HydroLogic

Flexibele modelnabewerking & Inundatie toolbox

HYDROLIB slotsymposium

Inhoud

- Inundatie toolbox
- Hands-on demonstratie

Het idee

- Geautomatiseerder lezers voor de verschillende output bestanden:
  - *his.nc bestanden
  - *clm.nc, *fou.nc, *map.nc bestanden
- Automatische analyse van inundaties:
  - Vertalen van inundatiepatronen in mesh formaat naar raster figuren
  - Metadata uitlezen

Inundatieanalyse in de Gelderse Vallei

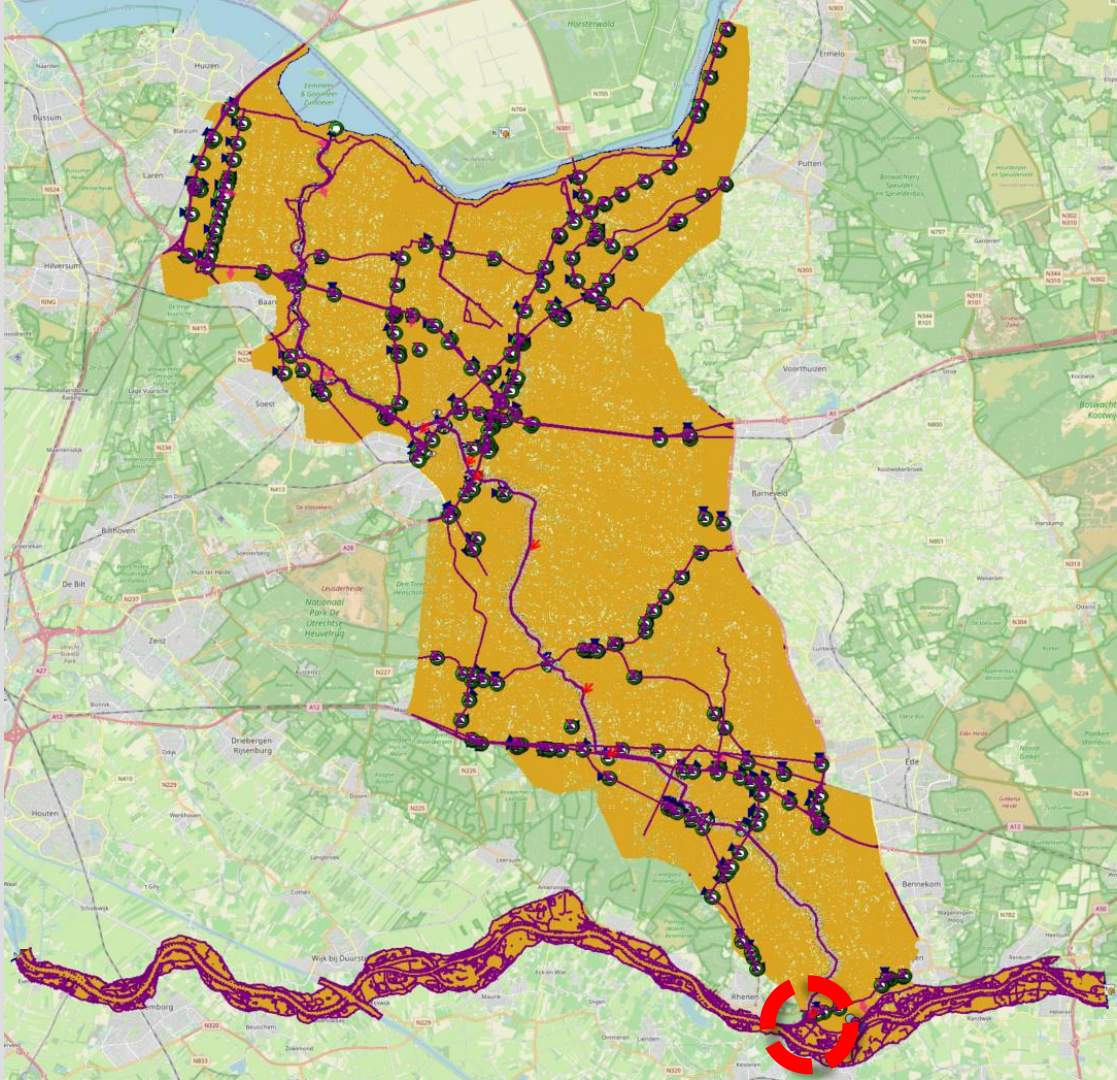
Conceptresultaten

HydroLogic

waterschap vallei en veluwe

Aanpak

- 2D D-HYDRO FM-model
- Dijkdoorbraak in de Grebbendijk nabij Rhenen
- Berekenen inundatiepatroon in de Gelderse Vallei

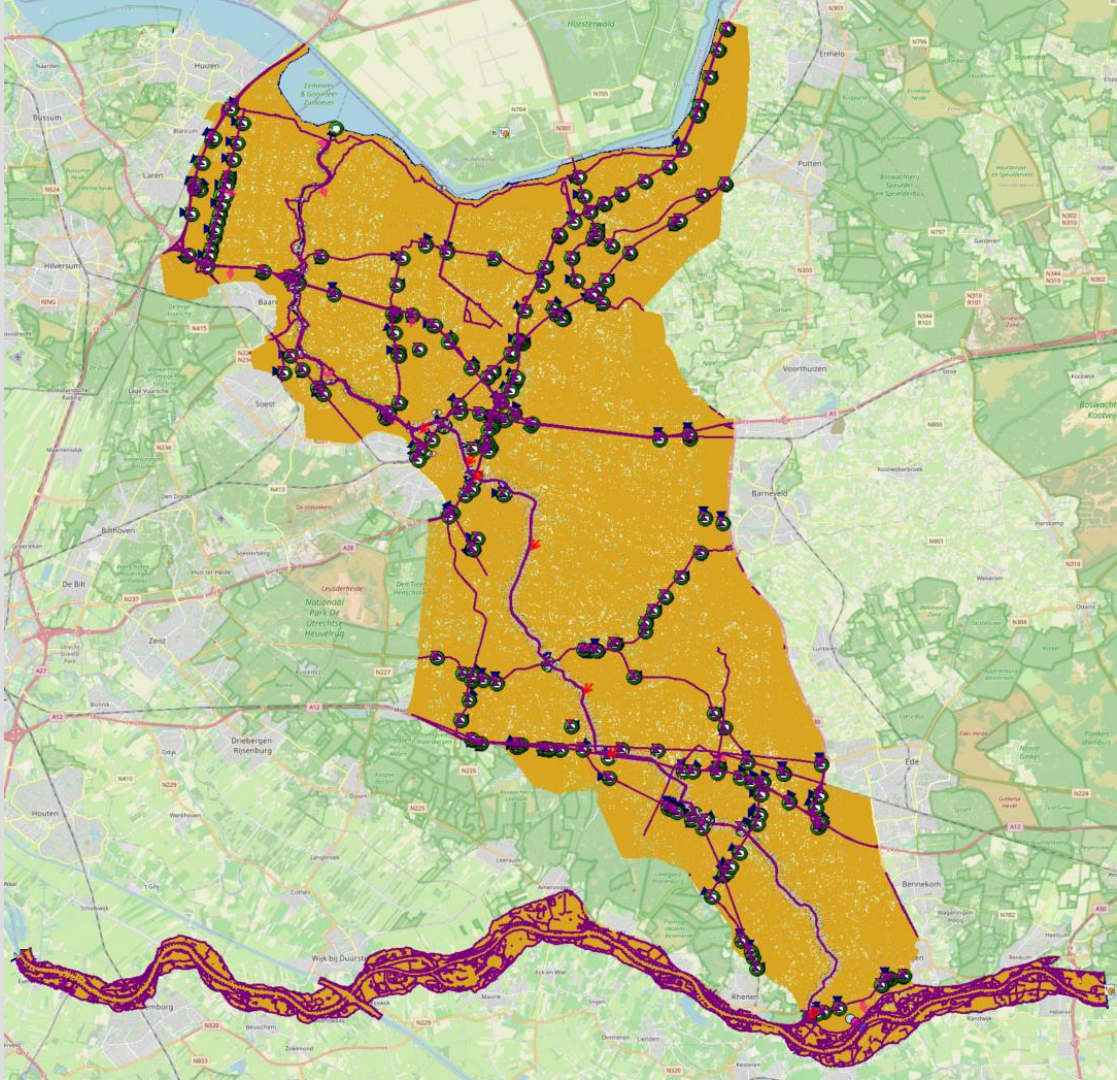


Model Resultaten

- His.nc:
  - dambreak_discharge
  - dambreak_flow_area
  - dambreak_crest_level
  - dambreak_crest_width

