

Coastal Modeling System

Advanced Topics



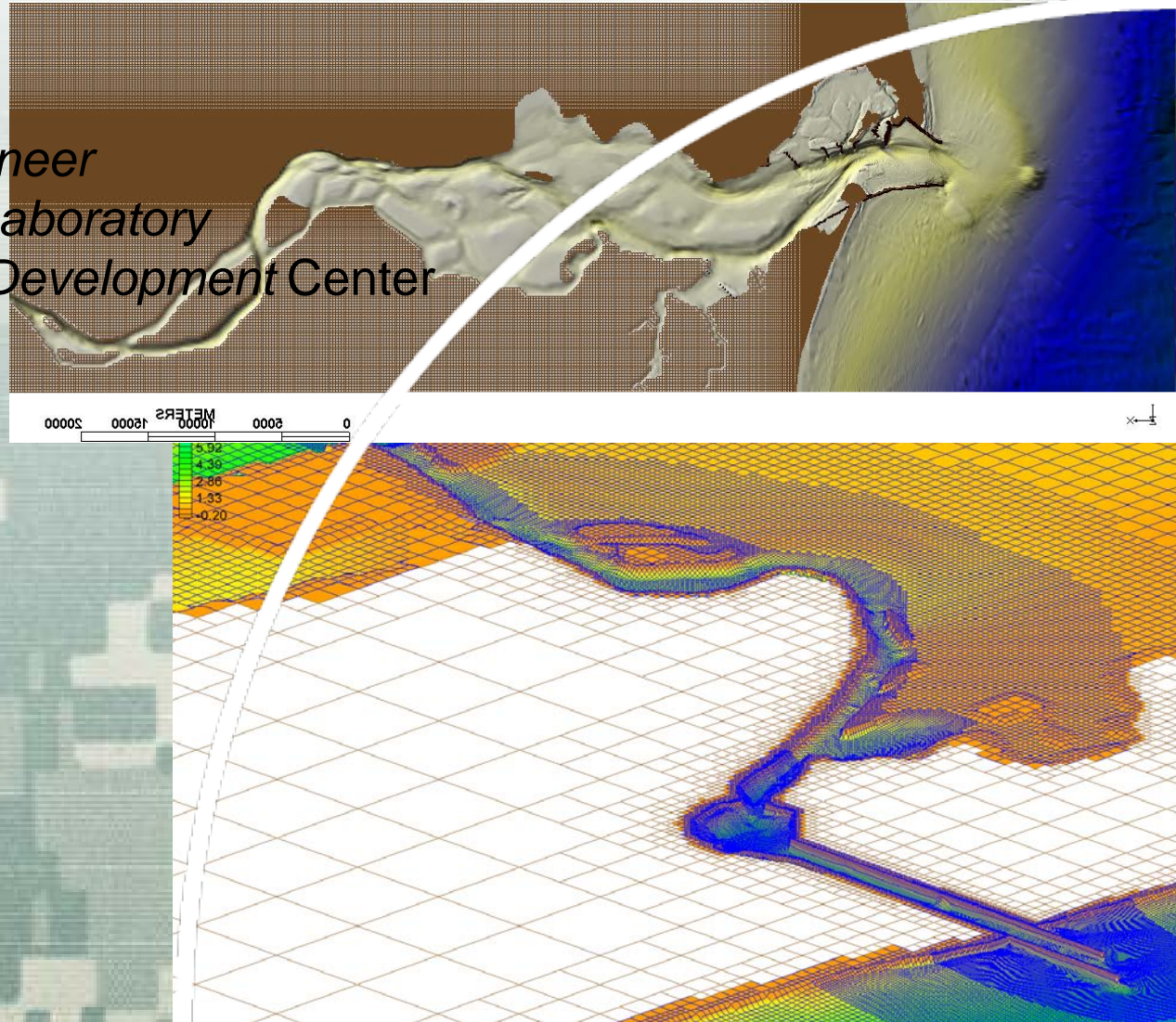
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Engineer Research and Development Center

June 22, 2012



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US Army Corps of Engineers
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Webinar Outline

- **18 June 2012 - Day 1**

- Introduction to CMS (slides)
- Overview of Documentation and Workshop Material – Read it!
- Tips for preparing bathymetry and other scattersets
- Tips for setting up and running
- Hydrodynamics

