Coupling Hydrological models through eWaterCycle

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TU Delft

netherlands eScience center

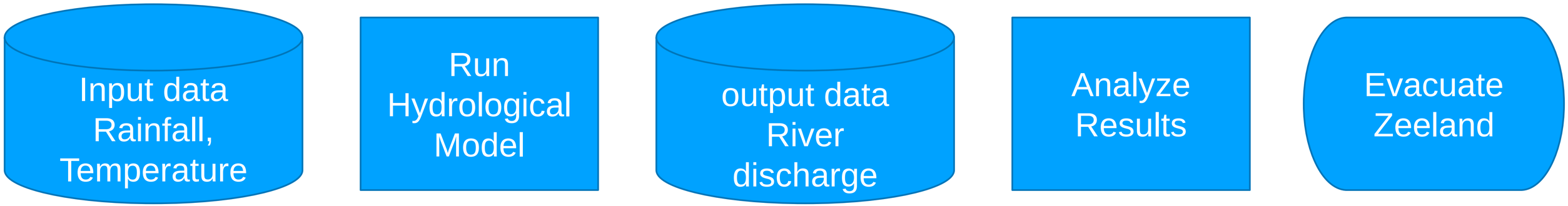

python™


Fortran77

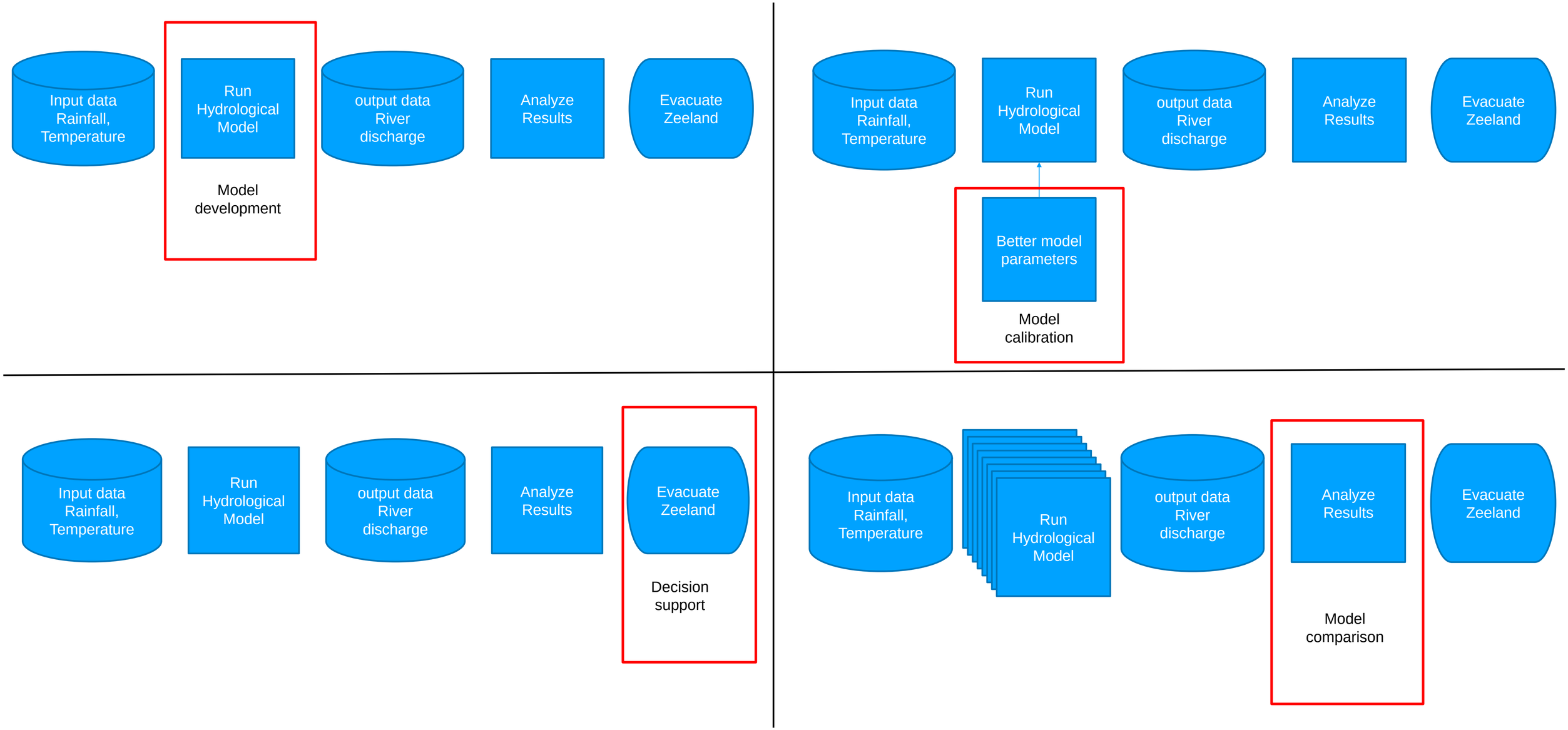

R


MATLAB

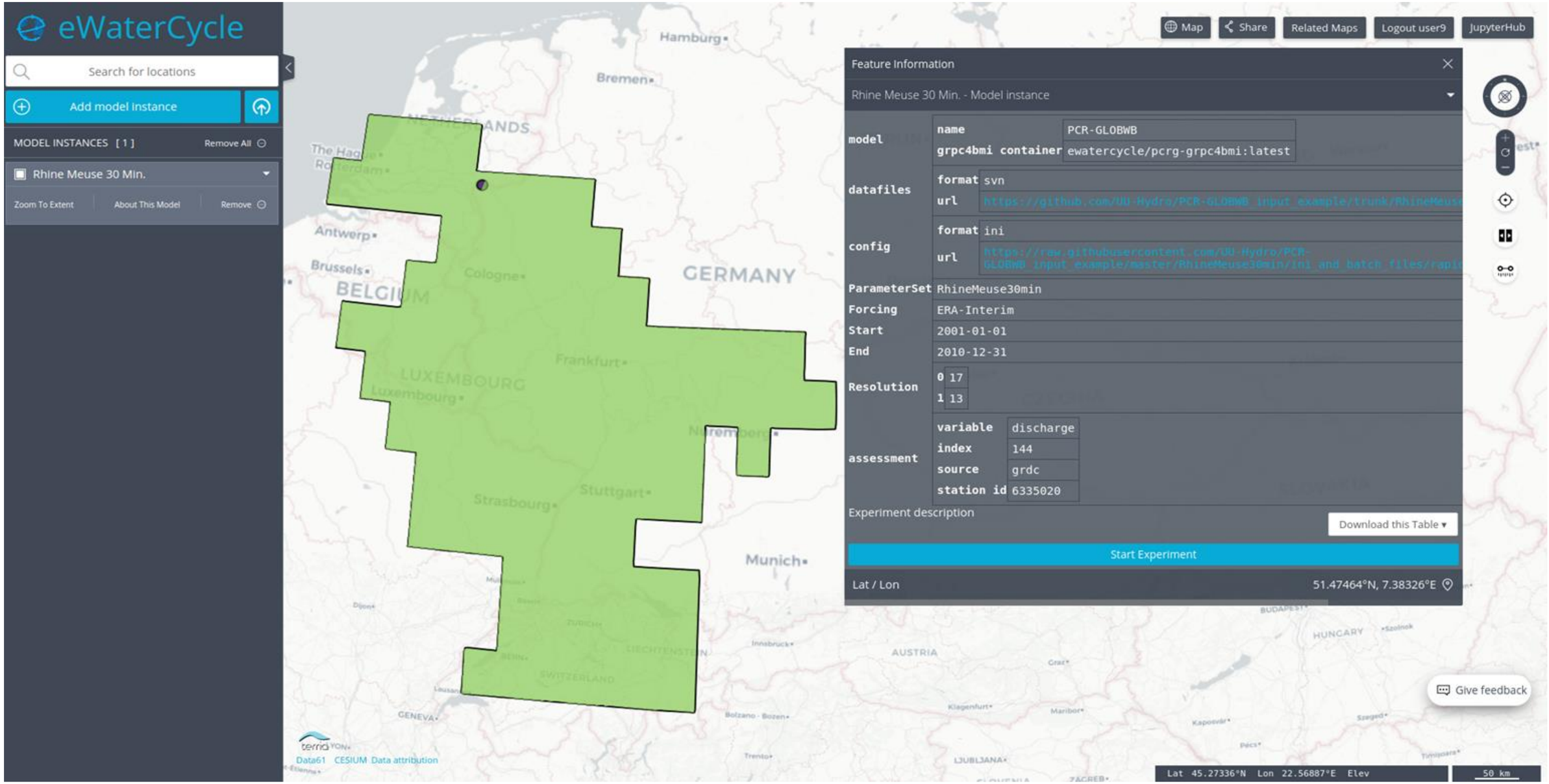
Hydrological Modelling workflow



Hydrological Modelling workflow variants



Explorer


eWaterCycle
Search for locations
Add model instance
MODEL INSTANCES [1]
Remove All
Rhine Meuse 30 Min.
Zoom To Extent
About This Model
Remove
Map
Share
Related Maps
Logout user9
JupyterHub
Feature Information
Rhine Meuse 30 Min. - Model instance