- Fou.nc:
  - Mesh2d_fourier001_max_depth

- Clm.nc:
  - Mesh2d_waterdepth



Model Resultaten

- His.nc:
  - dambreak_discharge
  - dambreak_flow_area
  - dambreak_crest_level
  - dambreak_crest_width

Import hisreader

Add hisreader to path and import HisResults

In [1]:
```
import os
import sys

currentdir = os.path.dirname(os.getcwd())
sys.path.append(currentdir + "/Readers")

from hisreader import HisResults
```

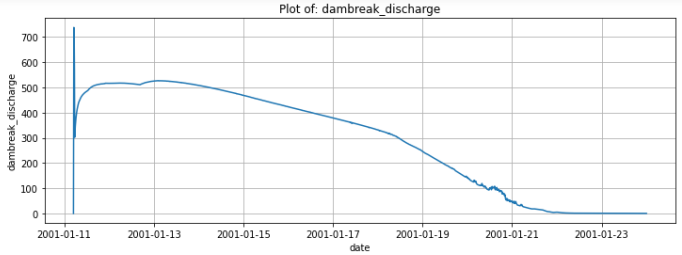
Load results

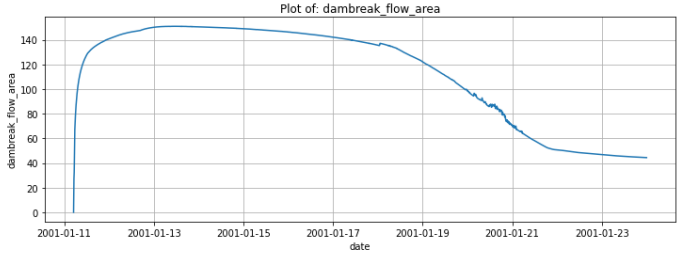
Load example model reults and make a quick plot to inspect the data for a measurement station.

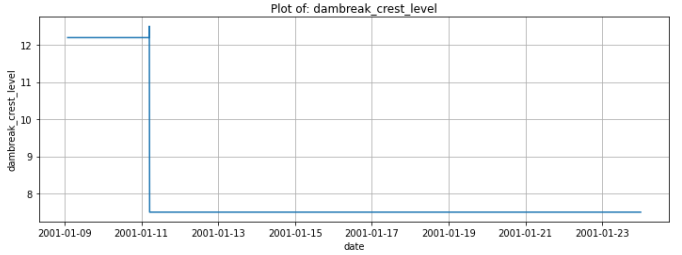
In [2]:
```
input_path = currentdir + "/Data/Grebbendijk/input/"
Results = HisResults(inputdir=input_path, outputdir=input_path + r"/csv/", structure_types=["dambreak"])

print(Results.bres_Grebbedijk_Landelijk_Gebied.simulated.columns)
```

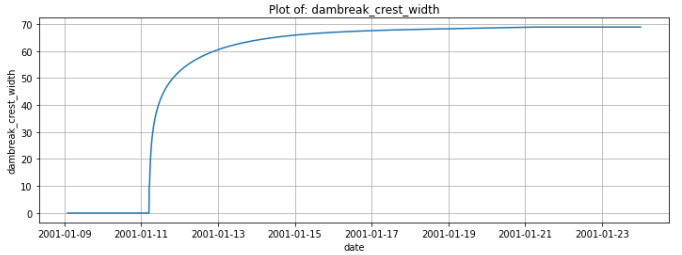
```
Index(['dambreak_s1up', 'dambreak_s1dn', 'dambreak_discharge',
       'dambreak_cumulative_discharge',
       'dambreak_breach_width_time_derivative', 'dambreak_water_level_jump',
       'dambreak_normal_velocity', 'dambreak_structure_head',
       'dambreak_flow_area', 'dambreak_crest_level', 'dambreak_crest_width'],
      dtype='object')
```

