# STWAVE

## What does it do?

- **STWAVE simulates**
  - **depth-induced wave refraction and shoaling**
  - **current-induced refraction and shoaling**
  - **depth- and steepness-induced wave breaking, diffraction, wind-wave growth**
  - **wave-wave interaction and whitecapping that redistribute and dissipate energy in a growing wave field.**
- **Provides an easy-to-apply, flexible, and robust model for nearshore wind-wave growth and propagation.**

# Use and Assumptions

## Why is it needed?

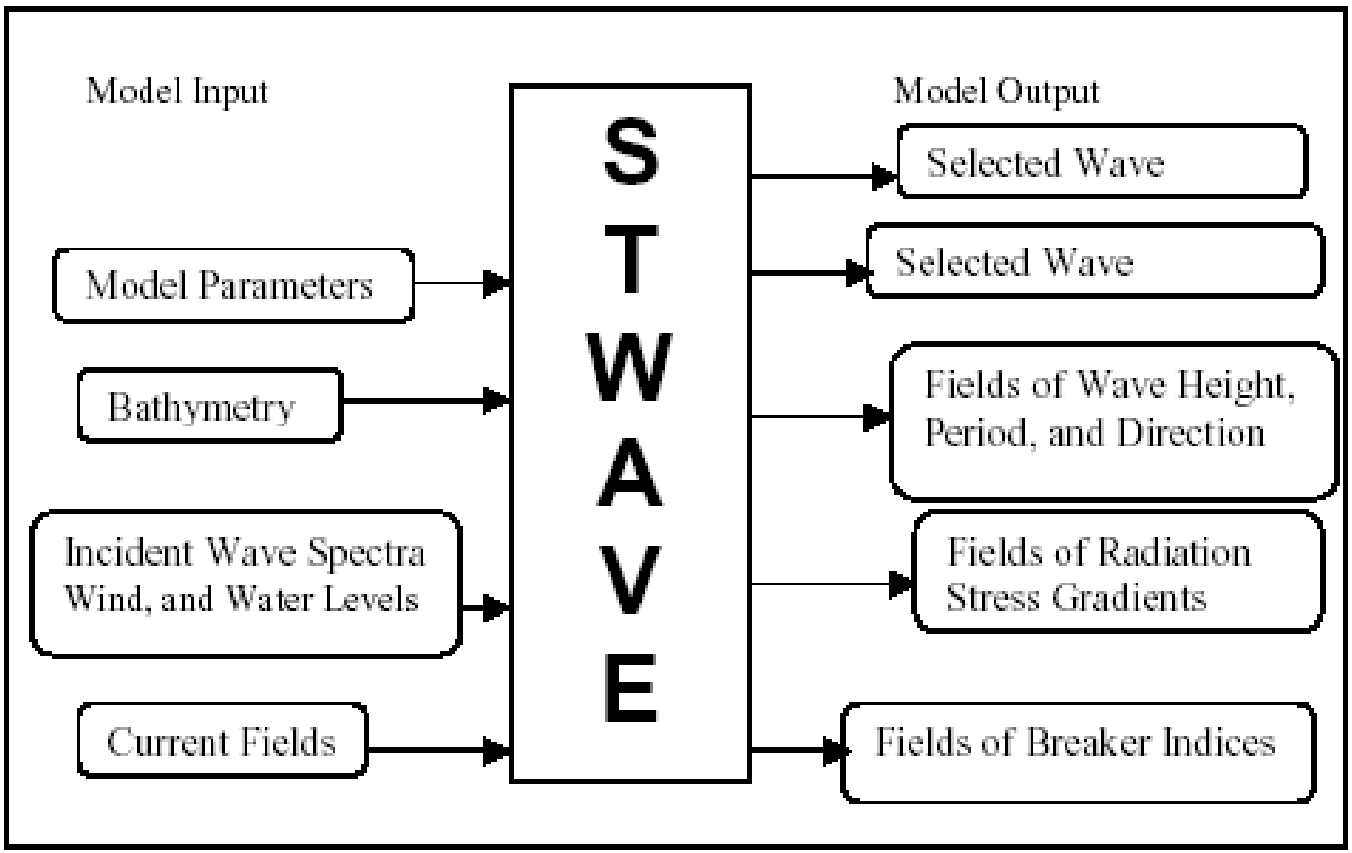
**To describe quantitatively the change in wave parameters (wave height, period, direction, and spectral shape) between the offshore and the nearshore (typically depths of 40 m or less).**

**In relatively deep water, the wave field is fairly homogeneous on the scale of kilometers; but in the nearshore, where waves are strongly influenced by variations in bathymetry, water level, and current, wave parameters may vary significantly on the scale of tens of meters.**

## Model Assumptions:

*a. Mild bottom slope and negligible wave reflection.*
*b. Spatially homogeneous offshore wave conditions.*
*c. Steady-state waves, currents, and winds.*
*d. Linear refraction and shoaling.*
*e. Depth-uniform current.*
*f. Bottom friction is neglected.*
*g. Linear radiation stress.*

# Model Input / Output

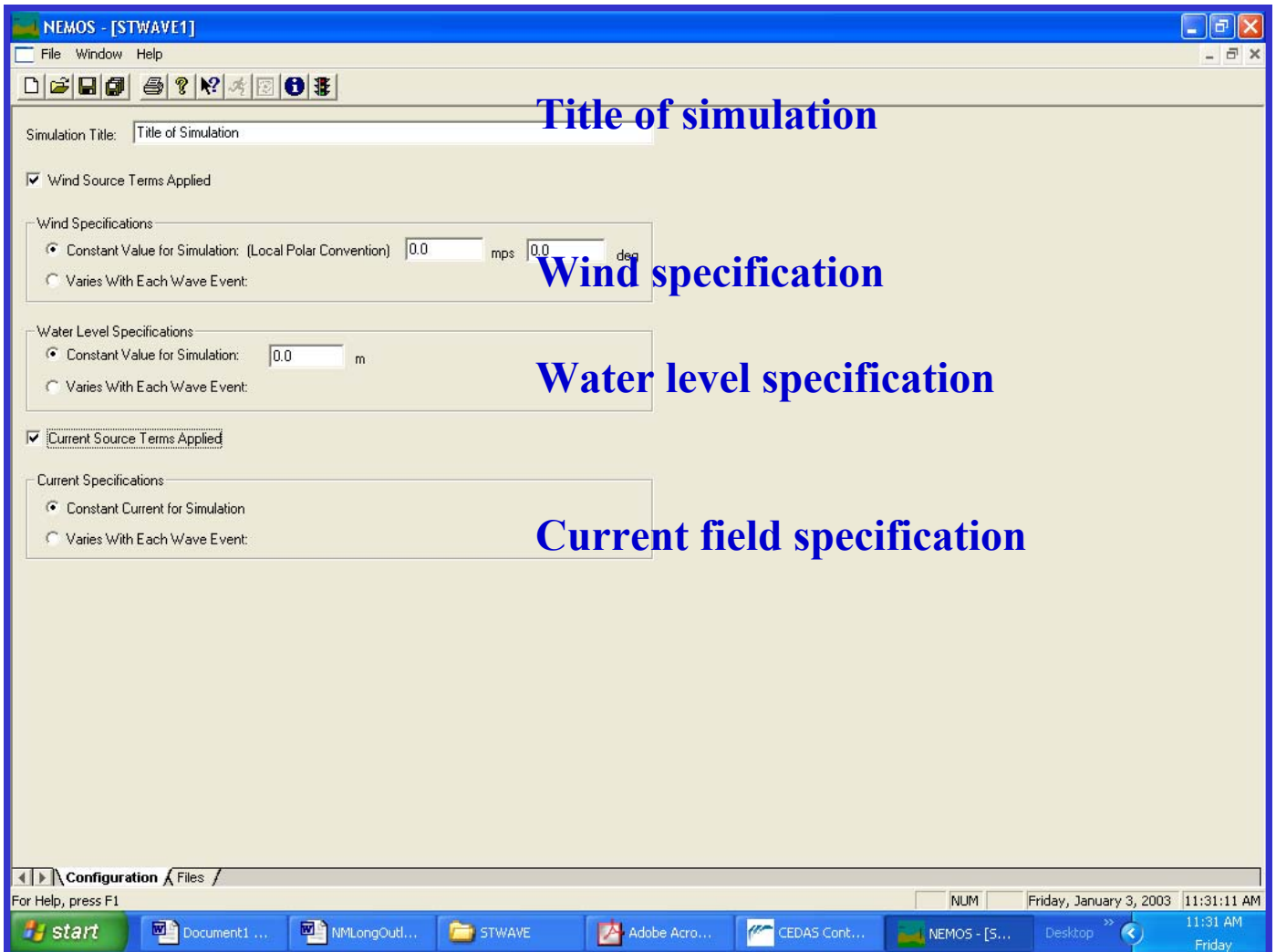



**Spectra**

**Parameters**

# CEDAS – NEMOS :

## STWAVE opening configuration screen



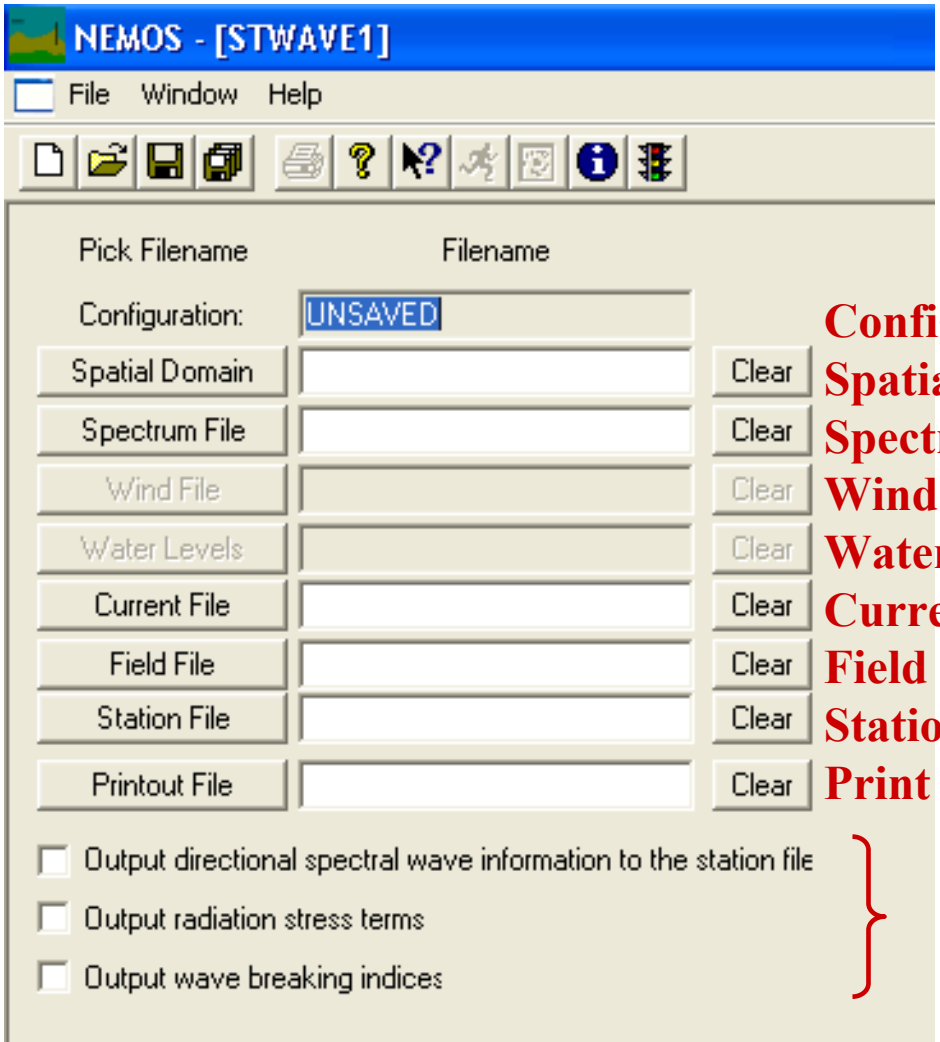

Title of simulation

Wind specification

Water level specification

Current field specification

# Files Screen




**Configuration file**
**Spatial Domain file (from GRIDGEN)**
**Spectrum file (from SPECGEN)**
**Wind information file**
**Water Level file**
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**Field file - results stored as binary file**
**Station file (from GRIDGEN)**
**Print file - examine results – text form**

