

NWS Standards for SLOSH Basin Database Development and SLOSH Simulation Studies

The SLOSH model is the only numerical storm surge model presently used by the National Weather Service (NWS). The NWS's Meteorological Development Laboratory (MDL) and the National Hurricane Center (NHC) are eager to work with States and their contractors who wish to provide updated/revised SLOSH databases and simulation studies. NWS wishes these SLOSH databases to be acceptable for its own uses and for inclusion into NWS operational forecasting. To be accepted, these updated databases must be of high quality and consistent with the methods and standards NWS/MDL uses to provide storm surge databases for the SLOSH model. Similarly, simulation studies using hypothetical hurricanes must adhere to the methodology and requirements of the hurricane evacuation program used by NHC in generating SLOSH Maximum Envelopes of Water (MEOWs) and Maximum of the MEOWs (MOMs).

NWS Standards for SLOSH Basin Databases

1. Depths and land elevations must all be referenced to the same common datum. That datum must be traceable to NAVD-1988. All elevation and bathymetric data used will be made available to the NWS, allowing the NWS to do checks and comparisons. Source documentation will accompany these data, including a determination of the accuracy of these data.
2. In averaging different datasets for depths and terrain, the averaging must be done in a consistent manner. For example, we have been using depths from the NGDC dataset and elevations from USGS Digital Elevation Models (DEM's). The NGDC depths are generally on a 90 m by 90 m grid and USGS DEM's are on a 30 m by 30 m grid. Either the depth from the 90 m by 90 m dataset are downscaled, or the 30 m by 30 m data must be up scaled.
3. SLOSH grid averages from new data will be compared to values obtained by averaging the USGS and NGDC DEM data. A map showing these differences will be produced by the contractor. Resolution of these differences must be documented for grid cell elevation differences exceeding (2.0??) ft.

4. Barriers along the coastline must be entered into the SLOSH database. The elevations for these barriers will be the heights of the barrier (to the nearest foot) for solid structures (levees, roadways, etc.). For dune elevations, an agreed upon method for determining the dune elevation must be developed.
5. Water channels, rivers, and streams will be incorporated into the SLOSH database for water features of 1/10 grid cell width and larger, and will include channel depth, bank height (if necessary), and flow direction relative to the grid cell. Connection of the entire 1-dimensional channel is required. As a minimum, all channels of the existing NWS basin database will be included.
6. Vegetation will be entered into the database with a tree/no tree designation as a minimum. Data sources used in the vegetation derivation will be documented.
7. All data must be formatted to SLOSH input requirements.
8. Sub-grid cuts between barrier islands and chokes and expansions in 1-dimensional flows will be incorporated as required.
9. A database of vectorized barriers and 1-D flow channels will be developed and provided to MDL.
10. Testing of the SLOSH model for the basin will include testing with minimal tropical cyclones as well as intense, Cat 5 (as appropriate) hurricanes. The minimal storms will help assure that 1-D channels and cuts are operating as expected. Cat 5 hurricanes will assure that the model remains stable.
11. The Federal government is granted all rights to the SLOSH database and simulation studies, which may be used by the NWS, emergency managers and SLOSH users in any manner that government sees fit.

NWS Acceptance Standards for SLOSH Hypothetical Storm Surge Studies

1. Hypothetical storm track directions for each SLOSH basin study shall be selected from: north, north-northeast, northeast, east-northeast, east, east-southeast, southeast, south-southeast, south, south-southwest, southwest, west-southwest, west, west-northwest, northwest, north-northwest. The direction selection shall be based on the tracks of historical storms, plus a direction of two compass points (one of the above-listed directions) to the left and two compass points to the right. The hypothetical track directions shall include a continuous sweep of directions, not leaving any gaps in direction between the leftmost and rightmost directions. A set of hypothetical storm tracks paralleling the coastline of the basin shall be used. In such cases where the parallel tracks can come from opposite directions two such sets of parallel tracks shall be used. The most recent operational SLOSH basin studies shall be consulted as a guide to hypothetical storm track direction. Basin re-studies shall use at a minimum the same directions used in the present operational SLOSH basin study.
2. Hypothetical storm track spacing shall be no greater than 10 statute miles between tracks of any single direction.
3. Hypothetical storm track intensity shall be set by Saffir-Simpson categories. Up to landfall, Category 1 storms shall have a delta-P of 20 mb., Category 2 shall have a delta-P of 40 mb., Category 3 shall have a delta-P of 60 mb., Category 4 shall have a delta-P of 80 mb., and Category 5 shall have a delta-P of 100 mb. The most recent NWS operational SLOSH basin studies shall be consulted as a guide to hypothetical storm track intensity, and for post-landfall delta-P values (the “fill rate”).
4. Hypothetical storm track forward speeds shall be 5, 10 or 15, and 25 statute miles per hour (mph) (5, 10 and 25 or 5, 15, and 25) for basins south of Chesapeake Bay, VA. The most recent operational SLOSH basin studies shall be consulted as a guide to hypothetical storm track forward speed for selecting 10 mph or 15 mph. Basins from Chesapeake Bay northward shall have forward speeds consistent with the most recent operational SLOSH basin studies.
5. Hypothetical storm radius of maximum winds (RMW) shall use the radius/radii used in the present NWS operational SLOSH studies of the

basin, typically 20 to 25 statute miles. Unless already provided for by the latest NWS operational SLOSH studies of the basin, an additional complete set of computations using an RMW of 35 or 40 statute miles shall be made. The most recent NWS operational SLOSH basin studies shall be consulted as a guide to the post-landfall rate of change of hypothetical storm RMW's.

6. Tide stage for initialization of SLOSH model runs shall be set at 0.0 ft. (Mean Sea Level (MSL)) for one complete set of SLOSH computations and at a basin-appropriate high tide value for a second complete set of SLOSH computations.
7. SLOSH time-history settings for .REX files shall be set at a maximum time step of 15 minutes.
8. Computational instabilities shall be absent from all .REX files.
9. Every envelope file computed shall be available for examination by NWS storm surge specialists.
10. For each SLOSH basin the Envelopes of Highest Water (EOHW's) produced by all the hypothetical storms shall be composited into Maximum Envelopes of Water (MEOW's) in this fashion: 25 and 40 mile RMW data shall be composited together by the same direction, Saffir-Simpson category, and tide level. The result shall be a MEOW for each direction, forward speed, tide level, and Saffir-Simpson category.
11. At a minimum for each SLOSH basin the MEOW's produced by all the hypothetical storms shall be composited into Maximum of MEOW's (MOM's) by Saffir-Simpson category and tide level. Additional MOM's may need to be produced in different fashions as noted in the basin's operational SLOSH data files.
12. Historical storms which have impacted the basin being studied shall be run on the re-built basin for comparison with the same storms in the current operational basin.
13. The numbers and values for the items in Standards 1 through 7 above shall be agreed upon between NWS and the Contractor prior to the Contractor's initiation of calculations.