

CMSWave to GenCade

Rusty Permenter

Research Hydraulic Engineer

Coastal Hydraulics Engineer

10/18/2012



What is it?

- Tool to allow use of CMS-Wave output as wave stations within GenCade
 - ▶ converts CMS-Wave observation stations to .map file usable within SMS
 - ▶ Inserts wave stations into GenCade files



CMS-Wave

- CMS-Wave is a nearshore spectral wave model
- Allows for wave modeling in and around inlets
- Can use save stations in order to monitor certain grid locations.
- Additional features include grid nesting, wave-wave interaction, and wave overtopping

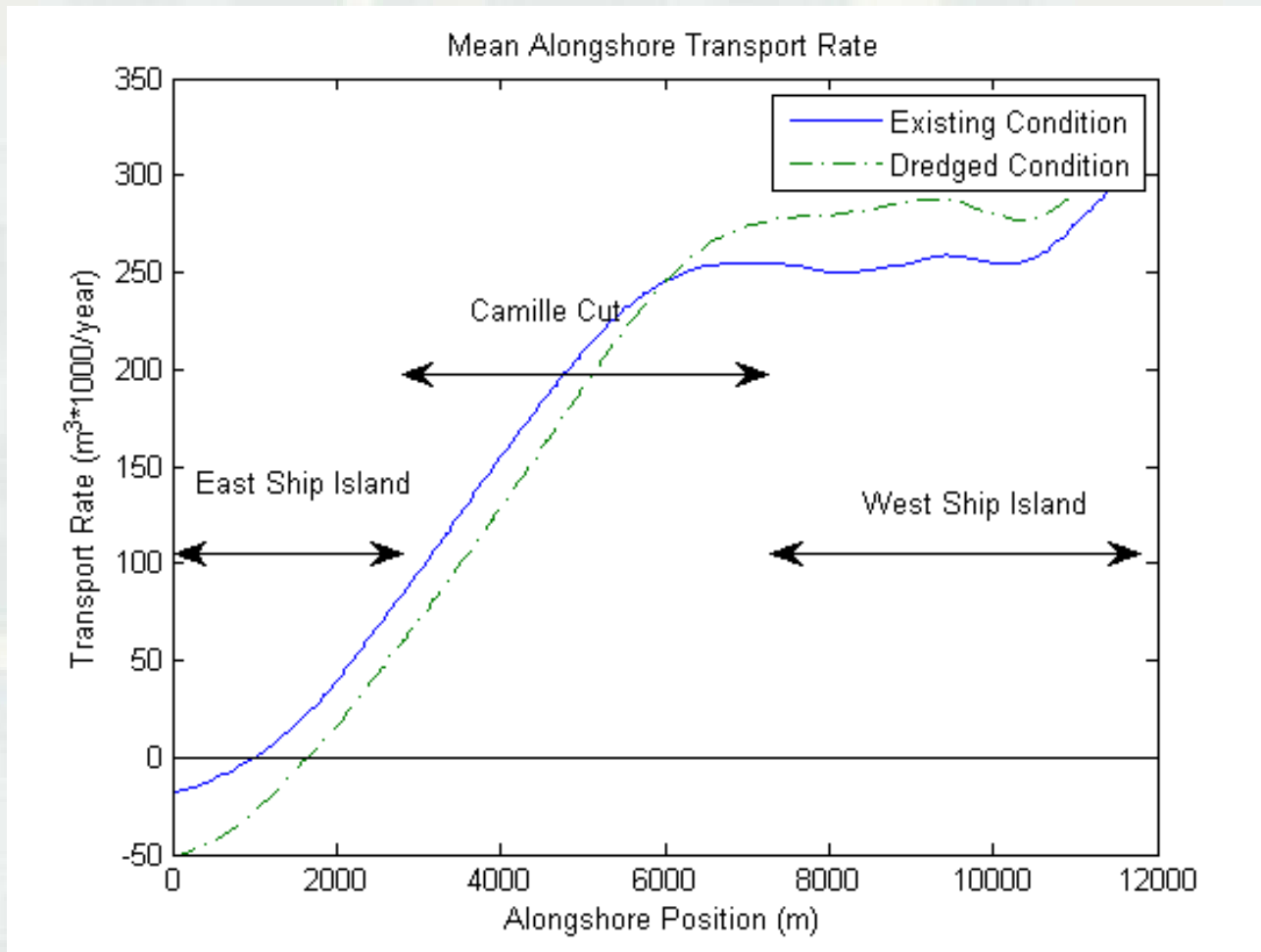


Purpose

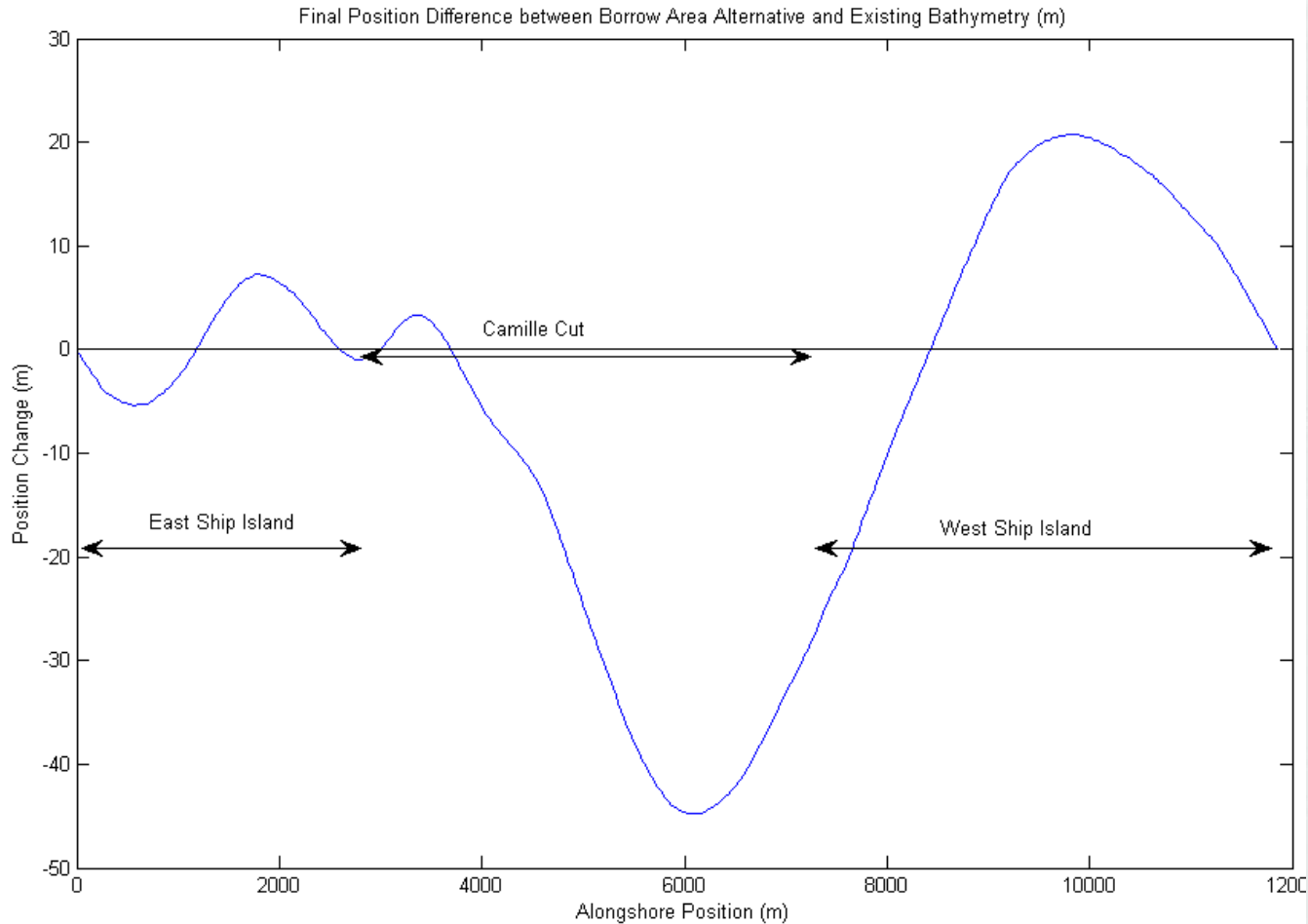
- Accounts for presence of nearshore bathymetry in model
- Allows for sensitivity analysis of various projected bathymetries
 - ▶ Used to determine optimal location of borrow areas



