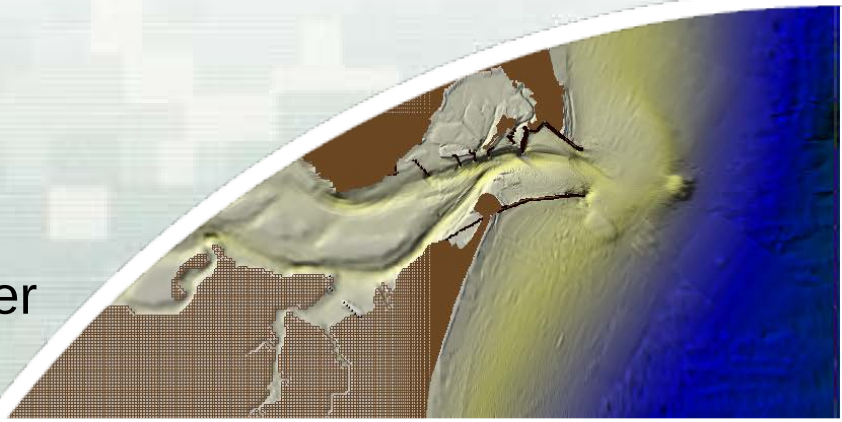
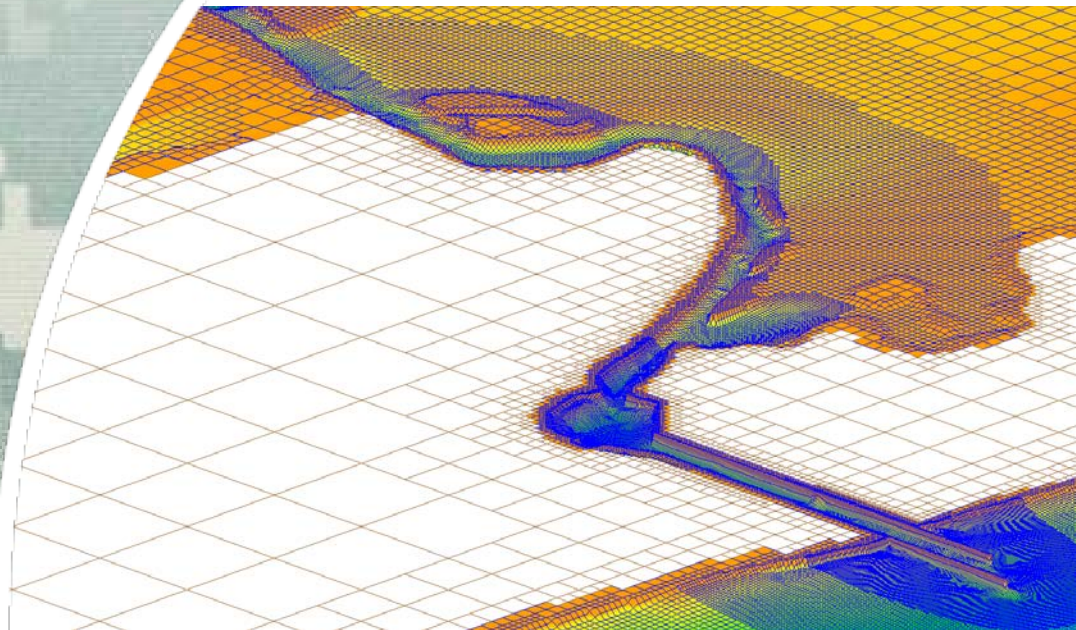
Coastal Modeling System

Advanced Topics

Alex Sánchez
Research Hydraulic Engineer
Coastal and Hydraulics Laboratory
Engineer Research and Development Center
June 22, 2012





