Exercise 6: Water cycles and signature

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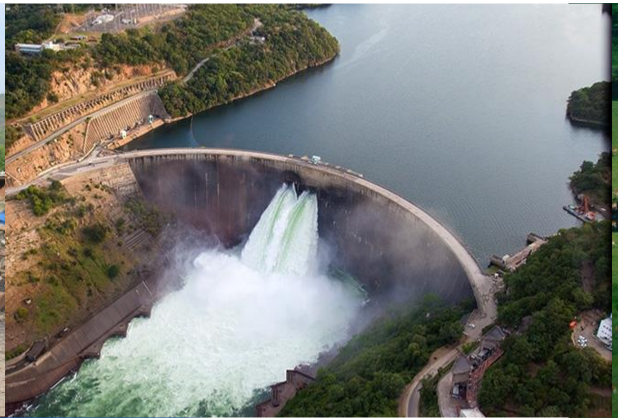


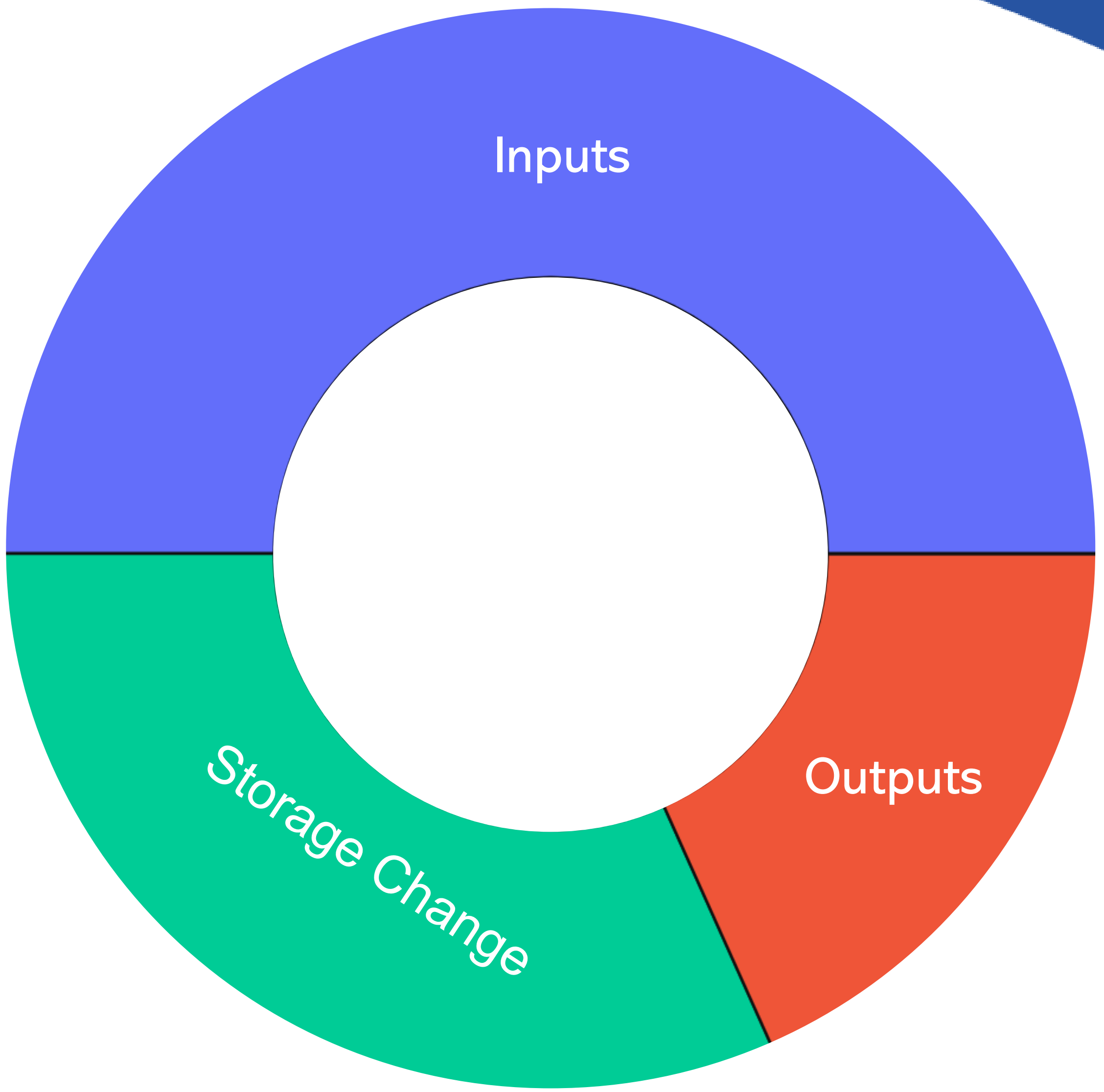
Water cycle

A water balance is used to understand the flows through a system.