model
name PCR-GLOBWB
grpc4bmi container ewatercycle/pcrg-grpc4bmi:latest
datafiles
format svn
url https://github.com/UU-Hydro/PCR-GLOBWB_input_example/trunk/RhineMeuse
config
format ini
url https://raw.githubusercontent.com/UU-Hydro/PCR-GLOBWB_input_example/master/RhineMeuse30min/ini_and_batch_files/rapid
ParameterSet RhineMeuse30min
Forcing ERA-Interim
Start 2001-01-01
End 2010-12-31
Resolution
0 17
1 13
assessment
variable discharge
index 144
source grdc
station id 6335020
Experiment description
Download this Table
Start Experiment
Lat / Lon
51.47464°N, 7.38326°E
Hamburg
Bremen
NETHERLANDS
Antwerp
Brussels
BELGIUM
Cologne
GERMANY
LUXEMBOURG
Luxembourg
Frankfurt
Nuremberg
Stuttgart
Strasbourg
Munich
AUSTRIA
HUNGARY
SWITZERLAND
GENEVA
Innsbruck
Graz
Klagenfurt
Maribor
LJUBLJANA
ZAGREB
Give feedback
Data61 CESIUM Data attribution
Lat 45.27336°N Lon 22.56887°E Elev
50 km

Notebooks

File Edit View Run Kernel Tabs Settings Help

/ pcrglobwb /

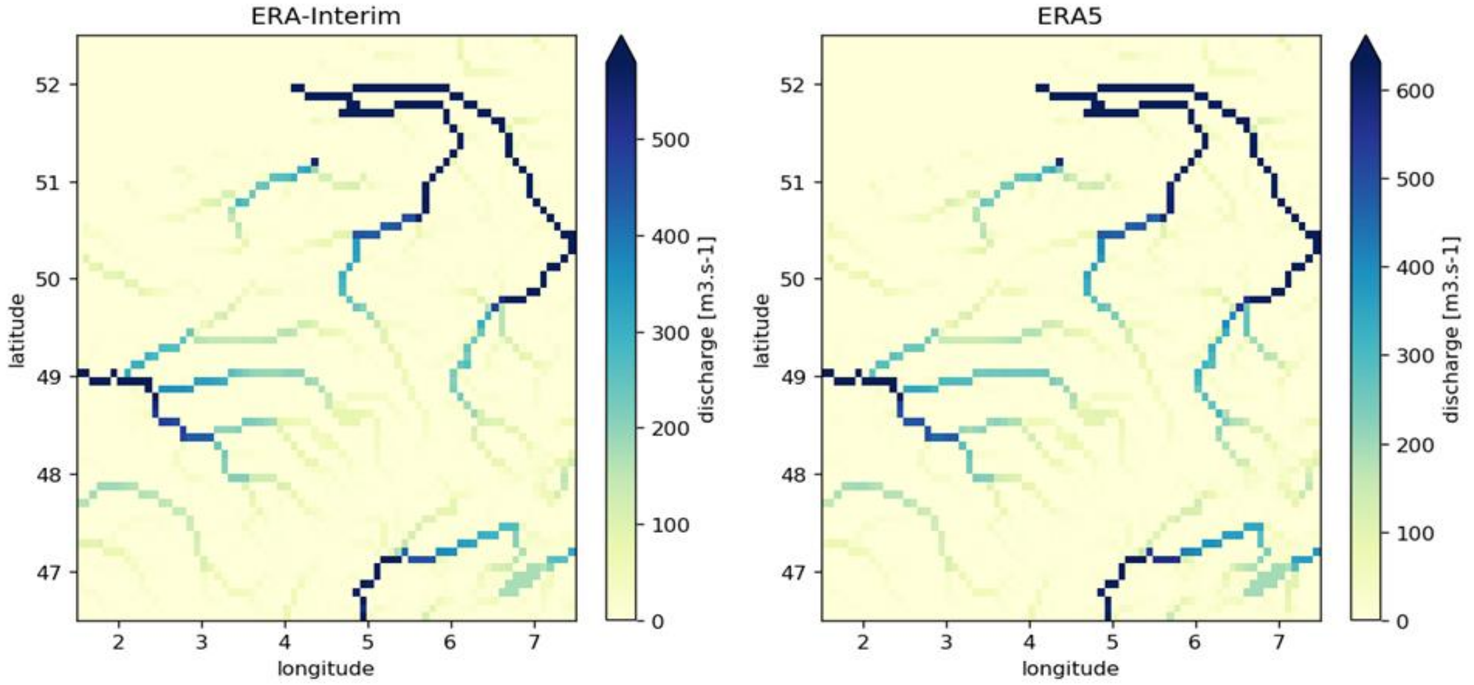
Name	Last Modified
00_pcrglobwb_run_notebooks_as_script.sh	a day ago
01_pcrglobwb_preprocessing.ipynb	a day ago
02_pcrglobwb_testrun.ipynb	a day ago
03_pcrglobwb_fullruns.ipynb	a day ago
04_pcrglobwb_analysis.ipynb	a day ago
README.md	a day ago