Ship Island Mean Transport



Ship Island Mean Transport



Developing Wave Spectra

- Waves may be inputted into CMS-Wave as either an historical time series or as a set of representative wave conditions
- Waves must be binned prior to use within CMS-Wave for a set of wave conditions



Developing Wave Spectra

- In order to reduce computation time waves can be binned by height, period and direction
- Waves can also be divided into seasonal distributions of each characteristic binned event
- Spectrum can then be generated by inserting representative wave conditions into CMS-Wave



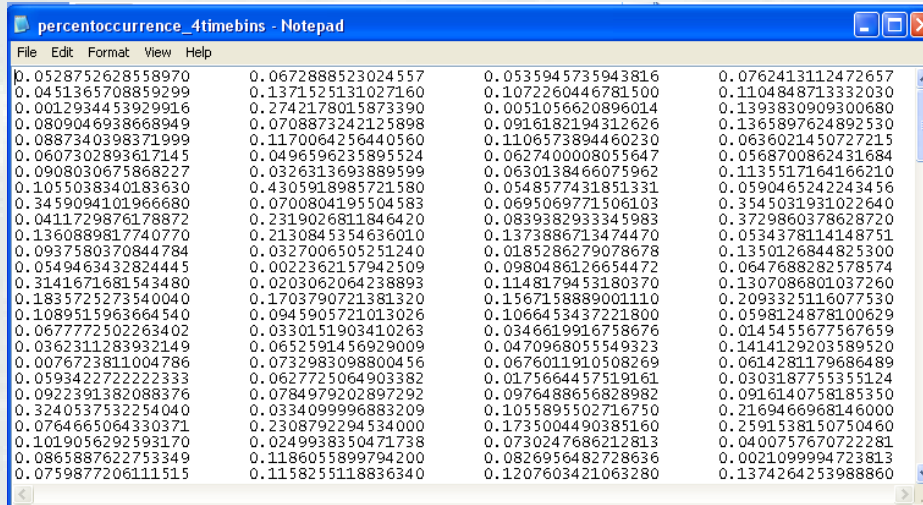
Binning Wave Data

- Steps for Binning
 - ▶ Decide bin limits
 - ▶ Find average H,T, and Direction for each bin
 - ▶ Determine percent occurrence for each binned event
 - ▶ Write percent occurrence file for input into cms2map executable