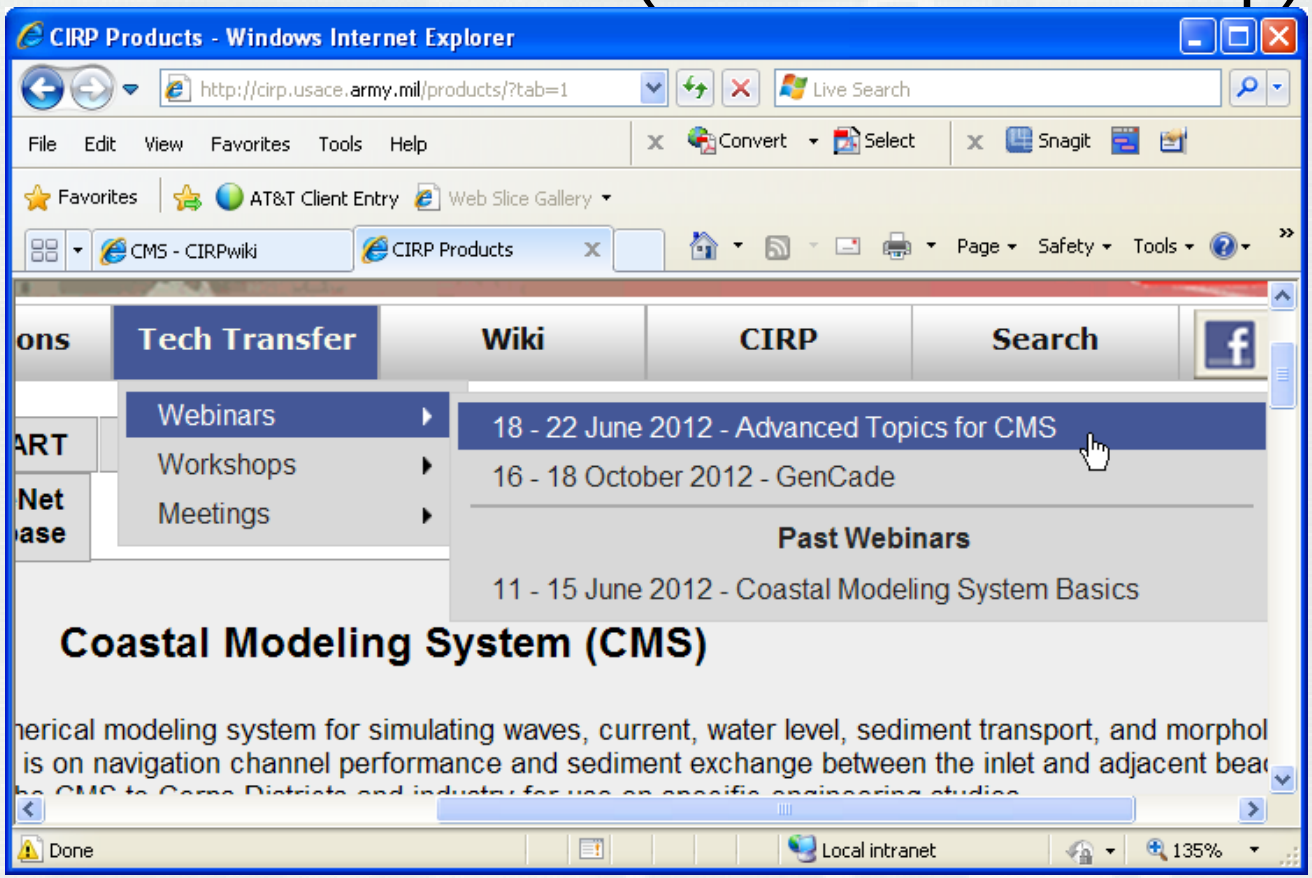
US Army Corps of Engineers
BUILDING STRONG®