02_pcrglobwb_testrun.ipynt

Code Python 3

Visualize maps for the final timestep

[6]:
```
fig, axs = plt.subplots(1, 2, figsize=(10, 5), dpi=120)
for [name, da], ax in zip(maps.items(), axs):
    da.isel(time=-1).plot(ax=ax, cmap='YlGnBu', robust=True)
    ax.set_title(name)

plt.tight_layout()
fig.savefig(f'pcrglobwb_{basin_name}_discharge_map', bbox_inches='tight', dpi=300)
```

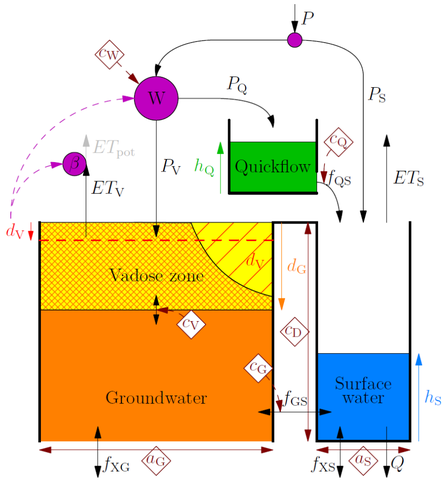


Compare the model output with observations

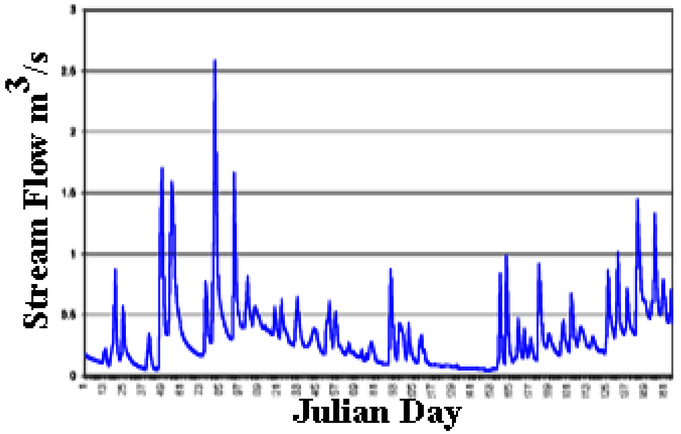
Forcing

pre processing

Hydrological model

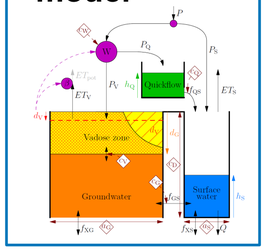


Hydrograph



V
2.04
3.22
2.44

Hydrological model



Downloading

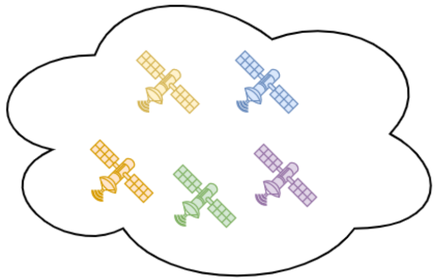
Regridding

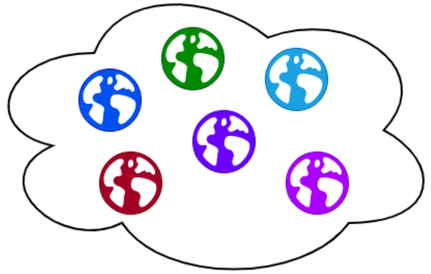
Selection

Derivation

Model Specific Format

Forcing





Datasets

Downloading

ESMValTool
Earth System Model eValuation Tool

Shape Selection

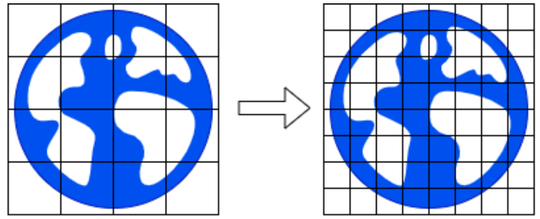
Regridding

Derivation

G	Y
0.01	12
0.03	14
0.02	2

X	Y	J
1	5	H
2	5	B
3	5	A
4	5	H

Model Specific Formats



