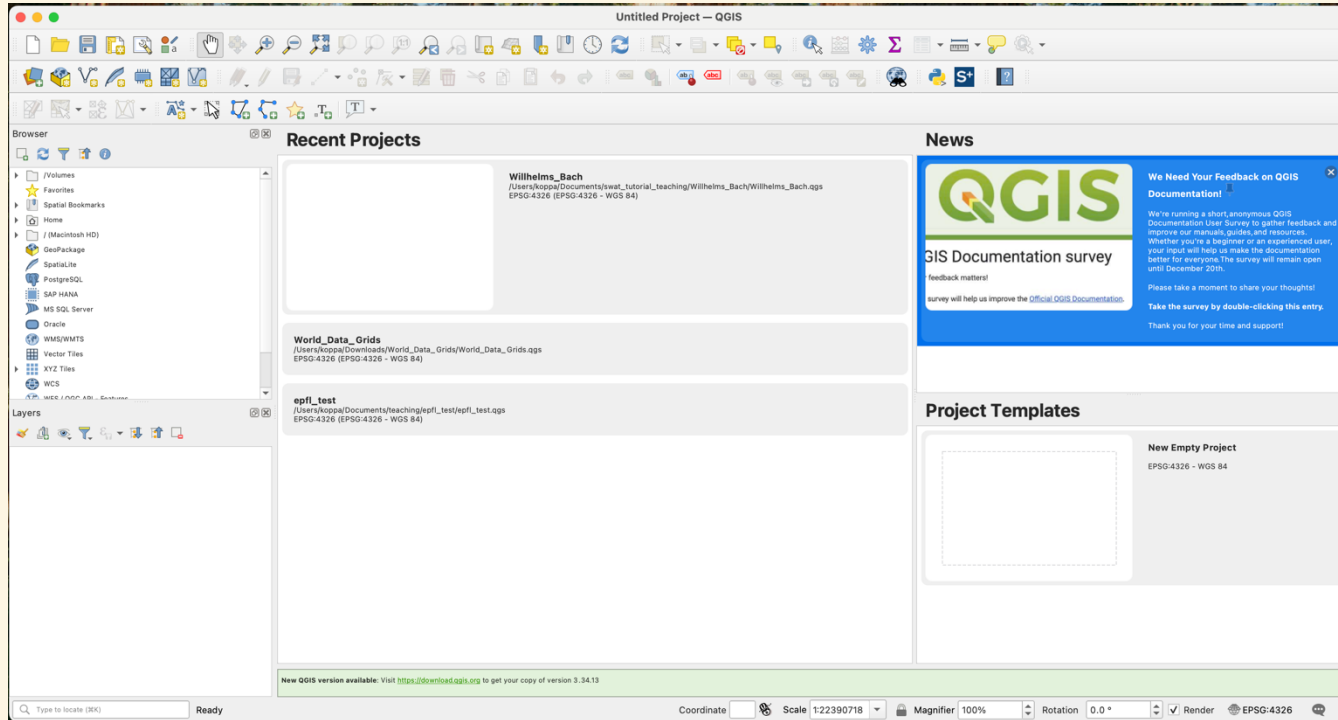


A wide-angle landscape photograph showing a river valley. In the foreground, a steep hillside is covered in terraced vineyards with rows of green grapevines. A dirt road winds through the vineyards. Below the vineyards, a small town with several buildings is situated on the riverbank. The river is a deep blue color and flows through the valley. In the distance, a large dam is visible across the river. The background consists of rolling green hills under a clear blue sky.

