



US Army Corps  
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## Flood&Coastal Storm Damage Reduction R&D Program

# MOdeling Relevant PHysics Of Systems for Estimating Risk (MORPHOS)

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- Description** MORPHOS is a physics-based modeling capability for tropical and extra-tropical storm risk assessment. Its goal is to more rigorously represent the underlying physical processes and reduce dependence on empirical tuning factors. To facilitate model development, focused research is performed as needed on key physical processes. The MORPHOS spiral development strategy provides for the development of an integrated suite of tools for a wide range of coastal engineering needs. The models developed can be applied: “stand-alone,” being forced with specified boundary conditions from measurements or some other readily available source; as an integrated system on a desktop PC; or as an integrated system on high-performance computing assets. The model or system applied is dependent on the scope of the project.
- Benefits** The integrated suite of tools will incorporate improved objective estimates of winds, waves, currents and water levels, and coastal response (erosion, breaching, and accretion) during extreme events, without having to adjust or tune coefficients to produce realistic results. Most existing modeling systems focus on developing effective empirical tuning methods for optimizing calibration. This works well for operational systems but does not address the critical needs for advancing modeling technology, reducing the need for empirical factors, and developing models that are more generally applicable and required for risk assessment. MORPHOS provides for a robust, standardized approach to establishing the risk of coastal communities to future occurrences of storm events.
- Status** Capabilities being developed under MORPHOS include improvements to the wind and pressure field estimation for hurricanes; the development of a new Time-Stepping WAVE model (TSWAVE), which includes advancing nearshore wave modeling technology to include consistently-scaled spectral source terms that operate equally well in deep or shallow water; improved morphology change prediction capabilities with the CHL 2D (horizontal) steady-state nearSHORE morphology response model (C2SHORE); a test bed environment for the assessment of model performance against both known standards and challenging real-world scenarios; and the advancement of the estimation of hurricane risk factors which will include consideration of climate variation effects.

**Available Support**

MORPHOS supports the U.S. Army Corps of Engineers Districts and Divisions through the development of cutting-edge products. Consulting firms and individual engineers or scientists contracted by the Districts and Divisions are providing services to our primary customer base and will also apply MORPHOS tools. The model or system applied is dependent on the budget and scope of the project. For instance, a local project may be able to be accomplished by a typical engineer user on a desktop while a regional application would require High Performance Computer resources and a more sophisticated user. MORPHOS capabilities can also be applied to develop large databases and information systems that will serve as national assets and accessed by the professional community to assist in problem solving and project design for the benefit of society.

**Application**

The MORPHOS team has participated in and MORPHOS tools applied for the Hurricane Katrina Interagency Performance Evaluation Task Force (IPET), the Louisiana Coastal Protection and Restoration (LACPR) Program, the Mississippi Coastal Improvement Program (MSCIP), the North Carolina Floodplain Mapping Program (NCFMP), and the Federal Emergency Management Agency (FEMA) flood map applications for Regions III, IV, and VI.

**Point of Contact**

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For more information go to: <http://www.frf.usace.army.mil/morphos>.