- **19 June 2012 - Day 2**

- Wind and Atmospheric Pressure
- Initial and Boundary Conditions

- **20 June 2012 – Day 3**

- Surface roller
- Salinity Transport
- Sediment Transport

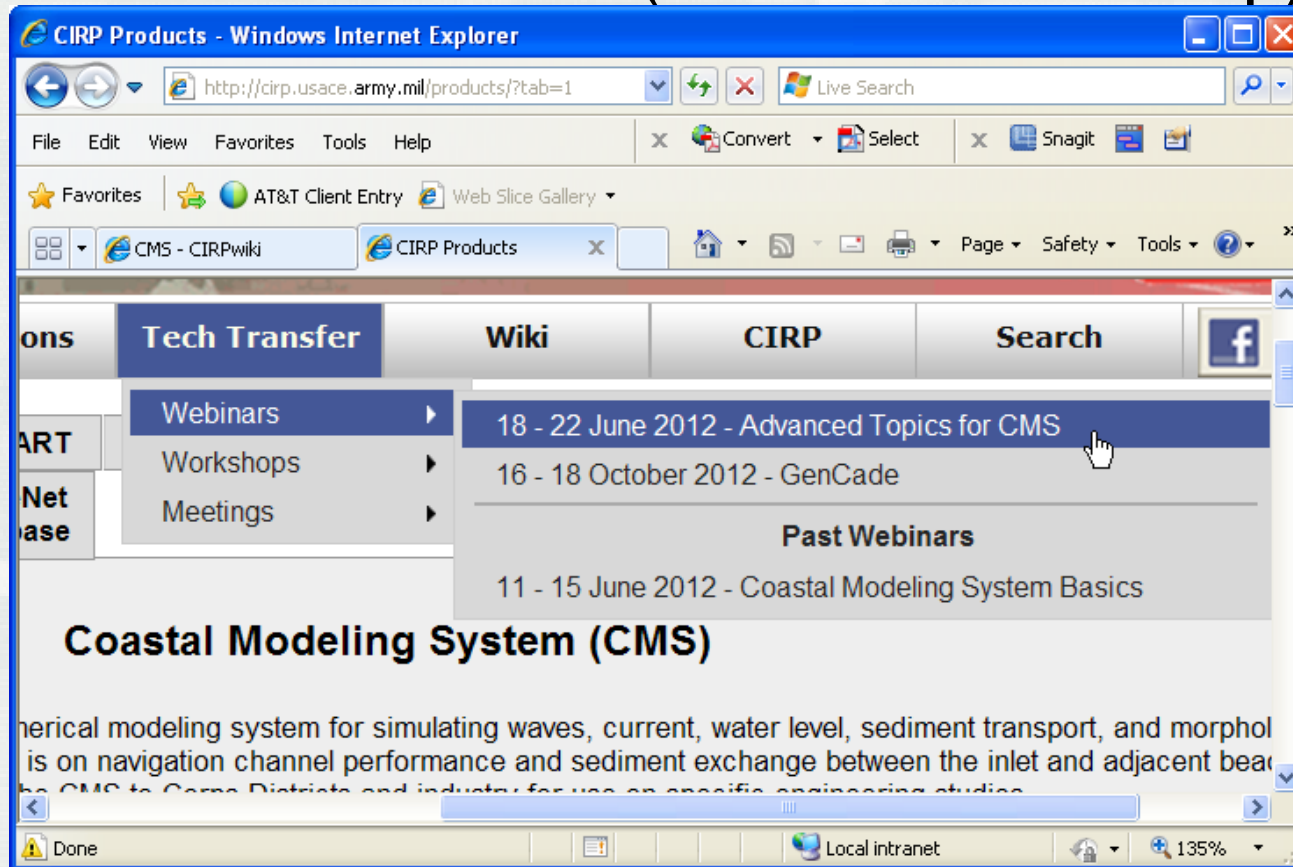
- **21 June 2012 - Day 4**

- Multiple-sized sed. transp.
- Numerical Methods
- Advanced Output