In [3]:
```
Results.bres_Grebbedijk_Landelijk_Gebied.simulated_plot("dambreak_discharge")
Results.bres_Grebbedijk_Landelijk_Gebied.simulated_plot("dambreak_flow_area")
Results.bres_Grebbedijk_Landelijk_Gebied.simulated_plot("dambreak_crest_level")
Results.bres_Grebbedijk_Landelijk_Gebied.simulated_plot("dambreak_crest_width")
```









Model Resultaten

- Clm.nc:
  - Mesh2d_waterdepth

Example for reading clm-file for Gelderse Vallei

The clm.nc file is read and *variable* is extracted. Next, the mesh data is converted to a raster and saved to a .tiff

In [1]:
```
import os
import sys

import matplotlib.pyplot as plt
import numpy as np

currentdir = os.path.dirname(os.getcwd())
sys.path.append(currentdir)
sys.path.append(currentdir + "\Readers")

from flowmeshreader import load_classmap_data, mesh_to_tiff
from inundation_toolbox import arrival_times
from plotting import raster_plot_with_context
```

In [2]:
```
# set paths
input_file_path = currentdir + r"\Data\Grebbendijk\input\DFM_clm.nc"
output_file_path = currentdir + r"\Data\Grebbendijk\output\arrival_time.tiff"
```

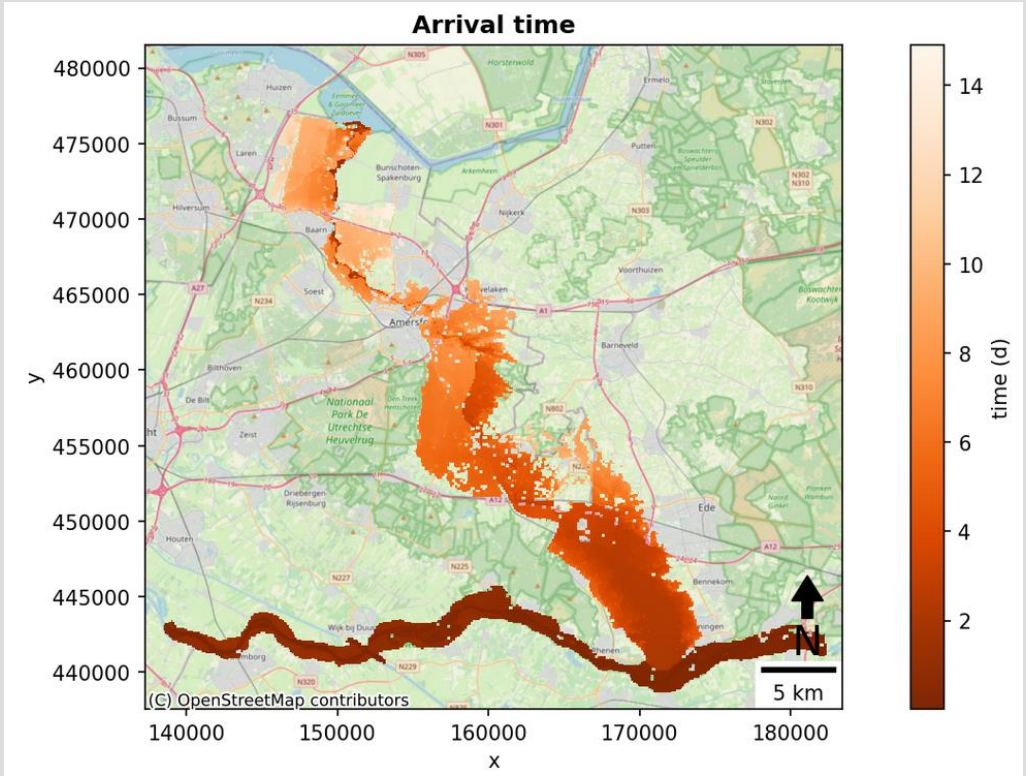
In [3]:
```
# raster options
resolution = 100  # m
distance_tol = 150  # m
interpolation = r"nearest"
```