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

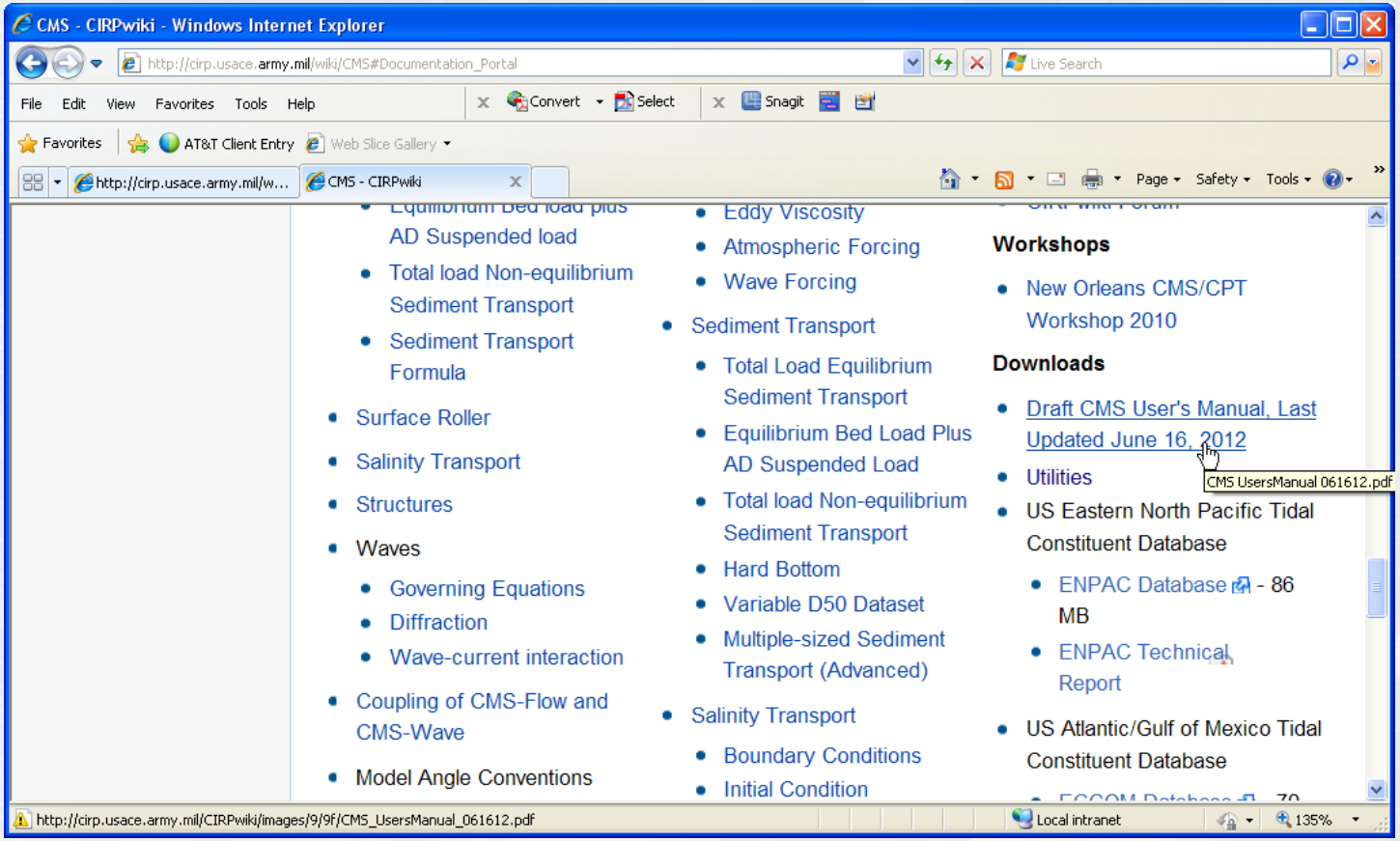
Webinar Material

- CMS-Flow data folder (same as workshop)



