

# Simple Planar Beach Setup

Delft3D FM Waves Model

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Day 3

Wave energy converter modeling



# Develop Simple channel with turbines

## Module will highlight the following:

- › Setup Swan in Delft3D FM Wave Model
- › Develop Grid in RGF-Grid
- › Apply bathymetry and boundary conditions
- › Set up output locations
- › Execute model
- › Develop model with turbines
- › View Results

# Building Planar Beach



# First Steps

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- › Open Delft3D FM Suite 2024: Empty Project

# Delft3D-FM Suite: GUI Walkthrough

1) Menu to access GUI features

The screenshot displays the Delft3D-FM Suite GUI. The top menu bar includes File, Home, View, Map, and Spatial Operations. The Map menu is expanded, showing options like North Arrow, Zoom Previous, Zoom Next, Map Coordinate System, Export As Image, Query Features, and Query Time Series. The Spatial Operations menu is also visible, containing Show Profile, Add Load, Add Observation Point, Find Grid Cell, Grid Profile, Area, and Water Quality. The main map area shows a grid and features identified on the right. The right panel, titled 'Map', lists various features and layers, including FlowFM, Area, Boundary Conditions, Boundaries, Sources and Sinks, Laterals, and Estimated Grid-snapped features. The bottom panel shows a Messages window with logs of project operations.

2) Map showing grid, and features identified on right ->

3) Spatial actions menu bar

4) Map Display Layers

5) Messages indicating success, warning, and errors

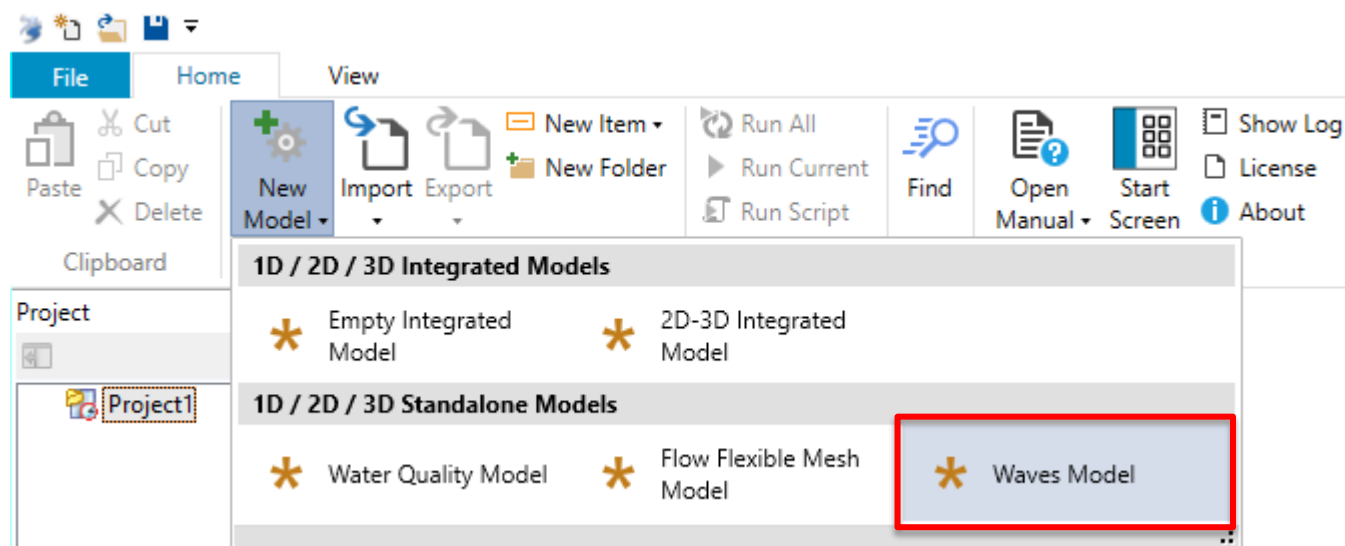
# Setting up a simple model

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- › **Build grid**
- › Add bathymetry
- › Set up boundary conditions and forcing
- › Set up processes and time parameters
- › Create observation points
- › Set up output
- › Run model
- › Visualize Results

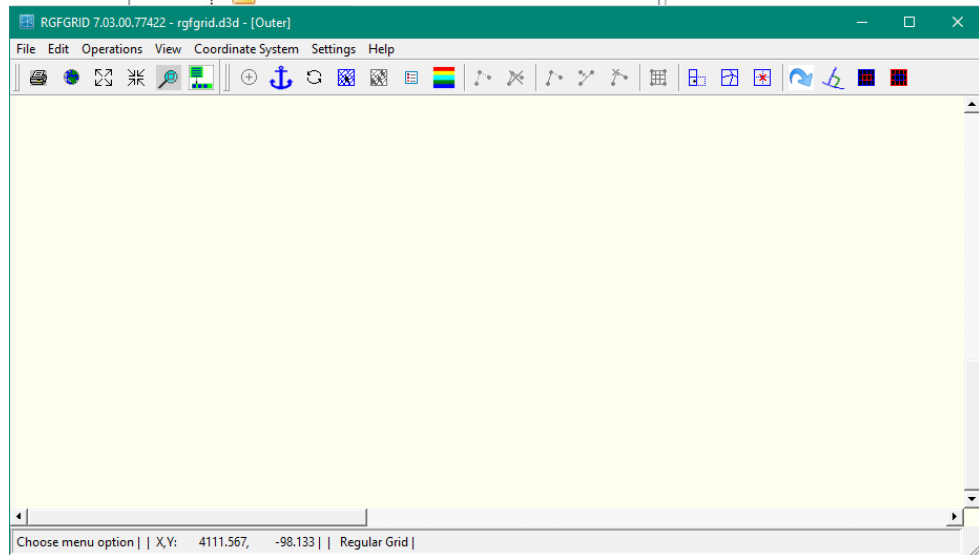
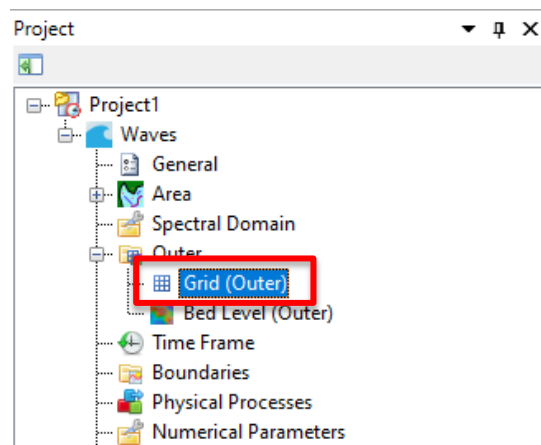
# Start a new model

- › Start a new waves model as shown on the right.
- › Click New Model → Waves Model



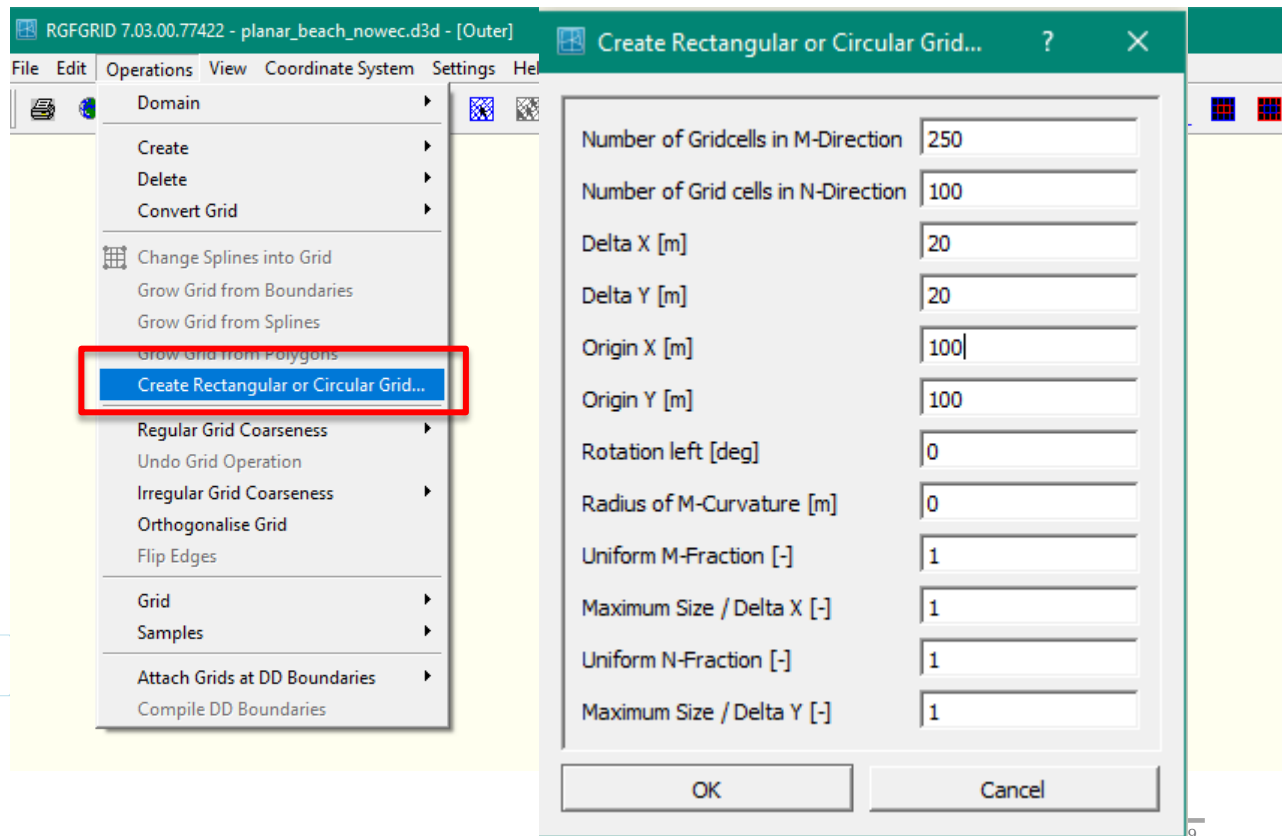
# Grid Development

- › Expand Outer in the Project Panel
- › Double click on Grid (Outer) to open RGF Grid.
- › New window will appear
- › Program is used to build rectilinear, curvilinear, and unstructured grids.



# Generate a simple Rectangular Grid

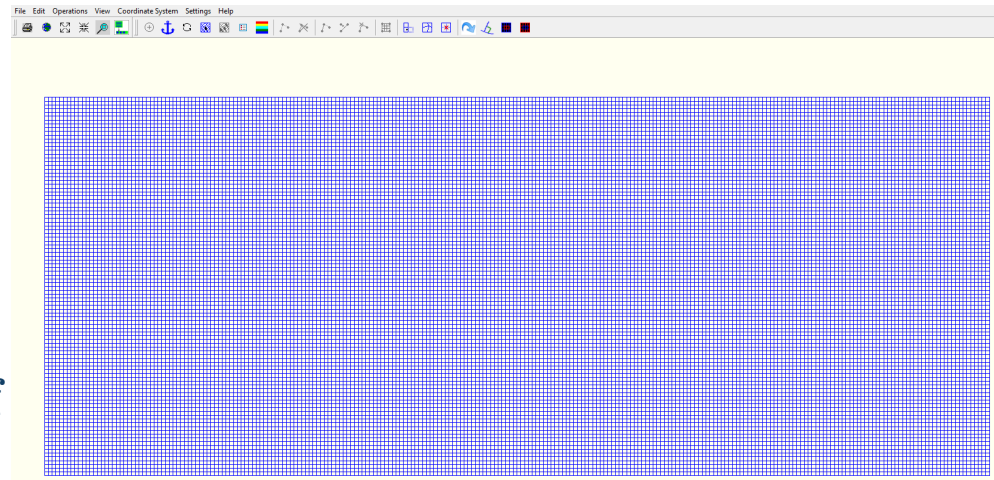
- Select Operations -> Create Rectangular or Circular Grid.
- Simple grids can be generated by defining the number and size of cells.
- Adjust Origin (X,Y) so that no grid cell is at zero.
- This is by default a Cartesian convention