In [4]:
```
variable = r"Mesh2d_waterdepth"
```

In [5]:
```
# Load mesh coordinates and data from netCDF
clm_data, map_data = load_classmap_data(input_file_path, variable, method="lower", map_data=False)
```

In [6]:
```
# Compute inundation specific variables
t_arrival = arrival_times(clm_data, np.timedelta64(1200, "s"), time_unit="D", arrival_threshold=2)
```

In [7]:
```
# Plot arrival times
_, _, grid_data = mesh_to_tiff(
        t_arrival,
        input_file_path,
        output_file_path,
        resolution,
        distance_tol,
        interpolation=interpolation,
    )
fig, ax = raster_plot_with_context(
    raster_path = output_file_path,
    epsg = 28992,
    clabel = "time (d)",
    cmap = "Oranges_r",
    title = "Arrival time",
    )
```



Model Resultaten

- Fou.nc:
  - Mesh2d_fourier001_max_depth

Example for reading fou-file for Gelderse Vallei

The fou.nc file is read and *variable* is extracted. Next, the mesh data is converted to a raster and saved to a .tiff

In [1]:
```
import os
import sys

import matplotlib.pyplot as plt

currentdir = os.path.dirname(os.getcwd())
sys.path.append(currentdir + "\Readers")

from flowmeshreader import load_fou_data, mesh_to_tiff
from plotting import raster_plot_with_context
```

In [2]:
```
# set paths
input_file_path = currentdir + r"\Data\Grebbendijk\input\DFM_fou.nc"
output_file_path = currentdir + r"\Data\Grebbendijk\output\fou.tiff"
```

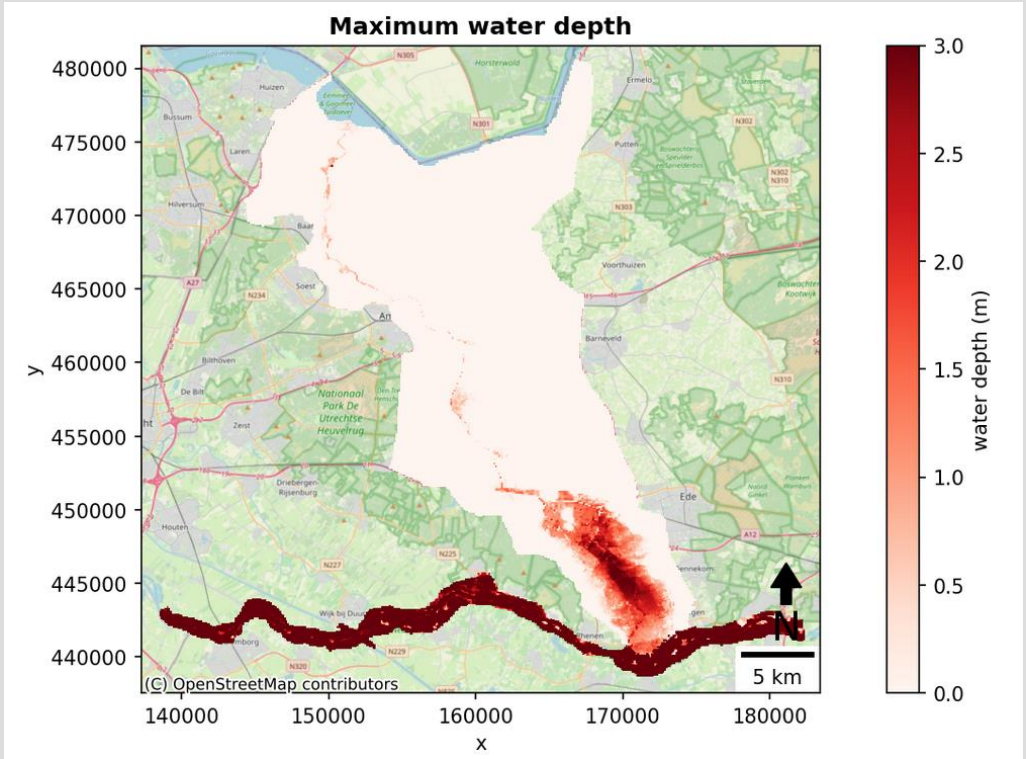
In [3]:
```
# raster options
resolution = 100  # m
distance_tol = 150  # m
interpolation = r"nearest"
```

