CMS-WAVE: MODEL SETUP

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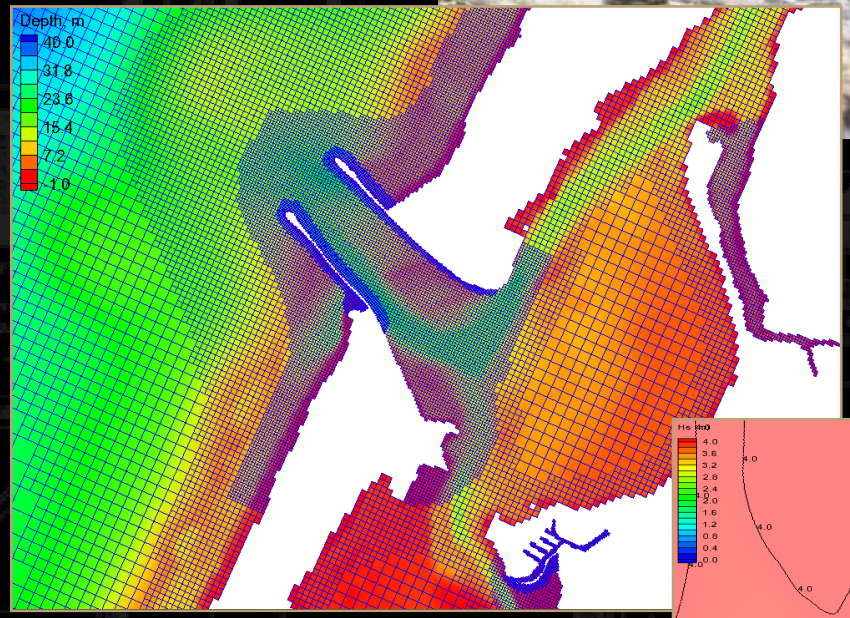
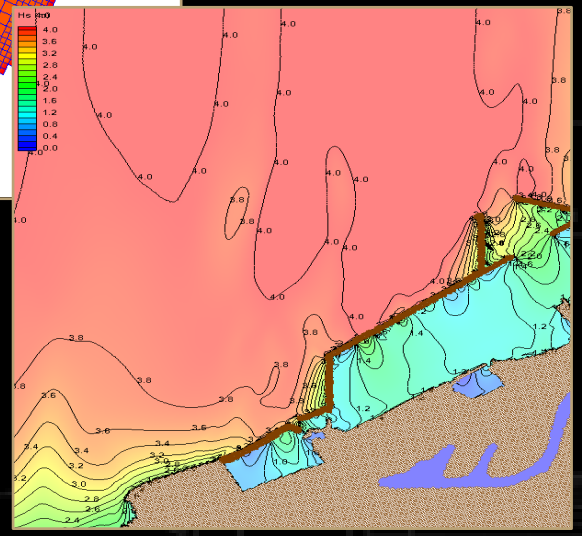
US Army Engineer Research and Development Center (ERDC)

CMS Basics Webinar Series
29 July – 02 August 2024





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CIRP

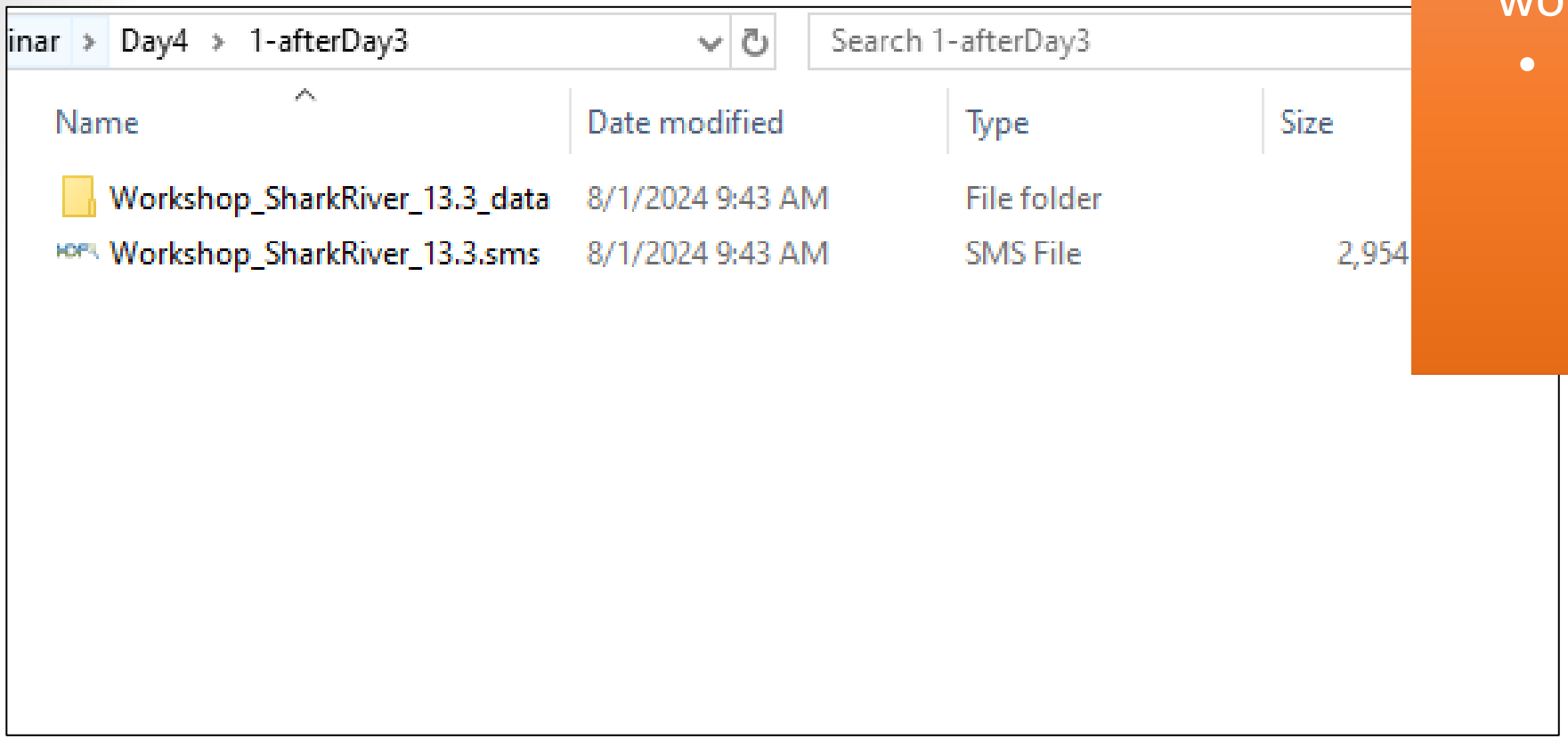
Presentations

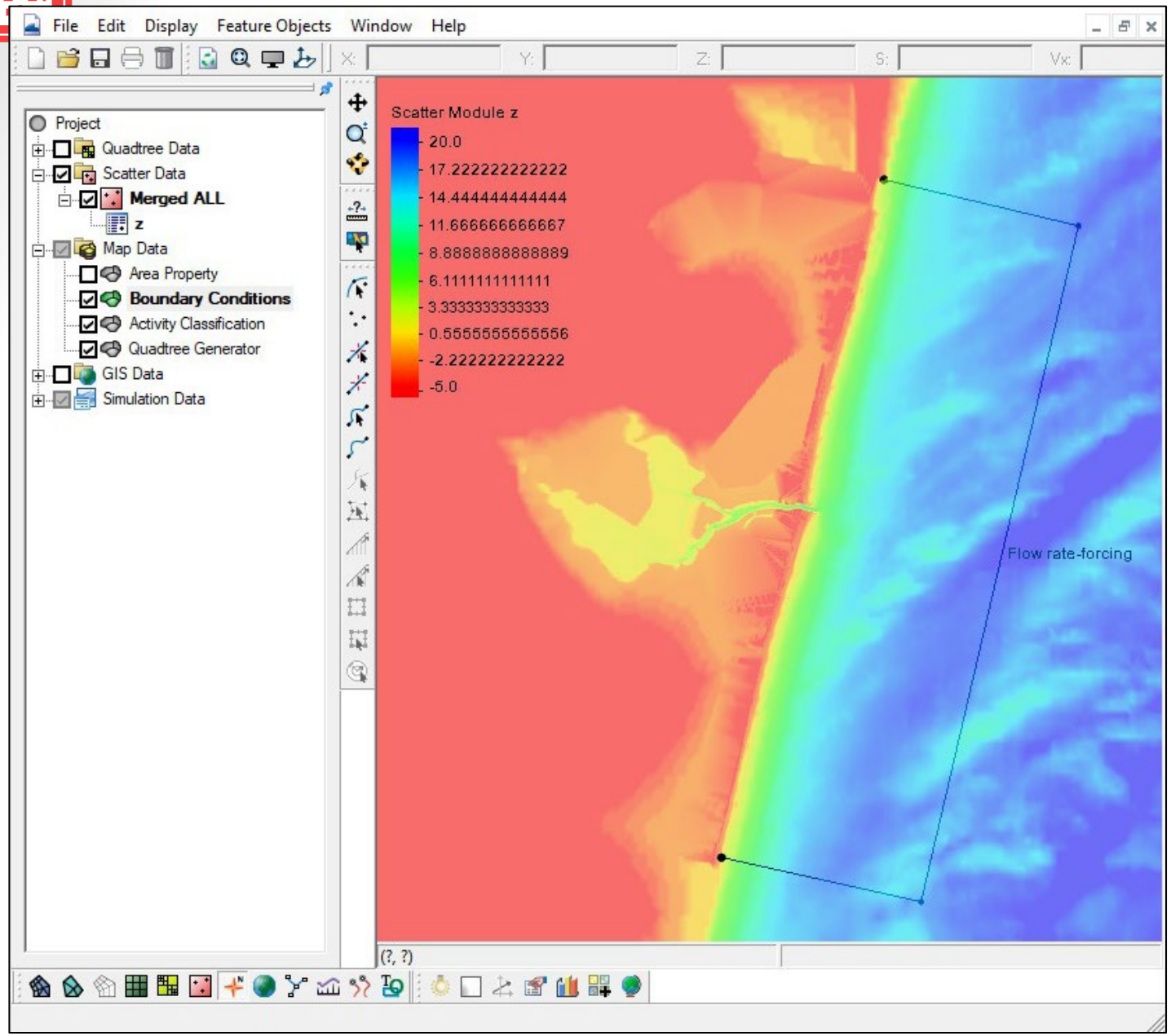
- CMS-Wave grid creation
- CMS-Wave Spectra and Model Control

Demo

- Creating CMS-Wave grids
- Creating Wave Spectra from bulk criteria
- Importing Wave Spectra information from Wave Gauge/Buoy/WaveNet
- Export/Launch CMS-Wave
- Steering – Interactive CMS-Flow and CMS-Wave

- Load project from previous work
  - Files can be found in Day4/1-afterDay3 folder





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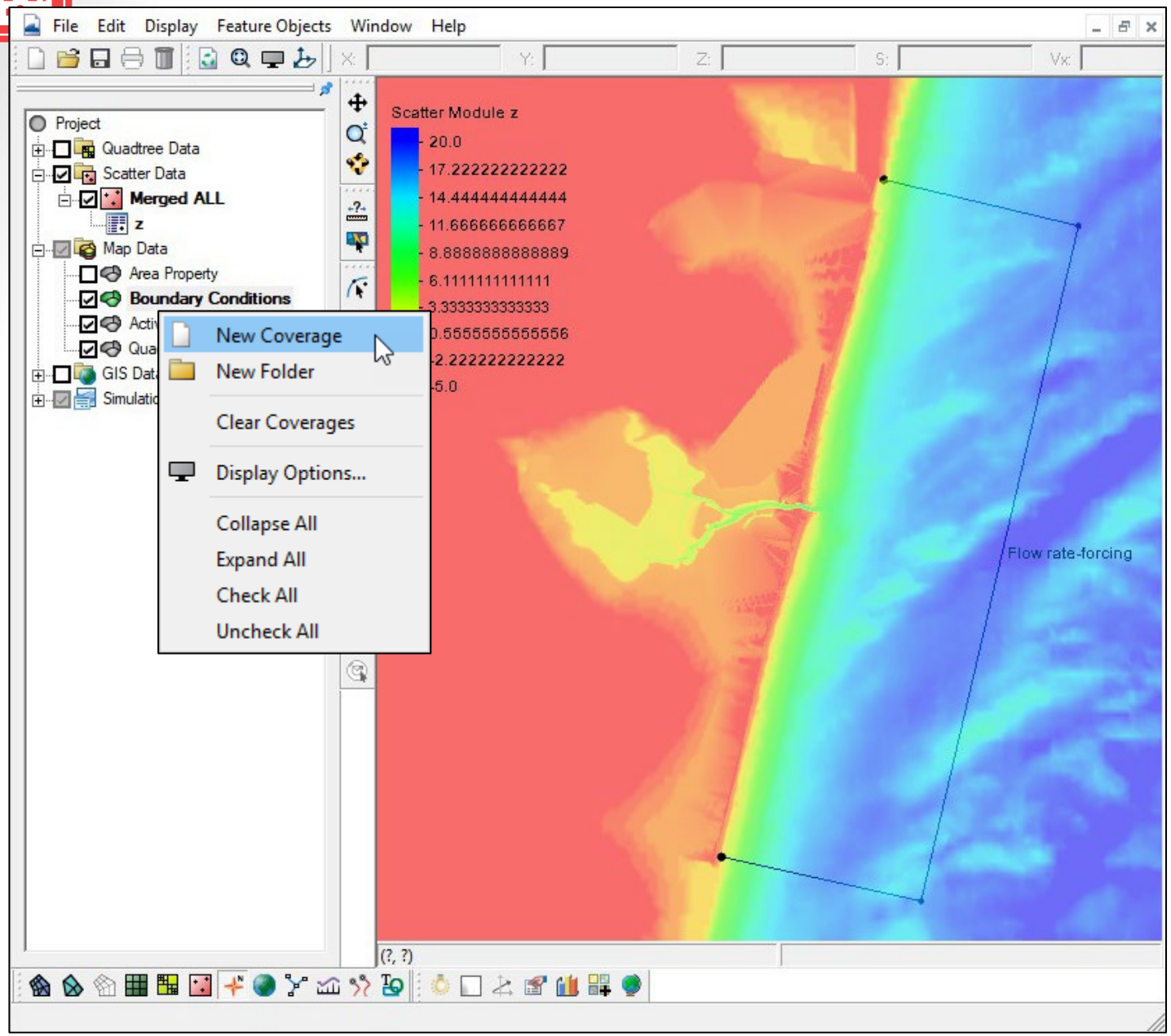

- Load project from previous work
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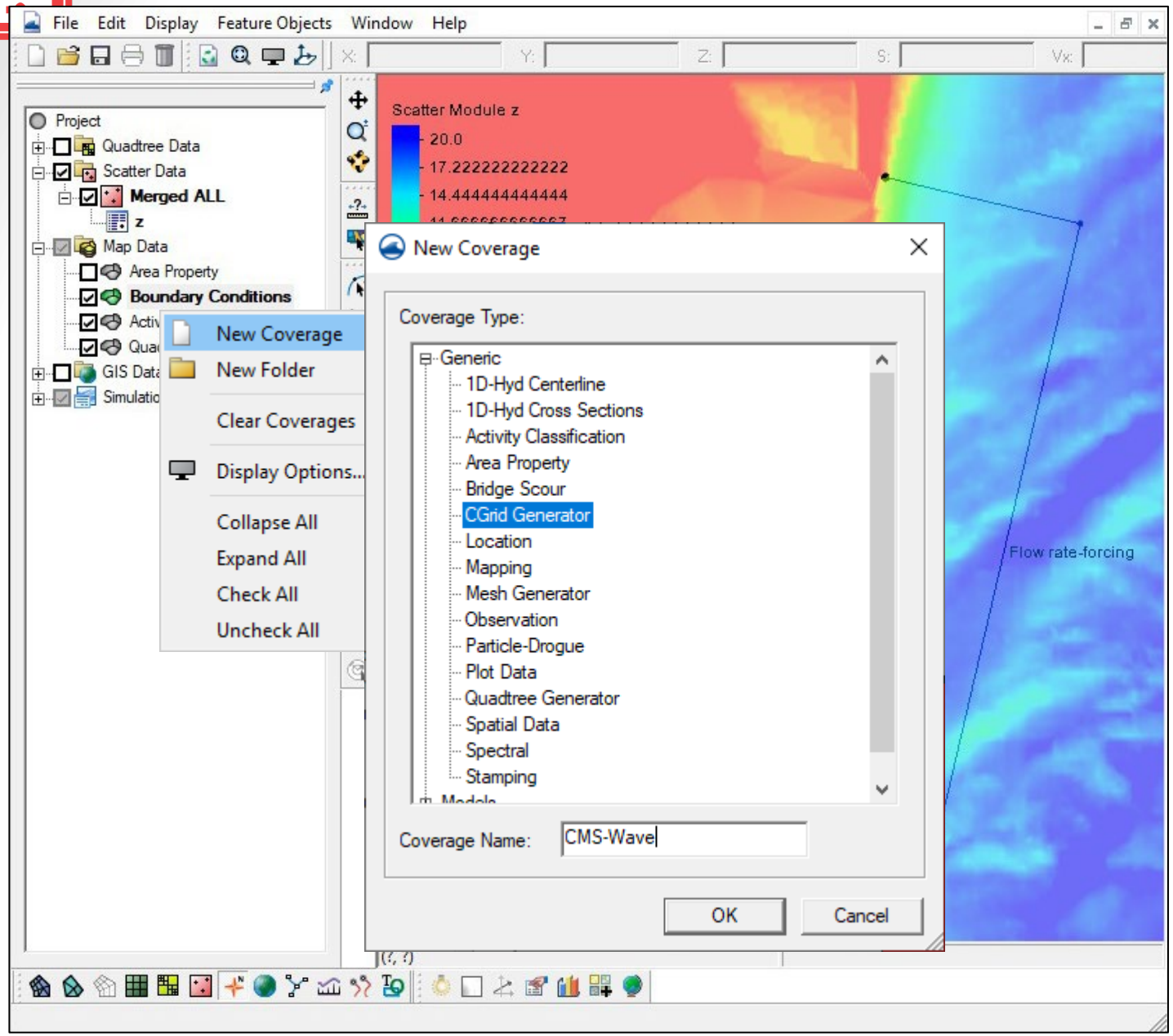
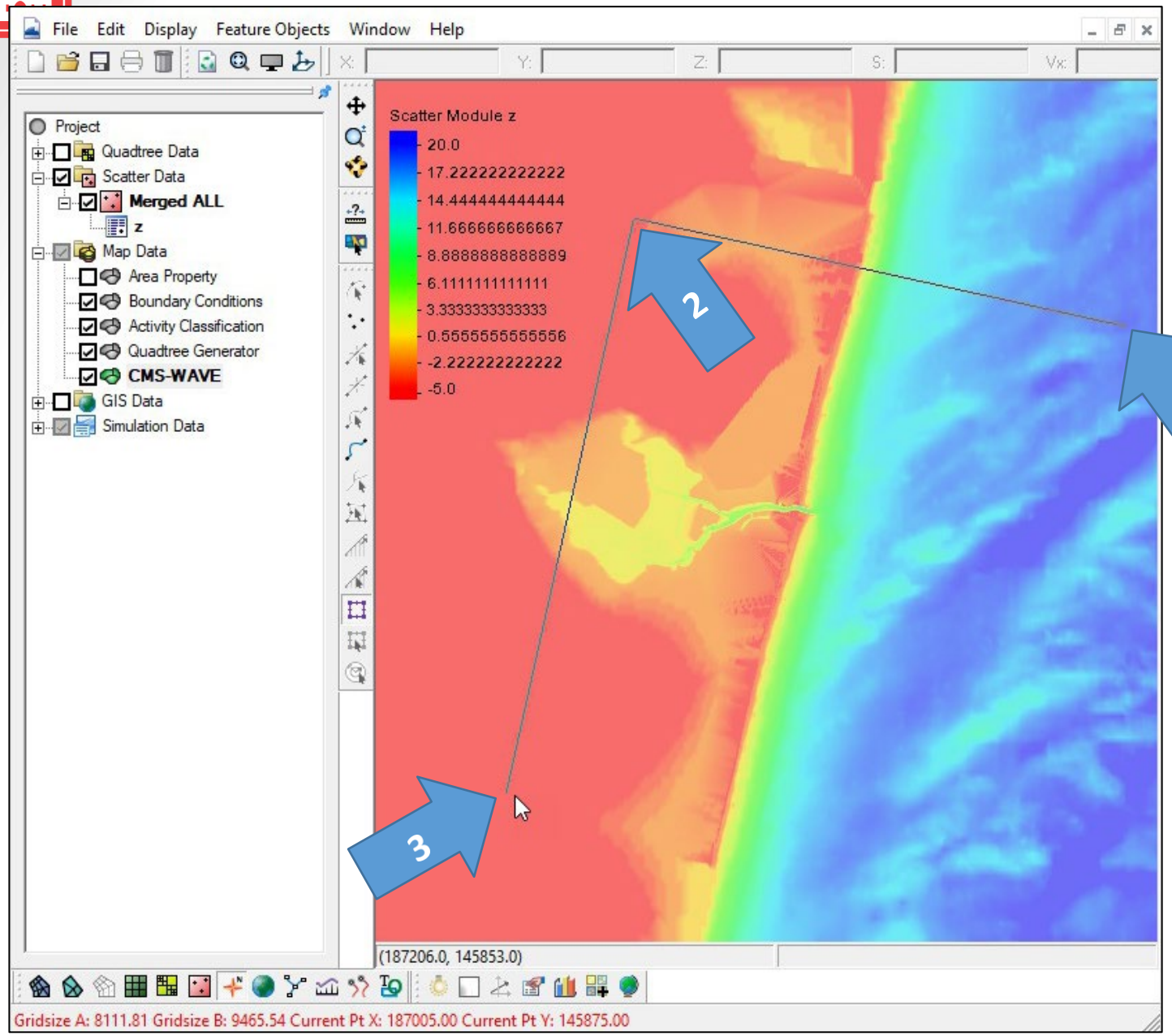
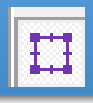
- Right click on “Map Data”
  - New Coverage