http://cirp.usace.army.mil/workshops/nap12/NAP-Workshop.html

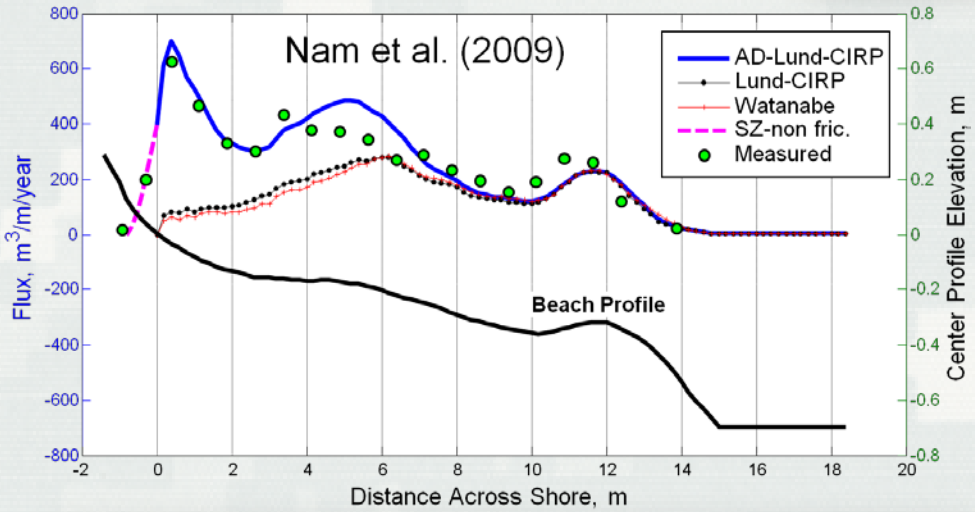
Draft CMS User Manual

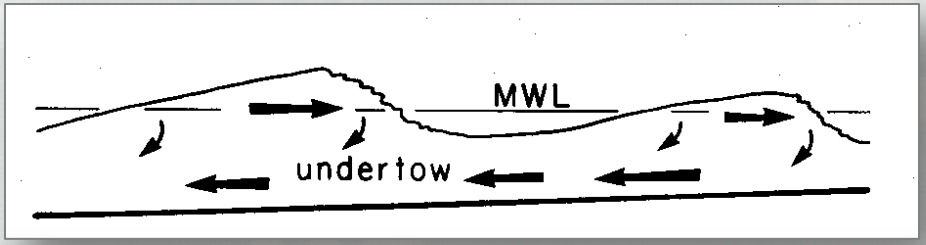


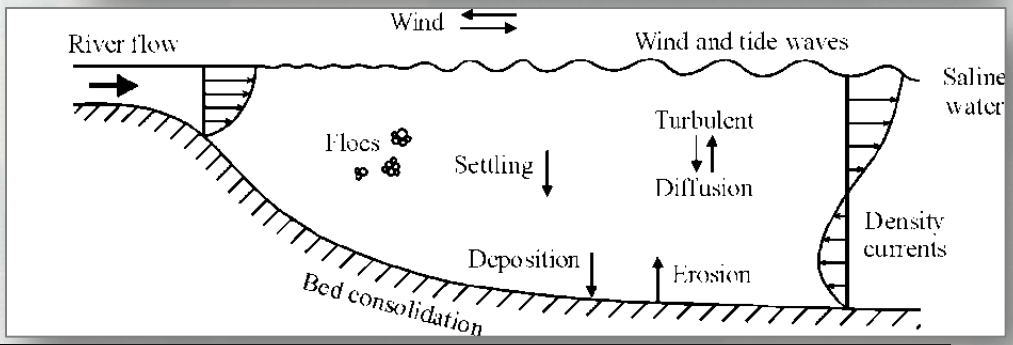
http://cirp.usace.army.mil/wiki/CMS

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

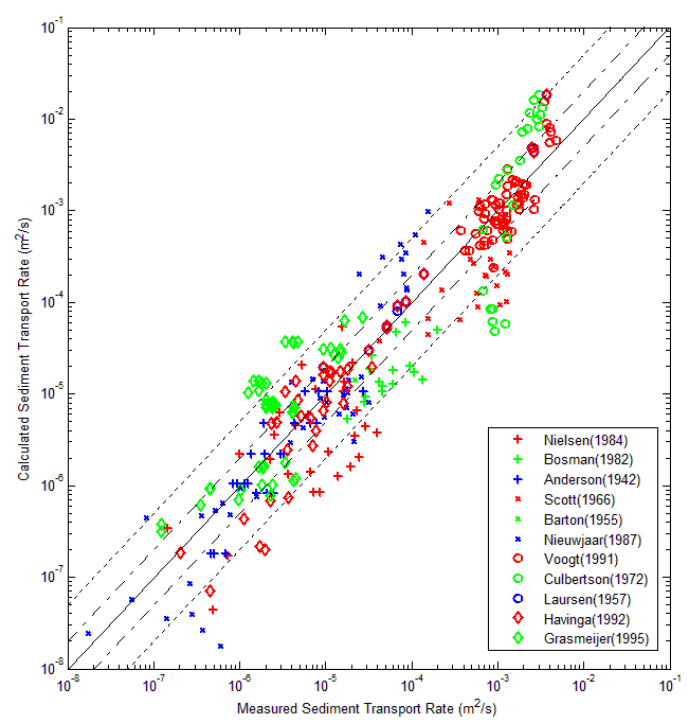






New Multiple-sized Sediment Transport Formula

- 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

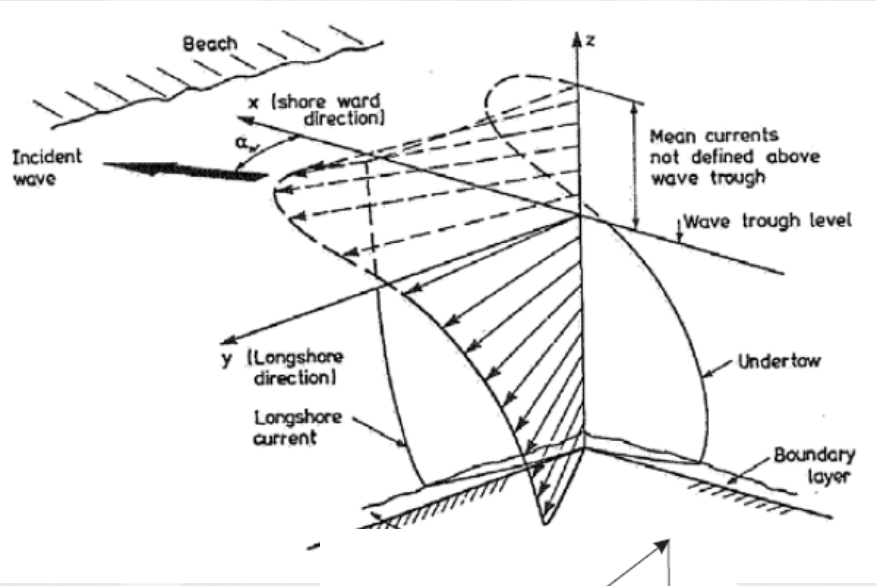


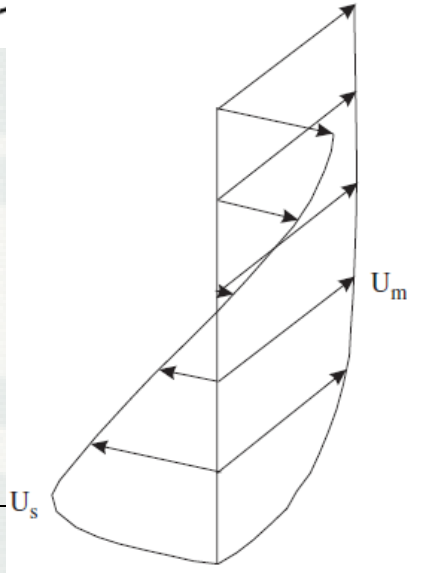
Bed load Transport Formula	% within factor of	
	2	5
Bailard and Inman (1981)	47	70
Dibajnia and Watanabe (1992)	41	72
Ribberink (1998)	32	52
Lund-CIRP (2007)	**46**	**74**
Wu et al. (2011)	**55**	**86**

