

What's Special about the CMS?



Julie Dean Rosati

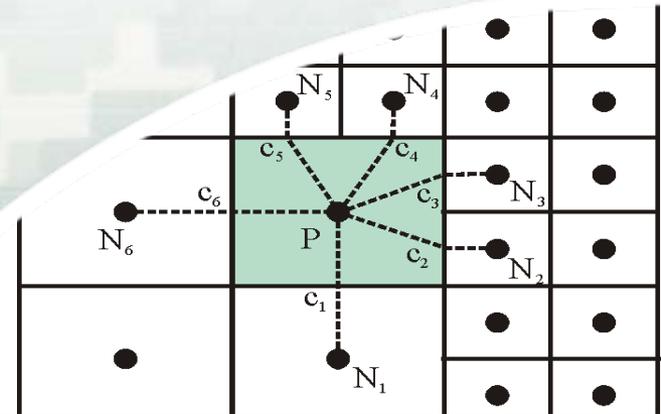
CIRP Program Manager

Nicholas C. Kraus

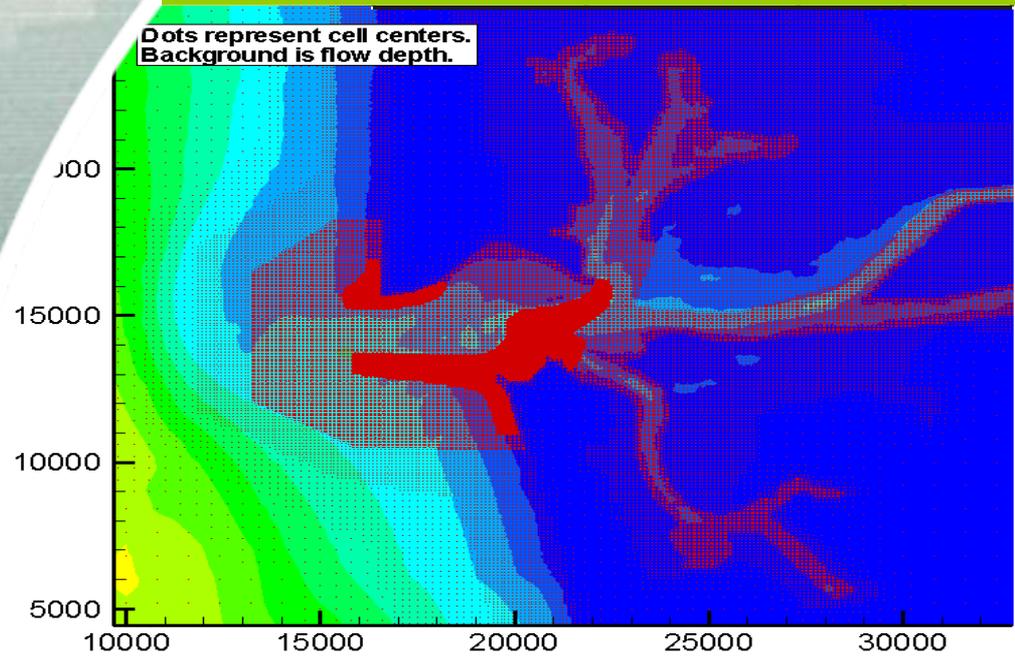
CIRP Assistant PM

ERDC, Coastal & Hydraulics Lab.

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Dots represent cell centers.
Background is flow depth.



US Army Corps of Engineers
BUILDING STRONG



Coastal Modeling System USACE Needs – Dictate Development



- Districts and Divisions need and want to do work in house.
- Districts supported by ERDC, consulting companies, and academia.
- Early CIRP decision to produce technology that **runs efficiently on PCs** (does not preclude porting to HPC).
- Support the **SMS interface** as integral part of **a System**.
- Must simulate **at least a dredging cycle** (6-12 months), and to **decades** and beyond, including storms, for calculating channel infilling and inlet morphology development.
- Fast code & multi-disciplinary team → **finite-volume method- FVM** (finite-differences), instead of finite-element method - FEM.
- **Meso-scale physics** as center.
- **System** → integrated & automated coupling of waves, flow, sediment transport, & morphology change.