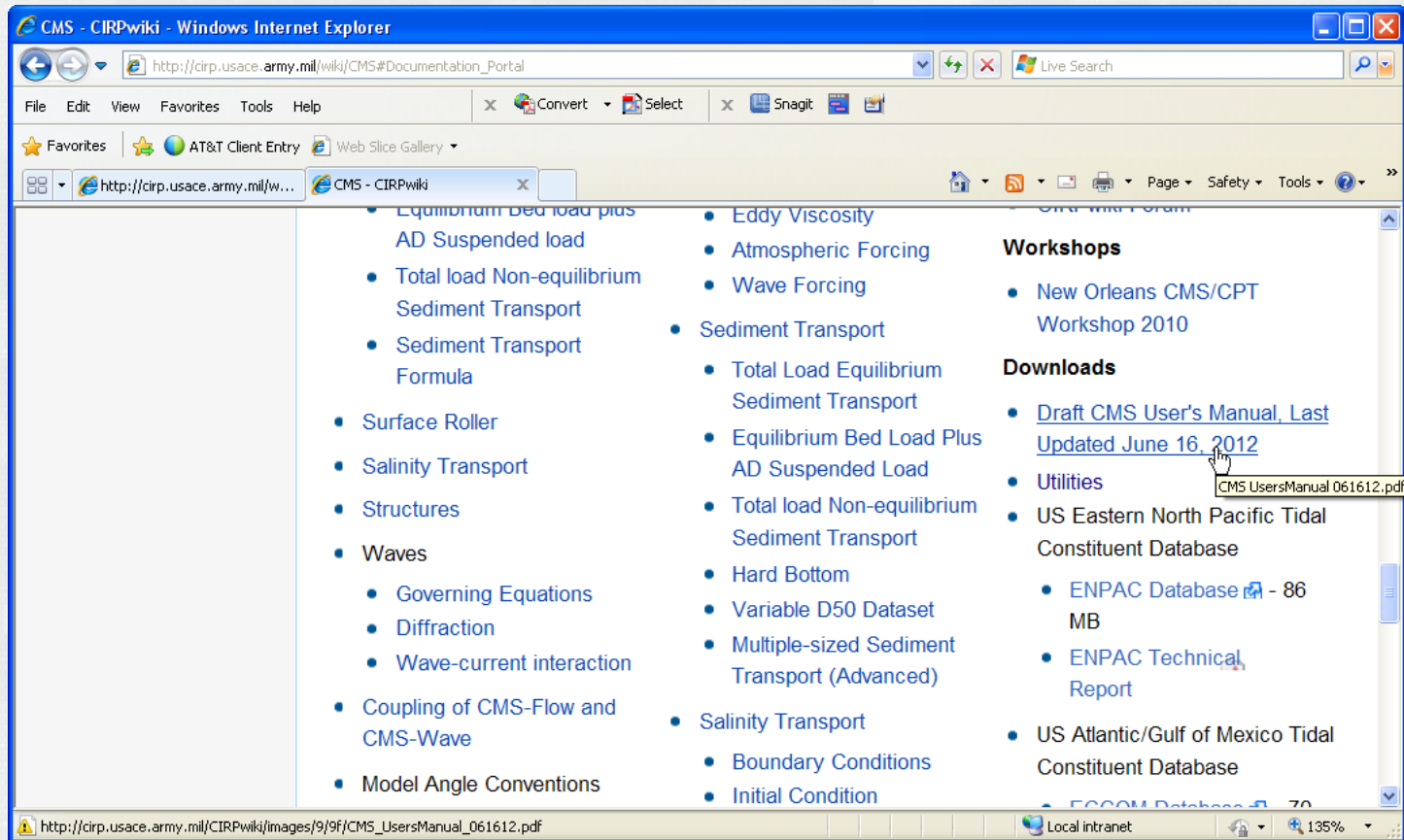
- **22 June 2012 - Day 5**

- Scripting
- Problem Solving
- Model Calibration
- Post-processing
- Upcoming features

- CMS-Flow data folder (same as workshop)



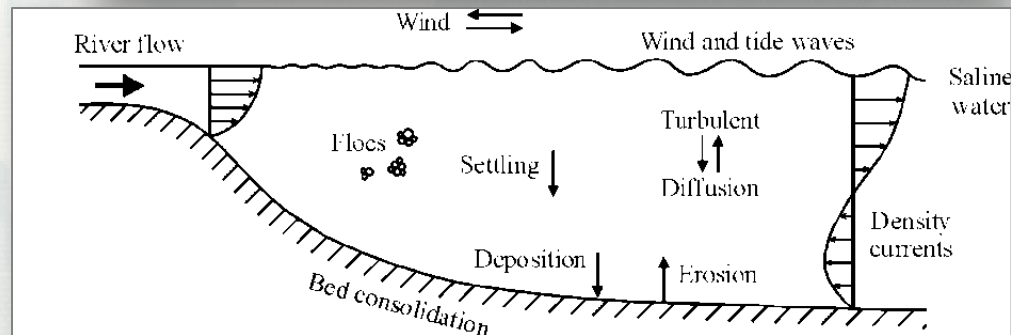
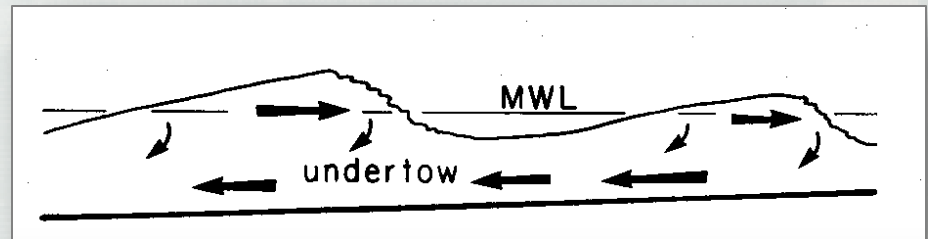
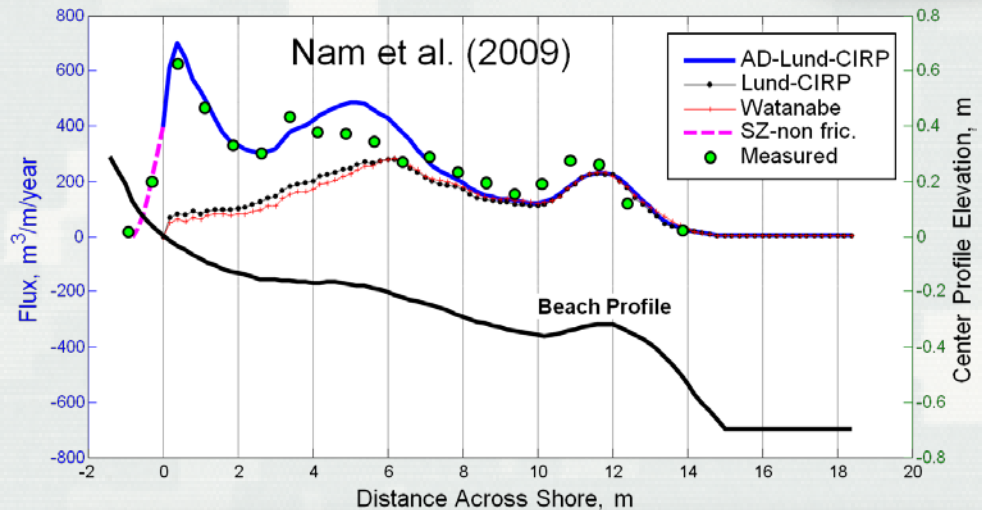
Draft CMS User Manual



