

# NOAA Office of Coast Survey Coastal Ocean Modeling R&D and operational implementations

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and ...*



NOAA SCHISM WORKSHOP AND BOOT CAMP 2021  
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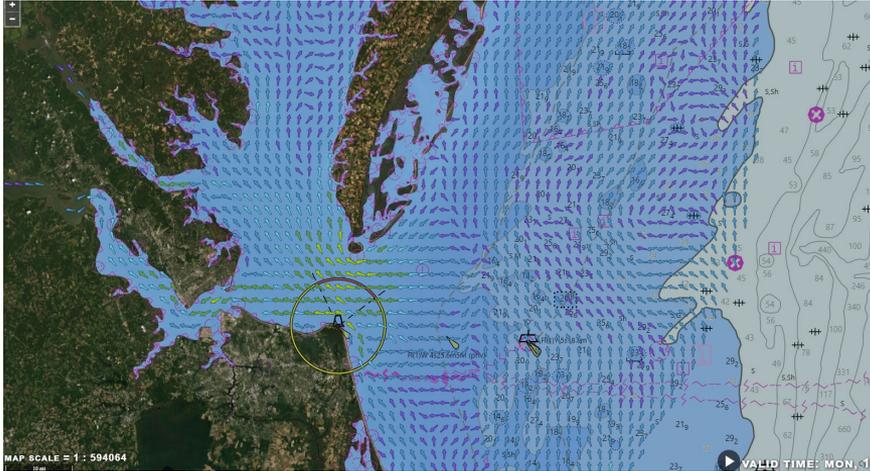
# Disaster mitigation and coastal resiliency



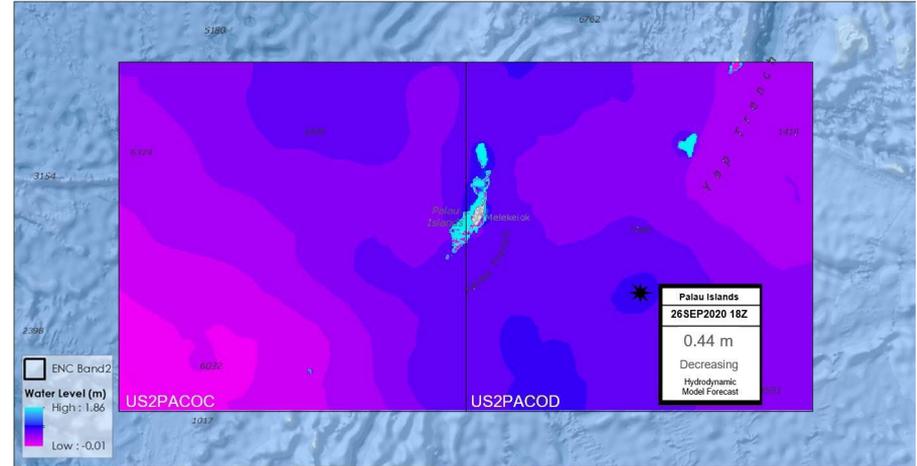
Aerial imagery of inland-coastal flooding during **Hurricane Harvey**, 2017 in Houston, TX.

Credit: [NOAA Remote Sensing Division](#)

# Safe and precise navigation



Surface current (S-111) product provided to support Navigation from current NOAA Operational Forecast System at the Chesapeake Bay ([Precision Navigation Data Gateway](#)).



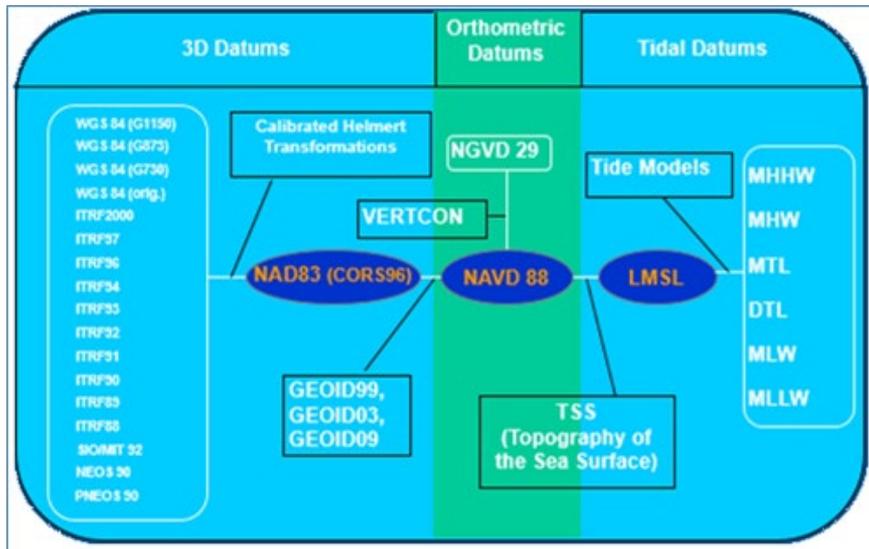
Water level (S-104) products on ENC Band 2 tiles for Palau in Pacific Ocean based on G-ESTOFS modeling results.