# Save Grid

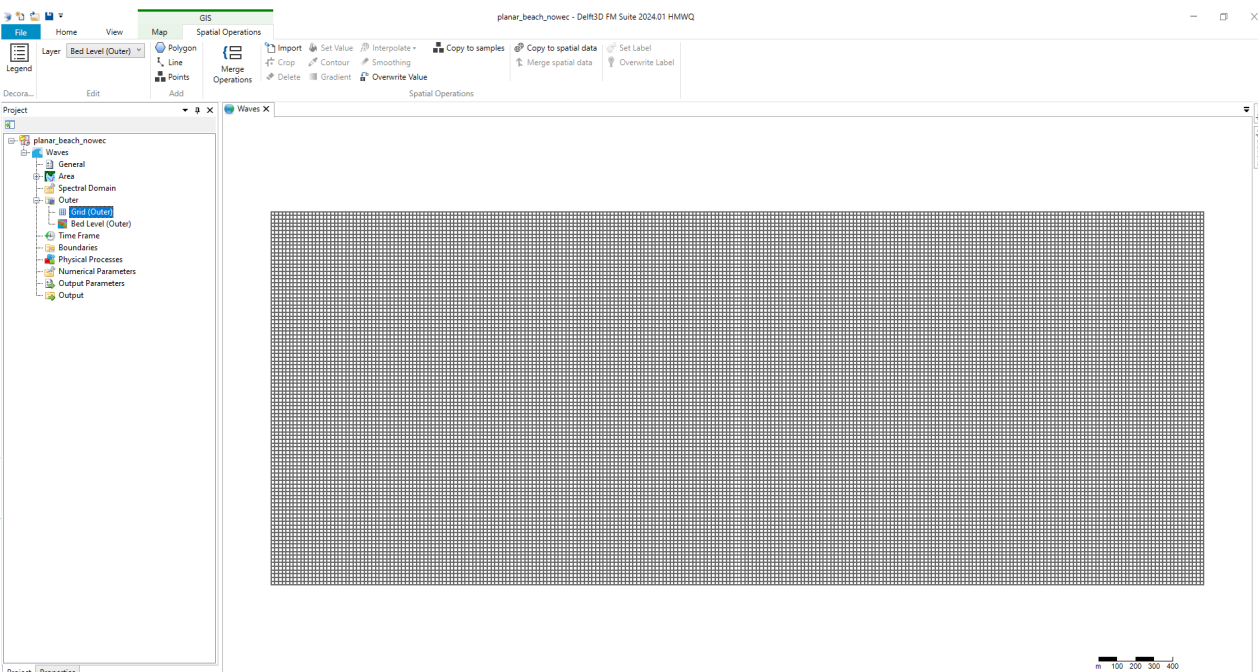
- › Basic Structured Grid is developed.
- › **File-> Save Project (nothing appears)**
- › **File -> Exit**
- › Grid will appear in Map view of GUI

Creates a  
.grd file



# Grid will appear in Map view of GUI

› Creates \*.grd file



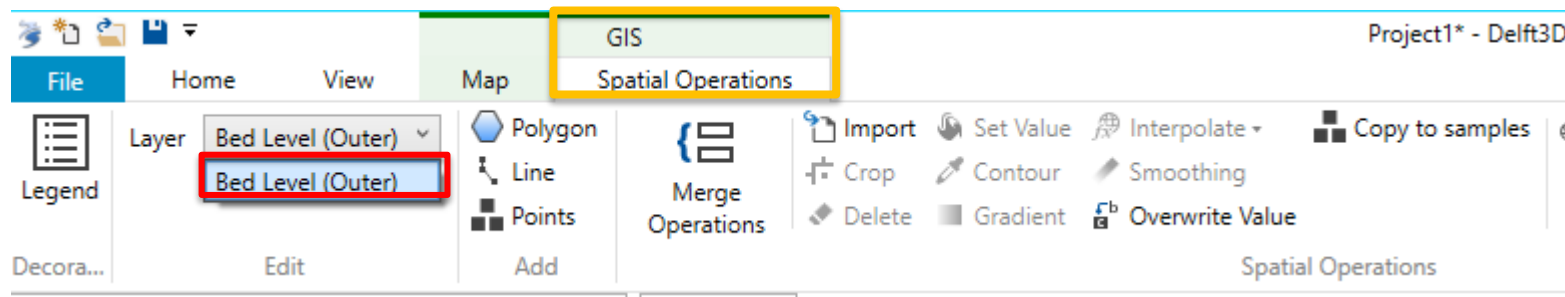
# Setting up a simple model

- › Build grid ☒
- › **Add bathymetry**
- › Set up boundary conditions and forcing
- › Set up processes and time parameters
- › Create observation points
- › Set up output
- › Run model

# Bathymetry

**Bathymetry is applied in the GIS Spatial Operations Menu!!!**

- › Add bathy to the grid
- › Select the **bed level** layer in the **GIS -Spatial Operations** tab
- › This menu allows you apply spatial data to grid from an xyz file or assign bulk values across regions.

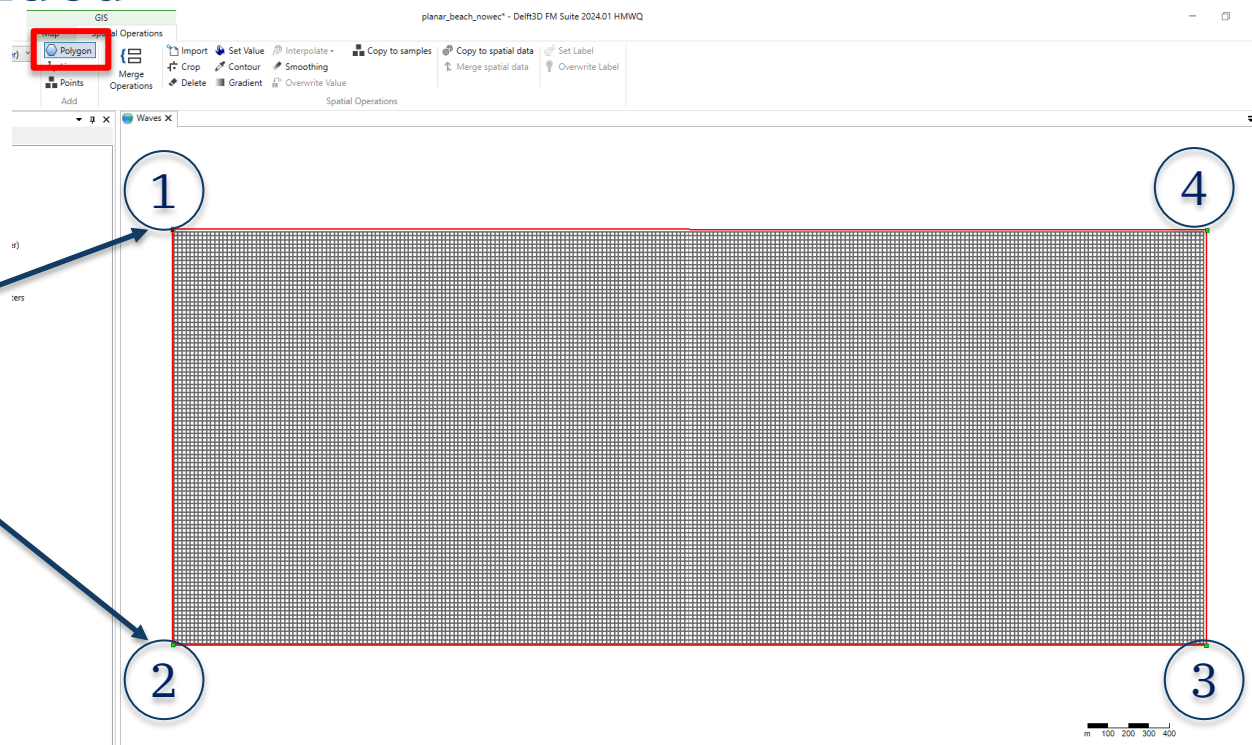


# Bathymetry Continued

- Draw a tight polygon around the grid

- Click polygon in the GIS Spatial Operations Tab

1. Click near the top corner grid node.
2. Move the mouse to the bottom left grid cell and left click once.
3. Move to the bottom right and click.
4. Move the mouse to the upper right and then double click to close the polygon



Better to make a polygon bigger than the grid than smaller  
Can use scroll disk (center of the mouse) to move the grid

# Bathymetry Continued

- › Select **Gradient**
- › Enter 15 to set an offshore depth of 15 m and -2 to set an elevation of 2m onshore.
- › *Depths are positive downward (soundings)*