SWAT+ Model Setup Hydrology for Engineers

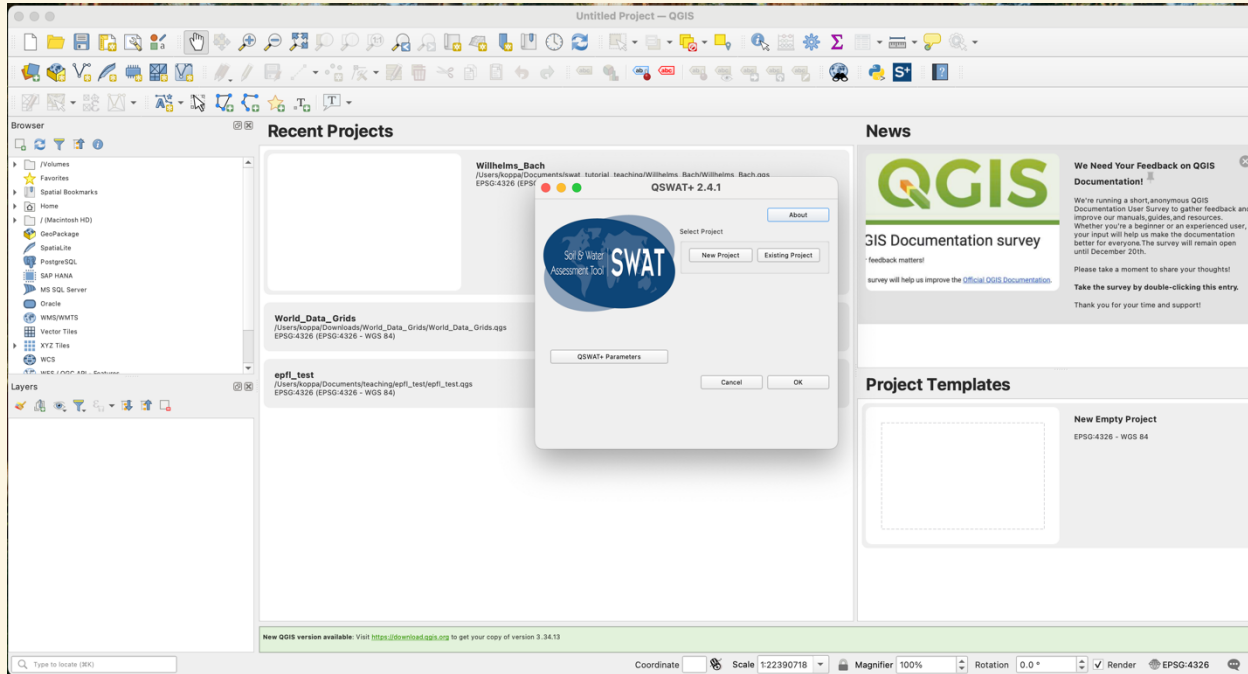
Prerequisites

Make sure QGIS is installed



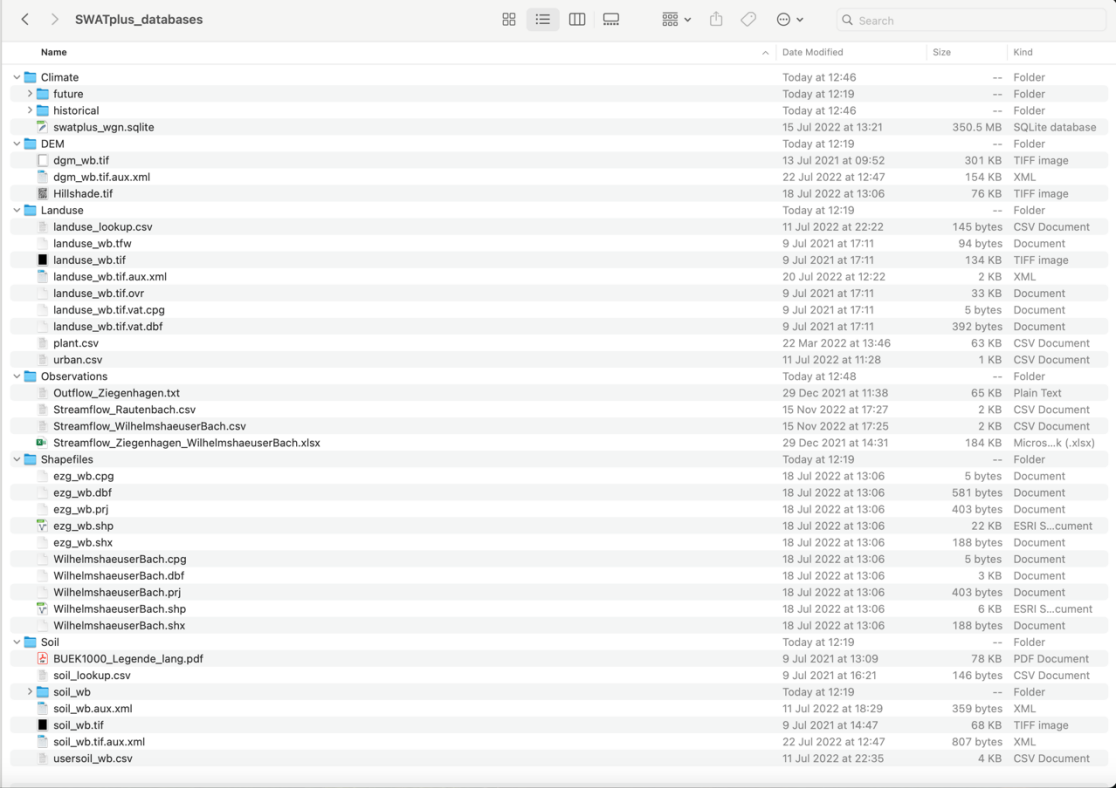
Prerequisites

Make sure QSWAT+ and SWAT+ editors are installed



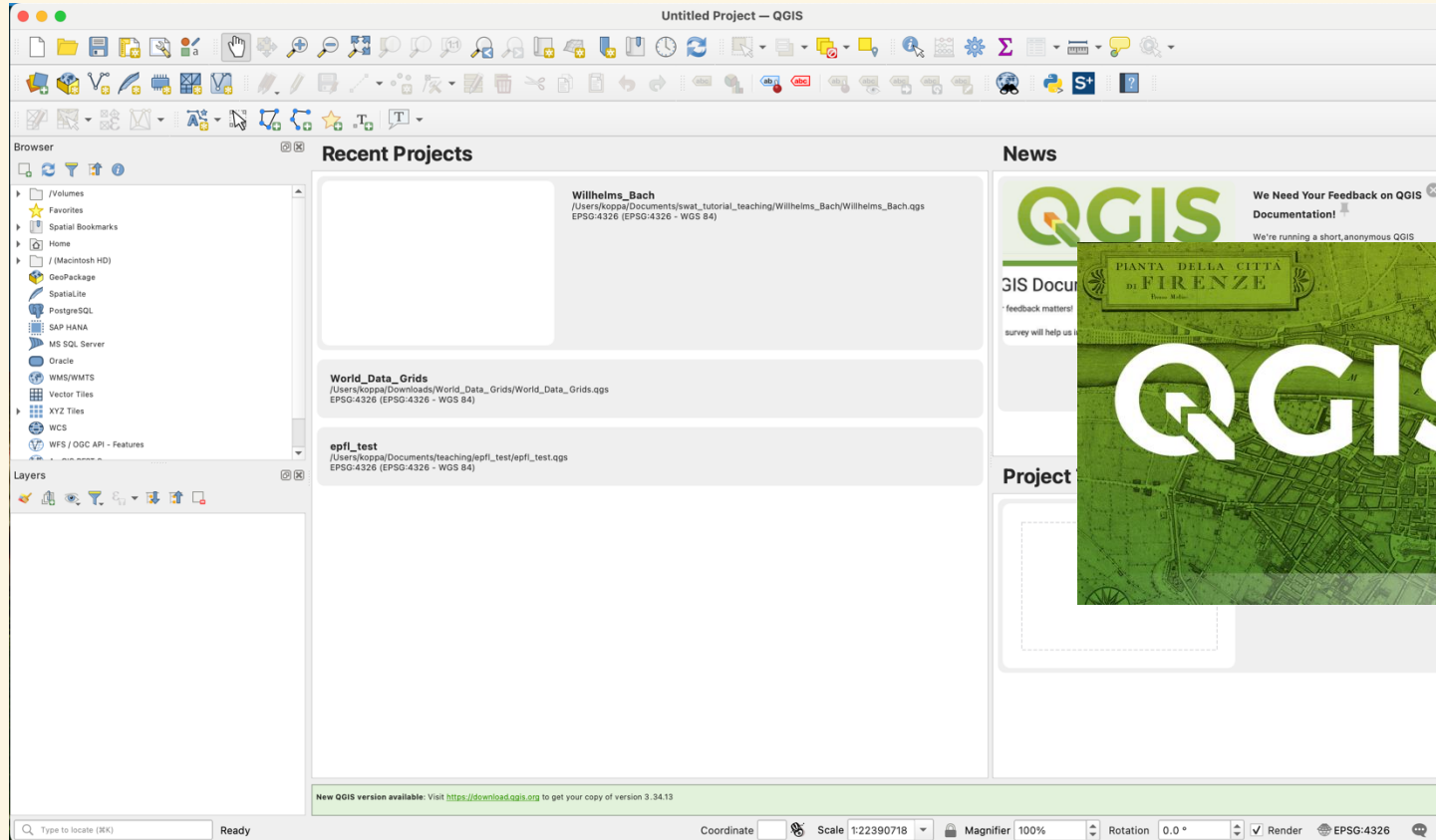
Download the input datasets

[Google drive download link](#)