# Vertical datum transformation(Vdatum)



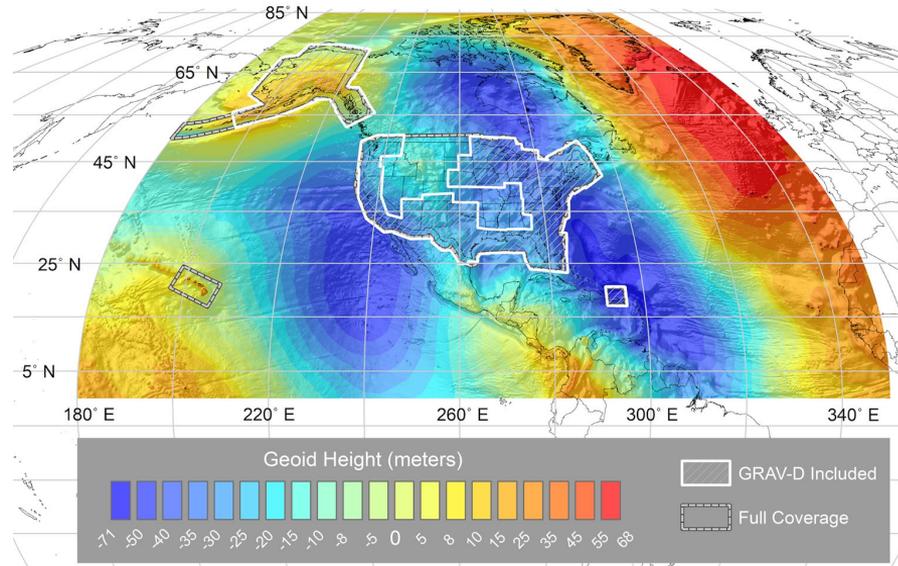
Collaboration between OCS, NGS, and CO-OPS

Models and data are used to develop vertical datum transformations



Using xGeoid where available  
 Working towards global transformations as well  
 Correcting to current Local Mean Sea Levels

Experimental Geoid 2020 (xGEOID20)