- Load project from previous work
  - Files can be found in Day4/1-afterDay3 folder
- Right click on “Map Data”
  - New Coverage
  - Generic | Cgrid Generator
  - Rename to “CMS-Wave”

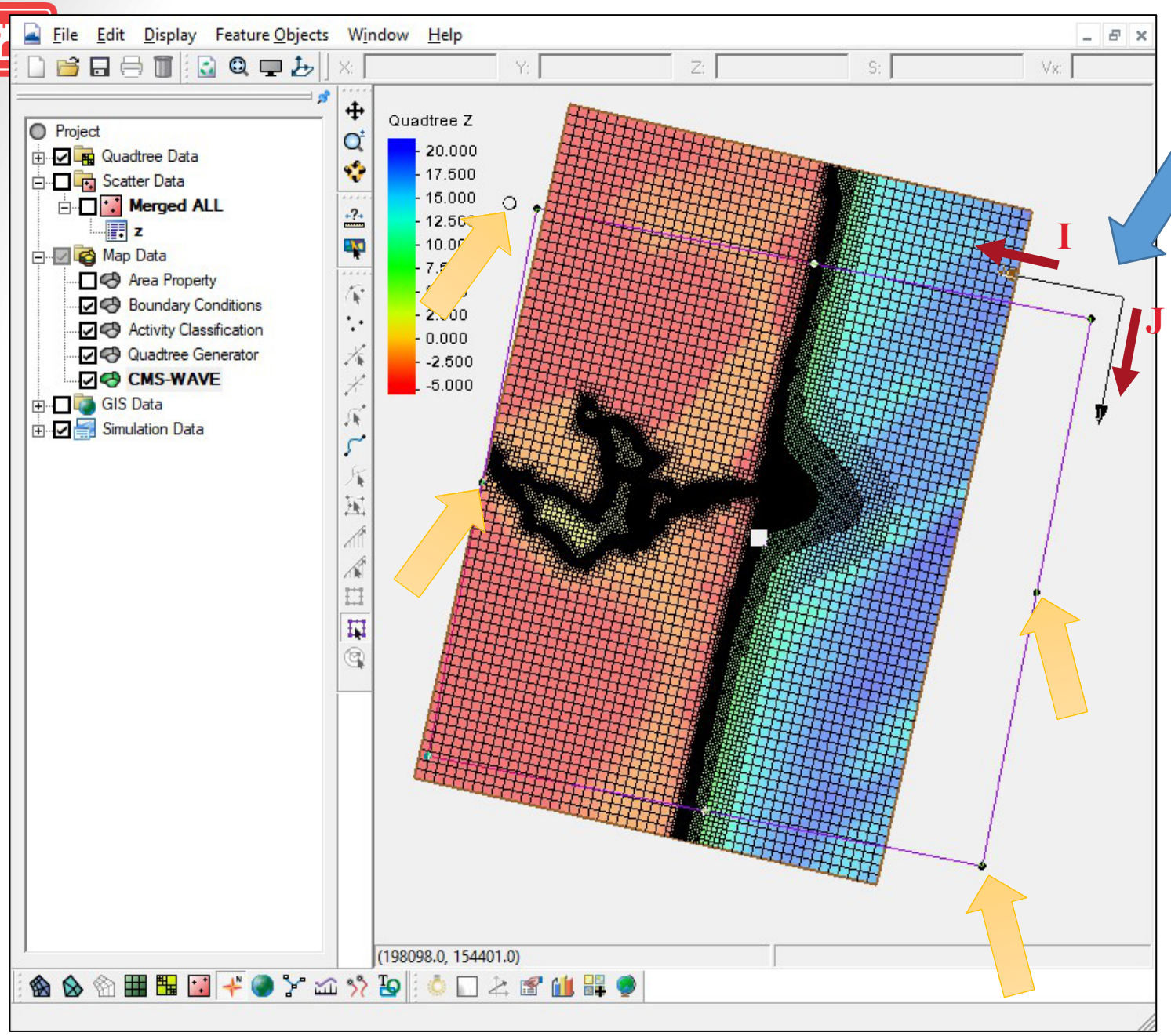


- Select CMS-Wave
- Select Create Grid Frame tool 

- Define domain of CMS Wave grid by clicking three points –
- **Starting offshore (1)** moving toward shoreline (2), then other corner on land side (3)

- Note: Order **MUST** be correct

- Accuracy not required, we can edit afterward.

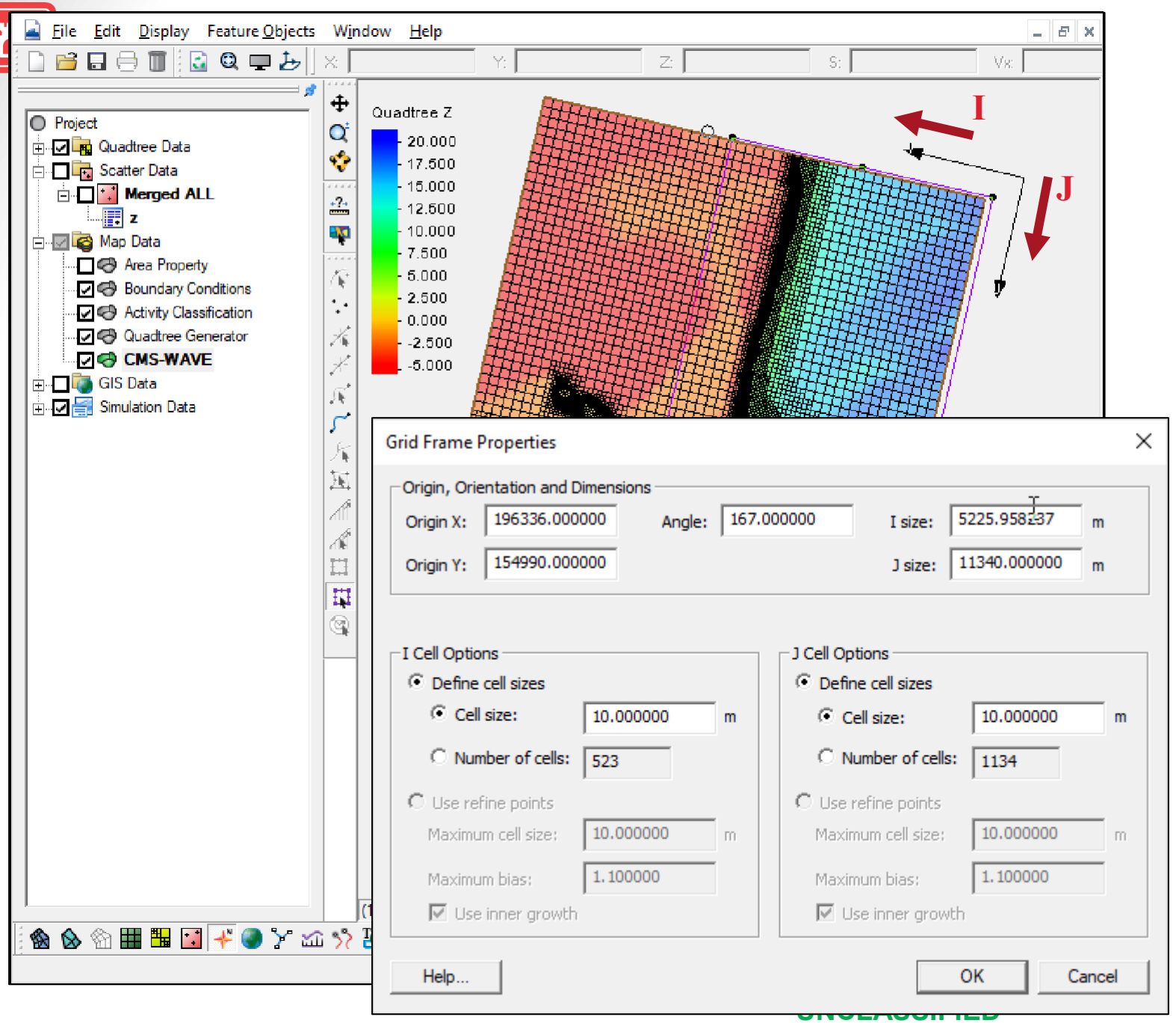


- Click Select Grid Frame tool

- Click frame selector
- You can now resize with corner or edge center points
- You can rotate around IJ Axis with handle

- Make sure to SAVE frequently as you go along.

** **Note**: the location of the IJ Triad. I-direction is directed onshore.

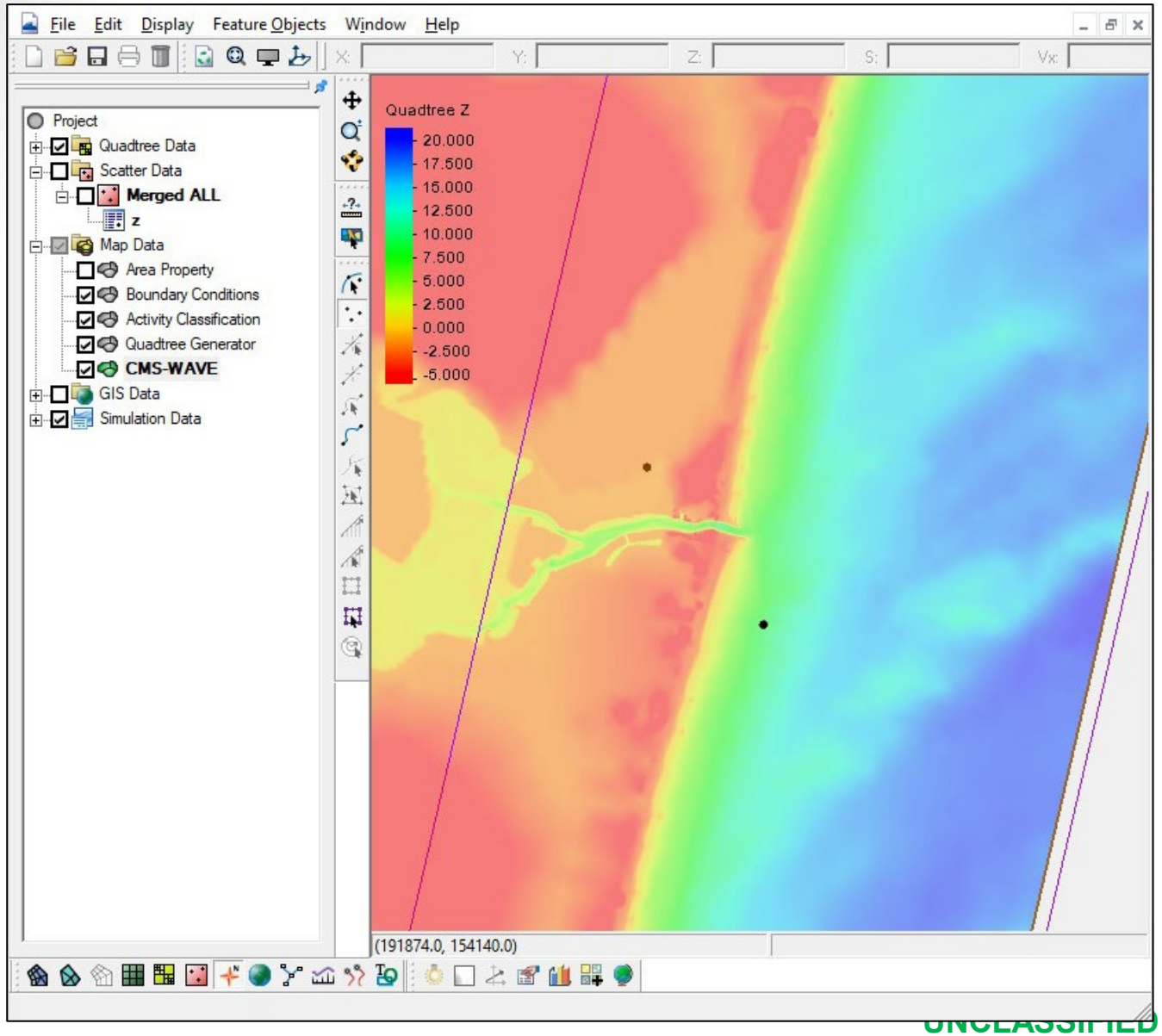


- Many times, we make the Wave Grid the same size or just a little larger than the Flow grid, unless the flow grid is very large.

- Turn off Scatter visibility
- Turn on Quadtree visibility

- Back side does not need to match the flow if the wave energy will most likely be dissipated.

DEFINE LOCATIONS FOR FINER RESOLUTION

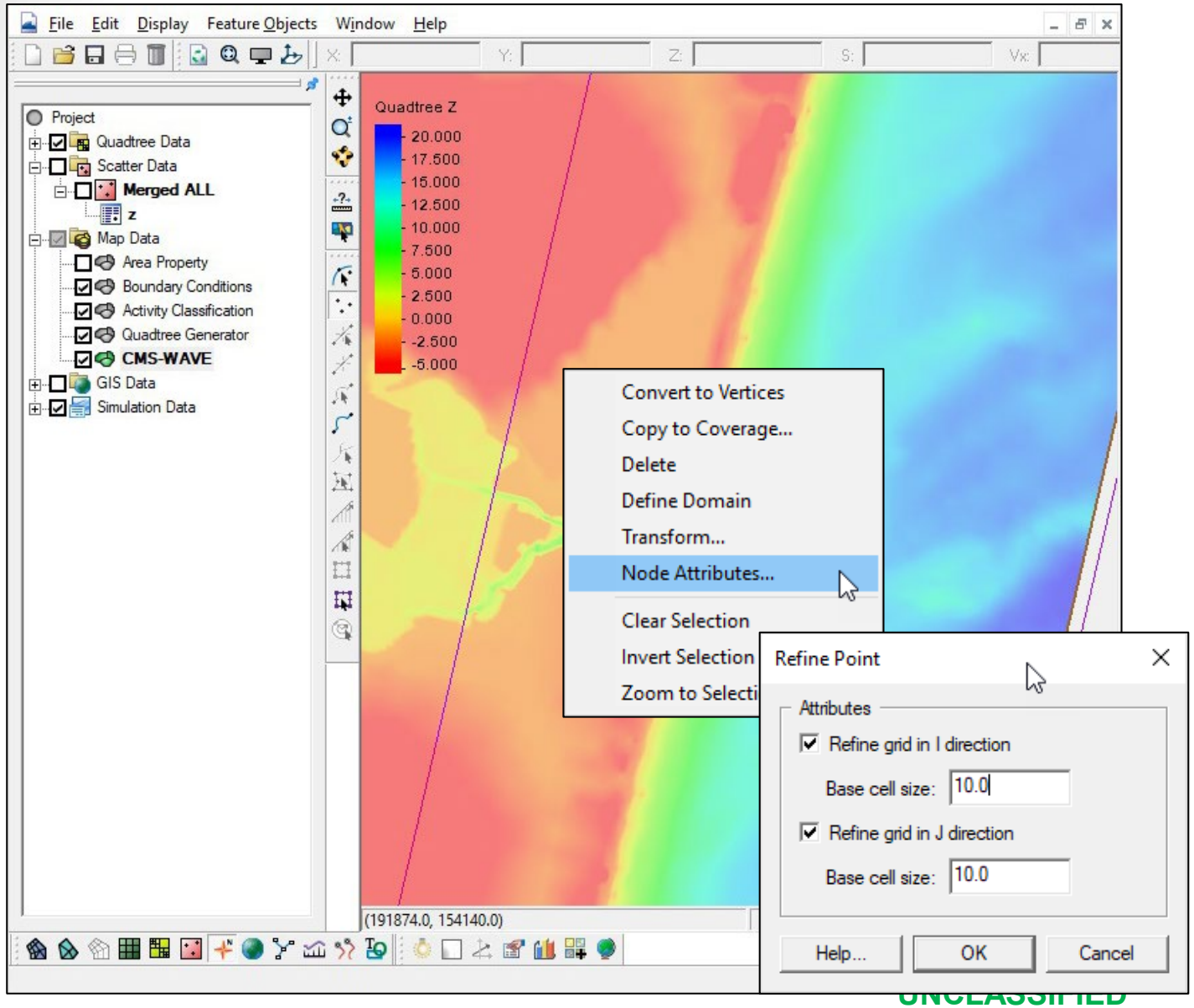


Resolution for Cartesian Grids is done with “refine points”.

- Create feature points.
- Then select | right-click and set node attributes

- You can set refinement in:
  - I-direction
  - J-direction
  - Both
- Refinement starts at feature point center and increases outward.

DEFINE LOCATIONS FOR FINER RESOLUTION



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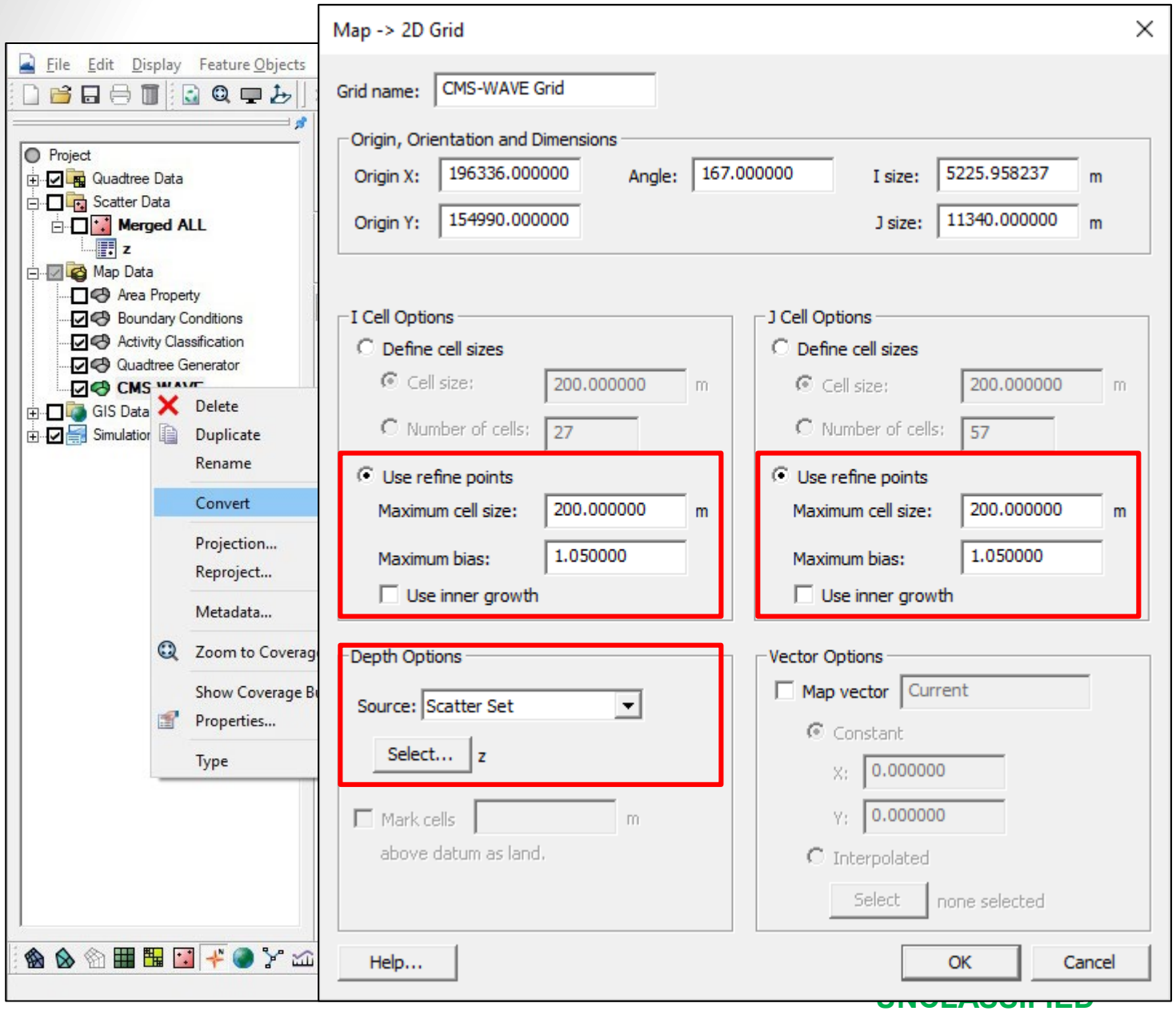
CREATE CARTESIAN GRID