<http://cirpwiki.info/wiki/CMS>

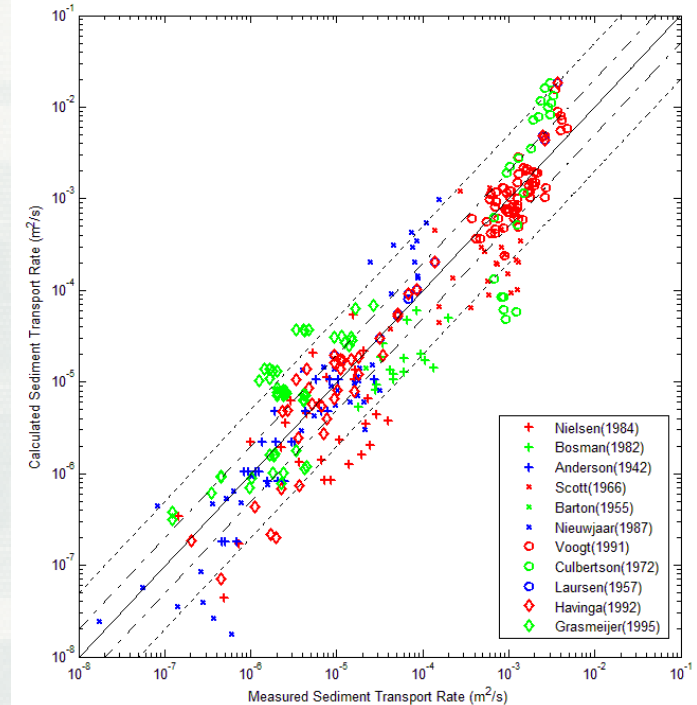
Upcoming Features: CMS-Flow

- Swash-zone
- Cross-shore sediment transport
- Mixed sediments
 - Mix-Sed (SEDZLJ)
 - CMS-Sed
- Linking to tidal databases
 - (TPXO, ADCIRC, LeProvost)
- Boundary condition extraction tool
- Parallelization for HPC



New Multiple-sized Sediment Transport Formula

- Largest source of error in modeling
- Existing formula designed for
 - Graded sediments under currents only (e.g. Wu et al. 2000) or
 - Sorted sediments under waves and currents (e.g. Lund-CIRP)
- Database being compiled
- Lab experiments
- Work will benefit whole lab

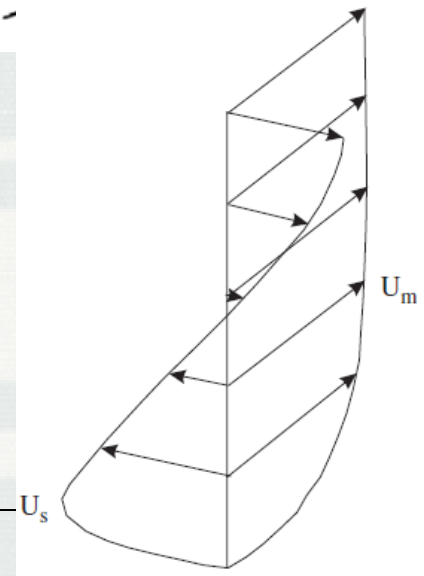
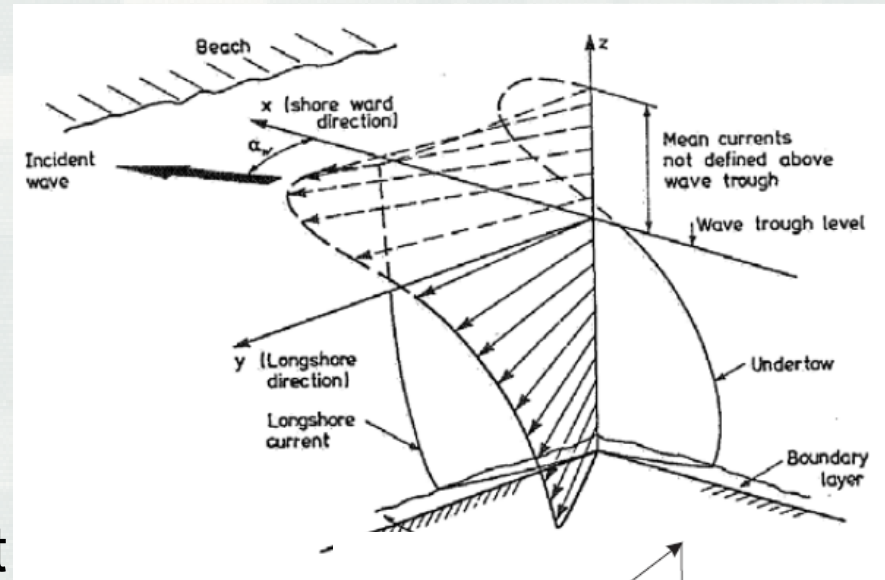