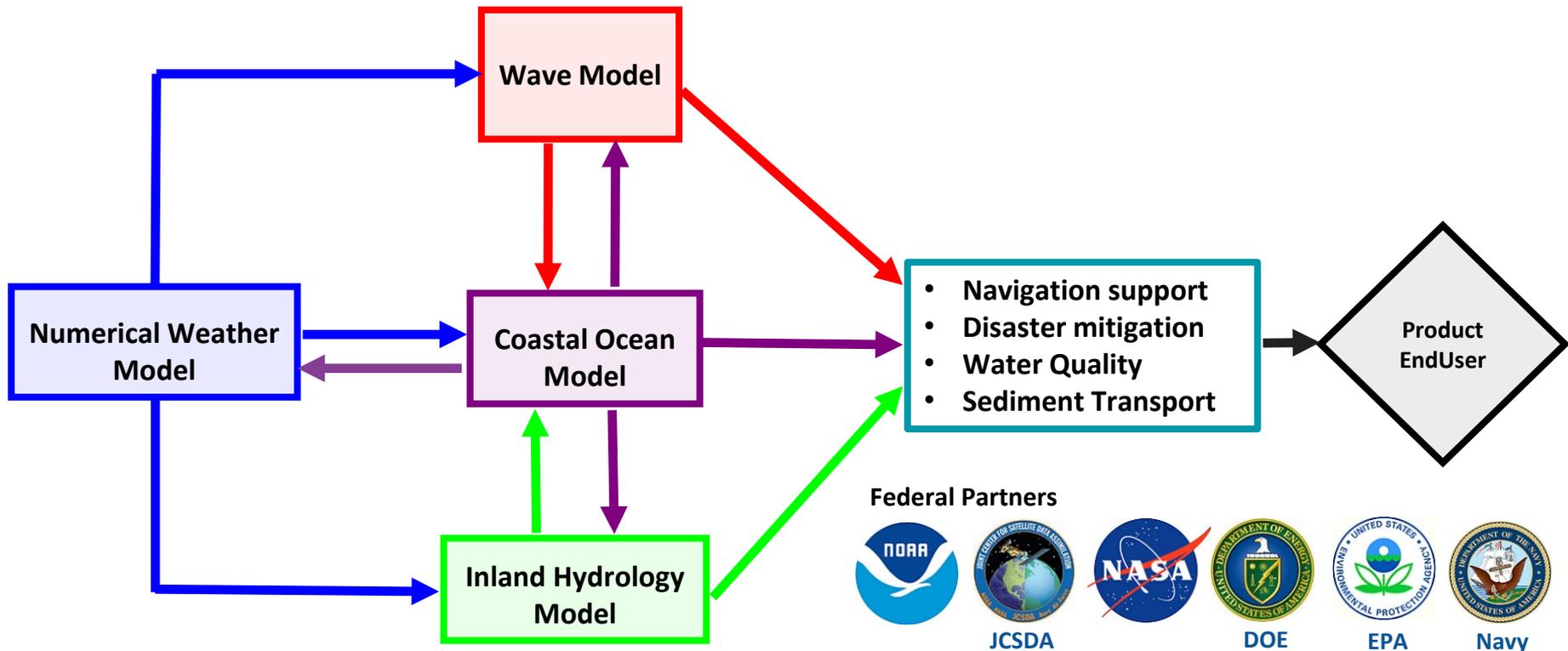
xGeoid 2020 and connection to Vdatum

<https://beta.ngs.noaa.gov/GEOID/xGEOID20/>

All model configurations and results are pre-decisional and for official use only.

# Coastal ocean models coupling framework

- Unified Forecast System



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# NOS' next generation coastal model

- National (i.e. basin) scale **coverage**
- Adaptive, flexible and high fidelity **resolution** (2km~25m)
- Advanced numerical and computational technology to ensure optimal **performance**
- Seamlessly switch between 2D and 3D modes (based on End User need)
- Architecture agnostic (**HPC and cloud support**)
- Resolve shelf, nearshore and estuarine physics (waves, inland hydrology, Sea ice, ..)
- UFS/NEMS compliance
- Efficient I/O
- **Community support**



# NOS Storm Surge Modeling Team: Products and services

## **Operational**

- Global Extratropical Surge and Tide Operational Forecast System (GESTOFS)

## **Pre-operational**

- Inland-Coastal Flooding Operational Guidance System (ICOGS)

## **Upgrade / Research and development**

- Hurricane Storm Surge On-Demand Forecast System (HSOFS)
- COASTAL Act: Name Storm Event Model (NSEM)
- Enhancing Northern Pacific Ocean Modeling capabilities in Support of Disaster Prevention and Safe Navigation



# SCHISM based: Inland-Coastal Flooding Operational Guidance System (ICOGS)

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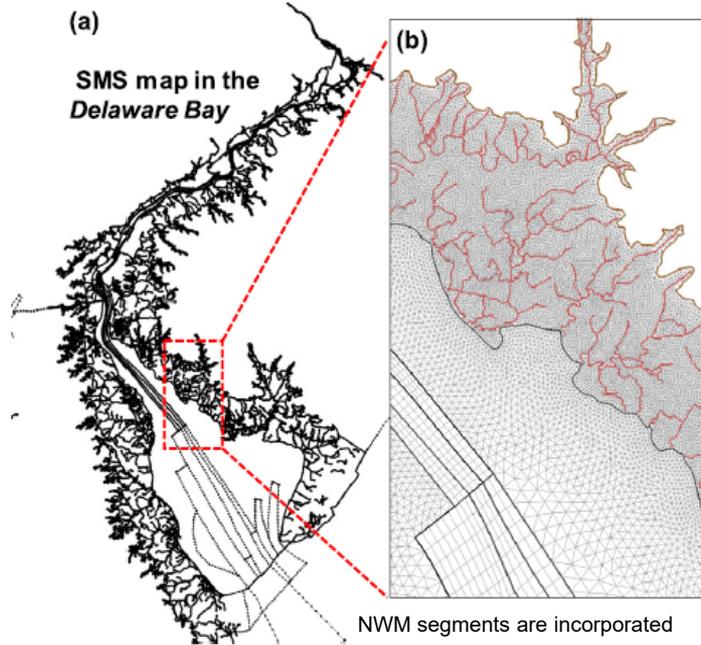
# Inland-Coastal Flooding Operational Guidance System (ICOGS)