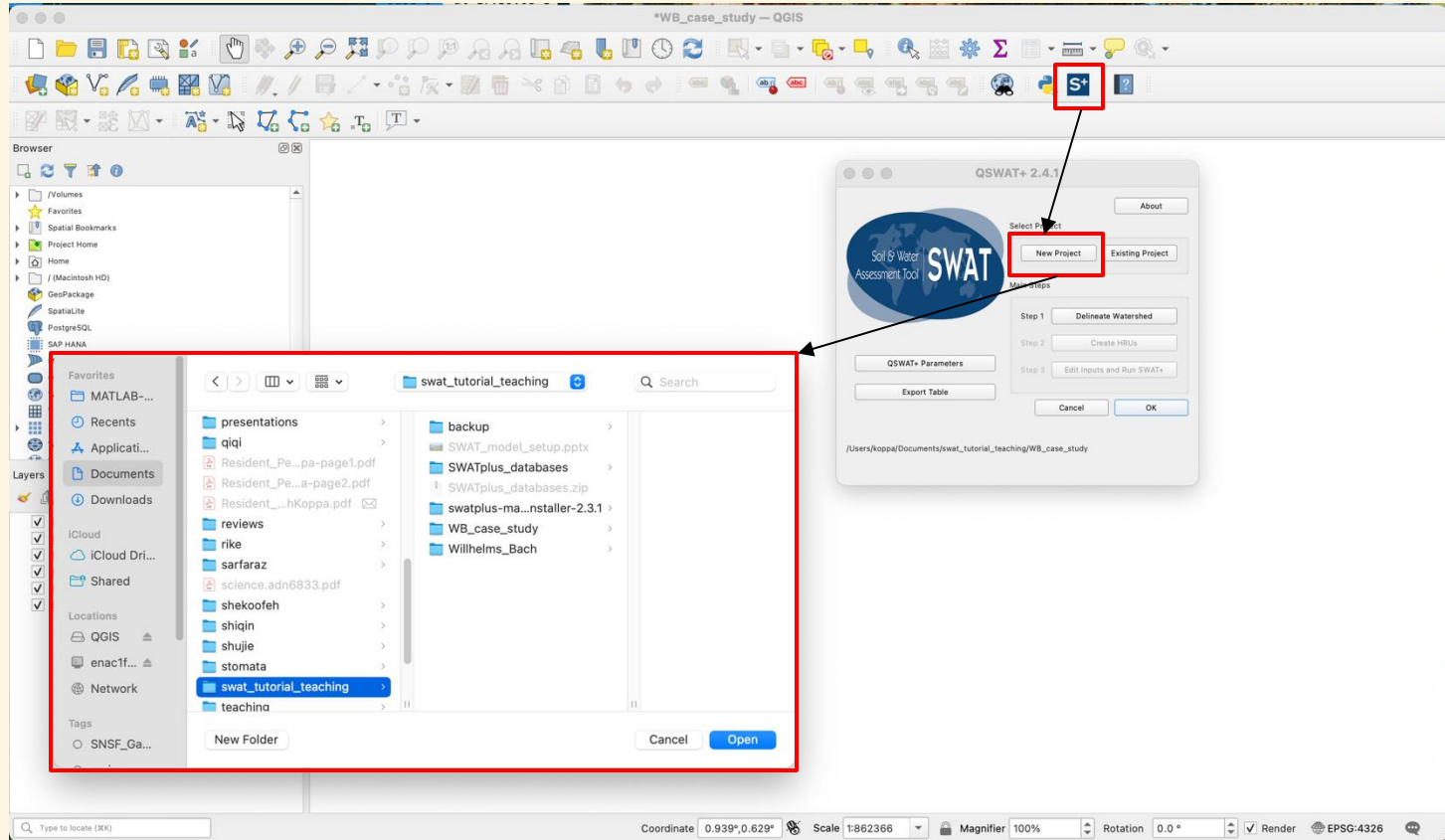


Name	Date Modified	Size	Kind
Climate	Today at 12:46	--	Folder
future	Today at 12:19	--	Folder
historical	Today at 12:46	--	Folder
swatplus_wgn.sqlite	15 Jul 2022 at 13:21	350.5 MB	SQLite database
DEM	Today at 12:19	--	Folder
dgm_wb.tif	13 Jul 2021 at 09:52	301 KB	TIFF image
dgm_wb.tif.aux.xml	22 Jul 2022 at 12:47	154 KB	XML
Hillshade.tif	18 Jul 2022 at 13:06	76 KB	TIFF image
Landuse	Today at 12:19	--	Folder
landuse_lookup.csv	11 Jul 2022 at 22:22	145 bytes	CSV Document
landuse_wb.tfw	9 Jul 2021 at 17:11	94 bytes	Document
landuse_wb.tif	9 Jul 2021 at 17:11	134 KB	TIFF image
landuse_wb.tif.aux.xml	20 Jul 2022 at 12:22	2 KB	XML
landuse_wb.tif.ovr	9 Jul 2021 at 17:11	33 KB	Document
landuse_wb.tif.vat.cpg	9 Jul 2021 at 17:11	5 bytes	Document
landuse_wb.tif.vat.dbf	9 Jul 2021 at 17:11	392 bytes	Document
plant.csv	22 Mar 2022 at 13:46	63 KB	CSV Document
urban.csv	11 Jul 2022 at 11:28	1 KB	CSV Document
Observations	Today at 12:48	--	Folder
Outflow_Ziegenhagen.txt	29 Dec 2021 at 11:38	65 KB	Plain Text
Streamflow_Rautenbach.csv	15 Nov 2022 at 17:27	2 KB	CSV Document
Streamflow_WilhelmshaeuserBach.csv	15 Nov 2022 at 17:25	2 KB	CSV Document
Streamflow_Ziegenhagen_WilhelmshaeuserBach.xlsx	29 Dec 2021 at 14:31	184 KB	Micros...k (.xlsx)
Shapefiles	Today at 12:19	--	Folder
ezg_wb.cpg	18 Jul 2022 at 13:06	5 bytes	Document
ezg_wb.dbf	18 Jul 2022 at 13:06	581 bytes	Document
ezg_wb.prj	18 Jul 2022 at 13:06	403 bytes	Document
ezg_wb.shp	18 Jul 2022 at 13:06	22 KB	ESRI S...cument
ezg_wb.shx	18 Jul 2022 at 13:06	188 bytes	Document
WilhelmshaeuserBach.cpg	18 Jul 2022 at 13:06	5 bytes	Document
WilhelmshaeuserBach.dbf	18 Jul 2022 at 13:06	3 KB	Document
WilhelmshaeuserBach.prj	18 Jul 2022 at 13:06	403 bytes	Document
WilhelmshaeuserBach.shp	18 Jul 2022 at 13:06	6 KB	ESRI S...cument
WilhelmshaeuserBach.shx	18 Jul 2022 at 13:06	188 bytes	Document
Soil	Today at 12:19	--	Folder
BUEK1000_Legende_lang.pdf	9 Jul 2021 at 13:09	78 KB	PDF Document
soil_lookup.csv	9 Jul 2021 at 16:21	146 bytes	CSV Document
soil_wb	Today at 12:19	--	Folder
soil_wb.aux.xml	11 Jul 2022 at 18:29	359 bytes	XML
soil_wb.tif	9 Jul 2021 at 14:47	68 KB	TIFF image
soil_wb.tif.aux.xml	22 Jul 2022 at 12:47	807 bytes	XML
usersoil_wb.csv	11 Jul 2022 at 22:35	4 KB	CSV Document

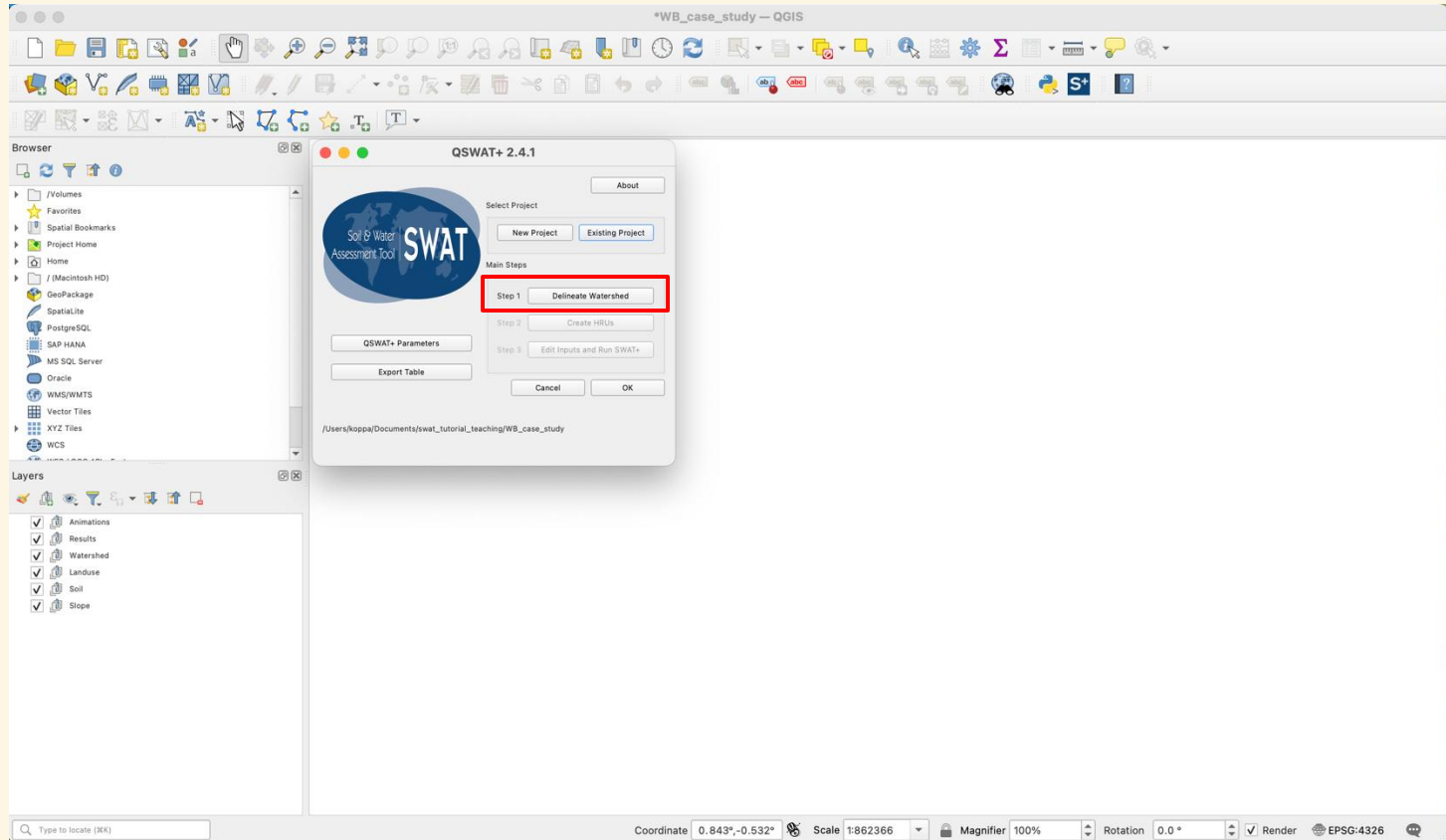
Start QGIS



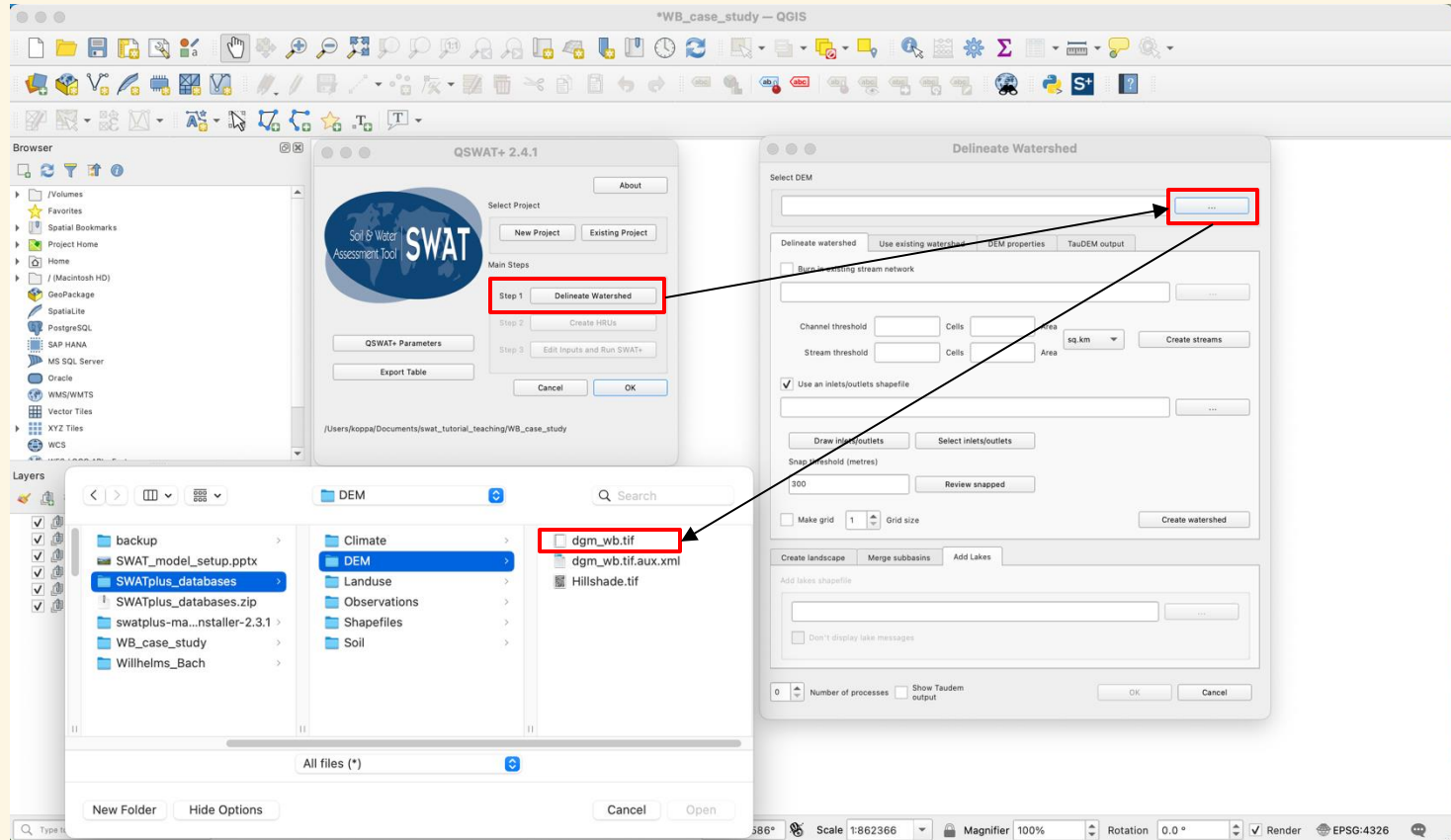
Start QGIS



Delineate Watershed



Load digital elevation model (DEM)



Create streams

What happens when these parameters are changed?