**Output options**

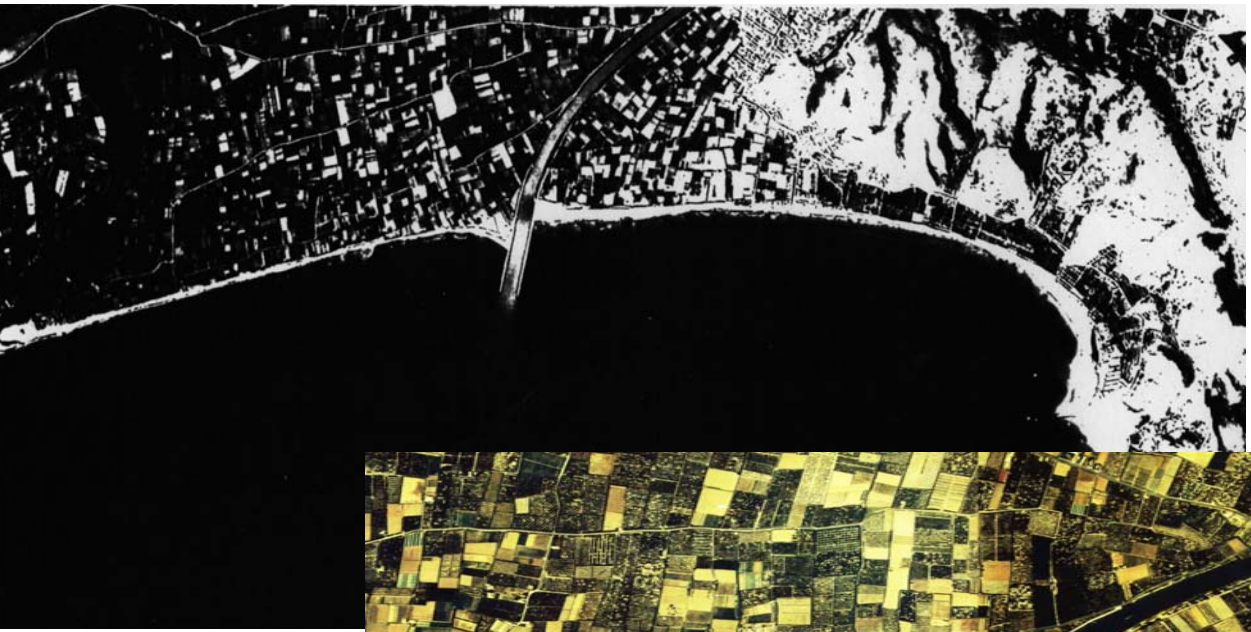
# STWAVE within CEDAS

## Topics:

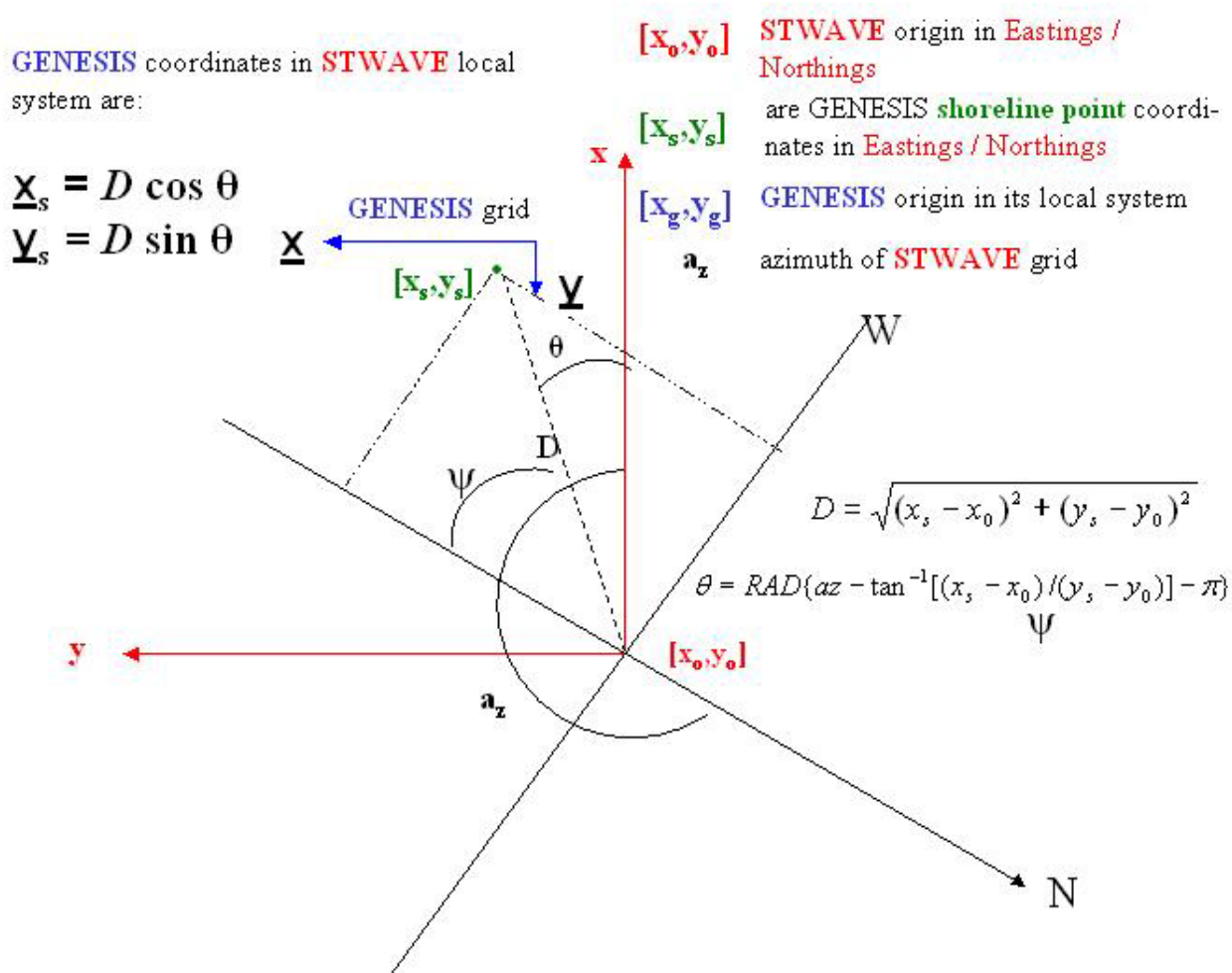
- Create a grid and specify “stations” for later gage analysis
- Prepare wave data for use in WSAV and SPECGEN
- Analyze wave data and produce a “permutation” file for use in SPECGEN
- Run SPECGEN to produce boundary conditions for STWAVE
- Run STWAVE and visualize results


The example chosen is a location on the coast of Spain.