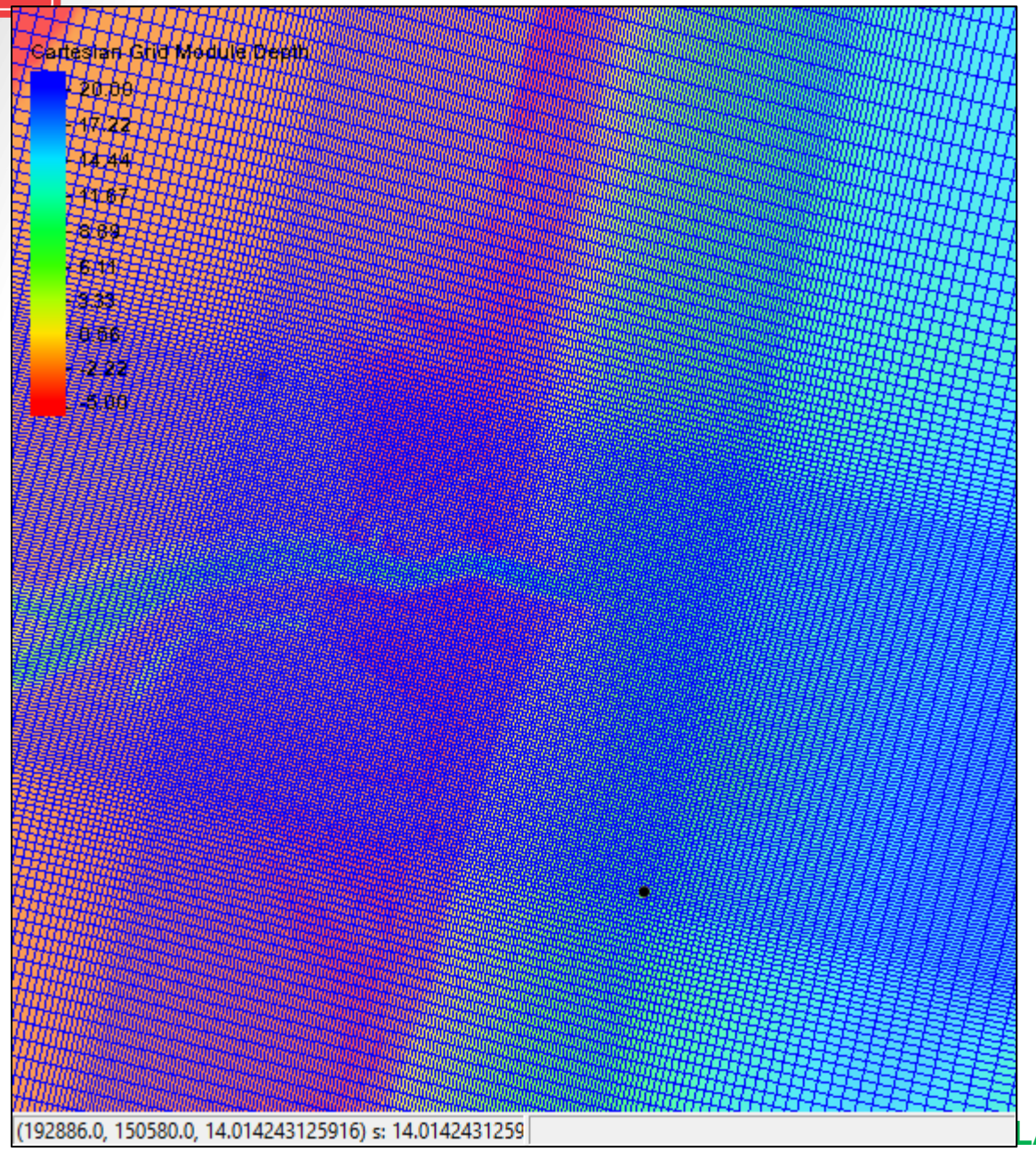


- Right-click on CMS-Wave coverage in data tree
- Convert | Map -> 2d Grid

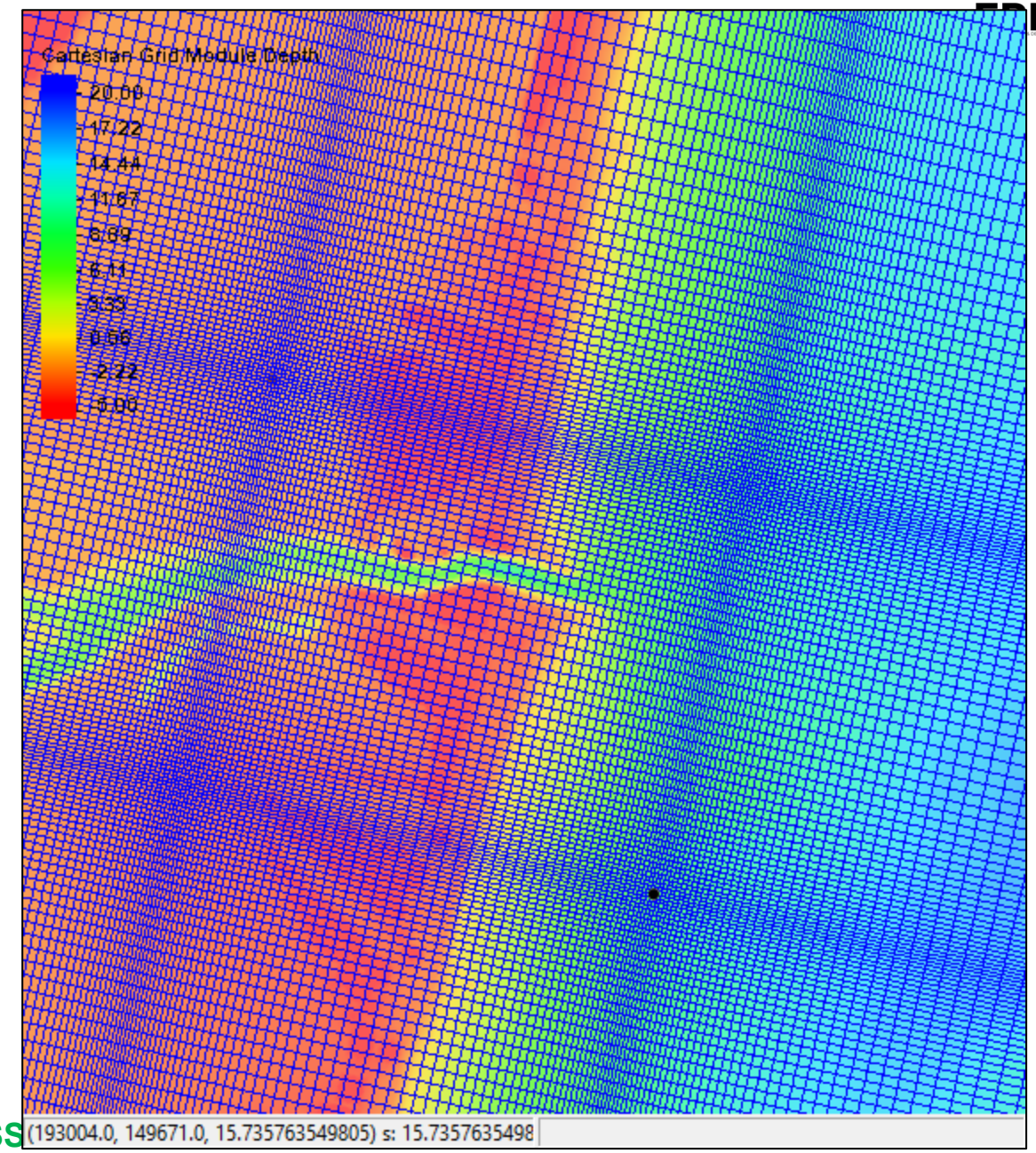
- Use refine points
- Maximum cell size – the size of the largest cells away from refine points.
- Maximum bias – determines how fast the increase in cell size away from refine points.
- Use inner growth – Unchecked, keeps cell resolution small until the next/last refine point.

UNCLASSIFIED

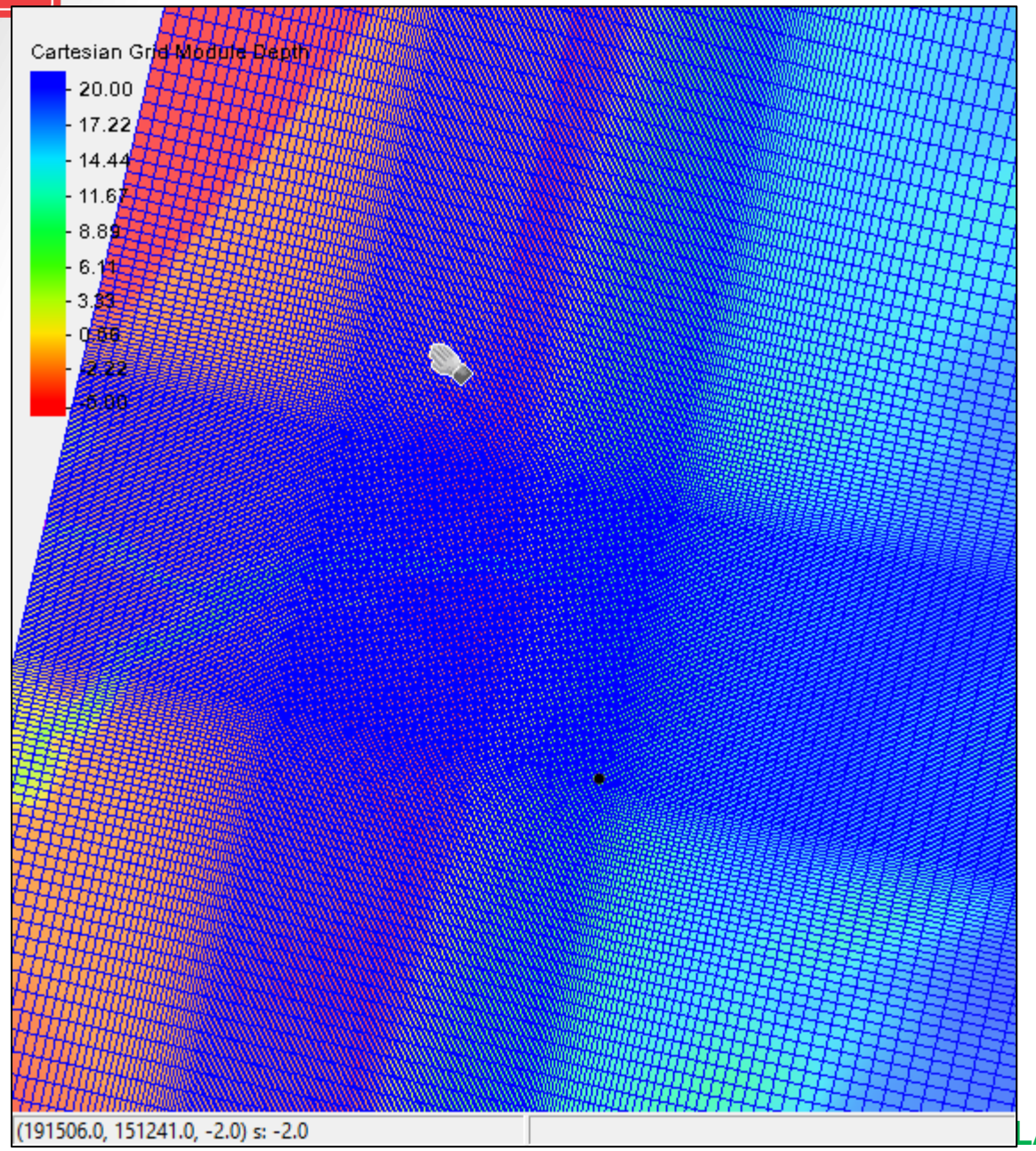
Inner Growth - *unchecked*



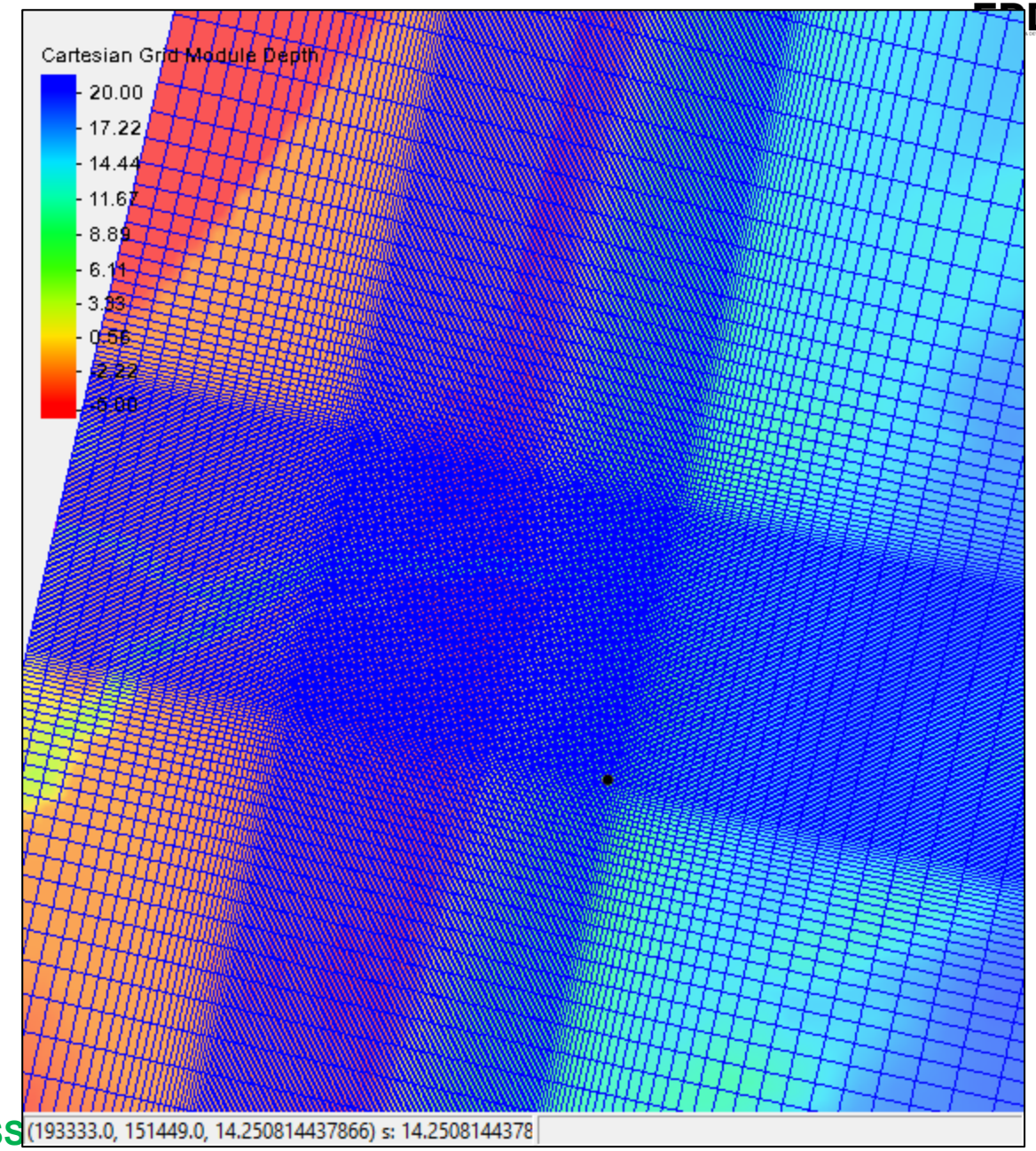
Inner Growth - *checked*



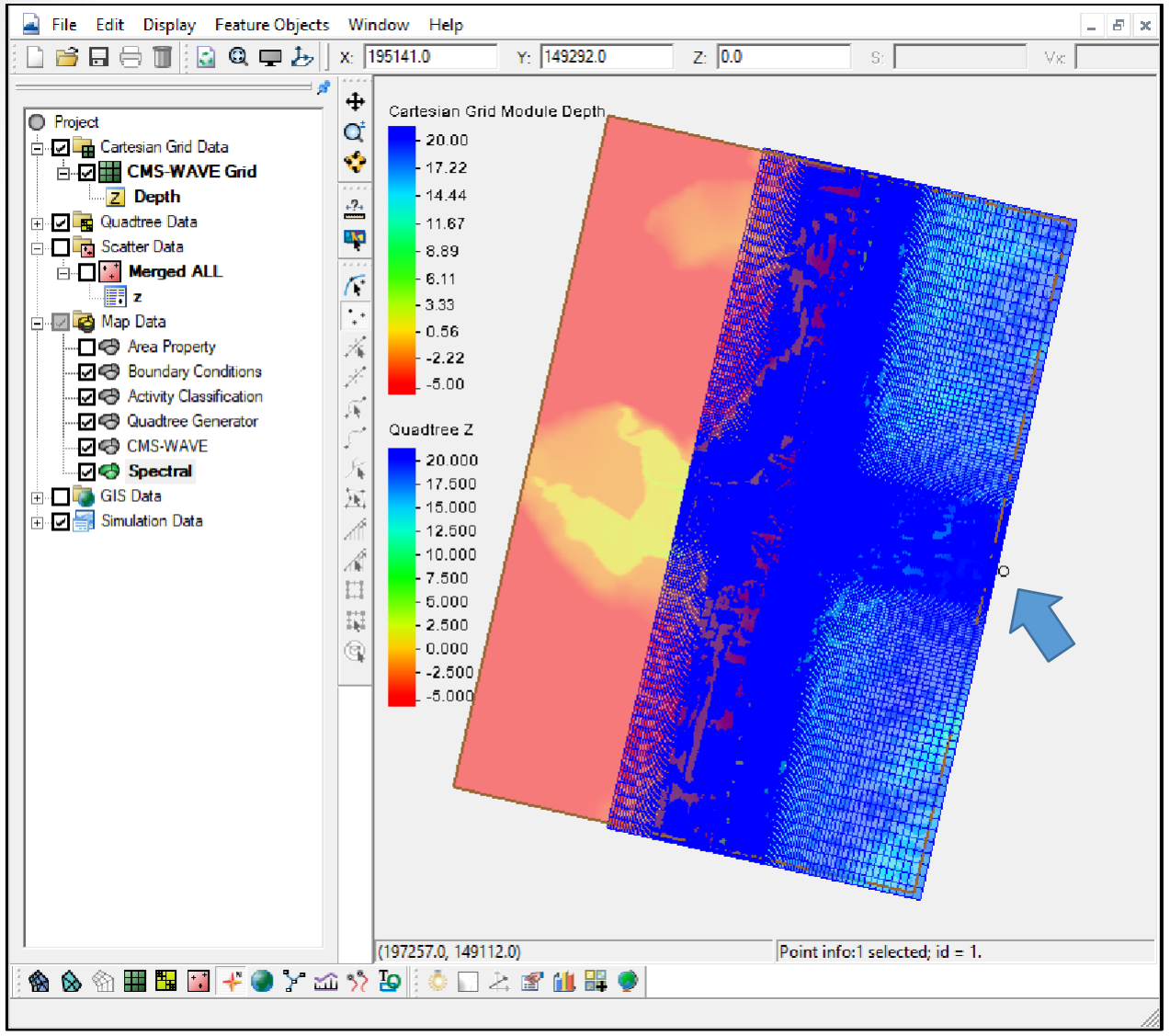
Bias – 1.05



Bias – 1.10



SPECTRAL INPUT

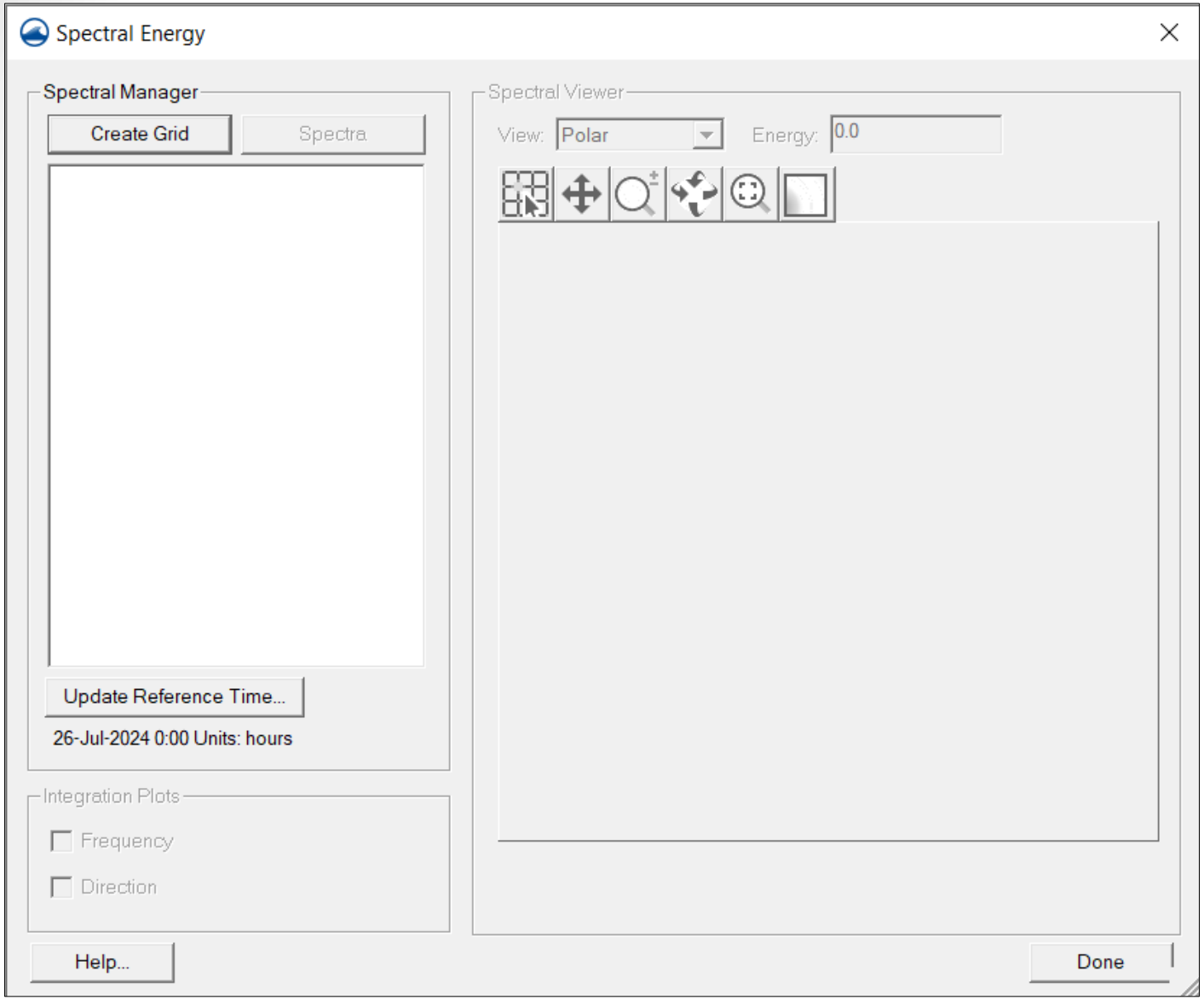


Project files saved at this point in – Day4/2-afterWaveCreate folder

- Turn on display of Quadtree grid to see both

- Add Spectral Coverage to Map Module
  - Right-click on “Map Data”
  - New Coverage
  - Generic | Spectral
- Add Feature Point for spectral information (normally middle of offshore edge)