In [4]:
```
variable = r"Mesh2d_fourier001_max_depth"
```

In [5]:
```
# Load mesh coordinates and data from netCDF
node_data = load_fou_data(input_file_path, variable)
```

In [6]:
```
# convert to raster and save as tiff
_, _, grid_data = mesh_to_tiff(
    node_data,
    input_file_path,
    output_file_path,
    resolution,
    distance_tol,
    interpolation=interpolation,
)
```

In [7]:
```
fig, ax = raster_plot_with_context(
    raster_path = output_file_path,
    epsg = 28992,
    clabel = "water depth (m)",
    cmap = "Reds",
    title = "Maximum water depth",
    vmin=0,
    vmax=3
    )
```

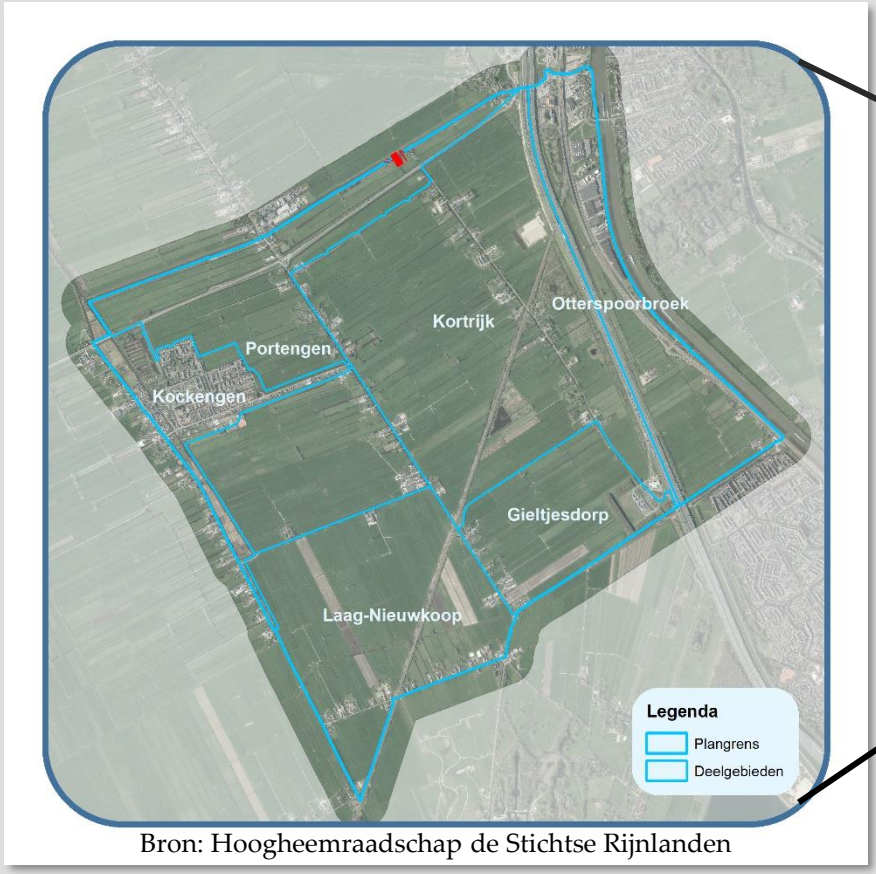


Conclusie

- Geautomatiseerde modelnabewerking
- Voor zowel his.nc bestanden als clm.nc, fou.nc, en map.nc bestanden
- Modulaire code, met voorbeeld notebooks
- Met online documentatie