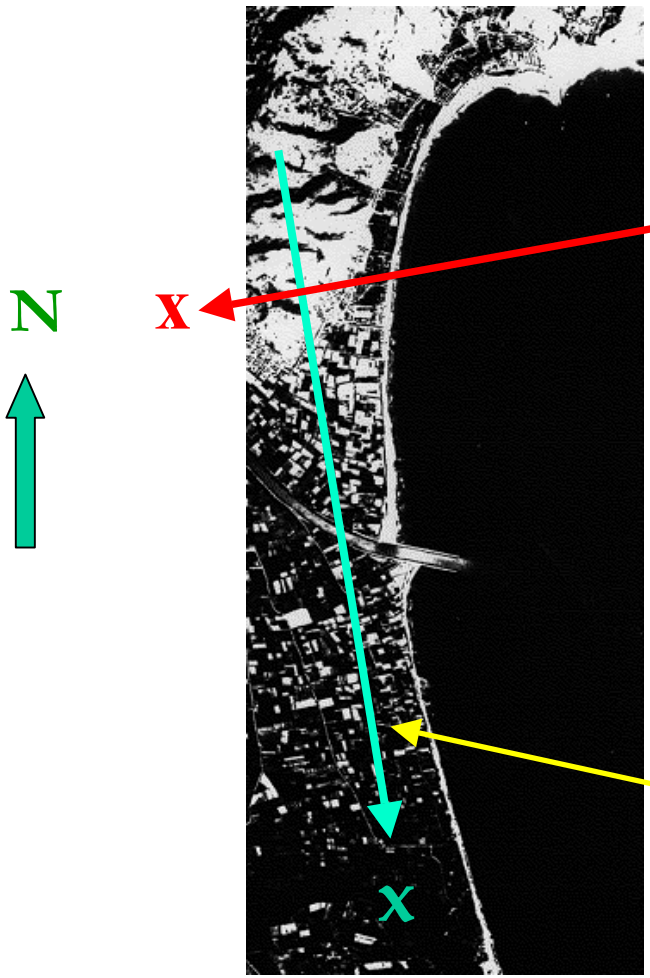
# Ariel Photographs

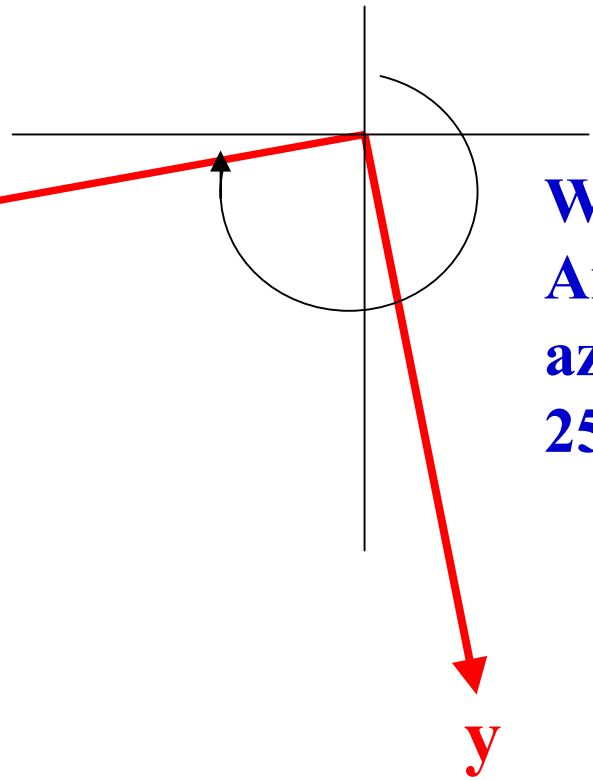


# STWAVE / GENESIS Axes Relationship



# STWAVE / GENESIS Axes



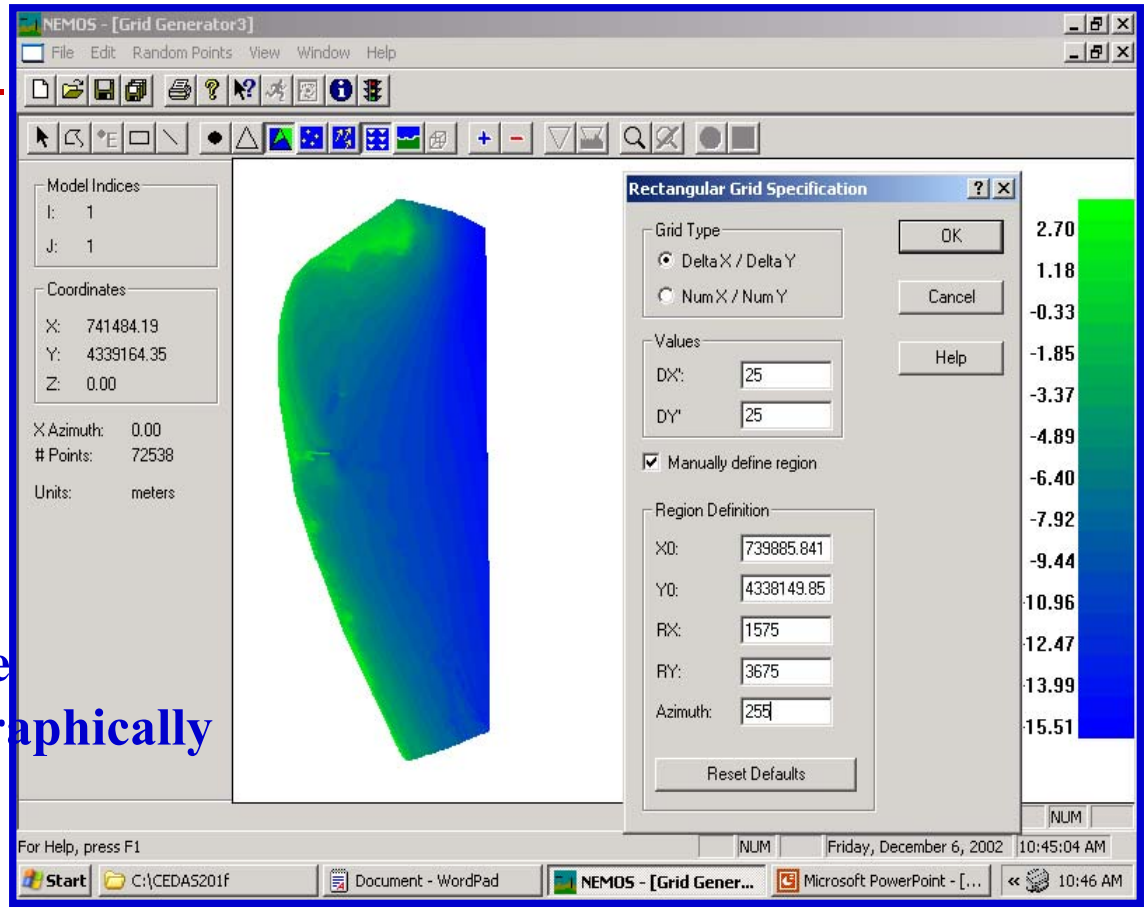




**Wave Model Axes at an azimuth of 255 deg**

**GENESIS shoreline**

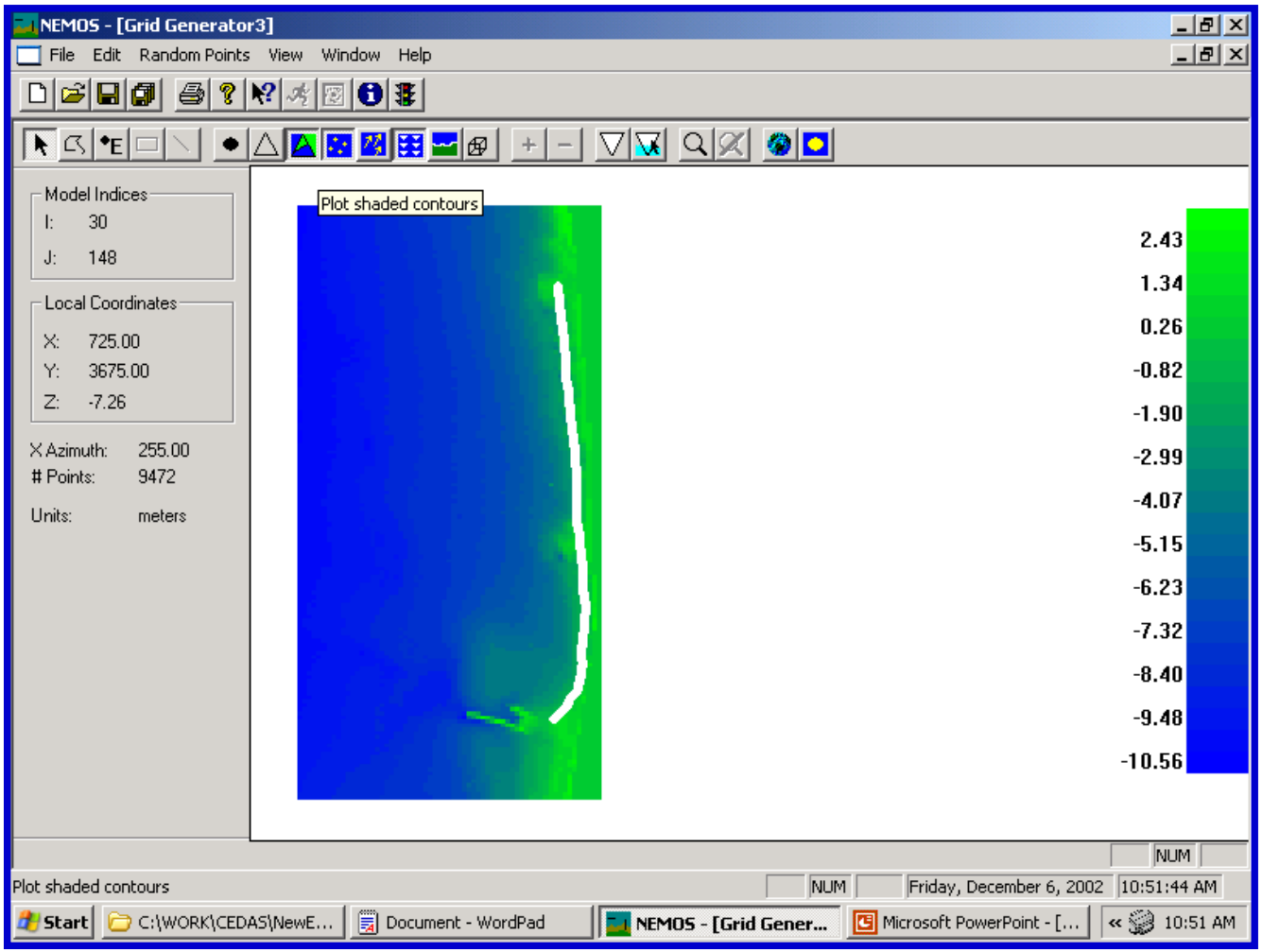
# Building a Grid

**STEP 1: Bathymetry data are imported into GRIDGEN – File JR_bathyxyz.txt as Local. The grid is constructed by manually specifying the same origin coordinates, axes length, and azimuth as shown**