SIMPLE SPECTRAL INPUT



- Select point
- Right-click | Node Attributes
- Click Create Grid
  - Enter 167 degrees
  - Select “Local”
  - Click OK
- Click OK on Spectral Energy Grid dialog
- Define Spectral Energy Grid
  - Number bins (freq., dir.)
  - Set frequency bin ranges
  - Set direction bin ranges
  - Click OK

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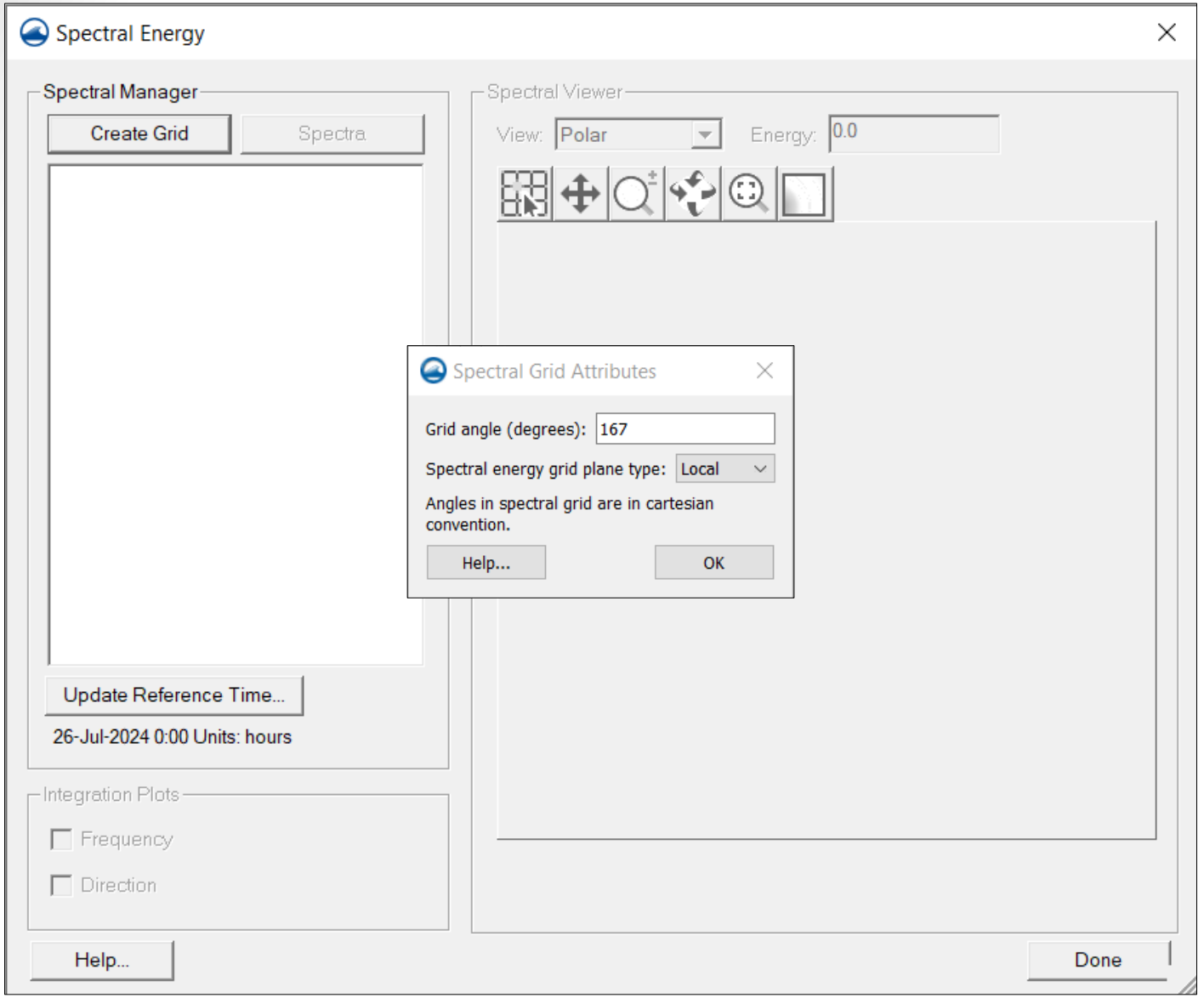

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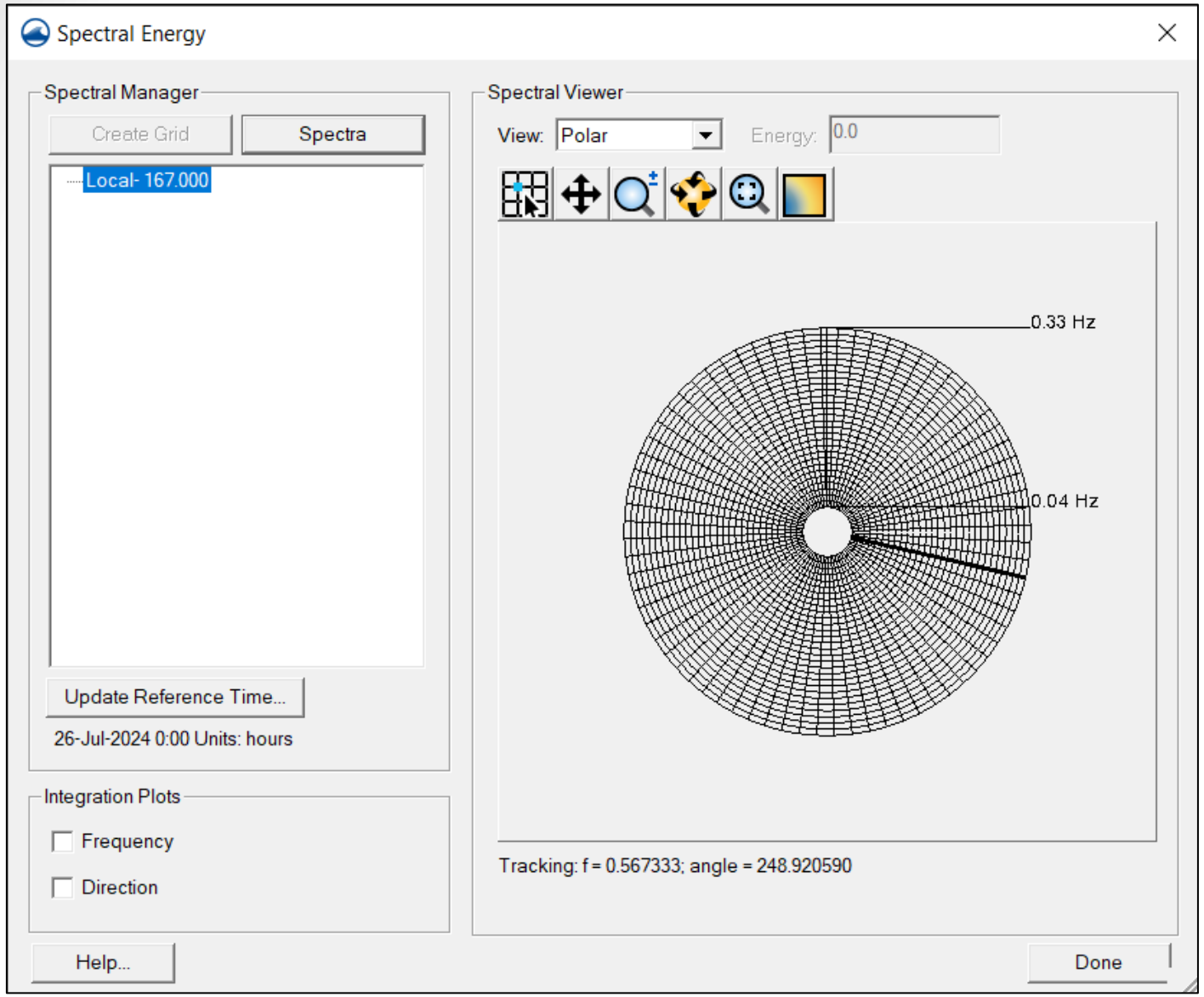

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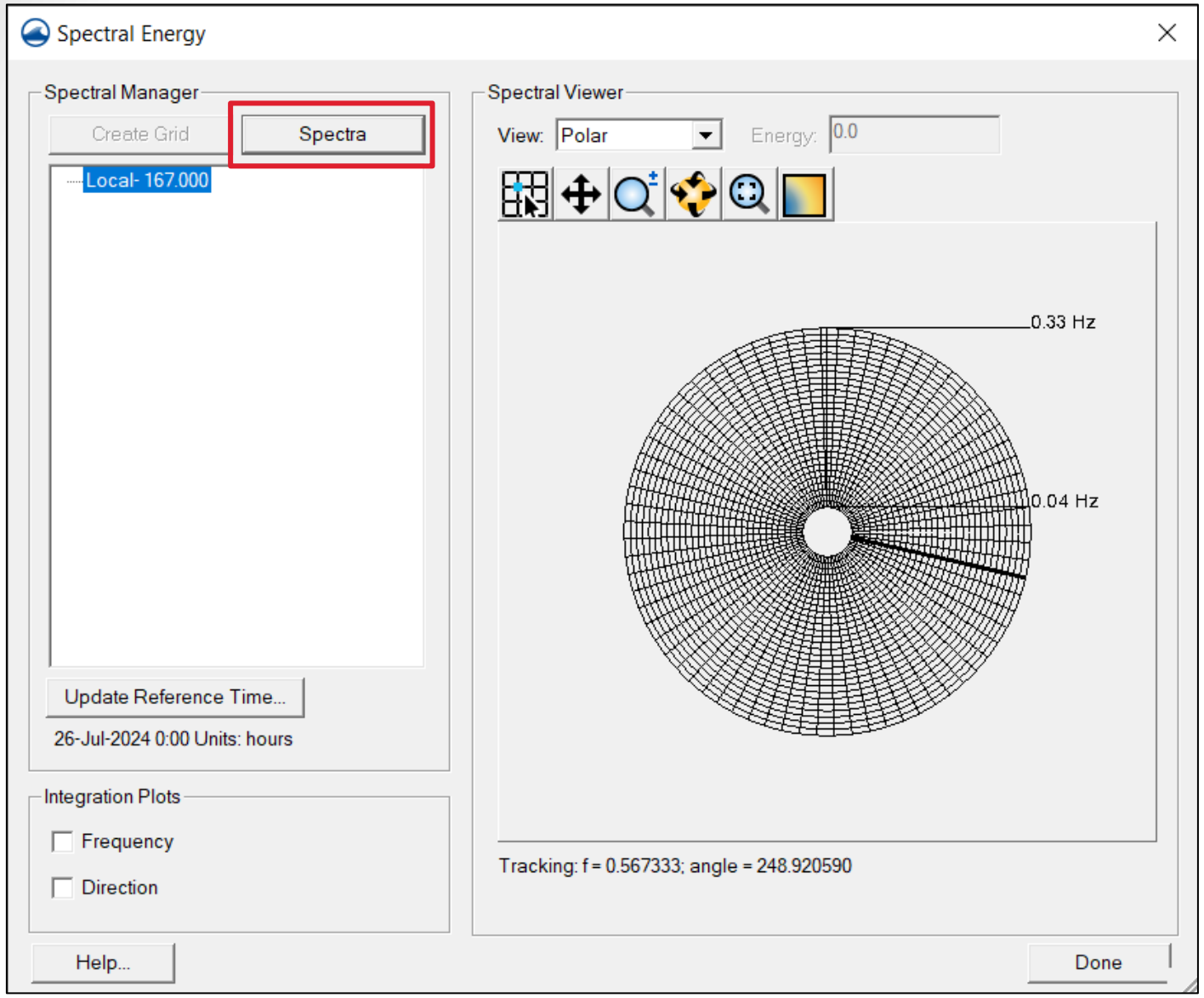
SPECTRAL INPUT FROM WAVE CHARACTERISTICS

(CUT/PASTE OR HAND ENTRY)

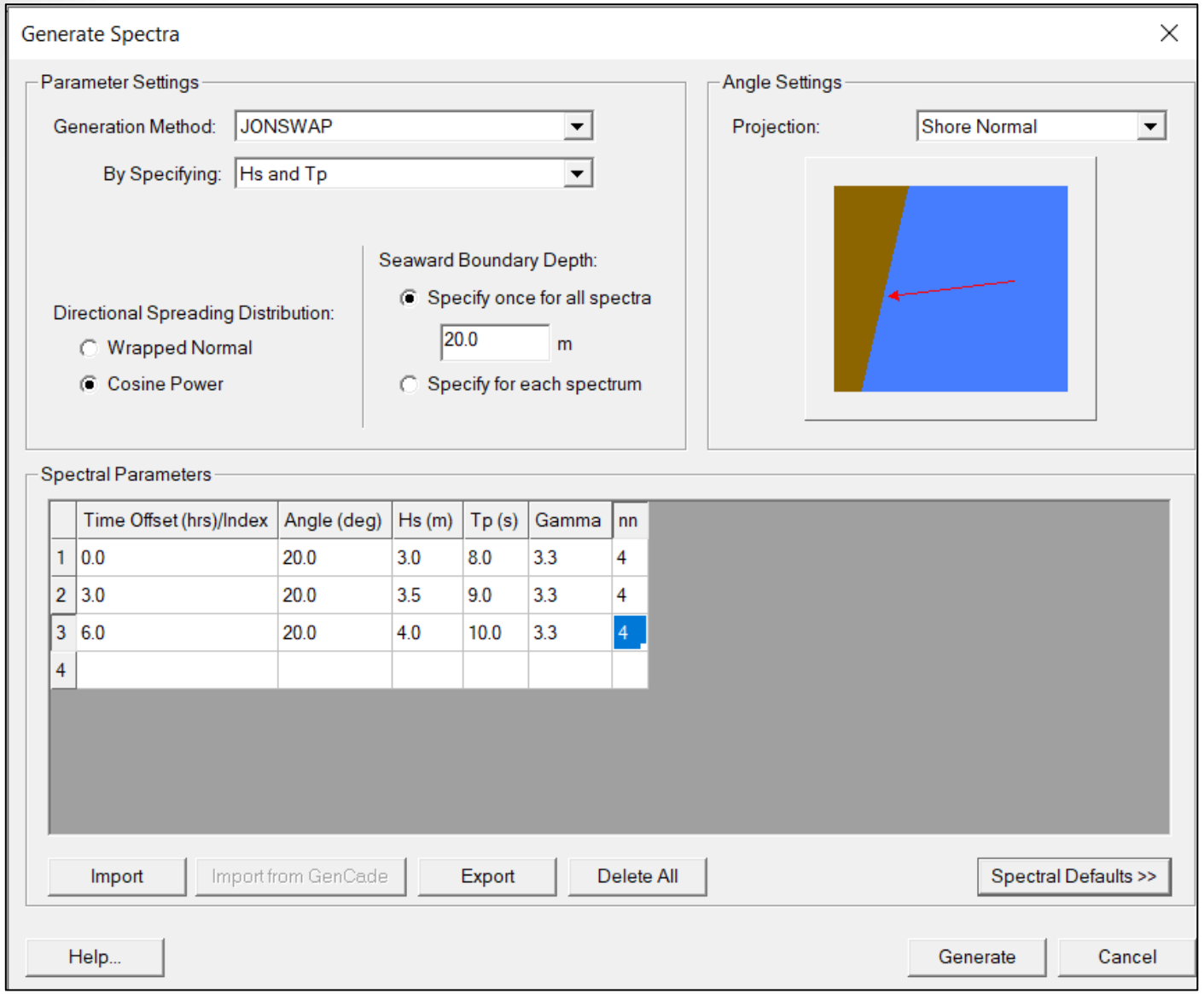


We need to enter the wave characteristic data to create a wave spectral grid.

- Click "Spectra"

SPECTRAL INPUT FROM WAVE CHARACTERISTICS

(CUT/PASTE OR HAND ENTRY)



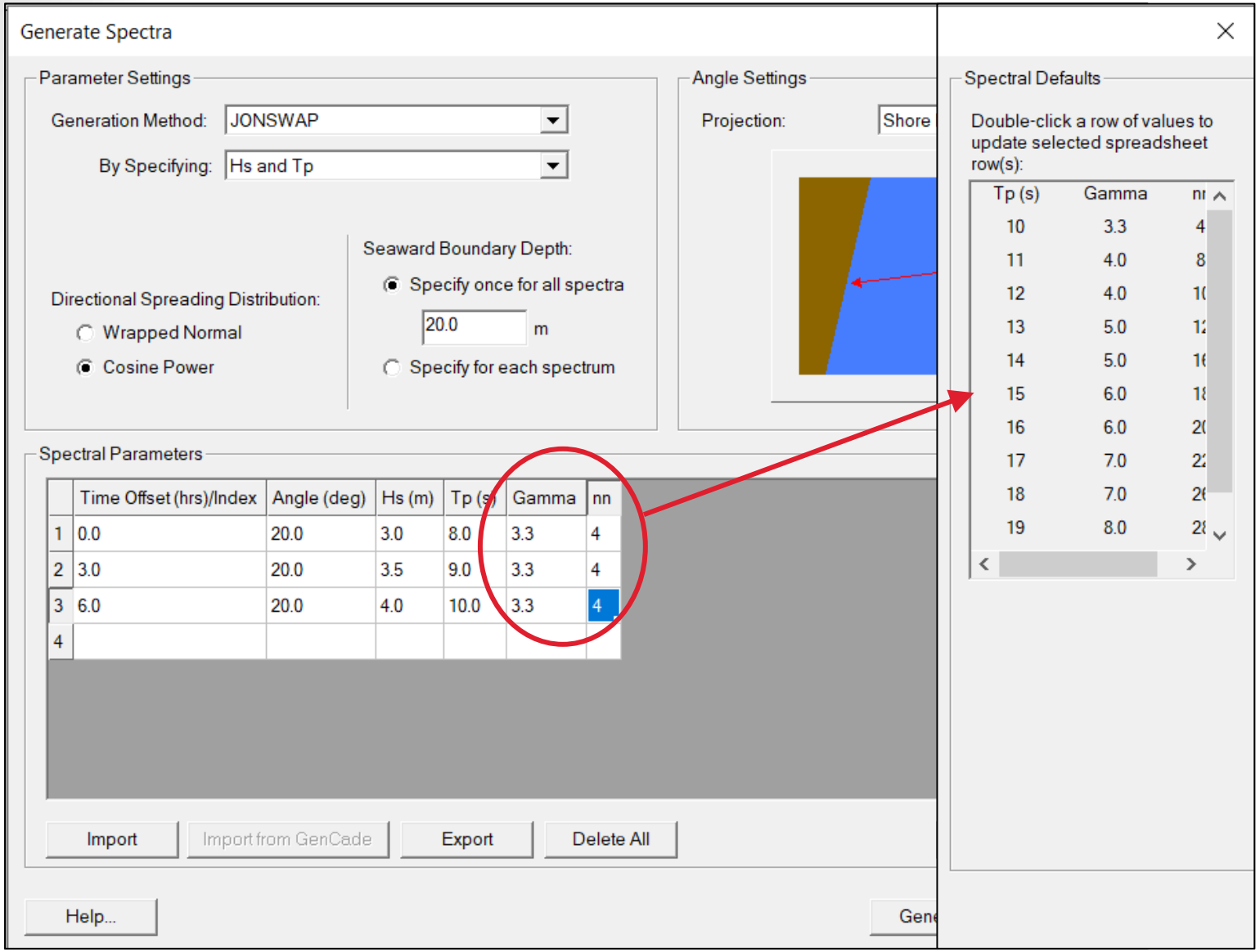
We need to enter the wave characteristic data to create a wave spectral grid.