A water cycle/wheel/circle summarises the flows through a system over a certain period.

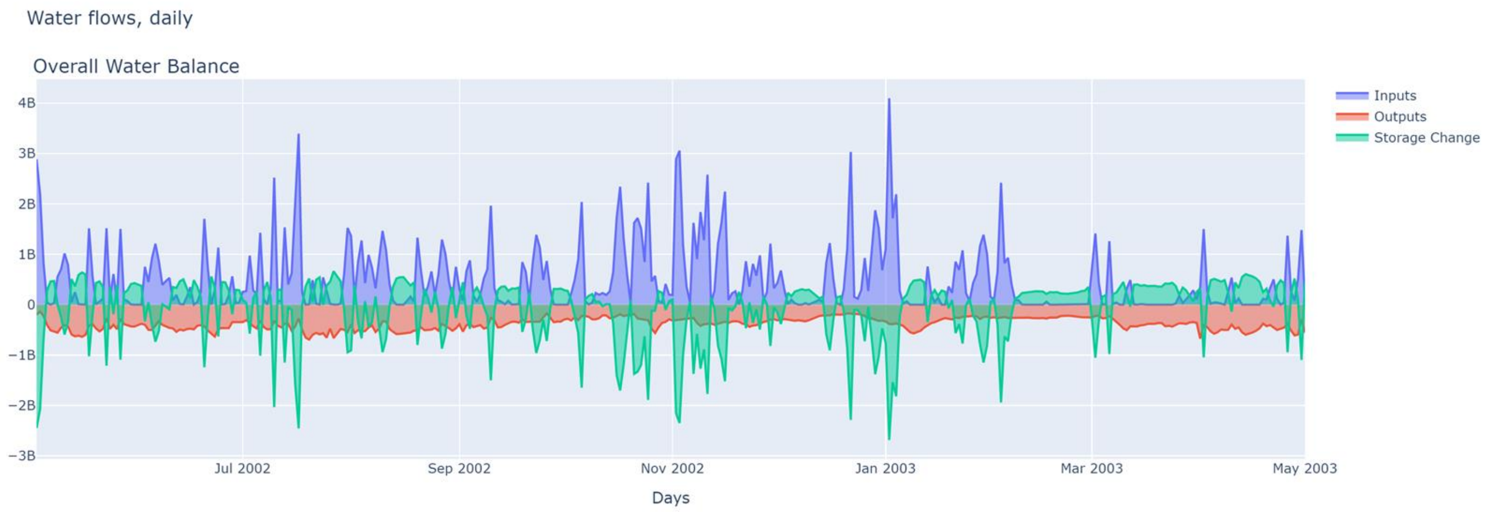
The inputs to the system equal the outputs from the system plus whatever changed in the system.