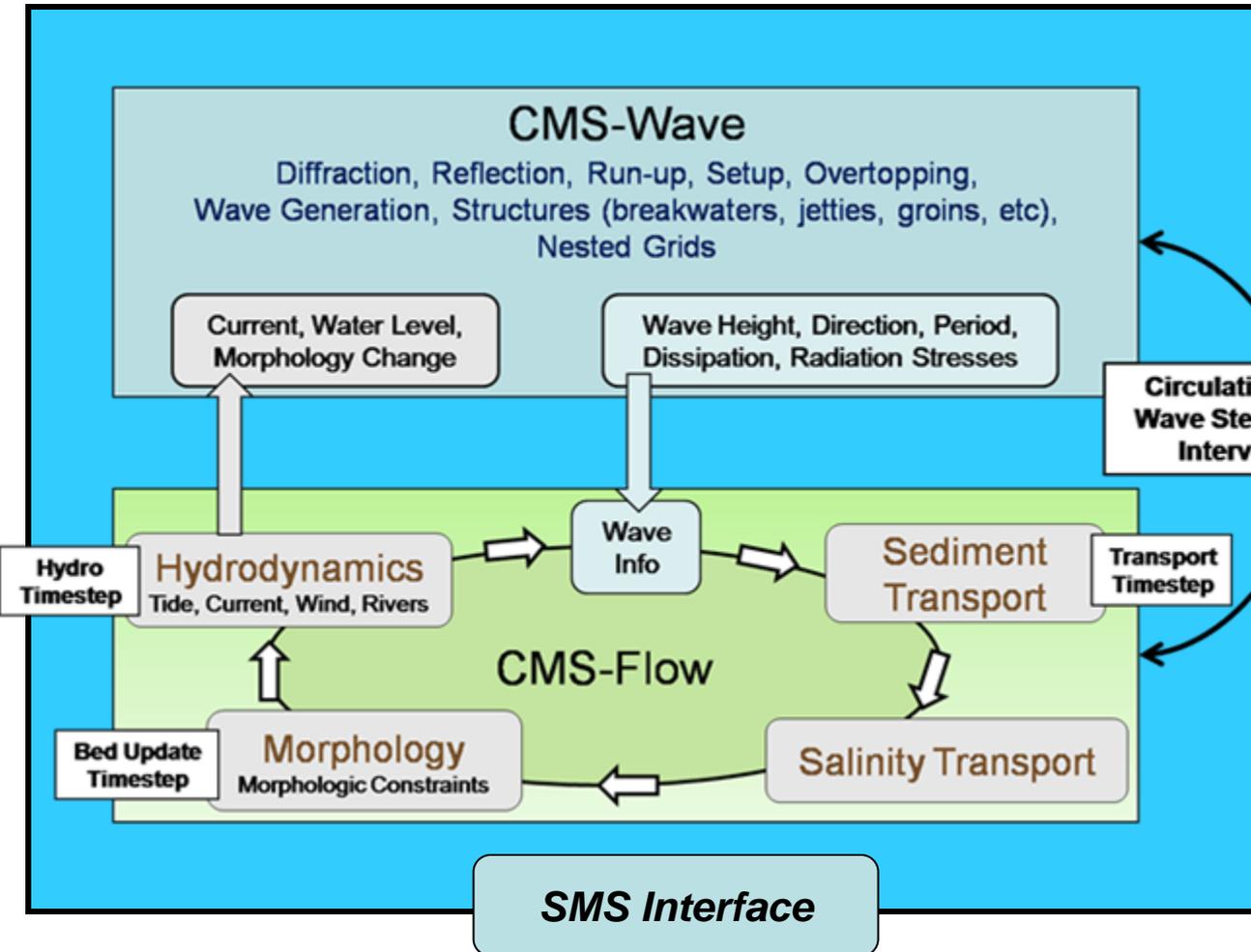
So, What's Special about the CMS?



- Top-down design for running by Districts and consultants.
 - PC as base platform (now benefitting from multi-core PCs)
 - Long-term simulations (years)
 - Cover navigation needs (channels, jetties, breakwaters)
- FVM possesses stability and conserves water volume locally (a problem for FEM codes).
- Rectangles allow much faster solvers than triangles (and most engineers prefer rectangles).
- CMS implicit solution code – fast (year-long simulation ~ 1 day simulation time).
- CMS explicit solution code – easy to program; can be ported to HPC.



CMS



Since 1997...

- 32 workshops
- Many coastal Districts run CMS independently

Advantages...

- Robust
- Conserves volume
- Physics-based
- Integrated system
- User-friendly
- Explicit and Implicit solvers



CMS Development Team

(large and growing)



- CHL – Tanya Beck, Mitch Brown, Honghai Li, Lihwa Lin, Alex Sanchez, Nick Kraus
- Lund Univ., Sweden – Magnus Larson, Hans Hanson
- URS Corp. – Chris Reed
- Univ. of Mississippi – Weiming Wu
- Univ. of South Florida – Ping Wang
- FIT – Gary Zarillo
- Japan – Hajime Mase, Nobu Ono
- Coastal Analysis – Adele Militello Buttolph
- Hunter College and NAN – Frank Buonaiuto



CMS – What's Special? Collaboration & Exciting Plans



1. Have achieved goal of practical multiple-year morphology change simulations on a PC (the CMS has been in operation since about 2002).
2. Sustained SMS support by CIRP lifts interface capabilities for all ERDC models.
3. PTM developed jointly with DOER Program, continuing.
4. CMS-Wave – many features for representing coastal structures and nearshore.
5. Models tested and advanced with collaboration of Corps Coastal Working Group, consultants, and academia.
6. CMS widely available; many people trained.
7. Implicit model fast. With telescoping grid, will eliminate need for most regional models or replace regional models.
8. Explicit model best for HPC applications.
9. Can start tackling difficult morphology problems such as shoreline change, fine resolution of sand bodies, and mixed sediment transport at inlets.



CMS – What's Special?

Thank you very much!



**Overtopping Galveston Seawall
Hurricane Ike, September 2008**



**Shark River Inlet, NJ
Formation of new ebb shoal,
December 2008 NAN survey**

Discussion and Questions