Creates a  
.dep file

Gradient operation

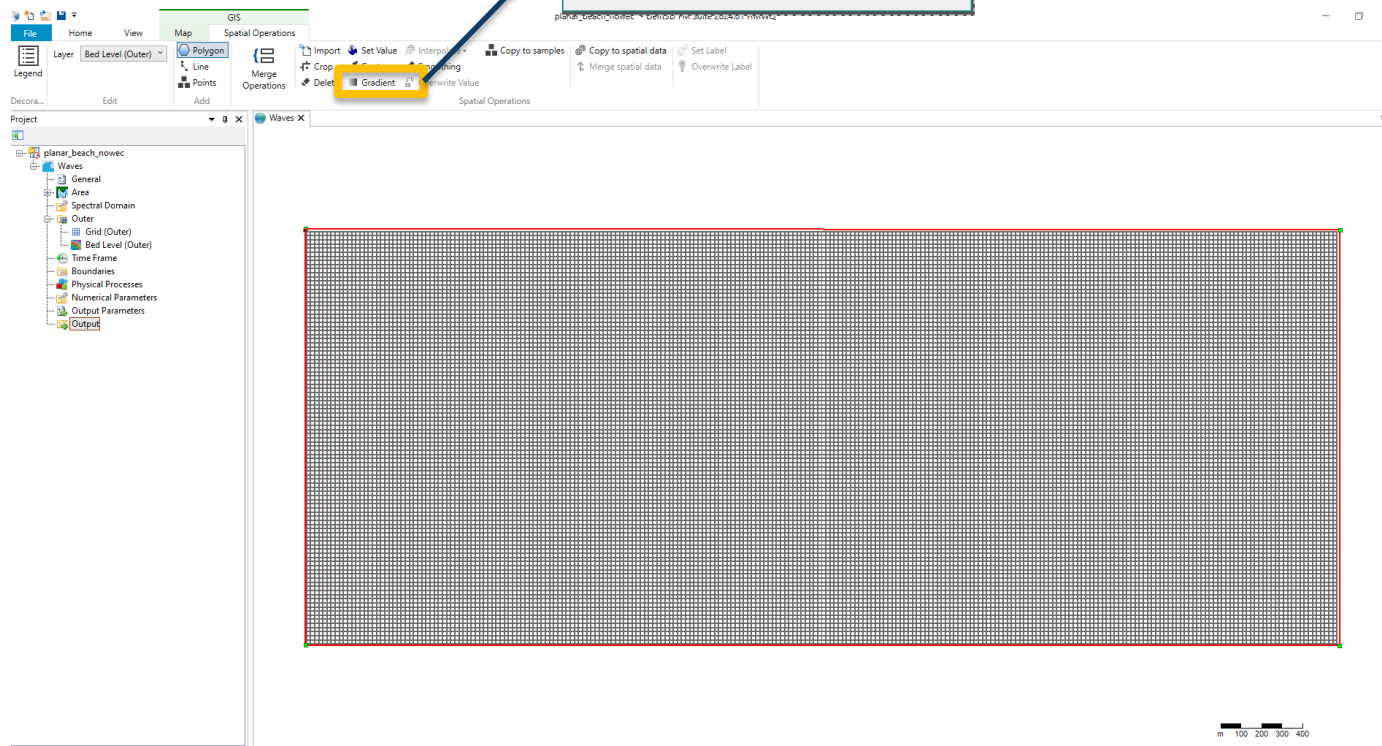
Please specify the operation parameters

Angle

Initial value

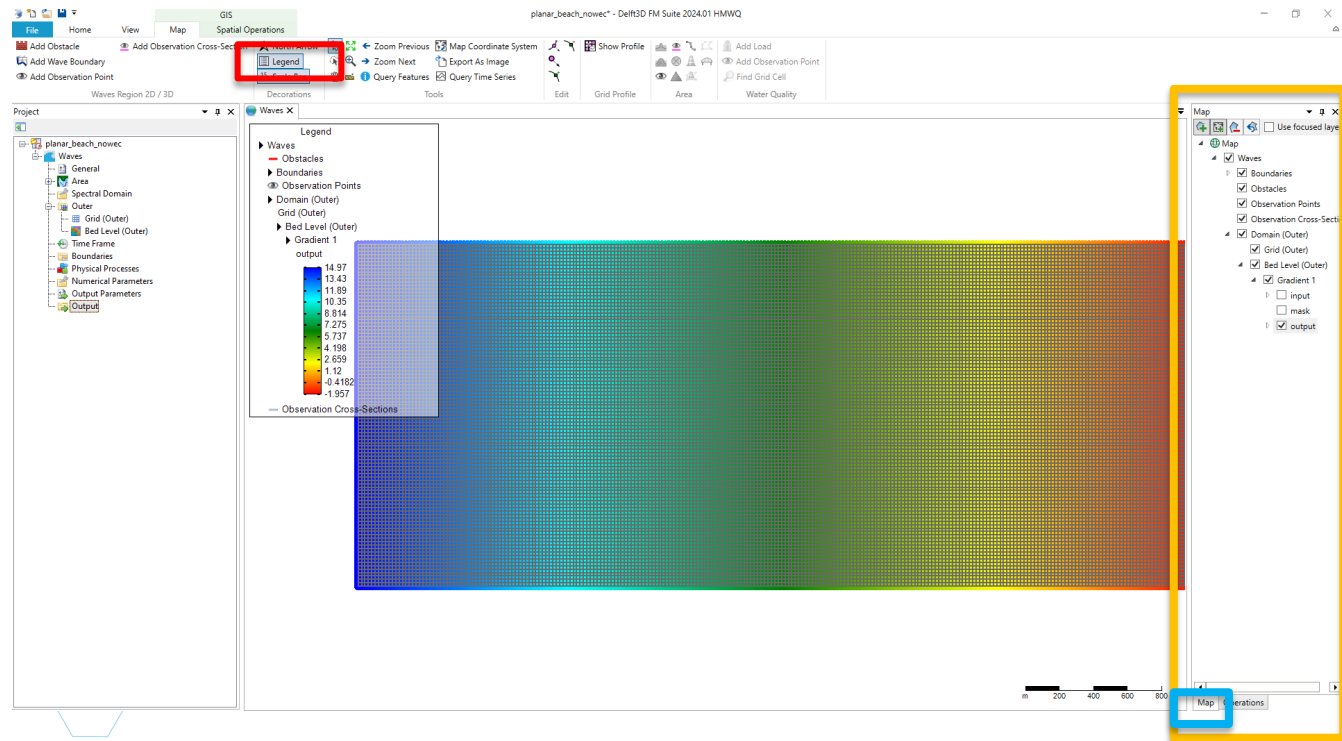
Final value

Pointwise operation



# Bathymetry Continued

- › To view **legend**.  
Select Legend in GIS-Map tab.
- › Different layers can be toggled on and off in the **Maps Panel** (right).
- › Bathymetry will be under Domain – Bed Level



Locate map tab on bottom right corner

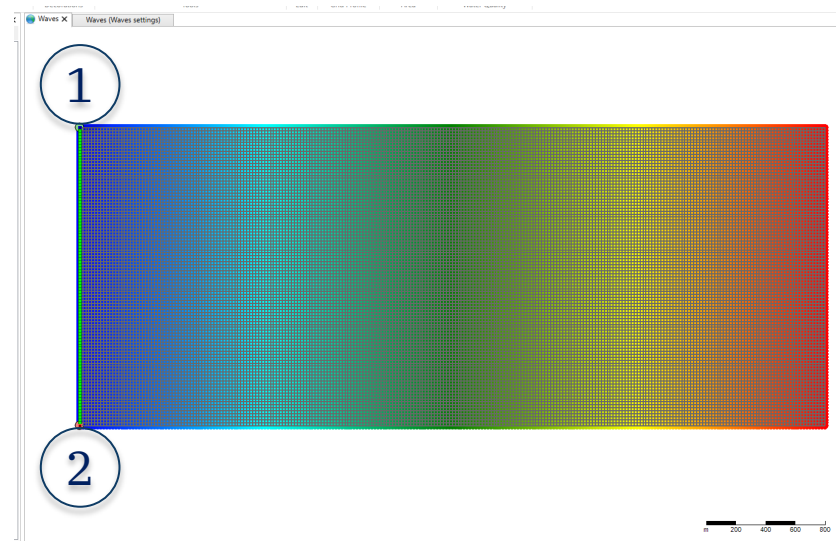
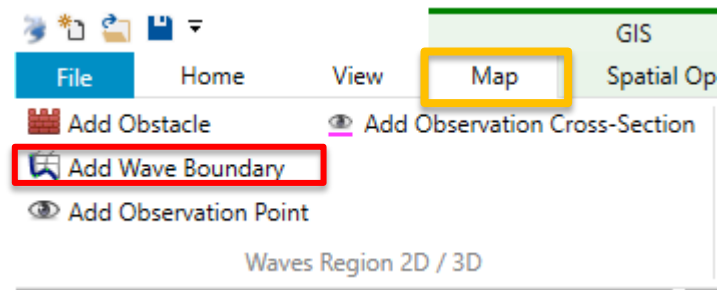
# Setting up a simple model

---

- › Build grid ☒
- › Add bathymetry ☒
- › **Set up boundary conditions and forcing**
- › Set up processes and time parameters
- › Create observation points
- › Set up output
- › Run model

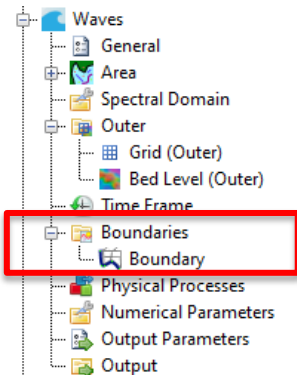
# Boundary Conditions Continued

- › Click **Add Wave Boundary** in the **GIS-Map** tab.
- 1. Select the click near the top grid point on offshore ocean (left side)
- 2. Double click near the bottom point
- › The boundary will snap to the nearest grid nodes
- › This creates a wave boundary.

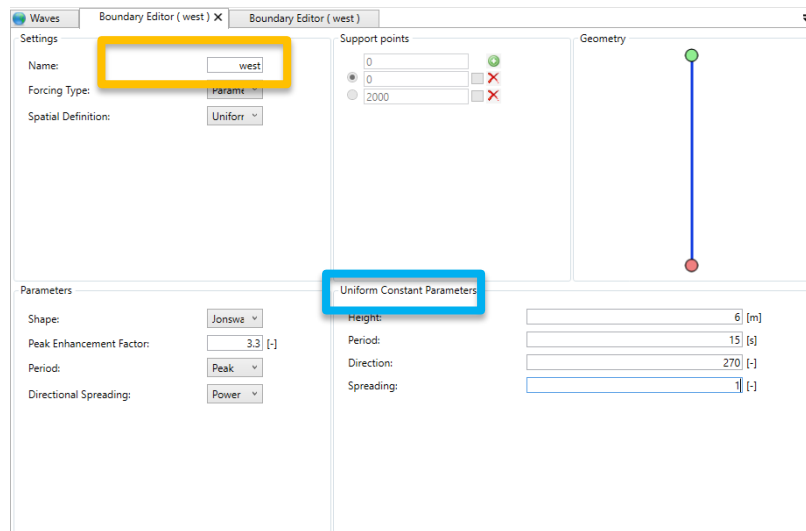


# Boundary Conditions Continued

- › Rename the boundary by double clicking **Boundary** in the project panel and changing the name to **west**.



- › Update Uniform Constant Parameters



**Uniform Constant Parameters**

Height:	<input type="text" value="6"/> [m]
Period:	<input type="text" value="15"/> [s]
Direction:	<input type="text" value="270"/> [-]
Spreading:	<input type="text" value="1"/> [-]

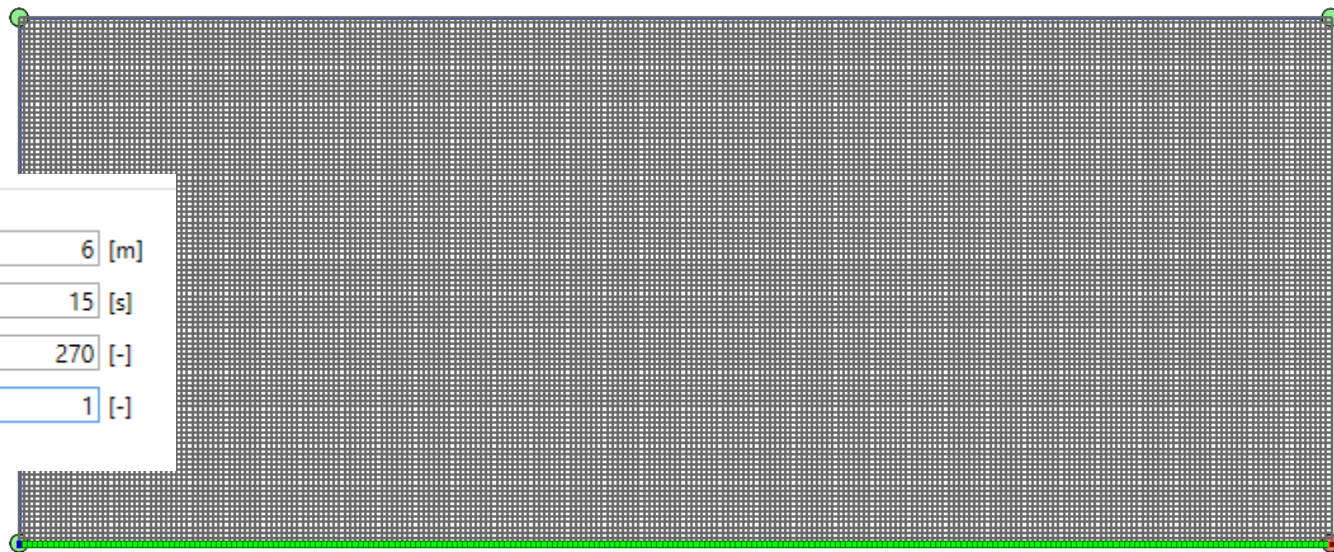
# Boundary Conditions Continued

- › Add boundaries along the north and south. And update with the same parameters

Updates  
.mdw file

## Uniform Constant Parameters

Height:  [m]  
Period:  [s]  
Direction:  [-]  
Spreading:  [-]



# Physical Processes

Can change physical processes like wind growth or bottom friction

- › Double Click on Physical Processes in the Project panel.
- › Uncheck “Wind growth” and “Quadruplets”
- › Change Bed friction coef. To 0.067 m<sup>2</sup>/s<sup>3</sup>.

Updates  
.mdw file

General

Physics mode third generation

Wave setup ☐

Wind growth ☐

Quadruplets ☐

White capping formulation Komen

Refraction ☒

Frequency shifting ☒

Wave force computation dissipation 3d

Breaking

Depth induced breaking ☒

Alpha 1 [-]

Gamma 0.73 [-]

Triads

Triads ☐

Bed friction

Bed friction JONSWAP

Bed friction coef. 0.067 [m<sup>2</sup>/s<sup>3</sup>]

# Setting up a simple model

- › Build grid ☒
- › Add bathymetry ☒
- › Set up boundary conditions and forcing ☒
- › **Set up processes and time parameters**
- › Create observation points
- › Set up output
- › Run model

# Set Time Frame: Time Points and Reference Date

SWAN will run until “steady state” is reached –i.e., the wave action balance equation is solved to a certain accuracy

In this tutorial, only one point in time. When a time series is applied, SWAN runs each time point to steady state.