Inputs = Outputs + Storage change



Water cycle and signature example

The Rhine basin for an example year



Water cycles and signature

1. Install Jupyter notebook
2. Open and execute WaterCycles.ipynb using Jupyter notebook
3. Play CWatM with specific outputs and for your coordinates
4. Execute WaterCycles.ipynb, updating the outputs path and basin outlet coordiantes

1. Install Jupyter Notebook

Getting started with the classic Jupyter Notebook

conda

We recommend installing the classic Jupyter Notebook using the conda package manager. Either the miniconda or the miniforge conda distributions include a minimal conda installation.

Then you can install the notebook with:

```
conda install -c conda-forge notebook
```

pip

If you use `pip`, you can install it with:

```
pip install notebook
```

Congratulations, you have installed Jupyter Notebook! To run the notebook, run the following command at the Terminal (Mac/Linux) or Command Prompt (Windows):

```
jupyter notebook
```

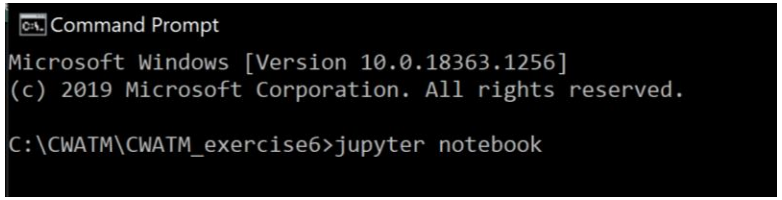
See Running the Notebook for more details.