**The grid could have been constructed graphically**

# Insert Shoreline Points



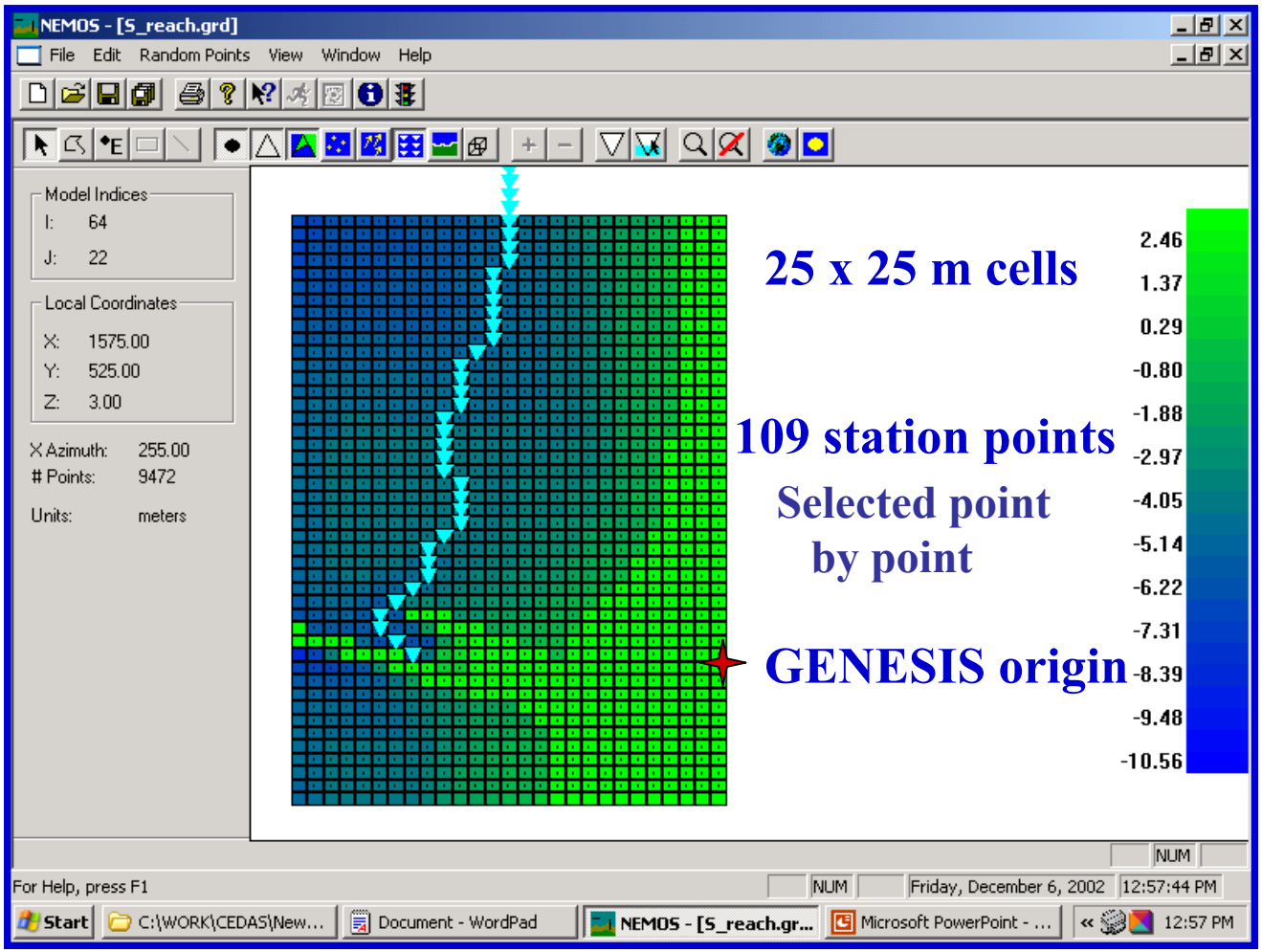

**Step 2: Import**

**File:**

**J57shorelineXY.txt**

# Create GENESIS Grid

Step 3

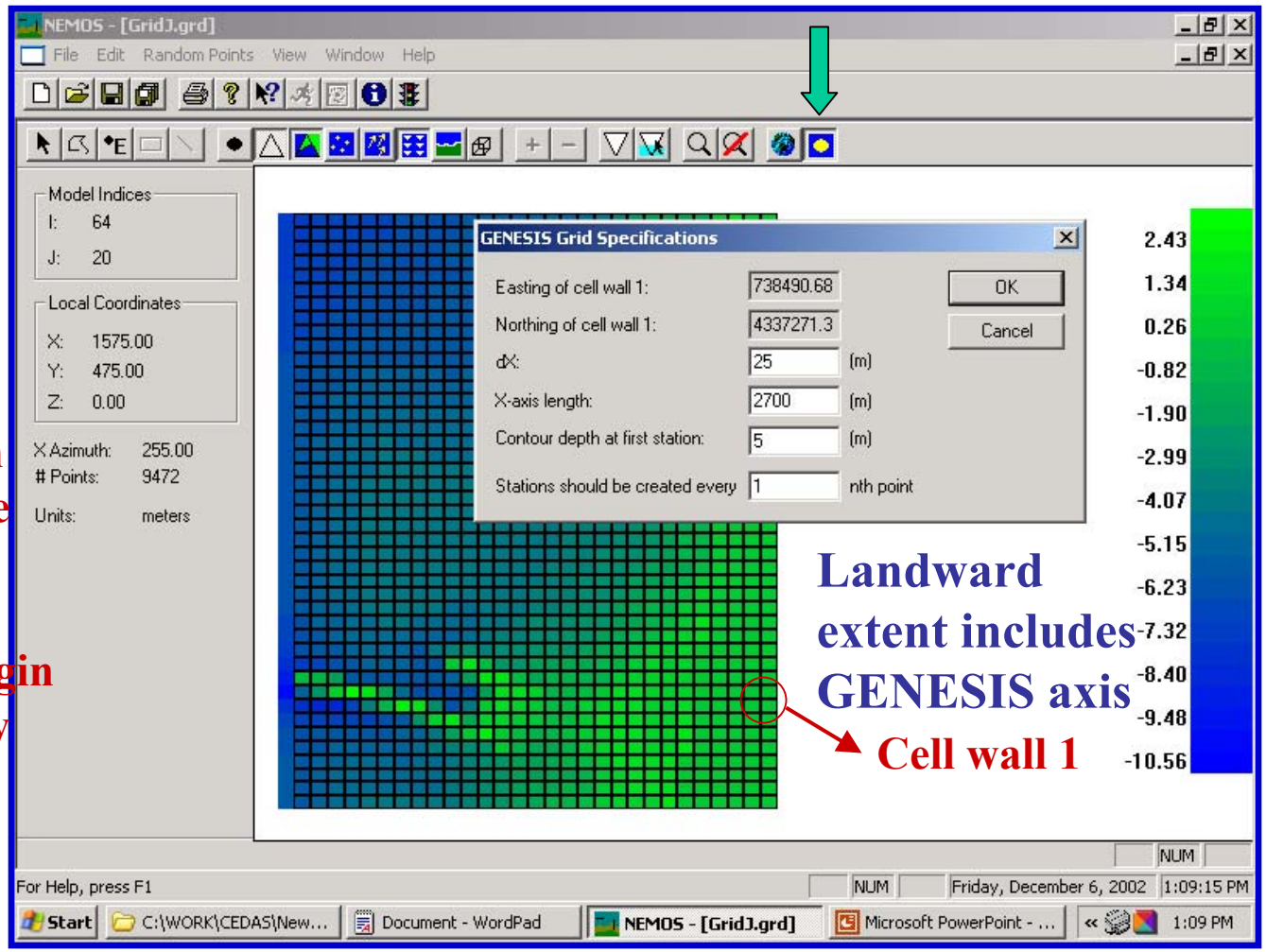


# Create GENESIS Grid

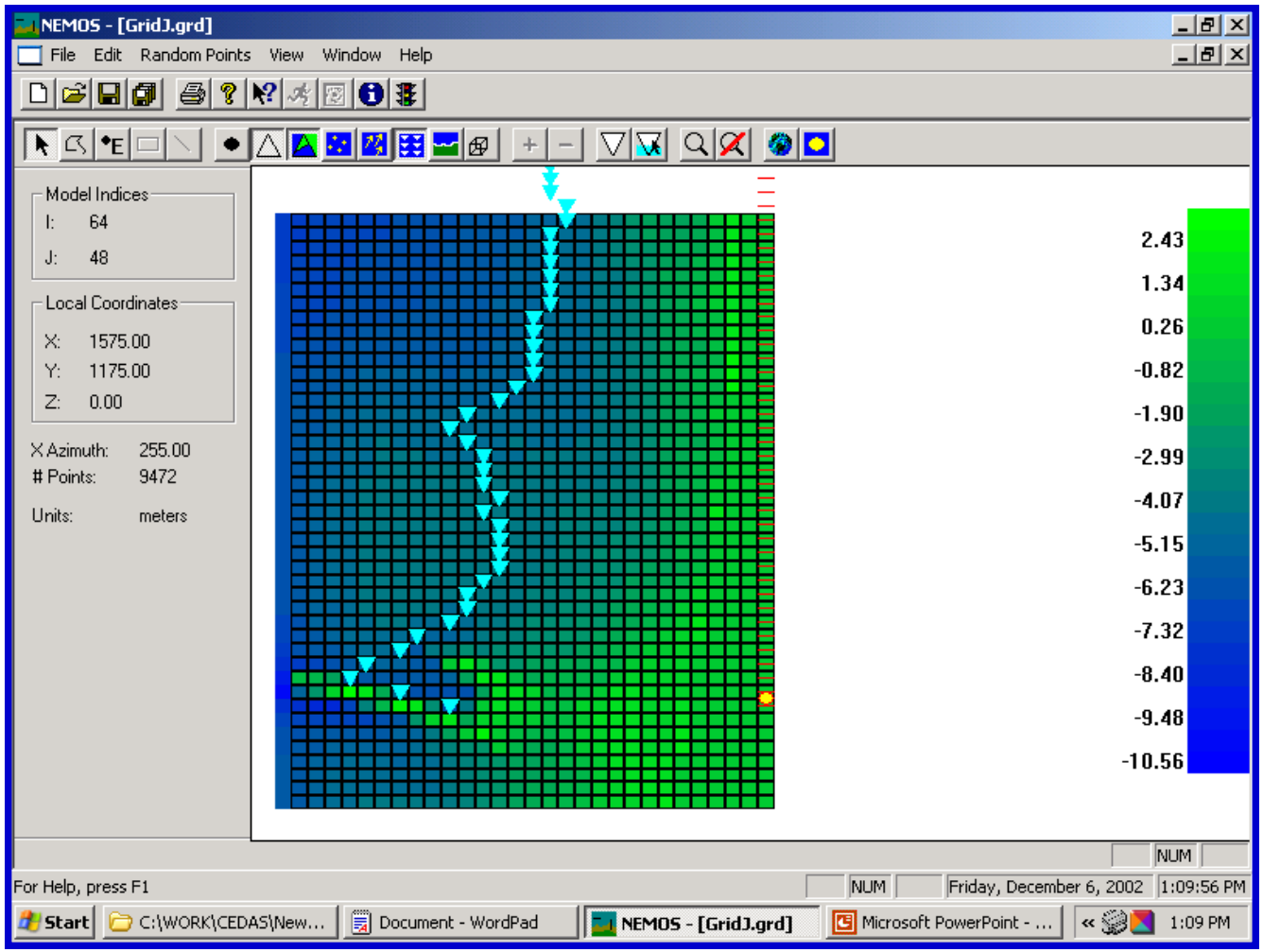
## Step 3 Cont'd

**Cell wall 1 coincides with center of wave grid cell**

**GENESIS origin lies ½ dx away**



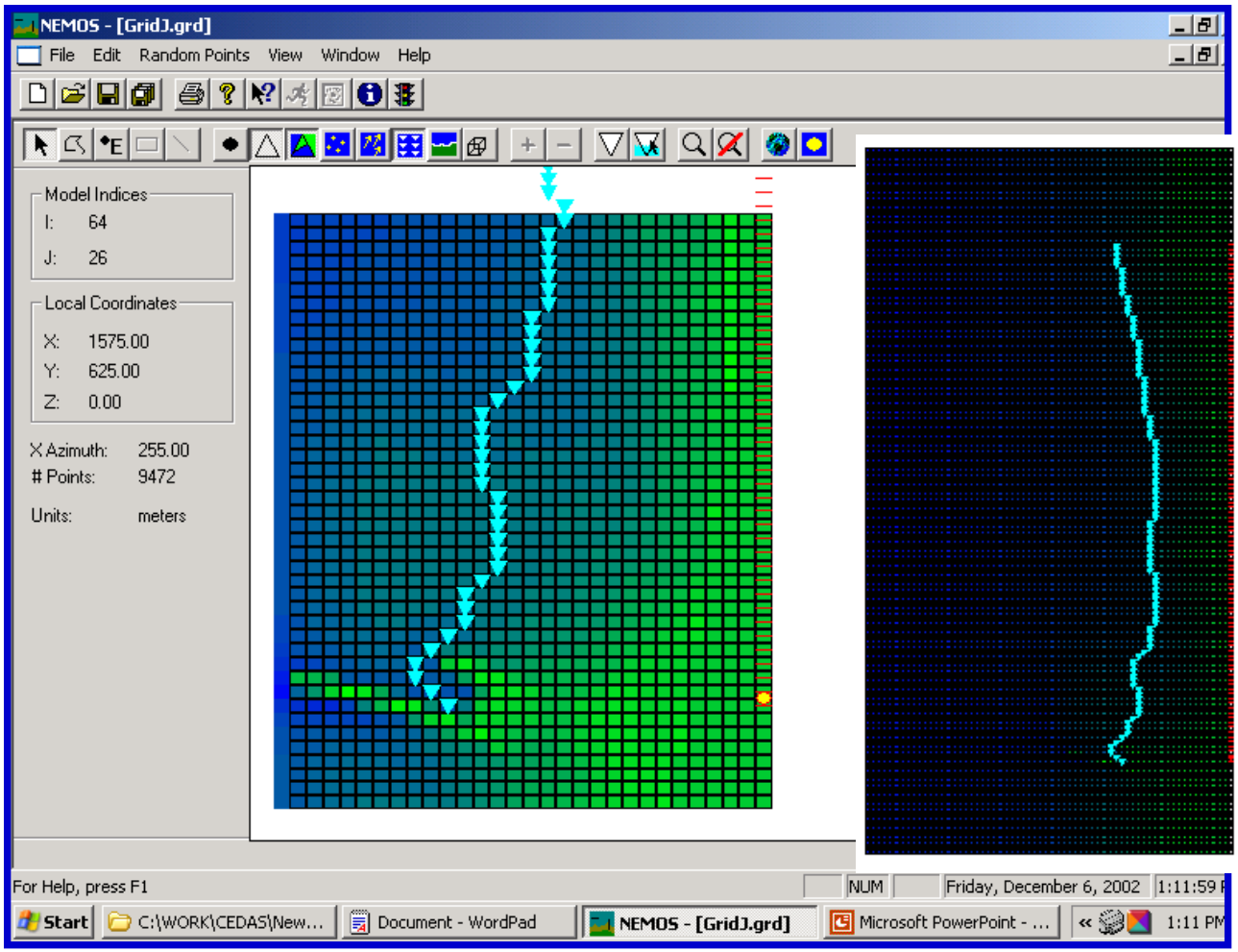
# Automated Station Selection




**Stations placed column by column according to a depth closest to selected depth**

**Points adjusted by dragging**

# Resulting Grid




**Step 4: Export the wave model**

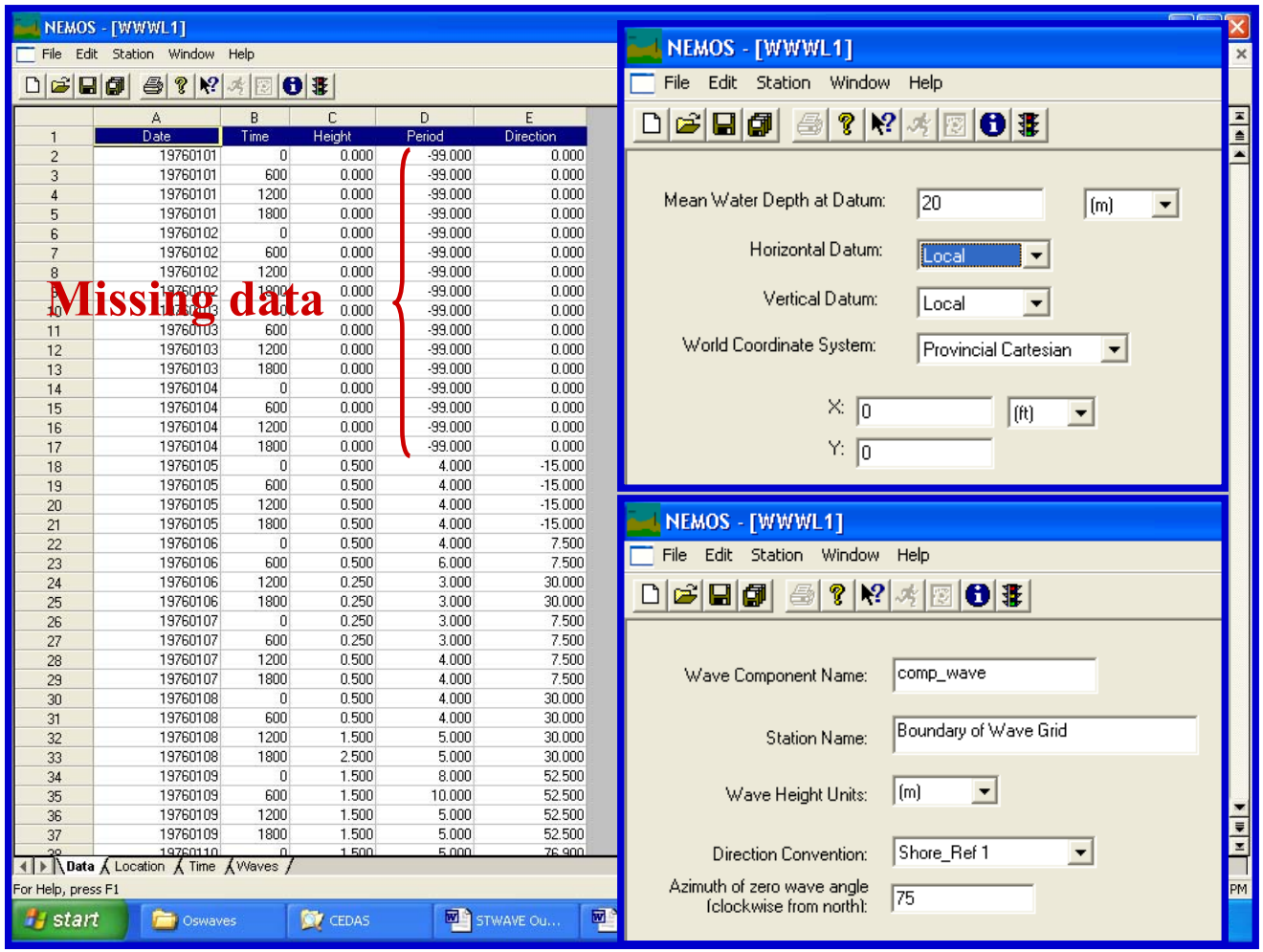
**SPD file (JCspd.nc)**

**Station file (Jcsta.nc)**

**And the GENESIS**

**SPD file (JCGENspd.nc)**

# Prepare Wave Data



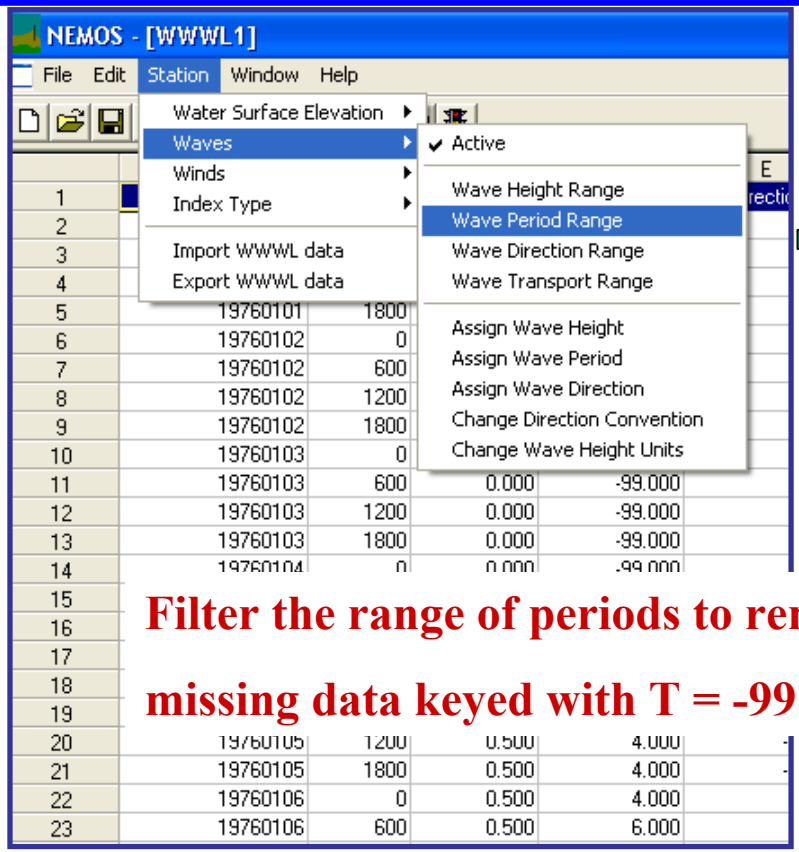

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | Date | Time | Height | Period | Direction |
| 2 | 19760101 | 0 | 0.000 | -99.000 | 0.000 |
| 3 | 19760101 | 600 | 0.000 | -99.000 | 0.000 |
| 4 | 19760101 | 1200 | 0.000 | -99.000 | 0.000 |
| 5 | 19760101 | 1800 | 0.000 | -99.000 | 0.000 |
| 6 | 19760102 | 0 | 0.000 | -99.000 | 0.000 |
| 7 | 19760102 | 600 | 0.000 | -99.000 | 0.000 |
| 8 | 19760102 | 1200 | 0.000 | -99.000 | 0.000 |
| 9 | 19760102 | 1800 | 0.000 | -99.000 | 0.000 |