Hands-on demonstratie

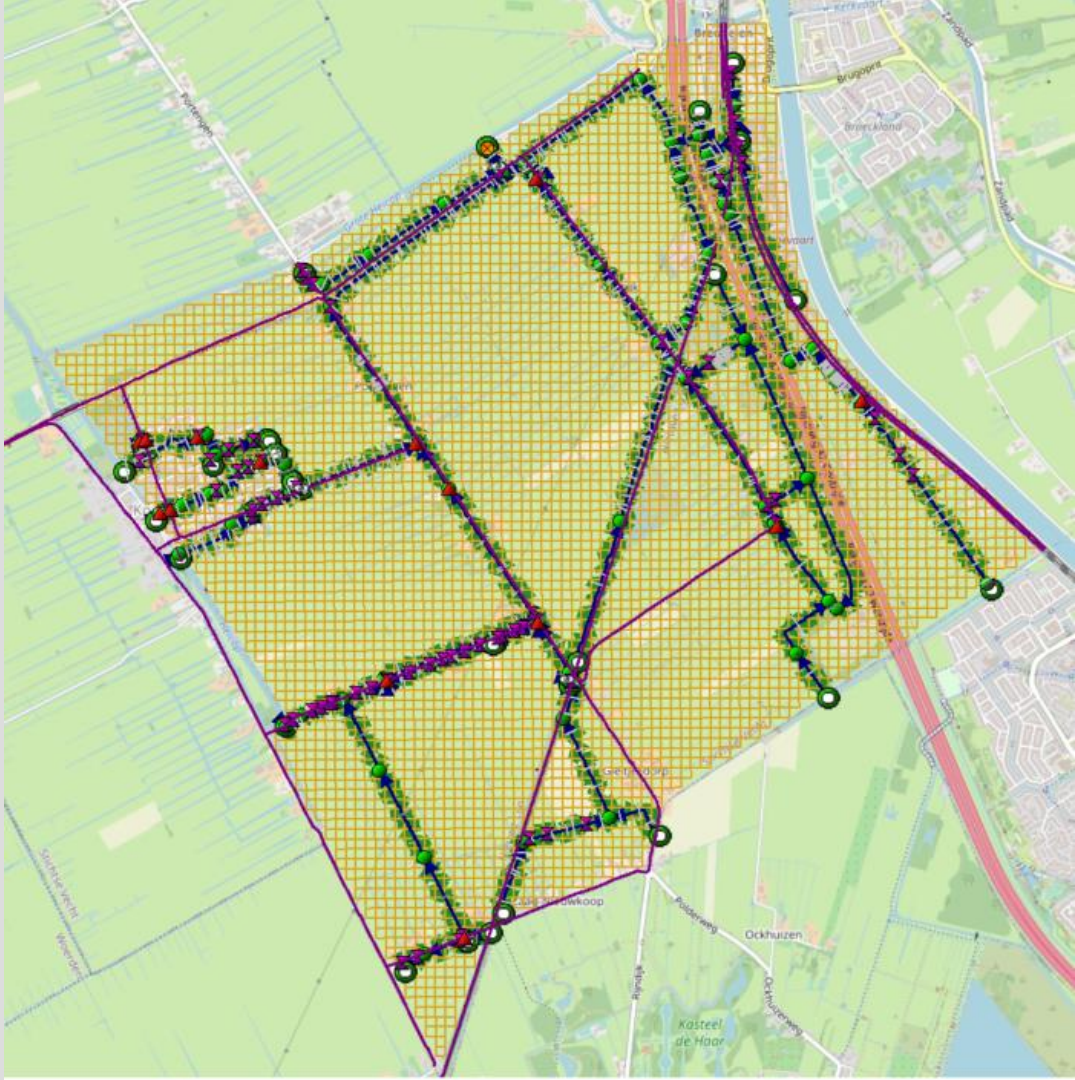
Studiegebied: Polder de tol



Bron: Hoogheemraadschap de Stichtse Rijnlanden

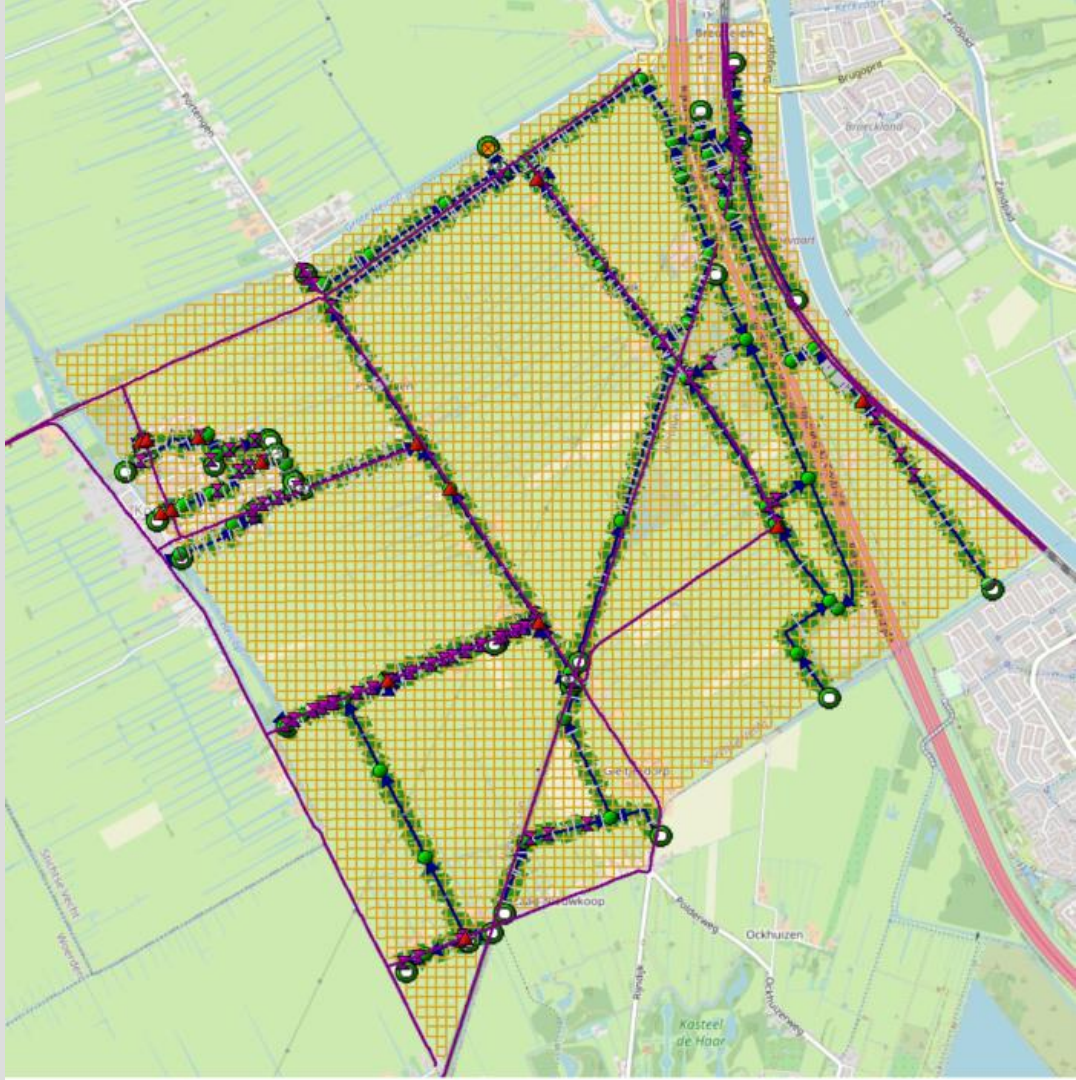
Aanpak

- 2D D-HYDRO FM-Model
- Piekbui: 46 mm in 6 uur
- Berekenen van inundatiepatronen



Resultaten

- Clm.nc:
  - Mesh2d_waterdepth
- Fou.nc:
  - Mesh2d_fourier002_max_depth
- Map.nc:
  - Mesh2d_waterdepth



Hands on demo:

- Handleiding:
  - https://hydrologicbv.github.io/D-HYDROLOGIC/index.html
  - https://bit.ly/3TeSEZ6

Conclusies:

- Flexibele nabewerkings scripts
- Eenvoudig bruikbare analyse van inundaties

HydroLogic

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