This is an exceprt from https://jupyter.org/install.html

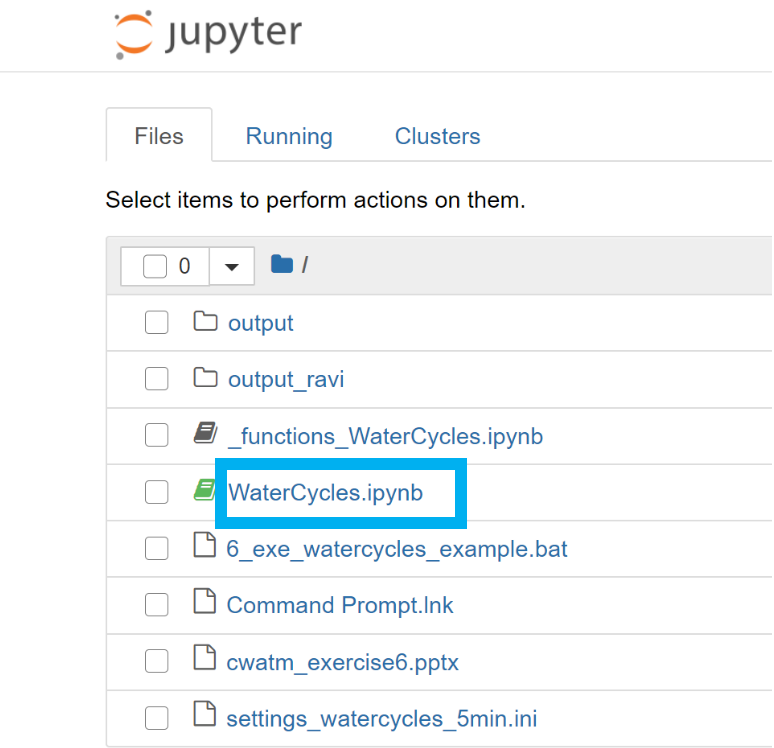
2. WaterCycles.ipynb

Open up the terminal within the Exercise 6 folder and type

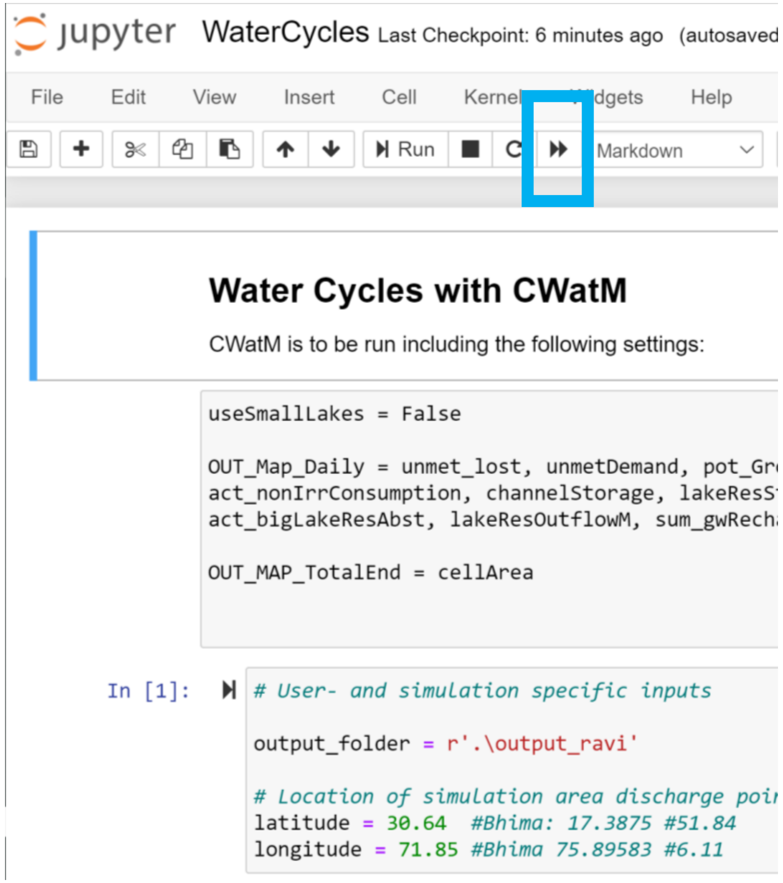
```
jupyter notebook
```



Click WaterCycles.ipynb



Execute the notebook



3. Play CWatM with these settings

Bring your settings file from exercise 5 into the exercise 6 folder, and include the following settings:

```
PathOut = ./output

useSmallLakes = False

OUT_Map_Daily = unmet_lost, unmetDemand,
pot_GroundwaterAbstract, discharge,
storGroundwater, nonFossilGroundwaterAbs,
Precipitation, totalET, EvapoChannel,
EvapWaterBodyM, act_nonIrrConsumption,
channelStorage, lakeResStorage, totalSto,
sum_actTransTotal, sum_actBareSoilEvap,
sum_interceptEvap, sum_openWaterEvap,
addtoevapotrans, lakeResInflowM,
act_bigLakeResAbst, lakeResOutflowM,
sum_gwRecharge, sum_capRiseFromGW, baseflow,
act_totalIrrConsumption, sum_runoff,
returnFlow, act_SurfaceWaterAbstract

OUT_MAP_TotalEnd = cellArea
```

Alternatively, the settings file *settings_watercycles_5min.ini* already has the correct settings. Simply change `MaskMap` and `Gauges` to the coordinates of the outlet of any basin of interest.