## › Time Frame Editor :

- Time points specifies when in time the boundary conditions are applied

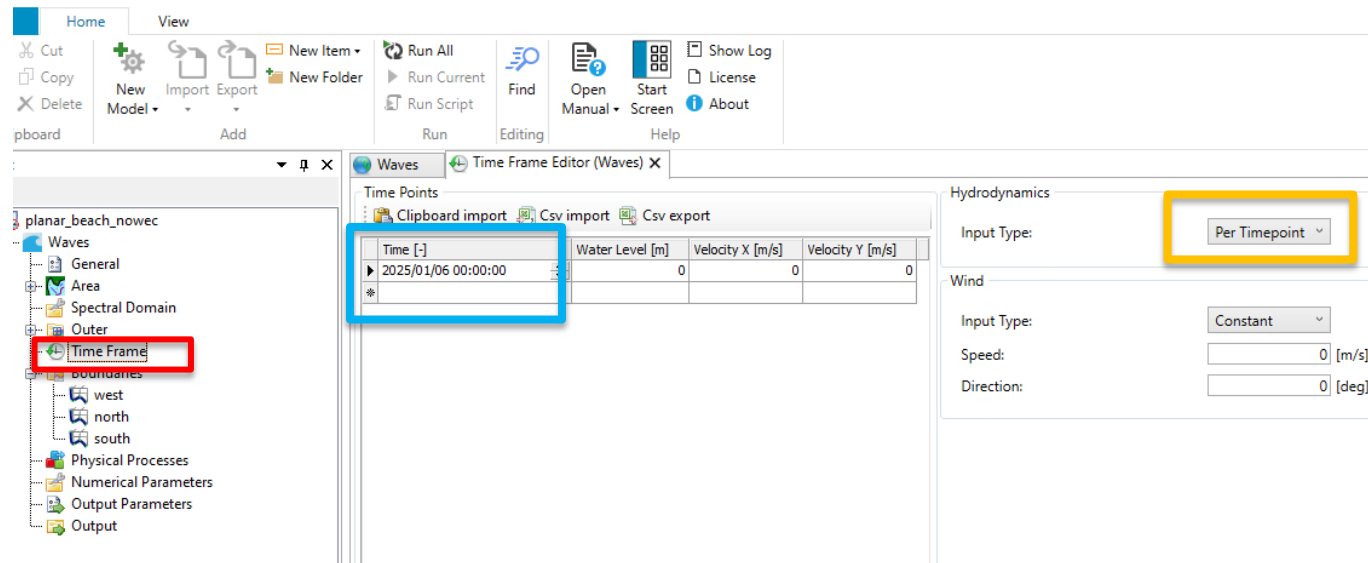
## › Reference Date (in General Settings):

- References WHEN the time points start

**Reference date must precede first time point**

# Set Time Points in Time Frame

- › Double Click on Time Frame
- › Select Input Type as *Per Timepoint*.
- › Set the Time to today's date.
- › Keep Water Level, and Velocity at 0.
- › D-Waves\_User\_Manual section 4.6



Updates  
.mdw file

# Reference Date

- › Make sure Reference date is the same or precedes the time set in TimeFrame

Updates  
.mdw file

Waves Time Frame Editor (Waves) Waves (Waves settings) X

General Spectral Domain Physical Processes Numerical Parameters Output Parameters

General Settings

Project name

Project number

Reference date 2025-01-06

Directional convention nautical

INPUT template file

Communication

Communication file

Write communication files

Communication interval 60 [min]

Append to com file

Mass flux to com

Meteo File

Simulation mode

Simulation mode stationary

D-Waves time step 10 [min]

# Domain Specific Settings

- › Double Click on **General** in the Project panel.
- › Select the **Domain specific settings** tab
- › Update the **Directional Space** and **Frequency Space** values to those below

Updates  
.mdw file

The screenshot displays the Waves software interface. On the left, the Project panel shows a tree view with 'planar\_beach\_nowec' as the root. Under it, 'Waves' is expanded, and 'General' is highlighted with a red box. The main panel shows the 'Waves (Waves settings)' window with the 'Domain specific settings' tab selected, highlighted with a yellow box. The 'Outer' domain is selected in the 'All Domains' list. The 'Directional Space' section is highlighted with a blue box, and the 'Frequency Space' section is highlighted with a purple box. Both sections have the 'Use custom values' checkbox checked. The 'Directional Space' settings are: Type: Circle, Nr. of directions: 72, Start direction: 0, End direction: 360. The 'Frequency Space' settings are: Nr. of frequencies: 24, Start frequency: 0.05, End frequency: 1.

Section	Parameter	Value	Unit
Directional Space	Type	Circle	
	Nr. of directions	72	[-]
	Start direction	0	[deg]
	End direction	360	[deg]
Frequency Space	Nr. of frequencies	24	[-]
	Start frequency	0.05	[Hz]
	End frequency	1	[Hz]

# Setting up a simple model

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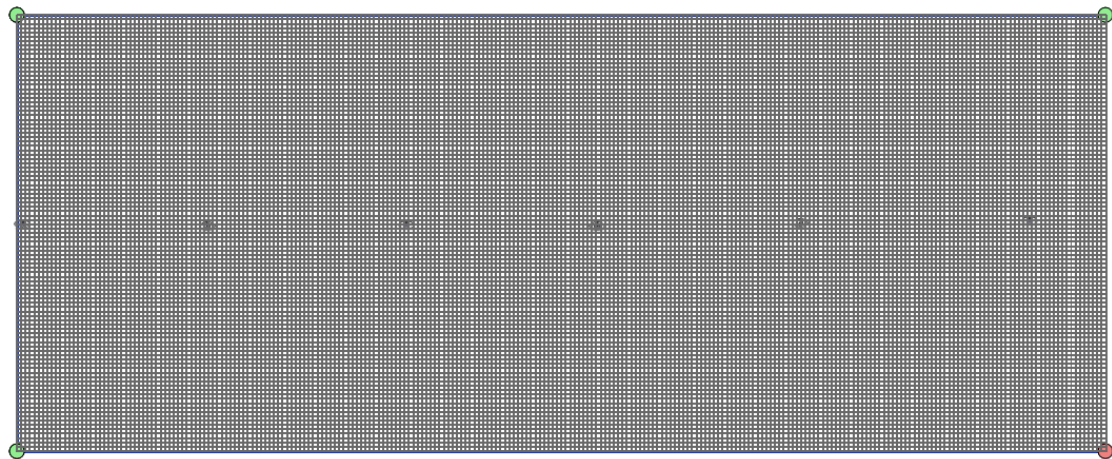
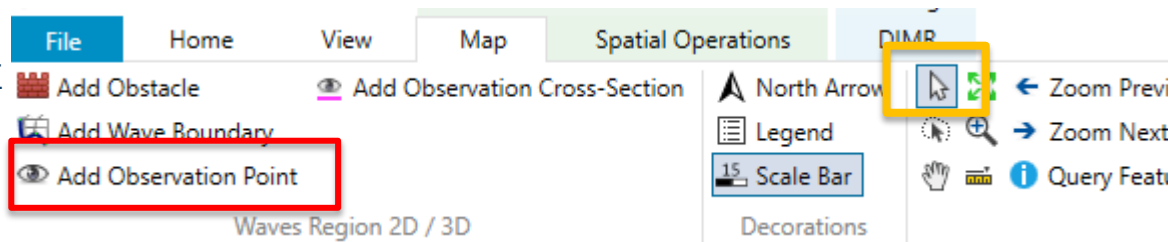
- › Build grid ☒
- › Add bathymetry ☒
- › Set up boundary conditions and forcing ☒
- › Set up processes and time parameters ☒
- › **Create observation points**
- › Set up output
- › Run model

# Observation points

- › In the GIS – Map tab, click **Add Observation Point** to determine where you want to see file outputs.

- › Click once on the map to set an observation point.

- › Click the **select arrow** or press escape to stop adding observation points



Creates  
.loc file

# Setting up a simple model

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- › Build grid ☒
- › Add bathymetry ☒
- › Set up boundary conditions and forcing ☒
- › Set up processes and time parameters ☒
- › Create observation points ☒
- › **Set up output**
- › Run model

# Output Parameters

- › Outputs are in NetCDF format
- › Options to write 1D and 2D spectra
- › Check “Keep a Copy of SWAN INPUT files” if unchecked
- › Check “Write Tables” to see point output at observation locations

General	Spectral Domain	Physical Processes	Numerical Parameters	Output Parameters	Domain specific settings
⤴ Map					
Map file interval		<input type="text" value="60"/> [min]			
⤴ Tables					
Write tables		<input checked="" type="checkbox"/>			
Write 1D spectra		<input type="checkbox"/>			
Write 2D spectra		<input type="checkbox"/>			
Location file		<input type="text"/>			
⤴ Hotstart					
Write/read hotstart		<input type="checkbox"/>			
⤴ Miscellaneous					
Test output level		<input type="text" value="0"/>			
Trace subroutine calls		<input type="checkbox"/>			
Write NetCDF		<input checked="" type="checkbox"/>			
Use NetCDF single precision		<input type="checkbox"/>			
Keep a copy of the Swan INPUT file(s)		<input checked="" type="checkbox"/>			

# Setting up a simple model

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- › Build grid ☒
- › Add bathymetry ☒
- › Set up boundary conditions and forcing ☒
- › Set up processes and time parameters ☒
- › Create observation points ☒
- › Set up output ☒
- › **Run model**

# Model is now set up to run without turbines

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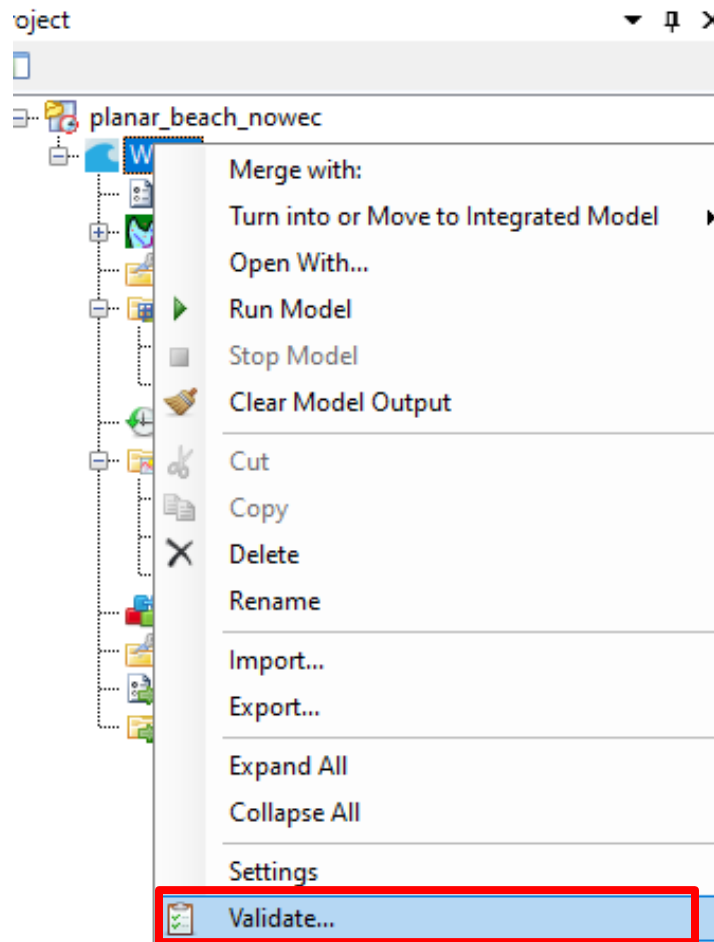
- › The steps outlined above get us to a base model with relevant components
  - Structured grid
  - Basic bathymetry
  - Boundary conditions
- › Save model in File -> Save as
  - Select a save location
    - Name the file `planar_beach_nowec.dsproj`
  - Make sure the project folder contains a subfolder called Waves and in that a subfolder called input.