Bed load Transport Formula	% within factor of	
	2	5
Bailard and Inman (1981)	47	70
Dibajnia and Watanabe (1992)	41	72
Ribberink (1998)	32	52
Lund-CIRP (2007)	46	74
Wu et al. (2011)	55	86

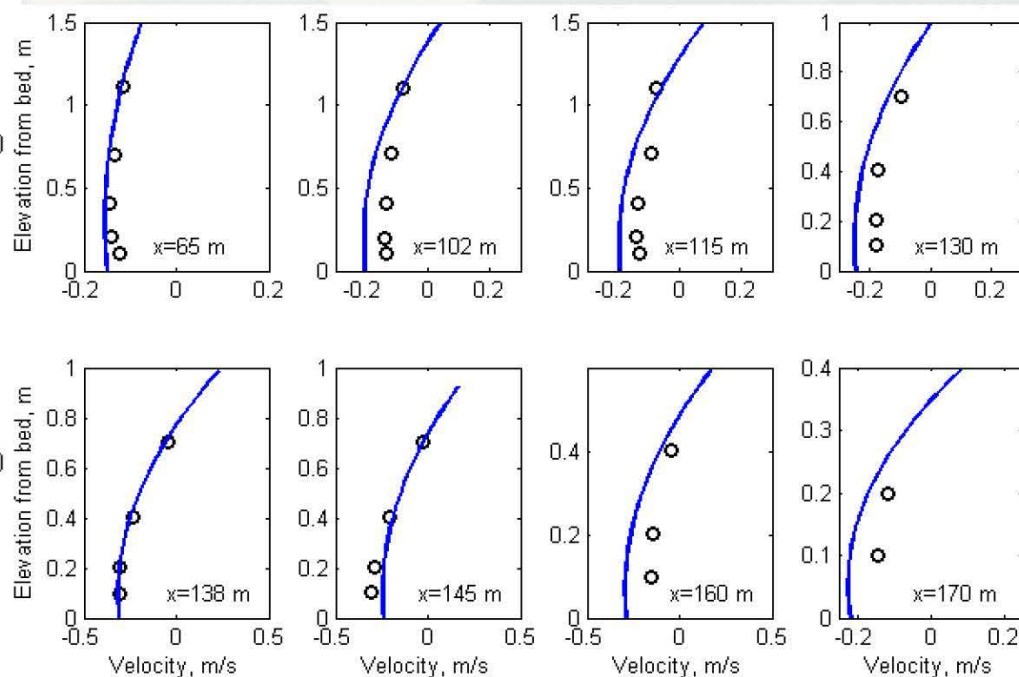
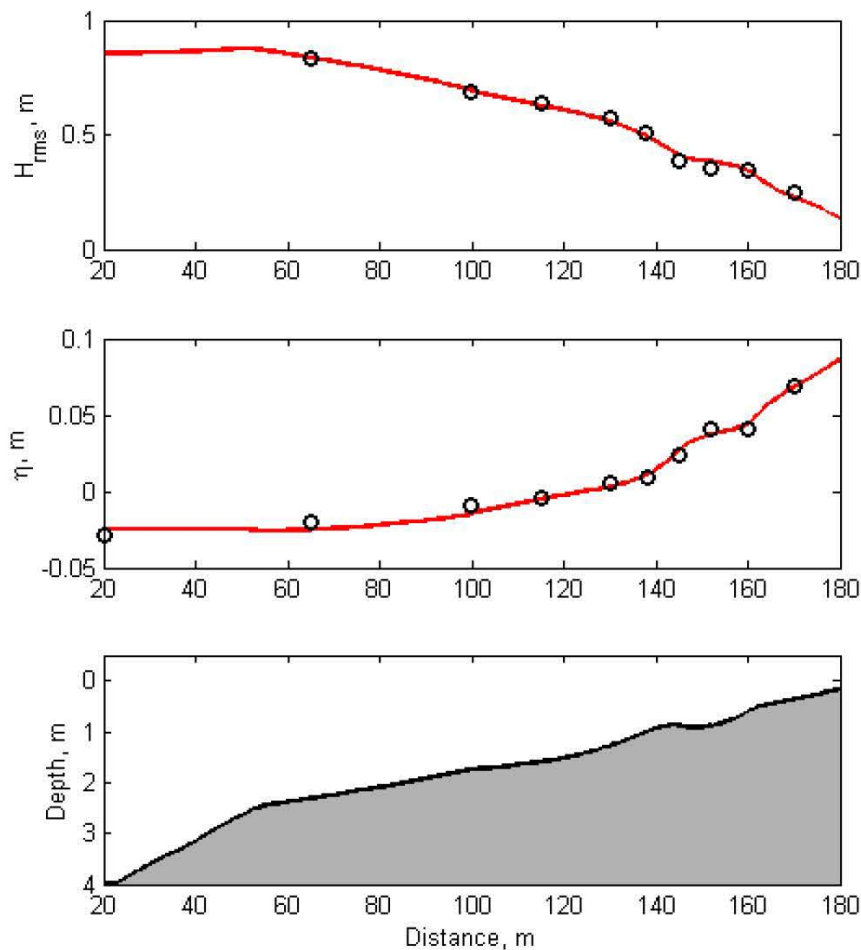
Suspended load Transport Formula	% within factor of	
	2	5
Bijker (1968)	23	52
Bailard (1968)	30	65
van Rijn (1989)	32	52
Lund-CIRP (2007)	33	65
Wu et al. (2011)	48	83