For example, for the Nile basin

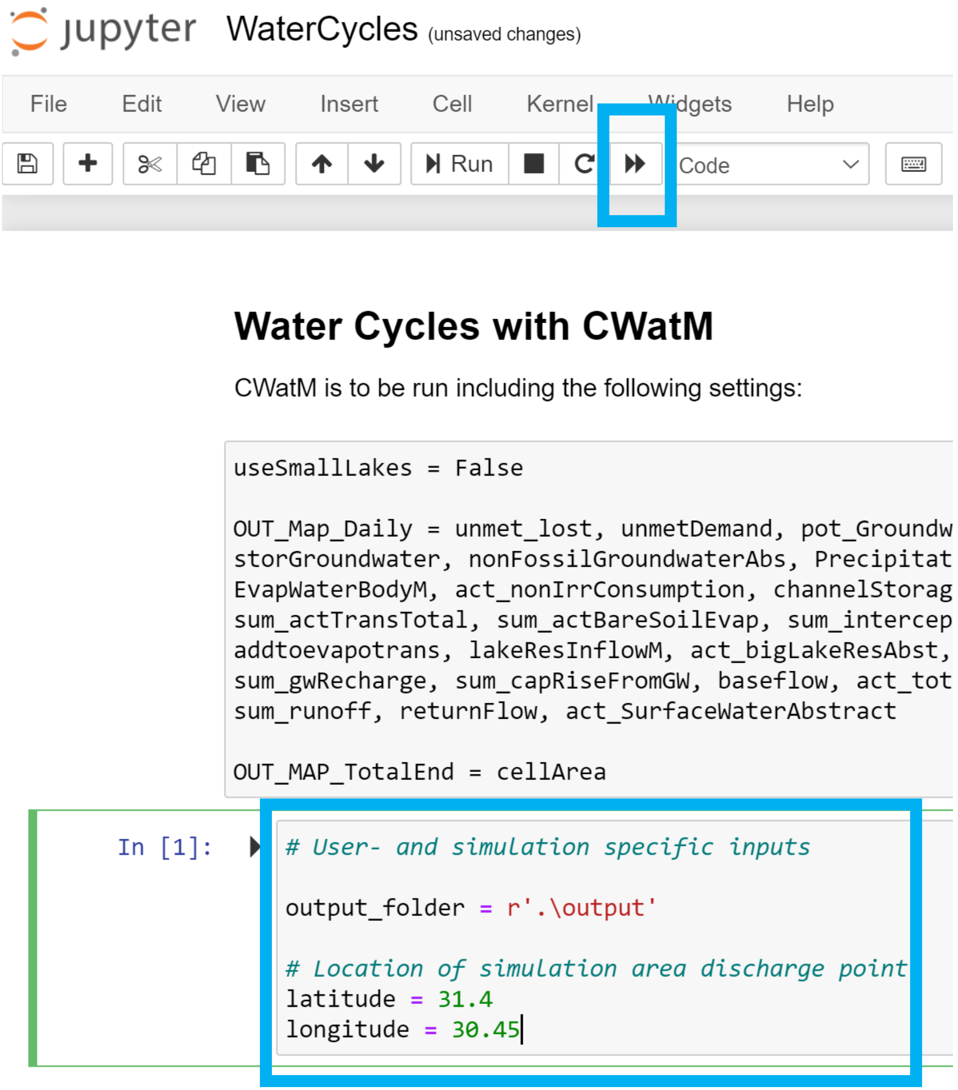
MaskMap = 30.45 31.4

Gauges = 30.45 31.4

4. WaterCycles, new basin

Update the output folder and the coordinates to the assocaited basin outlet, and then execute!