# Run The Model



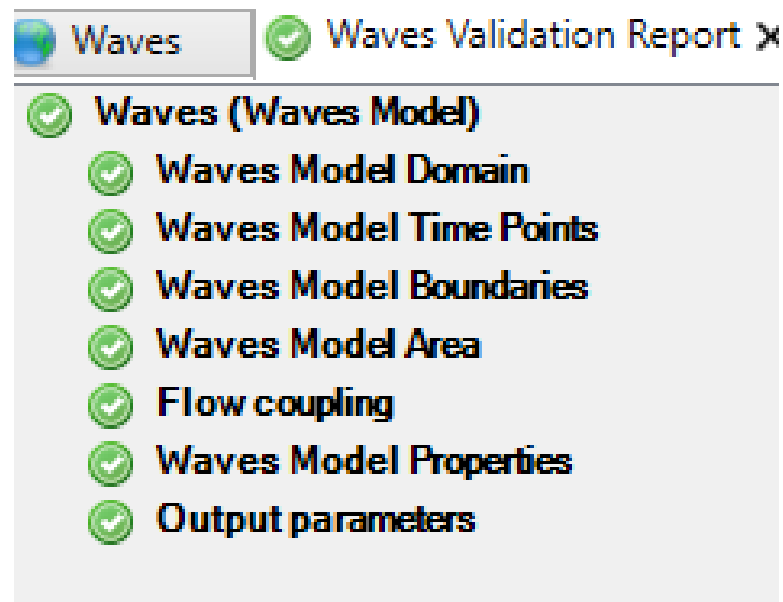
# Check the Model

- › We're ready to run the model
- › A good check prior to executing is to “validate” first to make sure all settings are input
- › Right Click on Wave and select Validate



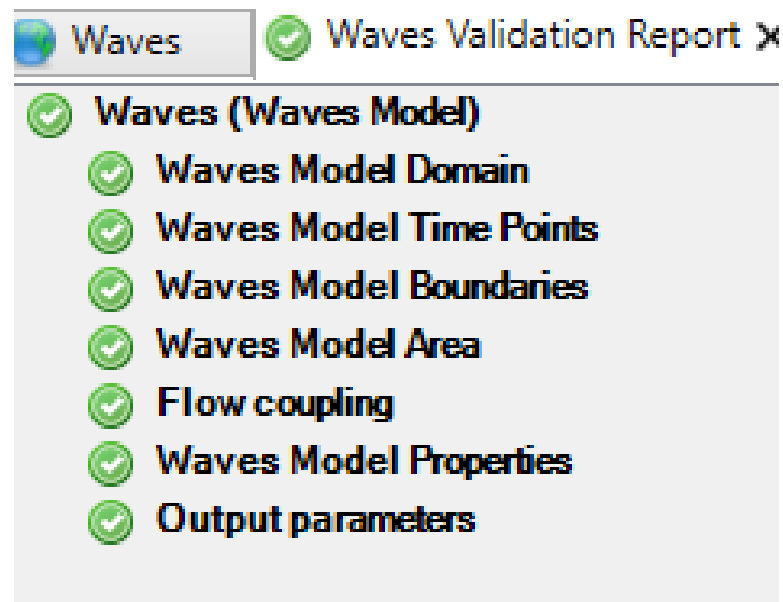
# Results of Validation

- › All check –boxes should be green
- › Some may show as red if something is not properly set up and it will tell you what those are.
  - Common issues may be inconsistent timing of start/stop and boundary conditions
- › Warnings with ! May also appear and you can select the item to evaluate why



# Results of Validation

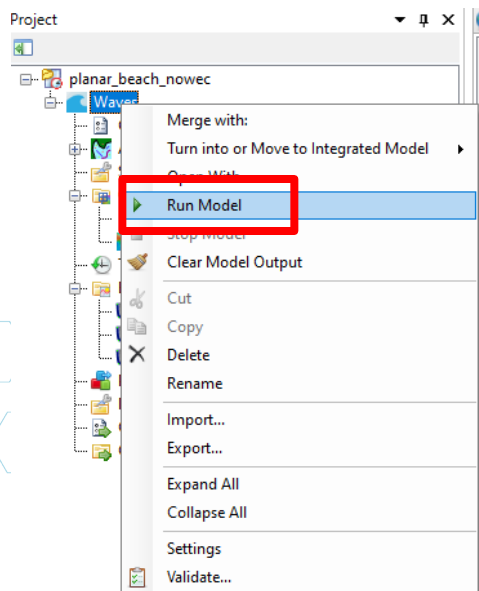
- › Check text files that were generated by GUI



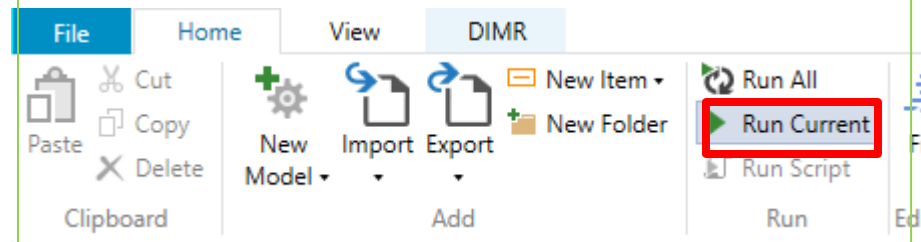
# Run the model

## › 2 Ways to execute

### › Right Click Waves and select run

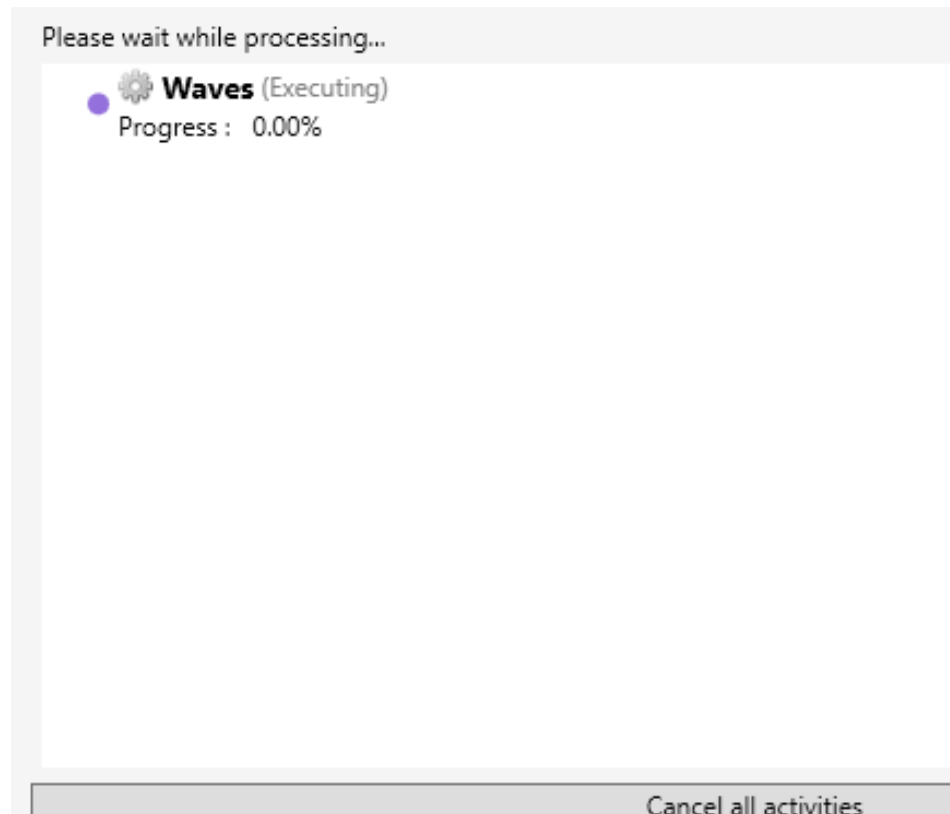


### › In Home Menu select Run Current



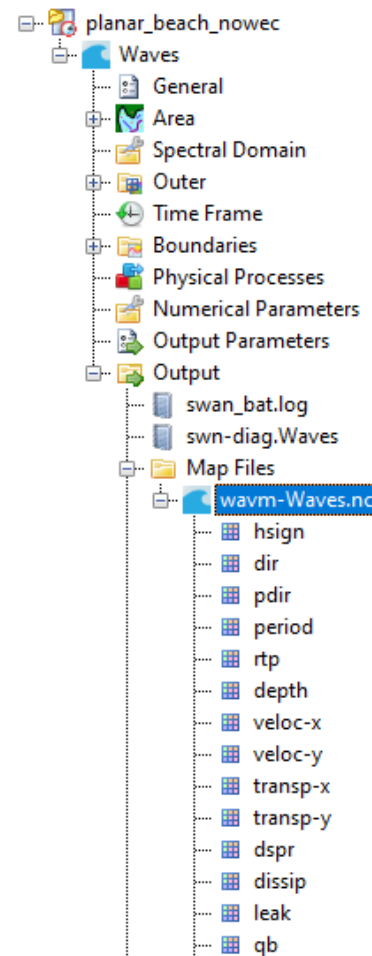
# Model running

- › If model is run from the GUI, a box will appear showing progress
- › NOTE: This is not the only way to run these models
- › Models can be run with bash scripts, on Linux, or other means.



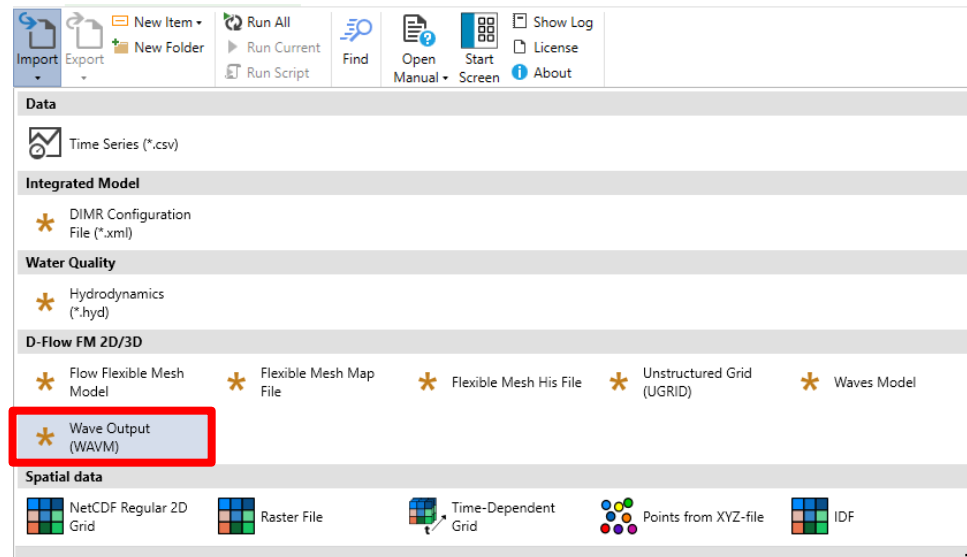
# Success!!

- › Model run was successful
- › Save model and results will be saved to an output folder in same location as the input folder
- › Model results appear in the Project Pannel. Expand the Output folder and wavm-Waves.nc under Map File to view a list of variables



# View Existing Model Results

- To view the results, click on Import in the Home Tab and select Wave Output (WAVM).
- Navigate to the wave output file in output folder (e.g.: planar\_beach\_nowec.dsproj\_data\Waves\output)
- Select the NetCDF file wavm-Waves.nc and click open



# View Results: Map

- The output results will appear in the Project Panel.
- Select the variable layer under Output > Map in the **Map** panel to display a variable.
- Add a **legend** to inspect values.