| 10 | 19760103 | 0 | 0.000 | -99.000 | 0.000 |
| 11 | 19760103 | 600 | 0.000 | -99.000 | 0.000 |
| 12 | 19760103 | 1200 | 0.000 | -99.000 | 0.000 |
| 13 | 19760103 | 1800 | 0.000 | -99.000 | 0.000 |
| 14 | 19760104 | 0 | 0.000 | -99.000 | 0.000 |
| 15 | 19760104 | 600 | 0.000 | -99.000 | 0.000 |
| 16 | 19760104 | 1200 | 0.000 | -99.000 | 0.000 |
| 17 | 19760104 | 1800 | 0.000 | -99.000 | 0.000 |
| 18 | 19760105 | 0 | 0.500 | 4.000 | -15.000 |
| 19 | 19760105 | 600 | 0.500 | 4.000 | -15.000 |
| 20 | 19760105 | 1200 | 0.500 | 4.000 | -15.000 |
| 21 | 19760105 | 1800 | 0.500 | 4.000 | -15.000 |
| 22 | 19760106 | 0 | 0.500 | 4.000 | 7.500 |
| 23 | 19760106 | 600 | 0.500 | 6.000 | 7.500 |
| 24 | 19760106 | 1200 | 0.250 | 3.000 | 30.000 |
| 25 | 19760106 | 1800 | 0.250 | 3.000 | 30.000 |
| 26 | 19760107 | 0 | 0.250 | 3.000 | 7.500 |
| 27 | 19760107 | 600 | 0.250 | 3.000 | 7.500 |
| 28 | 19760107 | 1200 | 0.500 | 4.000 | 7.500 |
| 29 | 19760107 | 1800 | 0.500 | 4.000 | 7.500 |
| 30 | 19760108 | 0 | 0.500 | 4.000 | 30.000 |
| 31 | 19760108 | 600 | 0.500 | 4.000 | 30.000 |
| 32 | 19760108 | 1200 | 1.500 | 5.000 | 30.000 |
| 33 | 19760108 | 1800 | 2.500 | 5.000 | 30.000 |
| 34 | 19760109 | 0 | 1.500 | 8.000 | 52.500 |
| 35 | 19760109 | 600 | 1.500 | 10.000 | 52.500 |
| 36 | 19760109 | 1200 | 1.500 | 5.000 | 52.500 |
| 37 | 19760109 | 1800 | 1.500 | 5.000 | 52.500 |
| 38 | 19760110 | 0 | 1.500 | 5.000 | 76.900 |