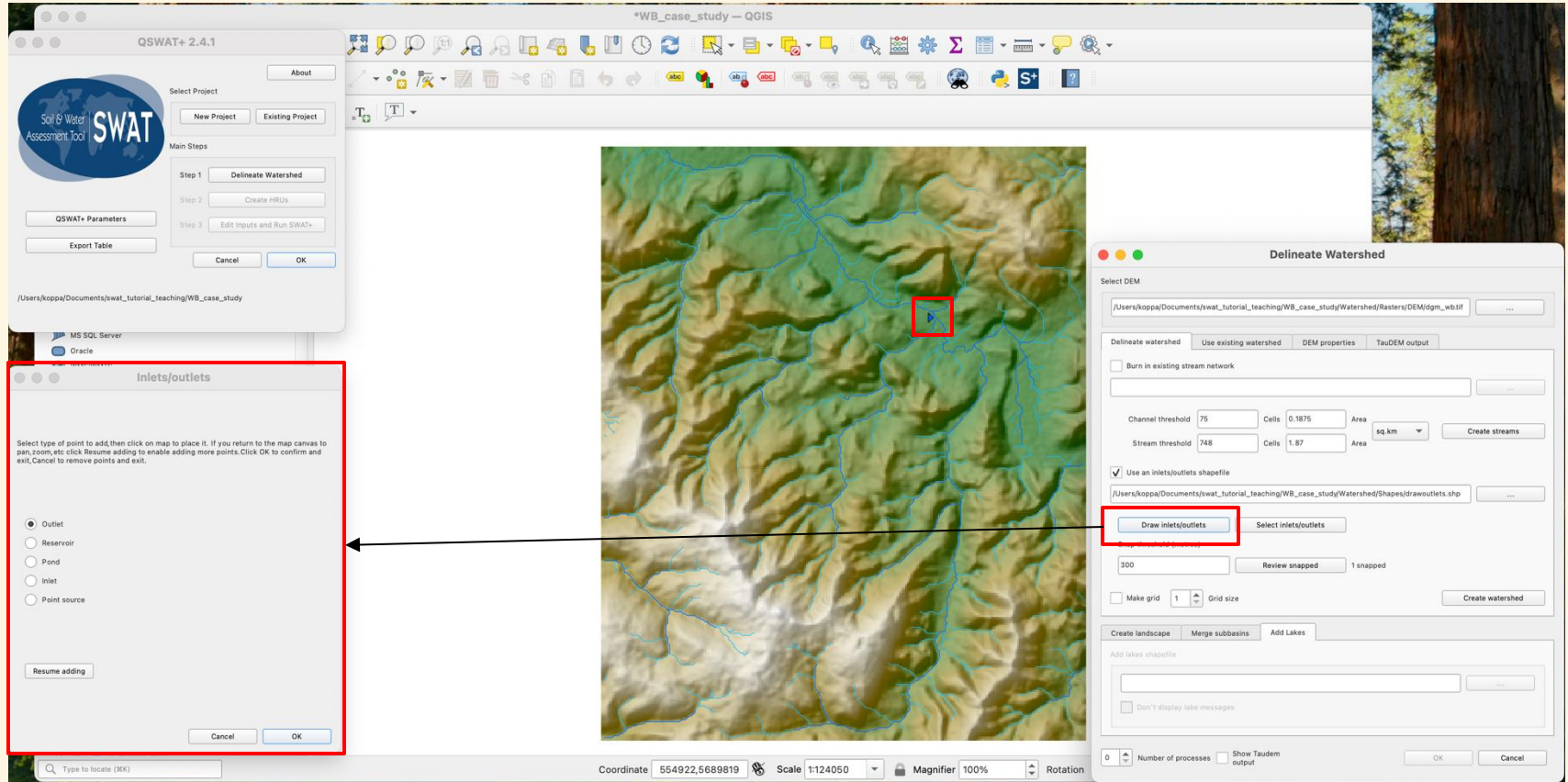
The screenshot displays the QSWAT+ 2.4.1 software interface. The main window shows a topographic map with a watershed delineation. The 'Delineate Watershed' dialog box is open, and the 'Create streams' button is highlighted with a red rectangle. An arrow points from the text 'What happens when these parameters are changed?' to the 'Create streams' button.

The 'Delineate Watershed' dialog box contains the following parameters:

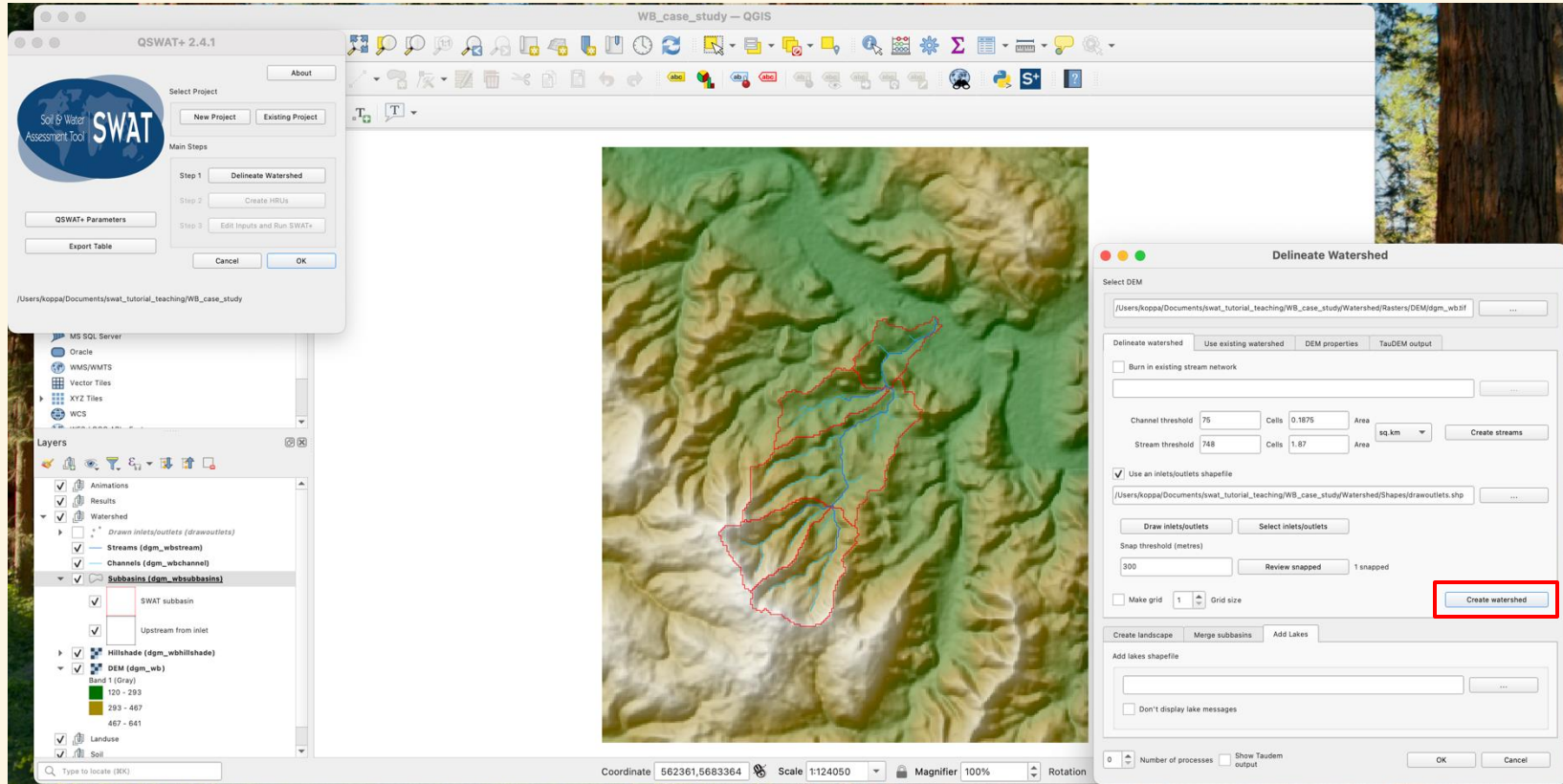
- Select DEM: /Users/koppa/Documents/swat_tutorial_teaching/WB_case_study/Watershed/Rasters/DEM/dgm_wb.tif
- Delineate watershed: Use existing watershed (checked), DEM properties, TauDEM output
- Burn in existing stream network: ☐
- Channel threshold: 75, Cells: 0.1875, Area: sq km
- Stream threshold: 748, Cells: 1.87, Area: sq km
- Use an inlets/outlets shapefile: ☒
- Draw inlets/outlets:
- Snap threshold (metres): 300,
- Make grid: ☐ Grid size: 1,
- Create landscape:
- Add lakes shapefile:
- Don't display lake messages: ☐
- Number of processes: 0, ☐ Show TauDEM output

Create outlet

What is an outlet and why is it needed?