Quasi-3D Approach

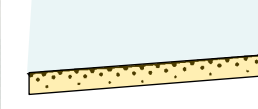
- Simulates vertical variation of horizontal velocities due to:
 - Wave and wind surface stress, bottom stress, helical flow, and Coriolis (geostrophic acceleration).
- Semi-analytical solution to vertical velocity profiles so that the dispersion and wave-current interaction terms can be calculated analytically without numerical integration - Very efficient

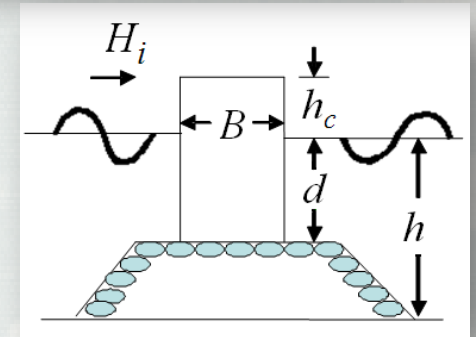
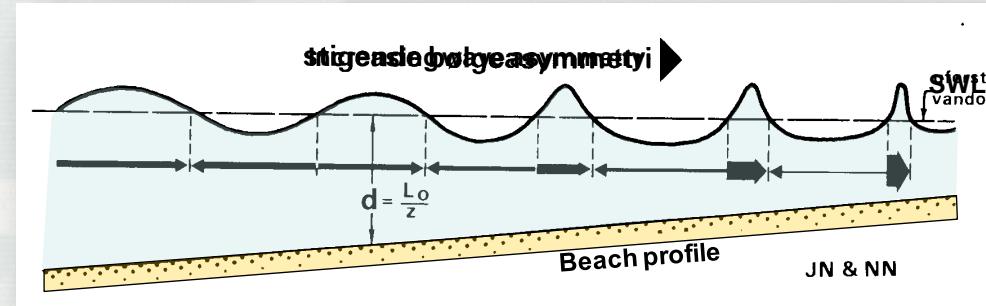