**Import ASCII wave data file into WWWL**

**Specify location information**

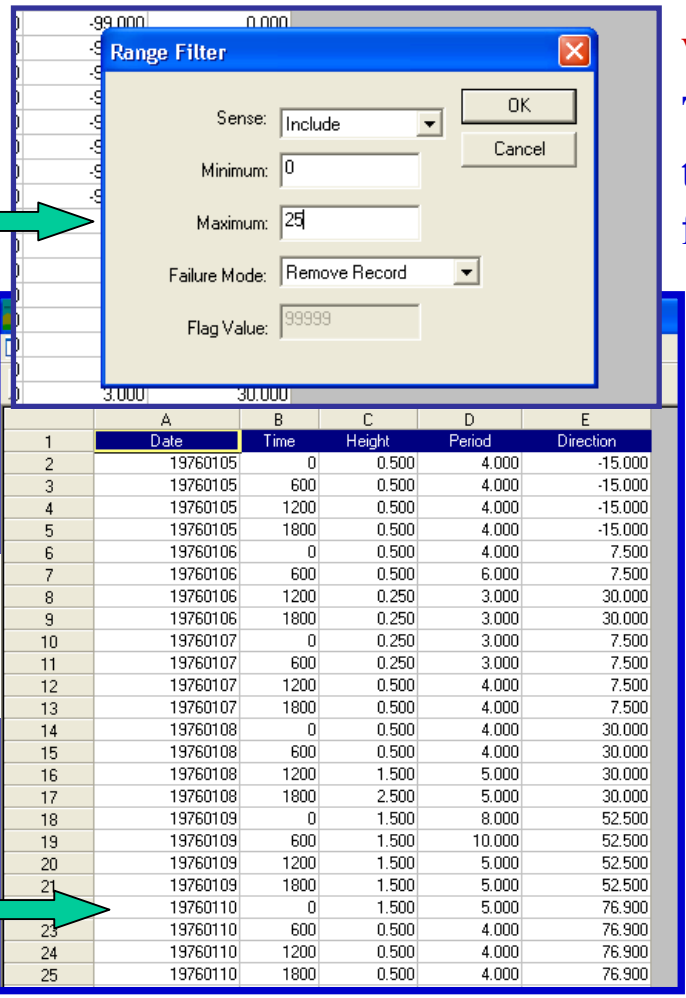
**Specify direction convention**

# Filtering Data




**Filter the range of periods to remove missing data keyed with T = -99**

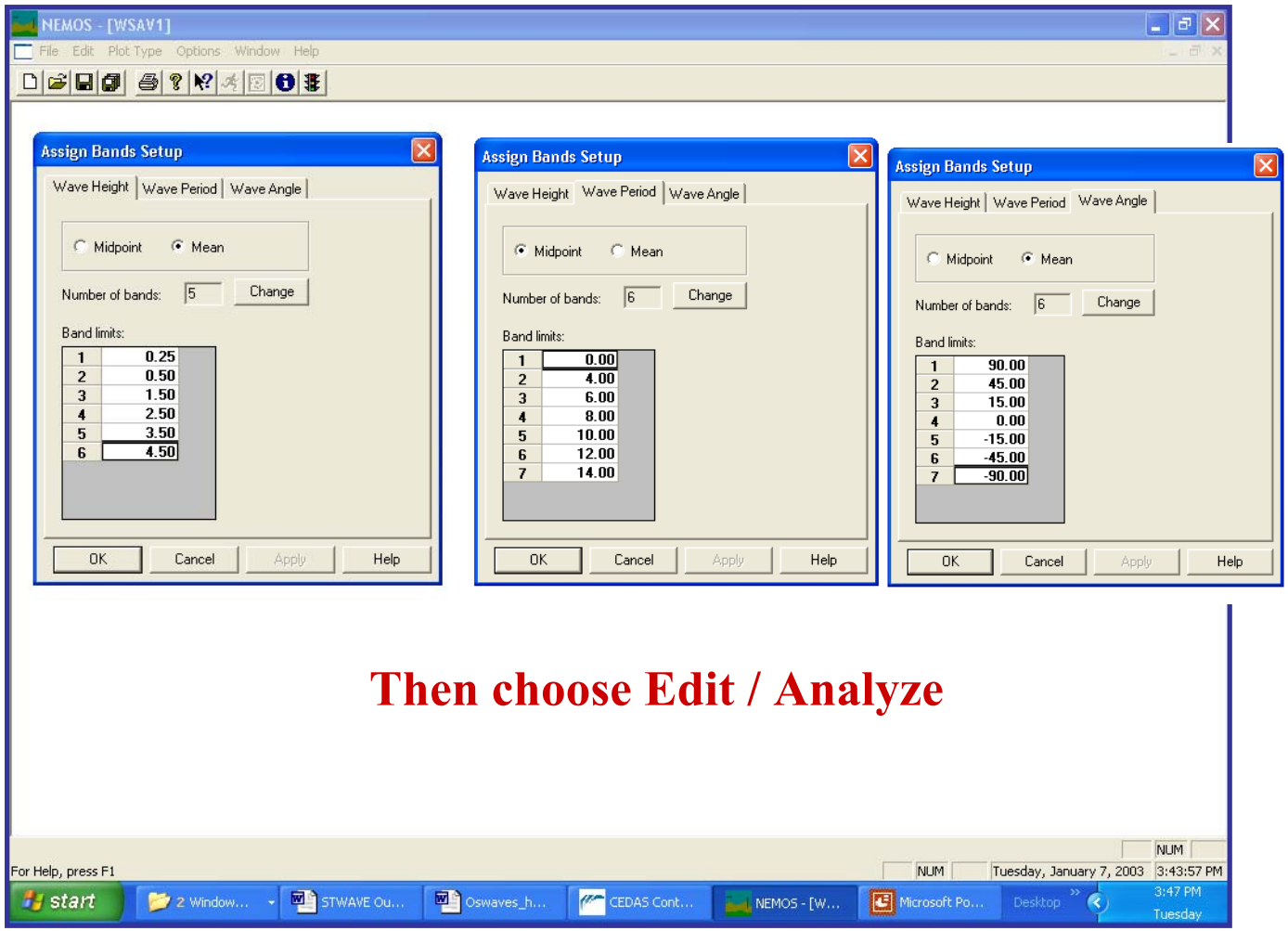
**Filter results**




**Why filter?**
**To be able to analyze for statistical properties**

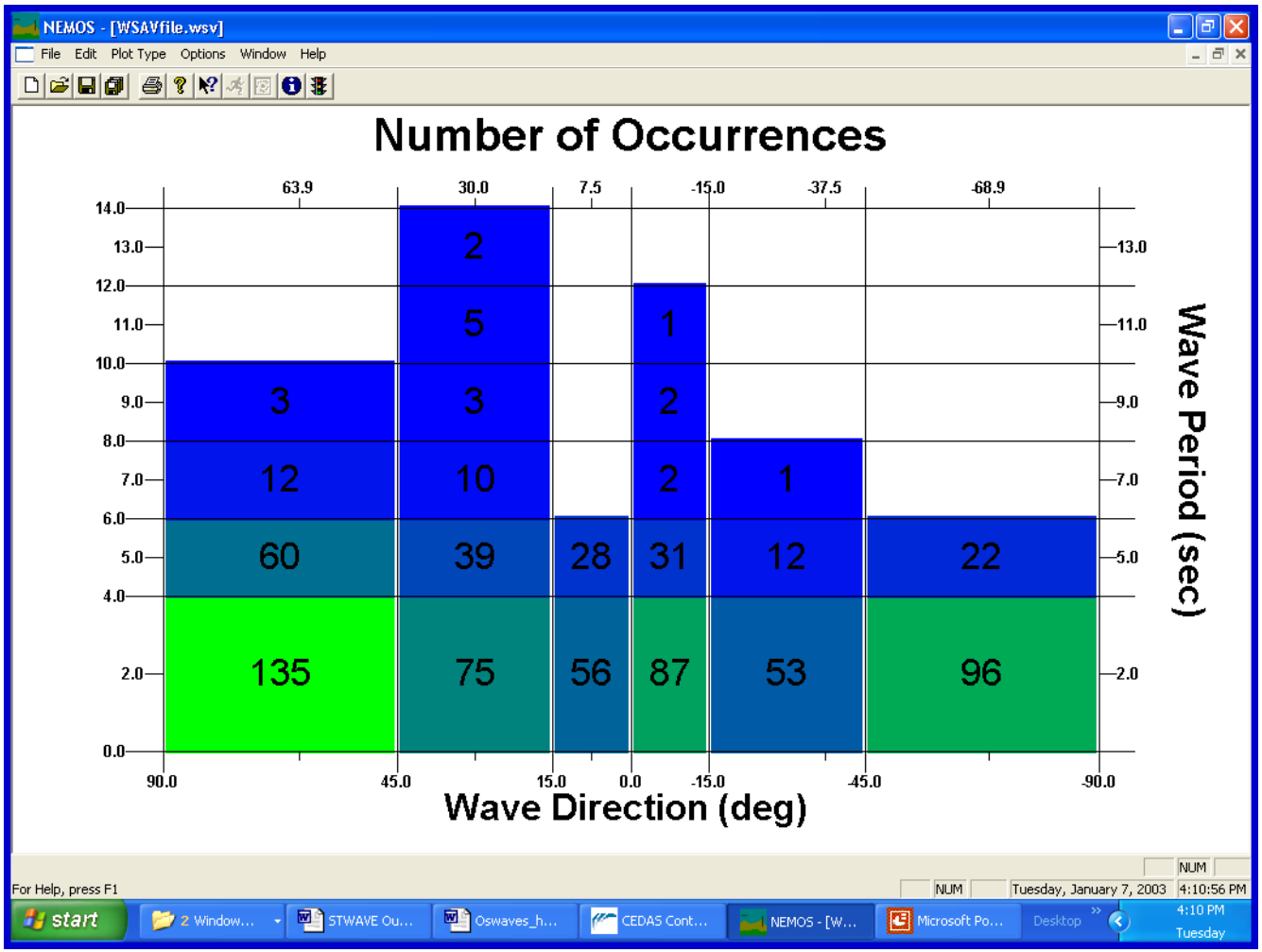
# Set Height, Period, and Angle Bands

W
S
A
V



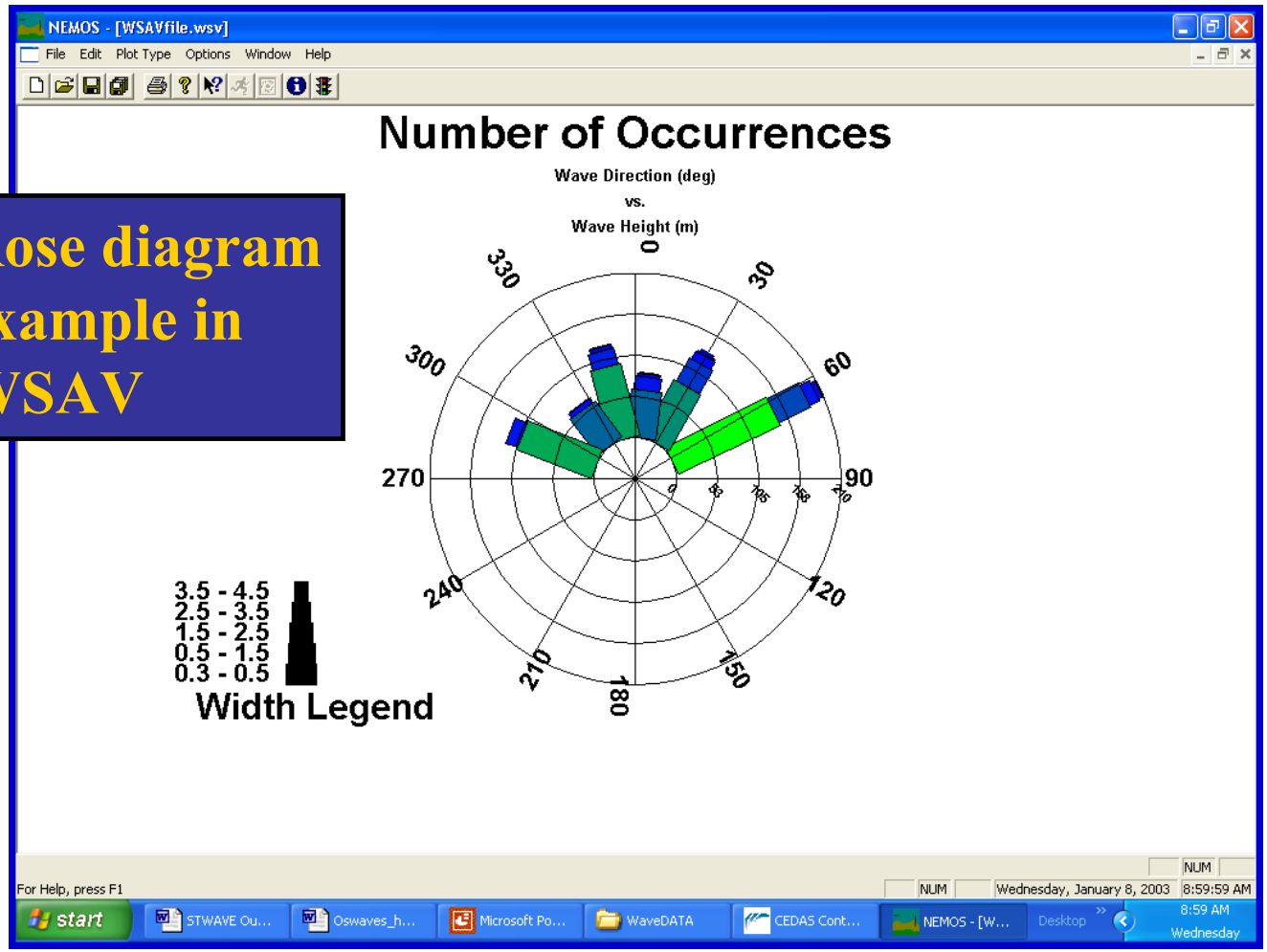