Create watershed



Create HRUs – Landuse and soil maps

The screenshot displays the QGIS interface with the SWAT+ 2.4.1 application window. The 'Create HRUs' dialog box is open, showing the 'Landuse and soil' tab. The dialog is configured with the following settings:

- Select landuse map:** `its/wat_tutorial_teaching/WB_case_study/Watershed/Rasters/Landuse/landuse_wb.tif`
- Select soil map:** `Documents/wat_tutorial_teaching/WB_case_study/Watershed/Rasters/Soil/soil_wb.tif`
- Select landuse and soil database:** `/Users/koppa/Documents/wat_tutorial_teaching/WB_case_study/qgisfile`
- Soil data:** ☒ usersoil, ☐ STATSGO, ☐ SSURGO/STATSGO2
- Landuse lookup:** `landuse_lookup`
- Soil lookup:** `soil_lookup`
- Usersoil:** `usersoil_wb`
- Plant:** `plant0`
- Urban:** `urban0`
- Set slope bands (%):** `[0, 5, 9, 10, 9999]`
- Slope bands:** `[0, 5, 9, 10, 9999]`
- Short channel merge:** ☒ Percent of subbasin, ☐ Area (ha)
- Reservoir threshold:** `101` % water
- Read choice:** ☐ Read from maps, ☐ Read from previous run
- Optional:** ☐ Elevation bands
- Generate FullHRUs checkbox:** ☒ (checked)
- Subbasins count:** 5
- Channels count:** 45
- Full HRUs count:** 449

The 'Read' button at the bottom right of the dialog is highlighted with a red box. The background map shows a topographic view of a watershed area with a red outline indicating the study area.

Create HRUs

The screenshot displays the QSWAT+ 2.4.1 software interface. The main window shows a topographic map of a watershed with a red outline. The 'Create HRUs' dialog box is open on the right, with the 'Split landuses' option selected under the 'Optional' section. The 'Split Landuses' dialog box is also open, showing a table with two rows: 'AGRL' and 'WWHT', both with a 'Percent' of 50. The 'Save splits' button is highlighted in red. The 'Create HRUs' dialog box also shows the 'Threshold method' set to 'Percent of landscape unit' and the 'Target' value set to 4.0.

Create HRUs Dialog Box:

- Landuse and soil: **HRUs**
- Optional:
 - ☒ Split landuses
 - ☐ Exempt landuses
- Single/Multiple HRUs:
 - ☐ Dominant landuse, soil, slope
 - ☒ Dominant HRU
 - ☐ Filter by landuse, soil, slope
 - ☐ Filter by area
 - ☐ Target number of HRUs
- Threshold method:
 - ☒ Percent of landscape unit
 - ☐ Area (ha)
- Target: 5 Number of HRUs 4.0
- Buttons: Create HRUs, Cancel

Split Landuses Dialog Box:

Landuse	Sub-landuse	Percent
AGRL	CORN	50
WWHT		50

Buttons: Add sub-landuse, Delete sub-landuse, Delete split landuse, Cancel edits, Save edits, **Save splits**, Cancel

Create HRUs

The screenshot displays the QGIS interface with the SWAT+ 2.4.1 'Create HRUs' dialog box open. The dialog is titled 'Create HRUs' and has two tabs: 'Landuse and soil' and 'HRUs'. The 'HRUs' tab is active, showing options for 'Single/Multiple HRUs'. The 'Target number of HRUs' is set to 449. The 'threshold method' is set to 'Percent of landscape unit'. The background map shows a topographic view of a watershed with subbasins and HRUs delineated. The SWAT+ 2.4.1 'Main Steps' panel is visible on the left, showing the progress of the setup process.

SWAT+ 2.4.1 Main Steps:

- Done: Delineate Watershed
- Done: Create HRUs
- Step 3: Edit Inputs and Run SWAT+

Optional: Split landuses, Exempt landuses

Single/Multiple HRUs:

- ☐ Dominant landuse, soil, slope
- ☐ Dominant HRU
- ☐ Filter by landuse, soil, slope
- ☐ Filter by area
- ☒ Target number of HRUs

Target: 5 Number of HRUs 449

threshold method:

- ☒ Percent of landscape unit
- ☐ Area (Ha)

Create HRUs, Cancel

Open SWAT+ editor

Enter relevant details and start the editor

SWAT+ Editor

Welcome to SWAT+ Editor 2.3.1

[Read our release notes](#) to learn more about this release.

RECENT PROJECTS

SWAT+ Editor Project from QSWAT+

This is the first time opening your QSWAT+ project in SWAT+ Editor. We need to import your GIS data into SWAT+ objects. This may take a few seconds to several minutes depending on the size of your project.

Project display name

WB_case_study

Briefly describe your project location (main river, country)

Germany

25 character limit; spaces will be converted to underscores

☐ Use SWAT+ lite? This is a lite version of the model that greatly simplifies hydrology and plant growth and does not simulate nutrients, concentrating on gully formation and stream degradation.

Start Cancel

Open SWAT+ editor

Explore the different watershed characteristics

SWAT+ Editor 2.3.1

[Read our release notes](#) to learn more about this release.

Open another project

Create a new project

RECENT PROJECTS

WB_case_study

Current project: WB_case_study

Germany

/Users/koppa/Documents/swat_tutorial_teaching/WB_case_study

SWAT+ Project information

Total area	1,987.75 ha	Software	SWAT+ Editor 2.3.1, QSWAT+ 2.4.1
Simulation period	1980 - 1985	Last saved	Sun, Dec 8, 2024 6:30 PM