Regridding

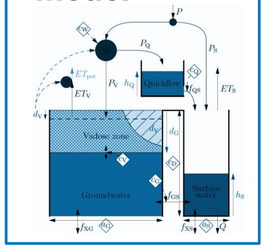
Selection

Derivation

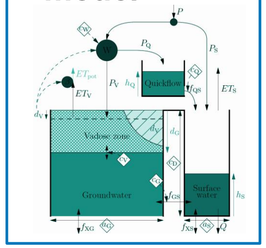
V
2.04
3.22
2.44

Model Specific Format

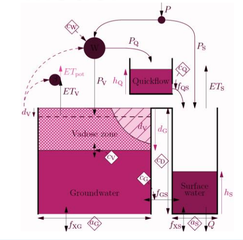
Hydrological model



Hydrological model



Hydrological model



The *Basic Model Interface* (BMI) provides a standard interface for model communication.

BMI identifies about 30 functions needed for model coupling.

- Not all of them need be implemented
- Many of them are trivial to implement

```
void initialize(in string config_file);
void update(void);

void get_var_grid(in string var_name, out int gid);
void get_var_units(in string var_name, out string units);

void get_value(in string var_name, in array<> dest);
```

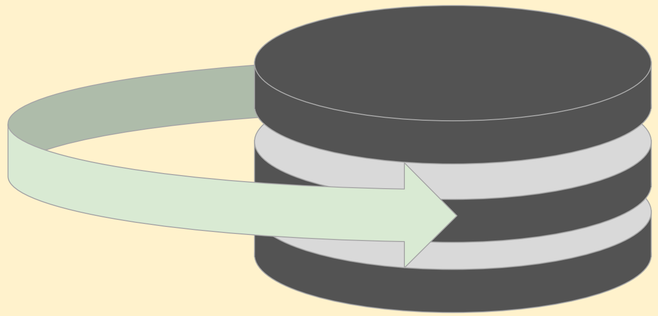
Slide by Eric Hutton

CSDMS
community surface dynamics modeling system

The *BMI* standardizes how to advance a model in time and get and set its data.

```
int initialize(in string config_file);
```

```
int update(void);
```



```
int get_value(
    in string var_name, in array<> dest
);
```