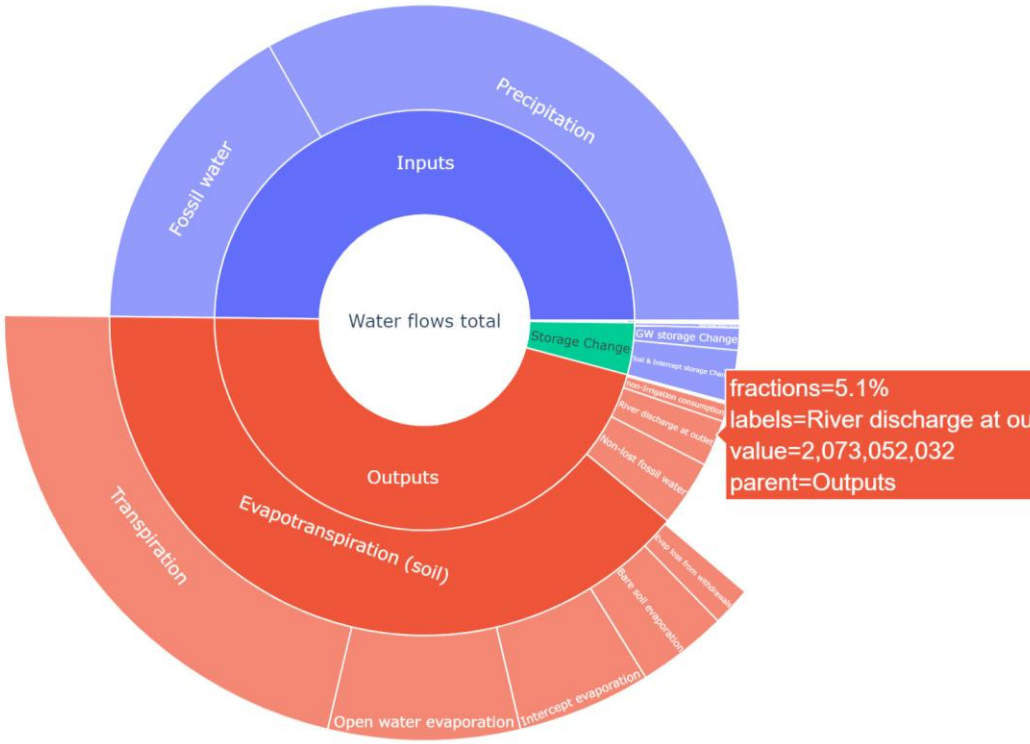
output_folder = r’.\output’



Ravi subbasin

MaskMap = 71.85 30.64 (long lat)

Gauges = 71.85 30.64 (long lat)