**Then choose Edit / Analyze**

# WSAV Graphics




**Analysis:**
**22 events selected**
**Save permutation file for use in SPECGEN**

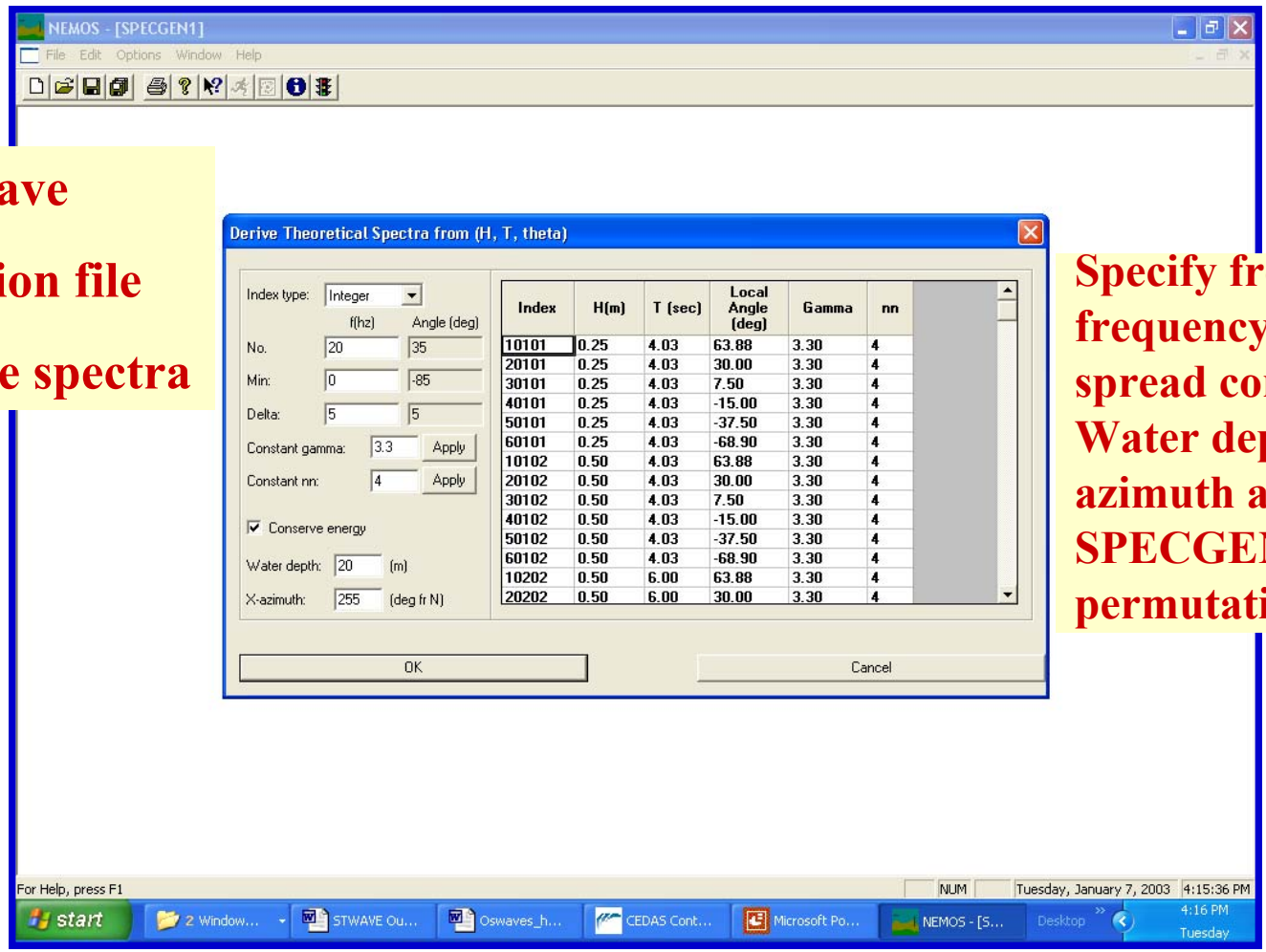
# WSAV Graphics




**Rose diagram example in WSAV**

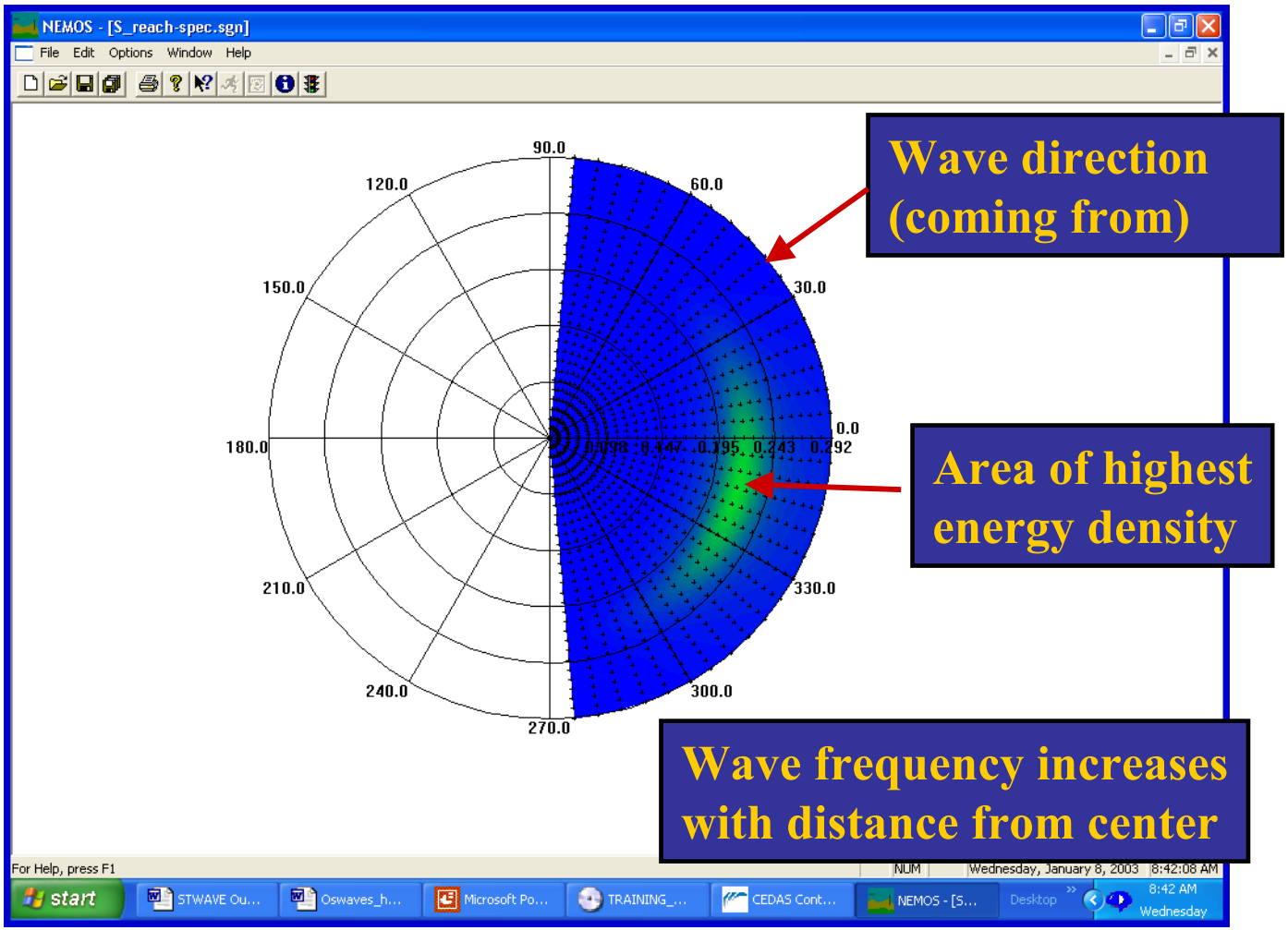
# Run SPECGEN

Import wave permutation file and derive spectra

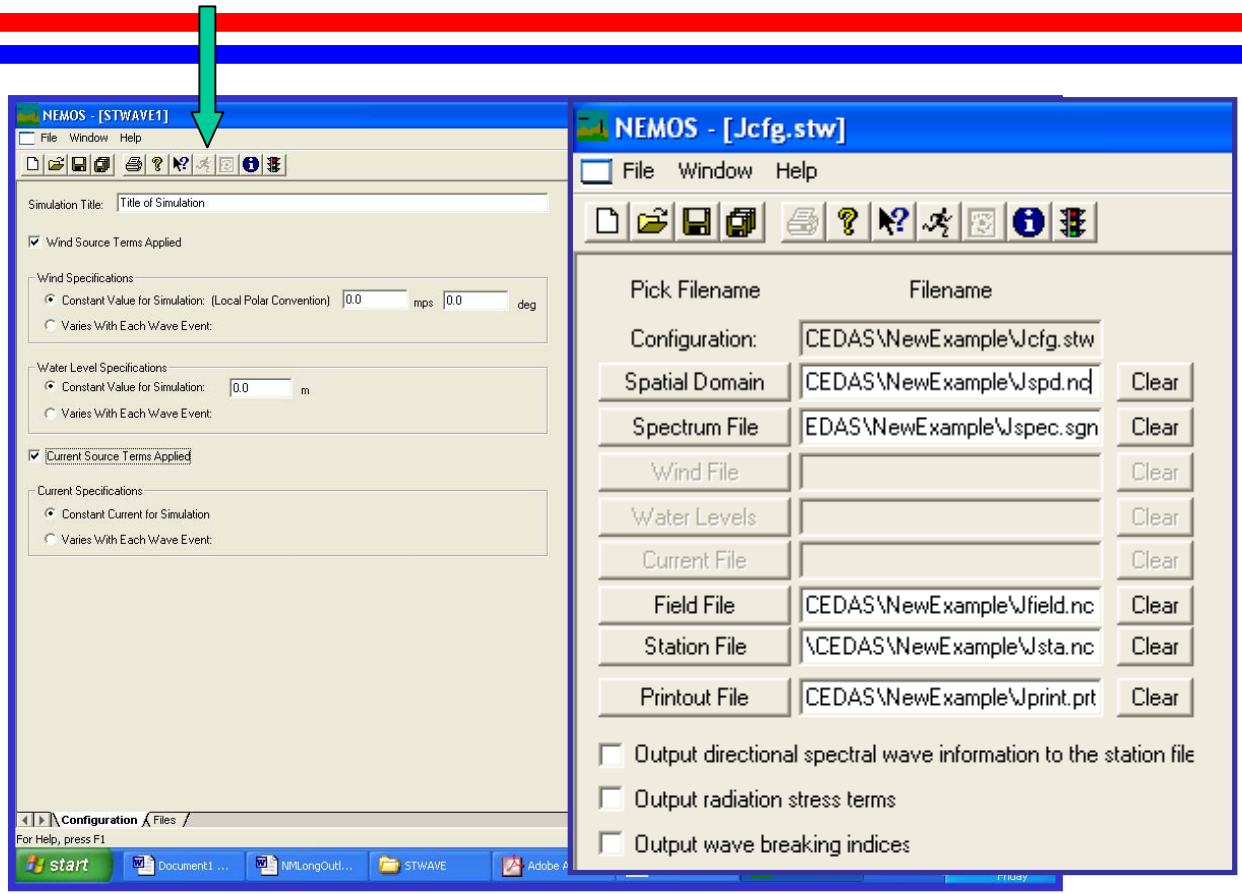



Specify frequency bins, frequency & direction spread controls. Water depth and azimuth are passed to SPECGEN through the permutation file.