Percent Occurrence Guidelines

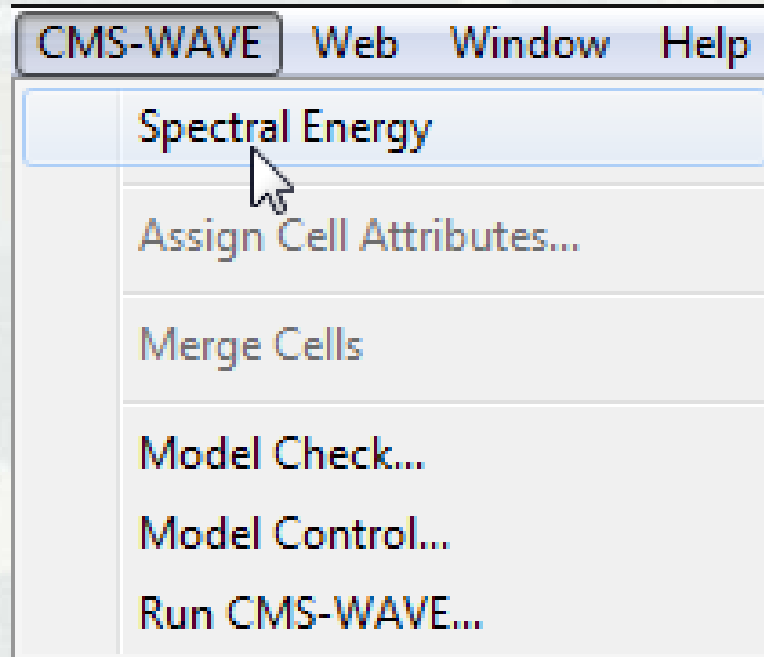
- Rows represent one wave event
- Percent occurrence for each sequential time period are written in each row separated by spaces



```
percentoccurrence_4timebins - Notepad
File Edit Format View Help
0.0528752628558970 0.0672888523024557 0.0535945735943816 0.0762413112472657
0.0451365708859299 0.1371525131027160 0.1072260446781500 0.1104848713332030
0.0012934453929916 0.2742178015873390 0.0051056620896014 0.1393830909300680
0.0809046938668949 0.0708873242125898 0.0916182194312626 0.1365897624892530
0.0887340398371999 0.1170064256440560 0.1106573894460230 0.0636021450727215
0.0607302893617145 0.0496596235895524 0.0627400008055647 0.0568700862431684
0.0908030675868227 0.0326313693889599 0.0630138466075962 0.1135517164166210
0.1055038340183630 0.4305918985721580 0.0548577431851331 0.0590465242243456
0.3459094101966680 0.0700804195504583 0.0695069771506103 0.3545031931022640
0.0411729876178872 0.2319026811846420 0.0839382933345983 0.3729860378628720
0.1360889817740770 0.2130845354636010 0.1373886713474470 0.0534378114148751
0.0937580370844784 0.0327006505251240 0.0185286279078678 0.1350126844825300
0.0549463432824445 0.0022362157942509 0.0980486126654472 0.0647688282578574
0.3141671681543480 0.0203062064238893 0.1148179453180370 0.1307086801037260
0.1835725273540040 0.1703790721381320 0.1567158889001110 0.2093325116077530
0.1089515963664540 0.0945905721013026 0.1066453437221800 0.0598124878100629
0.0677772502263402 0.0330151903410263 0.0346619916758676 0.0145455677567659
0.0362311283932149 0.0652591456929009 0.0470968055549323 0.1414129203589520
0.0076723811004786 0.0732983098800456 0.0676011910508269 0.0614281179686489
0.059342272222333 0.0627725064903382 0.0175664457519161 0.0303187755355124
0.0922391382088376 0.0784979202897292 0.0976488656828982 0.0916140758185350
0.3240537532254040 0.0334099996883209 0.1055895502716750 0.2169466968146000
0.0764665064330371 0.2308792294534000 0.1735004490385160 0.2591538150750460
0.1019056292593170 0.0249938350471738 0.0730247686212813 0.0400757670722281
0.0865887622753349 0.1186055899794200 0.0826956482728636 0.0021099994723813
0.0759877206111515 0.1158255118836340 0.1207603421063280 0.1374264253988860
```



Developing Wave Spectra



Developing Wave Spectra

Cartesian Grid Module Depth

8.8
7.6
6.4
5.2
4.0
2.8

Create Spectral Energy Grid

Frequency Distribution		Angle Distribution	
Number:	30	Number:	35
Delta:	0.01 Hz	Delta:	5.0 deg
Minimum:	0.04 Hz	Minimum:	-85.0 deg
Maximum:	0.33 Hz	Maximum:	85.0 deg