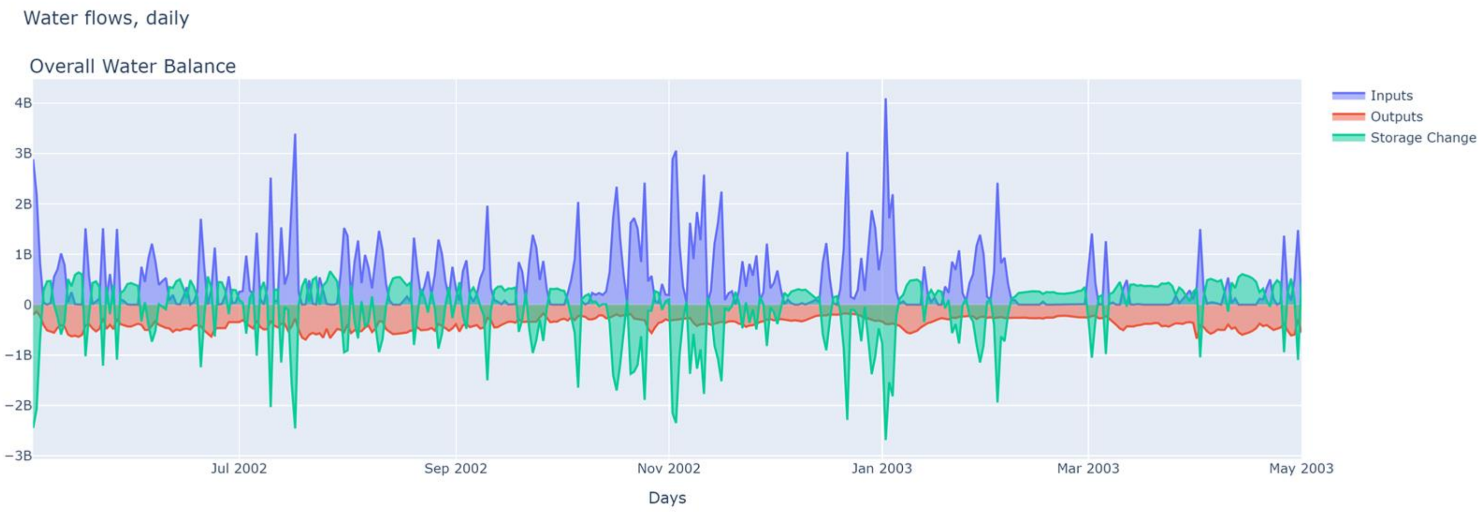


StepStart = 01/04/2002
SpinUp = 01/05/2002
StepEnd = 01/05/2003

Rhine basin

MaskMap = 6.11 51.84

Gauges = 6.11 51.84

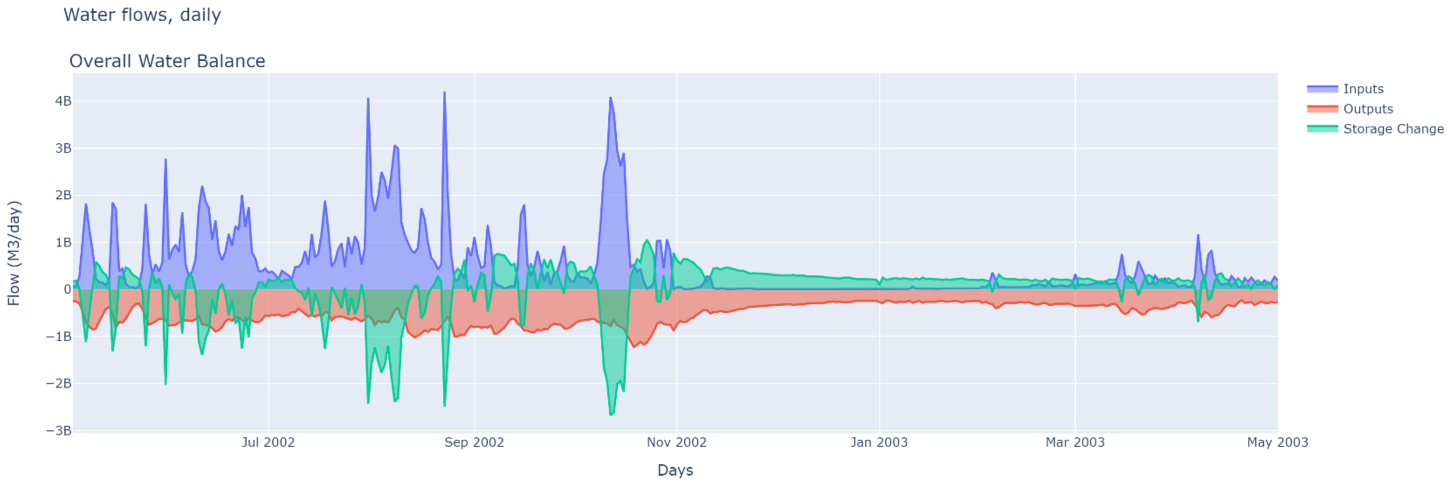


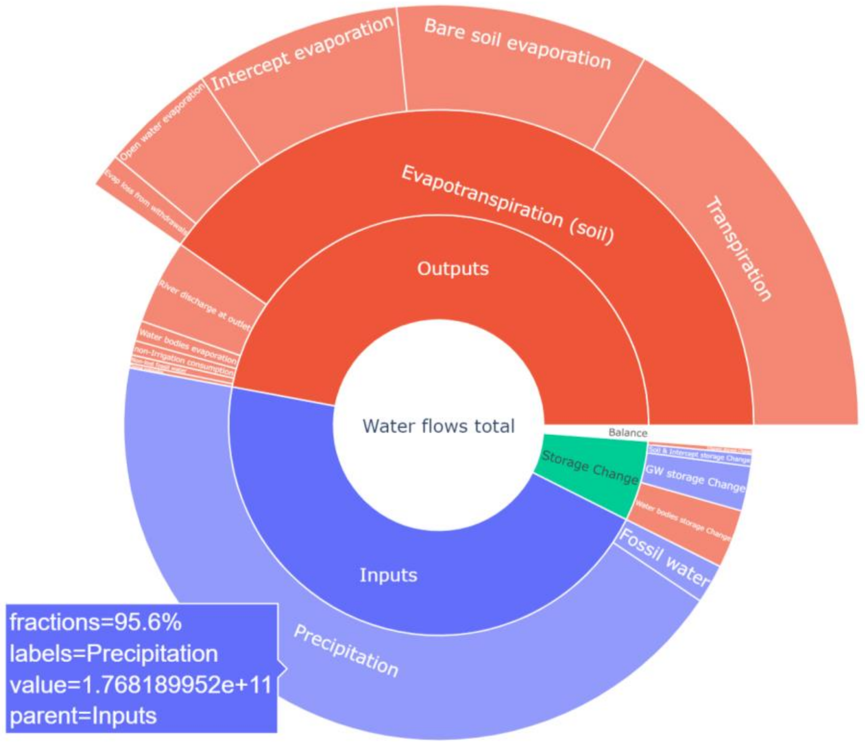
StepStart = 01/04/2002
SpinUp = 01/05/2002
StepEnd = 01/05/2003