Quasi-3D Results: LIP 11D Test-1B



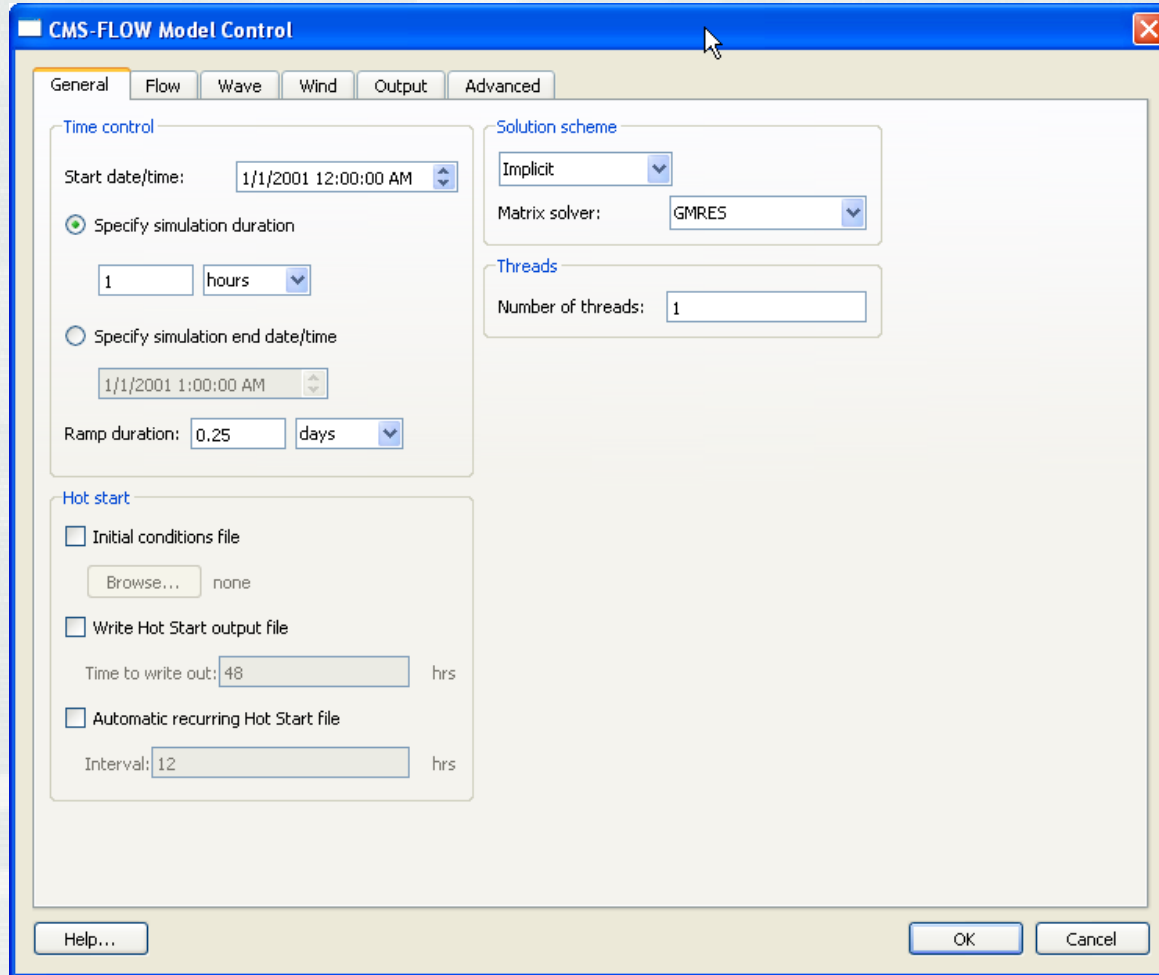
CMS-Wave

- Waves in swash zone
 - Wave calculations at complex structures
 - Coupling with Navy & NOAA operational models and buoys
 - Modeling jetty stone breaching/blowout
- 



SMS 11.1 Preview

- Grid smoothing for telescoping grids
- Improved time control
- Matrix solver
- Harmonic BC