Spectral Energy

Spectral Manager

Create Grid Generate Spectra

Import Spectra Export Spectra

New_Spectral_Grid

Spectral Viewer

View: Polar Energy: 0.0

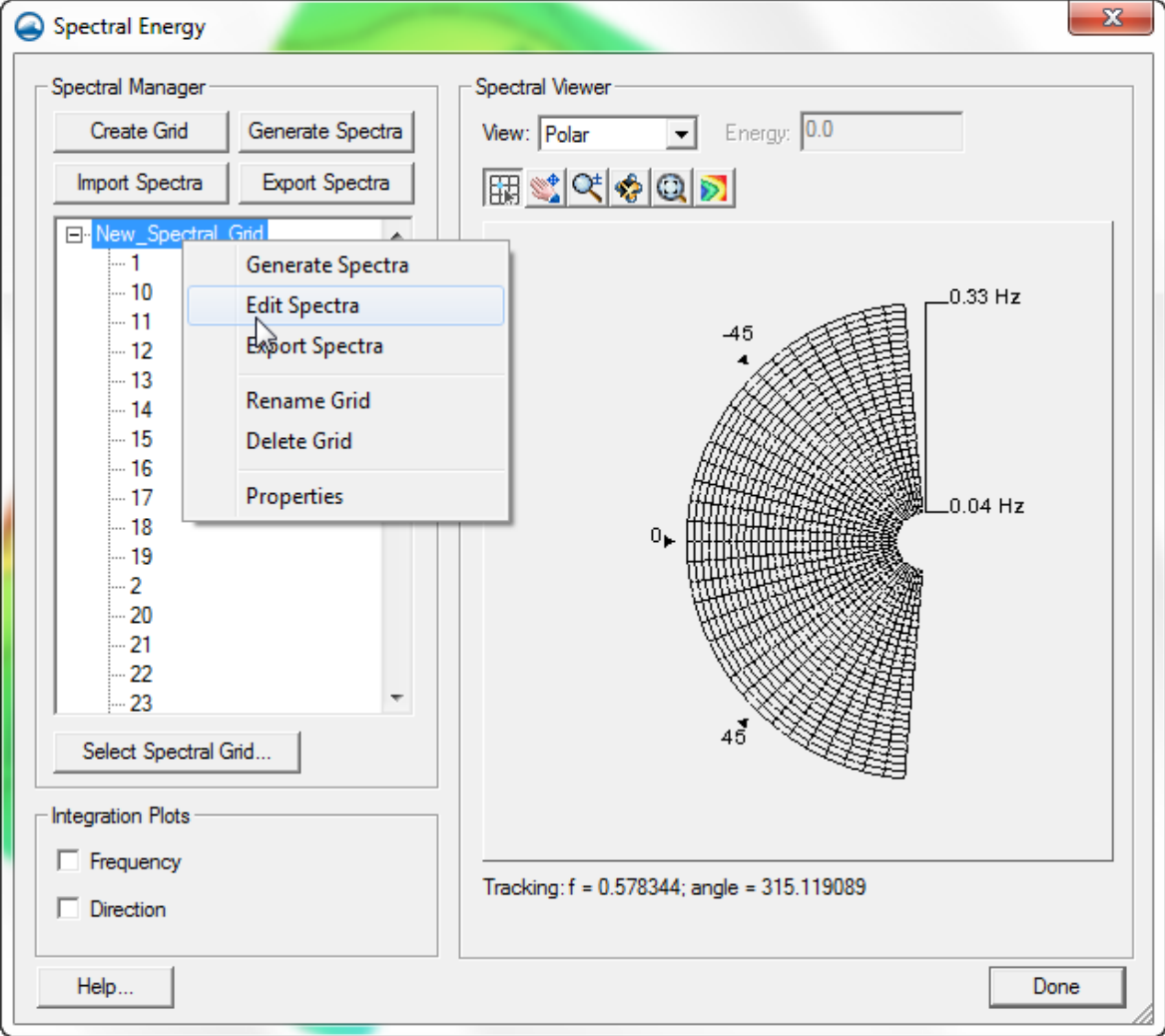
Spectral Energy

20.4
15.8
11.2
6.6
2.0

Tracking: f = 0.578344; angle = 315.119089



Developing Wave Spectra



Developing Wave Spectra

Edit Spectra

Parameter Settings

Generation Method: TMA (Shallow Water)

Replace Old Spectra

Directional Spreading Distribution:

Wrapped Normal

Cosine Power

Seaward Boundary Depth:

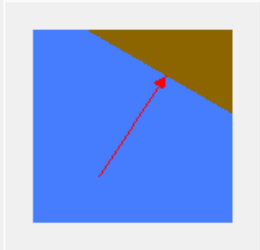
Specify once for all spectra

0.001 m

Specify for each spectrum

Angle Settings

Projection: Shore Normal



Spectral Parameters

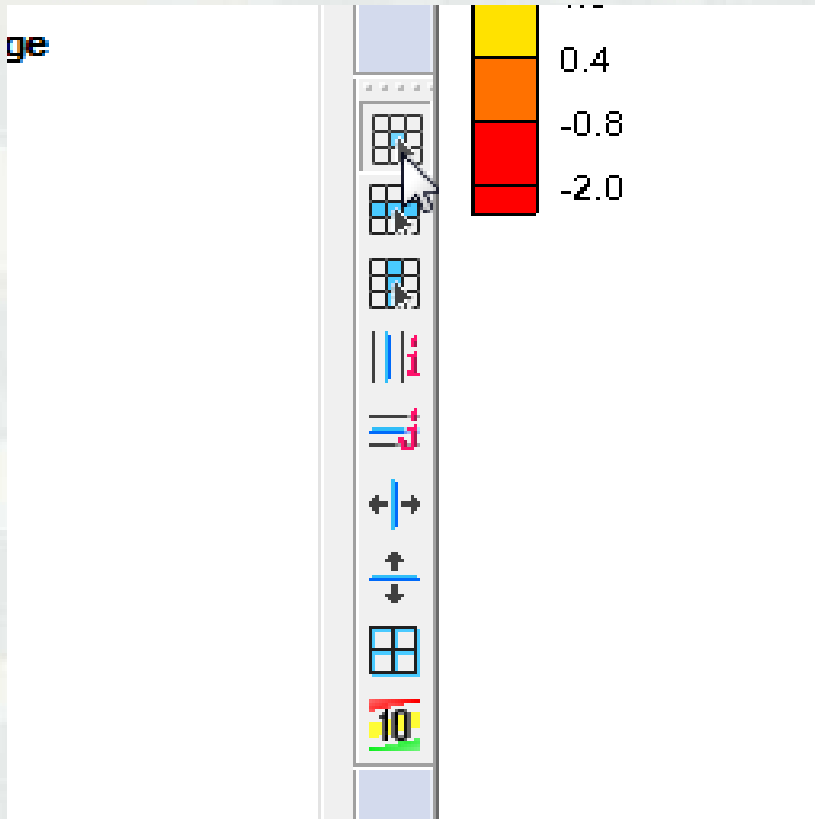
	Index	Angle (deg)	Hs (m)	Tp (s)	Gamma	nn	Gauge Depth (m)
1	1	-3.436	4.48	11.11	3.3	4	7.0
2	10	-11.152	4.48	12.5	3.3	4	7.0
3	11	-12.952	4.442	12.5	3.3	4	7.0
4	12	-5.574	4.414	11.11	3.3	4	7.0
5	13	-13.222	4.315	12.5	3.3	4	7.0
6	14	-7.64	4.268	11.11	3.3	4	7.0
7	15	-11.924	4.215	12.5	3.3	4	7.0
8	16	-9.851	4.207	11.11	3.3	4	7.0
9	17	-13.438	4.197	12.5	3.3	4	7.0