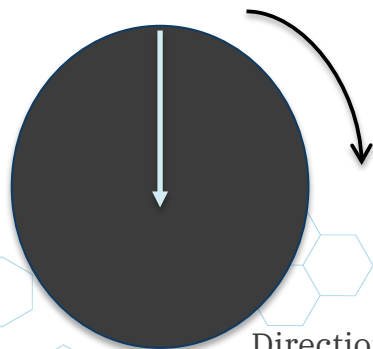
# Results Direction Bug

- › Note that there is a bug in the GUI – if the model is run in the GUI, the executable always outputs in Cartesian regardless of the input
- › The stand-alone SWAN, however, will report Nautical convention

Nautical

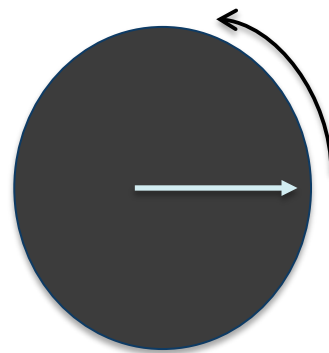
$360^\circ$

$0^\circ$



Direction waves are coming FROM.  
Angles change clockwise

Direction waves are going TOWARDS.  
Angles change counterclockwise



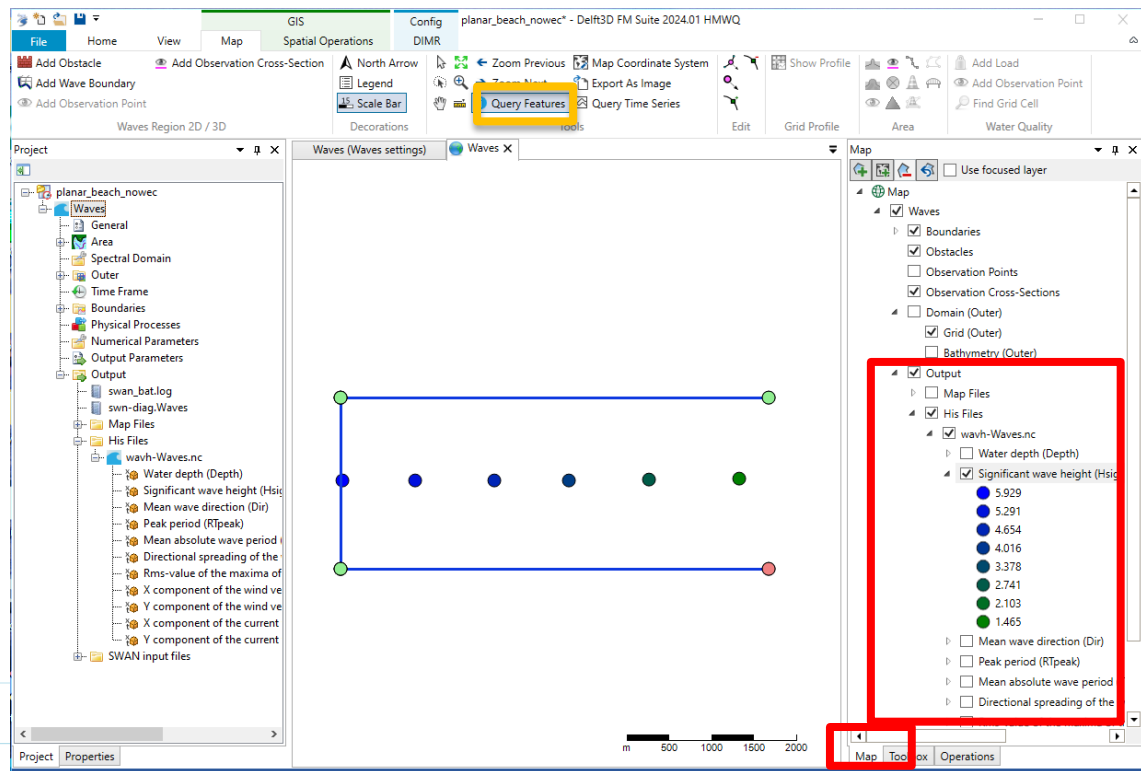
Cartesian

$360^\circ$

$0^\circ$

# View Results: Observation Points

- Select the variable layer in the Output > **His Files** Map panel to display a variable.
- Use the **Query Tool** to inspect values
- The output is the steady state reached that solved the wave action value equation



# Add Wave Energy Converteres



# Reminder

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- › WECS are represented in SNL-SWAN as obstacles.
- › WEC parameters are defined by the following :
  - OBSCASE (keyword in standalone, file in Delft3D)
  - Power Matrix OR Relative Capture Width
  - IF using Delft3D-WAVE, an .obt and .pol file to define device parameters and locations
- › We will use a Power Matrix in this example

# Grid Size

- › Make sure the grid size corresponds with the WEC's physical dimension specified in the Power Matrix
- › SWAN will normalize by the size of the grid cell

```
50 # obstacle width
15 # number of significant wave height entries
0.5 # list of wave height entries
```

```
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
15 # number of peaks
3 # list of periods
```

```
50 # obstacle width
15 # number of significant wave height entries
0.5 # list of wave height entries
```

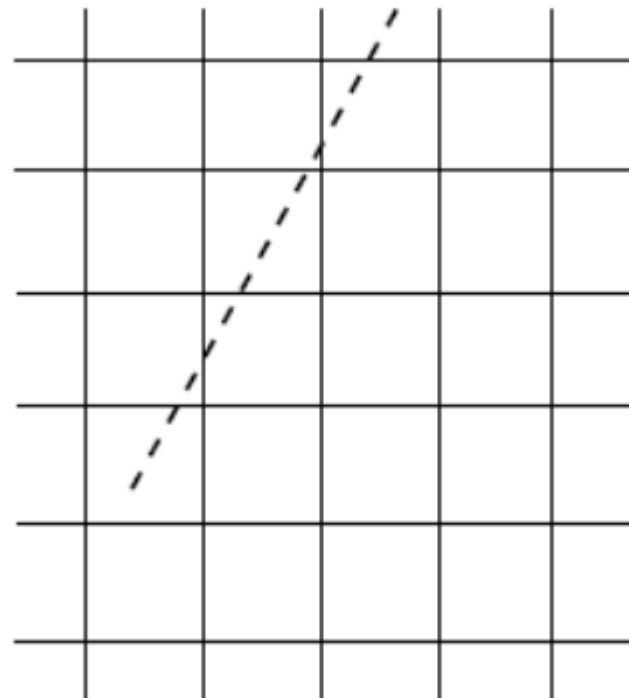
```
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
15 # number of peaks
3 # list of periods
```

# power matrix table is entered below

4.44	5.07	7.97	12.15	16.77	17.14	11.94	9.16	6.57	4.39	4.00	3.00	2.86	1.95	1.71
16.65	19.00	29.48	46.94	56.61	52.38	37.14	28.73	19.84	16.62	12.94	9.33	7.29	7.40	4.49
0.00	41.54	63.14	92.37	110.74	109.49	64.96	55.91	38.49	29.09	22.06	19.26	12.74	11.21	11.50
0.00	66.29	99.03	150.67	200.97	164.91	105.27	85.30	58.63	52.31	40.56	28.76	24.22	19.31	17.57
0.00	0.00	160.23	241.82	261.83	226.36	166.20	117.65	83.09	69.87	57.47	39.24	28.51	26.20	23.73
0.00	0.00	212.52	319.26	372.09	327.17	210.96	151.98	116.43	93.66	75.42	66.09	44.81	42.09	30.83

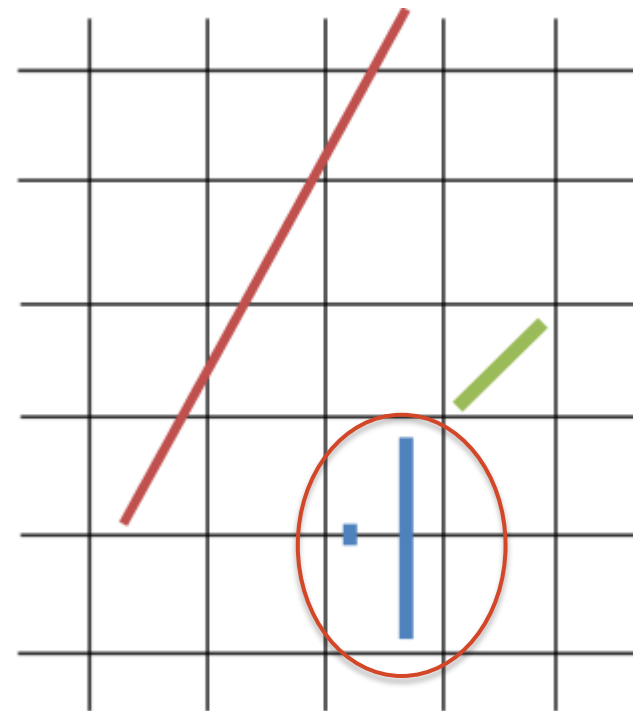
# Reminder: Best Practice: Grids

- Obstacles are treated as lines running through the computational grid.
- When calculating the action density flux from one grid point to its neighbors, SWAN first determines if the connecting grid line crosses an obstacle line.
- If and only if a grid line is crossed by an obstacle line, the transmission coefficient applied to the flux between those nodes.



# Reminder: Best Practice: Grids, Continued

- › The two blue obstacles shown will have the exact same influence on the model solution, even though they have much different widths.
- › Both obstacles cross the same computation grid line, SWAN will apply their transmission coefficient the same volumetric fluxing face.
- › Both obstacles cross one grid cell, so SWAN assumes it is one grid cell wide.



# Reminder: Best Practice: Grids, Continued

- › Due to grid discretization, the green obstacle does not intersect and computational grid lines. In this situation it will have no effect.
- › Most WEC types can capture Energy from all directions.
  - It is Important that WEC definitions account for that fact.
    - Define an obstacle at an angle to cross two perpendicular grid lines.
    - OR
    - Define two perpendicular obstacles that both cross grid lines. Power extracted for each obstacle must be summed.
- › If nested, obstacles will extract energy from any grid lines they cross. Be aware of this when analyzing results or coupling to a flow model.