- Click "Spectra"

- Manually enter Wave Angle, Height, Period, and spectral defaults by hand entering or cut/paste from another location.
- Enter offshore grid depth

SPECTRAL INPUT FROM WAVE CHARACTERISTICS

(CUT/PASTE OR HAND ENTRY)



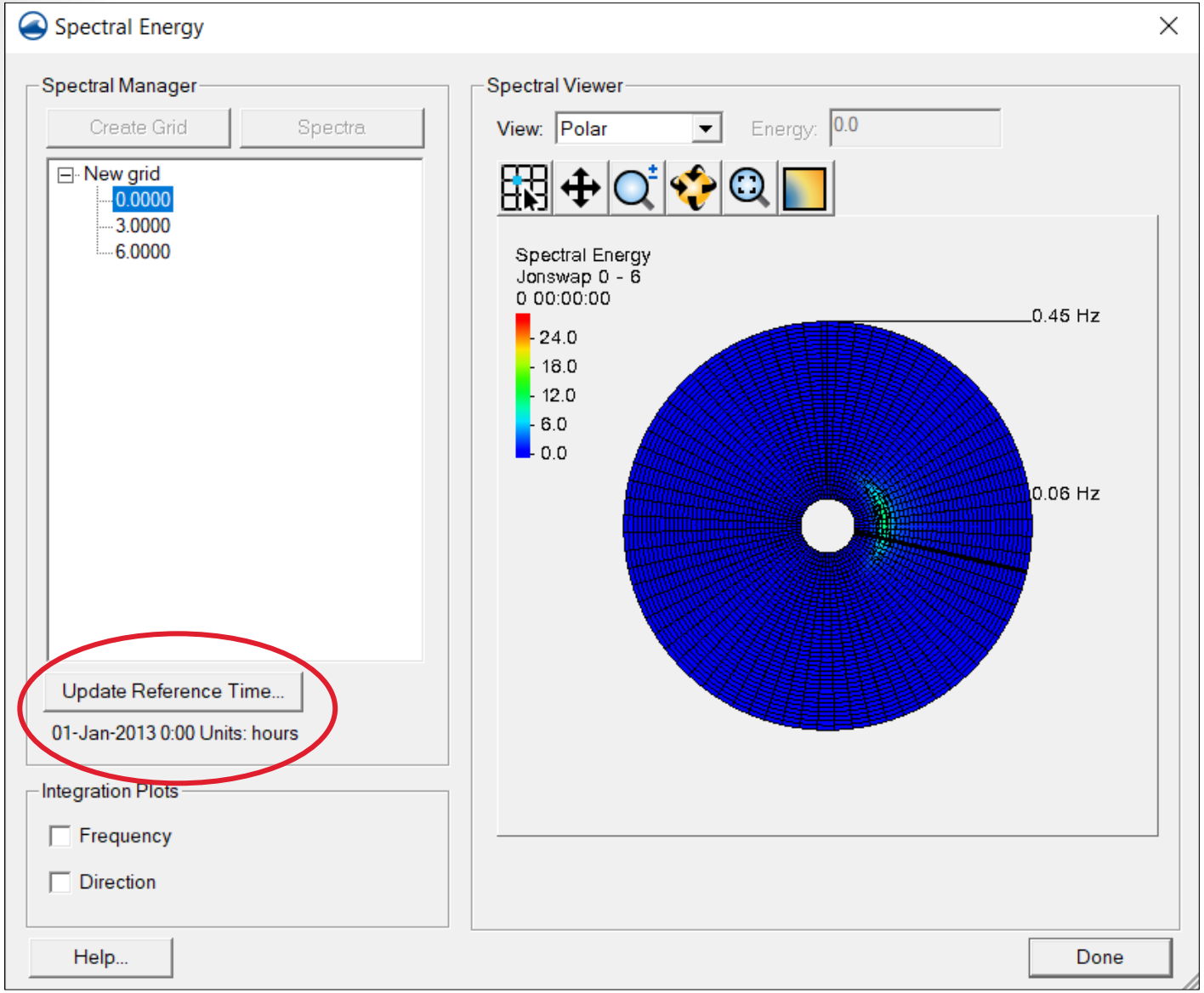
We need to enter the wave characteristic data to create a wave spectral grid.

- Click "Spectra"

- Manually enter Wave Angle, Height, Period, and spectral defaults by hand entering or cut/paste from another location.
- Enter offshore grid depth
- Enter Gamma and nn
  - See “Spectral Defaults”

SPECTRAL INPUT FROM WAVE CHARACTERISTICS

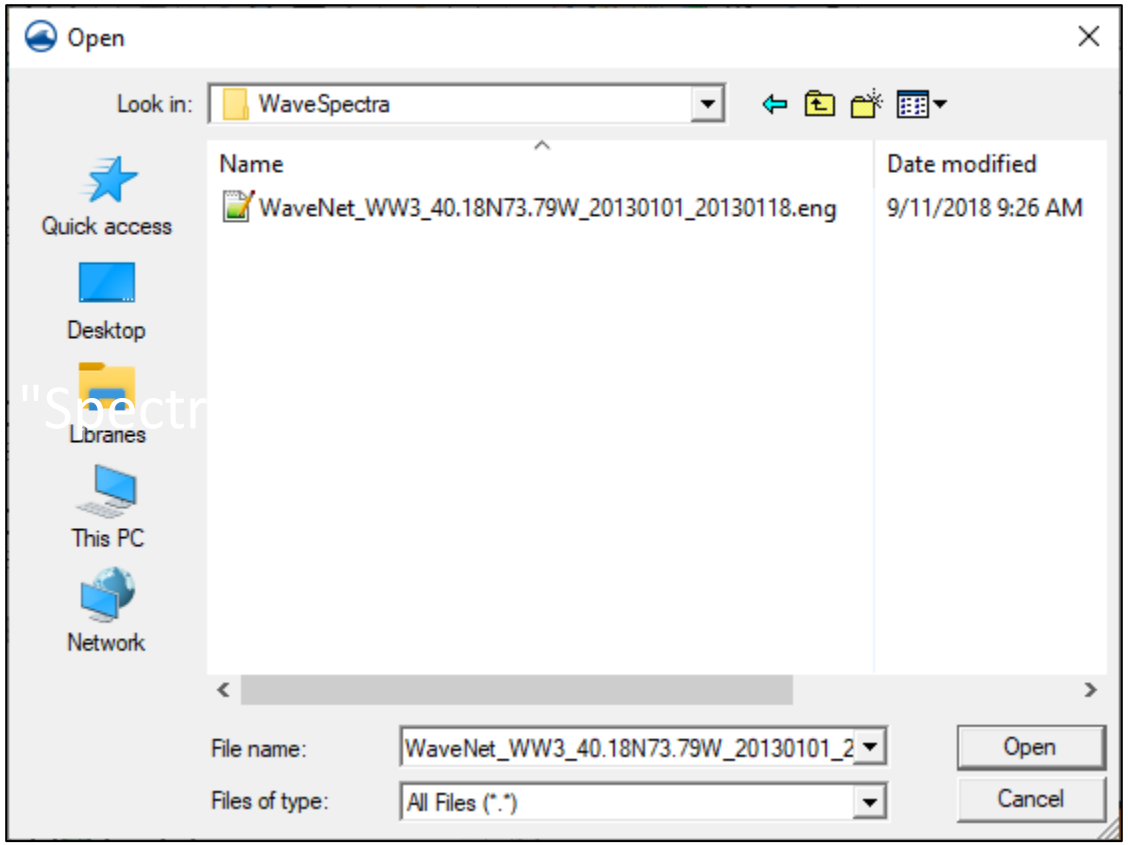
(CUT/PASTE OR HAND ENTRY)



We need to enter the wave characteristic data to create a wave spectral grid.

- Update Reference Time

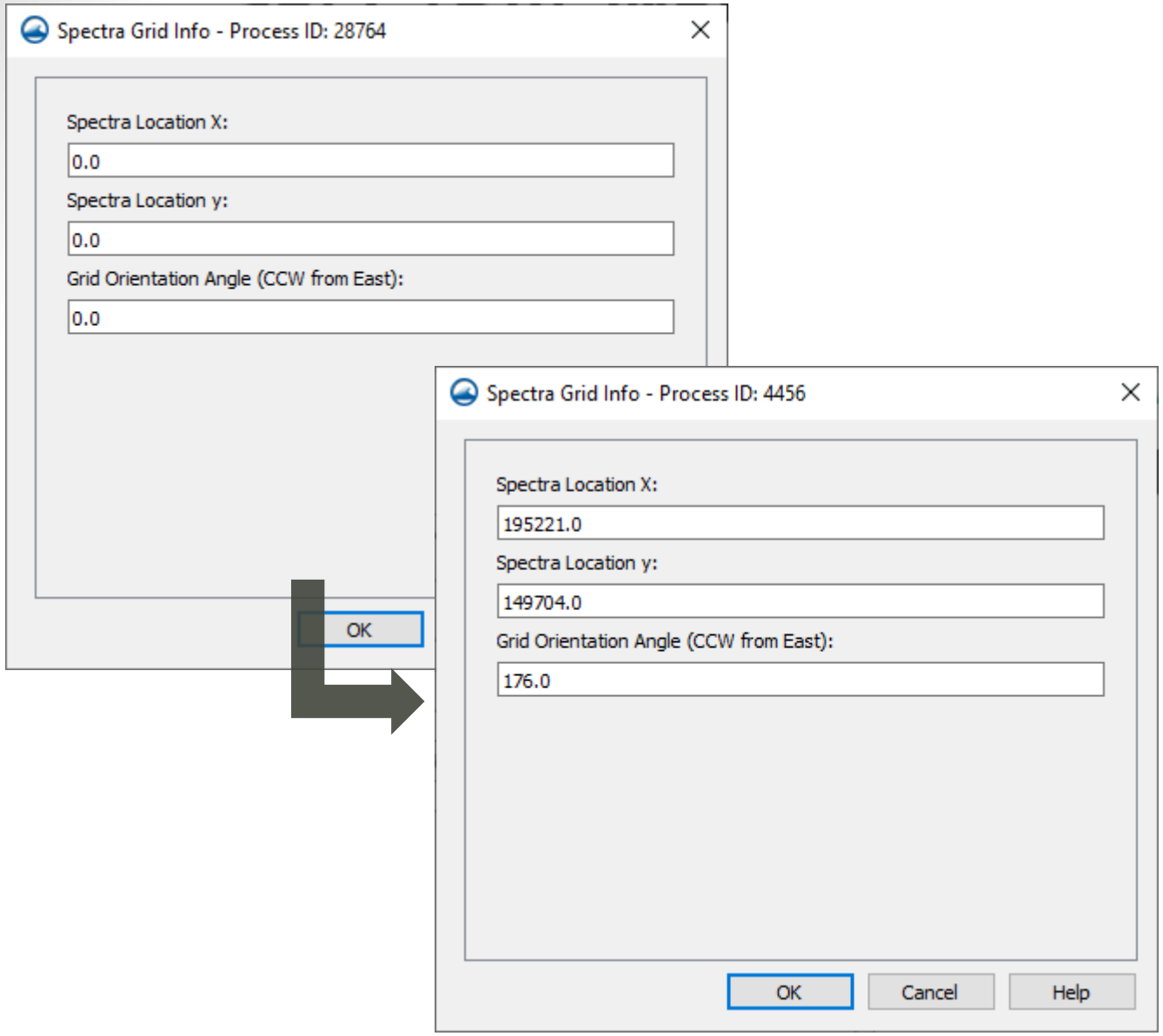
SPECTRAL INPUT FROM GAUGE



There are tools to take information from gauges and buoys (CDIP/WW3/NDBC) and put in correct CMS-Wave format. We will discuss some of these in an Advanced Webinar.

- On the main screen, choose File | Open from the pull-down menus.
- Go to the “WaveSpectra” folder underneath Day 4.
- Select the “WaveNet…” file and Open.

SPECTRAL INPUT FROM GAUGE



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- Enter the X/Y coordinates for the location of the Spectral Forcing (195221,149704)
- Enter the Grid Angle (176)
- Click OK

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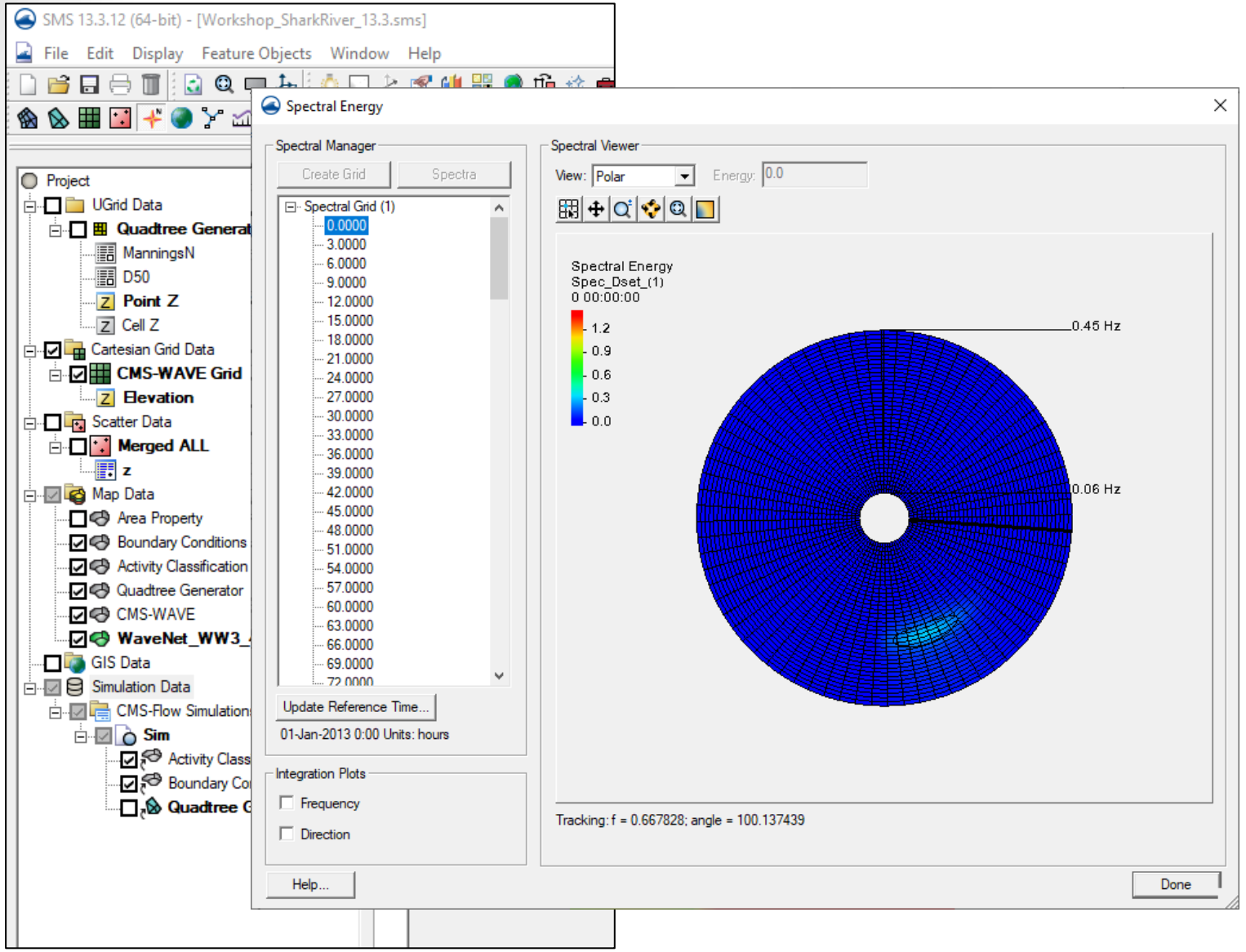
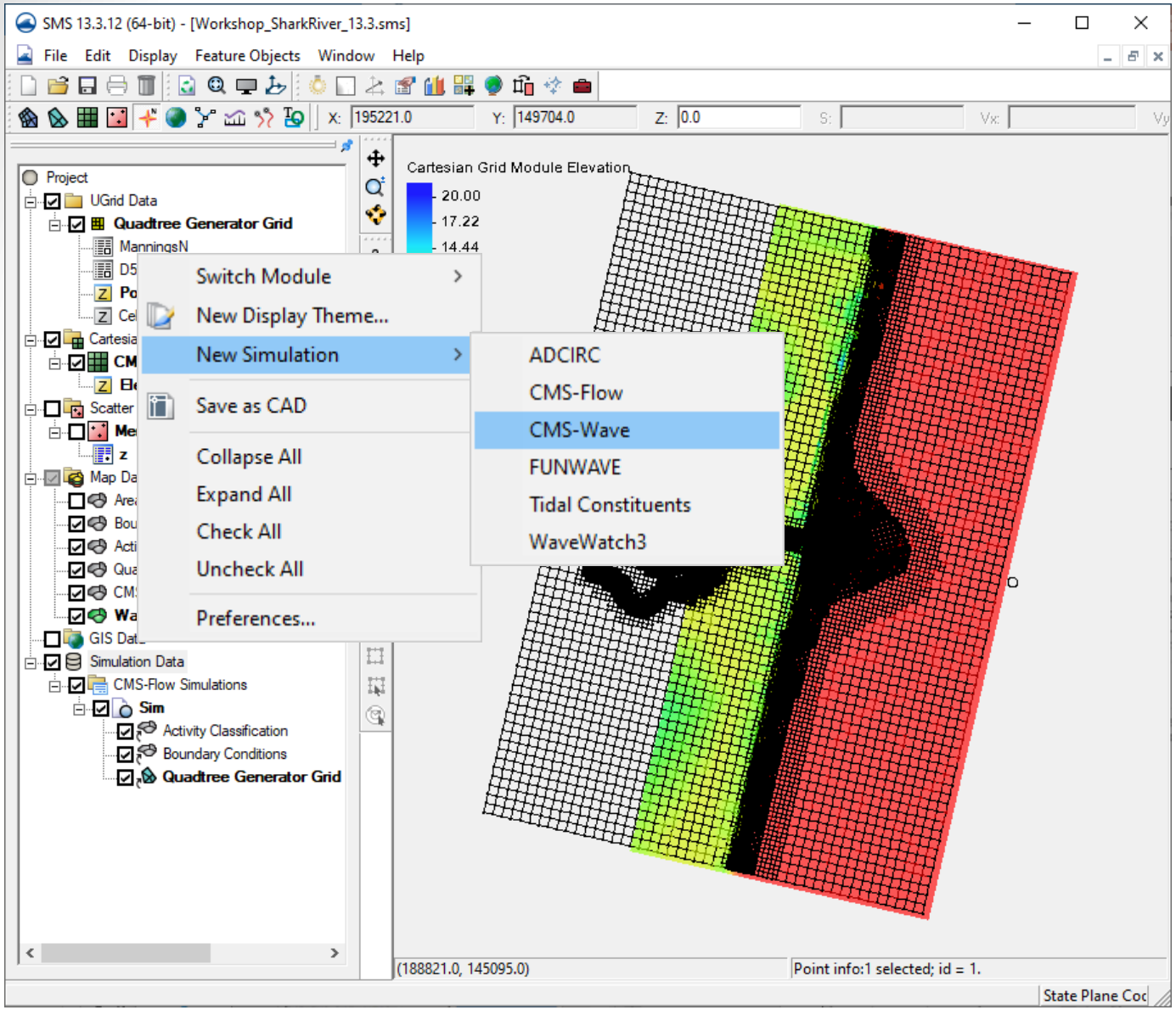


There are tools to take information from gauges and buoys (CDIP/WW3/NDBC) and put in correct CMS-Wave format. We will discuss some of these in an Advanced Webinar.