Import Import from GenCode Export Spectral Defaults >>

Help... Edit Cancel



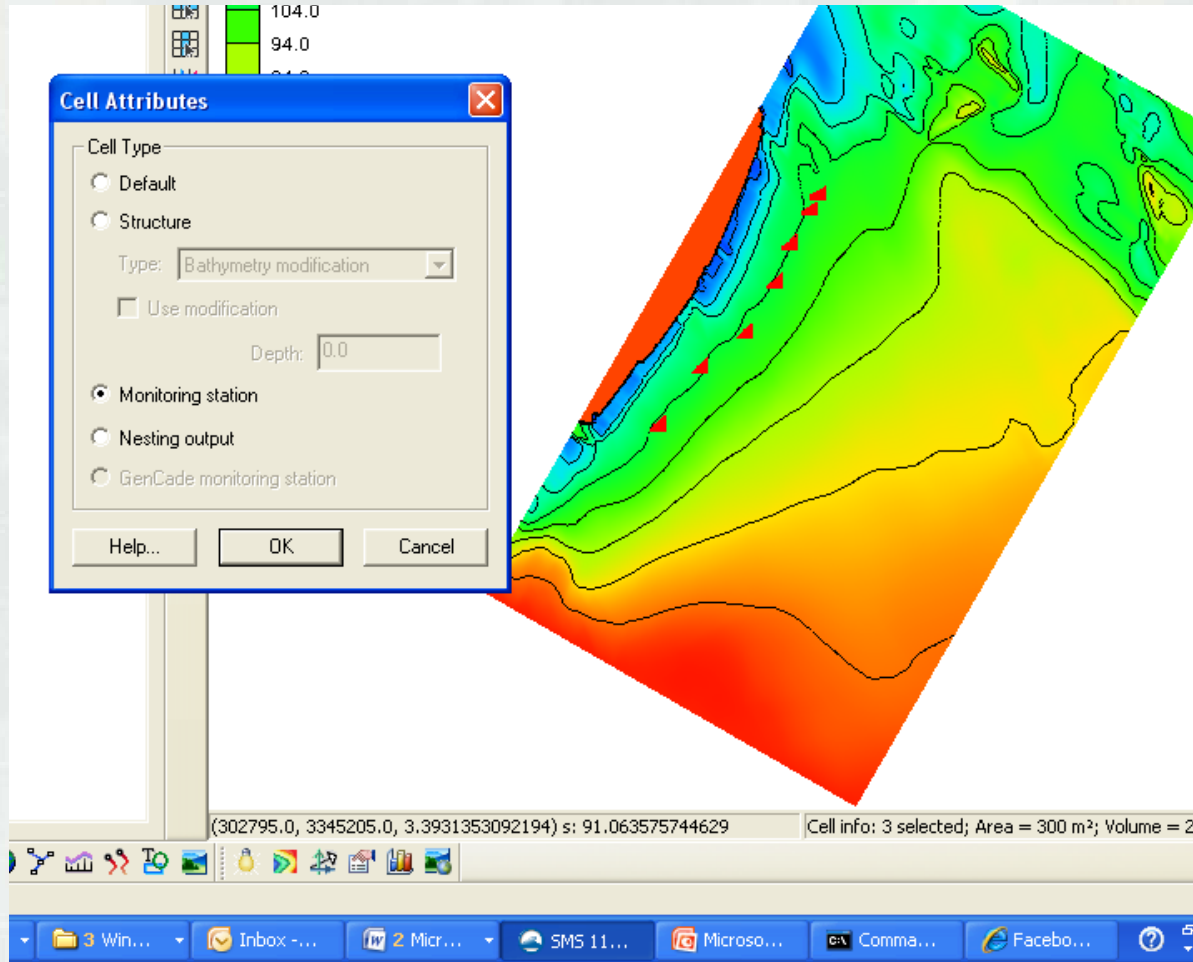
Creating Observation Points



- Click on select cell button
- Hold Shift key while selecting multiple save stations
- Right click on screen and select Cell Attributes tab



Creating Observation Points



Writing .ctrl for CMS2MAP

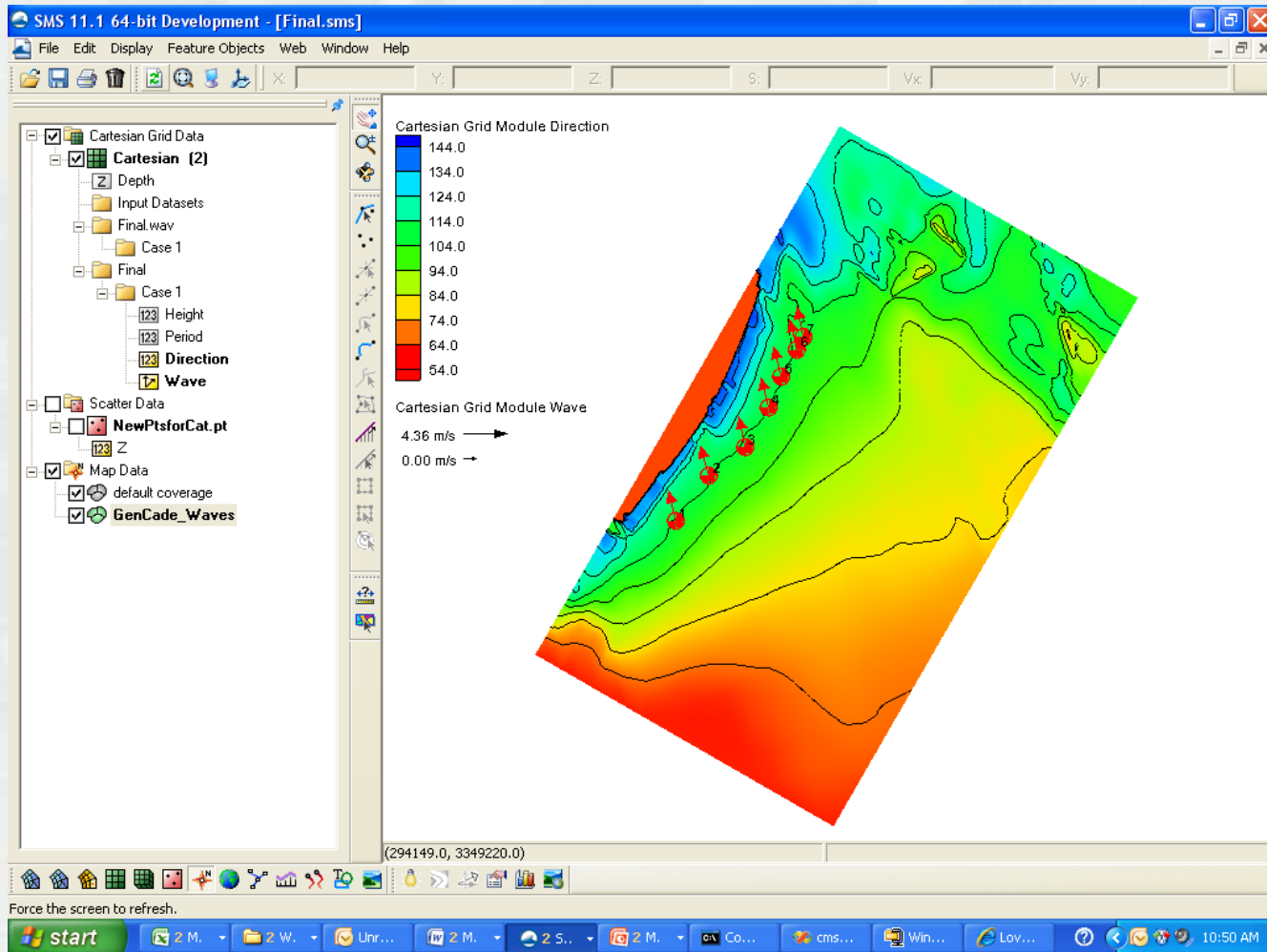
- The .ctrl file contains the cards necessary for CMS2MAP to write to either an existing GenCade grid or a .map file readable in SMS