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**

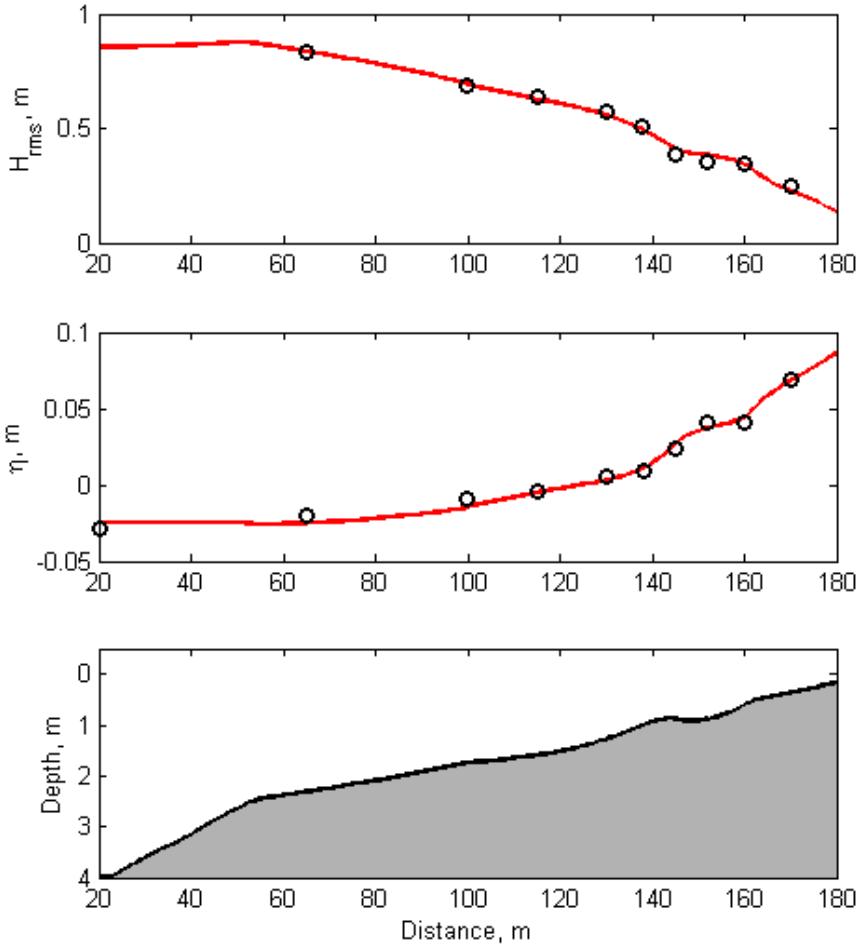
Quasi-3D Approach

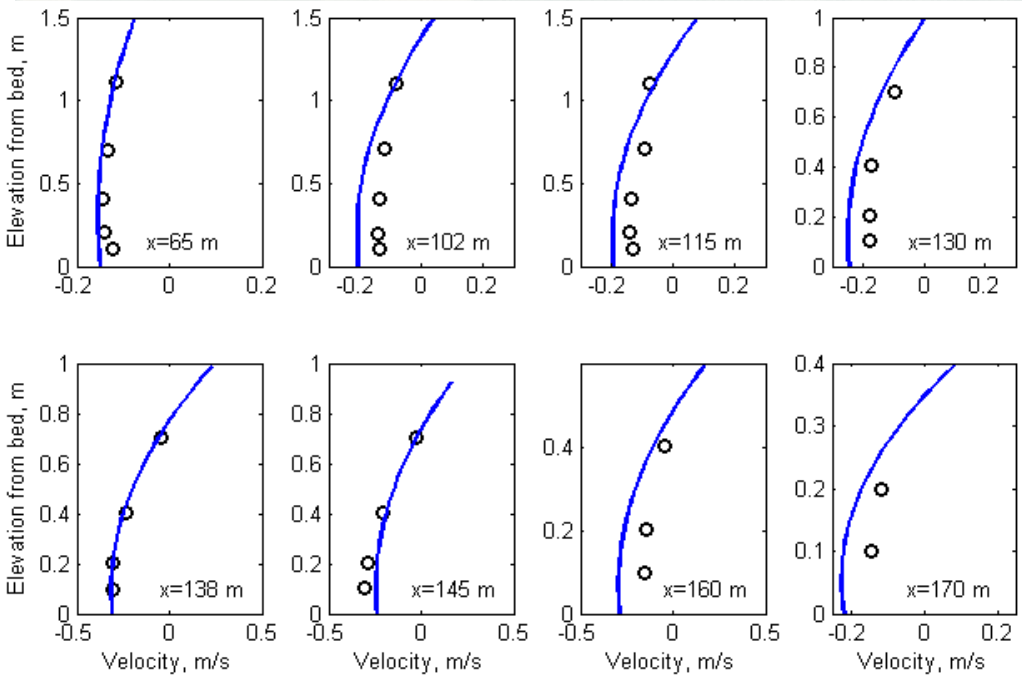
- Simulates vertical variation of horizontal velocities due to:
  - Wave and wind surface stress, bottom stress, helical flow, and Coriolis (geostrophic acceleration).
- Semi-analytical solution to vertical velocity profiles so that the dispersion and wave-current interaction terms can be calculated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





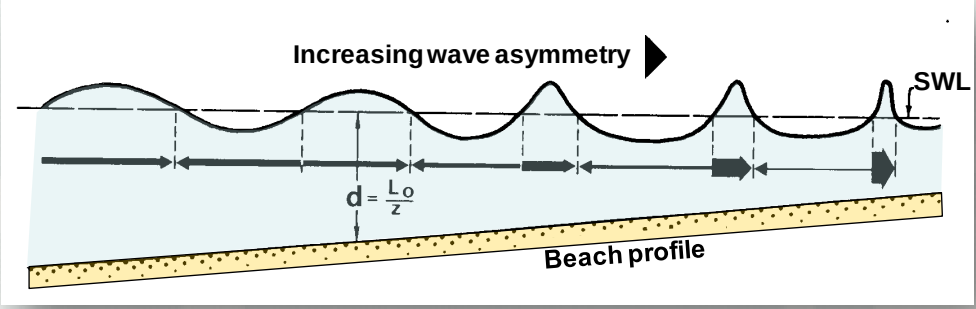
Quasi-3D Results: LIP 11D Test-1B



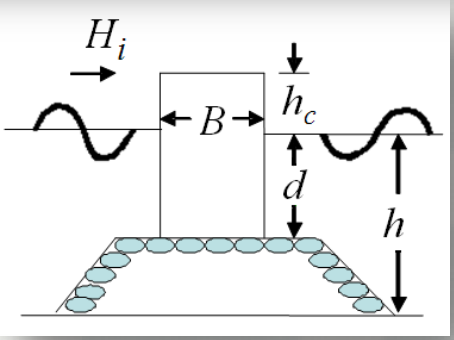


FY12 Planned Activities (cont.)

