Science behind the Sea Level Affecting Marshes Model (SLAMM)

The Sea Level Affecting Marshes Model (SLAMM) is geoenabled by data available over the Internet:

- National Wetland Inventory (NWI) Wetlands Data – FWS
- Dike locations primarily from NWI maps – FWS
- Tide ranges – NOAA
- Historic relative sea level rise -NOAA
- NAVD-MTL correction using VDATUM software -NOAA
- Digital elevation models and LiDAR - USGS
- LiDAR – Digital Coast and Misc. Sources
- Projected eustatic sea-level rise – IPCC
- Landuse, Landcover and impervious surface -MRLC and NOAA C-Cap
- LiDAR – Digital Coast and Misc. Sources
- National Wildlife Refuges- FWS

Other input data

Accretion and erosion data are typically found through a literature search, as there is no existing repository for either of those parameters.

Overwash data are currently calculated using historical hurricane track data. The frequency is determined by the number of class 3 and above hurricanes that have crossed near or within the study area in the last 100 years.

Primary Processes modeled

Sea Level Affecting Marshes Model (SLAMM) simulations include five primary processes that affect wetland fate under different scenarios of sea level rise:

- **Inundation**: The rise of water levels and the salt boundary is tracked by reducing elevations of each cell as sea levels rise, thus keeping MTL (Mean Tide Level) constant at zero. The effects on each cell are calculated based on the minimum elevation and slope of that cell. In the rare case where accretion or sedimentation exceeds sea level rise, aggradation is possible.

- **Erosion**: Erosion is triggered based on a threshold of maximum fetch and the proximity of the wetland to estuarine water or open ocean. When these conditions are met, horizontal erosion occurs at a rate based on site specific parameters.

- **Overwash**: Barrier islands of under 500 meter width are assumed to undergo overwash during each 25 year time-step due to storms encountered. Beach migration and transport of sediments are calculated.

- **Saturation**: Coastal swamps and fresh marshes can migrate onto adjacent uplands as a response of the water table to rising sea level close to the coast.

- **Salinity**: In a defined estuary, salt marsh, brackish marsh, and tidal fresh marsh can migrate based on changes in salinity, using a geographically realistic salt wedge model.

Each of SLAMM's cells may be composed of multiple SLAMM categories. Model initial conditions assign each of these cells to 100% of a single category. However, to allow incremental change in the model in smaller horizontal steps than the cell width, the cell can track the width of multiple classes in a single cell.

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Advancements between SLAMM 5 and 6

Accretion Feedback Component: Feedbacks based on wetland elevation, distance to channel, and salinity may be specified.

Salinity Model: Multiple time-variable freshwater flows may be specified.
Salinity is estimated and mapped at MLLW, MHHW, and MTL.
Habitat switching may be specified as a function of salinity.

Integrated Elevation Analysis: SLAMM will summarize site-specific categorized elevation ranges for wetlands as derived from LiDAR data or other high-resolution data sets.

Flexible Elevation Ranges: If site-specific data indicate that wetlands range outside of SLAMM defaults, a different range for land categories may be specified within the interface, ex: Alaska and wind-driven tides on the southern coast of Texas.

Open Graphics Library (OpenGL) 3D rendering: The open-source three-dimensional graphics library of SLAMM landscapes includes rendering of tide ranges. This feature is important for understanding spatial relationships and for quality assurance (QA) of spatial inputs.

Improvements in Graphical User Interface GUI: Improvements of the interface include buttons that allow easy integration of site and sub-site parameters into a single matrix that may be edited, exported to Excel, or pasted into the matrix from Excel.
Integrated Help File / User's Manual: An integrated help file/user's manual is available in acrobat reader (pdf) format and also context-sensitive help in HTML format.

Backwards Compatibility to SLAMM5: SLAMM5 file structures can be imported into the new interface quickly and seamlessly.
File Setup Verification: Ensures input rasters have the correct format and that appropriate files have been specified. File-names and locations now are flexible. User-friendly error messages are displayed if files are not compatible for some reason.

New Maps: Screen maps of elevations, salinity, and variable accretion rates are available in "Set File Attributes" and "debug-mode" execution as well as automatic pasting of maps to Microsoft Word. SLAMM land-cover colors are editable and choices are saved along with parameters in the SLAMM6 file.

Open Source: Non-distributable third-party components (that interfaced with Excel and rendered maps in 3D) have been replaced.

Links to information about the current version of SLAMM:

Short cut
Google: SLAMM

http://www.warrenpinnacle.com/prof/SLAMM/ - Johnathan Clough's Warren Pinnacle Consulting, Inc Environmental Modeling SLAMM information page

http://warrenpinnacle.com/SLAMMFORUM/ - SLAMM Forum for updates, technical questions, and feedback. There are 112 Topics and 69 members of the forum.

http://warrenpinnacle.com/prof/SLAMM6/SLAMM_6_Users_Manual.pdf - SLAMM 6 User Manual

http://warrenpinnacle.com/prof/SLAMM6/SLAMM6_Technical_Documentation.pdf - SLAMM 6 Technical Documentation

http://warrenpinnacle.com/prof/SLAMM6/SLAMM6_Open_Source.zip - SLAMM 6 source code

http://www.warrenpinnacle.com/prof/SLAMM/SLAMM_Model_Overview.html - SLAMM Model Overview.

http://warrenpinnacle.com/prof/SLAMM/SLAMM_Presentation.ppt - provides a download of the SLAMM overview PowerPoint.

http://www.warrenpinnacle.com/prof/SLAMM/SLAMM_Projects.html - lists of SLAMMS current and recent projects. Provides links to these projects.

http://www.warrenpinnacle.com/prof/SLAMM/SLAMM_Versions.html - History of SLAMM versions.

http://www.warrenpinnacle.com/prof/SLAMM/SLAMM_Bibliography.html - SLAMM bibliography.