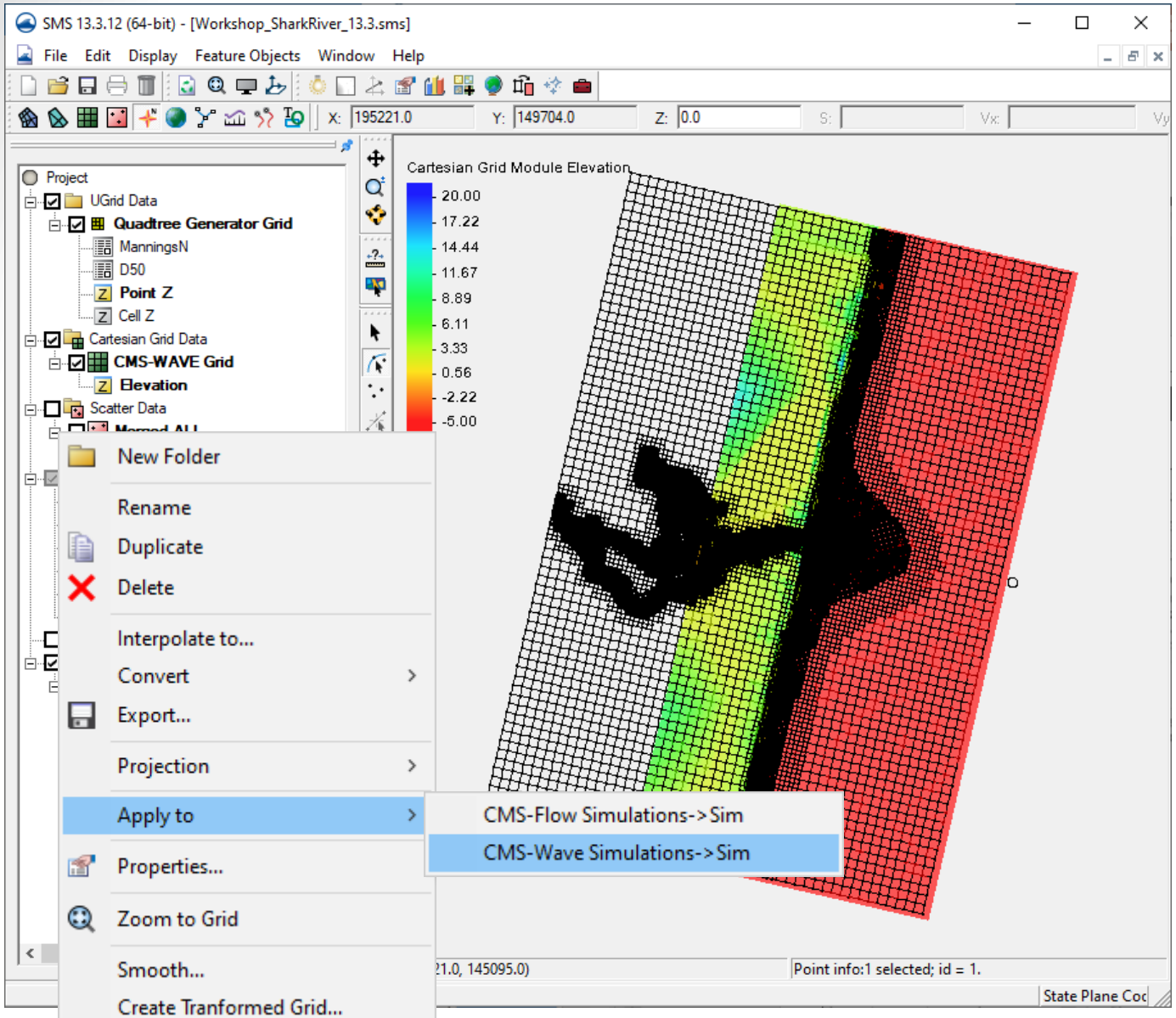
- A new coverage is created.
- Double-click the spectra point and open the spectral dialog.
- All times and spectra from the file are added to a new spectral grid.
- The reference time should already be set.

CREATE CMS-WAVE SIMULATION



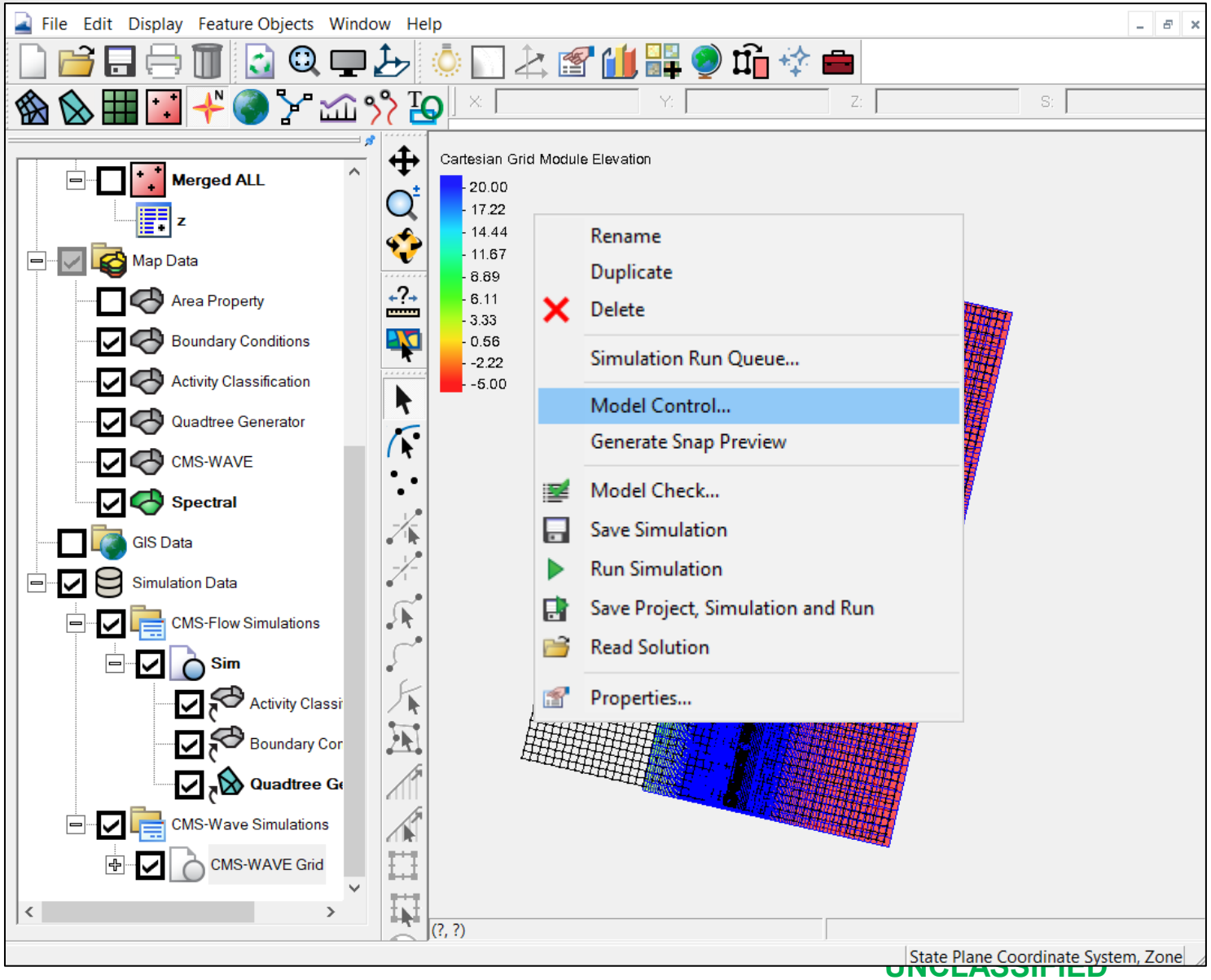
- Right click in open area in Data Tree and choose “New Simulation” | “CMS-Wave”

CREATE CMS-WAVE SIMULATION



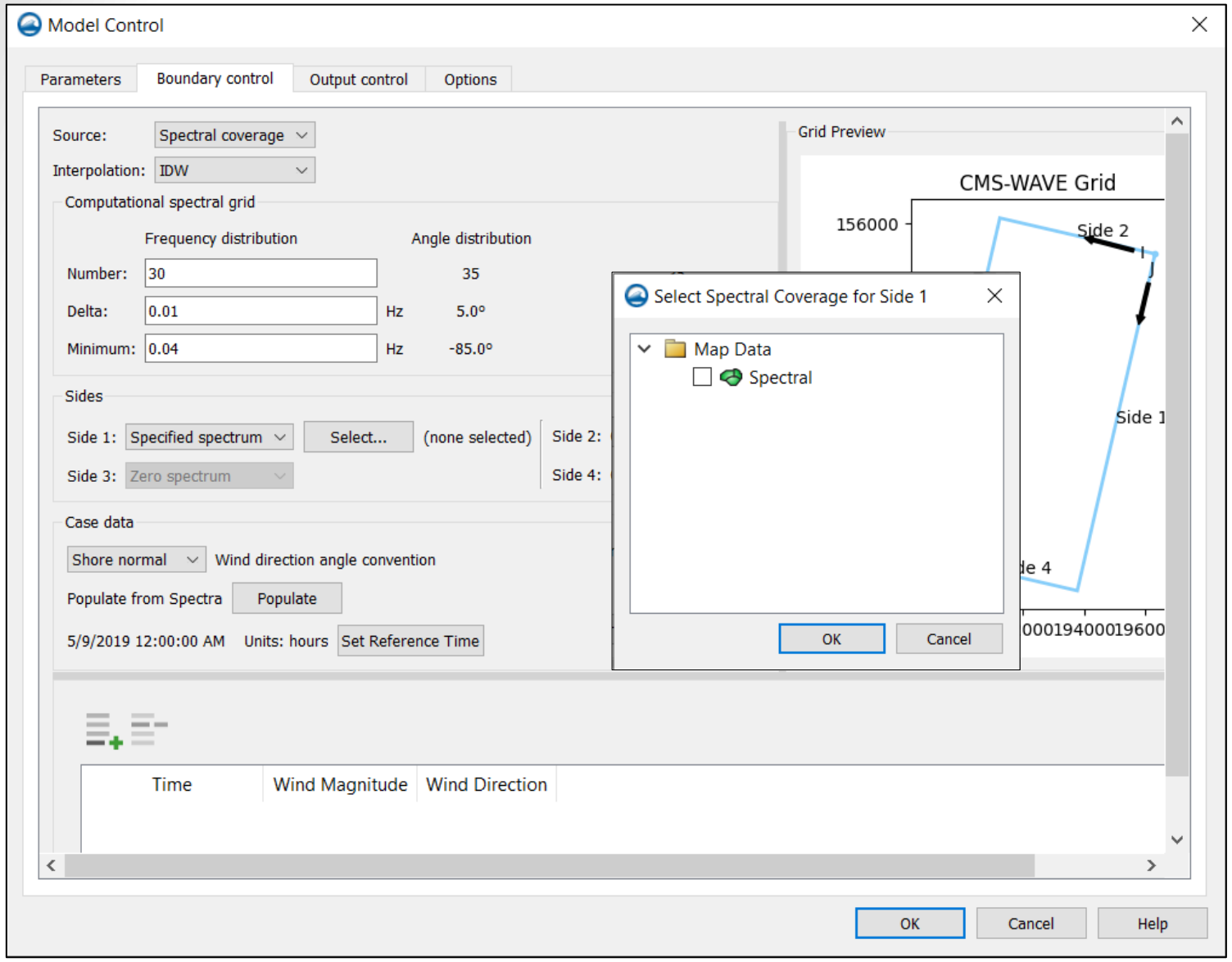
- Right click in open area in Data Tree and choose “New Simulation” | “CMS-Wave”
- Right click on CMS-Wave Grid and choose “Apply to”, then “CMS-Wave Simulations → Sim”

CMS-WAVE MODEL CONTROL



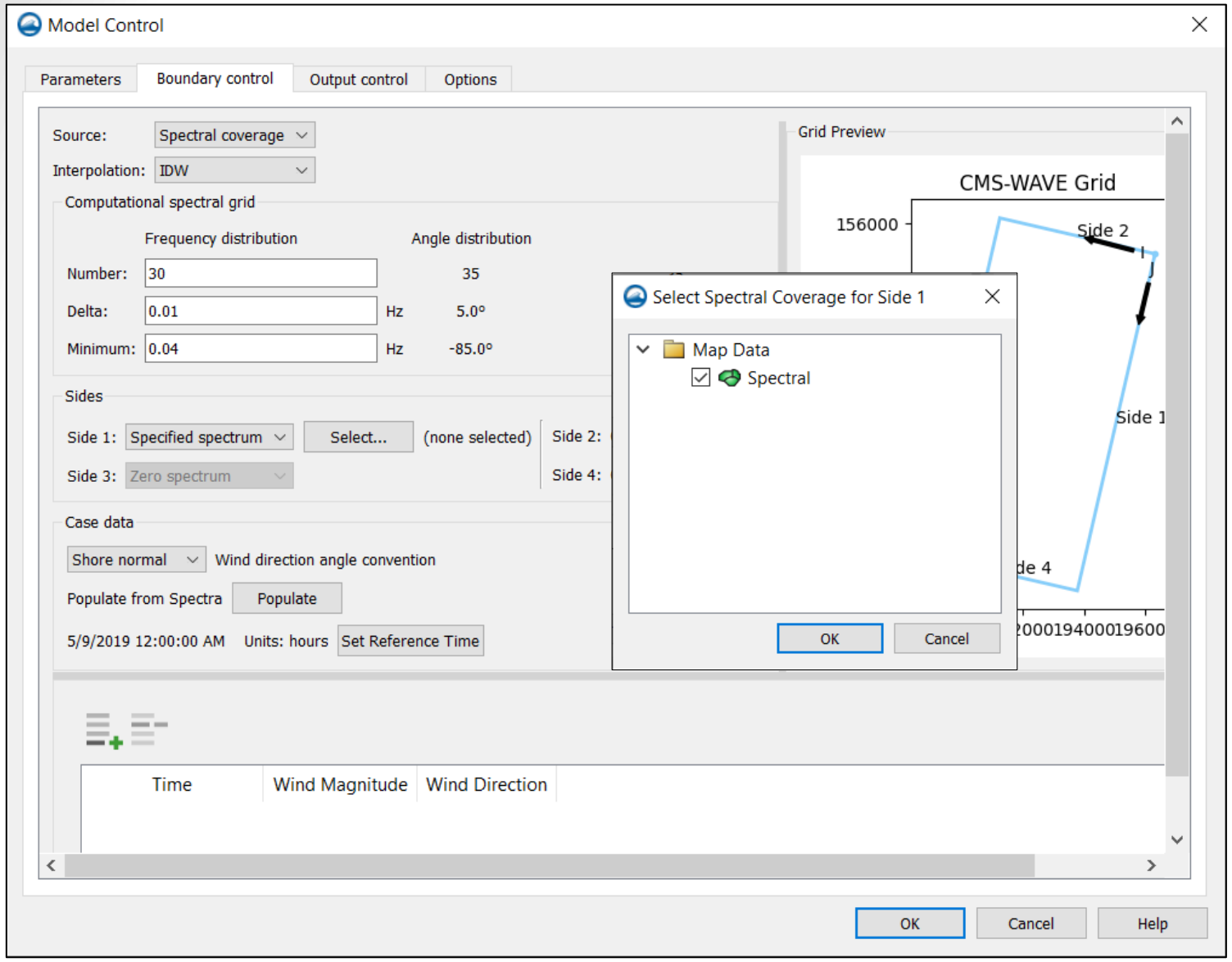
- Right click on CMS-Wave Simulations → CMS-Wave Grid
- CMS-WAVE menu option appears
- Choose Model Control

CMS-WAVE MODEL CONTROL



- Right click on CMS-Wave Simulations → CMS-Wave Grid
- CMS-WAVE menu option appears
- Choose Model Control
- Boundary control tab
  - Side 1 – open boundary (always!)
  - Specified spectrum, Select…

CMS-WAVE MODEL CONTROL



- Right click on CMS-Wave Simulations → CMS-Wave Grid
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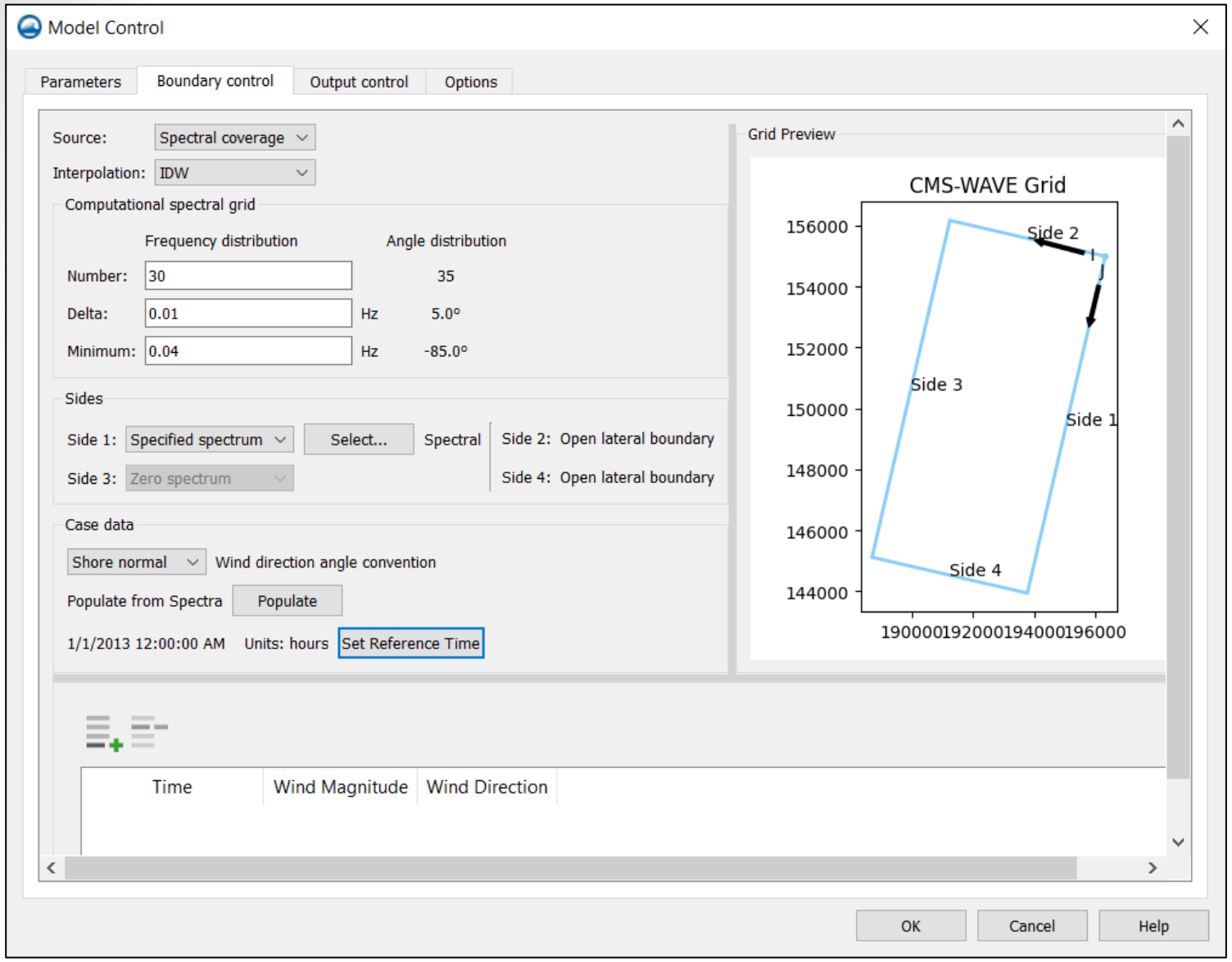
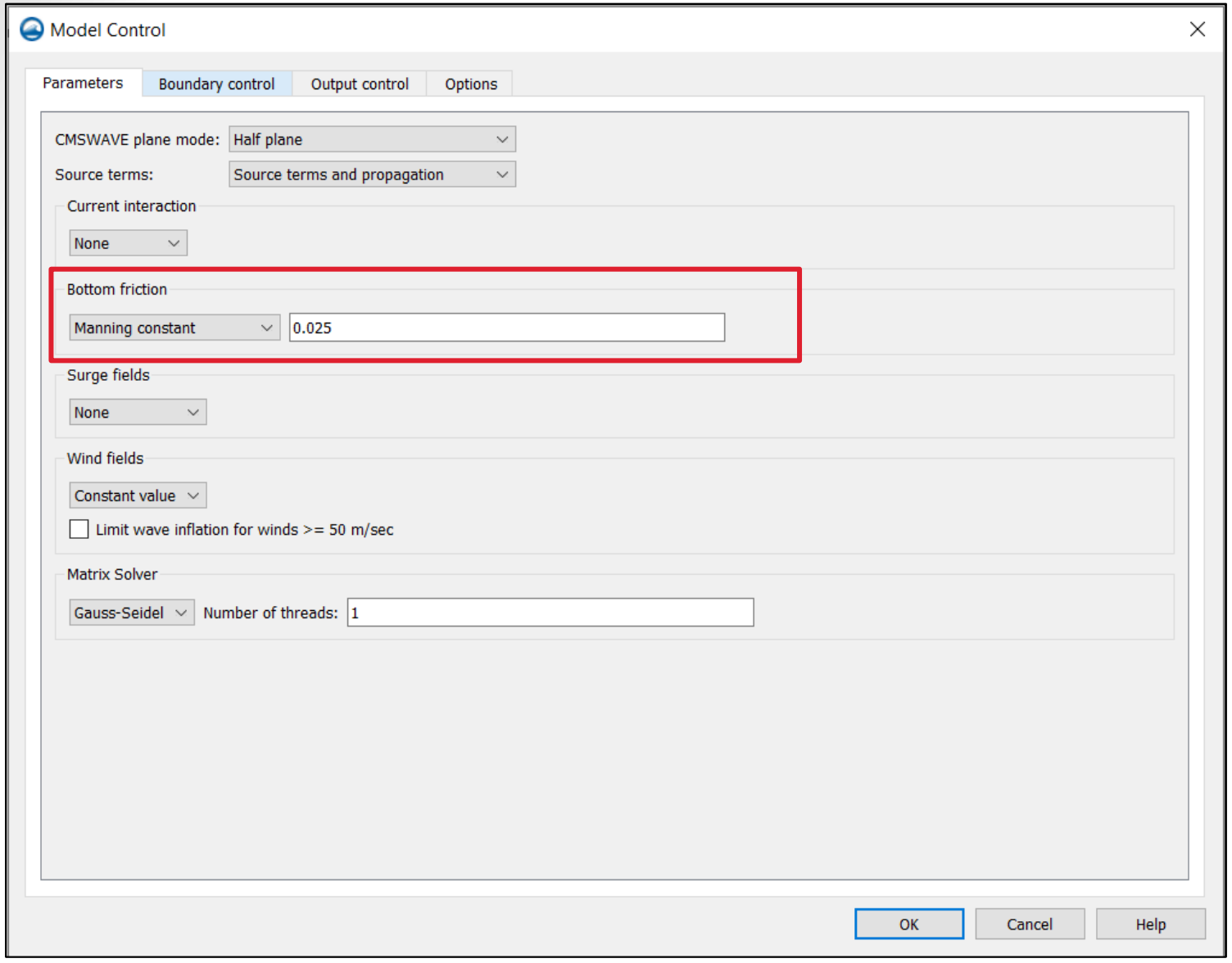
- Choose Model Control
- Boundary control tab
  - Side 1 – open boundary (always!)
  - Specified spectrum, Select…
  - Check box for Spectral map coverage