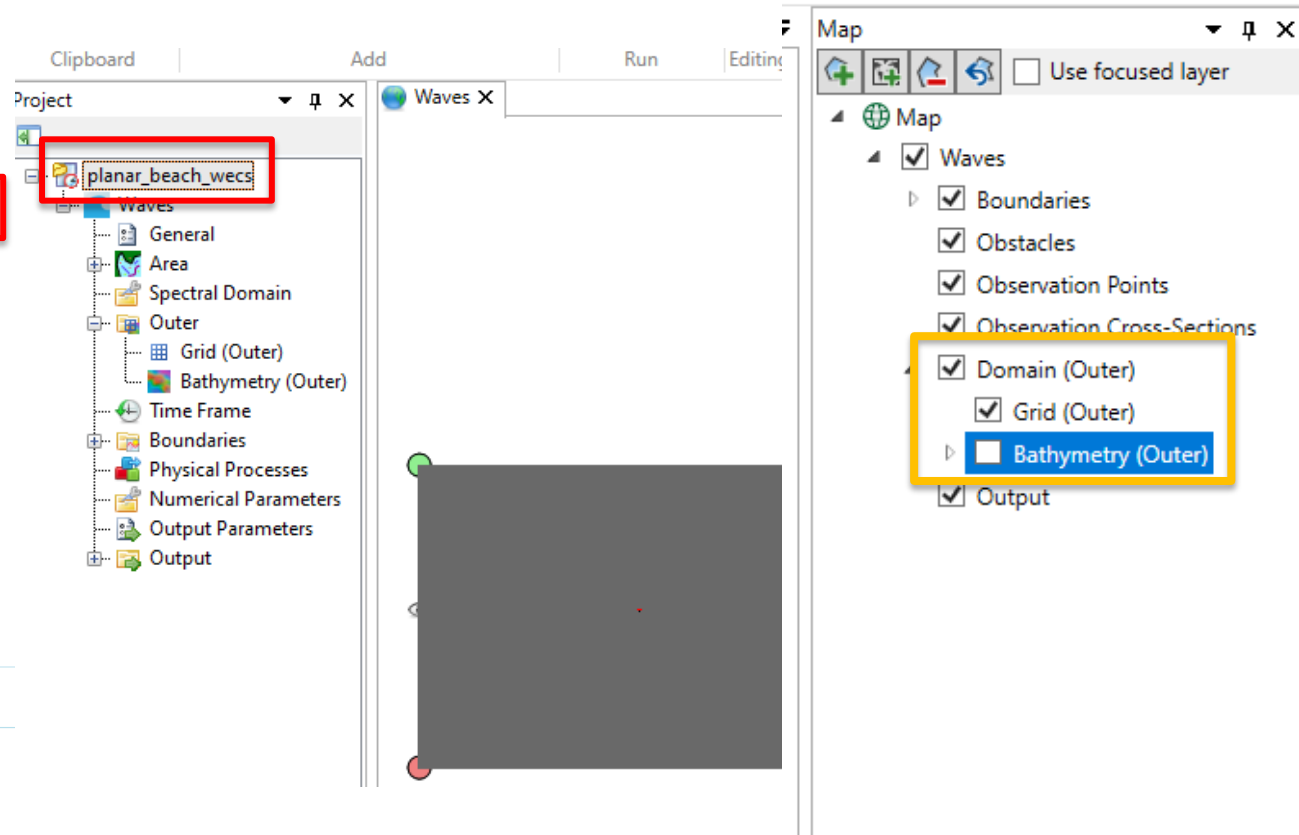


# Create WEC Model

- › Open the no wec project and save as **planar\_beach\_wecs**

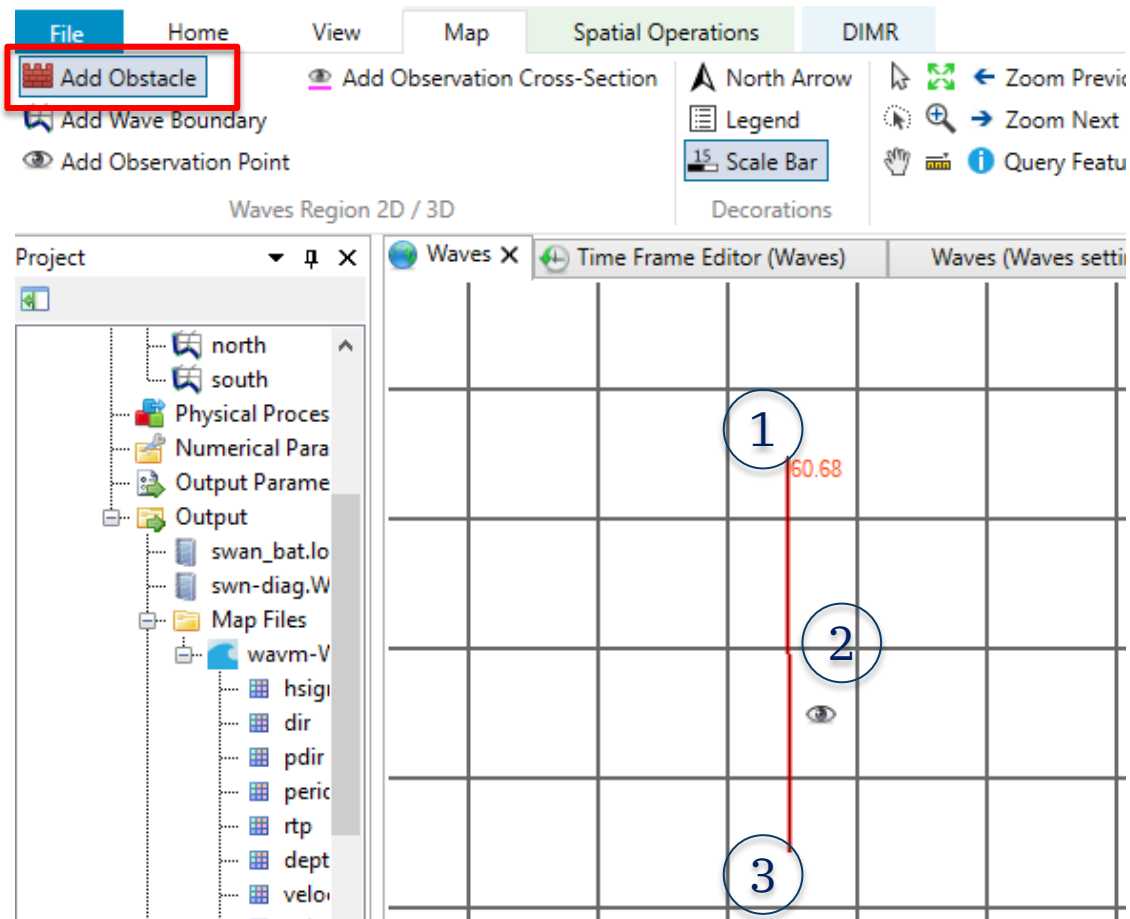
- › Display the grid.

(Double click and wait a second)



# Add Obstacles

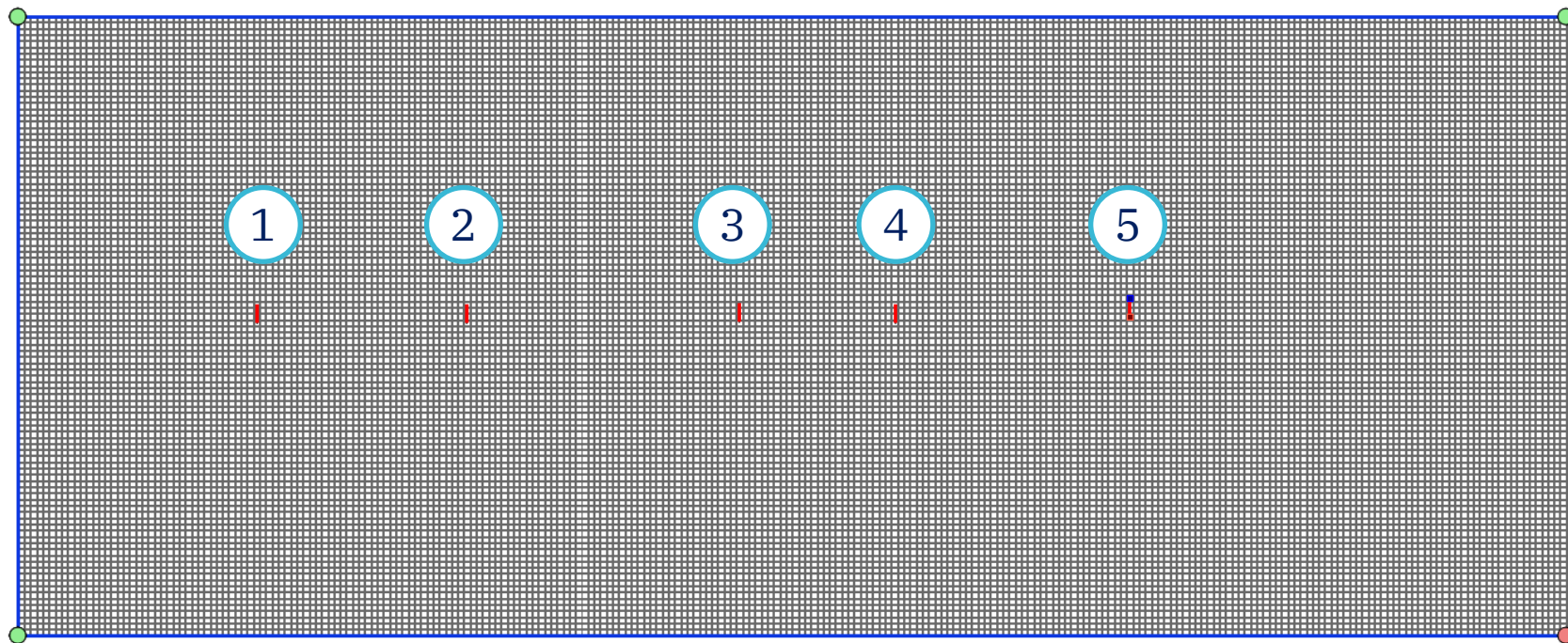
- › Zoom into a section of the grid.
- › Select **Add Obstacles** in the GIS-Map tab.
- › Draw an obstacle by
  1. clicking within a grid cell
  2. move the cursor across a grid line,
  3. then double click to create the obstacle.
- › Make it ~60m long – make sure this is consistent with the WEC width



# Add Obstacles

- › Create a total of 5 obstacles aligned from offshore to onshore.
- › Draw the obstacles consistent with the obstacle width specified in the Power.txt file

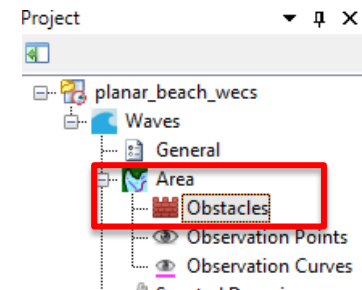
Creates  
.pol file



# WEC integration, cont

- › In the Project panel, expand Area and **double click on Obstacles** to open the Obstacles panel.
- › Update the Parameters such of Transmission Coefficient and Reflection Type.
- › Set:
  - **Transmission Coefficient: 0.5**
  - Type: Sheet
  - Reflection Type: No
- › Save Project

Creates  
.obt file



Obstacles X								
Name	△	Type	Transmission Coefficient	Height	Alpha	Beta	Reflection Type	Reflection Coefficient
Obstacle01		Sheet	0.5				No	
Obstacle02		Sheet	0.5				No	
Obstacle03		Sheet	0.5				No	
Obstacle04		Sheet	0.5				No	
Obstacle05		Sheet ▼	0.5				No	

# Delft3D implementation

“Waves.obt” file defines Obstacle parameters

```
[ObstacleFileInformation]
  FileVersion   = 02.00
  PolylineFile  = case_2_obs_new.pol
[Obstacle]
  Name          = Obstacle 1
  Type          = sheet
  TransmCoef    = 5.0000000e-001
  Reflections   = no
[Obstacle]
  Name          = Obstacle 2
  Type          = sheet
  TransmCoef    = 5.0000000e-001
  Reflections   = no
[Obstacle]
  Name          = Obstacle 3
  Type          = sheet
  TransmCoef    = 5.0000000e-001
  Reflections   = no
```

“Waves.pol” file defines location of obstacles

```
Obstacle 1
2 2
235.85975 44.68599
235.86035 44.68599
Obstacle 2
2 2
235.85975 44.68859
235.86035 44.68859
Obstacle 3
2 2
235.85975 44.69118
235.86035 44.69118
```

- “OBCASE” file has a single number defining the obcase you choose
- These files must be located in the run directory

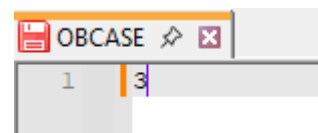
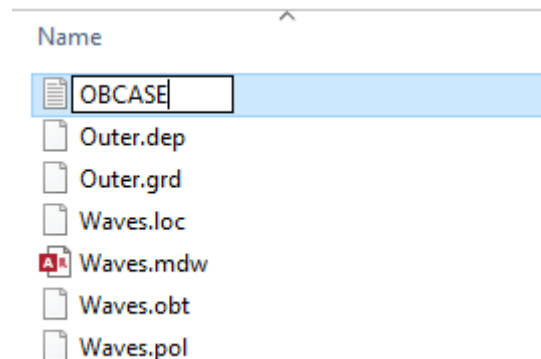
# OBCASE options

- › Next, we will create the OBCASE and Power.txt files.
- › The OBCASE determines how what parameterization for the wec is used.