Object totals

5 Subbasins

536 HRUs

45 Channels

6 Aquifers

0 Reservoirs

45 Routing Units

45 Landscape Units

45 Recall (point source/inlet data)

0 Export Coefficients

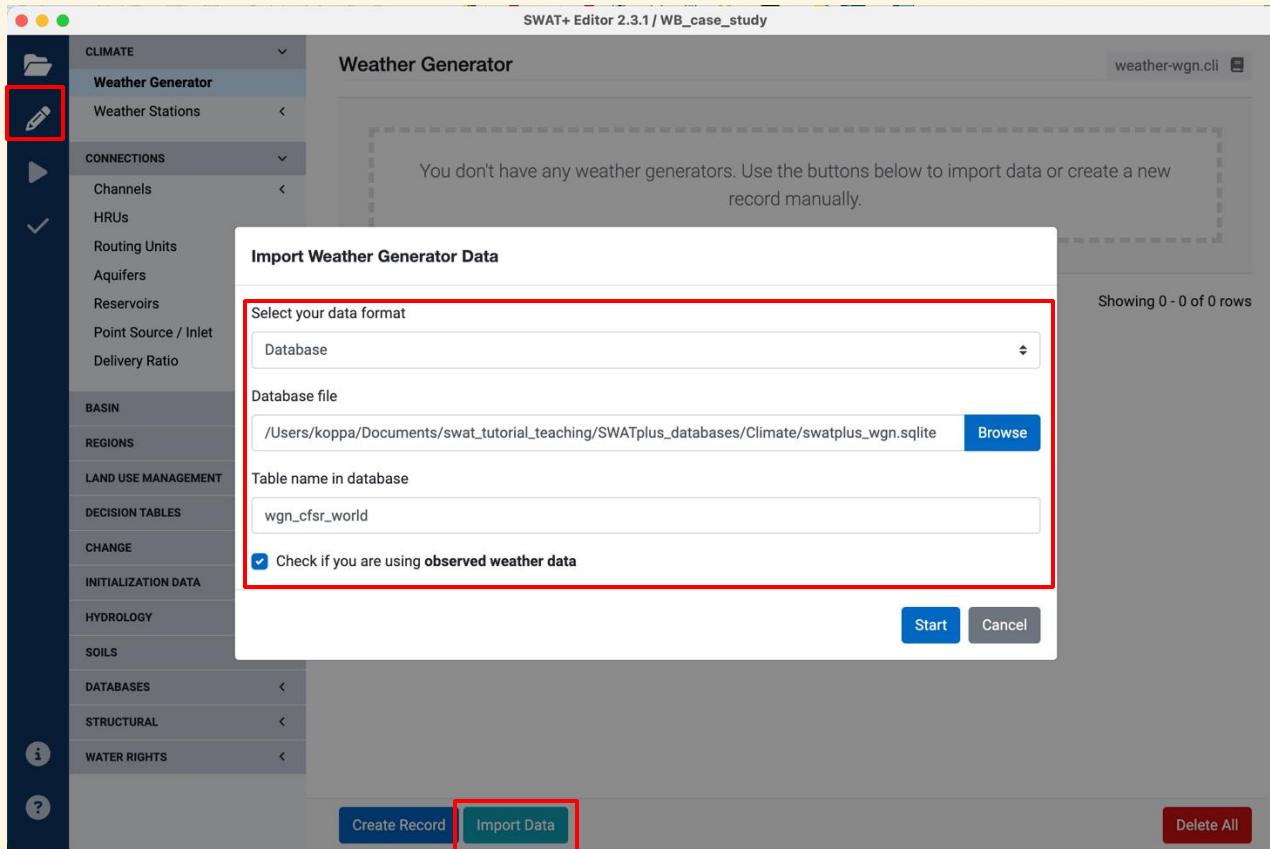
0 Delivery Ratio

Land use distribution

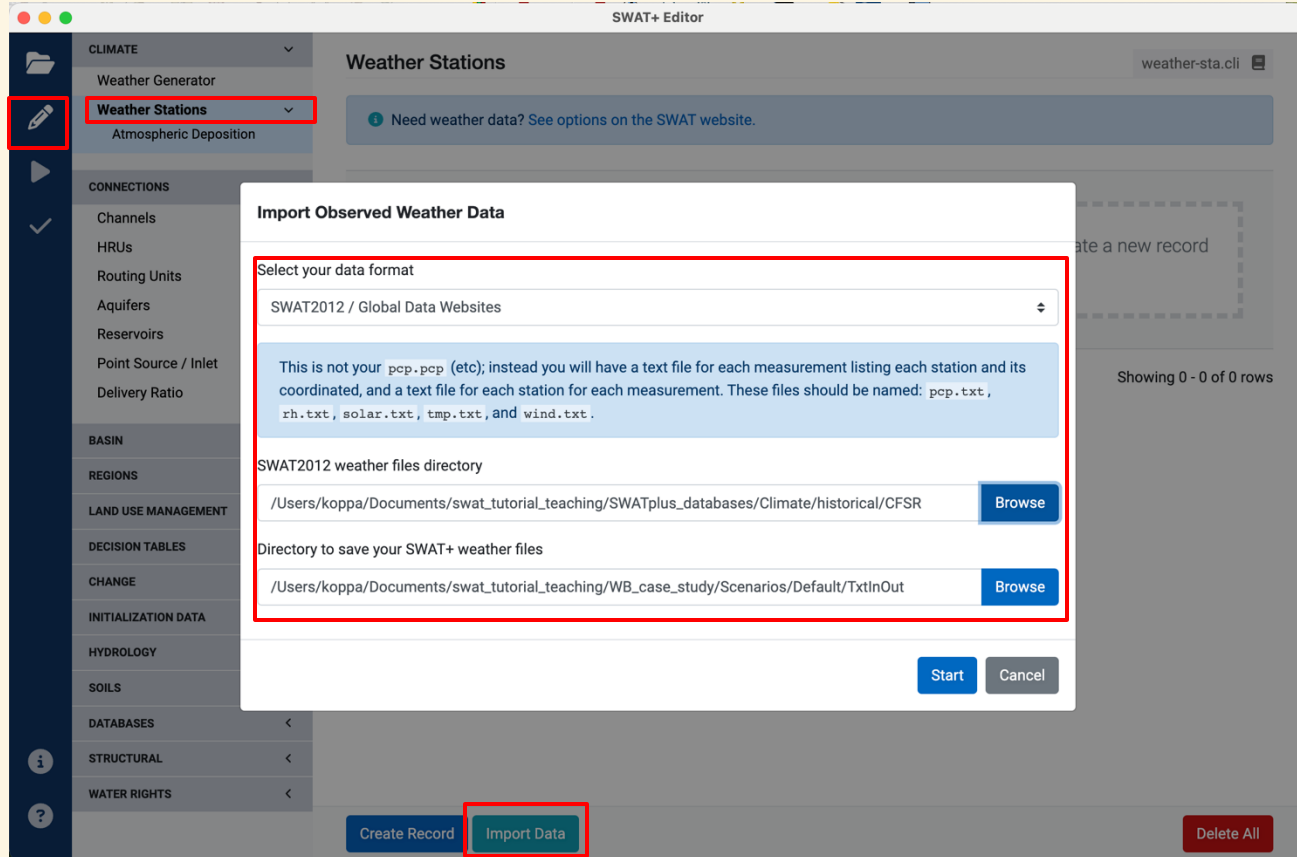
corn, past, fodb, shrb, fomi, uidu, frse, urbn, orcd, wwht