The world's first flexible inland-coastal flood modeling system

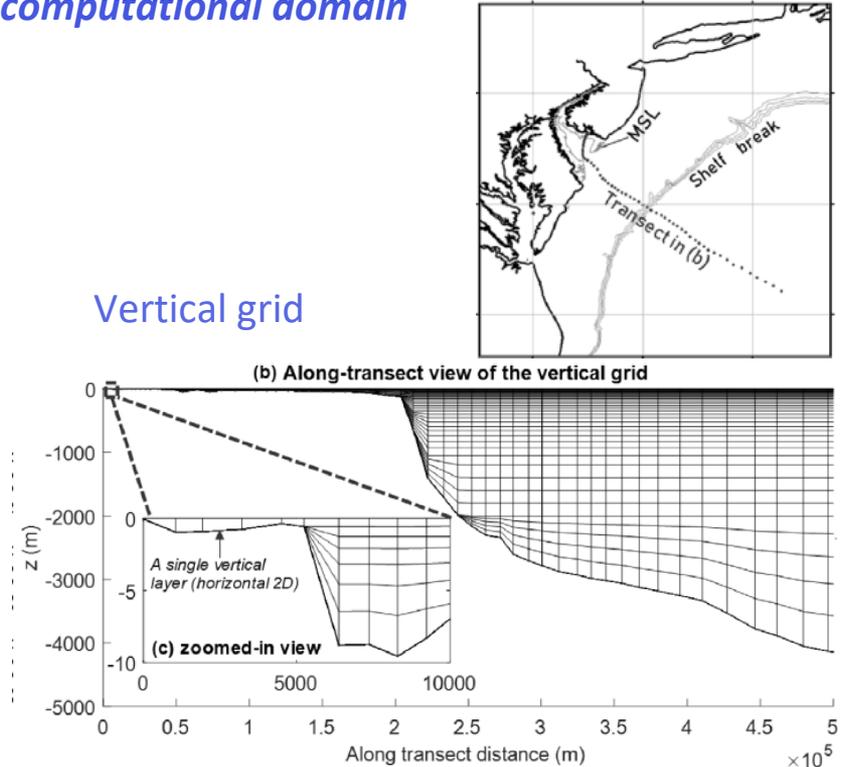


## Optimized design for SCHISM computational domain

### Horizontal mesh



### Vertical grid





# ICOGS to Support Precise Navigation and Coastal Resilience

## Lower Mississippi at New Orleans





# Summary and outlook

- Established a 2D/3D model engine to support coastal resilience and precise navigation
- Pre-operational testing Inland-Coastal Flooding Operational Guidance System (**ICOGS**):
  - Once a day 3D guidance for Navigation support
  - Four times a day on-demand 2D modeling guidance for disaster mitigation
- To enable cloud infrastructure for preparation, computation, model-data comparison and model result visualization

All model configurations and results are pre-decisional and for official use only.



# Thanks for your attention!



# References:

Y. Zhang, F. Ye, H. Yu, W. Sun, S. Moghimi , E. Myers and others. Simulating compound flooding events in a hurricane. *Ocean Dynamics* , 2020, 101526, doi: [doi.org/10.1007/s10236-020-01351-x](https://doi.org/10.1007/s10236-020-01351-x).

F. Ye, Y. Zhang, H. Yu, W. Sun, S. Moghimi , E. Myers, K. Nunez, R. Zhang, H. Wang, A. Roland and others. Simulating storm surge and compound flooding events with a creek-to-ocean model: importance of baroclinic effects. *Ocean Modelling*, 2020, 101526, doi: [doi.org/10.1016/j.ocemod.2019.101526](https://doi.org/10.1016/j.ocemod.2019.101526).

W. Huang, F. Ye, Y. Zhang, K. Park, J. Du, S. Moghimi, E. Myers, S. Pe'eri, J. Calzada, H.C Yu, K. Nunez, and Z. Liu. Compounding factors for extreme flooding around Galveston Bay during Hurricane Harvey, (2021), *Ocean Modelling*, 158, 101735. doi: [doi.org/10.1016/j.ocemod.2020.101735](https://doi.org/10.1016/j.ocemod.2020.101735)

F. Ye, W. Huang, Y. Zhang, S. Moghimi, E. Myers, S. Pe'eri, and H. Yu. A cross-scale study for compound flooding processes during Hurricane Florence, (submitted), *Natural Hazards and Earth System Sciences*.

Moghimi, S., A. Van der Westhuysen, A. Abdolali, E. Myers, S. Vinogradov, Z. Ma, F. Liu, A. Mehra, N. Kurkowski. Development of an ESMF Based Flexible Coupling Application of ADCIRC and WAVEWATCH III for High Fidelity Coastal Inundation Studies. *J. Mar. Sci. Eng.* 2020, 8, 308. <https://doi.org/10.3390/jmse8050308>

Moghimi, S., S. Vinogradov, E. Myers, Y. Funakoshi, A.J. Van der Westhuysen, A. Abdolali, Z. Ma, F. Liu. Development of a Flexible Coupling Interface for ADCIRC Model for Coastal Inundation Studies. NOAA technical memorandum, NOS CS 41, 2019, doi: [doi.org/10.25923/akzckc14](https://doi.org/10.25923/akzckc14).