# SPECGEN Graphics



# Run STWAVE

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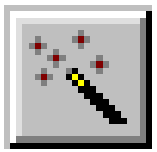
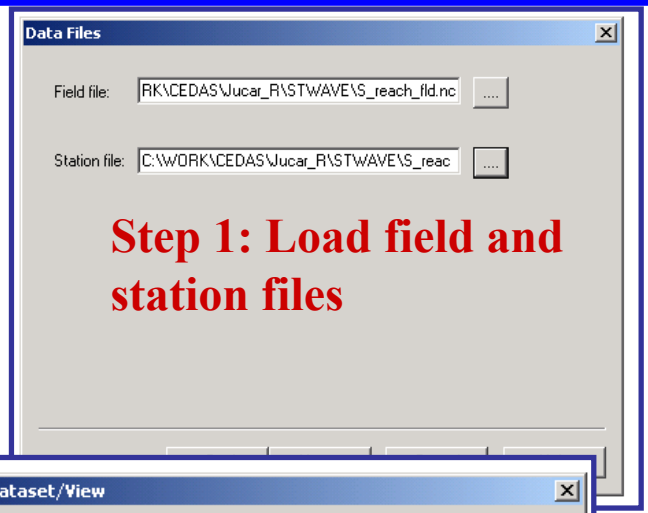
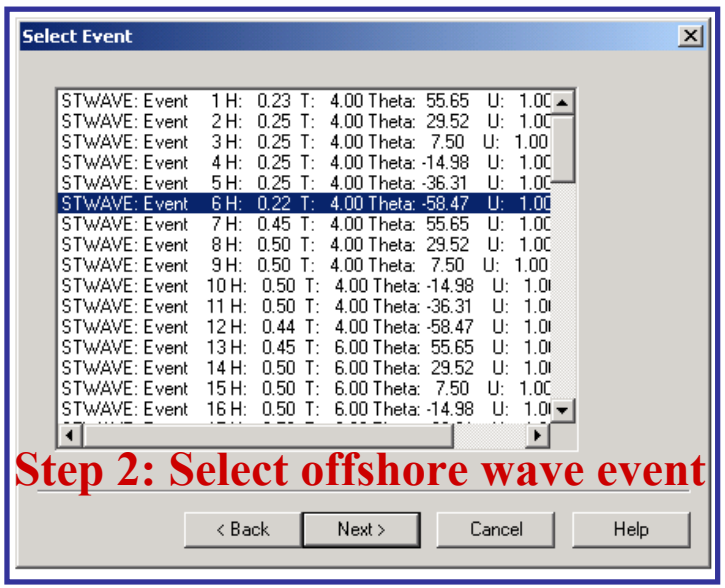
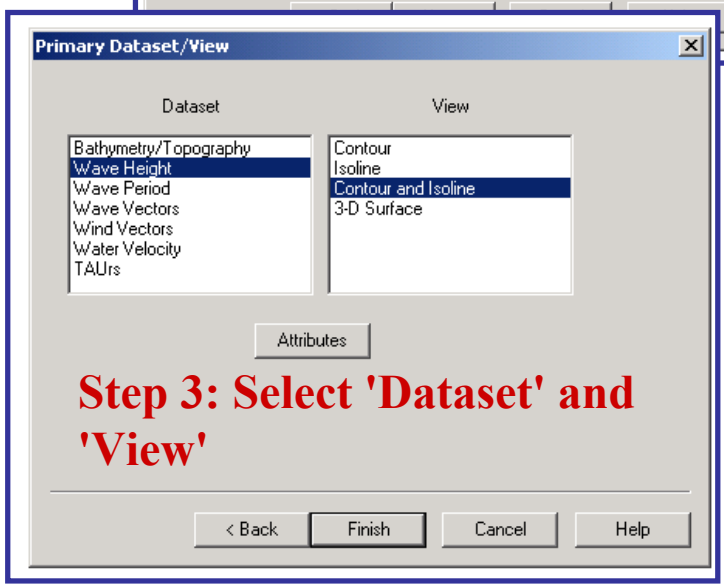
# WMV: Visualization



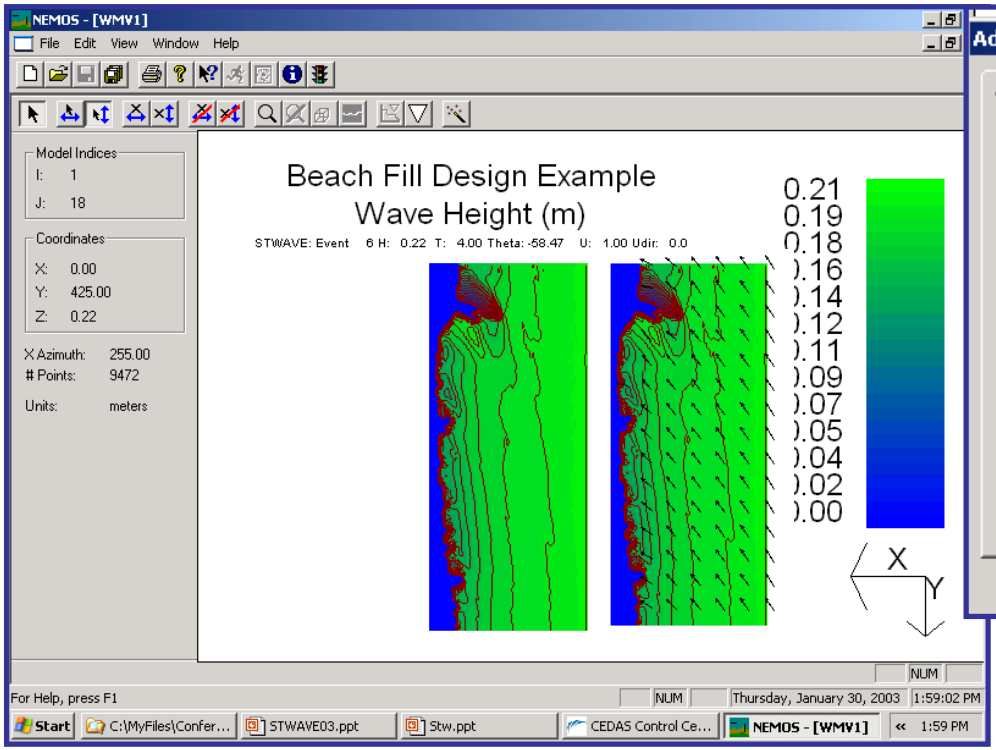
**The setup wizard is used to change the data being visualized**

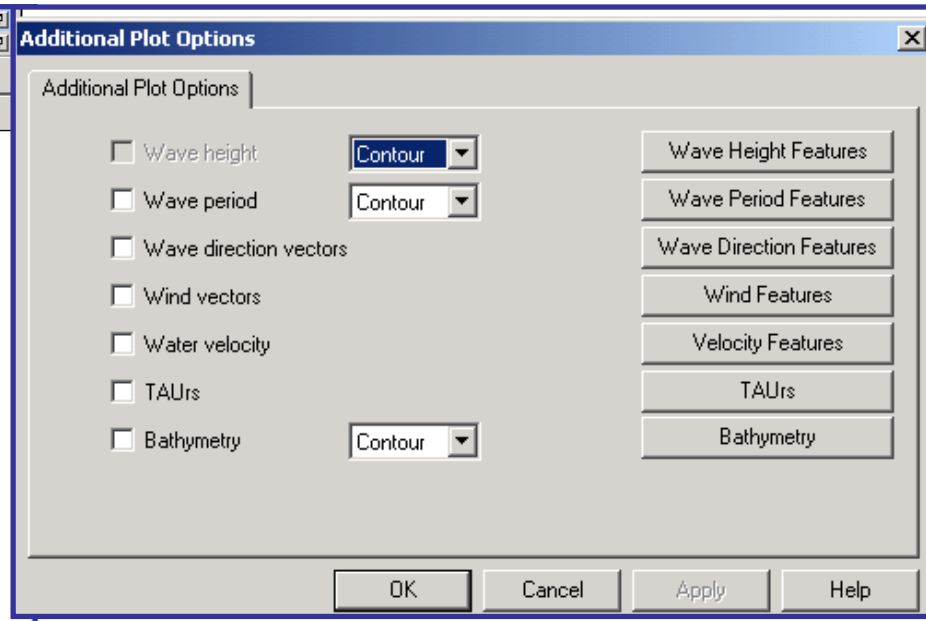


# WMV: Visualization



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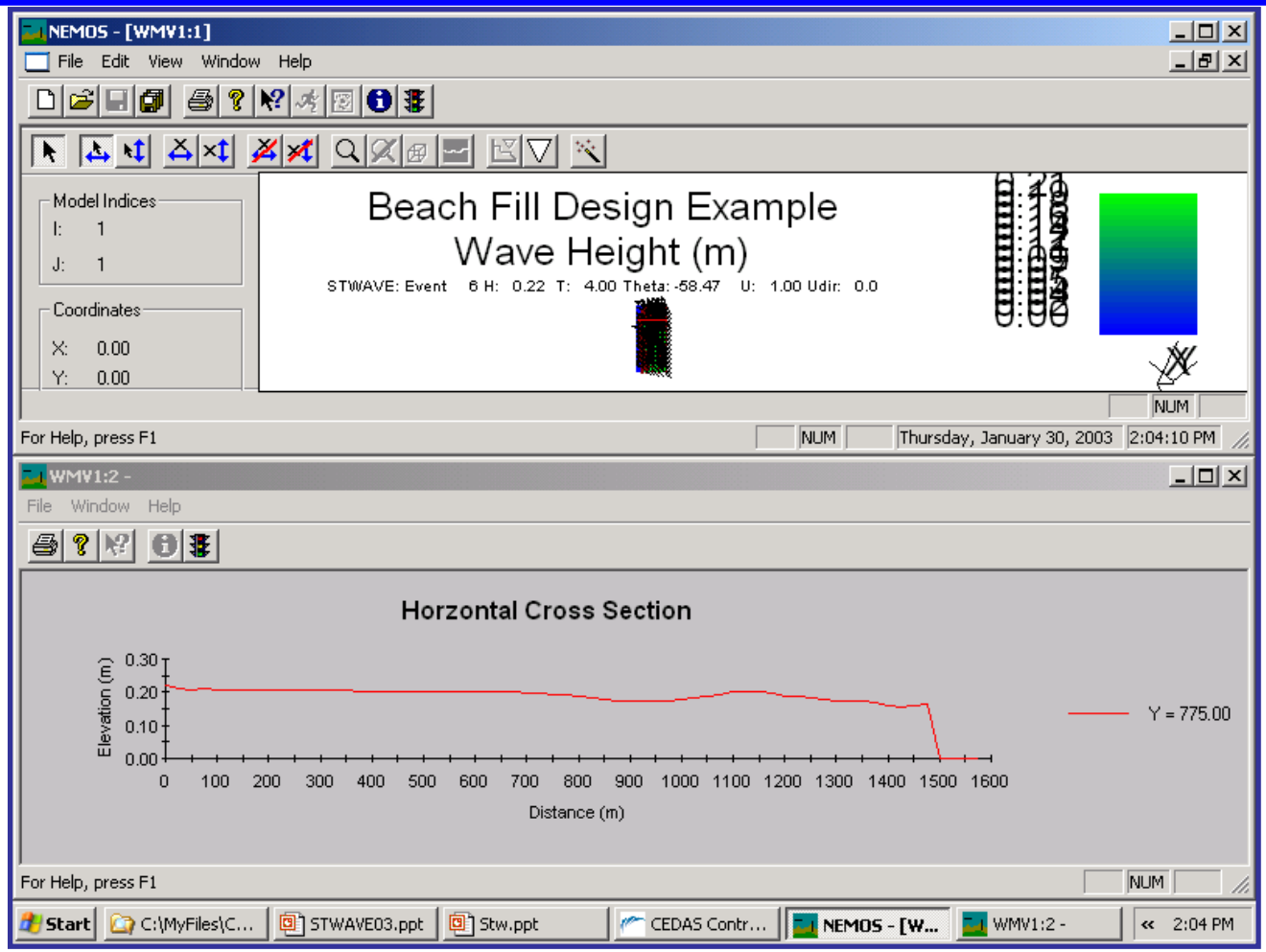


**Draw horizontal cross-section**

**Move horizontal cross-section**

**Delete horizontal cross-section**