Get startedChange Name/DescriptionRe-import from GIS

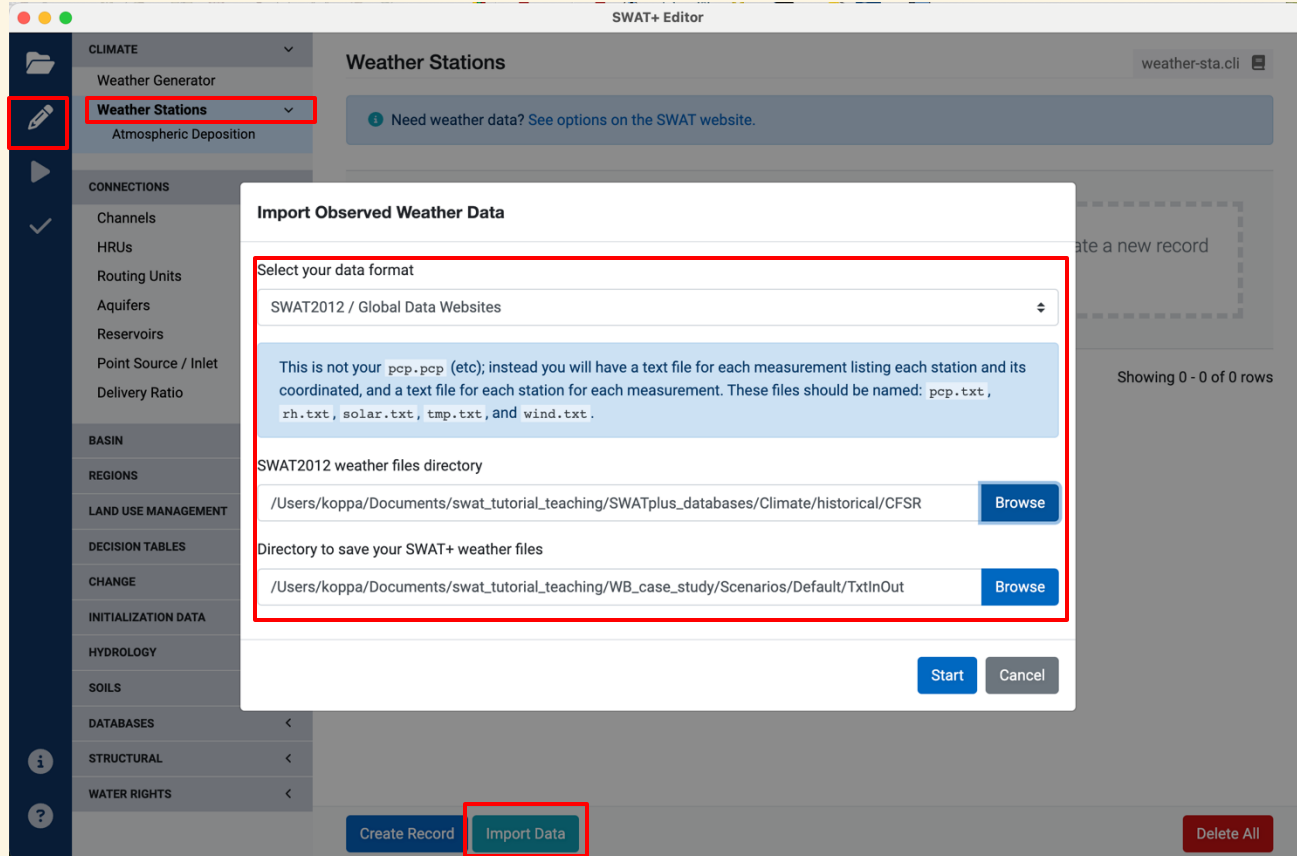
Load weather generator data



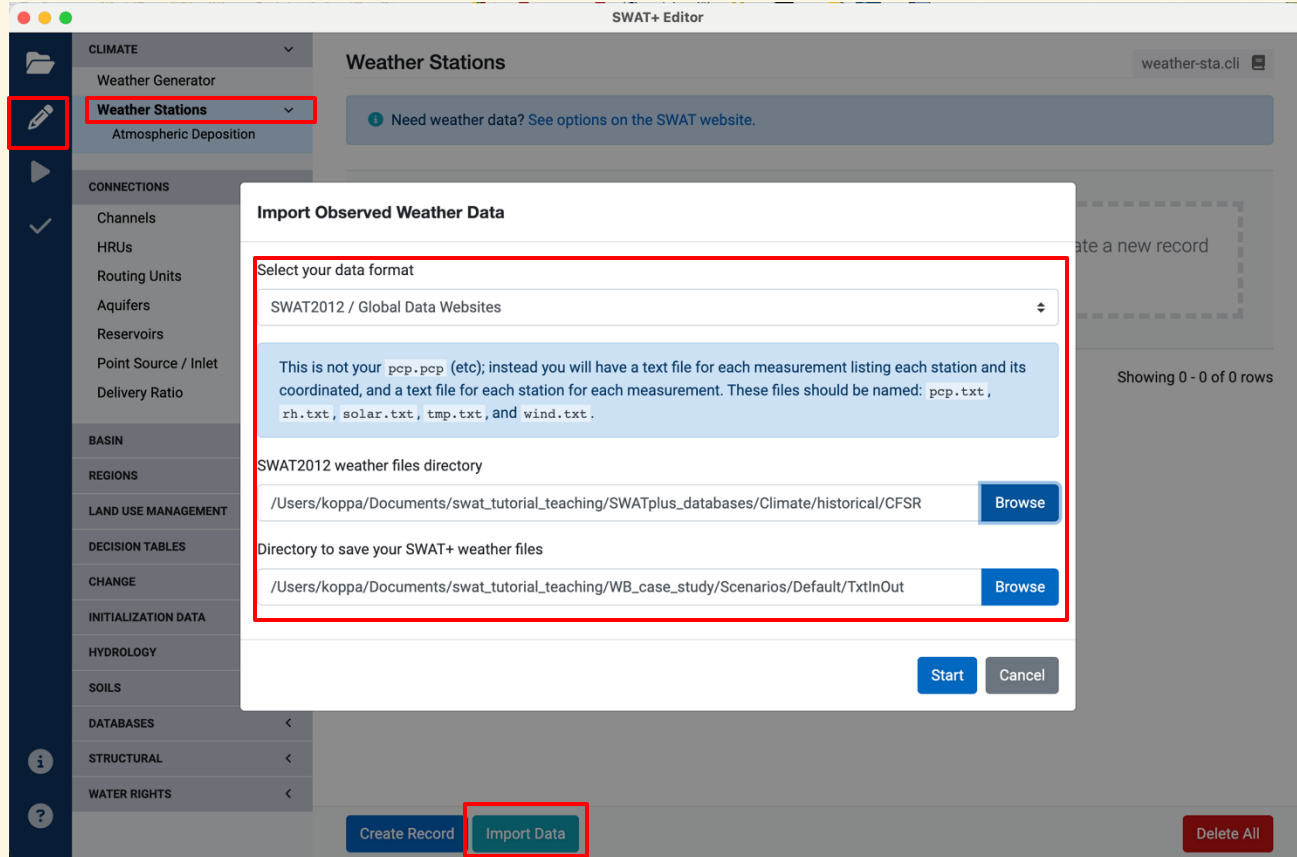
Load observed data



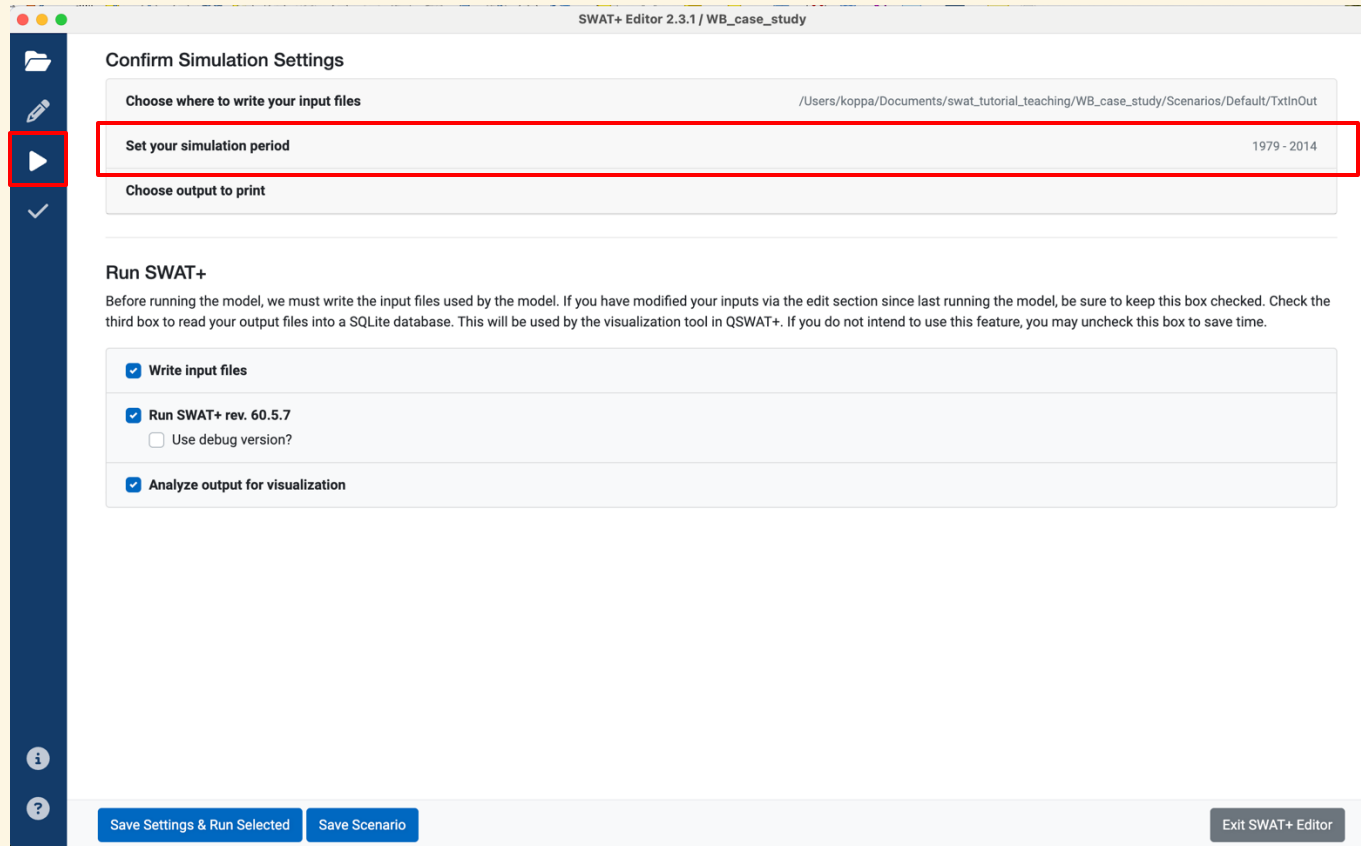
Load observed data



Run SWAT+

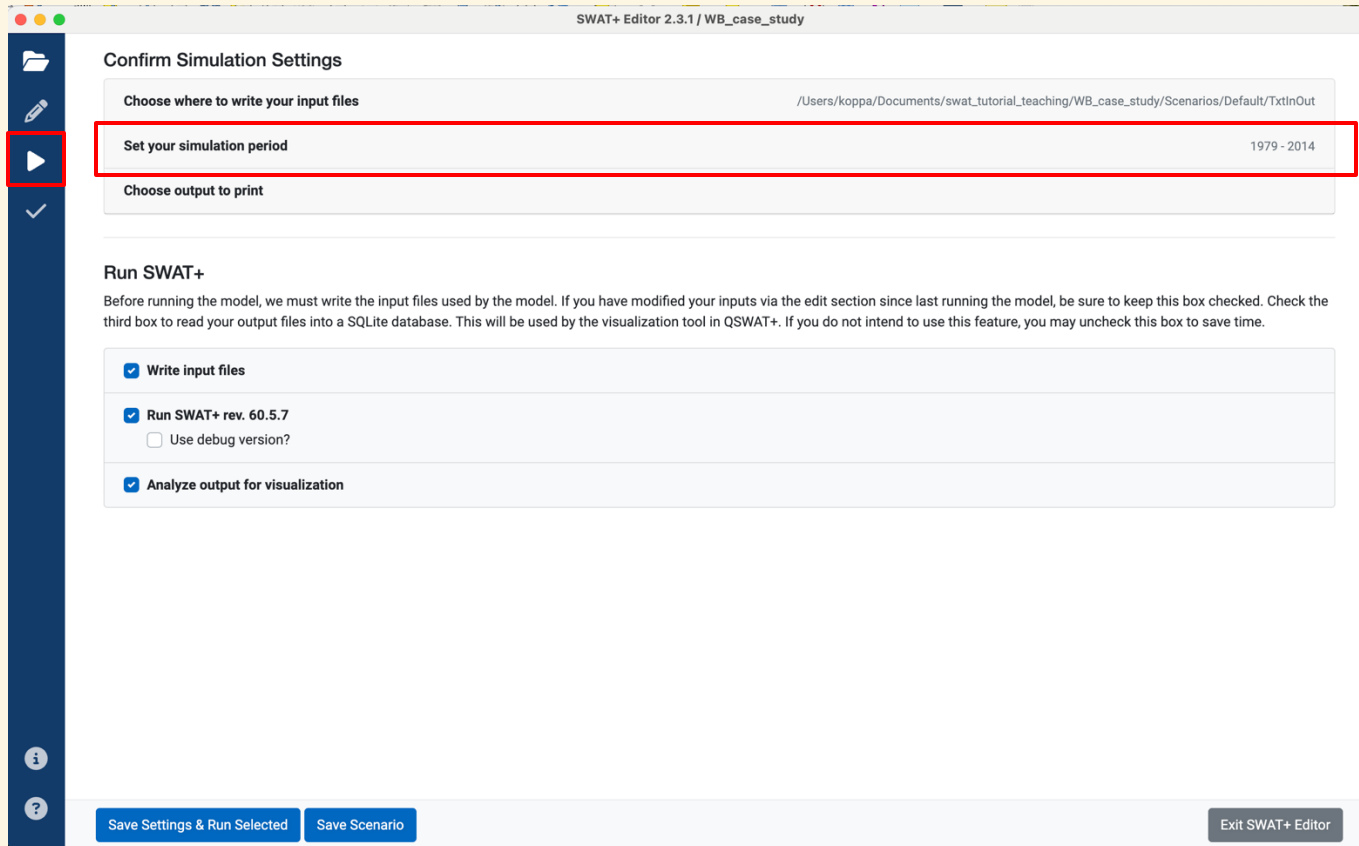


Run SWAT+: set simulation period



Run SWAT+: choose output to write out

Figure out how to set model time step to daily



Run SWAT+: choose output to write out

Number of years to skip printing output

	Daily	Monthly	Yearly	Average	Outputs
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Model Components					
Channel	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	channel_sd channel_sdmorph
Aquifer	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	aquifer
Reservoir	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	reservoir
Point Source (Recall)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	recall
Routing Unit	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	ru
Hydrology	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	hyd
Water Allocation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	water_allo
Basin Model Components					
Channel	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	basin_sd_cha basin_sd_chamorph
Aquifer	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	basin_aqu
Reservoir	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	basin_res