0100...1101

1010...1001

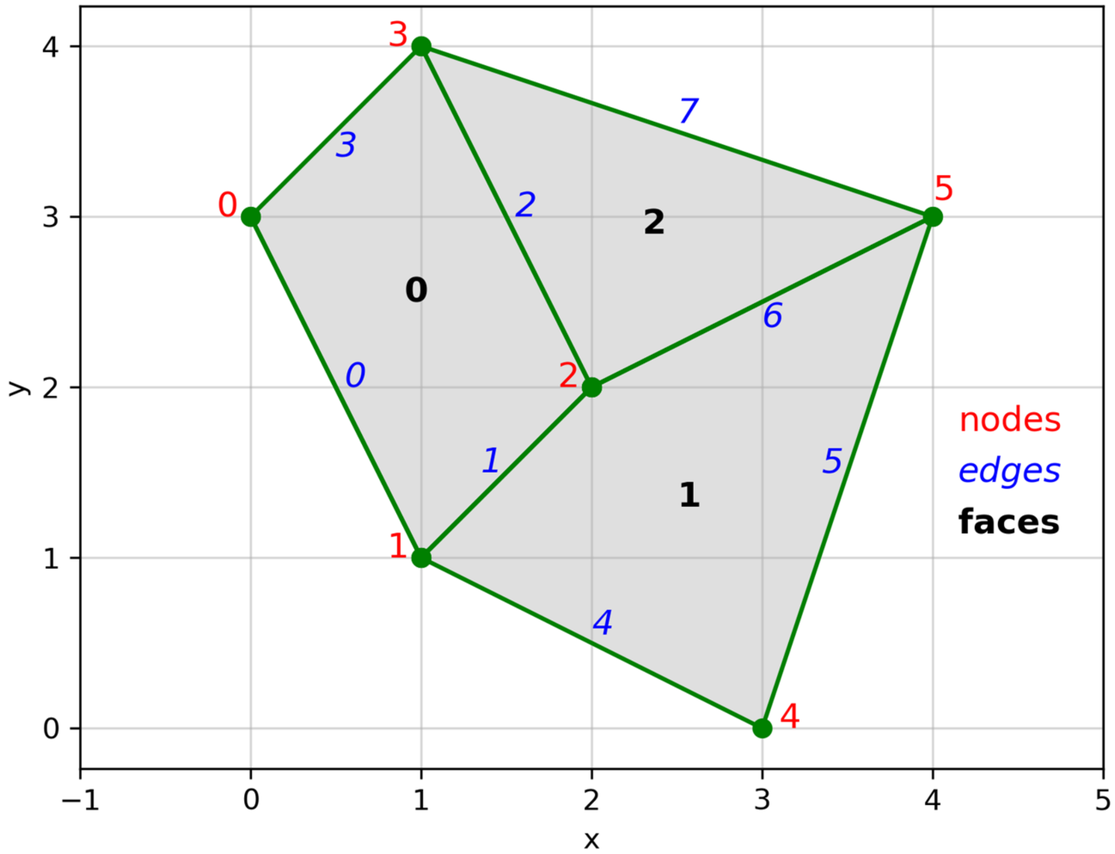
```
int set_value(
    in string var_name, in array<> src
);
```

```
int finalize(void);
```

Slide by Eric Hutton

CSDMS
community surface dynamics modeling system

The *BMI* provides functions that describe a model variable's grid.

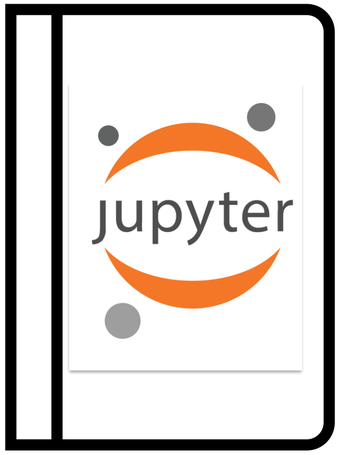


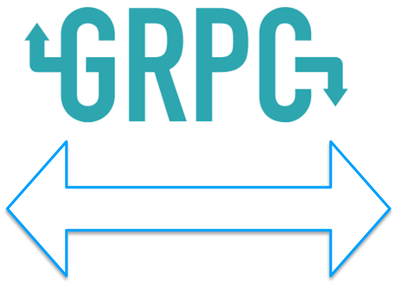

```
int get_var_grid(in int grid_id, out int grid);

int get_grid_edge_nodes(
    in int grid_id, in array<int, 1> edge_nodes
);
int get_grid_face_edges(
    in int grid_id, in array<int, 1> face_edges
);
```