WEC Performance Information	Frequency-variable Kt	Frequency-constant Kt
No Information	N/A	Obcase 0
Power Matrix (real seas, peak period)	N/A	Obcase 1
Power Matrix (regular waves and amplitude)	Obcase 3	N/A
RCW Curve	Obcase 4	Obcase 2

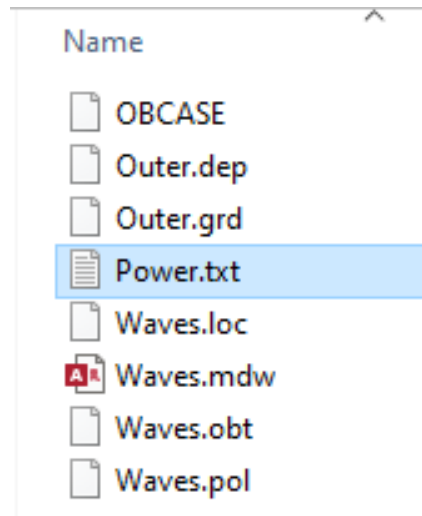
# Create OBCASE file

- › Open the project input folder  
“planar\_beach\_wecs.dsproj\_data\Waves\input”
- › Create an extensionless file called OBCASE
- › Open in an editor and end enter the number 3 for this example – corresponds to Power Matrix
- › Save file



# Create Power.txt file

- › Open the project input folder  
“planar\_beach\_weecs.dsproj\_data\Waves\input”
- › We will use a Power Matrix where the power generated is indexed for each wave height and period.
- › for this example, copy the Power.txt file from  
“planar\_beach\_demo\planar\_beach\_weecs.dsproj\_data\Waves\input” into  
your project input directory



# Hs Bins



WEC's physical dimension  
(meters)

# Tp Bins



```

50 # obstacle width
15 # number of significant wave height entries
0.5 # list of wave height entries
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
15 # number of peak period ent
3 # list of period values
4
5
6
7
8
9
10
11
12
13
14
15
16
17 # power matrix table is entered below
4.44 5.07 7.97 12.15 16.77 17.14 11.94 9.16 6.57 4.39 4.00 3.00 2.86 1.95 1.71
16.65 19.00 29.48 46.94 56.61 52.38 37.14 28.73 19.84 16.62 12.94 9.33 7.29 7.40 4.49
0.00 41.54 63.14 92.37 110.74 109.49 64.96 55.91 38.49 29.09 22.06 19.26 12.74 11.21 11.50
0.00 66.29 99.03 150.67 200.97 164.91 105.27 85.30 58.63 52.31 40.56 28.76 24.22 19.31 17.57
0.00 0.00 160.23 241.82 261.83 226.36 166.20 117.65 83.09 69.87 57.47 39.24 28.51 26.20 23.73
0.00 0.00 212.52 319.26 372.09 327.17 210.96 151.98 116.43 93.66 75.42 66.09 44.81 42.09 30.83

```

- SWAN needs the WEC width to determine how much power to take out from energy field
- Must draw the WEC size consistent with the obstacle width

Hs

Tp

# Hs Bins

WEC's physical dimension  
(meters)

Wave Heights (meters)

Wave Periods (seconds)

Power Matrix (units kW)

# Tp Bins

```

50 # obstacle width
15 # number of significant wave height entries
0.5 # list of wave height entries
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
15 # number of peak period entries
3 # list of period values
4
5
6
7
8
9
10
11
12
13
14
15
16
17 # power matrix table is entered below

```

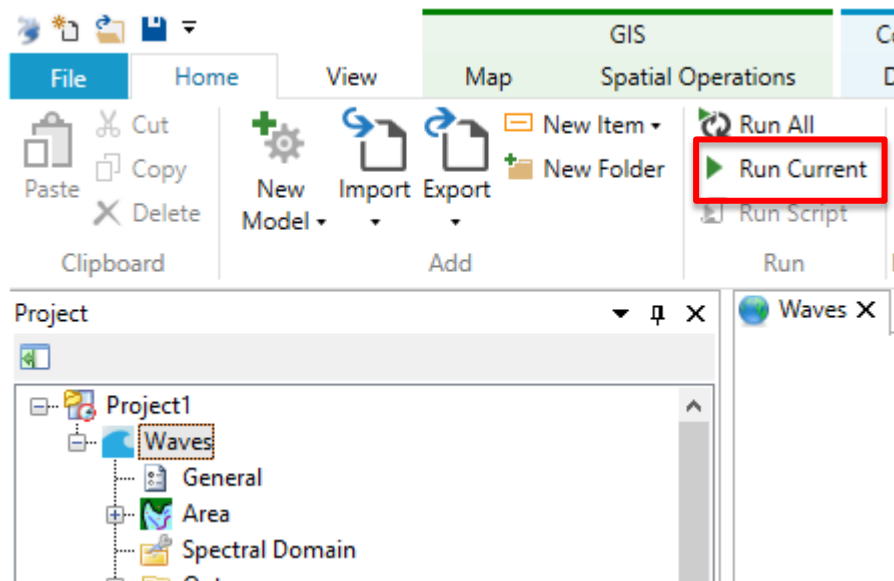
Hs

Tp

4.44	5.07	7.97	12.15	16.77	17.14	11.94	9.16	6.57	4.39	4.00	3.00	2.86	1.95	1.71
16.65	19.00	29.48	46.94	56.61	52.38	37.14	28.73	19.84	16.62	12.94	9.33	7.29	7.40	4.49
0.00	41.54	63.14	92.37	110.74	109.49	64.96	55.91	38.49	29.09	22.06	19.26	12.74	11.21	11.50
0.00	66.29	99.03	150.67	200.97	164.91	105.27	85.30	58.63	52.31	40.56	28.76	24.22	19.31	17.57
0.00	0.00	160.23	241.82	261.83	226.36	166.20	117.65	83.09	69.87	57.47	39.24	28.51	26.20	23.73
0.00	0.00	212.52	319.26	372.09	327.17	210.96	151.98	116.43	93.66	75.42	66.09	44.81	42.09	30.83

# Run the model

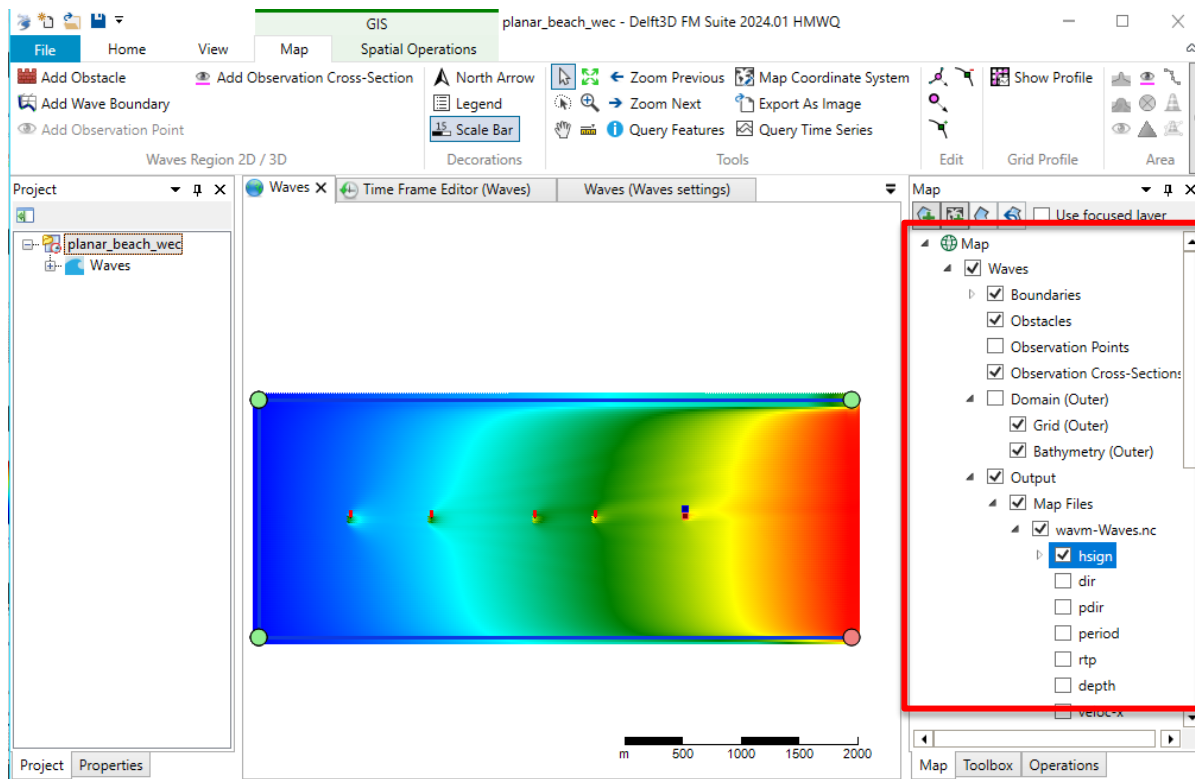
- › Reopen the wec model in Delft3d FM.
- › File -> Open -> Browse
- › Highlight the Wave model by clicking once.
- › Select **Run Current** from the Home tab



# Inspect the model results

› The model output will appear in the Project panel and the results can be displayed by selecting the Output variable in the **Map** panel.

› Notice the influence near and in the lee of the WECs.



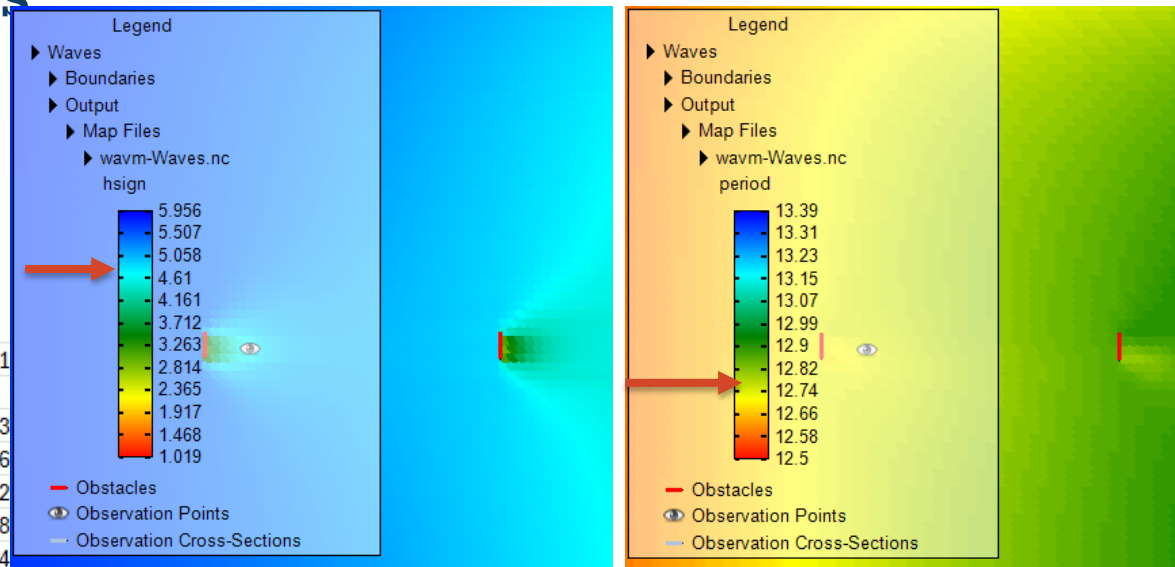
# Evaluate the Power Generation

- Save the model.
- Power output is saved in a “POWER\_ABS.OUT” file in the project folder.
  - For this example, “planar\_beach\_wecs.dsproj\_data\Waves\output”.
- Several iterations are performed for each obstacle.
  - You want to use the last iteration.
- This shows the watts generated for each obstacle (wec).

POWER_ABS.OUT	
1	Iteration: 1
2	Power absorbed by obstacle 1 = 767394.7500000 W
3	Power absorbed by obstacle 2 = 570529.7500000 W
4	Power absorbed by obstacle 3 = 385894.8437500 W
5	Power absorbed by obstacle 4 = 192941.5937500 W
6	Power absorbed by obstacle 5 = 44051.6210938 W
7	Iteration: 2
8	Power absorbed by obstacle 1 = 789945.8125000 W
9	Power absorbed by obstacle 2 = 605252.3125000 W
10	Power absorbed by obstacle 3 = 414473.2500000 W
11	Power absorbed by obstacle 4 = 206304.6562500 W
12	Power absorbed by obstacle 5 = 44921.4765625 W
13	Iteration: 3
14	Power absorbed by obstacle 1 = 805410.0000000 W
15	Power absorbed by obstacle 2 = 644134.6250000 W
16	Power absorbed by obstacle 3 = 456051.7812500 W
17	Power absorbed by obstacle 4 = 229791.0937500 W
18	Power absorbed by obstacle 5 = 46864.5468750 W
19	Iteration: 4
20	Power absorbed by obstacle 1 = 812230.8750000 W
21	Power absorbed by obstacle 2 = 669341.5625000 W
22	Power absorbed by obstacle 3 = 490437.6250000 W
23	Power absorbed by obstacle 4 = 253578.8281250 W
24	Power absorbed by obstacle 5 = 49318.8476562 W
25	

# Evaluate the Results

		Peak Period																																																																																																																																																																																																																																																																																																																																																																																													
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Power absorbed by obstacle 2 = 669341.5625000 W

The power matrix indicates a value around 638,000 Watts. Aligned with the results.

# Next Steps

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## › Try to alter the inputs:

- Boundary condition, wave height and period and locations
- Obstacle length
- Number of obstacles
- Orientation of obstacles