CMS-WAVE MODEL CONTROL



- Right click on CMS-Wave Simulations → CMS-Wave Grid
- CMS-WAVE menu option appears
- Choose Model Control
- Boundary control tab
  - Side 1 – open boundary (always!)
  - Specified spectrum, Select…
  - Check box for Spectral map coverage
  - Set Reference Time (01/01/2013)

CMS-WAVE MODEL CONTROL

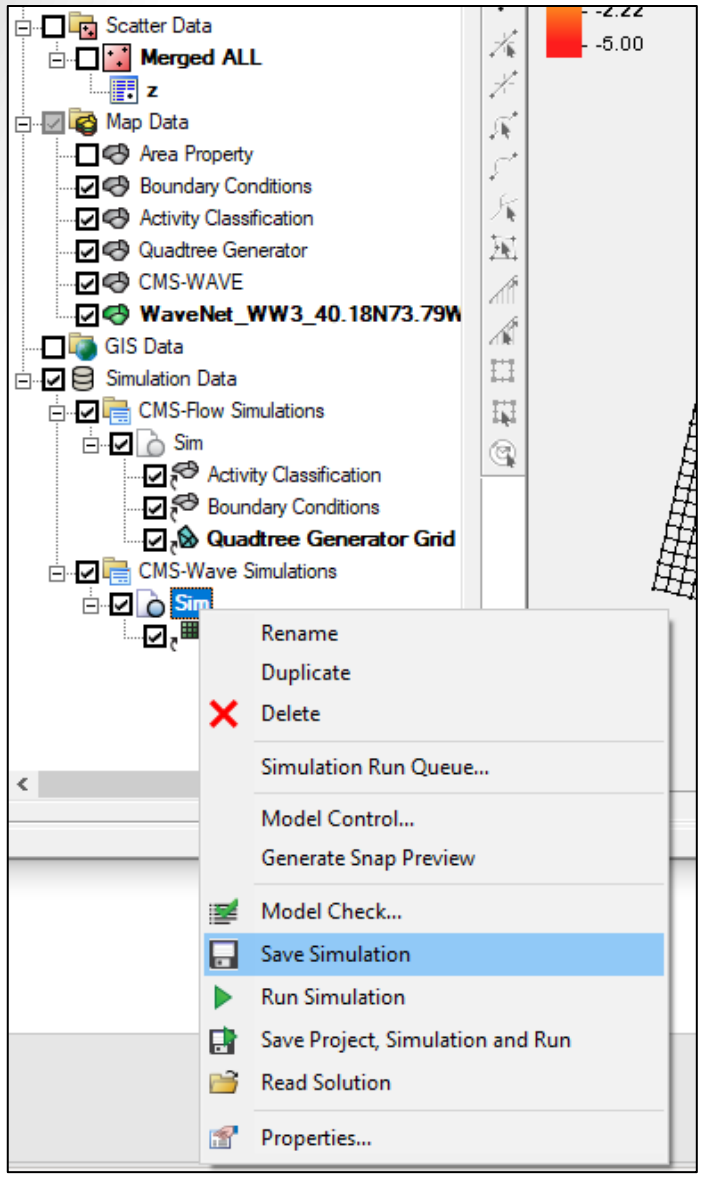


Modify options in Model Control as desired

- Bottom Friction type/value
- Wave breaking type
- Fast mode ON|OFF
- Extra output datasets
- Number of threads (processors)
- Wetting/Drying
- Runup
- …

- Click OK

CMS-WAVE MODEL RUN



Save Project

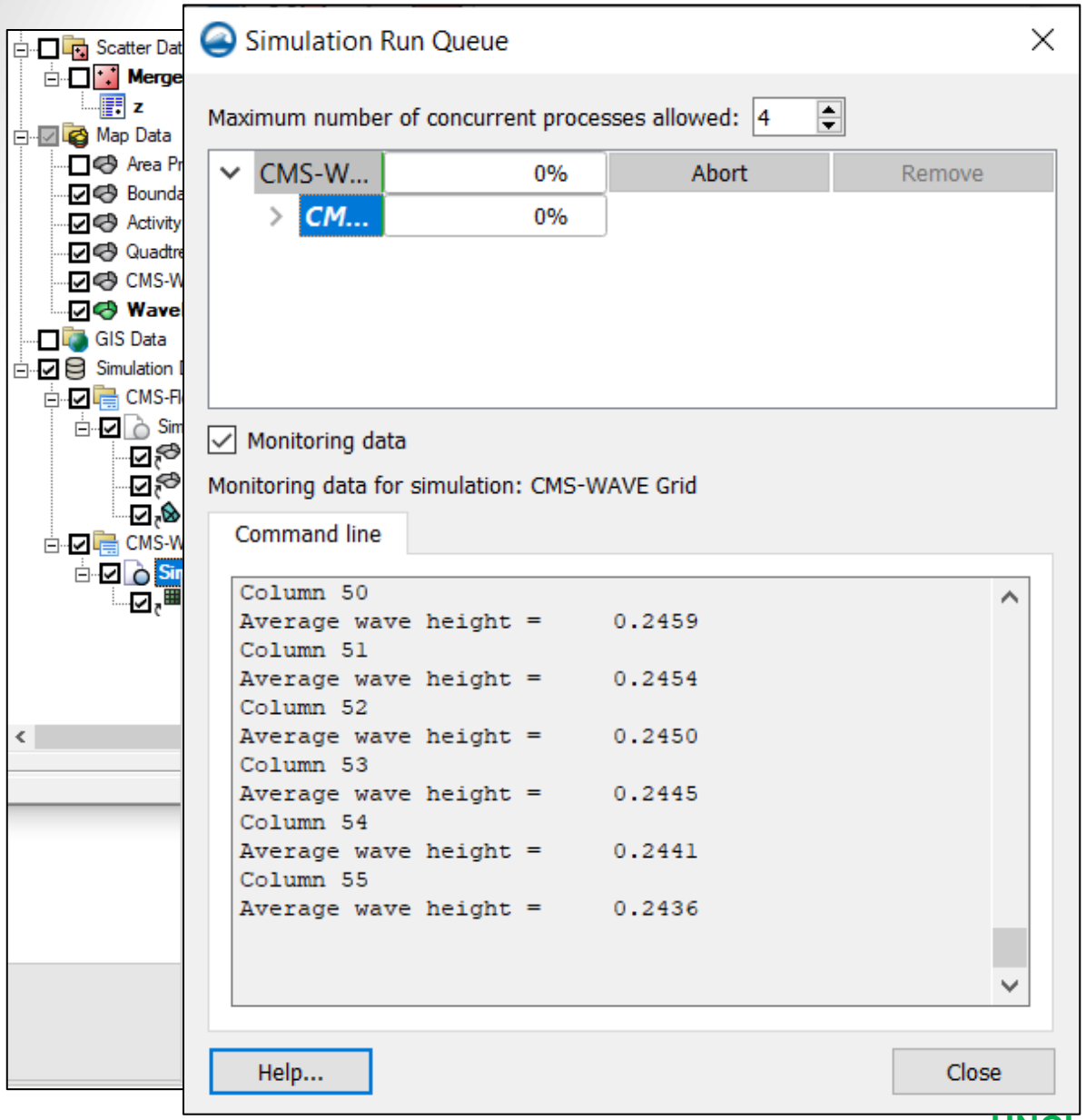
Right click on “Sim” under wave simulations.

- Save Simulation, then
- Run Simulation

Or

- Save Project, Simulation, and Run

CMS-WAVE MODEL RUN



Save Project

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- Save Simulation, then
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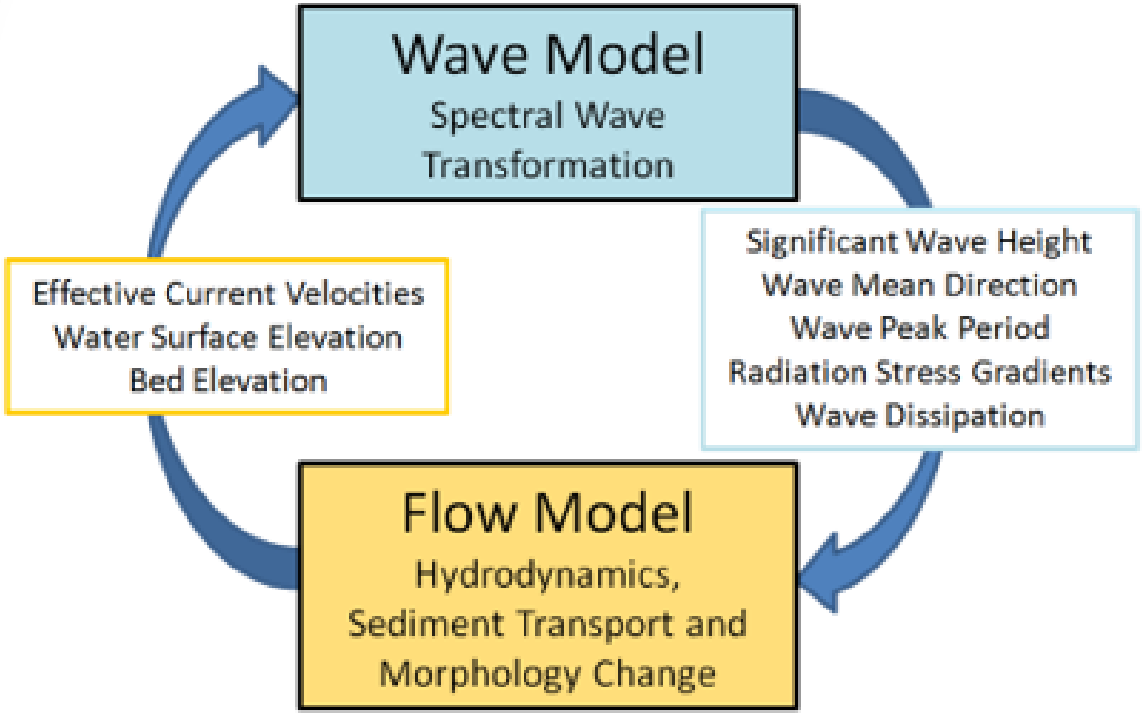
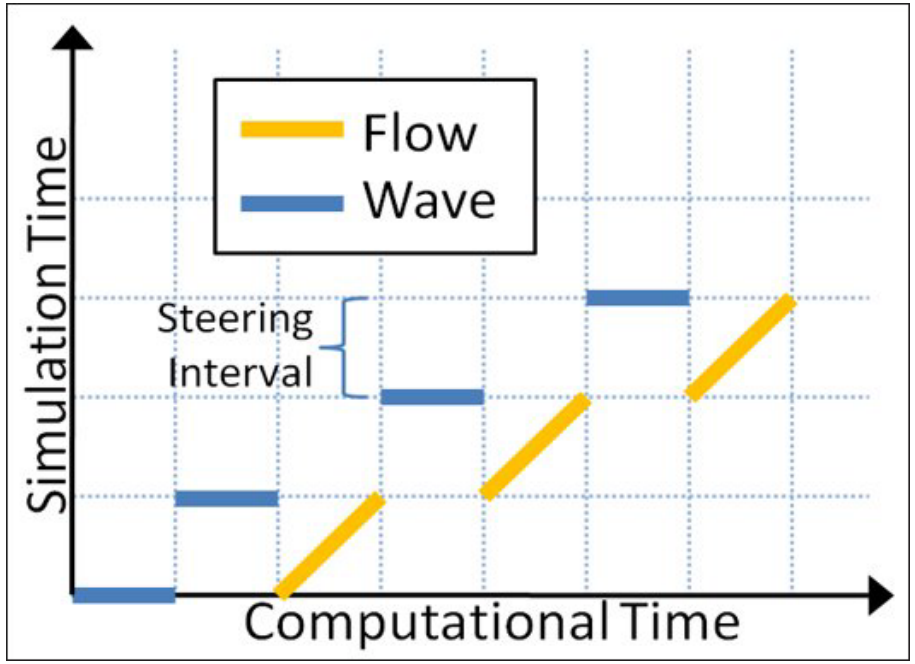
Or

- Save Project, Simulation, and Run

COUPLED FLOW & WAVE: INLINE STEERING

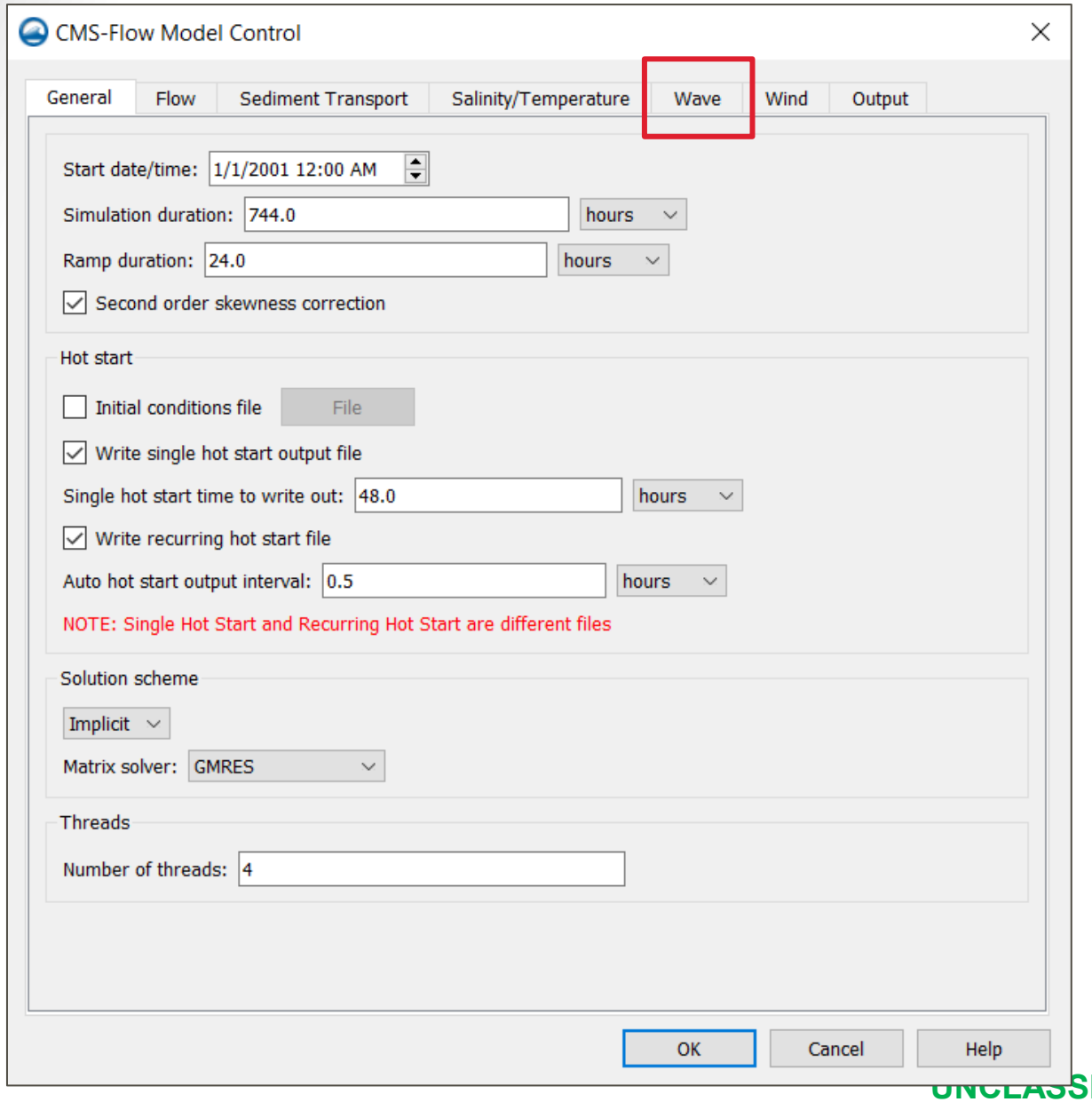
Inline steering – wave-induced currents and radiation stress gradients *steer* flow towards updated solution





Adjustments to future water levels made with astronomical tide estimates to reduce the effect of a time lag in response.