Point Source (Recall)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	basin_psc
Nutrient Balance					
Basin	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	basin_nb
Landscape Unit	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	lsunit_nb
HRU	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	hru_nb
Water Balance					
Basin	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	basin_wb
Landscape Unit	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	lsunit_wb
HRU	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	hru_wb
Plant Weather					
Basin	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	basin_pw

Run SWAT+: choose output to write out and run the model

Run SWAT+

Before running the model, we must write the input files used by the model. If you have modified your inputs via the edit section since last running the model, be sure to keep this box checked. Check the third box to read your output files into a SQLite database. This will be used by the visualization tool in QSWAT+. If you do not intend to use this feature, you may uncheck this box to save time.

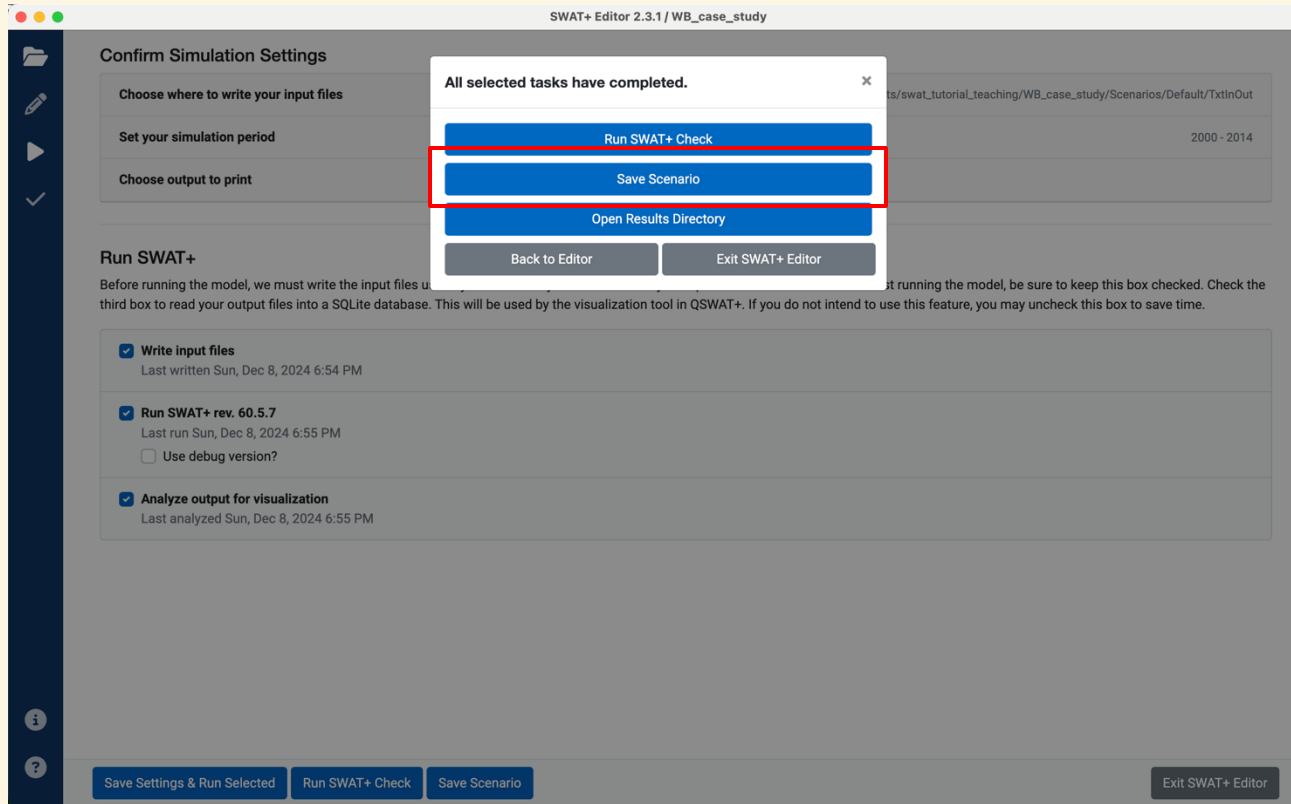
- ☒ Write input files
- ☒ Run SWAT+ rev. 60.5.7
 - ☐ Use debug version?
- ☒ Analyze output for visualization

Save Settings & Run Selected

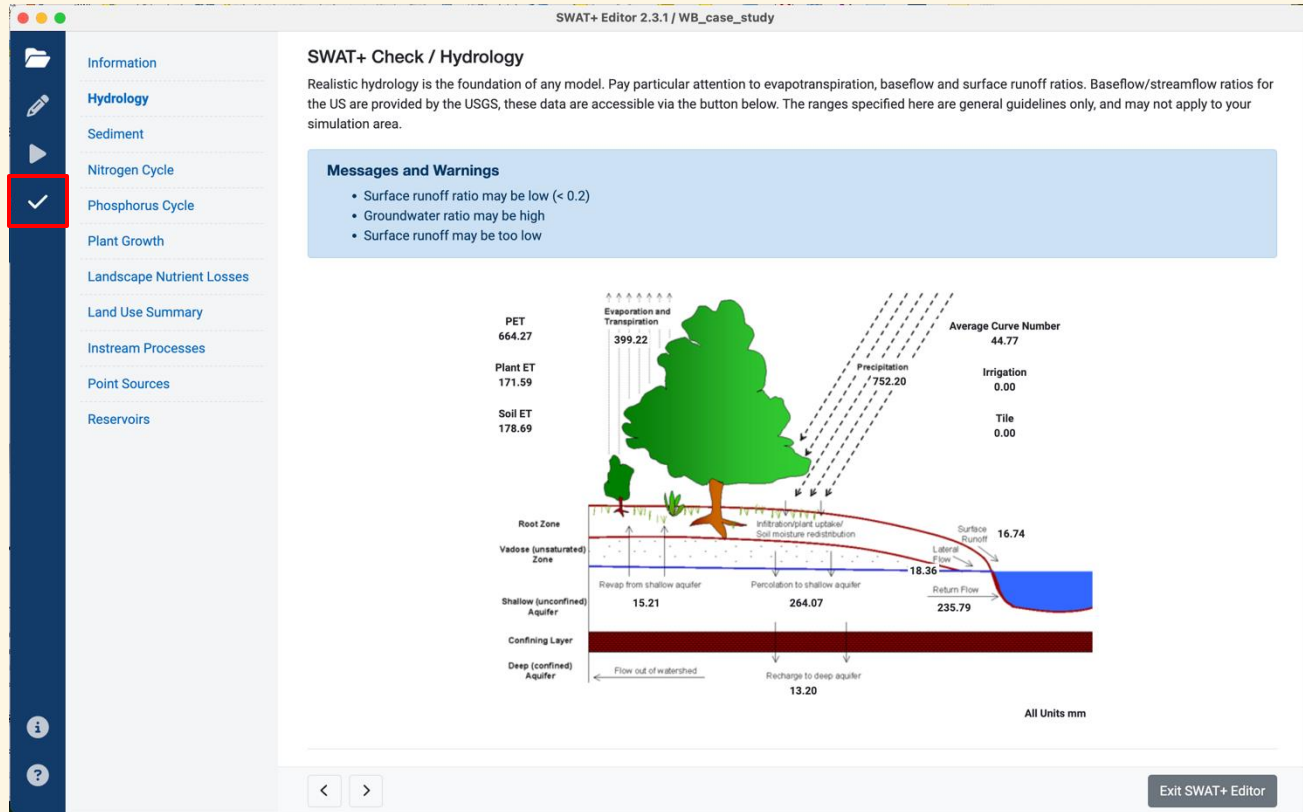
Save Scenario

Exit SWAT+ Editor

Save the model run as a scenario



Check output with SWAT+ check



Visual results with QSWAT+