CMS-Wave



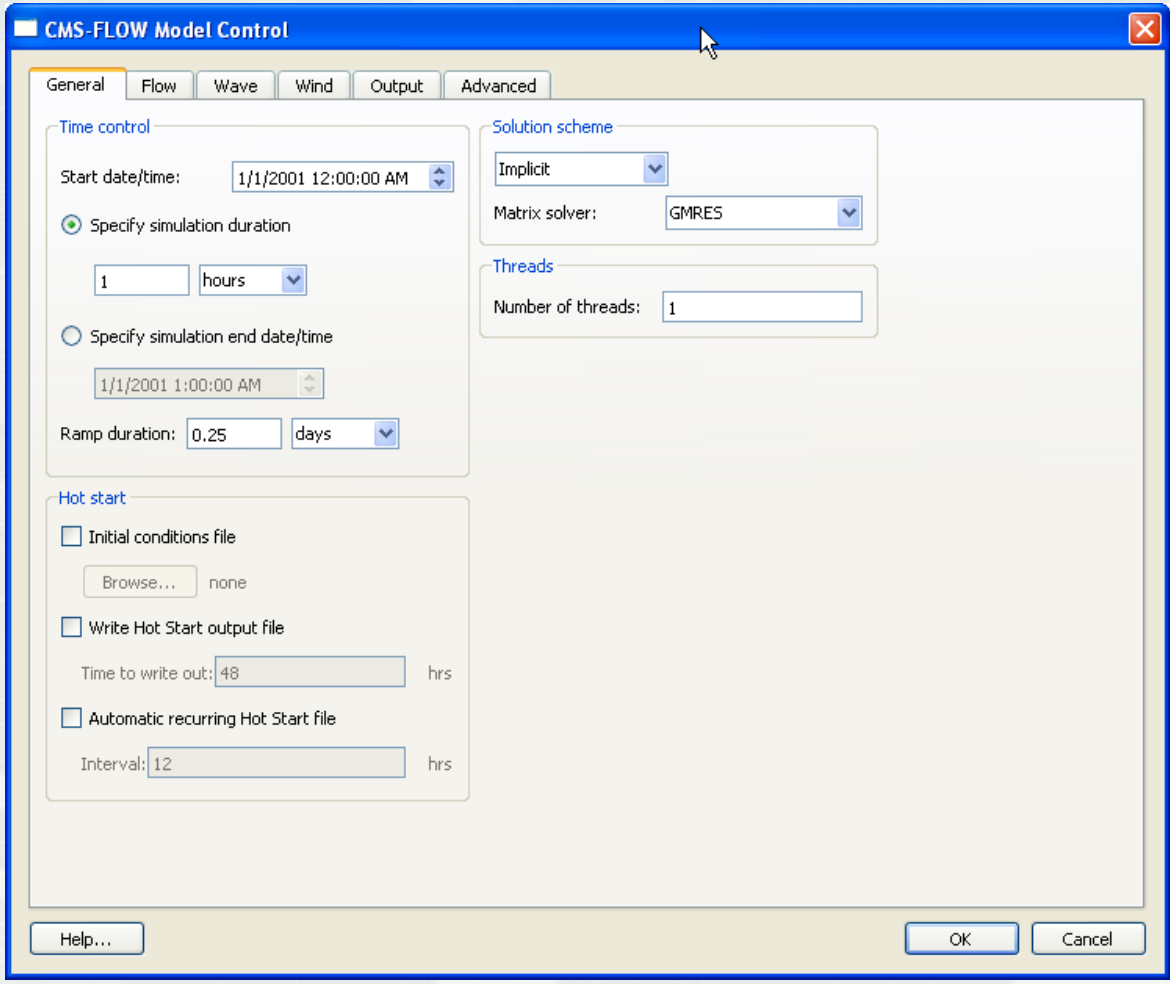
- Waves in swash zone
- Wave calculations at complex structures



- Coupling with Navy & NOAA operational models and buoys
- Modeling jetty stone breaching/blowout