CMS-FLOW Model Control

General Flow Wave Wind Output Advanced

Time control

Start date/time: 1/1/2001 12:00:00 AM

☒ Specify simulation duration

1 hours

☐ Specify simulation end date/time

1/1/2001 1:00:00 AM

Ramp duration: 0.25 days

Solution scheme

Implicit

Matrix solver: GMRES

Threads

Number of threads: 1

Hot start

☐ Initial conditions file

Browse... none

☐ Write Hot Start output file

Time to write out: 48 hrs

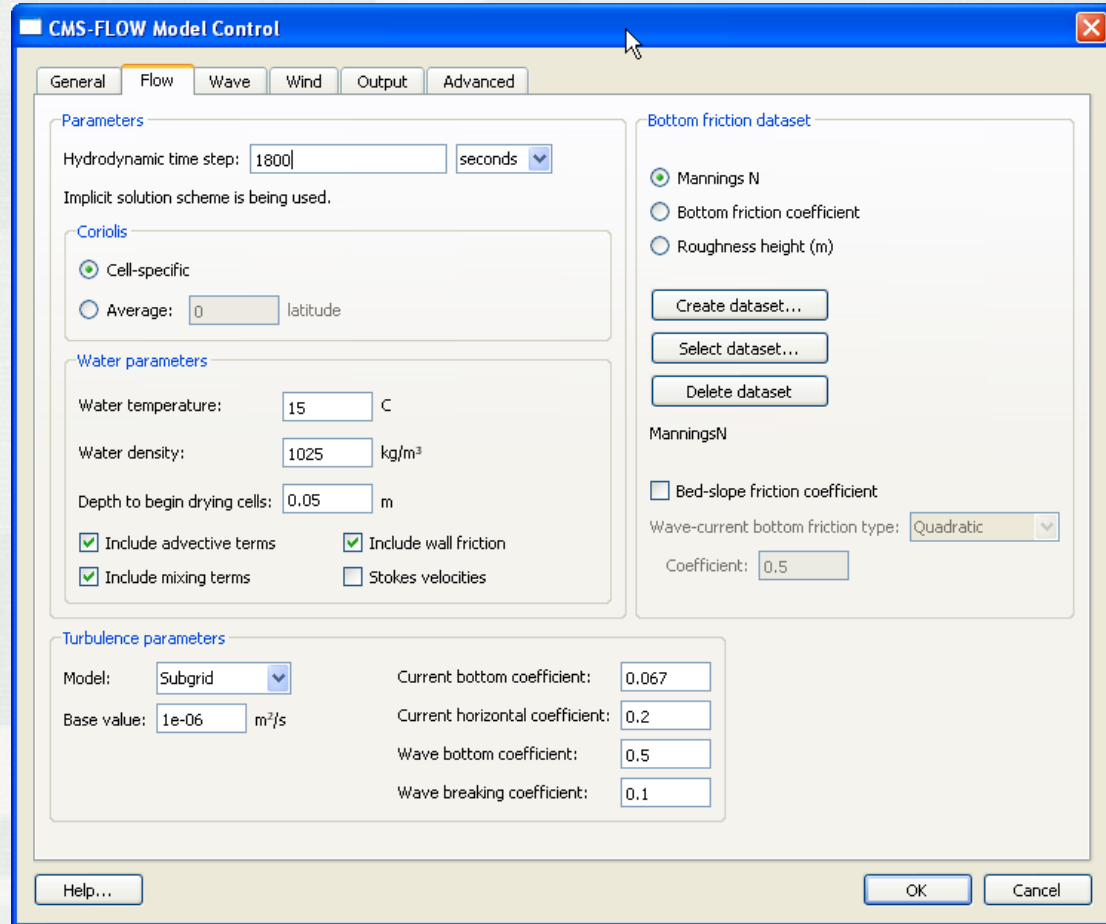
☐ Automatic recurring Hot Start file

Interval: 12 hrs

Help... OK Cancel

SMS 11.1 Flow Tab

- Wave flux velocity
 - Stokes velocity
 - Surface roller
- Turbulence options
 - Models and coefficients
- Bottom friction
 - Wave-current BBL
 - Bed-slope coefficient



CMS-FLOW Model Control

General | **Flow** | Wave | Wind | Output | Advanced

Parameters

Hydrodynamic time step: 1800 seconds

Implicit solution scheme is being used.

Coriolis

☒ Cell-specific

☐ Average: 0 latitude

Water parameters

Water temperature: 15 C

Water density: 1025 kg/m³

Depth to begin drying cells: 0.05 m

☒ Include advective terms ☒ Include wall friction

☒ Include mixing terms ☐ Stokes velocities

Bottom friction dataset

☒ Mannings N

☐ Bottom friction coefficient

☐ Roughness height (m)

Create dataset...

Select dataset...

Delete dataset

ManningsN

☐ Bed-slope friction coefficient

Wave-current bottom friction type: Quadratic

Coefficient: 0.5

Turbulence parameters

Model: Subgrid

Base value: 1e-06 m²/s

Current bottom coefficient: 0.067

Current horizontal coefficient: 0.2

Wave bottom coefficient: 0.5

Wave breaking coefficient: 0.1

Help... OK Cancel

SMS 11.1 Wind Tab

- Spatially variable winds
- Meteorological stations

CMS-FLOW Model Control

General Flow Wave **Wind** Output Advanced

Type: Meteorological stations

Meteorological stations

	Name	X (m)	Y (m)	Height (m)
1	Station 1	12312	46751	10
2	Station 2	78654	712961	10
3				

Parameters

Direction (deg.)

Wind from:

North = 0 deg. South = 180 deg.
East = 90 deg. West = 270 deg.

Import From File...

Anemometer height: 10 m

Velocity (m/s)

Curve undefined

Curve undefined

Help... OK Cancel

Output Tab for SMS 11.1

- Switches for individual variables in in groups
- Output groups split into separate files
- Statistics
- Compression
- ASCII files

CMS-FLOW Model Control

General Flow Wave Wind **Output** Advanced

Output times lists

List 1
List 2
List 3
List 4

Output times:

Start time (hrs)	Increment (hrs)	End time
0	0.5	1000

Delete

Statistical output

Group	Start time (hrs)	End time
<input checked="" type="checkbox"/> Hydrodynamics	0	24
<input checked="" type="checkbox"/> Sediment Transport	0	24
<input type="checkbox"/> Salinity	0	720

Output datasets

☒ 123 Water Surface Elevation List 1

☒ Velocity List 1

☒ Morphology List 1

☒ 123 Depth (through time)

☒ 123 Morphology Change

☒ Transport List 1

☒ 123 Sediment Total-Load Concentration

☒ 123 Sediment Total-Load Capacity

☒ 123 Fraction Suspended

☒ Total Sediment Transport

☒ 123 Salinity Concentration

☒ Waves List 1

☐ Wind List 1

☒ 123 Eddy Viscosity List 1

Output options

☐ Tecplot snap shot (*.dat) and history files (*.his)

☐ SMS Super ASCII files (*.sup, *.xy, *.dat)

☐ XMD file compression

Simulation label: Inlet_K5

Help... OK Cancel