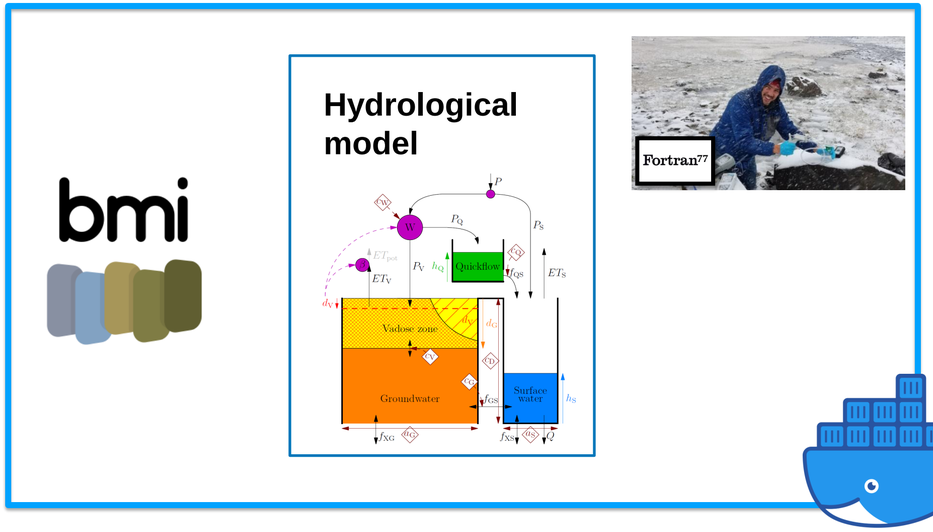
etc.

Slide by Eric Hutton

CSDMS
community surface dynamics modeling system





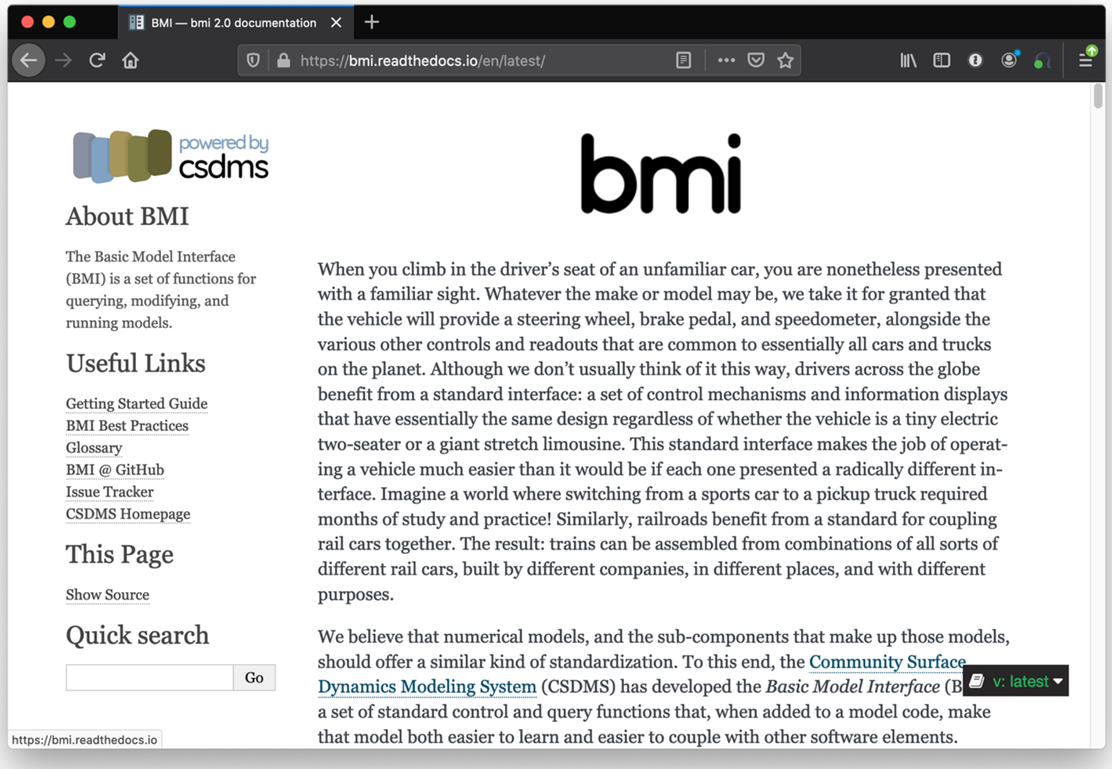



```
#model Run

model = BmiClientDocker(image='model_location', input_dir='./ESMValToolResults')

model.initialize('settings_file.cfg')

output = []

while model.get_current_time() < model.get_end_time():

    model.update()

    output.append(model.get_value('discharge'))
```

Thank You – Be in Touch

https://ewatercycle.org

https://bmi.readthedocs.io



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