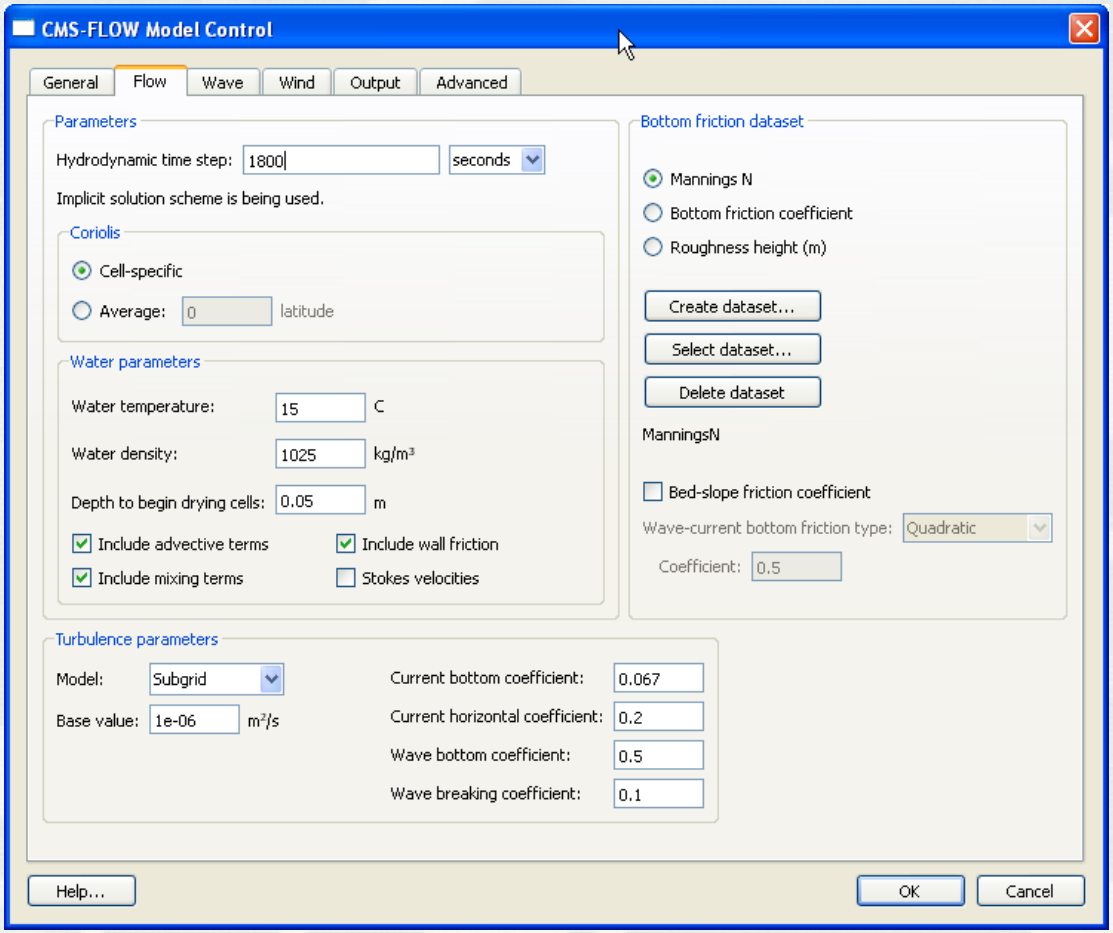
SMS 11.1 Preview

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



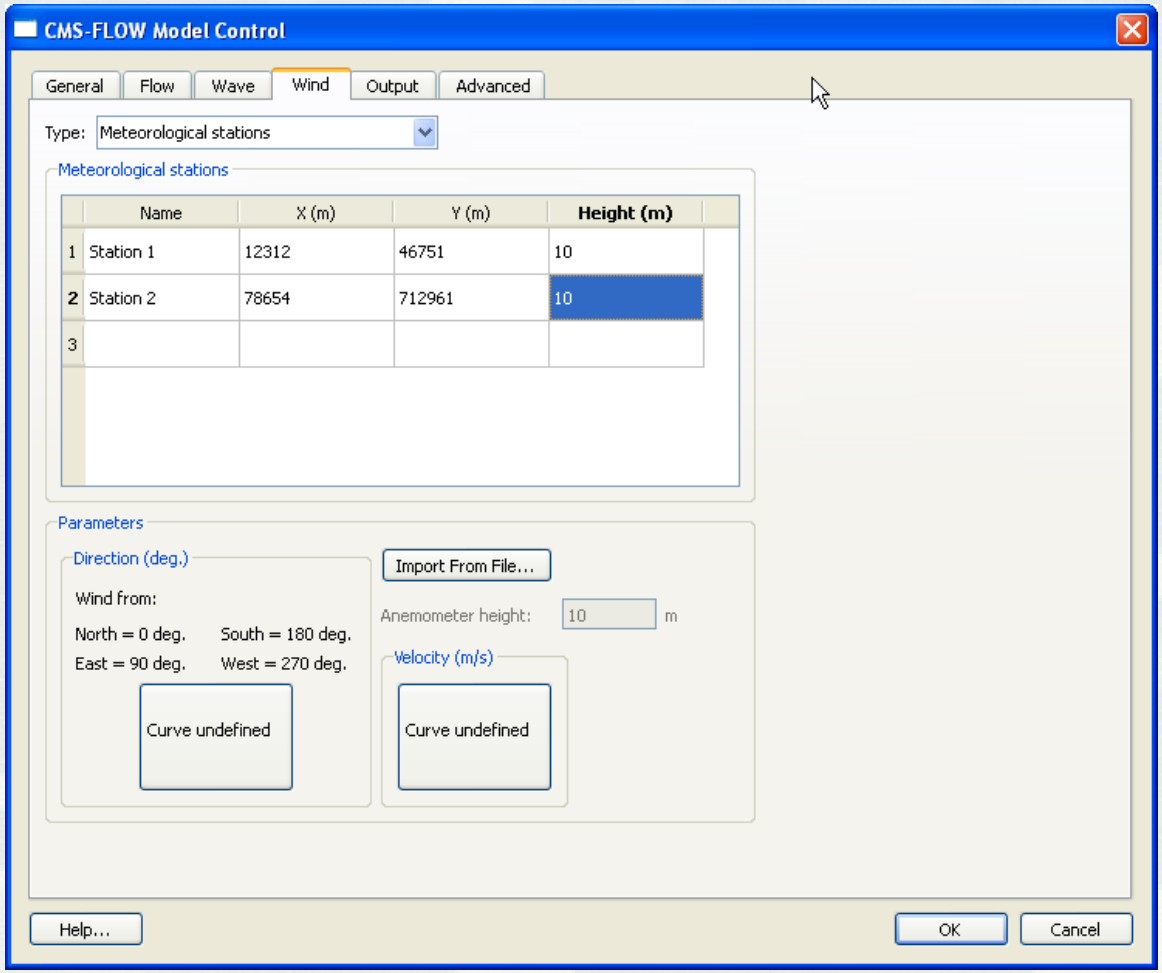
SMS 11.1 Flow Tab

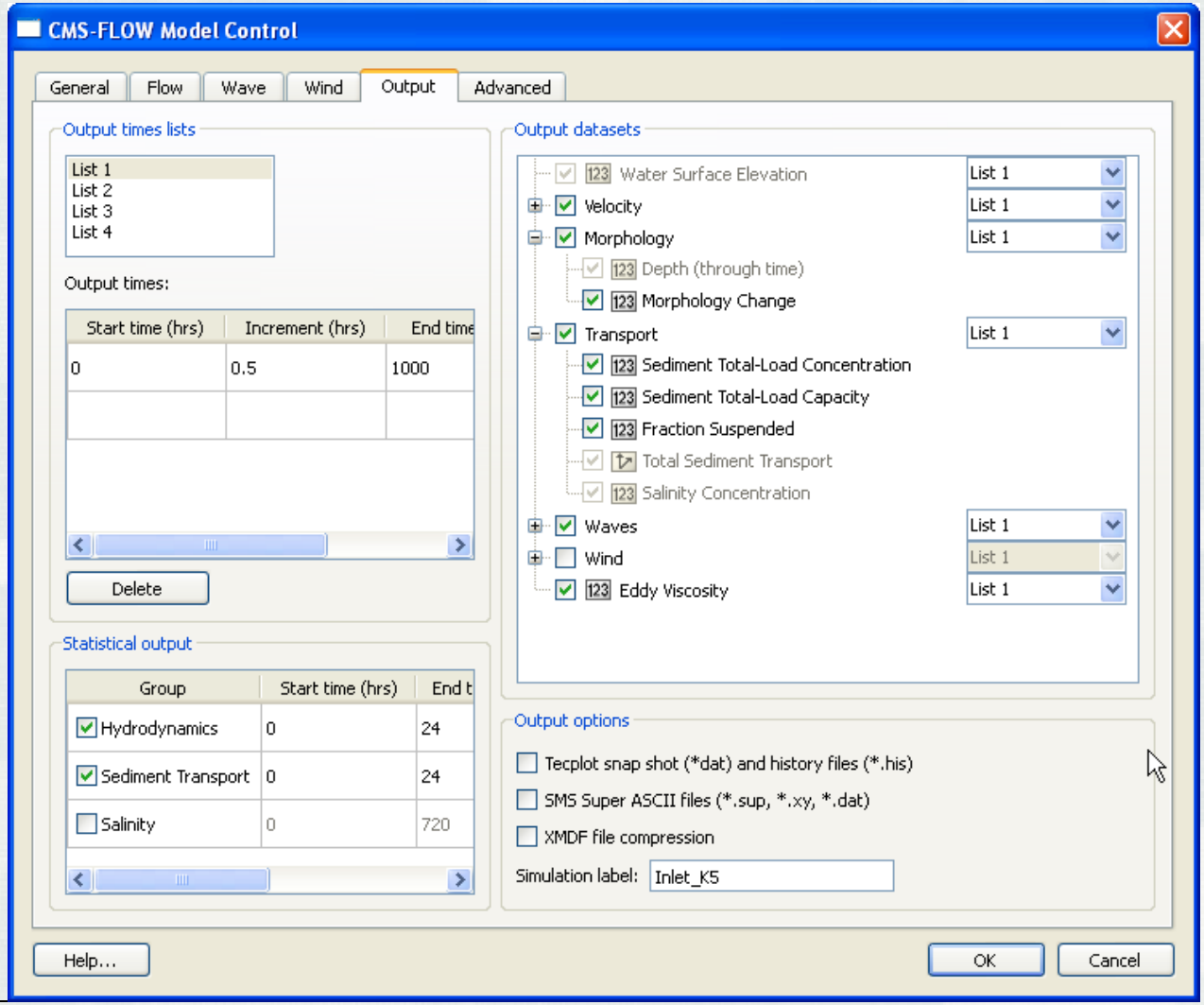
- Wave flux velocity
  - Stokes velocity
  - Surface roller
- Turbulence options
  - Models and coefficients
- Bottom friction
  - Wave-current BBL
  - Bed-slope coefficient



SMS 11.1 Wind Tab

- Spatially variable winds
- Meteorological stations



Output Tab for SMS 11.1

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