Writing .ctrl for CMS2MAP

Control Card	Description	Default Value
SIMFILE:	CMS-Wave control file (*.sim):	<i>Required Input</i>
STDFILE:	CMS-Wave options file (*.std):	<i>Required Input</i>
DEPFILE:	CMS-Wave depth file (*.dep):	<i>Required Input</i>
SELHTSOUTFILE:	CMS-Wave station output file (selhts.out):	<i>Required Input</i>
CMSTSFLAG:	Flag for CMS to GenCade conversion mode: <1> = time-series (process-based) mode ... (1 CMS wave event → 1 GenCade Wave) <0> = steady state mode..... (1 CMS wave event → Many GenCade Waves)	1
FREQFILE:	[if CMSTSFLAG = 0] → % Frequency of Occurrence file (ASCII file: 1 row per CMS-Wave event x 1 column per time period to distribute output over)	<i>Required Input if CMSTSFLAG = 0</i>
NTIMEBINS:	[if CMSTSFLAG = 0] → Number of time periods to distribute output time series over	1
RANDOMFLAG:	[if CMSTSFLAG = 0] → Flag for random temporal distribution: <0> = same order as input wave events <1> = randomly distributed	0
FORMATOUT:	Flag for output format: <SMS_Map_Wave_File> = SMS Map File; <GenCade_Wave_File> = GenCade Wave Files	SMS_Map_Wave_File
MAPFILE:	[if FORMATOUT = SMS_Map_Wave_File] → Output Time Series SMS *.map file	GenCade_SMS.map
STARTDATE:	Output time series start date <yyyymmddHHMMSS>	19000101000000
TIMESTEPOUT:	Output time series timestep (hours)	3.0
TSOUTLENGTH:	Output time series length (hours)	8760.0 (1 year)
GENFILEIN:	[if FORMATOUT = GenCade_Wave_File] → <Optional> Existing GenCade Control Filename	GenCade_waves.gen
X0:	[if GENFILEIN not supplied] → GenCade Grid X-Origin	0.0
Y0:	[if GENFILEIN not supplied] → GenCade Grid Y-Origin	0.0
AZIMUTHGEN:	[if GENFILEIN not supplied] → <Optional> GenCade Grid Azimuth	Same as CMS-Wave
NX:	[if GENFILEIN not supplied] → Number of GenCade Grid Cells	0
DX:	[if GENFILEIN not supplied] → GenCade Grid Cell Resolution/Width	0.0

SMS Wave Stations



BUILDING STRONG®

ERDC

Innovative solutions for a safer, better world

Future Work

- Finalize binning code to allow binning for seasonal distributions
- Write .eng files for use in CMS-Wave