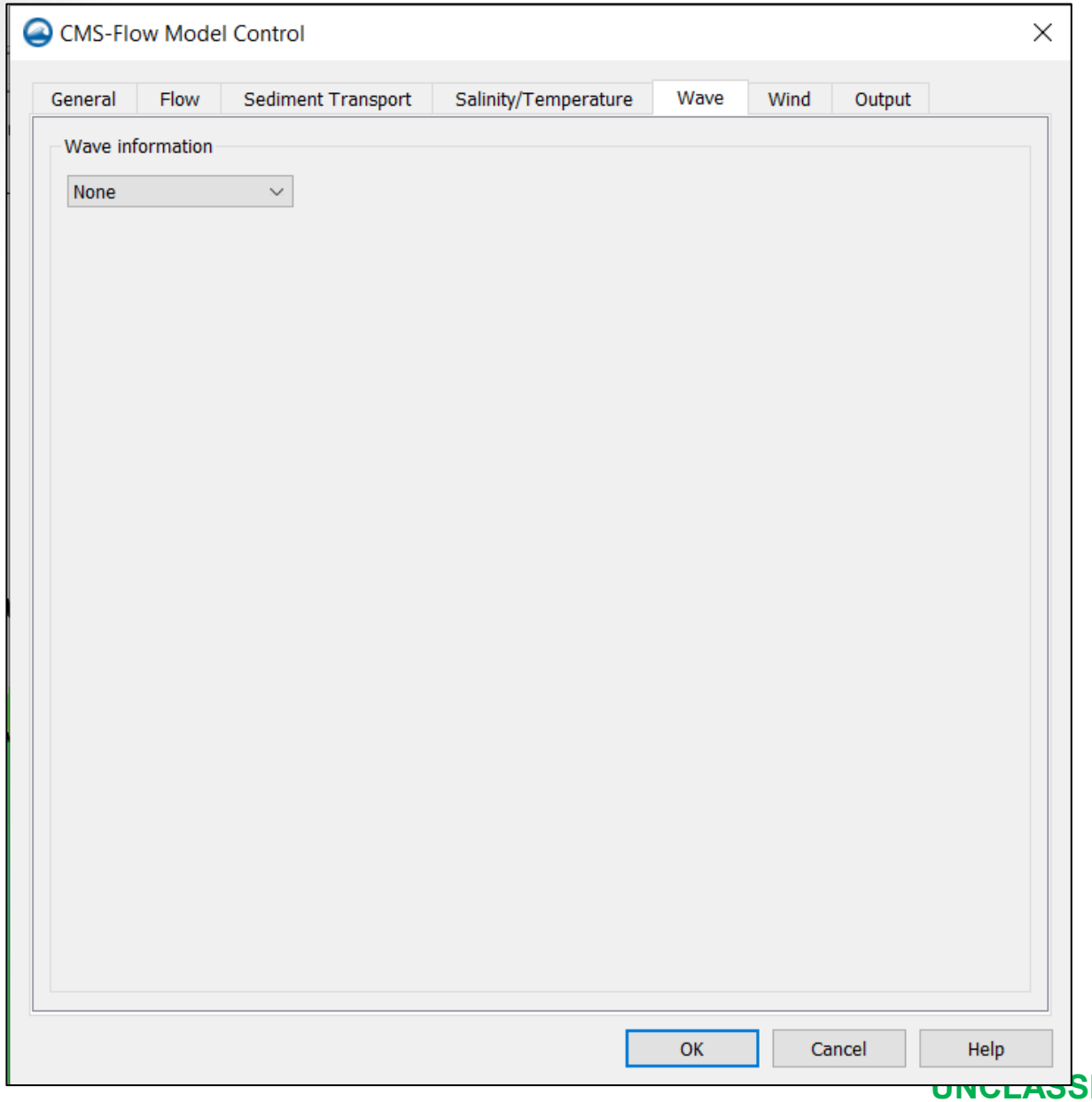
COUPLED FLOW & WAVE: INLINE STEERING



Steering control in CMS-Flow model control

- Open Wave tab

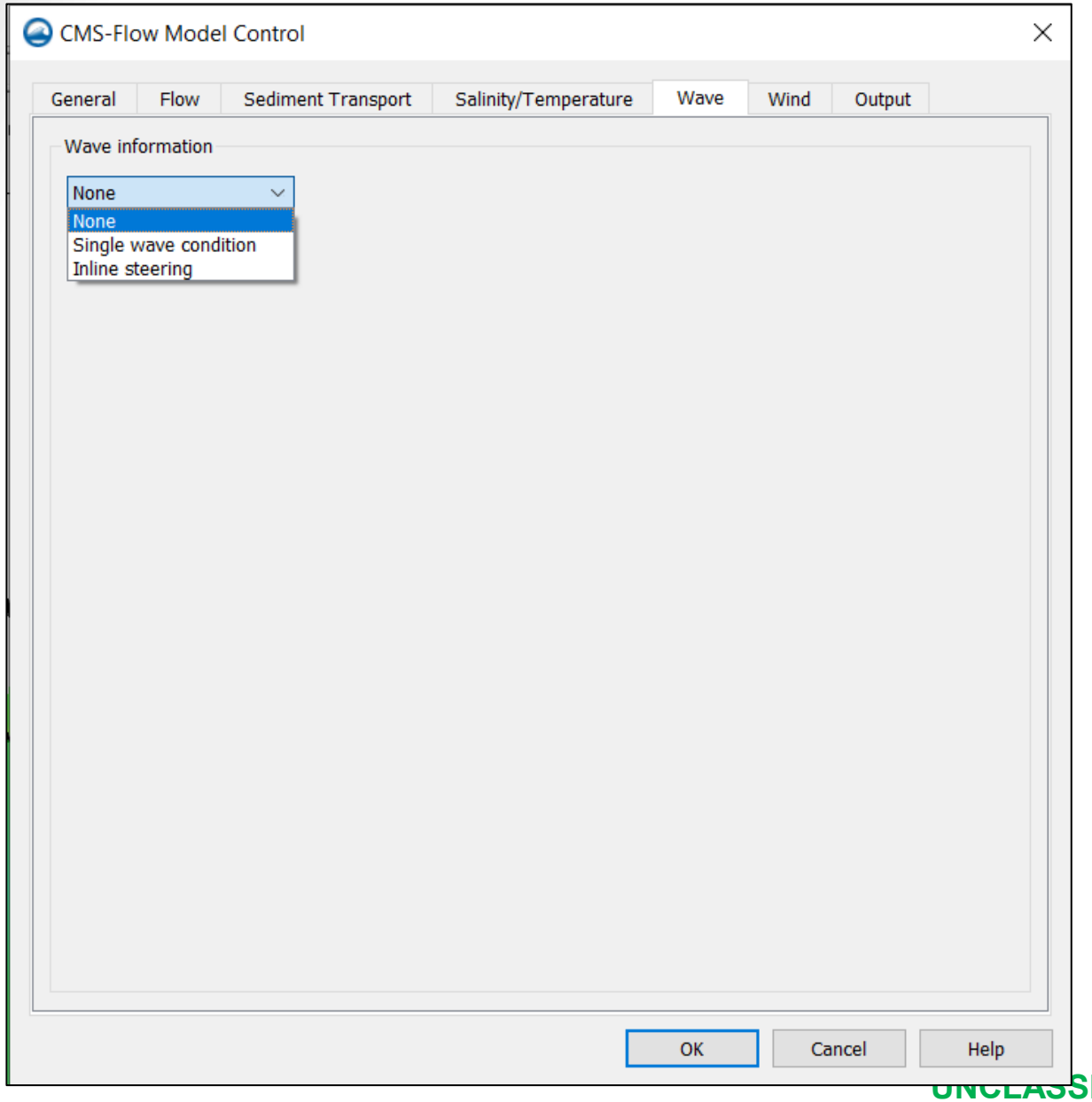
COUPLED FLOW & WAVE: INLINE STEERING



Steering control in CMS-Flow model control

- Open Wave tab
- Select drop-down menu…

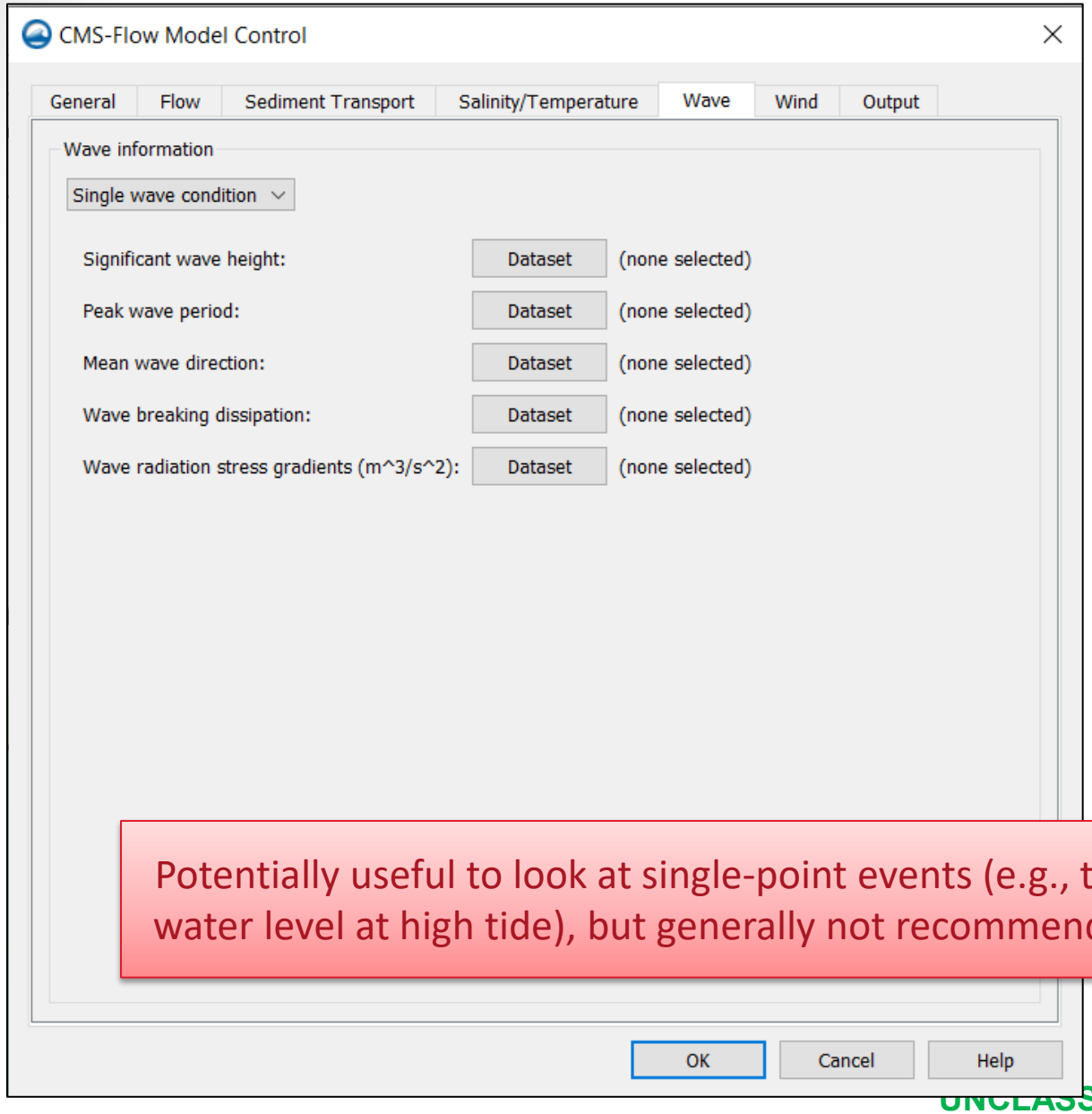
COUPLED FLOW & WAVE: INLINE STEERING



Steering control in CMS-Flow model control

- Open Wave tab
- Select drop-down menu…

COUPLED FLOW & WAVE: INLINE STEERING

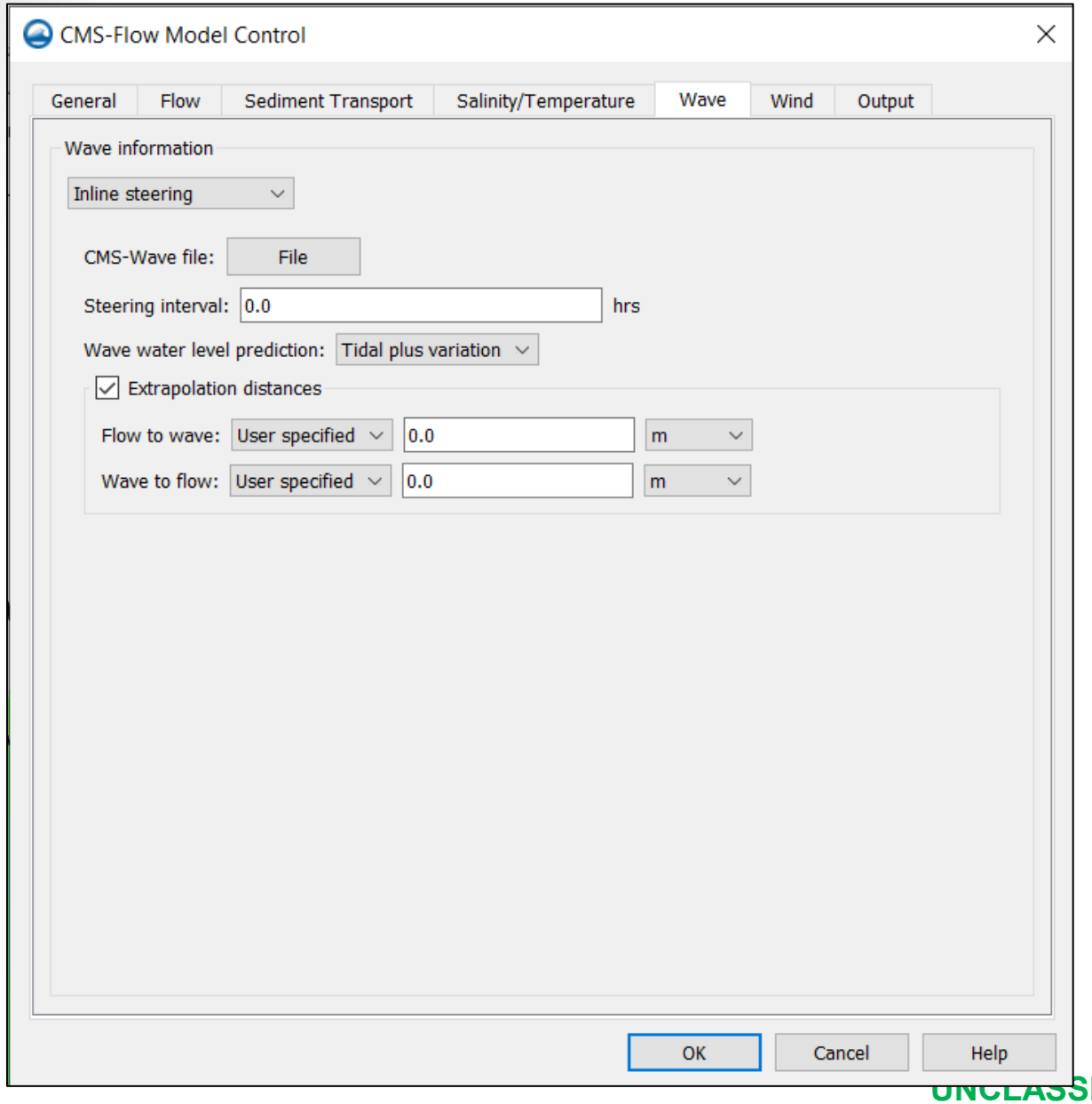


Steering control in CMS-Flow model control

- Open Wave tab
- Select drop-down menu…
  - Single wave condition

Potentially useful to look at single-point events (e.g., total water level at high tide), but generally not recommended.

COUPLED FLOW & WAVE: INLINE STEERING

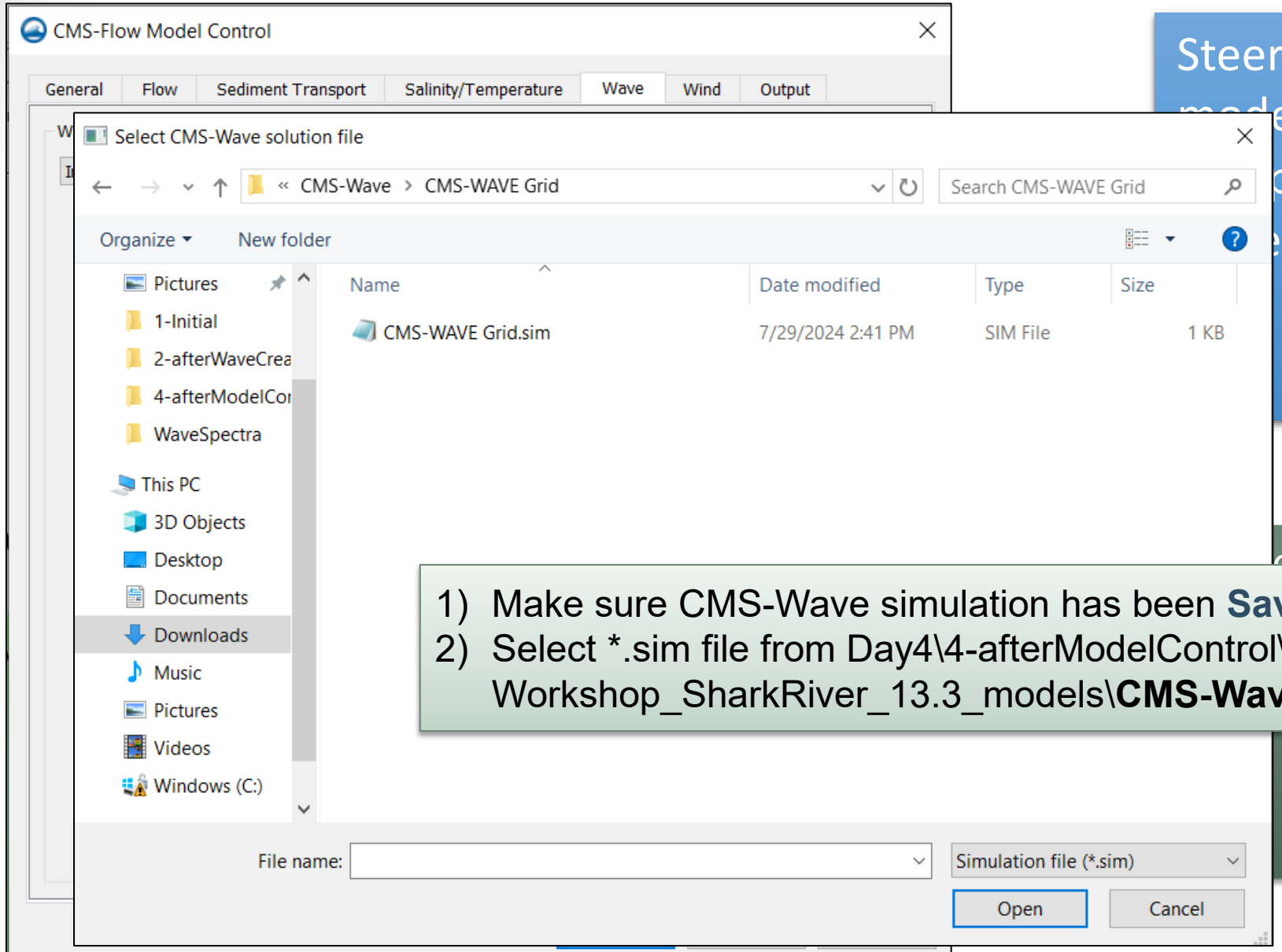


Steering control in CMS-Flow model control

- Open Wave tab
- Select drop-down menu…
  - Single wave condition
  - Inline steering

- Select CMS-Wave file (*.sim)

COUPLED FLOW & WAVE: INLINE STEERING



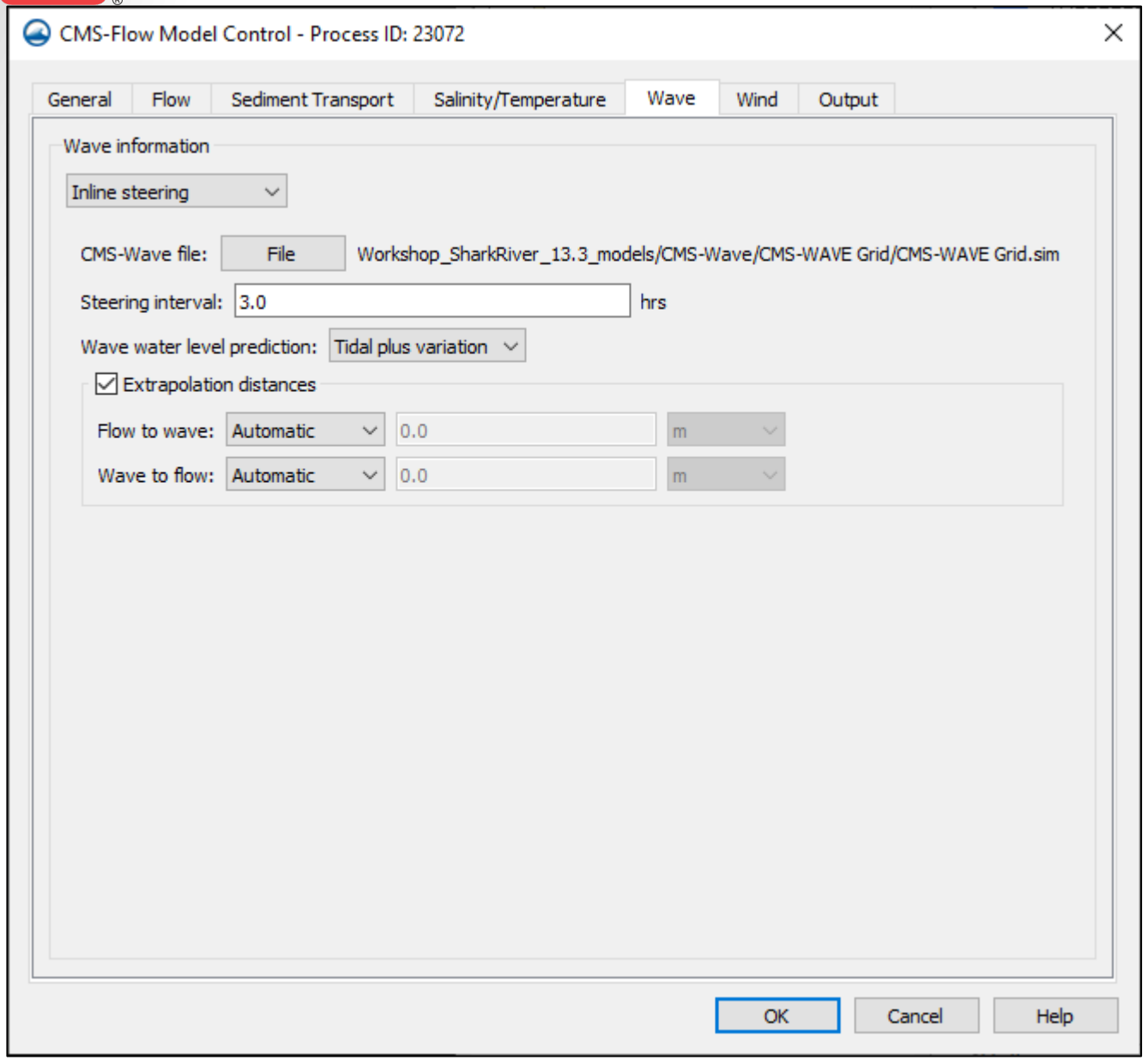
Steering control in CMS-Flow

- model control
- pen Wave tab
- elect drop-down menu…
  - Single wave condition
  - Inline steering

ect CMS-Wave file (*.sim)

1) Make sure CMS-Wave simulation has been **Saved (exported)**
2) Select *.sim file from Day4\4-afterModelControl\ Workshop_SharkRiver_13.3_models**CMS-Wave\CMS-WAVE Grid**

COUPLED FLOW & WAVE: INLINE STEERING



Steering control in CMS-Flow model control

- Open Wave tab
- Select drop-down menu…
  - Single wave condition
  - Inline steering

- Select CMS-Wave file (*.sim)
- Define steering interval (frequency of information exchange)
- Always set extrapolation distance from User specified to Automatic if you are not entering a good value for distance.

QUESTIONS?

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