Krishna basin

MaskMap = 80.875 15.875

Gauges = 80.875 15.875



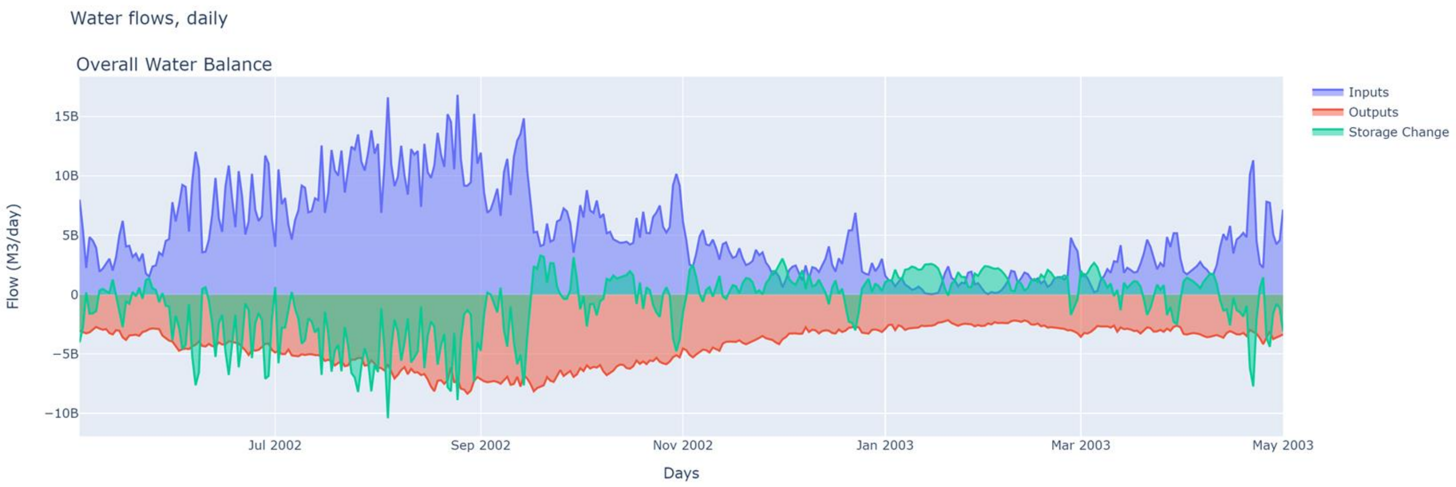


StepStart = 01/04/2002
SpinUp = 01/05/2002
StepEnd = 01/05/2003

Nile basin

MaskMap = 30.45 31.4

Gauges = 30.45 31.4



StepStart = 01/04/2002
SpinUp = 01/05/2002
StepEnd = 01/05/2003